Council Roundup for April 16, 2018

The Newberg City Council met on April 16, 2018 and took the following actions:

- Approved the following Resolutions:
  Resolution 2018-3461, Yamhill County agreement for dog license revenue.
  Resolution 2018-3457, Changes to policies for Affordable Housing Trust Fund
  Resolution 2018- 3460, Municipal Judge Evaluation

- Directed staff to continue negotiations on the sale of the Animal Shelter.
- Approved Council Minutes from March 19, 2018.
- Appointed Elise Yarnell to the Budget Committee.

In other business, the Council:
- Tabled Resolution 2018-3459, Water Hardship Connection request to June 16, 2018.
- Held two executive sessions: 1 on real property, 1 on pending litigation.
- Heard reports on the Capital Improvement Plan, and 2014 Stormwater Master Plan.

City Council Work Session
April 16, 2018 - 6:00 PM
Public Safety Building 401 East Third Street

I. CALL MEETING TO ORDER

II. ROLL CALL

III. REVIEW OF THE COUNCIL AGENDA AND MEETING

IV. COUNCIL BUSINESS ITEMS

IV.A February 2018 Fund Financial Statements
RCA Information Financial Reports - 2018-02 Feb.pdf

V. EXECUTIVE SESSION PURSUANT TO ORS 192.660 (2) E REAL PROPERTY TRANSACTIONS

VI. ADJOURNMENT

PUBLIC COMMENT

WORK SESSIONS ARE INTENDED FOR DISCUSSION. NO ACTION WILL BE TAKEN ON THE AGENDA ITEMS AND NO DECISIONS WILL BE MADE. NO ORAL OR WRITTEN TESTIMONY WILL BE HEARD OR RECEIVED FROM THE PUBLIC.

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order ___ No.	**Ordinance ___ No.**	**Resolution ___ No.**	**Motion ___**	**Information XX**
SUBJECT: Newberg Fund Financial Statements for February 2018			**Contact Person (Preparer) for this Item: Matt Zook Dept.: Finance**	

Included with this report are the fund financial statements for February 2018. The financial statements represent the City's ongoing commitment at all levels of the organization to monitor financial status and make adjustments on a monthly basis. These are provided for your information and review, as well as an opportunity for you to ask questions and keep abreast of the financial health of the City. As you review these statements, please feel free to contact me directly in advance of the meeting with questions or comments. This will provide me with an opportunity to come to the Council Work Sessions with sufficient information to answer your questions. No formal action is required at the meeting.

As a reminder, most revenue is not recognized in an equal amount every month. Property taxes are received primarily in November, February, and May. Water revenue tends to trend higher in the summer months. Community Development revenue, such as building and planning fees as well as system development charges, is harder to predict. Transient Lodging Tax and Marijuana Tax is received quarterly. 9-1-1 Fund tax revenue is paid on a quarterly basis but delayed by up to 3 months after the close of the quarter, which at times puts the ending fund balance in a negative position, although the budget is managed so that the fund remains positive once the full fiscal year revenue is received. The point is that while 67% of the fiscal year has transpired through February, the year-to-date revenue received may reflect less or more depending on the revenue cycle. At this point, many of the revenues are on track as expected.

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* *67%*	2016-17 PRIOR YTD
City Budget Totals					
Total Beg Fund Balance	$ 37,027,145	$ 40,611,931	$ 40,611,931	110%	39,824,311
Total Revenues	62,560,841	3,278,448	35,738,835	57%	32,312,876
Total Beg Fund Bal & Revenues	99,587,986	43,890,379	76,350,766		72,137,186
Total Expenses	73,599,226	2,809,388	32,169,499	44%	31,394,627
Total Contingencies / Reserves	25,988,760	-	-	0%	-
Total Exp & Contingen / Reserves	99,587,986	2,809,388	32,169,499	32%	31,394,627
Total Monthly & YTD Net Gain / (Loss)		$ 469,060	$ 3,569,336		
Total Ending Fund Balance			$ 44,181,267		40,742,560
City Services					
General Fund (01)					
Beg Fund Balance	$ 3,077,675	$ 3,564,316	$ 3,564,316	116%	3,313,037
Revenues					
General Government	-	-	-	0%	-
Municipal Court	12,777	406	6,164	48%	7,936
Police	1,060,968	99,088	742,489	70%	729,562
Fire	363,258	-	108,977	30%	102,535
Communications	41,483	-	31,112	75%	29,631
Library	116,430	2,912	63,331	54%	68,470
Planning	708,100	44,753	500,000	71%	546,700
Property Taxes	7,855,522	240,105	7,479,327	95%	7,353,771
Other Taxes	66,400	775	52,732	79%	65,854
Franchise Fees	1,520,823	100,181	264,402	17%	246,885
Intergovernmental	1,387,137	88,438	987,353	71%	898,060
Miscellaneous	2,244,616	38	2,887	0%	8,828
Interest	21,233	4,013	23,205	109%	13,697
Transfers	1,174,924	45,572	758,392	65%	605,046
Revenue Total	16,573,671	626,281	11,020,372	66%	10,676,974
Expenses					
General Government	210,073	11,492	144,507	69%	158,025
Municipal Court	312,131	24,557	197,167	63%	239,821
Police	6,871,213	530,804	4,389,397	64%	4,066,010
Fire	3,866,703	322,319	2,576,928	67%	2,551,153
Communications	3,509,676	113,912	1,585,531	45%	693,087
Library	1,767,171	145,384	1,180,883	67%	1,008,321
Planning	1,262,702	56,617	519,351	41%	602,497
Transfers	143,834	1,151	47,558	33%	120,720
Contingency	607,843	-	-	0%	-
Unappropriated Ending Balance	1,100,000	-	-	0%	-
Total Expenses	19,651,346	1,206,236	10,641,322	54%	9,439,633
Monthly & YTD Net Gain / (Loss)		$ (579,955)	$ 379,050		
Ending Fund Balance			$ 3,943,365		4,550,378

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* 67%	2016-17 PRIOR YTD
Public Safety Fee (16)					
Beg Fund Balance	$ 109,612	$ 171,860	$ 171,860	157%	163,546
Revenues	496,809	46,693	340,376	69%	328,875
Expenses	542,792	36,479	291,336	54%	374,258
Contingencies / Reserves	63,629	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 10,214	$ 49,040		
Ending Fund Balance			$ 220,900		118,164
EMS (05)					
Beg Fund Balance	$ 87,036	$ 79,659	$ 79,659	92%	1,245,742
Revenues	501,000	44,605	353,479	71%	337,443
Expenses	551,741	48,847	387,323	70%	1,115,376
Contingencies / Reserves	36,295	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ (4,242)	$ (33,844)		
Ending Fund Balance			$ 45,816		467,809
911 Emergency (13)					
Beg Fund Balance	$ 23,357	$ 19,080	$ 19,080	82%	10,713
Revenues	221,000	-	111,084	50%	108,743
Expenses	224,876	17,591	140,765	63%	136,227
Contingencies / Reserves	19,481	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ (17,591)	$ (29,682)		
Ending Fund Balance			$ (10,601)		(16,770)
Civil Forfeiture (03)					
Beg Fund Balance	$ 25,234	$ 25,268	$ 25,268	100%	24,302
Revenues	200	36	254	127%	863
Expenses	25,434	765	765	3%	-
Contingencies / Reserves	-	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ (730)	$ (512)		
Ending Fund Balance			$ 24,756		25,165
Library Gift & Memorial (22)					
Beg Fund Balance	$ 63,516	$ 88,497	$ 88,497	139%	92,550
Revenues	135,600	306	28,732	21%	16,450
Expenses	160,000	1,974	45,608	29%	28,527
Contingencies / Reserves	39,116	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ (1,668)	$ (16,876)		
Ending Fund Balance			$ 71,620		80,473

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* *67%*	2016-17 PRIOR YTD
Building Inspection (08)					
Beg Fund Balance	$ 932,354	$ 1,107,774	$ 1,107,774	119%	746,431
Revenues	825,318	73,746	594,479	72%	538,957
Expenses	706,767	56,232	431,431	61%	358,864
Contingencies / Reserves	1,050,905	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 17,514	$ 163,048		
Ending Fund Balance			$ 1,270,822		926,523
Streets (Operating) (02)					
Beg Fund Balance	$ 489,326	$ 736,256	$ 736,256	150%	816,245
Revenues	2,913,541	223,314	1,846,944	63%	900,216
Expenses	3,306,928	106,269	1,716,882	52%	1,594,318
Contingencies / Reserves	95,939	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 117,045	$ 130,063		
Ending Fund Balance			$ 866,318		122,143
Water (Operating) (07)					
Beg Fund Balance	$ 8,874,908	$ 8,995,620	$ 8,995,620	101%	7,784,122
Revenues	5,877,525	403,844	4,520,656	77%	4,096,568
Expenses	6,024,114	296,925	2,756,120	46%	2,985,411
Contingencies / Reserves	8,728,319	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 106,918	$ 1,764,536		
Ending Fund Balance			$ 10,760,156		8,895,279
Wastewater (Operating) (06)					
Beg Fund Balance	$ 10,812,028	$ 11,973,385	$ 11,973,385	111%	12,445,970
Revenues	8,147,159	801,290	5,521,757	68%	5,412,605
Expenses	11,252,805	426,914	4,771,125	42%	5,227,731
Contingencies / Reserves	7,706,382	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 374,376	$ 750,632		
Ending Fund Balance			$ 12,724,017		12,630,844
Stormwater (Operating) (17)					
Beg Fund Balance	$ 898,152	$ 1,028,956	$ 1,028,956	115%	1,169,140
Revenues	1,488,924	134,062	1,008,431	68%	914,487
Expenses	2,174,253	95,563	1,575,914	72%	1,036,892
Contingencies / Reserves	212,823	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 38,500	$ (567,483)		
Ending Fund Balance			$ 461,473		1,046,735

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* 67%	2016-17 PRIOR YTD
Administrative Support (31)					
Beg Fund Balance	$ 553,185	$ 728,861	$ 728,861	132%	474,296
Revenues	4,750,352	381,980	3,063,282	64%	2,893,980
Expenses					
City Manager	640,981	46,404	397,214	62%	321,781
Human Resources	216,501	13,128	124,356	57%	115,943
Emergency Management	-	-	-	0%	-
Finance	734,726	55,151	478,237	65%	442,242
Gen Office(Postage/Phones)	177,289	12,257	94,876	54%	92,584
Utility Billing	323,036	23,649	222,310	69%	203,261
Information Technology	1,071,444	70,241	686,408	64%	690,734
Legal	480,443	37,703	296,483	62%	255,989
Fleet Maintenance	208,735	18,667	151,241	72%	118,866
Facilities Repair/Replacement	835,675	54,172	501,010	60%	255,031
Insurance	366,446	(15,183)	315,143	86%	289,899
Transfers	3,362	280	2,241	67%	18,357
Contingencies / Reserves	244,898	-	-	0%	-
Total Expenses	5,303,536	316,469	3,269,519	62%	2,804,686
Monthly & YTD Net Gain / (Loss)		$ 65,512	$ (206,237)		
Ending Fund Balance			$ 522,624		563,589
Capital Improvement Projects					
Streets CIP's (18)					
Beg Fund Balance	$ 168,396	$ 168,834	$ 168,834	0%	165,646
Revenues	5,894,337	39,522	1,081,086	18%	1,031,441
Expenses	5,892,337	39,073	1,077,038	18%	1,029,233
Contingencies / Reserves	170,396	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 449	$ 4,048		
Ending Fund Balance			$ 172,882		167,854
Water / Wastewater / Stormwater CIP's (04)					
Beg Fund Balance	$ -	$ -	$ -	0%	-
Revenues	7,278,467	37,462	1,724,209	24%	1,702,363
Expenses	7,278,467	37,462	1,724,209	24%	1,702,363
Contingencies / Reserves	-	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ -	$ -		
Ending Fund Balance			$ -		-
Street SDC (42)					
Beg Fund Balance	$ 2,965,113	$ 2,936,734	$ 2,936,734	99%	2,824,984
Revenues	2,365,125	98,412	1,271,819	54%	249,857
Expenses	3,971,000	24,204	153,916	4%	271,320
Contingencies / Reserves	1,359,238	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 74,207	$ 1,117,903		
Ending Fund Balance			$ 4,054,638		2,803,520

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* *67%*	2016-17 PRIOR YTD
Water SDC (47)					
Beg Fund Balance	$ 298,518	$ 572,610	$ 572,610	192%	821,631
Revenues	734,713	78,598	392,823	53%	395,721
Expenses	1,028,931	1,564	783,318	76%	862,030
Contingencies / Reserves	4,300	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 77,034	$ (390,495)		
Ending Fund Balance			$ 182,115		355,322
Wastewater SDC (46)					
Beg Fund Balance	$ 4,516,526	$ 5,106,412	$ 5,106,412	113%	4,527,496
Revenues	830,000	137,226	655,573	79%	708,269
Expenses	1,579,724	5,003	716,190	45%	411,084
Contingencies / Reserves	3,766,802	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 132,224	$ (60,617)		
Ending Fund Balance			$ 5,045,795		4,824,681
Stormwater SDC (43)					
Beg Fund Balance	$ 94,806	$ 106,284	$ 106,284	112%	167,567
Revenues	71,200	5,470	39,145	55%	23,698
Expenses	55,000	1,577	47,145	86%	93,947
Contingencies / Reserves	111,006	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 3,892	$ (8,000)		
Ending Fund Balance			$ 98,284		97,317
Debt					
Debt Service (General Op) (09)					
Beg Fund Balance	$ 36,946	$ 38,270	$ 38,270	104%	216,728
Revenues	743,425	21,805	567,971	76%	552,501
Expenses	736,006	-	460,125	63%	654,998
Contingencies / Reserves	44,365	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 21,805	$ 107,846		
Ending Fund Balance			$ 146,116		114,231
City Hall (10)					
Beg Fund Balance	$ 512,086	$ 552,745	$ 552,745	108%	509,076
Revenues	93,000	11,461	98,971	106%	107,496
Expenses	108,486	-	103,486	95%	98,718
Contingencies / Reserves	-	-	-	0%	-
Unappropriated Ending Balance	496,600	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 11,461	$ (4,515)		
Ending Fund Balance			$ 548,230		517,854

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* 67%	2016-17 PRIOR YTD
Reserves					
PERS Stabilization Reserve (25)					
Beg Fund Balance	$ 179,255	$ 179,840	$ 179,840	100%	-
Revenues	-	83	1,101	0%	119,612
Expenses	179,255	14,987	119,893	67%	-
Contingencies / Reserves	-	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ (14,904)	$ (118,792)		
Ending Fund Balance			$ 61,048		119,612
Vehicle / Equipment Replacement (32)					
Beg Fund Balance	$ 1,372,748	$ 1,431,306	$ 1,431,306	104%	1,176,384
Revenues	$ 1,114,077	$ 97,873	$ 780,052	70%	564,375
Expenses					
General Government	-	-	-	0%	1,373
City Manager's Office	1,468	-	-	0%	-
Human Resources	1,013	-	-	0%	-
Finance	17,496	-	-	0%	-
Information Technology	76,396	-	68,272	89%	109,231
Legal	423	-	-	0%	-
Municpal Court	4,114	-	-	0%	-
Police	461,425	30,118	124,048	27%	131,581
Communications	153,488	-	-	0%	-
Library	13,103	-	-	0%	1,382
Planning	2,975	-	-	0%	-
Building	26,412	-	-	0%	-
PW Administration	1,556,524	24,939	189,550	12%	41,935
Fleet Maintenance	11,048	52	402	4%	311
Facilities Repair/Replacement	160,940	1,445	26,759	17%	56,893
Contingencies / Reserves	-	-	-	0%	-
Total Expenses	2,486,825	56,555	409,030	16%	434,040
Monthly & YTD Net Gain / (Loss)		$ 41,318	$ 371,022		
Ending Fund Balance			$ 1,802,328		1,306,719

SUMMARY REPORT

FEB 2018

FUNDS	2017-18 BUDGET	MONTH OF FEB 2018	2017-18 YTD	Current YTD *Compare to Budget* *67%*	2016-17 PRIOR YTD
Community Projects					
Cable TV Trust (23)					
Beg Fund Balance	$ 37,825	$ 37,897	$ 37,897	100%	37,504
Revenues	200	52	379	189%	238
Expenses	38,025	-	-	0%	-
Contingencies / Reserves	-	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 52	$ 379		
Ending Fund Balance			$ 38,275		37,742
Economic Development (14)					
Beg Fund Balance	$ 554,825	$ 617,748	$ 617,748	111%	570,191
Revenues	457,771	6,146	51,214	11%	44,170
Expenses	882,174	2,741	25,570	3%	12,407
Contingencies / Reserves	130,423	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ 3,405	$ 25,644		
Ending Fund Balance			$ 643,392		601,954
Transient Lodging Tax (19)					
Beg Fund Balance	$ 343,718	$ 343,718	$ 343,718	100%	149,857
Revenues	1,047,427	8,181	664,683	63%	585,748
Expenses	1,391,145	15,958	521,469	37%	471,539
Contingencies / Reserves	-	-	-	0%	-
Monthly & YTD Net Gain / (Loss)		$ (7,777)	$ 143,214		
Ending Fund Balance			$ 486,932		264,065

City Council Business Session
April 16, 2018 - 7:00 PM
Public Safety Building 401 East Third Street

I. CALL TO ORDER

II. ROLL CALL

III. PLEDGE OF ALLEGIANCE

IV. CITY MANAGER'S REPORT

V. COUNCIL APPOINTMENT OF ELISE YARNELL TO BUDGET COMMITTEE

V.a RCA Budget Committee Appointment
RCA Motion - Elise Yarnell Appointment.pdf

VI. PUBLIC COMMENTS

(30 minutes maximum which may be extended at the mayor's discretion; an opportunity to speak for not more than five (5) minutes per speaker allowed)

VII. CONSENT CALENDAR

VII.a Resolution 2018-3461 Authorizing an intergovernmental agreement between Yamhill County and the City of Newberg regarding dog control licensing revenue
RCA Res 2018-3461
IGA Newberg-DogRevenue 031918.pdf

VII.b March 19, 2018 Council Minutes
RCA Council Minutes 2018-0416.pdf

VIII. PUBLIC HEARINGS

VIII.a Resolution 2018-3459, A hardship request for water service to Tax Lot 3324AD-00600
Del Boca Vista Water Hardship.pdf
May 2016 Water Hardship presentation

IX. NEW BUSINESS

IX.a Resolution 2018-3457, A Resolution amending Policies and Procedures for Administration of the City of Newberg's Affordable Housing Trust Fund and

repealing Resolution No. 2016-3306
Rev. RCA_Resolution_2018-3457.doc

IX.b Capital Improvement Plan
CIP 2018.pdf

IX.c 2014 Stormwater Master Plan Annual Review
RCA Information Stormwater Master Plan April 2018.doc
Attachment 1 - final_newbergswmp_rev2015.02.02_e-version.pdf

IX.d Resolution 2018-3460, Municipal Judge Evaluation
RCA Res 2018-3460.pdf

X. COUNCIL BUSINESS

XI. EXECUTIVE SESSION PURSUANT TO ORS 192.660 (2) H LEGAL COUNSEL CONCERNING LEGAL RIGHTS AND DUTIES REGARDING CURRENT LITIGATION OR LITIGATION LIKELY TO BE FILED

XII. ADJOURNMENT

COMMENTS

Council accepts comments on agenda items during the meeting. Fill out a form identifying the item you wish to speak on prior to the agenda item beginning and turn it into the City Recorder. Speakers who wish the Council to consider written material are encouraged to submit written information in writing by 12:00 p.m. (noon) the day of the meeting.

ADA STATEMENT

ACCOMMODATION OF PHYSICAL IMPAIRMENTS: In order to accommodate persons with physical impairments, please notify the City Recorder's Office of any special physical or language accommodations you may need as far in advance of the meeting as possible and no later than two business days prior to the meeting. To request these arrangements, please contact the City Recorder at (503) 537-1283. For TTY services please dial 711.

ORDER

The Mayor reserves the right to change the order of items to be considered by the Council at their meeting. No new items will be heard after 11:00 p.m., unless approved by the Council.

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order No. ___	**Ordinance No.** ___	**Resolution No.** ___	**Motion** XX	**Information** ___
SUBJECT: To consent to the Mayor's Appointment of Elise Yarnell to the Budget Committee			**Contact Person (Preparer) for this Motion: Mayor Andrews Dept.: Council**	

RECOMMENDATION:
Approve the appointment by Mayor Andrews to the Budget Committee listed in the executive summary.

EXECUTIVE SUMMARY:
To appoint Elise Yarnell as a new member to the Budget Committee from April 16, 2018 to December 31, 2019.

Budget Committee:
The Budget Committee consists of our seven City Council members and seven citizens with one position open, previously held by Ms. Megan Morris, with a term that will expire December 31, 2019.

Ms. Yarnell has been a resident of the community for two years. She is the Healthcare Administrator at Providence Medical Group where she has six years of progressive leadership in finance, strategic planning, people development, and mission-driven values. She looks forward to serving the Budget Committee and the community by providing an optimistic viewpoint and fresh perspective to a growing population.

FISCAL IMPACT:
Not applicable.

STRATEGIC ASSESSMENT (RELATE TO COUNCIL PRIORITIES FROM SEPTEMBER 2017):
Not applicable.

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order ___ No.	**Ordinance ___ No.**	**Resolution _xx_ No. 2018-3461**	**Motion ___**	**Information ___**
SUBJECT: Resolution approving Resolution 2018-3461 authorizing an intergovernmental agreement between Yamhill County and the City of Newberg regarding dog control licensing revenue.			**Contact Person (Preparer) for this Motion: Matt Zook Dept.: Finance File No.:**	

RECOMMENDATION: Approve Resolution 2018-3461

EXECUTIVE SUMMARY:

In 2017, the Yamhill County Sheriff's Office (YCSO) ceased providing dog control services to the City of Newberg and its residents, as well as other jurisdictions in Yamhill County who do not contract directly with the YCSO for police services. However, the Yamhill County continues to license dogs throughout the County, including within the City of Newberg. The intergovernmental agreement (IGA) presented to Council for approval seeks to appropriately and equitably distribute dog control licensing revenue collected by the County from Newberg dog owners and keepers back to the City to assist in its dog control duties. The IGA allows the County to retain 25% of the revenue to cover the costs of administering the licensing program. The remaining 75% will come to the City of Newberg.

FISCAL IMPACT:

A rough estimate of the amount of revenue to be received by the City is between $10,000 and $20,000 per year. The IGA would be retroactively effective to October 1, 2017, in conjunction with the timeframe the YCSO stopped providing dog control service. These funds would be received into the General Fund.

RESOLUTION NO. 2018-3461

A RESOLUTION AUTHORIZING AN INTERGOVERNMENTAL AGREEMENT BETWEEN YAMHILL COUNTY AND THE CITY OF NEWBERG REGARDING DOG CONTROL LICENSING REVENUE

RECITALS:

1. The City of Newberg operates its own police department and does not contract with the Yamhill County Sheriff's Office for police services.

2. Until recently, the Yamhill County Sheriff's Office provided dog control services tot eh City of Newberg and its residents. The Sheriff's Office ceased providing dog control services to the City and its residents in 2017.

3. At this time, pursuant to ORS 609.100 and County ordinance, the County continues to license dogs throughout Yamhill County, including within the jurisdictional boundaries of City. Except within Yamhill County cities that contract with the Sheriff's Office for police services, cities with Yamhill County, including the City of Newberg, currently perform dog control functions within their own jurisdictional boundaries.

4. The purpose of this agreement is to equitably distribute dog control licensing revenue collected by and on behalf of the County, between the County and City, to compensate county for administrative costs associated with the licensing program, and to provide revenue to the City for performing dog control functions within the jurisdictional boundaries of the City.

THE CITY OF NEWBERG RESOLVES AS FOLLOWS:

1. This agreement, as presented in Exhibit A, is entered into between the parties under ORS Chapter 190 governing intergovernmental agreements.

2.

- **EFFECTIVE DATE** of this resolution is the day after the adoption date, which is: April 17, 2018.

ADOPTED by the City Council of the City of Newberg, Oregon, this 16th day of April, 2018.

_____
Sue Ryan, City Recorder

ATTEST by the Mayor this _____ day of _____, 2018.

_____
Bob Andrews, Mayor

Exhibit A

INTERGOVERNMENTAL AGREEMENT
BETWEEN YAMHILL COUNTY AND THE CITY OF NEWBERG
REGARDING DOG CONTROL LICENSING REVENUE

This intergovernmental agreement is between Yamhill County, a political subdivision of the State of Oregon ("County"), and the City of Newberg, a municipal corporation ("City").

RECITALS:

A. The City of Newberg operates its own police department, and does not contract with the Yamhill County Sheriff's Office for police services.

B. Until recently, the Yamhill County Sheriff's Office provided dog control services to the City of Newberg and its residents. The Sheriff's Office ceased providing dog control services to the City and its residents in 2017.

C. At this time, pursuant to ORS 609.100 and County ordinance, the County continues to license dogs throughout Yamhill County, including within the jurisdictional boundaries of City. Except within Yamhill County cities that contract with the Sheriff's Office for police services, cities within Yamhill County, including the City of Newberg, currently perform dog control functions within their own jurisdictional boundaries.

D. The purpose of this agreement is to equitably distribute dog control licensing revenue collected by and on behalf of the County, between the County and City, to compensate County for administrative costs associated with the licensing program, and to provide revenue to the City for performing dog control functions within the jurisdictional boundaries of the City.

NOW, THEREFORE;

IT IS HEREBY AGREED BY THE COUNTY AND THE CITY AS FOLLOWS:

1. This agreement is entered into between the parties under ORS Chapter 190 governing intergovernmental agreements.

2. For the term of this agreement, the City agrees to enforce its own dog control ordinance or ordinances, as well as licensing requirements adopted by the County, within the jurisdictional boundaries of the City.

3. The County agrees to continue operating its dog licensing program, and to collect licensing fees from all dog owners and keepers residing in Yamhill County, as specified in the County's Dog Control Ordinance.

4. The County agrees to continue collecting dog license fees from dog owners and keepers residing in Yamhill County, including dog owners and keepers residing within the jurisdictional boundaries of the City.

5. The County agrees to remit to the City 75 percent of all licensing revenue collected from dog owners and keepers residing within the jurisdictional boundaries of the City, and to retain 25 percent of such revenue. Payments shall be calculated and made at the end of each quarter in which dog license fees are collected, by County to City.

6. Each party shall indemnify and hold harmless the other party from all claims, costs, damages or expenses of any kind, including attorney's fees and other costs and expenses of litigation, for personal or property damage arising out of that party's performance required by this agreement. It is the intent of this section that each party assumes any and all liability for its respective torts, errors and omissions.

7. This Agreement may be amended by both parties in writing. No changes to or waivers of provisions of this Agreement will be valid unless they have been reduced to writing and signed by both parties.

8. Both parties shall retain records of services provided under this Agreement for (i) three years after the end of the fiscal year during which they were created; or (ii) any longer period required by law or to complete any audit or resolve pending audit findings.

9. County, through its Sheriff's Office, shall provide reasonable access to the books, documents, papers and records of County and any subcontractor that are directly pertinent to this Agreement for the purpose of making audit, examination, excerpts or transcripts.

10. This Agreement constitutes the entire Agreement between the parties. There are no understandings, agreements or representations, oral or written, regarding this Agreement, that are not specified in this Agreement.

11. This Agreement may be terminated immediately at any time by mutual written consent of both parties or by either party upon thirty (30) days written notice. In addition, either party may terminate this Agreement effective immediately upon receipt of written notice to the other party under any of the following conditions:

a. Any party breaches any duty, term, or condition of this Agreement; or

b. Either party commits a fraud or misrepresentation upon the other party.

Following termination, this agreement shall continue to apply to all revenue previously collected by the County and owed to the City under the terms of this Agreement.

This agreement is retroactively effective as of October 1, 2017.

DONE at mcMinnville, Oregon on the dates specified below.

CITY OF NEWBERG

By:_____
Joe Hannan
City Manager

Date:_____

YAMHILL COUNTY

By:_____
Mary Starrett
Chair, Yamhill County Board of Commissioners

Date:_____

FORM APPROVED BY:

_____
TIMOTHY S. SADLO
Senior Assistant County Counsel

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order ___ No.	**Ordinance ___ No.**	**Resolution ___ No.**	**Motion** XX	**Information ___**
SUBJECT: Council Minutes			**Contact Person (Preparer) for this Motion: Sue Ryan Dept.: City Recorder**	

RECOMMENDATION: Approve Council Minutes for March 19, 2018.

NEWBERG CITY COUNCIL MINUTES
REGULAR SESSION
March 19, 2018, 7:00 PM
PUBLIC SAFETY BUILDING (401 E. THIRD STREET)

EXECUTIVE SESSION #1 Performance of a Public Officer
Start: 5:00 p.m.
Stop: 5:35 p.m.
Staff: Municipal Judge Larry Blake, Jr.
Topic: Municipal Judge annual evaluation

A work session was held at 5:40 p.m. preceding the meeting. Present were Mayor Andrews, Councilors Patrick Johnson, Denise Bacon, Mike Corey, Scott Essin, Stephen McKinney, and Matt Murray. City staff present were City Manager Joe Hannan, City Recorder Sue Ryan, Community Development Director Doug Rux, Human Resources Director Anna Lee, and Public Works Director Jay Harris. Also present were Yamhill County Commissioners Mary Starrett, Rick Olson, and Stan Primozich.

The Council met in a joint session with the Yamhill County Commissioners to discuss transit needs and operations for Newberg. Councilor Essin thanked those who had worked on this project. He explained the proposed Newberg Transit Center in downtown and four new routes that would circulate back to the Transit Center in the Transit Master Plan. Components included purchasing land for a Transit Center, signs at all bus stops, and install bus shelters. There was discussion on Lyft tickets in place of Dial-A-Ride, and what changes would expand ridership. City Manager Hannan explained this would not increase the number of buses or employees, but would use the existing buses and employees. Instead of a long circular route, all the buses would come back to the Transit Center. They could purchase property for the Transit Center, and as grants came in reimburse the City for the purchase.

County Commissioner Starrett asked if the proposed Transit Center property was currently for sale. CM Hannan said there were some parcels for sale downtown that would work. County Commissioner Primozich said the plan should represent Newberg's needs. Issues included old buses, and the perception of YCTA as unreliable. County Commissioner Olson clarified ODOT has final approval for Transit Master Plan. Newberg was currently underserved. Building a system in Newberg would take time. The Transit Authority was responsible for the entire County and there were needs in other cities as well.

Councilor Johnson thought the greatest challenge in Newberg was public awareness. Commissioner Starrett explained a Medicaid program for non-emergency medical transportation when Dial-A-Ride was not available. Councilor McKinney said Newberg had been underserved for a long time, and there was no way of assessing what was needed because citizens did not depend on a transit system because there was nothing to serve them. Commissioner Primozich said when the final plan would identify bus stops and routes for Newberg. Commissioner Olson encouraged the City to plan for transit for new development, especially on collector and arterial streets.

Community Development Director Rux reported on Economic Development. In 2016 and 2017 two Economic Vitality Summits identified a process for community needs and how to address them. A group was going to University of Oregon on strategic action plans to create steps to achieve goals in a three-to-six month timeframe. This group would then train people in the local community. CDD Rux said Yamhill County contracted with SEDCOR to provide economic development surfaces. Their focus was on eight of the ten communities, and collaboration with Newberg and McMinnville on their economic development efforts. He asked about possible grant funding from the County.

Commissioner Primozich said SEDCOR was going to be leading their economic development efforts. The state entity would hire a person to be housed in Yamhill County. SEDCOR brought a number of significant partners which would help with their economic development efforts. The grant program was being funded through lottery dollars. They would be funding SEDCOR from those dollars, and they would have SEDCOR use a committee to allocate remaining grant funding. The grant program was not being abandoned, but would have to be realigned with the amount of money that would come in. Commissioner Starrett clarified SEDCOR would be the agent, but the County would make the decision of who received the grants. Commissioner Olson said as elected officials they were not economic development experts. He wanted the experts to make recommendations for the grants and then the Commission would decide where the money would go in conjunction with SEDCOR. There was discussion regarding the small and large grant process and criteria.

CDD Rux gave an update on the Riverfront Master Plan. The City received a grant and signed an IGA with ODOT to move forward with the Plan. He explained the land included in the Plan. This was an opportunity to revitalize and revision this area. A citizens committee had been appointed and they would start meeting in May. The process would take about 18 months, and it might require Comprehensive Plan and zone changes. There was discussion regarding the challenges of the old landfill site at Rodgers Landing next to the Willamette River.

CALL MEETING TO ORDER
Mayor Andrews called the business session to order at 7:00 p.m.

ROLL CALL

Members Present:	Mayor Bob Andrews	Stephen McKinney	Mike Corey
	Denise Bacon	Patrick Johnson	Matt Murray
	Scott Essin	Stephen McKinney	
Staff Present:	Joe Hannan, City Manager	Truman Stone, City Attorney	
	Sue Ryan, City Recorder	Doug Rux, Community Development Director	
	Matt Zook, Finance Director	Jay Harris, Public Works Director	
	Kaaren Hofmann, City Engineer	Rosa Olivares, Community Engagement Specialist	
	Daniel Keuler, Senior Accountant	Paul Chiu, Senior Engineer	

PLEDGE OF ALLEGIANCE: The Pledge of Allegiance was performed.

CITY MANAGER'S REPORT: City Manager Hannan reported on his activities including the draft City budget, successful TVF&R annexation which would be effective July 1, seismic upgrade funding from the State, financing proposals for communications and DEQ, Design Star program, Police Academy graduation, County Commission town hall meeting, Animal Shelter appraisal, Chamber planning sessions, Pension Subcommittee meeting, Channel 12 interview on selling street signs, Cameo Theatre historic designation and renovation, new public art brochure, more vacation rentals in Newberg, and more parking for the library.

PUBLIC COMMENTS: Pat Haight, Newberg resident, was concerned about the City changing the riverfront. She discussed traffic on Main Street and how people were not stopping for pedestrians. Cars were speeding into town off Rex Hill at 50-60 mph. People did not slow down through town as if it was not a town at all. She thought there needed to be more police enforcement. She asked the Council to take the lead on this issue.

Shari Ralston, owner of Western Oregon Dispensary, said her business had been open for more than two years. It was not a burden on the police force or City resources. She asked the Council to reconsider their denial of her previous request to stay open an hour longer, until 9 p.m. There were many cities that allowed dispensaries to stay open past 8 p.m. She had received many requests from Newberg citizens for the time change. In 2017,

recreational marijuana dispensaries turned in over $300,000 in tax revenue and the City would get a portion of that. Most of her business was in the evening. She planned to turn in the paperwork for the time change request. There was discussion regarding the plans for the old bank building near Ms. Ralston's business.

Rebecca Wallis, Family Pet Partners, said the amount of dogs they were able to help through Dispatch calls last year was 67 dogs. They saved the Police Department 134 hours in dealing with these dogs. So far this year they had surpassed 30 dogs. They were working on getting a building to provide community services. She planned to attend the strategic training. She discussed volunteers who helped in this work, their five locations, and how they were a registered animal rescue entity.

Robert Soppe, Newberg resident, complained that the recent City Charter amendment was not on the City's website as of today. He also had an issue with Resolution 2018-3442 for rehabilitation of sewer lines and laterals in northeast Newberg. The Wastewater Master Plan called for I & I projects to be done in the oldest section of town but this project was in Springbrook basin,which was a relatively new area of town. It was the least desirable area to rehabilitate and was not a priority. The current low bidder was not included when this project came before Council last year. He did not think this was the appropriate location to spend a quarter of a million dollars. There was no mention in the resolution of the previous resolution and why this project did not happen last year. Councilor McKinney asked to pull Resolution 2018-3442 from the consent calendar for further discussion. The resolution was pulled.

CONSENT CALENDAR:

MOTION: Corey/Bacon moved to approve the Consent Calendar including Resolution 2018-3446, A Resolution to authorize the City Manager to enter into a construction contract with Whitney Equipment Company, Inc. for the installation of the new replacement hypochlorite generation system at the water treatment plant in the amount of $133,129.38; Resolution 2018-3454, A Resolution authorizing refunding of a loan from the Special Public Works Fund with the Oregon Infrastructure Finance Authority; Resolution 2018-3456, A Resolution accepting a grant award from the Department of Land Conservation and authorizing the City Manager to execute all grant documents; and Council Minutes for February 20, 2018. Motion carried (7 Yes/0 No).

PUBLIC HEARING: Ordinance 2018-2823:

Mayor Andrews opened the public hearing. He called for abstentions, conflicts of interest, or objections to jurisdiction. There were none.

City Engineer Hofmann gave the staff report. She said Chapter 13 of the Municipal Code addressed public utilities and services in the City. Over the last several years, the City Council had adopted utility master plans and SDC methodologies. The revisions addressed the need to update the SDC portions of the chapter. The League of Oregon Cities had released a new model ordinance on Friday. This section would need to be updated again once the Affordable Housing Committee completed their work. She highlighted the proposed revisions including removing the word "residential" from the definition of qualified public improvement, adding a section to grant waivers for water and wastewater SDCs for single family residences once per year, providing distinction between credits and deductions, adding language that indexed SDCs automatically each year on April 1, adding credits were only available for excess capacity and the project must be on the project list adopted by Council, specifying the rate by which the developer could finance SDCs, and specifying credits could not be redeemed for cash. Staff had also created a guidance manual, procedures, and forms for use moving forward.

Councilor McKinney asked if the Council would be better served if they waited until the other items were completed before adopting the ordinance. CDD Rux did not think so, as this cleared up ambiguities and made the process consistent.

Councilor Murray asked why they were declaring an emergency in the ordinance. CE Hofmann said it had to do with indexing the SDCs, and the Master Fee Schedule going into effect April 1. It would also capture the changes before construction season began.

Proponents: Robert Soppe, Newberg resident, was pleased to see the Code being cleaned up where appropriate. The standards set by the old definition of qualified public improvement were likely violated in the past as the old language did not represent the intent. The new language was far more appropriate with some minor exceptions. Item 3 in the definition referred to "in a public way" and he thought it should be "in a public right-of-way." On the definition for reimbursement fee, he thought it would be more appropriate to refer to "unused capacity" and not simply "capacity." He thought the Oxford comma should be standard in City documents. In Section 13.05.120, there was mention of "certified non-profit entities". He questioned if that was a well-defined term. He also noted that the language allowed waivers for wastewater and water SDCs, but not stormwater SDCs. He asked if that was intentional.

City Attorney Stone agreed with the comments regarding the Oxford comma. He said "public way" was a term and he gave the definition.
Opponents: None
Unknown: None
Mayor Andrews closed the public hearing.
CE Hofmann recommended approval of the ordinance.

MOTION: Corey/Bacon moved to waive the second reading of Ordinance 2018-2823. Motion carried (7 Yes/0 No).

MOTION: McKinney/Corey moved to approve Ordinance 2018-2823, An Ordinance amending Chapter 13 of the Newberg Municipal Code to modify system development charge regulations and declaring an emergency to be read by title only. Motion carried (7 Yes/0 No).

Resolution 2018-3455, Repeal of SDC resolutions:
CE Hofmann said this resolution went along with the ordinance that was just adopted. It would repeal previous resolutions which addressed SDC waivers. The proposed waivers were for certified non-profit and low to moderate income projects.

MOTION: Bacon/Johnson moved to approve Resolution 2018-3455, A Resolution repealing Resolutions 2007-2698 and 96-1951 addressing waivers to System Development Charges. Motion carried (7 Yes/0 No).

Master Fee Schedule, 2018:
Mayor Andrews opened the public hearing. He called for abstentions, conflicts of interest, or objections to jurisdiction. There were none.

Finance Director Zook and Senior Accountant Keuler presented the Master Fee Schedule for 2018/19. They explained the purpose of the Schedule. Some of the fees were tied to a CPI, which for 2017 was 4.2%, and some of the fees were tied to the Construction Cost Index for Seattle which for 2017 was 7.7%. The Municipal Services Statement fees were also included for clarity to the public, even though those fees were established through a separate process which involved the Citizen Rate Review Committee. Other notable changes were a $5 increase in the lien search fee, the Fire and EMS would be irrelevant once the TVF&R annexation took place, the permit center building, engineering, and planning fees were subject to the CPI change, and there was an increase to the license fee for exhibitors. The new fees would go into effect on April 1.

There was discussion regarding the license fee for exhibitors, which did not cover the full cost of processing the permit. Councilor Johnson thought the Old Fashioned Festival should be made aware of the fee increase.
There was no public testimony.
Mayor Andrews closed the public hearing.
FD Zook recommended approval of the resolution.

MOTION: Corey/Murray moved to approve Resolution 2018-3443, A Resolution updating the Master Fee Schedule for the City of Newberg. Motion carried (7 Yes/0 No).

NEW BUSINESS: College Street LID: Senior Engineer Chiu said this project would provide sidewalks and bike lanes on the west side of College Street from Aldercrest to Foothills. ODOT and the City would fund the project. Staff was asked to look into the possibility of an LID to help pay for the project. He summarized staff's analysis. After the analysis was done, staff did not recommend a College Street Local Improvement District. This was because the amount collected would be much smaller than what was collected by the previous LID, and due to the time and effort to make an LID happen.

Councilor McKinney confirmed that they still planned to put in the sidewalks. He asked if they could anticipate fewer pitfalls in this process than the previous process and if it would help them keep their promise to the citizens who had already participated in the sidewalk projects. Engineer Chiu said that was correct, they were still planning to put in the sidewalks. CE Hofmann said there still might be issues with the IGA with ODOT, but not adding an LID would take away some of the complexities of the project.

There was discussion on the sidewalks and paying for them, how things would be different in this process than the previous process, and possibly doing the LID in the future if the costs changed. Councilor Bacon said this put the City in an awkward position, as citizens helped pay for sidewalks in the previous project through an LID, and in this project the citizens would not help pay for sidewalks. Councilor McKinney asked how they would make sure the first group of citizens was not taken advantage of.

CE Hofmann said the City had to pay much more for the previous project. This was due to several change orders. Now there were protections in place so that it would not happen again. There were some milestones in place where the work could be stopped, and the scope of work reexamined before moving forward depending upon cost escalation.

Robert Soppe, Newberg resident, thought LID waivers should be a Council decision. The waivers would apply to only 22% of the affected properties, and objection by 60% of the LID participants could block the formation of an LID. He thought there would be enough objection to this LID for it not to be established.

Councilor Johnson was in favor of not forming the LID because there were protections in place to make sure the project scope did not exceed its budget. He said staff had made a good analysis as to how much staff time would be required, and the chances they had to pass the LID in this neighborhood.

MOTION: Johnson/Murray moved to not form a Local Improvement District for College Street sidewalks and bike lanes from Aldercrest Drive to Foothills Drive. Motion carried (7 Yes/0 No).

Resolution 2018-3442, I & I Contract:
CE Hofmann said Instituform was not on the bid list from last year because they did not bid last year. The Springbrook area was not in the 2015 master I & I plan. This would be the last project in the Springbrook basin. Improvements in the Springbrook basin had made a significant difference in the area. There was discussion regarding the overflows in the Springbrook area and how the assumptions had changed in the master plan.

MOTION: Johnson/Corey moved to approve Resolution 2018-3442, A Resolution to authorize the City Manager to enter into a construction contract with Insituform Technologies LLC for the lining of 5,822 feet of Wastewater pipe and grouting of 114 lateral connections in the amount of $244,624.20. Motion carried (7 Yes/0 No).

There was a brief recess.

Pavement Management Phase 2: CE Hofmann gave a background on the street system in the City and the goal of maintaining this asset. The roads were given a Pavement Condition Index (PCI) rating. In 2016 the City's average PCI was 73, and the Council directed staff to maintain that PCI. She discussed what was included in pavement management, and the different funding scenarios to maintain the PCI of 73. The Transportation Utility Fee was implemented to fund about half of the needed funding. She explained how that funding would be allocated for good and poor condition streets, fee waivers, and how modifications could be done. She then discussed maintenance, pavement projects done in the last five years, and the projects to be done in the next five years. Discussion ensued on the Pavement Condition Index and the portion of the roads that would be improved within 10 years, repair/replacement options for pavement, need for more funding, and when gravel roads should be improved.

CM Hannan said a state gas tax had recently been passed and there would be serious discussions regarding City funding during the budget process. He thought they should not discount the significant projects that would be done through the TUF and other City projects. They did need $1 million more per year for pavement maintenance, but they would be making a difference with what was currently being done. Councilor Johnson said this was still just a band aid on the problem, but they would have to wait until the communications upgrade issue was resolved before they could fix the streets. Councilor McKinney said they were still losing ground, even with the TUF. He wanted the Council to get serious about making substantial headway.
CE Hofmann said staff would come back in the fall with some additional information about gravel streets, PCI and the summer projects, and projects for next year.

Mayor Andrews announced that the TVF&R annexation passed. He asked when the amended Charter would be published. City Recorder Ryan said she would be posting it to the website soon.

EXECUTIVE SESSION #2 Real Property
Start: 9:48 p.m.
Stop: 10:24 p.m.
Staff: City Manager Joe Hannan, CDD Doug Rux
Topic: Animal Shelter appraisal

ADJOURNMENT: The meeting was adjourned at 10:24 p.m.

ADOPTED by the Newberg City Council this 16th day of April, 2018.

_____
Sue Ryan, City Recorder

ATTESTED by the Mayor this 16th day of April, 2018.

_____Bob Andrews, Mayor

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018	
Order No. ___ **Ordinance No. ___** **Resolution No.** 2018-3459 **Motion ___** **Information ___**	
SUBJECT: A hardship request for water service to Tax Lot 3324AD-00600	**Contact Person (Preparer) for this Motion: Kaaren Hofmann, City Engineer** **Dept.: Public Works - Engineering** **File No.:**

HEARING TYPE: ADMINISTRATIVE

RECOMMENDATION:

Staff recommends approval of Resolution No. 2018-3459 denying the water hardship request by the Del Boca Vista for Tax Lot 3324AD-00600.

EXECUTIVE SUMMARY:

On March 9, 2018, City staff reviewed the hardship application submitted to the city by Del Boca Vista requesting to connect a vacant lot to the Sunny Acres Water Company system. The written hardship request prepared by Del Boca Vista is attached as Exhibit "A".

Chapter 13.15 of the Newberg Municipal Code (NMC) authorizes the Newberg City Council to approve hardship connections to the City's water system provided certain criteria are met. The applicant prepared written findings relative to the criteria, and those findings are attached in the request. City staff has reviewed the written findings and does not concur with the applicant that the aforementioned property meets the hardship request criteria as outlined in NMC 13.15.

- NMC 13.15.110 (A) & (B) states "Notwithstanding the provisions of this chapter relative to water service to users outside the city limits, no new or additional water connection for the purpose of providing water to a user situated outside the corporate limits of the city shall be permitted, save and except the connections as are in use or are ready for use on or before the last-mentioned date. No new water users shall be connected to group customer lines, and no new single residential users shall be connected after the last-mentioned date, it being the intention of this amendment that the city shall not serve or supply water to any additional users outside the city limits save and except those then in service or ready for service."

- NMC 13.15.120 (A)(1) states that "The new or additional water connection can be used only to supply water to an existing structure and will not be used to allow any new development."

The applicant states in their materials that their site is a vacant lot and they will be adding a new structure. This does not meet the eligibility requirement.

FISCAL IMPACT:

The applicant paid the fee associated with the hardship request.

RESOLUTION NO. 2018-3459

A RESOLUTION DENYING A HARDSHIP REQUEST FOR WATER SERVICE TO TAX LOT 3324AD-00600

RECITALS:

1. On March 9, 2018, Del Boca Vista representing Tax Lot 3324AD-00600 submitted a written request, attached as Exhibit "A", request a connection to the Sunny Acres Water District.

2. Chapter 13.15 of the Newberg Municipal Code (NMC) authorizes the Newberg City Council to approve hardship connections to the City's water system provided certain criteria are met. The applicant prepared written findings relative to the criteria, which are attached as Exhibit "A".

3. City staff has reviewed the written findings and does not concur with the applicant that the aforementioned property meets the hardship request criteria as outlined in NMC 13.15.

4. NMC 13.15.110 (A) & (B) states "Notwithstanding the provisions of this chapter relative to water service to users outside the city limits, no new or additional water connection for the purpose of providing water to a user situated outside the corporate limits of the city shall be permitted, save and except the connections as are in use or are ready for use on or before the last-mentioned date. No new water users shall be connected to group customer lines, and no new single residential users shall be connected after the last-mentioned date, it being the intention of this amendment that the city shall not serve or supply water to any additional users outside the city limits save and except those then in service or ready for service."

5. NMC 13.15.120 (A)(1) states that "The new or additional water connection can be used only to supply water to an existing structure and will not be used to allow any new development." The applicant states in their materials that their site is a vacant lot and they will be adding a new structure. This does not meet the eligibility requirement.

THE CITY OF NEWBERG RESOLVES AS FOLLOWS:

1. The City Council hereby denies the water hardship request in Exhibit "A".

- **EFFECTIVE DATE** of this resolution is the day after the adoption date, which is: April 17, 2018.

ADOPTED by the City Council of the City of Newberg, Oregon, this 16th day of April, 2018.

_____
Sue Ryan, City Recorder

ATTEST by the Mayor this 19th day of March, 2018.

_____
Bob Andrews, Mayor

Exhibit A

DEL BOCA VISTA
A LIMITED LIABILITY COMPANY

March 9, 2018

Honorable Mayor and Council
Newberg City Hall
414 E 1st St
Newberg, OR 97132

Re: Water Hardship Service Request for Tax Lot 3324AD-00600

Mayor Andrews,

We respectfully request the City Council's consideration and approval for a water service connection to Tax Lot 3324AD-00600 as permitted by Municipal Code 13.15.120 Exceptions Due to Hardships.

Attached you will find a response to the Hardship code provisions along with supporting figures and documents.

The core of our hardship request is the inability to locate a water well on the property that will not be 100 feet or more away from current or future septic drain fields as mandated by Yamhill County and State rules.

Thank you for your consideration and we look forward to discussing our request at the next available Council meeting.

Sincerely,

Daniel Danicic, PE

500 E. Hancock Street Newberg, Oregon 97132 971-706-2058

Narrative

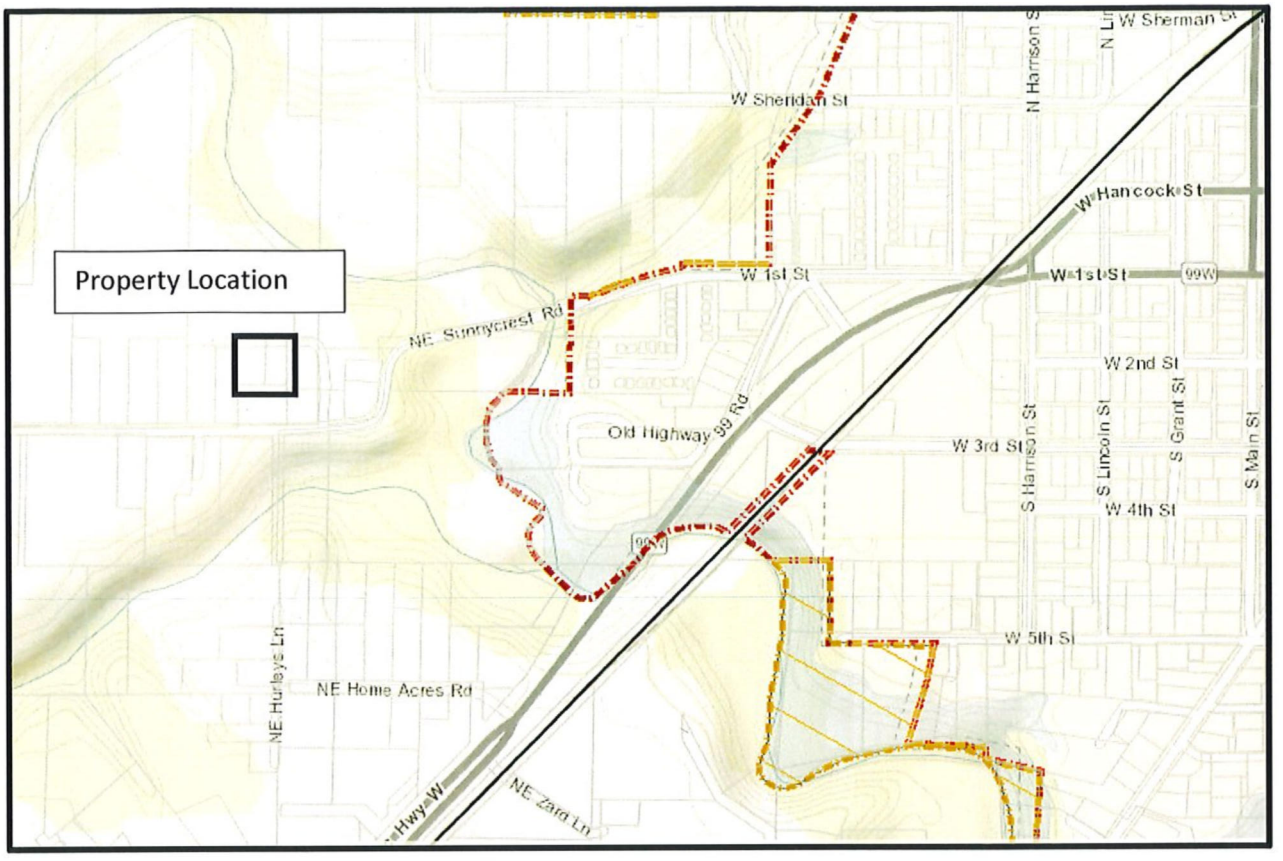
Tax lots 3324AD-00500 and 00600 are vacant properties in Yamhill County which can be developed with residential structures. See page 3 for vicinity maps. At 0.28ac and 0.34ac sizes, they are too small to accommodate a residence, well and septic system. We propose to build a residence on tax lot 00600 and its septic drain field on tax lot 00500 in an easement. This layout is shown on page 4. The site plan clearly demonstrates that this is the only layout possible.

Water wells must be 100 feet or more away from drain fields. When considering the location of the new drain field, space for future replacement and the location of existing drain field on tax lot 3324-02500, see figure on page 4, it is clear that there is no place on the lot to locate a well. For this reason, we are desire to connect to the Sunny Acres Water District (District) for water.

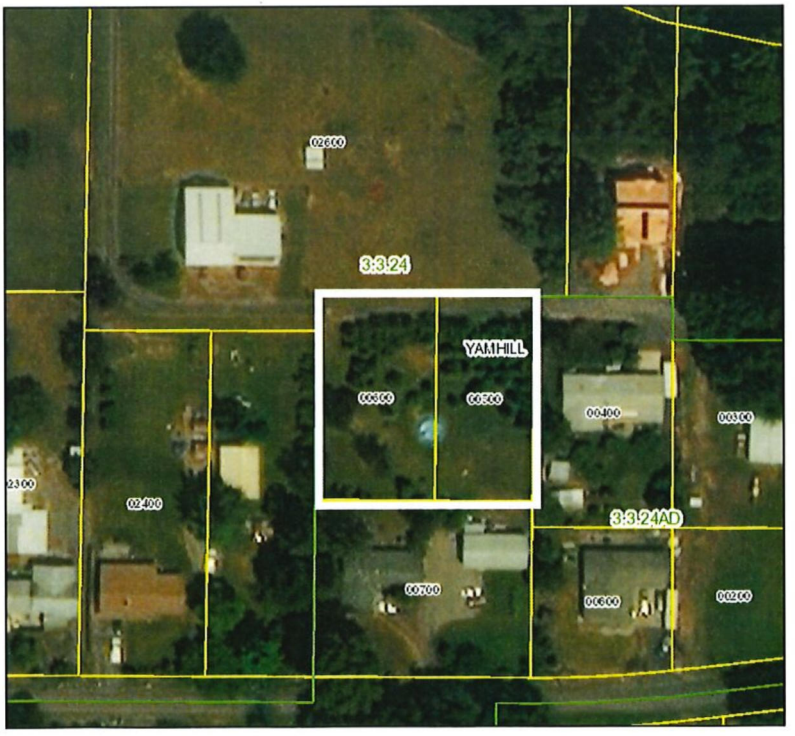
We met with District Board and received approval to connect to their water line in NE Sunnycrest Road. See page 5 for a copy of their approval letter. Our next step is to obtain approval from the City of Newberg since the District obtains their water from the City.

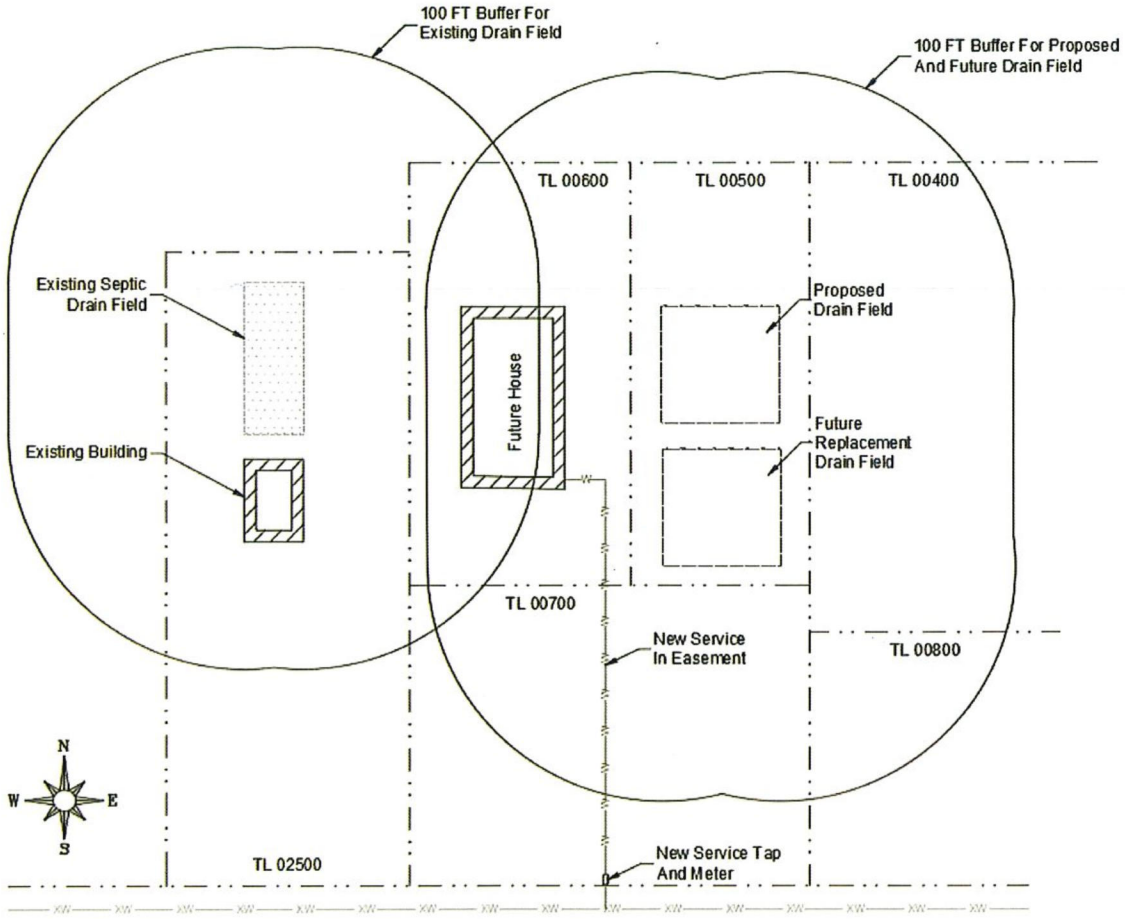
To obtain city approval we are asking the Newberg City Council to consider our request for a water connection under the provisions of Municipal Code Section 13.15.120 Exceptions Due To Hardships. Our response to the provisions of this section begin on page 6.

500 E. Hancock Street Newberg, Oregon 97132 971-706-2058



VICINITY MAP





NE Sunnycrest Rd

PROPOSED SITE LAYOUT

Sunny Acres Water Company
P.O. Box 3104
Newberg, Oregon 97132
(503)577-8510

RECEIVED FEB 01 2018

Revised Date. Due to phone conversation with Dan Danicic 1/22/18

January 26, 2018

Del Boca Vista
c/o Dan Danicic
500 E. Hancock St.
P.O. Box 3189
Newberg, Oregon 97132

Dear Mr. Danicic,

Re: Request for Water Hook-up on property @ Tax Lot # R3324AD 00600 and # R3324AD 00500 N.E. Sunnycrest Rd., Newberg, Ore.

Sunny Acres Water Company is allowing Del Boca Vista to go to the City of Newberg, with a representative from SWAC per SWAC policy, to request water connection from SWAC to Tax Lot # S3324AD 00600 and # S3324AD 00500.

SWAC would require a written acceptance from City of Newberg for hook-up on above property by **June** 10th, 2018 for review at next quarterly meeting.

Please contact Jim Cooper (503)577-8510 when meeting is scheduled with City of Newberg.

Sincerely,

Jim Cooper

Jim Cooper/ (503)577-8510 /Sunny Acres Water Company District Manager

Applicant response to Municipal Code

13.15.120 Exceptions due to hardships.

An exception to NMC 13.15.110 may be granted by the city council in cases of hardship. The following process shall be used in determining whether the exception shall be granted, and the criteria shall be strictly applied with the burden of proof upon the applicant:

A. Eligibility. The applicant must meet the following criteria:

1. The new or additional water connection can be used only to supply water to an existing structure and will not be used to allow any new development.

RESPONSE: The requested connection is to serve an existing lot of record which cannot be further divided.

2. Annexation of the property upon which the structure is located is not immediately practical.

RESPONSE: The property is not contiguous to city limits so therefore not immediately practical for annexation.

B. Hardship Determination. A request for a new or additional water connection due to hardship shall be accompanied by evidence of the following:

1. A genuine hardship exists due to quality and/or quantity of water for domestic consumption.

RESPONSE: Our hardship is the result of the inability to locate a well on the property due to the proximity of current and future septic drain fields. Refer to the proposed site layout on page 4.

2. All other alternatives have been investigated and are not economically feasible.

RESPONSE: The only other alternative to new water service is to have bottled water delivered to the site. This approach is cost prohibitive in addition to the need for a large storage tank as the typical residential water use is 3,000 gallons per month.

3. The dwelling to be served is in close proximity of existing services, either private or public, and the granting of the additional connection would not overburden existing lines, either private or public, or overburden the city's water supply.

RESPONSE: Adjacent properties currently benefit from connection to the Sunny Acres Water District which receives water from the City of Newberg. The 2017 Water Master Plan includes all areas within the city limits and UGB. All customers of existing small water districts supplied by the City are also included in the Master Plan analysis. The existing and future service area boundaries

are illustrated on Figure 1-1 of the Master Plan. This figure clearly identifies the property of this water connection request as part of the existing service area (See Figure on page 8 below). The Master Plan does not report that this creates a burden to the city's water supply.

C. Application for Hardship. A request in letter form for a hardship exception to NMC 13.15.110 shall be made to the city council. The request shall be accompanied by a statement and evidence to be used in the determination. The request shall be reviewed and a recommendation made to the city council by the public works department prior to the city council's consideration of the matter. A granting of the request for an exception can be made by the city council; provided, that all the conditions stated in subsection (B) of this section do exist.

RESPONSE: A letter request has been submitted.

D. Conditions of Hardship. Any exception granted shall be subject to the following conditions:

1. The owner of the property shall agree to pay the full cost of extending services to the parcel with all services meeting city standards and including all water connection fees and water system development charges.

2. The owner of the subject property agrees to annex to the city at such time as annexation is legally possible and is requested by the city. At the time of annexation, the property owner shall pay all system development charges then in effect, except wastewater, which shall be assessed in accordance with Chapter 13.10 NMC.

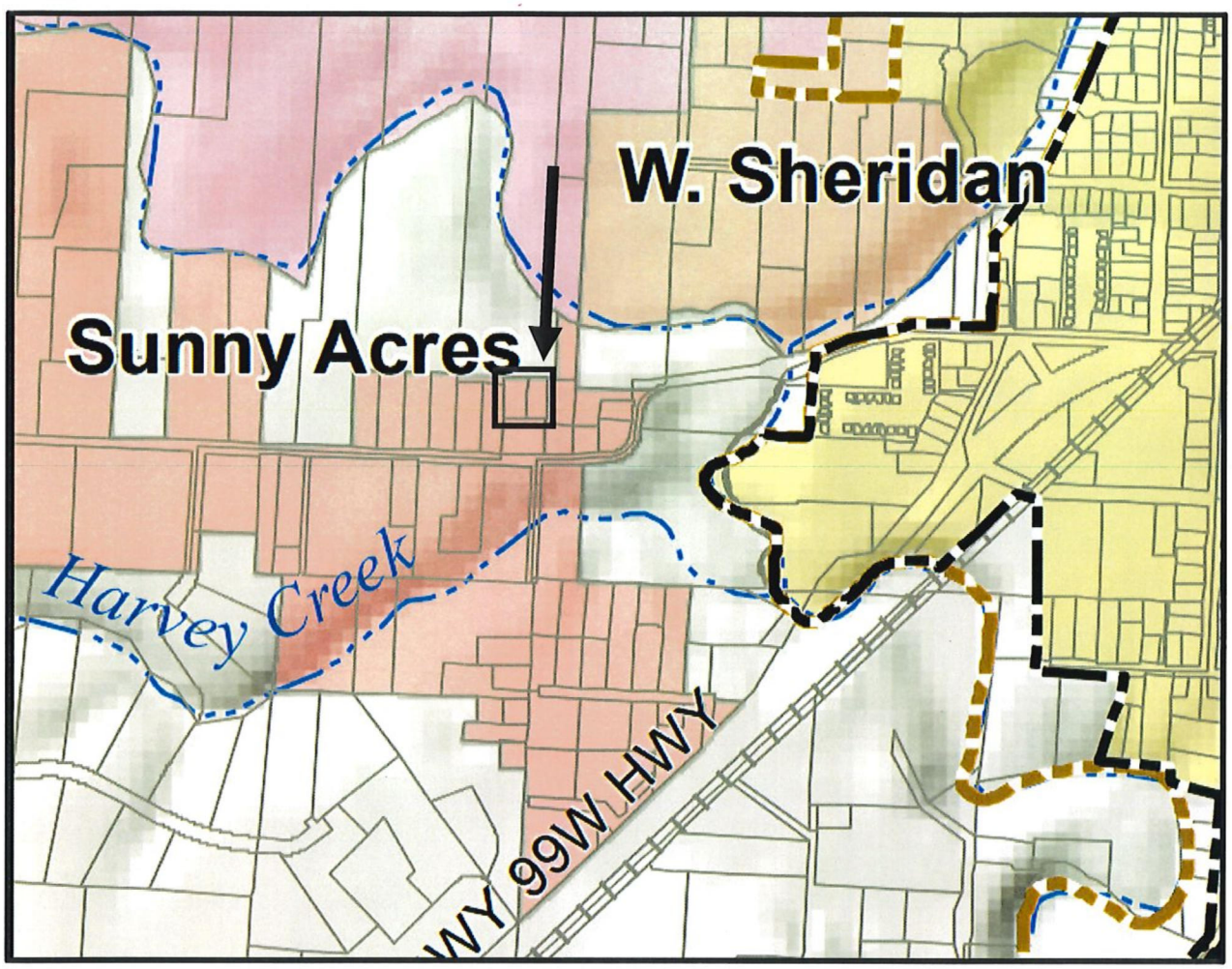
3. Water shall be for domestic purposes only and no water granted under this exception shall be permitted for agricultural use.

4. A written agreement as to the conditions under which the exception was granted shall be recorded on the Yamhill County deed records with the applicant paying all fees.

RESPONSE TO SECTIONS 1 THRU 4: The owner agrees to abide by each of the conditions listed above.

5. The city council may waive all or any portion of the city system development charges as it feels is in the best interest of the city.

RESPONSE: No request to waive fees is being requested by the owner.



Portion of Figure 1-1 of 2017 Water Master Plan

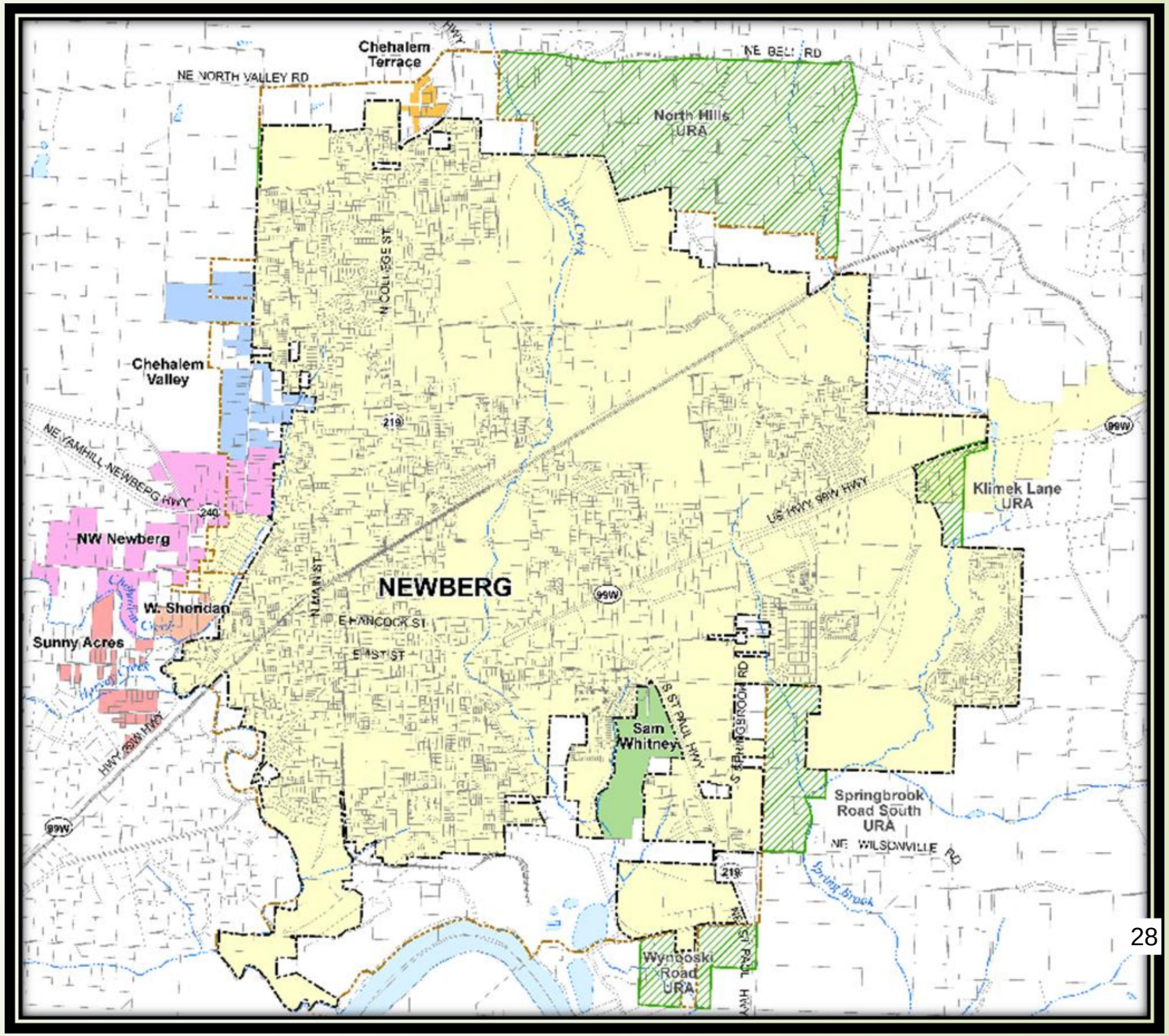
500 E. Hancock Street Newberg, Oregon 97132 971-706-2058
N:\Yamhill Co\Sunnycrest Road TL 500\Development\1 - Entitlements\Water Hardship\Letter to City Council V2.docx

GROUP WATER CONNECTIONS

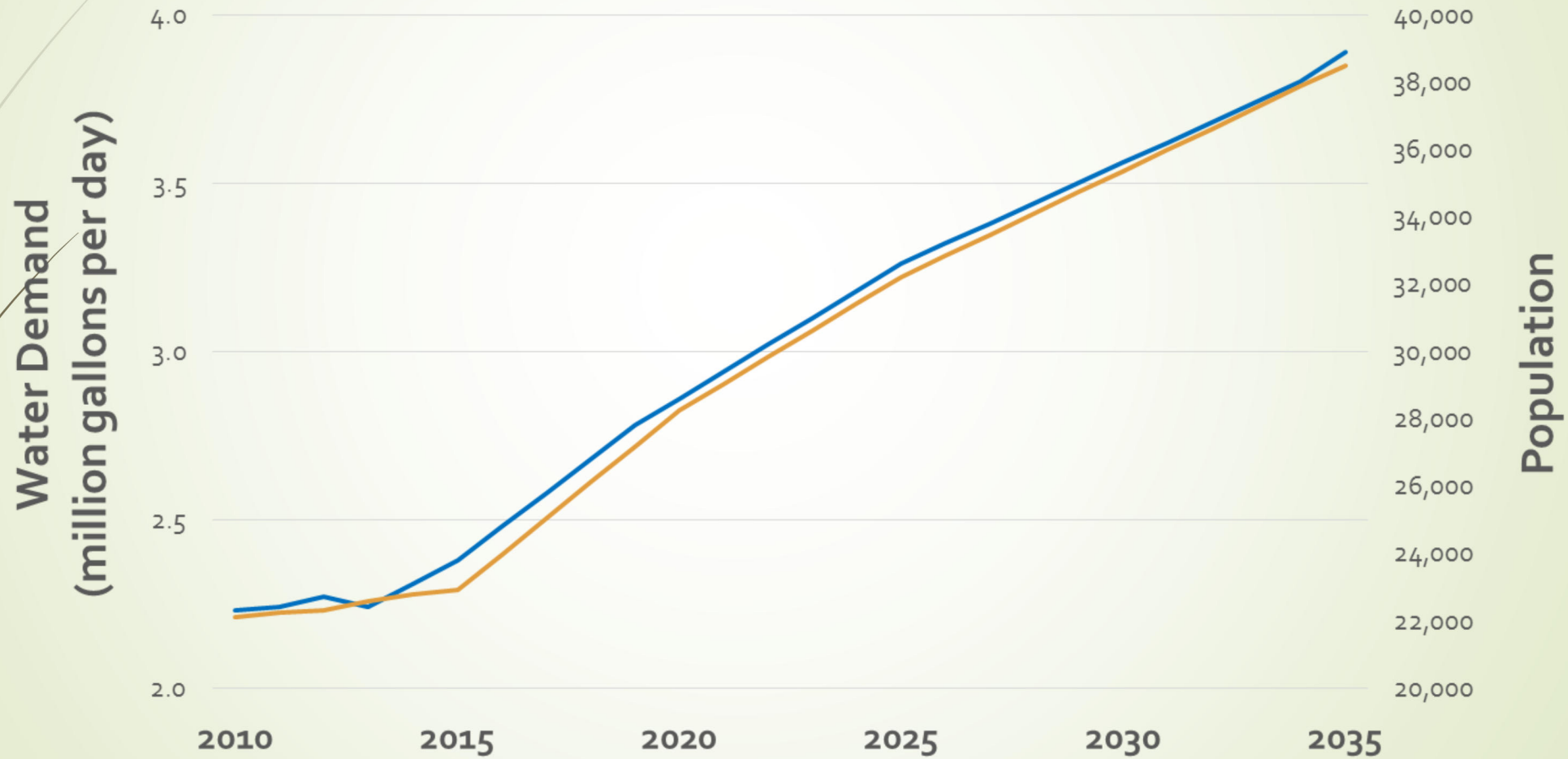
CITY COUNCIL WORK SESSION

MAY 16, 2016

WATER SERVICE AREA



Water Demand



History/Policy

- Ord. 1398 (May, 1965)
- Intention of the City is to not supply water to any additional users outside the City limits
- After December 1, 1965 there will be no new or additional water connections allowed to either individuals or as an additional connection to a group customer line
- Group Customers were to provide a sworn statement of the list of connections to the group system by July 1, 1965
- Property must have been ready for use by that December 1 date

History (cont.)

- Ord. 1912 (July, 1978)
- Maintains City's intent not to service properties outside the City
- Provides an Exception due to Hardships
- Creates criteria to prove a hardship and a process for the City Council to grant a hardship exception
- May connect as an individual or as an additional connection to a private group customer line
- Hardship comes with conditions under which exception was granted to be recorded against the property

History (cont.)

- September 20, 1988
- Presentation at the Council meeting indicates that the City has discovered several illegal connections in the water districts served by the City
- The Council through its goal setting process asked staff to review the existing water policy
- There was some interest in selling excess water to out of City residents
- Staff recommended policy change to the following:
  1. No hardship required for existing residences
  2. Residence must exist as of January 1, 1988
  3. Residence be in UGB or existing water district
  4. Properties agree to annex
  5. Water for domestic purpose only
  6. Water district make joint application with property owner and new agreement between water district and City be established
  7. Water district submit engineering study showing compliance with State Regulations

History (cont.)

- September 20, 1988 (cont.)
- A Councilor asked that the policy include not only existing residences, but any property that is abutting and can be subdivided and that there be a six month window to decide whether to hook up to system
- The remaining Council expressed concern that this would encourage development outside the City
- The City Attorney was directed to prepare an ordinance regarding water policy for Council consideration

History (cont.)

- October 3, 1988
- Council adopts an Interim Policy until an Ordinance can be fully vetted and revised
- Ord. 88-2247
- Applies to water districts/group customers only
- Requires residence to be in existence January 1, 1988
- District makes joint application and enter into agreement with City
- Expressly preempts Hardship provisions for those connecting to group customer lines
- Requires a 6 month Council review on policy

History (cont.)

- June 20, 1989
- Back before Council
- City Manager states that one request to connect during the grace period provided by Ord. 88-2247
- City Attorney reports that the City has not entered into any agreements with water districts and the City has not gone out and solicited agreements with the water districts due to personnel changes and other priorities
- Ord. 89-2264, slightly modifies 2247 to accommodate the single request by allowing request for service by January 1, 1988 or residence in existence by that date
- Maintains language that expressly preempts Hardship process for those connecting to group customer lines

Land Use

- Newberg Comprehensive Plan
  - Public Facilities and Services, Goal: To Plan and develop a timely, orderly and efficient arrangement of public facilities and service to serve as a framework for urban development
  - Policies: 2.d. – Sewer and water service shall not be provided outside the city limits except for cases of health hazards, where no other alternative exists, and where property owners agree to annex upon request of the City
  - Urbanization, Goals: 1. To provide for the orderly and efficient transition from rural to urban land uses
  - Policies: 1.a. The conversion of lands from rural to urban uses within the Urban Growth Boundary will be based on a specific plan for the extension of urban services

Land Use (cont.)

- Newberg Comprehensive Plan
  - Policies: 1.e. The City will support development within areas outside of the City limits but within the Newberg Urban Growth Boundary or Urban Reserve Area based on the following standards or restrictions:
  - Residential development will be allowed on the basis of one house per 10 acres, or any lot of record created prior to January 1, 1989
  - … The following strategies will be used to ensure that interim rural development does not inhibit long-term urbanization of lands within the Newberg UGB and Urban Reserve area (these include but are not limited to): 1) shadow plats, 2) cluster development, 3) redevelopment plans, 4) non-remonstrance agreements for annexation and provision of urban facilities

Land Use (cont.)

- Comprehensive Plan
  - III. Plan Classifications, 2. Residential Land Use, a. Low Density Residential (LDR) – The objective of this designation is to provide a wide range of housing types and styles, while allowing for an overall density of up to 4.4 units per acre
  - b. High Density Residential (HDR) – The objective of this designation is to provide multi-family housing of different types while maintaining an overall density of up to 21.8 units to the acre

Land Use (cont.)

- Newberg Urban Area Growth Management Agreement
  - V. Urban Services, d. Service Expansion Plans – City to share updated utility plans for services within UGB with Yamhill County

- Comprehensive Plan Designations:
  - 1208 NE Chehalem Drive – HDR
  - 1650 NE Chehalem Drive – LDR

Current Status

- There are seven known water associations/districts served by meters
- The number of current accounts served by the water associations/districts is unknown
- Number or properties connected to group customer lines is also unknown
- Number of connections since 1989 is unknown
- The City has not entered into a single agreement with ANY group customer or district
- There are 81 private customers (not associations/districts) served by the City outside of the City limits
- The hardships that that have been granted by the Council have not been reviewed to determine if any of the conditions have been triggered

Current Issues

- 1208 NE Chehalem Drive
  - NW Newberg Water Association
  - Currently undeveloped – wants to add an additional water services to serve a new structure
  - Would like a water connection
  - Hardship criteria not applicable
  - WOULD NOT QUALIFY AS HARDSHIP

Vicinity of 1208 NE Chehalem Dr

Current Issues

- 1650 NE Chehalem Drive
  - Chehalem Valley Water Association
  - Has a house (built after 1988)
  - Existing well is going dry– the property owners have exhausted all measures to rehabilitate the well
  - Has requested a hardship to connect to a group line – MEETS THE INTENT OF HARDSHIP
  - HARDSHIP CRITERIA NOT APPLICABLE

Vicinity of 1650 NE Chehalem Dr

WHERE DO WE GO FROM HERE?

- The Council should not entertain hardship requests to group customer lines per the Code.

- We need additional information from the current status list in order to develop a recommendation on the policy direction.

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order No. __	**Ordinance No. __**	**Resolution No. XX 2018-3457**	**Motion __**	**Information ___**
SUBJECT: A Resolution amending policies and procedures for administration of the City of Newberg's Affordable Housing Trust Fund to add non-voting advisory member(s) and repealing resolution no. 2016-3306			**Contact Person (Preparer) for this Motion: Doug Rux, Director Dept.: Community Development File No.:**	

RECOMMENDATION:

Adopt Resolution No. 2018-3457, amending Policies and Procedures for Administration of the City of Newberg's Affordable Housing Trust Fund and repealing Resolution No. 2016-3306.

EXECUTIVE SUMMARY:

On March 12, 2012 the Newberg City Council passed Ordinance No. 2012-2749 amending the Newberg Municipal Code (NMC), adding a new section establishing a Newberg Affordable Housing Trust Fund. NMC 3.35.050 Establishment of Policies and Procedures outlines the administrative procedures associated with the Newberg Affordable Housing Trust Fund (NAHTF) are established per city resolution. On April 16, 2012 the Newberg City Council adopted Resolution No. 2012-2988 establishing policies and procedures for administration of the NAHTF. On June 15, 2015, the Newberg City Council repealed Resolution No. 2012-2988 and adopted Resolution No. 2015-3202 amending the Policies and Procedures for Administration of the NAHTF. On August 17, 2015 the Newberg City Council repealed Resolution No. 2012-3202 and adopted Resolution No. 2015-3211 amending the Policies and Procedures for Administration of the NAHTF. On August 15, 2016 the Newberg City Council repealed Resolution No. 2015-3211 and adopted Resolution No. 2016-3306 amending the Policies and Procedures for Administration of the NAHTF.

The Newberg Affordable Housing Commission (NAHC) met on February 20, 2018 and discussed creating a non-voting, advisory position as part of the five voting member NAHC to provide more diversity to the discussion of affordable housing issues in Newberg. Staff was directed to bring a proposal on the amendment to the City Council for consideration. After discussion, staff is recommending changing the policy to add up to three non-voting, advisory members to the commission. The proposed language change is noted below in underline text:

5.7 The City of Newberg shall form an Affordable Housing Commission (AHC) that consists of five members and up to three non-voting, advisory members, appointed by the Mayor with the consent of the city council. The non-voting members shall not be counted to determine the existence of a quorum, shall not vote, but shall otherwise have the ability to participate as members of the commission. Membership of the commission should reflect representative broad interests regarding affordable housing in the community. The commission shall review applications for Newberg Affordable Housing Trust Funds to determine project eligibility and evaluate the applications based on the selection criteria. The commission shall provide recommendations to the city council who shall make final award decisions. In addition, the commission shall meet annually to prepare the

NAHTF's annual NOFA and RFP for consideration of approval by the city council. Otherwise, the commission will meet as necessary during the year.

Resolution No. 2018-3457 incorporates the recommended amendment to Section 5.7.

FISCAL IMPACT:

No fiscal impact is anticipated by the proposed change.

STRATEGIC ASSESSMENT (RELATE TO COUNCIL PRIORITIES FROM SEPTEMBER 2017):

Goal 8: Encourage Affordable Housing. The Affordable Housing Trust Fund is part of the City of Newberg's program to address housing affordability in Newberg. Amending the Policies and Procedures for Administration of the NAHTF will add an additional non-voting member to the NAHC expanding the views and depth of knowledge of the members in discussing and recommending activities for program implementation and expenditures of NAHTF funds.

ATTACHMENTS:
Resolution No. 2018-3457

RESOLUTION NO. 2018-3457

A RESOLUTION AMENDING POLICIES AND PROCEDURES FOR ADMINISTRATION OF THE CITY OF NEWBERG'S AFFORDABLE HOUSING TRUST FUND TO ADD NON-VOTING ADVISORY MEMBER(S) AND REPEALING RESOLUTION NO. 2016-3306

RECITALS:

1. On May 4, 2009, the Newberg City Council adopted Resolution No. 2009-2843 accepting the Newberg Affordable Housing Action Plan.

2. On February 23, 2011, the Newberg Affordable Housing Action Committee recommended that the Newberg City Council adopt an affordable housing trust fund and adopt policies and procedures for administration of the fund.

3. On March 15, 2012, the Newberg City Council passed Ordinance No. 2012-2749 establishing the Newberg Affordable Housing Trust Fund, to keep our community diverse and healthy by facilitating the production and preservation of affordable housing throughout Newberg.

4. On April 16, 2012, the Newberg City Council adopted Resolution No. 2012-2988 establishing Policies and Procedures for Administration of the Newberg Affordable Housing Trust Fund.

5. On June 15, 2015, the Newberg City Council repealed Resolution No. 2012-2988 and adopted Resolution No. 2015-3202 amending adopted Policies and Procedures for Administration of the Newberg Affordable Housing Trust Fund.

6. On August 17, 2015 the Newberg City Council repealed Resolution No. 2015-3202 and adopted Resolution No. 2015-3211 amending adopted Policies and Procedures for Administration of the Newberg Affordable Housing Trust Fund.

7. On August 15, 2016 the Newberg City Council repealed Resolution No. 2015-3211 and adopted Resolution No. 2016-3306 amending adopted Policies and Procedures for Administration of the Newberg Affordable Housing Trust Fund.

8. The Newberg Affordable Housing Commission (NAHC) met on February 20, 2018 and discussed amending the Policies and Procedures for Administration of the Newberg Affordable Housing Trust Fund to add a non-voting, advisory position to the five member NAHC structure and directed staff to prepare a proposal to the City Council for consideration. Staff proposes changes that will allow up to three non-voting, advisory positions to the NAHC.

THE CITY OF NEWBERG RESOLVES AS FOLLOWS:

1. Resolution No 2016-3306 is repealed.

2. The following Policies and Procedures for Administration of the Newberg Affordable Housing Trust Fund are adopted:

SECTION 1. Purpose

1.1 The purpose of the Newberg Affordable Housing Trust Fund (NAHTF) is to support the development, preservation, and rehabilitation of housing that is affordable to the citizens of Newberg with incomes that do not exceed 80% of the area median income. The NAHTF will have a dedicated source of revenue to provide ongoing funding for housing projects or programs that address the housing needs of these Newberg residents. The primary purpose of the NAHTF is to encourage the development, preservation, and rehabilitation of housing for homeownership or rent, at a cost that will enable very low, low and moderate-income families to afford quality housing while paying no more than thirty percent of gross household income on housing.

1.2 To promote the rehabilitation, preservation and production of quality, well-designed rental and ownership housing, the NAHTF will award funds to community development partners that are furthering the NAHTF mission. It is expected that the local contributions made through Newberg's Affordable Housing Trust Fund will maximize the leveraging of state and federal funds, as well as encourage private sector investment in affordable housing.

1.3 Understanding the high cost of housing regionally, it is evident that very low, low, and moderate - income households are not being served by the housing market. To address the disparity between the cost of housing and the means of resident household to afford housing, the Newberg Affordable Housing Trust Fund aims to provide direct financial support to projects that retain or increase the supply of needed housing for households earning less than 80% the area median income, which is to be defined through income limits established by the U.S. Department of Housing and Urban Development for Yamhill County, Oregon.

1.4 The administrative procedures associated with the Newberg Affordable Housing Trust Fund, including fund administration, determination of eligible applicants, eligible uses and activities, award preferences, eligibility criteria, award process, and selection criteria are hereby established.

SECTION 2. Eligible Applicants

2.1 The Newberg Affordable Housing Trust Fund is structured to ensure that many different types of organizations and persons are eligible to receive funds.

2.2 Eligible applicants include governmental subdivisions, community development corporations, local housing authorities, community action agencies, community-based or neighborhood-based non-profit housing organizations, other non-profit organizations, for-profit entities and private employers, and private landlords.

SECTION 3. Eligible Uses and Activities

3.1 Newberg Affordable Housing Trust Funds shall support the creation or preservation of housing that is affordable to households with incomes that do not exceed 80% of the area median income, as

established by the most current U.S. Department of Housing and Urban Development for Yamhill County, Oregon, as determined by the Community Development Director.

3.2 Newberg Affordable Housing Trust Funds will be limited to those activities that create, preserve or acquire housing within the Newberg city limits.

3.3 Housing developments financed by the NAHTF which receive subsidy, financing, tax credits or other assistance under a State or Federal housing programs, may contain market rate units insofar as permissible under those programs and/or to the extent that they are necessary to support the creation of and/or ongoing sustainability of the affordable housing units in the development. However, Newberg Affordable Housing Trust Funds may not be used to support such market rate units.

3.4 Affordable housing units developed utilizing subsidy from the Newberg Affordable Housing Trust Fund shall comply with the income and housing cost limits established by Newberg Municipal Code Section 15.242.030, as amended, and as restricted by a contract prepared by the City of Newberg. The city council reserves the right to make exceptions to the standards established by Newberg Municipal Code Section 15.242.030 for proposed projects it wishes to support and deems further the provision of affordable housing within the community.

3.5 The Newberg Affordable Housing Trust Funds can be provided as either a grant or a loan depending on the project or program receiving funding. To retain a significant degree of flexibility, the eligible uses have a broad application including the following:

3.5.a **Acquisition and construction of new affordable housing.** Eligible acquisition and construction costs include reasonable costs associated with building or land purchase, including but not limited to:

- Purchase price
- Option costs
- Financing fees including but not limited to the recording of trust deeds and promissory notes, title searches, and other third party costs related to securing the loan.
- Appraisal costs
- Closing costs
- Inspection fees
- Title insurance
- Relocation costs
- Architectural/engineering fees
- Permit fees
- System development charges
- Construction costs

3.5.b **Conservation** of energy through the use of "green" technologies provided that the benefits of the energy savings is passed on in the form of reduced costs to the qualified occupants of the affordable housing.

3.5.c **Land banking** to include the purchase of land to be dedicated toward the development of affordable housing in the near or long-term.

3.5.d **Predevelopment activities** undertaken by a community development organization in support of the development of affordable housing including planning, architectural services, engineering services, landscape design, legal services, surveys, appraisals, site clearance and demolition, environmental clearance, permit application fees and system development charges. Grant funding for these types of activities may be required to convert to a loan if the project receives full funding. For-profit developers are not eligible to apply for Newberg's Affordable Housing Trust Funds to assist with predevelopment costs.

3.5.e **Bridge loans** to assist in development of affordable housing (for rental or owner occupancy). Bridge loans are intended to provide funding to permit housing projects to proceed in advance of the availability of permanent project funding. Bridge loan funding is available for acquisition or construction activities.

3.5.f **Capacity building** for non-profit affordable housing providers in the form of direct grant awards to fund administration of an affordable housing project or program.

3.5.g **Rehabilitation and emergency repairs** as part of an established program to secure units as affordable or to provide direct benefits to existing very low to moderate income households.

Eligible rehabilitation and emergency repair costs include but are not limited to:

- Architectural/engineering fees
- Consultations
- Construction costs
- Relocation costs
- Financing fees including but not limited to the recording of trust deeds and promissory notes, title searches, and other third party costs related to securing the loan.
- Hazardous materials abatement including lead based paint noticing consistent with the Federal Lead Safe Housing Regulations HUD requirements at 24 CFR §35

3.5.h **Direct benefits** to very low to moderate income households through an established program including down payment assistance, rental assistance, mortgage foreclosure prevention, emergency housing vouchers, homeownership training, renter education, or other programs intended to increase housing opportunities for Newberg's low to moderate income residents.

3.5.i **Transitional and emergency housing** for homeless individuals and families through an established program to move people toward self-sufficiency.

3.5.j **Educational programs and services** for potential home owners and renters.

3.5.k **Other uses as deemed appropriate** by the Newberg City Council as supporting the development or preservation of affordable housing within the City of Newberg.

3.5.l. **Manufactured home rehabilitation and repair** as part of an established program to secure units as affordable or to provide direct benefits to existing very low to moderate income households.

////

Eligible rehabilitation and emergency repair costs include but are not limited to:

- Architectural/engineering fees
- Consultations
- Construction costs
- Relocation costs
- Financing fees including but not limited to the recording of trust deeds and promissory notes, title searches, and other third party costs related to securing the loan.
- Hazardous materials abatement including lead based paint noticing consistent with the Federal Lead Safe Housing Regulations HUD requirements at 24 CFR §35

SECTION 4. Program Goals

4.1 To help maintain the effectiveness and long-term viability of the NAHTF, preference will be given to the provision of loans over grants. General criteria of project selection are found in Section 8 of this resolution. In no particular order, the following preferences are provided as general guidance for future applicants for Newberg Affordable Housing Trust Funds.

4.1.a Developments that produce new affordable housing units. New affordable housing units shall include housing units constructed where none had existed previously, abandoned or fire-damaged residential units to be returned to residential use, and non-residential or mixed-use projects in non-residentially-zoned property. Any designated new affordable housing units shall be secured as affordable for future use through the recording of an appropriate legal instrument approved by the city attorney.

4.1.b Developments that provide new affordability. New affordability refers to existing housing where a new level of affordability is provided that does not currently exist. This could occur in rental or ownership housing where the number of affordable units is increased, where a portion of existing units will be made affordable to households at income levels substantially lower than the units previously served, or where the term of affordability on the units will be extended for a period of at least twenty-five (25) years.

4.1.c Developments that improve the energy efficiency and safety of existing affordable housing stock while maintaining affordability of the units.

4.1.d Developments of housing utilizing the land trust model to secure property and perpetual affordability.

4.1.e Developments that include joint ventures between multiple non-profit developers and/or for profit developers, working in partnership, to complete an affordable housing project.

4.1.f Developments that include a joint venture between service providers and non-profit affordable housing developers to create projects that contain additional benefits to low income individuals in the development of the project, or additional services for the resident upon completion.

4.1.g Developments that incorporate the use of "green" building materials, use of energy-efficient appliances, low-water use landscaping, and reduced storm water runoff. In addition, developments that incorporate building design and operational factors that minimize energy use and resource consumption as well as avoid indoor health impact.

4.1.h Developments that include affordable units for the disabled and the homeless.

4.1.i Projects that propose long-term affordability.

4.1.j Projects that are sponsored by non-profit organizations.

4.1.k Projects that use private funding sources and State funding sources to leverage the least amount of Newberg's Affordable Housing Trust Funds.

SECTION 5. Fund Administration

The Newberg Affordable Housing Trust Fund (NAHTF) originated through the direction of the Newberg City Council.

5.1 The City of Newberg acts as fiduciary agent and administrator of the funds. The city reserves the right to contract certain tasks to most effectively and efficiently achieve its administrative duties.

5.2 Funds dedicated to the Newberg Affordable Housing Trust Fund shall be exclusively reserved to support the eligible uses activities identified in Section 3, and shall not be used for the general operation of the city.

5.3 The City of Newberg shall accept requests for funding from the NAHTF's Time Sensitive Loan Program from eligible applicants at any time in order to accommodate affordable housing project opportunities that are time sensitive. Coordination with other private and government funding application timelines will help ensure that NAHTF funds are best applied to leverage additional resources in support of the housing projects. Project submittals deemed not time-sensitive will not be approved, but the applicant will be encouraged to submit their proposal to the annual request for proposals (RFP) funding process under the NAHTF' s Competitive Awards Program. Also, eligible applicants may submit proposals to the NAHTF's Rental Rehabilitation Loan Program at any time.

5.4 The City of Newberg shall annually issue a notice of funding available (NOFA) to announce the availability of funds. The City shall also issue a request for proposals (RFP) for affordable housing projects that are not time sensitive.

5.5 As a target in any given year, up to 60 percent of the NAHTF will be available for project loans and up to 25 percent will be available for project grants. The remaining 15 percent of the NAHTF will be available for project contingencies through grants and/or loans.

5.6 In any given year, at least 50% of the available funds within the NAHTF shall be available for use through the competitive awards program. In any given year, the city council may make an exception to this standard to take advantage of affordable housing opportunities.

5.7 The City of Newberg shall form an Affordable Housing Commission (AHC) that consists of five members and up to three non-voting, advisory members, appointed by the Mayor with the consent of the city council. The non-voting members shall not be counted to determine the existence of a quorum, shall not vote, but shall otherwise have the ability to participate as members of the commission. Membership of the commission should reflect representative broad interests regarding affordable housing in the community. The commission shall review applications for Newberg Affordable Housing Trust Funds to determine project eligibility and evaluate the applications based on the selection criteria. The commission shall provide recommendations to the city council who shall make final award decisions. In addition, the commission shall meet annually to prepare the NAHTF's annual NOFA and RFP for consideration of approval by the city council. Otherwise, the commission will meet as necessary during the year.

5.8 Newberg Affordable Housing Trust Funds will be allocated in a manner consistent with the threshold criteria provided Section 8, and consistent with state and local public contracting law.

5.9 Grant monies received into the NAHTF will have five percent of those monies reserved for administration.

SECTION 6. Match Requirements

6.1 The Newberg Affordable Housing Trust Fund is intended to support the development of needed housing. In addition, the City of Newberg believes that projects can become stronger and more successful through the partnership of many organizations. Therefore, the following match requirements apply to projects utilizing grants from the NAHTF.

6.1.a The Newberg Affordable Housing Trust Fund grant contribution shall not exceed 50% of the total project or program cost. Required match can be met utilizing government funding, direct contribution from the applicant, private donations, and the contribution of land, materials or labor to the project.

6.1.b In the case that land previously owned by the applicant is considered as required match, the value of the land shall be determined by a city approved certified appraisal completed by the applicant or real market value from the Yamhill County assessor office provided by the applicant, unless otherwise directed in Oregon Revised Statute or Newberg Municipal Code.

6.1.c The valuation of land, and available equity to be considered as matching funds, shall be verified by the city prior to the disbursement of an NAHTF grant when its value is considered as required matching funds.

6.1.d Donated materials and labor, which are proposed as required match through the development of a project shall have their value estimated at the time of application. The actual value of these contributions is subject to verification by the city at completion of the project.

6.1.e Award recipients shall provide verifiable accounting for donated labor and materials, when such was necessary to satisfy the NAHTF match requirements.

6.1.f If a recipient of an NAHTF grant has been deemed by the city to have failed to have fulfilled all the necessary grant award match requirements, the city may require a full or partial repayment of any NAHTF grants awarded to a project.

6.2 Approved loans provided by the NAHTF may cover up to 80% of a project's costs. Required match can be met utilizing government funding, direct contribution from the applicant, private donations, and the contribution of land, materials or labor to the project.

SECTION 7. Allocation of Funds

The Newberg Affordable Housing Trust Fund is structured to allow flexibility for the city and housing providers. The establishment of four distinct and separate award processes is intended to provide for both consistency and flexibility of the NAHTF program. Annually, the city shall issue a notice of funding availability (NOFA), announcing the availability of funds in the following year and the types of programs. The city shall issue the NOFA for the year through publication in the Newberg Graphic and on the city's website. The NOFA shall be issued on or near July 1st of the year.

First, there is the competitive awards program. Annually, the city will issue a request for proposals for affordable housing projects of a non-time sensitive nature. Proposals awarded funding through the RFP process shall be done through a competitive basis. Loans and/or grants may be awarded through this program.

Second, there is the time sensitive program. Through this program, applicants requesting funding from the NAHTF may submit requests at any time in the year to accommodate affordable housing project opportunities that are time sensitive. Coordination with other private and government funding application timelines will help ensure that NAHTF funds are best applied to leverage additional resources in support of the housing projects. Loans and/or grants may be awarded through this program.

Third, there is the rehabilitation program. This program is intended to assist private property owners with rental rehabilitation projects or homeowners with rehabilitation projects. Applications for this program may be submitted at any time and need not be considered under the competitive awards program. Applicants seeking funding assistance must be willing to enter into a contractual agreement with the city that will ensure the future affordability of the project units for a specific period of time. Only loans will be awarded through this program.

Fourth, there is the manufactured home rehabilitation and repair grant program. This program is intended to grant NAHTF monies to local non-profit organizations so they can rehabilitate and repair dwellings and make them safe and decent for rental or ownership by low or very low income families. Applications for this program may be submitted at any time and need not be considered under the competitive awards program. Applicants seeking funding assistance must be willing to enter into a grant agreement with the city.

The distribution of any and all NAHTF funds through competitive or non-competitive awards, as described in Sections 7.1 through 7.3, will be in accordance with state and local public contracting laws.

7.1 Competitive Awards Program

The City of Newberg has a limited amount of Newberg Affordable Housing Trust Funds to use each year in comparison to the scope of the housing needs within the community. As a result, it is essential that the funds

are used to meet the city's priorities in an efficient and cost-effective manner. To this end, a competitive award process uses a set of award criteria to evaluate proposals received through a request for proposals (RFP) process in terms of how they address the specific priorities outlined in the annual RFP.

The steps for making the competitive grant awards or loans are outlined below.

7.1.a The City of Newberg may issue an RFP Request for proposals on an annual basis depending on availability of funds, providing applicants with a minimum of 45 days to respond to the request. The RFP shall be issued on or near July 1st of the year.

7.1.b City staff shall assess the project proposals to determine if the eligibility criteria are met and shall develop a recommendation to provide to the Newberg Affordable Housing Commission and the city council.

7.1.c The Newberg Affordable Housing Commission will provide applicants the opportunity to make a presentation on their project proposal and provide community members the opportunity to comment by holding a public meeting.

7.1.d The Newberg Affordable Housing Commission will develop an award recommendation to the city council using the NAHTF criteria to determine which projects best meet the city's spending priorities. Each application will be rated on a numeric scale as established in the annual RFP for each criterion of selection (Section 8).

7.1.e The Newberg city council shall make a final decision on the award of Newberg Affordable Housing Trust Funds.

7.1.f The City of Newberg shall prepare an agreement between the city and the award recipient. The agreement shall outline the conditions of award and shall be executed prior to the disbursement of any Newberg Affordable Housing Trust Funds.

7.1.g An award granted to an applicant may be rescinded by the city if the applicant does not initiate the activities identified in response to the RFP in advance of the City's issuance of another RFP.

7.2 Time Sensitive Loan or Grant Program

The City of Newberg recognizes that the nature of affordable housing development is often opportunity driven and time sensitive. Through this program, applications may be submitted at any time during a given year. When applications are received, the city shall review them to determine if the applications meet the city's threshold criteria. If the criteria are met, then the funds may be awarded to, or reserved for, the applicant. Funds available through this process are awarded on a first come, first served basis.

7.2.a Project Eligibility. Projects are eligible to utilize funds for activities listed in Section 3.

7.2.b Project Security. Applicant must demonstrate and commit sufficient collateral to ensure the security of the loan. Security shall be demonstrated based upon an 80% loan to value ratio based upon the most current County Assessor records, unless otherwise recommended by the

NAHC and approved by the City Council. Loans shall be secured via recording of a Trust Deed and Promissory Note against the property.

7.2.c Loan Terms.

(1) Loan amounts will be determined by the proposed project need and amount available within the NAHTF.
(2) The standard interest rate is two percent (2%) below the prime rate.
(3) The standard term of the loan is two years.
(4) The applicant shall pay a loan processing fee equal to one percent (1%) of the loan or $100.00, whichever is greater.
(5) Standard loan terms may be modified by approval of the City Council.
(6) The applicant shall enter into an agreement guaranteeing the dwellings will only be occupied by families or individuals meeting the income guidelines.
(7) The applicant will be required to pay for all financing fees including but not limited to recording of trust deeds and promissory notes, title searches, and other third party costs related to securing the loan.

7.2.d Process.

(1) The city manager shall appoint a loan officer to process loan applications.
(2) The loan officer will prepare application specifications.
(3) The loan officer will review applications for eligibility, and qualify applicants as either standard or preferred applicants. The loan officer may establish a priority for awarding of qualified loans.
(4) Prior to awarding any loan, the application will be forwarded to the Newberg Affordable Housing Commission for consideration of recommendation for approval by the Newberg city council.
(5) The loan officer shall prepare the necessary documents and agreements to execute and provide for repayment of the loan.

7.3 Rehabilitation Loan Program

7.3.a Purpose

The purpose of the rehabilitation loan program is to loan NAHTF monies to local landlords or homeowners so they can rehabilitate dwellings and make them safe and decent for rental or ownership by low or very low income families.

7.3.b Eligibility

(1) The dwelling must be within the Newberg city limits.
(2) The dwelling must be rented to low or very low income families or individuals, or owned by low to very low income families according to income guidelines established by the Affordable Housing Commission. Preference will be given to units to be rented to very low income families or individuals.
(3) Repairs shall improve the overall livability of the dwelling by addressing health and safety issues and by making the home more energy efficient and affordable. Priority is placed on the repairs needed to make the home safe and to prevent further deterioration and escalated costs if left unattended. Typical examples of these

projects include new roofs, new windows, new electrical wiring, heating system repair/replacement, and utility repairs.

(4) The applicant shall demonstrate sufficient equity in the property and sufficient ability to repay the loan.

(5) The applicant shall demonstrate that the rehabilitation could not be accomplished using conventional loan programs.

(6) Preference shall be given to landlords who live in Newberg or the Newberg area, and who own 10 or fewer rental units, and who own the property outright or have substantial equity in the property.

7.3.c Project Security. Applicant must demonstrate and commit sufficient collateral to ensure the security of the loan. Security shall be demonstrated based upon an 80% loan to value ratio based upon the most current County Assessor records, unless otherwise recommended by the NAHC and approved by the City Council. Loans shall be secured via recording of a Trust Deed and Promissory Note against the property.

7.3.d. Loan Terms

(1) Loans are available in amounts ranging between $5,000.00 and $15,000.00. This amount may be increased up to $25,000.00 if the need for repairs is justified, if the Newberg Affordable Housing Commission recommends the City Council increase the loan amount, and if adequate equity is established.

(2) The standard interest rate is two percent (2%) below the prime rate.

(3) The standard term of the loan is five (5) years.

(4) The applicant shall pay a loan processing fee equal to one percent (1 %) of the loan or $100.00, whichever is greater.

(5) Standard loan terms may be modified by approval of the city council.

(6) The applicant shall enter into an agreement guaranteeing the dwellings will only be occupied by families or individuals meeting the income guidelines for the loan term.

(7) The applicant will be required to pay for all financing fees including but not limited to recording of trust deeds and promissory notes, title searches, and other third party costs related to securing the loan.

7.3.e Process

(1) The city manager shall appoint a loan officer to process loan applications.

(2) The loan officer will prepare application specifications. The loan officer will receive applications by a date specified in the notice of funding availability. The loan officer will accept applications after that date if funding remains available, and may establish a waiting list for applications in future funding cycles.

(3) The loan officer will review applications for eligibility, and qualify applicants as either standard or preferred applicants. The loan officer may establish a priority for awarding of qualified loans.

(4) Prior to awarding any loan, the application will be forwarded to the Affordable Housing Commission for consideration of recommendation for approval by the Newberg city council.

(5) The loan officer shall prepare the necessary documents and agreements to execute and provide for repayment of the loan.

(6) The applicant shall complete all repairs within one year of loan award.

7.4 Manufactured Home Rehabilitation and Repair Grant Program

7.4.a Purpose

The purpose of the manufactured home rehabilitation and repair grant program is to grant NAHTF monies to individuals or local non-profit organizations so they can rehabilitate and repair dwellings and make them safe and decent for rental or ownership to low or very low income families.

7.4.b Eligibility

(1) The dwelling must be within the Newberg city limits.

(2) The dwelling must be rented to low or very low income families or individuals, or owned by low to very low income families according to income guidelines established by the Affordable Housing Commission. Preference will be given to units to very low income families or individuals.

(3) Repairs shall improve the overall livability of the dwelling by addressing health and safety issues and by making the home more energy efficient and affordable. Priority is placed on the repairs needed to make the home safe and to prevent further deterioration and escalated costs if left unattended. Typical examples of these projects include new roofs, new windows, new electrical wiring, heating system repair/replacement, and utility repairs.

(4) The applicant shall demonstrate sufficient matching funds according to guidelines established by the Affordable Housing Commission.

(5) The applicant shall demonstrate that the rehabilitation and repair could not be accomplished using conventional loan programs.

7.4.c Project Match. Applicant must demonstrate and commit sufficient matching funds to secure the grant. Matching funds shall be based on a minimum one-third of the project costs, unless otherwise recommended by the NAHC and approved by the City Council. The maximum NAHTF grant amount is 50% of the project cost.

7.4.d. Grant Terms

(1) Grants are available in amounts ranging between $200.00 and $1,000.00.

(2) Grants may be for multiple projects under the manufactured home rehabilitation and repair program. Grants are available up to $10,000.00 for multiple projects. This amount may be increased up to $12,000.00 if the need for repairs is justified, if the Newberg Affordable Housing Commission recommends the City Council increase the grant amount, and if adequate matching funds are established.

(3) The applicant shall enter into an agreement guaranteeing the manufactured homes will only be occupied by families or individuals meeting the income guidelines for the grant for five years.

7.4.e. Process

(1) City staff shall assess the project proposals to determine if the eligibility criteria are met and shall develop a recommendation to provide to the Newberg Affordable Housing Commission and the city council.

(2) The Newberg Affordable Housing Commission will provide applicants the opportunity to make a presentation on their project proposal and provide community members the opportunity to comment by holding a public meeting.

(3) The Newberg Affordable Housing Commission will develop an award recommendation to the city council using the NAHTF eligibility criteria to determine which projects best meet the city's spending priorities. Each application will be rated on a numeric scale as established in criterion of selection (Section 8).

(4) The Newberg city council shall make a final decision on the award of Newberg Affordable Housing Trust Funds.

(5) The City of Newberg shall prepare an agreement between the city and the grant award recipient. The agreement shall outline the conditions of award and shall be executed prior to the disbursement of any Newberg Affordable Housing Trust Funds.

(6) An award granted to an applicant may be rescinded by the city if the applicant does not initiate the activities identified in grant request.

(7) The applicant shall complete all rehabilitation and repairs within one year of grant award.

SECTION 8. NAHTF Competitive Grant or Loan Award Threshold and Selection Criteria

8.1 The project is considered an eligible use or activity under Section 3, and benefits households earning less than 80% the area median income (threshold verification).

8.2 If the project is related to the provision of technical assistance to affordable housing providers, the use of Newberg Affordable Housing Trust Funds functions to increase the capacity of the organization to specifically address the mission of the NAHTF (threshold verification).

8.3 Newberg Affordable Housing Trust Funds shall be limited to the minimum amount necessary to complete the project. The lower the percentage of NAHTF funds requested, relative to the full project costs, the higher ranking the project shall be given.

8.4 The project addresses the unmet housing needs as identified in the Housing Element of the Newberg Comprehensive Plan.

8.5 The lower the income level that is targeted for the benefitting households, the higher the ranking the project shall be given.

8.6 The project provides new affordable housing, or new affordability, through retention or rehabilitation of existing housing, within the city. The greater the number of units provided, the higher the ranking the project shall be given.

8.7 The project retains the affordable housing units as affordable. The longer period of time the units remain affordable, the higher ranking the project shall be given.

8.8 The project addresses energy conservation through the integration of green building technologies in new construction, or achieves greater energy efficiency through rehabilitation of existing housing.

8.9 The project maximizes partnerships in the community (volunteers, in-kind contributions, cash contributions, multiple organization involved, etc).

8.10 The project utilizes already existing resources in effective and innovative ways. The project shall not duplicate service provided by another organization.

8.11 The agency submitting the proposal has the capacity to carry out the project and has had demonstrated successes completing projects of similar scope.

8.12 The budget and timeline are thorough and realistic.

8.13 The project is ready for implementation.

8.14 If the project includes the acquisition of property, the identified property is currently available for acquisition and the applicant has secured either a purchase option or letter of interest from the seller. If the applicant is also applying for federal funding (i.e. Community Development Block Grants or HOME) they should carefully review procurement requirements and limitations before obtaining a purchase option.

8.15 The relocation of existing residents will be minimized, and when necessary, the applicant has included accurate relocation assistance costs as part of the project pro forma.

8.16 The proposal demonstrates that Newberg Affordable Housing Trust Funds are the most appropriate funding source, and necessary, for the project.

8.17 Additional selection criteria may be developed and included in the annual RFP to best direct Newberg Affordable Housing Trust Funds toward an identified priority need. Numeric rankings for each of the selection criteria shall be incorporated into the annual RFP.

SECTION 9. Fund Revenue

9.1 The city manager is directed to create a new budget department code within the existing Fund 14 for monies within the NAHTF. Monies within the budget under line 14-4120-602000, Housing Authority Loans, shall be placed in this new department code.

9.2 All new revenue brought into the NAHTF shall be done so with the approval of the city council.

- **EFFECTIVE DATE** of this resolution is the day after the adoption date, which is: April 17, 2018.

ADOPTED by the City Council of the City of Newberg, Oregon, this 16th day of April, 2018.

_____
Sue Ryan, City Recorder

ATTEST by the Mayor this 19th day of April, 2018.

_____
Bob Andrews, Mayor

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order ___ No.	**Ordinance ___ No.**	**Resolution ___ No.**	**Motion ___**	**Information XX**
SUBJECT: Capital Improvement Plan			**Contact Person (Preparer) for this Item: Kaaren Hofmann, City Engineer Dept.: Public Works - Engineering File No.:**	

EXECUTIVE SUMMARY:

The Capital Improvement Plan (CIP) is the implementation plan for identified facility, transportation, storm drainage, water, and wastewater projects. The capital infrastructure needs within the CIP are identified through a variety of sources, including Master Plans, City Council goals, operational needs, and regulatory obligations. Attached is the proposed Five Year Plan for public improvements. The proposed projects to be funded by gas taxes, transportation utility fee, and rate/SDC funds; water, wastewater and stormwater systems. The proposed projects were included in the rate adjustments that were recommended by the Rate Review Committee and approved by the City Council at their last meeting.

Engineering Services works closely with Public Works Operations and Maintenance to complete the identified projects on an annual basis. The fiscal year 2018-2019 Capital Improvement Program implements the planning, design, and construction of the capital infrastructure needs of the City by prioritizing projects based on an analysis of the master plans and other studies in combination with the availability of funding. The scheduled projects in the years beyond FY 2018-2019 are not intended to be a spending commitment, but are included to show a proposed plan for the projects that are considered to be a priority at this particular snapshot in time. In fact, the projects in the wastewater section will be updated once the updated Master Plan is adopted by the Council in June. The Capital Improvement Projects for FY 2018-2019 will be discussed in more depth at the Council Business Meeting.

City of Newberg

Capital Improvement Plan

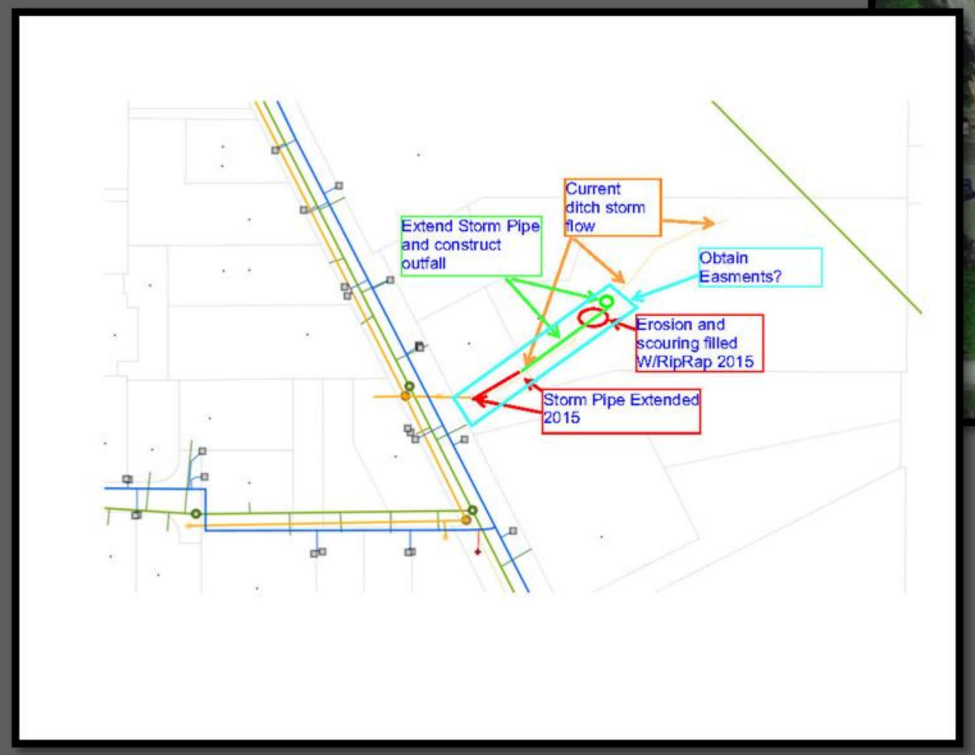
Fiscal Year 2018-2019

April 16, 2018

Update on FY17/18 Projects

- Inflow & Infiltration (I & I) - Underway
- Fifth Street (Underground &Pavement) - Underway
- Wastewater Master Plan - Near Adoption
- WWTP Oxidation Ditches - Complete
- Dayton Ave Lift Station - Underway
- Chehalem Wastewater Extension - Underway
- Lift Station Coatings - Underway
- Oxidation Ditch Rotor Replacements - Underway
- Dehydration Unit Burner Rebuild - Postponed
- Blaine Street Stormwater - Complete
- College Street Bike lanes and Sidewalks - Underway
- LED Street Light Conversion - Postponed
- Water Rights Review - Underway
- West Illinois Fire Flow - Underway
- Chehalem Water Extension Reduced – Underway
- Seismic Resiliency - Postponed
- College Street WL Relocation - Underway
- WTP Hypochlorite Generator - Complete
- Well # 8 Generator - Complete
- Maintenance Yard Improvements - Underway

800 Block Wynooski Stormwater



- The current pipe and outfall severely eroded the area east of Wynooski.
- This project would extend the outfall further down the slope to reduce the erosion.

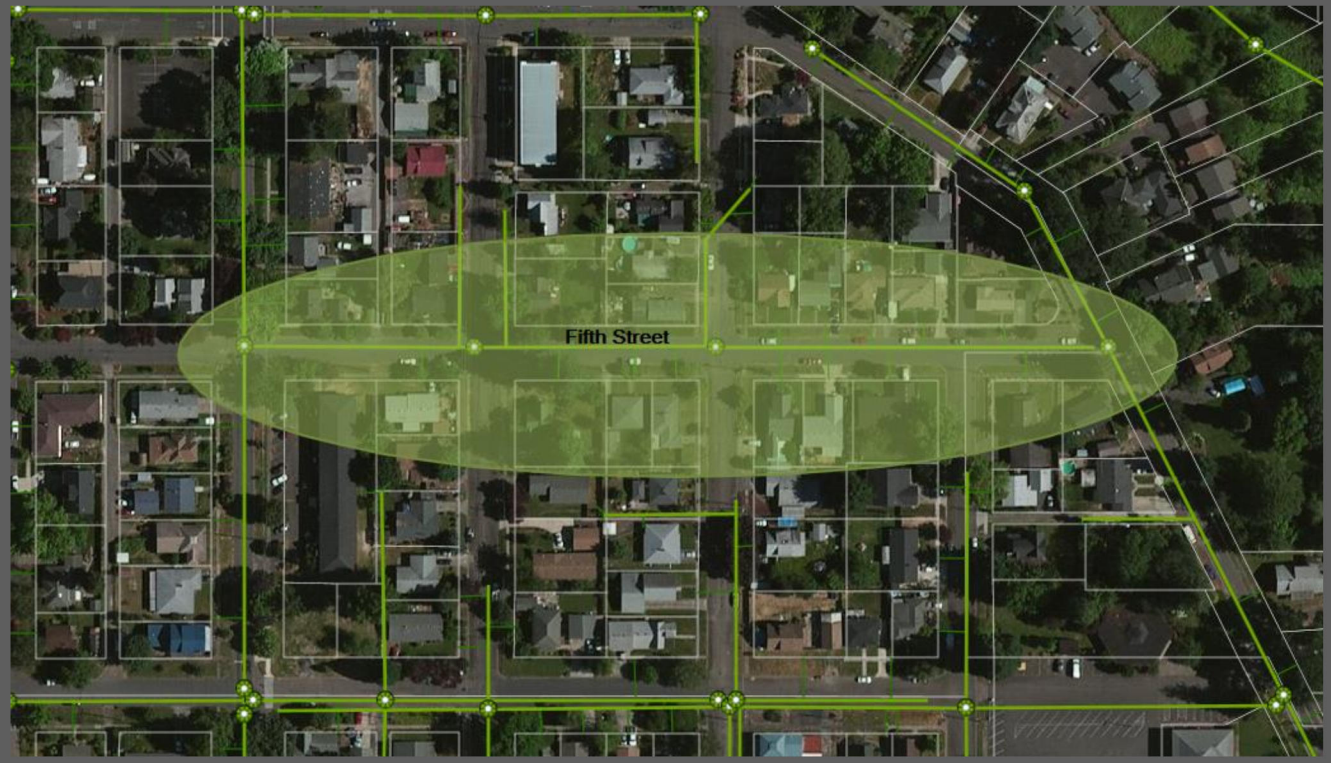
65

Inflow & Infiltration (I & I)

- $600,000 in FY 18/19
- Reduce peak flows to the WWTP
- Delay capacity related pipeline projects
- N. Springbrook Basin prior years
- Fifth Street, River-Wynooski
- Sixth Street, Projects prior to paving

Fifth Street Rehabilitation

- $340,000 in FY 18/19
- Existing pipe has 5 failure points
- Contributor of I & I
- Will construct with road improvements



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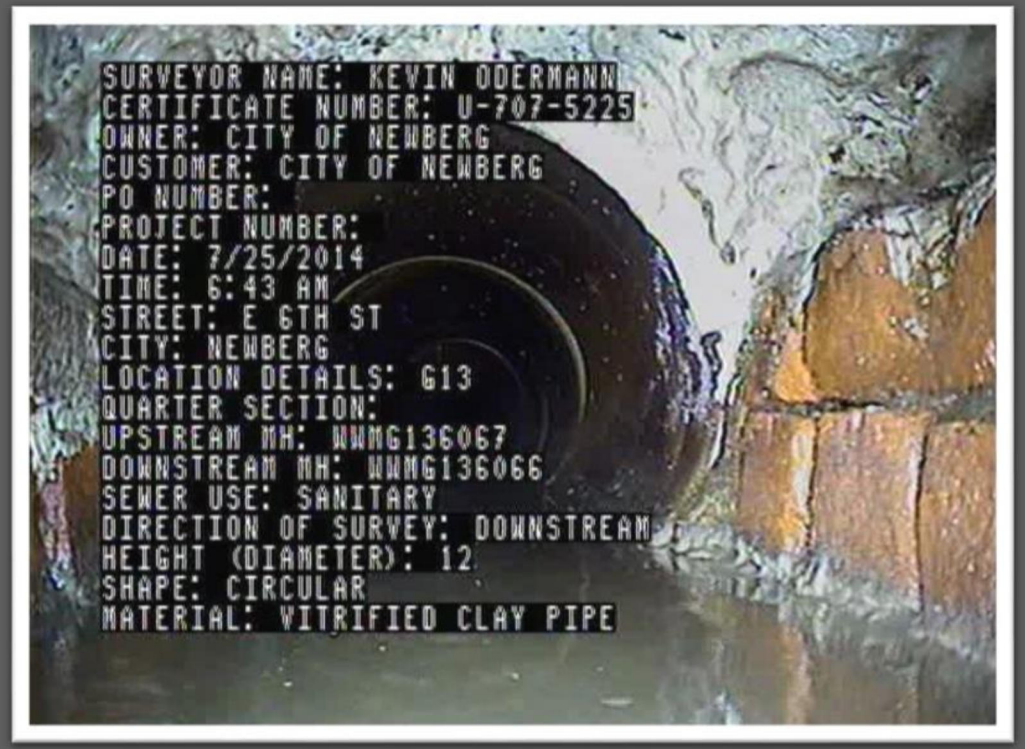
Sixth Street Rehabilitation



- This pipe is 70 – 80 years old
- Made of clay and the manholes are brick
- Blaine – River Street
- #2 project on the Dayton/Wynooski I & I list

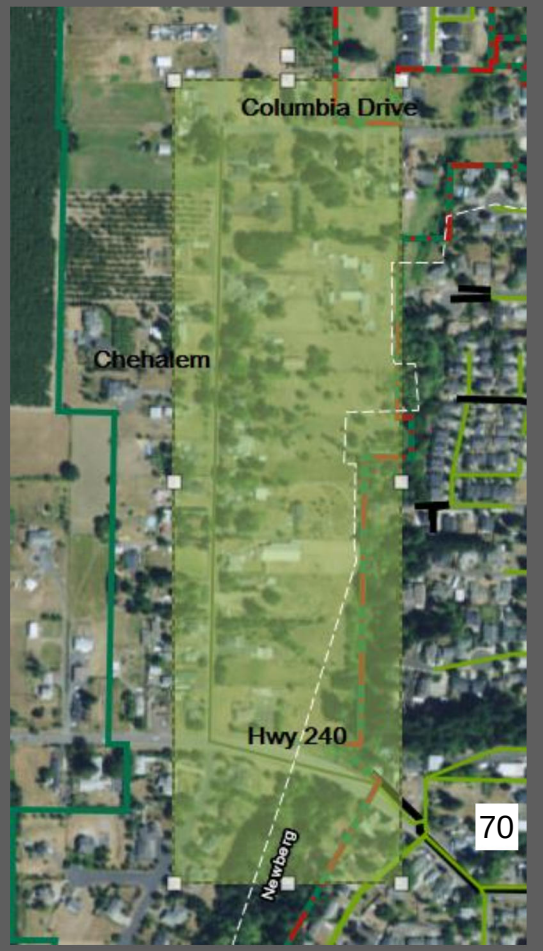
68

Dayton Avenue Lift Station

- Overflows into Chehalem Creek during very high intensity rainfall events
- Construction started in FY17/18
- $500,000 in FY 18/19
- Total cost = $ 2,500,000

Chehalem Wastewater Extension

- The properties along NE Chehalem Drive are starting to develop
- There in no existing public wastewater line in the area
- An extension from the current terminus in Hwy 240 across the bridge up to Columbia Drive will allow for a more orderly development (~2800 lineal feet)
- Constructed with the Chehalem Drive waterline project
- $1,000,000 total



Lift Station Coatings

- Coating of existing lift stations help with I & I issues
- Fernwood Lift Station - $100,000
- Creekside Lift Station - $100,000
- Would happen over a 2 year period
- Total cost = $200,000

71

Oxidation Ditch Rotor Replacements

- Rotors are key in the mixing and aeration of the wastewater process
- Total of 8 brush rotor aerators
- First failure occured in 2015
- Replacement of the 7 remaining original rotors (1987)
- One per year over the next 7 years

Old Rotor

New Rotor

72

Dehydration Unit Burner Rebuild

- Burner provides heat for drying sawdust used in the composting process
- Noticeable wear since the last time it was rebuilt 5 years ago
- Total Cost = ~$65,000

Existing Burner 2012

Replaced Burner 2012

73

PLC Study & Replacement

- The Programmable Logic Controller (PLC) is the system which holds all of the logic to run the treatment plant in an automatic mode.
- The Siemens PLC was installed in the late 1990's and is nearing its life expectancy.
- The PLC which we currently use is no longer being made by Siemens.
- Currently we are relying on a 3rd party who is still making parts to support these PLC's, but could stop production at any time making our system obsolete.

74

Villa Road Improvements

- Phase 1 is complete (Hess Creek Culvert)
- Phase 2 underway and will be complete in October 2018
- $500,000 in FY 18/19
- Total cost = $ 4,350,000

75

Pavement Rehabilitation

- $897,000 in FY 18/19
- Hayes Street from Springbrook to Providence
- Haworth from Villa to Springbrook
- 5th River to Wynooski
- 4th River to Wynooski
- Wynooski 4th to 7th
- Edgewood
- Dartmorth
- Melody Court
- Valeri
- Lewis Court

Crestview Drive; 99W to Springbrook Road

- Important transportation link to the north portion of the City
- Includes curbs, gutters, bike lanes & sidewalks, and replace existing substandard roadway segments
- $1,100,000 is City's share; $740,000 from State; $3,160,000 from Developers – Total Cost = $5,000,000
- Gramor & Springbrook Properties are partners

77

College Street; Bike lanes & Sidewalks

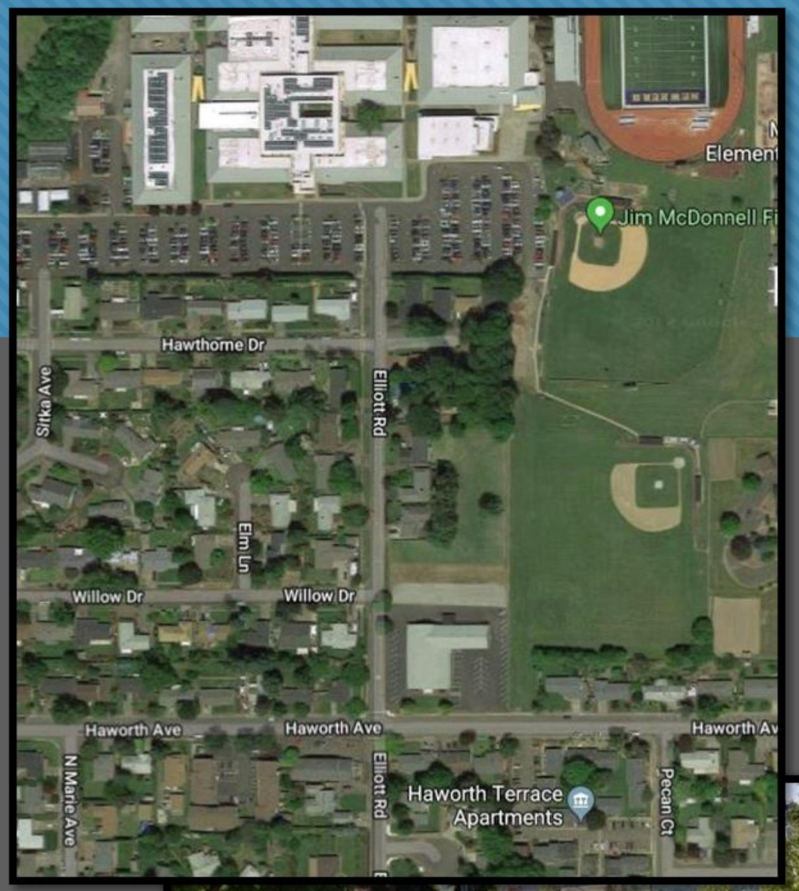
College Street looking North

- Aldercrest to Foothills
- Extend the sidewalks and bike lanes on the west side of the road
- College Street WL Relocation will be constructed ahead of this project
- $200,000 in FY 18/19
- Total City Cost = $300,000

78

N. Elliott Road

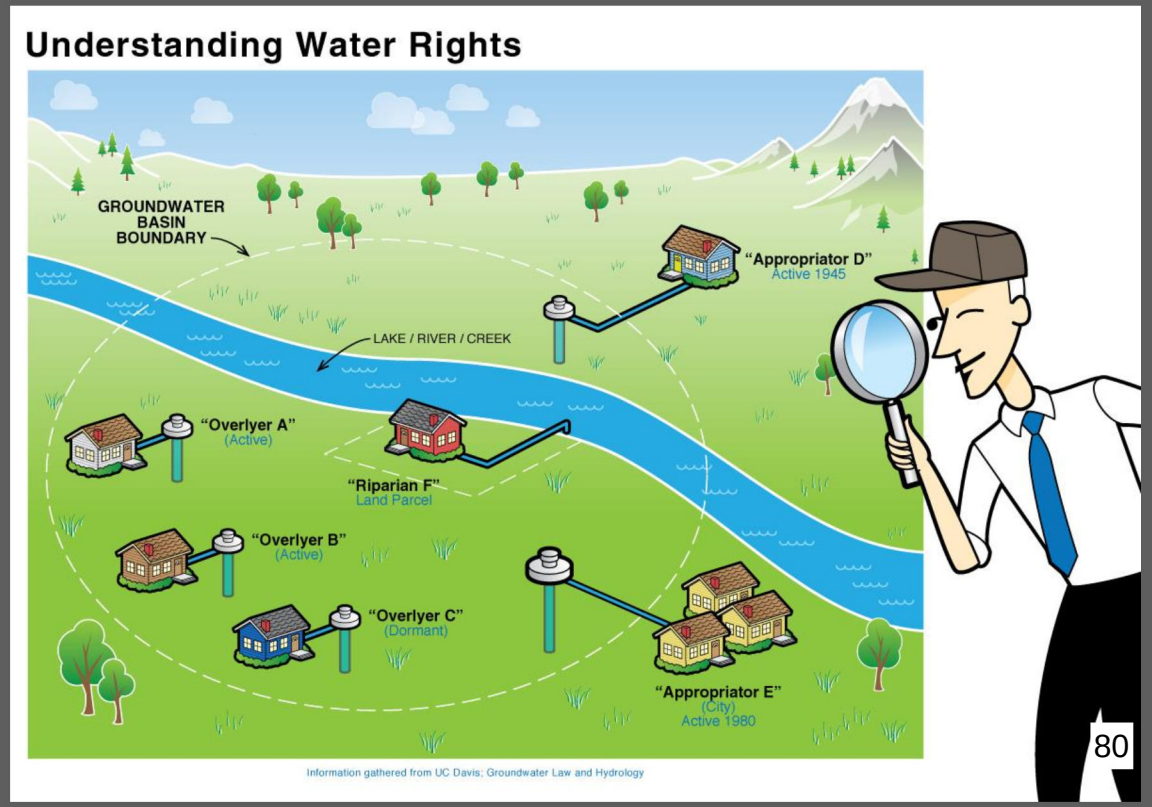
- This is the main entrance into the High School.
- There are substandard bike and pedestrian facilities on this roadway.
- There is no public drainage system in N. Elliott Road resulting in frequent ponding other than ditches.



79

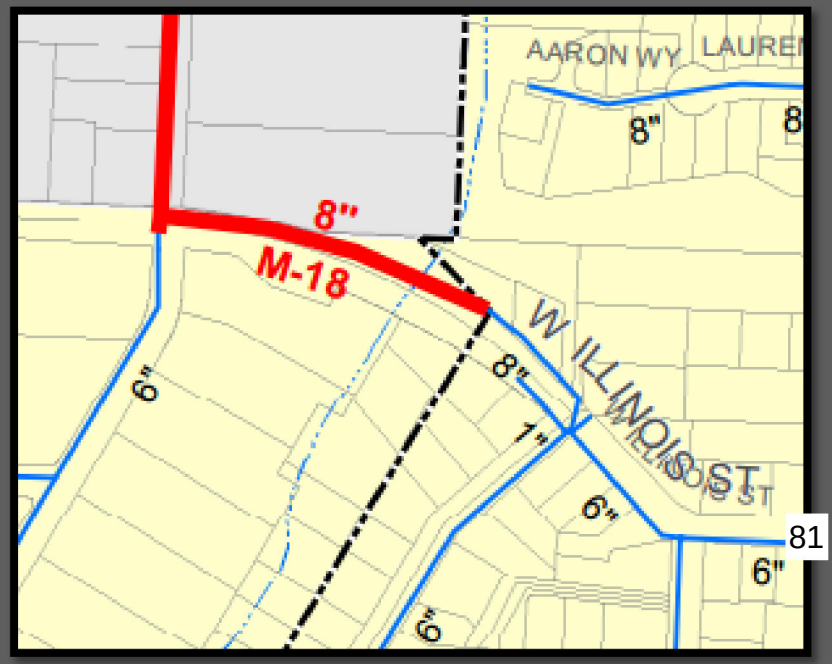
Water Rights Review and Reconfiguration

- Review our existing water rights
- Re-configure if necessary to match our current uses and needs
- Will be used in the Water Conservation Plan Update in 2018
- Total Cost = $25,000



West Illinois Fire Flow Project

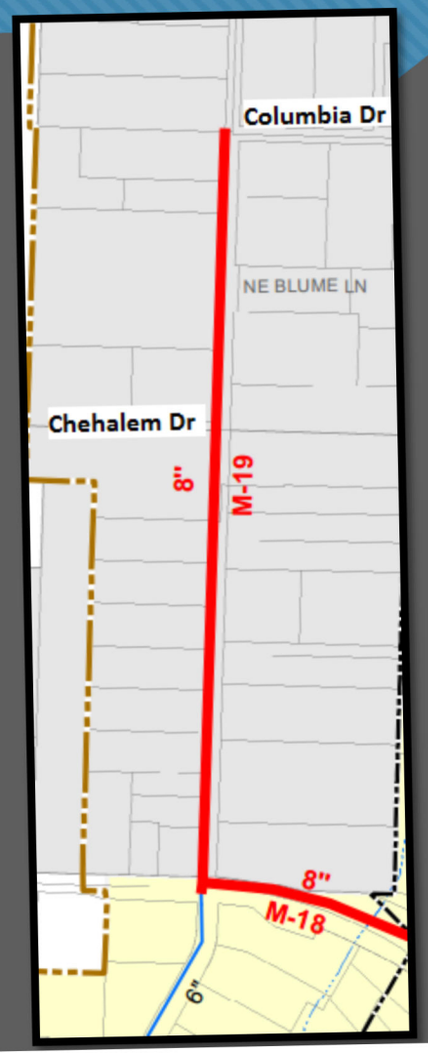
- This area of the City has existing 6” water lines
- The new Water Master Plan shows that the fire flows in this area do not meet the current standards
- New 8” water mains will solve this issue
- Construct with the Chehalem Water & Wastewater Extension
- Total Cost = $165,000



George Fox Fire Flow Project

- This area of the City has existing 4" and 6" water lines
- The new Water Master Plan shows that the fire flows in this area that do not meet current standards
- New 8" water mains will solve this issue
- Total Cost = $346,000

Chehalem Water Extension



- The properties along NE Chehalem Drive are starting to develop
- There in no existing public waterline in the area
- An extension from the current terminus in Hwy 240 across the bridge to Chehalem Drive
- Constructed with the Chehalem Drive wastewater line extension and the West Illinois Fire Flow project
- $1,000,000 total over multiple years

83

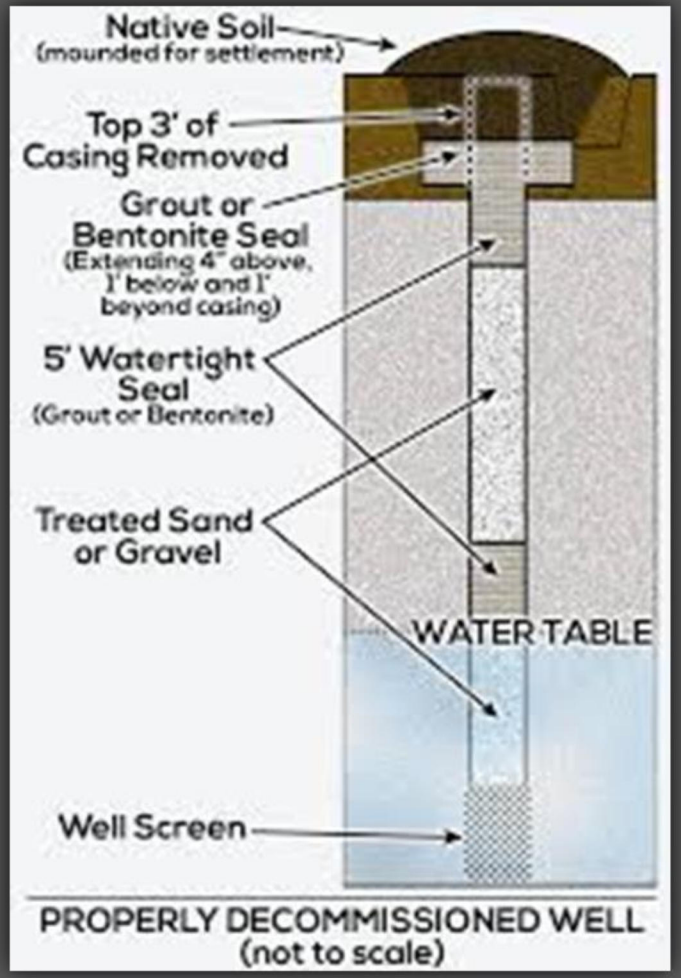
Seismic Resiliency Study

- Evaluate seismic hazards at the existing Water Treatment Plant
- Evaluate the water system for resiliency in the case of a seismic event
- Total Cost = $200,000

84

Decommission Wells #1 & #2

- Wells #1 & #2 have reached end of life and are not being used
- This project would properly decommission the wells per state standards
- $100,000 per well



85

College Street Waterline Relocation

- ODOT will be installing sidewalks and bike lanes on College Street from Aldercrest to Foothills– construction in 2018 - 2019
- The City's existing waterline will need be relocated prior to the road construction
- Total Cost = ~$470,000

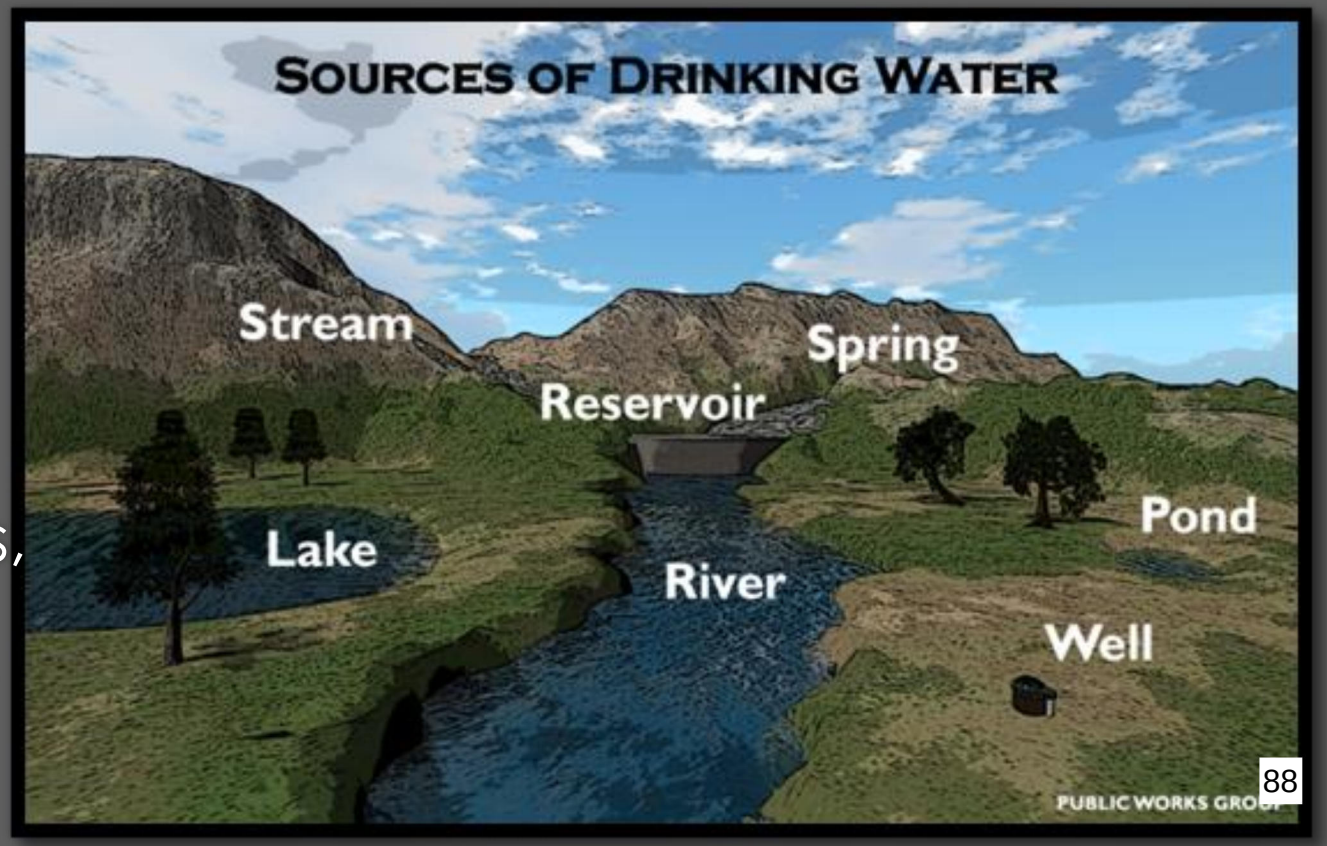
College Street Valves

- One of the reasons for the massive amount of flooding in 2014 when the waterline broke is the lack of valves to shut the water off.
- This project would add valves in strategic locations to minimize future problems.
- $200,000

87

Redundant Supply

- This project will look for another supply option on this side of the Willamette River – mostly for emergency purposes
- Provide 2 mgd which is our wintertime average usage
- This project will include water rights, exploration, property acquisition and potentially another treatment plant
- $3,619,000 over 5 years



Maintenance Yard

- The city acquired the property in 2015
- Fully functional facility is critical to adequate to respond in the future
- Improvements in process over next 5 years
- Frontage improvements and the remodel of several existing buildings is complete
- Installation of fuel tanks are planned for FY18/19
- Cost is about $60,000

89

CAPITAL IMPROVEMENT PROGRAM

March 20, 2018

Fiscal Years 2018 - 2023

The Capital Improvement Program (CIP) is the implementation plan for identified software, City facilities, transportation, storm drainage, water, and wastewater projects. The CIP may change based on the community's needs, available budget, regulatory impacts, etc….

Capital Improvement Program

FISCAL YEARS 2018 - 2023

INTRODUCTION

The capital infrastructure needs within the five year CIP are identified through a variety of sources, including Master Plans, City Council goals, operational needs, and regulatory obligations.

In keeping with the Council goals, Staff over the last several years has begun a program to reduce the amount of inflow and infiltration (I&I) that enters the wastewater system. I&I is the term used to describe surface and subsurface water that enters the wastewater piping system, caused primarily by aging infrastructure that needs to be repaired or replaced. The water enters into the wastewater pipes through cracks, holes, joint failures, faulty connections, and through holes in manhole covers. During large storm events I&I can create an overflow situation as the system is not built to handle the additional water. Although I&I is essentially 'clean water', the additional water flows to the wastewater treatment plant and must be treated with the normal wastewater flows. Normal dry weather processing at the wastewater treatment plant is approximately 3 million gallons per day, whereas, during heavy rainfall events the peak flows at the wastewater treatment plant are in excess of 20 million gallons per day. This additional flow due to excessive I&I create added operational and maintenance costs to the wastewater system.

Projects based on the adopted plans will be proposed for the next 5 fiscal years to aggressively repair and/or replace inadequate portions of the system. Although the costs to repair the aging wastewater collection system will be significant, it can no longer be postponed. Several projects were completed last fiscal year and there has been a noticeable reduction in I&I in those basins already. There will be one more in the Springbrook Basin this fiscal year. Next year the focus will be on the downtown area of the City.

Public Works is also committed to providing well maintained streets to our citizens. Although, this work started in 2012, there is a substantial amount of road repair yet to be completed. The road maintenance program budget continues to be under-funded, as identified in the 2014 City wide Pavement Management System Implementation Report. The Transportation Utility Fee was adopted and implemented in the last year. The City improved a significant number of road segments last summer and this will be continuing.

Since 2007, there has been a major proactive effort to repair and upgrade the City's Wastewater Treatment Plant. The City will continue the upgrade with the addition of roofing repairs, rotor replacements and structural repairs to the existing oxidation ditches. Future upgrades will be determined based on the update to the Master Plan to be completed in 2018.

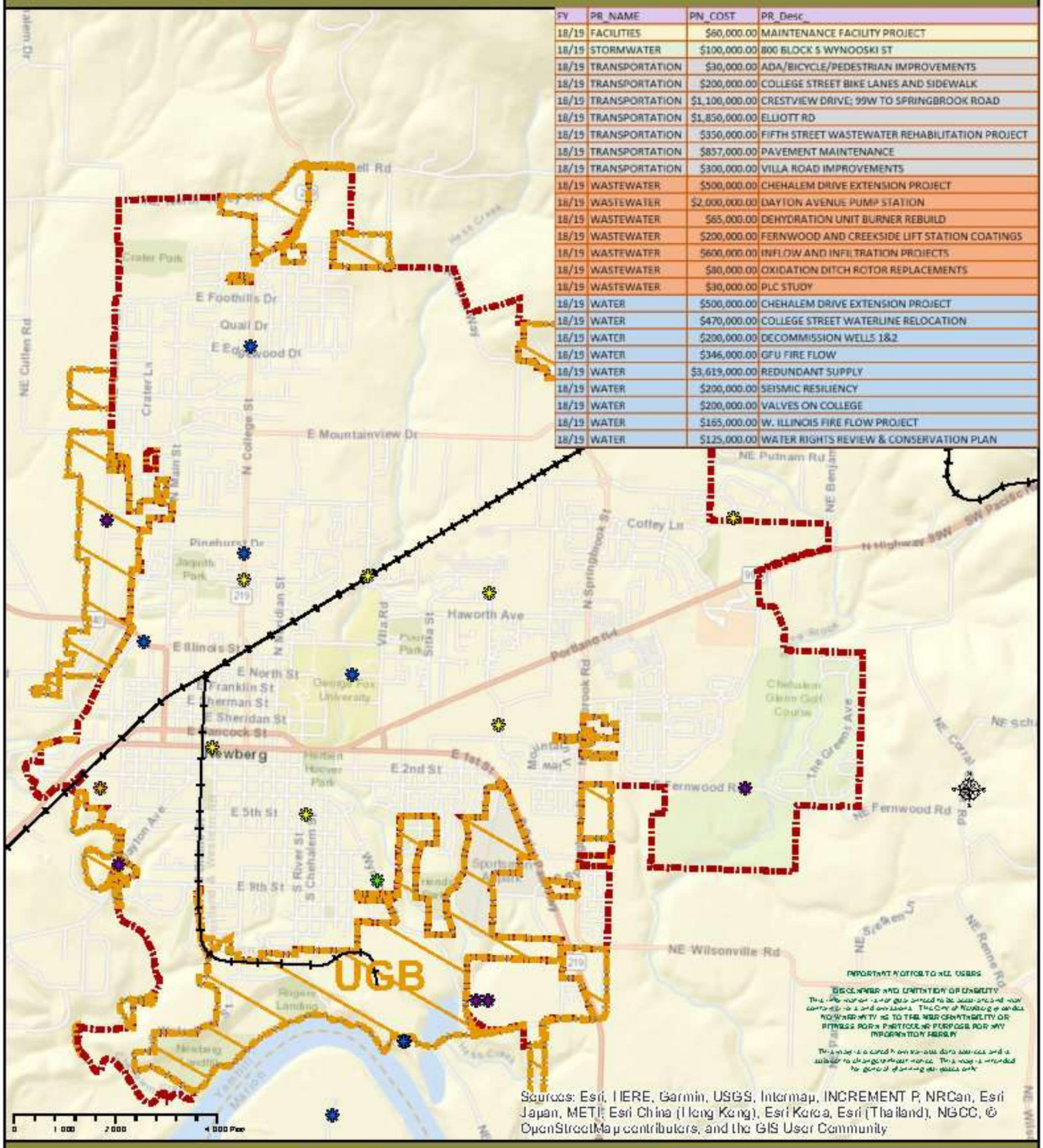
The City continues to focus its efforts towards establishing a high quality and adequate potable water supply, storage, and distribution system. With the completion of the Water Master Plan, additional projects have been added to address system deficiencies over the next several years. A project has also been added to extend water and wastewater lines up Chehalem Drive to facilitate development in this area.

The Engineering Division works closely with Public Works Operations and Maintenance Divisions to complete the identified projects on an annual basis. The fiscal year 2018-2019 Capital Improvement Program implements the planning, design, and construction of the capital infrastructure needs of the City by prioritizing projects based on an analysis of the master plans and other studies in combination with the availability of funding. The scheduled projects in the years beyond FY 2018-2019 are not intended to be a spending commitment, but are included to show a proposed plan for the projects that are considered to be a priority at this particular snapshot in time.

A map of the Capital Improvement Projects for FY 2018-2019 is shown on the following page.

Capital Improvement Projects FY 2017-18

FY	PR_NAME	PN_COST	PR_Desc_
18/19	FACILITIES	$60,000.00	MAINTENANCE FACILITY PROJECT
18/19	STORMWATER	$100,000.00	800 BLOCK S WYNOOSKI ST
18/19	TRANSPORTATION	$30,000.00	ADA/BICYCLE/PEDESTRIAN IMPROVEMENTS
18/19	TRANSPORTATION	$200,000.00	COLLEGE STREET BIKE LANES AND SIDEWALK
18/19	TRANSPORTATION	$1,100,000.00	CRESTVIEW DRIVE; 99W TO SPRINGBROOK ROAD
18/19	TRANSPORTATION	$1,850,000.00	ELLIOTT RD
18/19	TRANSPORTATION	$350,000.00	FIFTH STREET WASTEWATER REHABILITATION PROJECT
18/19	TRANSPORTATION	$857,000.00	PAVEMENT MAINTENANCE
18/19	TRANSPORTATION	$300,000.00	VILLA ROAD IMPROVEMENTS
18/19	WASTEWATER	$500,000.00	CHEHALEM DRIVE EXTENSION PROJECT
18/19	WASTEWATER	$2,000,000.00	DAYTON AVENUE PUMP STATION
18/19	WASTEWATER	$65,000.00	DEHYDRATION UNIT BURNER REBUILD
18/19	WASTEWATER	$200,000.00	FERNWOOD AND CREEKSIDE LIFT STATION COATINGS
18/19	WASTEWATER	$600,000.00	INFLOW AND INFILTRATION PROJECTS
18/19	WASTEWATER	$80,000.00	OXIDATION DITCH ROTOR REPLACEMENTS
18/19	WASTEWATER	$30,000.00	PLC STUDY
18/19	WATER	$500,000.00	CHEHALEM DRIVE EXTENSION PROJECT
18/19	WATER	$470,000.00	COLLEGE STREET WATERLINE RELOCATION
18/19	WATER	$200,000.00	DECOMMISSION WELLS 1&2
18/19	WATER	$346,000.00	GFU FIRE FLOW
18/19	WATER	$3,619,000.00	REDUNDANT SUPPLY
18/19	WATER	$200,000.00	SEISMIC RESILIENCY
18/19	WATER	$200,000.00	VALVES ON COLLEGE
18/19	WATER	$165,000.00	W. ILLINOIS FIRE FLOW PROJECT
18/19	WATER	$125,000.00	WATER RIGHTS REVIEW & CONSERVATION PLAN



Multi – Funded Project

The following project summary sheets were developed from a variety of sources. The projects affect all of the enterprise funds and include things like improvements to facilities and major software purchases.

Multi – Funded Project

Maintenance Facility Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$80,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	$1,000,000	☒	Maintenance
		☐	Required per Regulation
Future Years	$1,000,000	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$2,950,000*	☒	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

A master plan has been completed on what the newly expanded maintenance yard could look like. The proposed improvements for next fiscal year include the installation of fuel tanks for emergency purposes. The rest of the improvements include major site work, construction of a new fleet building and eventually a new administration building. A fully functional maintenance facility is critical to serve the existing and long term day to day needs of the City and to adequately respond to natural disasters with the needed man power and equipment.

PROPOSED FUNDING SOURCES:

The project is to be funded by utility funds, and system development charges.

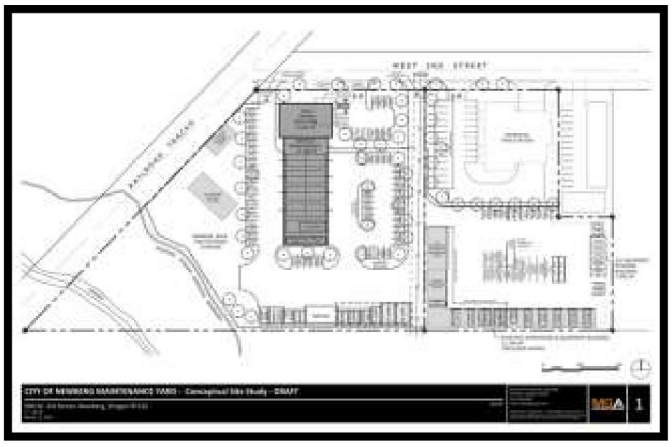


FIGURE 1 CONCEPTUAL PUBIC WORKS MAINTENANCE YARD PLAN

Transportation Projects

The Transportation Program provides planning, engineering, and construction for improvements to the City's transportation systems that preserve existing infrastructure, increase roadway capacity, improve safety mobility and/or enhance neighborhood livability.

The primary funding source for the roadway maintenance budget is the City's share of the state gas tax revenue. A secondary funding source for roadway improvements is federal funding distributed by ODOT through the Surface Transportation Program (STP), and can only be used for new roadway construction or full reconstruction of existing roadways, not maintenance projects.

The following project summary sheets were developed from the Transportation System Plan and associated studies while considering the available funds from state gas tax revenue, surface transportation program (federal funds exchange), and the Transportation Utility Fee and system development charges.

Transportation Program

Fifth Street Rehabilitation Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$350,000	☒	Safety/Liability
		☐	Council Goals
2020/2021	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$350,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

East Fifth Street from River Street to Wynooski Street is in need for rehabilitation. Since we will be working on the wastewater line on this street it made sense to complete the pavement rehabilitation. The sidewalks and curbs are also below standard. When the project is completed, the goal is to have completed the wastewater work, ADA & sidewalk, curb, gutter and pavement.

PROPOSED FUNDING SOURCES:

This will be paid for out of gas taxes.

FIGURE 2 FIFTH STREET ROAD CONDITIONS

Transportation Program

ADA/Bicycle/Pedestrian Improvements

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$30,000	☒	Safety/Liability
		☒	Council Goals
2019/2020	$30,000	☐	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$60,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

City Council established a comprehensive bicycle program in 2011 to implement the policies and recommended improvements in the ADA/Pedestrian/Bike Route Improvement Plan.

Projects are selected based on the City's need and available funding for each fiscal year. The ADA/ Pedestrian/Bike Route Improvement Plan is a resource the City often utilizes in selecting improvement projects. Current utility maintenance projects include replacement or installation of ADA accessible barriers identified in the plan. The ADA/Pedestrian/Bike Route Improvement Plan can be found on the city website.

PROPOSED FUNDING SOURCES:

This project is funded by the gas taxes that the City receives from the State of Oregon. A portion (1%) of the gas tax the City receives must be spent on bicycle projects in the right-of-way. The funding is split in the budget between the Street Capital Fund and the Street Maintenance Fund.

FIGURE 3 CURB RAMP NEEDED

Transportation Program

Villa Road Improvements

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$800,000	☒	Safety/Liability
		☒	Council Goals
2018/2019	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$2,500,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

Villa Road north of 99W is a two lane major collector roadway that has intermittent sections of curb and sidewalk improvements. The proposed roadway improvement project is to construct a full width street improvement project consisting of curbs, sidewalk, and bike lanes, from Fulton Street to Crestview Drive. The incomplete sidewalk connections are unsafe as it forces pedestrians onto the roadway shoulders and the vertical/horizontal alignments of the roadway are not to current standards.

Phase 1 of this project (replacement of the Hess Creek Culvert) was completed in fiscal year 2016/2017. This project will be complete in October 2018.

PROPOSED FUNDING SOURCES:

The project is to be funded by gas tax revenue, system development charges and the Federal Funds Exchange.

Figure 4 Looking North on Villa Road

Transportation Program

College Street Bike Lanes and Sidewalks

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$200,000	☒	Safety/Liability
		☒	Council Goals
2019/2020	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$300,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The 2007 ADA/Pedestrian/Bike Route Improvement Plan identified the project as a primary critical pedestrian and bikeway route. The incomplete sidewalk connections are unsafe as it forces pedestrians onto the roadway shoulders. This project will be a continuation of the project that was completed 3 years ago. The City has entered into an Intergovernmental Agreement with ODOT on this project. Design and right-of-way acquisition will be underway soon.

PROPOSED FUNDING SOURCES:

The project will be funded by ODOT Surface Transportation Project Fund (STP) with a funding match from the City gas tax revenues.

FIGURE 5 LOOKING NORTH ON COLLEGE STREET

Transportation Program

Crestview Drive; 99W to Springbrook Road

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$1,100,000	☒	Safety/Liability
		☒	Council Goals
2018/2019	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$1,100,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

Crestview Drive is an important transportation link to the north portion of the City. It will connect 99W at Providence Drive to N. Springbrook Road. The two sections on either end of the alignment have not been constructed. This improvement replaces the gravel roadway & substandard pavement and will include curbs, gutters, bike lanes and sidewalks.

PROPOSED FUNDING SOURCES:

The overall project is projected to cost $5,000,000. The Transportation SDC fund will contribute $1,100,000, the state will contribute $740,000, and the balance will be funded by Springbrook Properties and Gramor Developments.

Figure 6 Crestview drive looking east

Transportation Program

Elliott Road; 99W to Newberg High School

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$350,000	☒	Safety/Liability
		☒	Council Goals
2019/2020	$750,000	☒	Maintenance
		☐	Required per Regulation
Future Years	$750,000	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$1,850,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The TSP has identified this project as a high priority as it provides direct access to the high school. This project will construct full street improvements to include sidewalks and bike lanes. It will also include storm drainage improvements and street lighting.

PROPOSED FUNDING SOURCES:

The project will be funded by gas tax revenues and system development charges.

FIGURE 7 LOOKING SOUTH ON ELLIOTT ROAD

Transportation Program

N. Springbrook Road

POJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2021/2022	$400,000	☒	Safety/Liability
		☐	Council Goals
2021/2022	$1,000,000	☐	Maintenance
		☐	Required per Regulation
Future Years	0	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	***$1,400,000***	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project will provide sidewalks and bike lanes north of 99W. It will also install a signal at the intersection of Haworth and Springbrook Road. This project will also install storm drainage.

PROPOSED FUNDING SOURCES:

This project will be funded by gas taxes and transportation system development charges.

FIGURE 8 INTERSECTION OF SPRINGBROOK AND HAWORTH

Transportation Program

Pavement Preservation

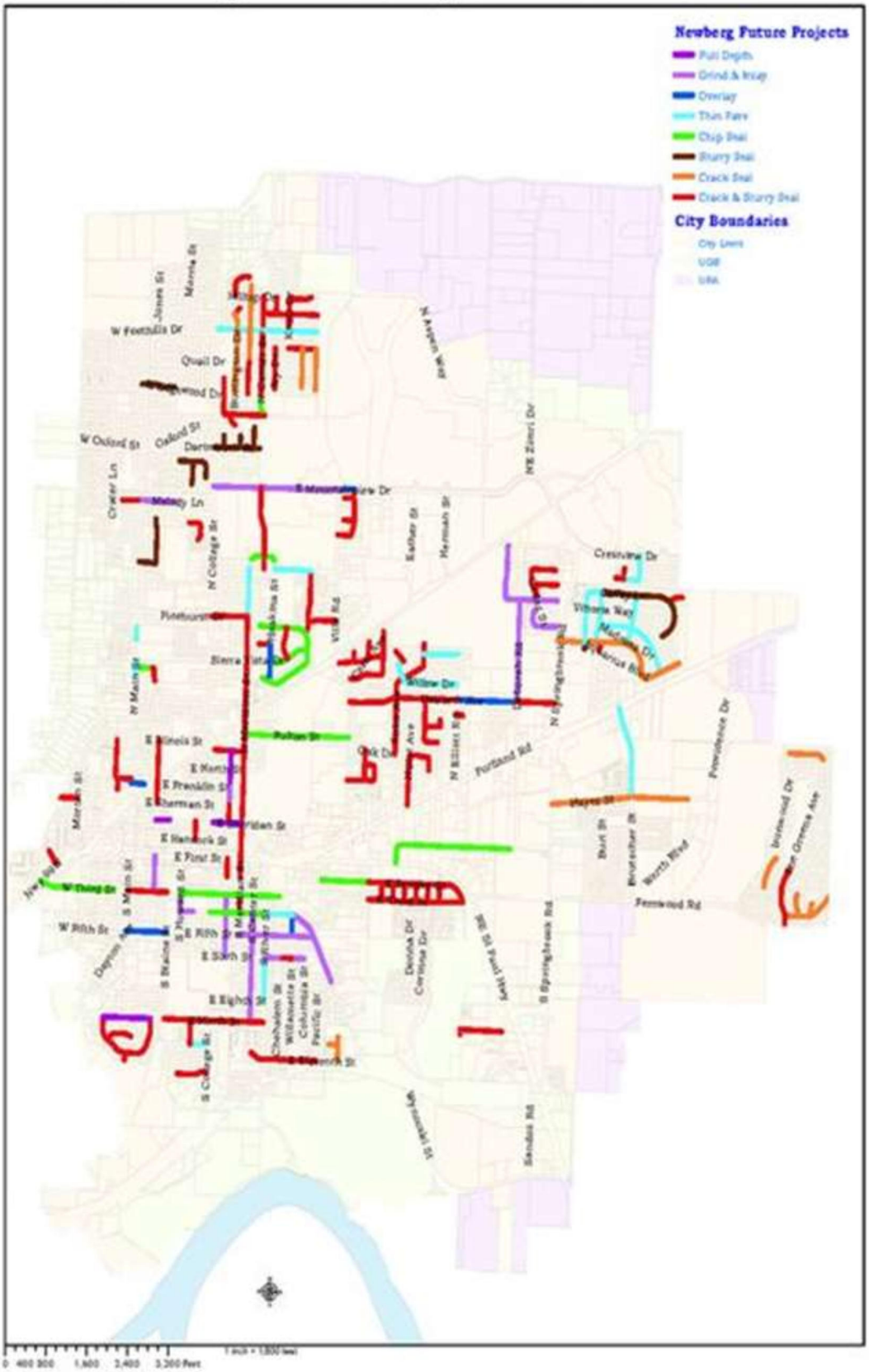
PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$507,400	☒	Safety/Liability
		☒	Council Goals
2019/2020	$1,400,000	☒	Maintenance
		☐	Required per Regulation
Future Years	$4,175,010	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$6,432,010*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The Council adopted a Transportation Utility Fee in the Spring of FY17/18 and it was implemented in the summer of FY17/18. The pavement preservation projects proposed over the next five years are shown on the map below.

Newberg Pavement Projects - Next Five Years



Stormwater Projects

The Stormwater Program provides planning, design and construction of improvements for the City's public storm drainage system. This program includes the conveyance system, water quality, and stormwater detention systems.

The 2014 Drainage Master Plan Update is used to plan for improvements to the overall City storm drainage system. Funding for the stormwater program is provided through stormwater utility rates and system development charges.

Stormwater Program

S. Blaine Street; Hancock to 11th Street

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2021/2022	$350,000	☒	Safety/Liability
		☐	Council Goals
2021/2022	$400,000	☒	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
***Project Total**	*$1,200,000*	☒	Cost Reduction
		☐	Future Capacity

**Project totals also includes costs from prior budget year*

PROJECT DESCRIPTION:

Flooding occurs in the system during the 10 year storm event including Second Street, Howard Street and at 6th Street and Blaine Street. Large segments of the existing pipe are constructed of corrugated metal and are near end of life. The project will decommission the existing stormwater pipes (shown in green below) and construct a new 24" stormwater mainline (shown in red) along South Blaine and 2nd Streets. Sections of the existing piping system will also be upsized to convey existing and future flows (shown in gold). This project will also include the storm system adjacent to 99W and the Second Street Parking Lot.

Due to funding constraints, the project is scheduled to be constructed in phases over several fiscal years. The first two phases of construction are complete.

PROPOSED FUNDING SOURCES:

This project is funded by the stormwater utility fee and a small amount of system development charges.

FIGURE 8 STORMWATER UTILITY LINES

Stormwater Program

N. Elliott Road

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2020/2021	$250,000	☒	Safety/Liability
		☐	Council Goals
2021/2022	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$250,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

There is no public storm drainage system in N. Elliot Road resulting in frequent ponding alongside the roadway. This project would add 18" storm pipe to the system as a part of the larger roadway project. Refer to the N. Elliot Road Improvement project description in the Transportation section for more information.

PROPOSED FUNDING SOURCES:

This project is funded by the stormwater utility fee and a small amount of system development charges.

FIGURE 9 STORMWATER UTILITY LINES

Stormwater Program

N. Springbrook Road

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2021/2022	$170,000	☒	Safety/Liability
		☐	Council Goals
2018/2019	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	***$170,000***	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

There are existing gaps in the public storm drainage system in N. Springbrook Road. The public storm system will be constructed as a part of the larger street project.

PROPOSED FUNDING SOURCES:

This project will be funded out of utility rates and system development charges.

FIGURE 10 N. SPRINGBROOK RD

Stormwater Program

800 Block of Wynooski Street

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$100,000	☒	Safety/Liability
		☐	Council Goals
2018/2019	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	***$100,000***	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The current pipe and outfall have severely eroded the area east of Wynooski Street. This project would extend the outfall further down the slope to reduce erosion.

PROPOSED FUNDING SOURCES:

This project will be paid for out of utility rates.

FIGURE 11 CURRENT PIPE AND OUTFALL

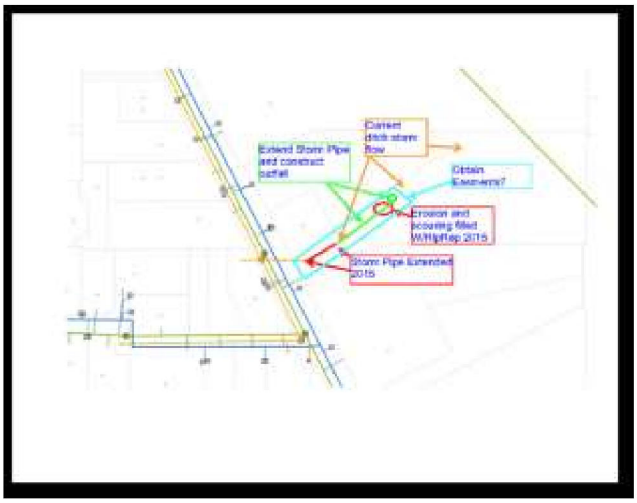


FIGURE 12 PROPOSED PLAN

Wastewater Projects

The Wastewater Program provides planning, design and construction of improvements for the City's public wastewater utility system. This program area includes the lift stations, wastewater treatment plant, and wastewater collection and conveyance system. About 10% of the wastewater budget over the next five years is allocated to the needed improvements at the wastewater treatment plant.

The following project list was developed from the Sewerage Master Plan, the 2007 Wastewater Treatment Facilities Plan Update and other associated studies, while considering the available funds from the wastewater utility rates and system development charges. Some larger capacity project have been removed from the list until the new Wastewater Master Plan update is complete in 2018.

Wastewater Program

Fifth Street Wastewater Rehabilitation Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$340,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	***$350,000***	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The existing wastewater line on Fifth Street from Chehalem to River is in need of rehabilitation. In addition there are several existing parcels that need access to the public wastewater line. This project would be constructed in conjunction with the pavement rehabilitation project for 2018.

PROPOSED FUNDING SOURCES:

This will be paid for out of wastewater rate funds.

FIGURE 13 FIFTH STREET WASTEWATER UTILITY LINE REPLACEMENT

Wastewater Program

Dehydration Unit Burner Rebuild

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$65,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$65,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The dehydration unit at the WWTP is used to dry sawdust for our composting process. The burner on the dehydration unit provides the heat for drying the sawdust, and typically runs around 1,300 degrees. The burner is a steel tower structure that is filled with fire brick on the inside to protect the steel from the high heat environment. It has been 5 years since we last rebuilt the burner, and there is noticeable wear as shown below on the left. The rebuild involves removing all the existing brick, stacking new brick and installing a coating over the top of it which reduces the erosion of the brick and extends the life. The Dehydration Unit went online in December 2009, the burner had to be rebuilt in 2012 as it did not originally include protective coating.

PROPOSED FUNDING SOURCES:

Wastewater rate revenue.

FIGURE 14 DEHYDRATION UNIT BURNER BEFORE AND AFTER CONDITION

Wastewater Program

Oxidation Ditch Rotor Replacements

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$80,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	$80,000	☒	Maintenance
		☐	Required per Regulation
Future Years	$425,000	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$595,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

There are a total of 8 brush rotor aerators in our two oxidation ditches at the Wastewater Treatment Plant. The brush rotors are key in mixing and aeration of the wastewater, enabling the bacteria to complete their work. This project involves replacing the remaining 7 original rotors which have been in operation since the plant startup in 1987. These rotors are 30 years old as of 2017, have an expected 25-30 year lifespan, and we experienced our first rotor failure in 2015. Our plan is to replace one rotor per year over the next 7 years. All of the rotors are inspected annually and will be replaced based on the need determined by those inspections.

PROPOSED FUNDING SOURCES:

Wastewater rate revenue.

FIGURE 15 OLD ROTOR (LEFT) NEW ROTOR (RIGHT)

Wastewater Program

Fernwood and Creekside Lift Station Coatings

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$170,000	☒	Safety/Liability
		☒	Council Goals
N/A	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$200,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

This project is to fix inflow and infiltration (I/I), concrete corrosion, and grout problems at these two lift stations. The project will involve bypass pumping around each station for a period of time for cleaning of the wetwell and applying the coating material. In addition to solving the above issues, it will also provide for much easier cleaning and maintenance as there will no longer be a porous surface for the grease and debris to attach to.

PROPOSED FUNDING SOURCES:

Wastewater rate revenue funds.

FIGURE 16 INFLOW & INFILTRATION AT THE FERNWOOD & CREEKSIE LIFT STATION

Wastewater Program

Sawdust Bays at the Wastewater Treatment Plant

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2021/2022	$350,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$350,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The current compost cure bay setup is configured to allow us to use three (3) of the covered storage bays as curing bays. They are equipped with blowers and temperature probes that enable us to use them as cure compost as we do in our tunnels. The compost must stay under cover in the inclement weather. Otherwise, it will become wet to the point of being unusable and prevent the composting. Adding the additional bays will allow us to move the sawdust storage out of the existing bays. This will free all current bays for curing and/or storage, as appropriate.

PROPOSED FUNDING SOURCES:

Wastewater rate revenue funds will pay for this project.

FIGURE 17 EXISTING CURING BAYS

Wastewater Program

Chehalem Drive Extension Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$990,000	☐	Safety/Liability
		☐	Council Goals
N/A	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	***$1,000,000***	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project would extend the public wastewater line from the existing terminus on the east side of Chehalem Creek in Hwy 240 to NE Chehalem Drive and then north in Chehalem Drive to just south of the intersection with Mountainview Drive. There have been several development inquiries in this area and the wastewater line extension would allow for orderly future development. This project would be constructed in conjunction with a similar waterline extension project.

PROPOSED FUNDING SOURCES:

This will be paid for out of system development charges.

FIGURE 18 EXTENDING THE PUBLIC WASTEWATER LINE

Wastewater Program

Dayton Avenue Lift Station

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$500,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	***$2,000,000***	☒	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The existing Dayton Avenue lift station and the 4,000 foot long 12-inch force main were constructed in 1993. The Gorman-Rupp top-side dry pumps are nearing the end of their service life and the storage volume of the station wet well is significantly undersized for the flows to the station. The station overflows into Chehalem Creek during very high flow events. The City hired a consultant to design the needed improvements to this lift station. Construction of the replacement station is expected to be complete by October 2018.

PROPOSED FUNDING SOURCES:

This will be paid for out of wastewater rate funds.

FIGURE 19 DAYTON AVE LIFT STATION (LEFT) & GORMAN- RUPP TOP-SIDE DRY LIFT (RIGHT)

Wastewater Program

Inflow and Infiltration Projects

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$600,000	☒	Safety/Liability
		☒	Council Goals
2019/2020	$600,000	☒	Maintenance
		☐	Required per Regulation
Future Years	$600,000/year	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total		☒	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The 2015 Inflow and Infiltration Report identified the need for significant replacements/rehabilitation of the older sections of the wastewater collections system throughout the City. The goal of the project is to rehabilitate or replace the aging pipe infrastructure to reduce the maintenance costs and the stormwater inflow and infiltration into the system based on the priorities listed in the 2015 report. Additionally, the Council approved the Private Lateral Program to assist in these efforts. This year's projects are mainline lining, rehabilitation of manholes, and replacement of a few laterals. The projects for next year include: S. River from 4th to 2nd, E. 4th from River to Willamette, E. 2nd from Church to Everest, E. 3rd from Church to Everest, Church from 2nd to 3rd, W. 3rd from Harrison to Grant & Garfield to Blaine, Howard from 3rd to 6th and 11th from River to Willamette.

PROPOSED FUNDING SOURCES:

This will be paid for out of wastewater rate and system development charge funds.

FIGURE 20 INFLOW & INFILTRATION PROGRAM

Wastewater Program

Operations Remodel Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$400,000	☐	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$400,000*	☒	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The existing treatment plant administration building was constructed in 1987 has a lot of underutilized space. The proposed remodel will allow for staff work stations and a staff Lunch and meeting room other than utilizing the main conference room.

PROPOSED FUNDING SOURCES:

This project is funded through the wastewater and water rate funds.

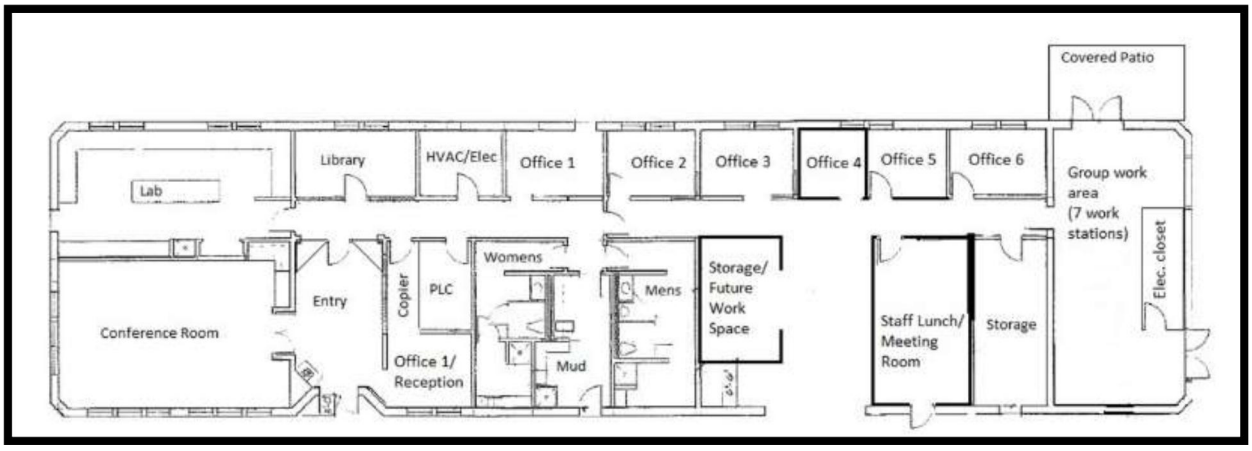


FIGURE 21 PUBLIC WORKS OPERATION REMODEL PRELIMINERY SKETCH

Wastewater Program

Existing Oxidation Ditches

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$900,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
***Project Total**	*$2,200,000*	☒	Cost Reduction
		☒	Future Capacity

**Project totals also includes costs from prior budget year*

PROJECT DESCRIPTION:

The two existing oxidation ditches were constructed in 1987 and need rehabilitation work to remain in service. In the future new oxidation ditches are proposed to be added after FY22/23. Rehabilitation to oxidation ditch #2 was completed summer of 2017. Only one ditch can be offline at any one time, therefore, they are shown to be completed over several years. The project started in FY16/17 and will be completed in 19/20.

PROPOSED FUNDING SOURCES:

This will be paid for out of wastewater rate and system development charge funds.

FIGURE 22 OXIDATION DITCH

Wastewater Program

Roofing Replacement at the Wastewater Treatment Plant

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2020/2021	$150,000	☒	Safety/Liability
		☐	Council Goals
2021/2022	$70,000	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$220,000*	☒	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The maintenance of roofs and gutters on the existing buildings at the 1980'streatment plant was deferred by prior administration. The building roof and gutter replacements completed to date include: Tunnels Building and Screw Press Room. The roof and gutters need to be completed at the Administration Building and several Secondary Buildings.

PROPOSED FUNDING SOURCES:

This will be paid for out of wastewater rate funds.

FIGURE 23 ROOF MAINTENANCE AT WASTEWATER TREATMENT PLANT

Wastewater Program

Villa Road Funnel Fix

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$400,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$400,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The existing pipe in Villa Road is an 8" diameter pipe. There are several larger pipes that flow into this segment. There has been one documented back up cause by this under capacity pipe. The project scope may be altered with the completion of the Wastewater Master Plan.

PROPOSED FUNDING SOURCES:

The project will be paid for out of the wastewater rate and SDC funds.

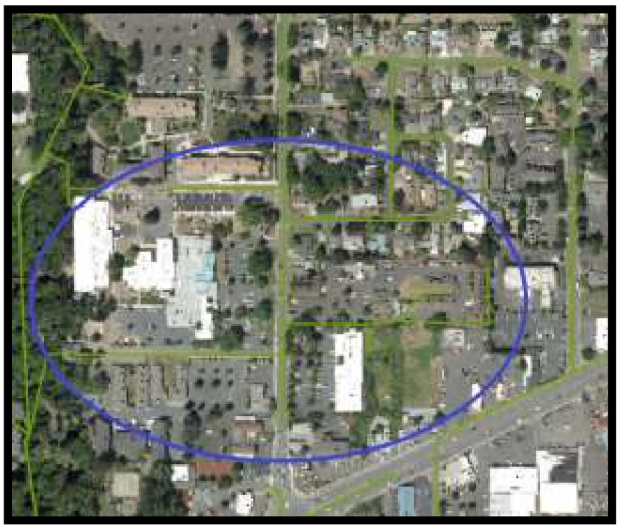


FIGURE 24 VICINITY MAP

Wastewater Program

Sixth Street Rehabilitation

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$300,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	$300,000	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$600,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The existing pipe in Sixth Street is 70-80 years old. The pipe is made of clay and the manholes are brick. The project is to replace the section between Blaine and River Street. We will also use this opportunity to pave Sixth Street.

PROPOSED FUNDING SOURCES:

This project will be funded by the wastewater rate funds.

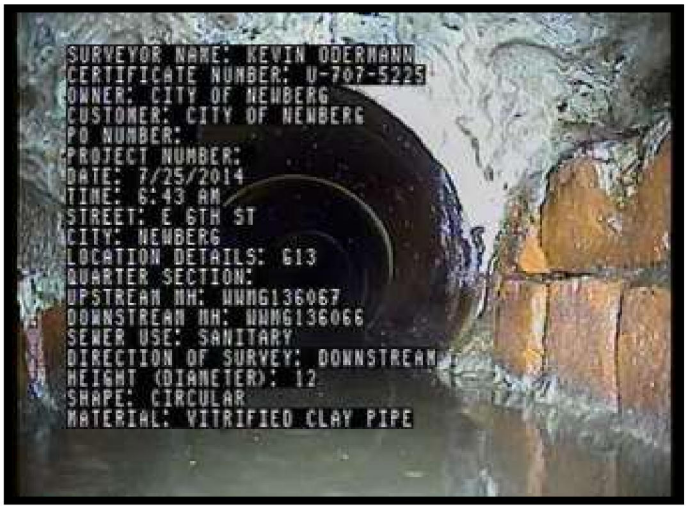


FIGURE 25 PIPE MADE OUT OF CLAY

Wastewater Program

Programmable Logic Controller Study and Replacement

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$30,000	☒	Safety/Liability
		☐	Council Goals
2020/2021	$1,500,000	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$1,530,000*	☒	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The Programmable Logic Controller (PLC) is the system which holds all of the logic to run the treatment plant in an automatic mode. The Siemens PLC was installed in the late 1990's and is nearing its life expectancy. The PLC which we currently use is no longer being made by Siemens. Currently we are relying on a 3rd party to support the PLC but they could stop production at any time making our system obsolete. We will first look at all of the options and then come back to purchase the new system.

PROPOSED FUNDING SOURCES:

This project will be funded using the wastewater rate funds.

FIGURE 246 PCL

FIGURE 27 PCL

Wastewater Program

Inflow and Infiltration Report

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2020/2021	$200,000	☐	Safety/Liability
		☐	Council Goals
N/A	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$200,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

An Inflow and Infiltration (I & I) study was completed for the Dayton and Wynooski Basins in 2015. Data has been recently gathered in the Springbrook and Hess Basins. This data will be used to complete a full report of the pipe performance in these basins and will evaluate the work that the City has completed over the last several years.

PROPOSED FUNDING SOURCES:

This project will be funded by the wastewater rate and SDC funds.

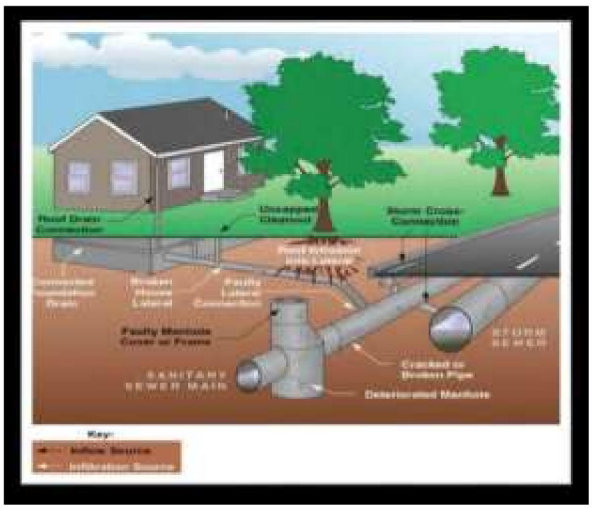


FIGURE 28 I&I ENTERING THE BASINS

Water Projects

The Water Program provides planning, design and construction of improvements for the City's public water utility system. This program area includes the well field, storage reservoirs, water treatment plant, pump station, and water distribution system.

The following project list was developed from the 2017 Water Master Plan and other associated studies while considering the available funds from the water utility rates and system development charges.

Water Program

Bell Road West Pump Station

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$725,000	☒	Safety/Liability
		☐	Council Goals
2020/2021	$725,000	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$1,450,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The proposed pump station is needed to supply adequate fire flow and constant service pressure to the Zone 2 expansion area. Once the Bell Road Reservoir is constructed, this pump station will be used to supply a future reservoir. This project should be constructed in conjunction with the N. College Street waterline extensions.

PROPOSED FUNDING SOURCES:

This project will be paid for out of water rate revenue and system development charge funds.

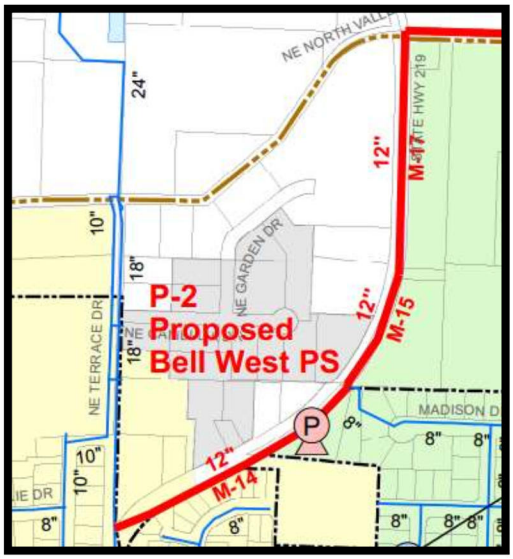


FIGURE 29 PROPOSED PUMP STATION SITE

Water Program

Chehalem Drive Extension Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$740,000	☐	Safety/Liability
		☐	Council Goals
Future Years	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$750,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project would extend the public water line from the existing terminus on the east side of Chehalem Creek in Hwy 240 to NE Chehalem Drive. There have been several development inquiries in this area and the water line extension would allow for orderly future development. This project would be constructed in conjunction with a wastewater extension.

PROPOSED FUNDING SOURCES:

This will be paid for out of system development charge funds.

FIGURE 25 CHEHALEM DRIVE PUBLIC WATER SERVICE LINE EXTENSION

Water Program

College Street Waterline Relocation

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$370,000	☐	Safety/Liability
		☐	Council Goals
2019/2020	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$470,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The Oregon Department of Transportation will be extending sidewalks and bike lanes further north on the west side of College Street. As a part of this project the City's existing water line will need to be lowered as it is too shallow. This work is scheduled to begin in 2017/2018 and will be coordinated with the waterline valve project.

PROPOSED FUNDING SOURCES:

This project will be paid for out of water rate funds.

FIGURE 31 WATERLINE RELOCATION FROM CRESTVIEW TO FOOTHILLS ON THE WEST SIDE OF COLLEGE STREET

Water Program

Valves on College Street

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$200,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$200,000*	☒	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

One of the reasons for the massive amount of flooding in 2014 when the waterline in College Street broke was the lack of valves on the existing line to shut the flow of water off. This project would add valves in strategic locations to minimize future problems. It will be coordinated with the College Street waterline relocation project.

PROPOSED FUNDING SOURCES:

This project will be paid for out of water rate funds.

FIGURE 32 2014 WATERLINE BREAK ON COLLEGE STREET CAUSING MASSIVE FLOOD

Water Program

Decommission Wells #1 and #2

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$200,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	N/A	☐	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$200,000*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

Wells #1 & #2 have reached the end of life and are not being utilized. This project would properly decommission the wells per state standards.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate and system development charge funds.

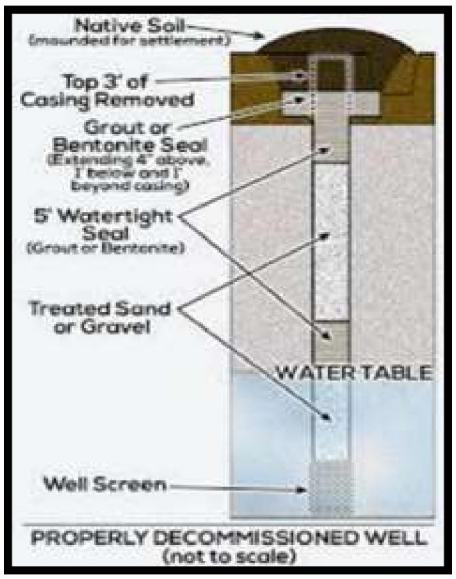


FIGURE 263 DECOMMISSION WELLS 1 & 2

Water Program

Downtown Fire Flow Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2020/2021	$552,000	☒	Safety/Liability
		☐	Council Goals
2021/2022	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$552,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project is to replace several non-looped sections of 1 and 2 inch diameter water mains along Hancock Street through downtown Newberg. Fire flow deficiencies occur in this area and the project will also improve fire hydrant spacing and coverage. This project will coordinate with the newly adopted Downtown Plan.

PROPOSED FUNDING SOURCES:

This project will be paid for out of water rate revenue and system development charge funds.

FIGURE 274 REPLACING DEFICIENT PIPE AND INADEQUATE FIRE HYDRANTS ON HANCOCK STREET

Water Program

Fixed Based Radio Read

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$350,000	☐	Safety/Liability
		☐	Council Goals
2020/2021	$375,000	☒	Maintenance
		☐	Required per Regulation
Future Years	350,000	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$1,025,000*	☒	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

The existing meter reading system requires that someone drive though the entire city to read the meters. The fixed based system will allow for the meters to be read from utility billing office in real time. This will cut down on labor costs and could detect a leak sooner. Rate payers will also have the ability to gain access to hourly real-time and historical water use information. Operations and treatment plant staff have access to real time data.

PROPOSED FUNDING SOURCES:

This project will be paid for out of water rate and SDC funds.

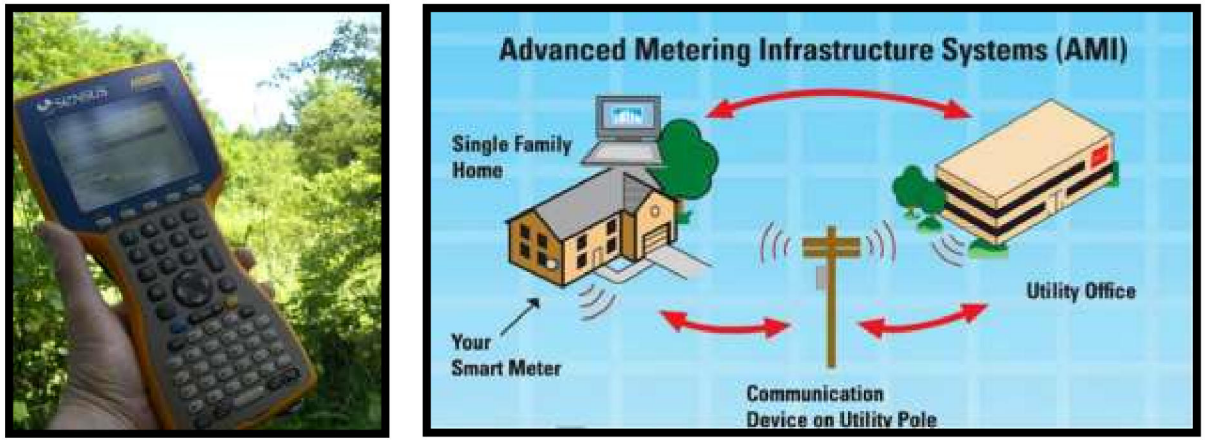


FIGURE 285 READING METERS CURRENTLY (LEFT) VS ADVANCED WATER METERING READING INFRASTRUCTURE SYSTEM (RIGHT)

Water Program

George Fox Fire Flow

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$346,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	N/A	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$346,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The water modeling in the recent master plan update revealed that this area has a fire flow and pressure deficiency under existing conditions and future growth. The installation of 1410 lineal feet of 8" waterlines will address this deficiency.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate revenue and SDC funds.

FIGURE 296 FIRE HYDRANT WATER FLOW

Water Program

N. College Street Waterline

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$241,000	☐	Safety/Liability
		☐	Council Goals
2020/2021	$192,000	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$433,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project extend waterlines from N. Terrace Drive to the intersection of N. College and N. Valley Road and then to the east down Bell Road. This will help supply water for future Zone 2 development. This project should be constructed in conjunction with the proposed Bell Road West Pump Station.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate revenue and SDC funds.

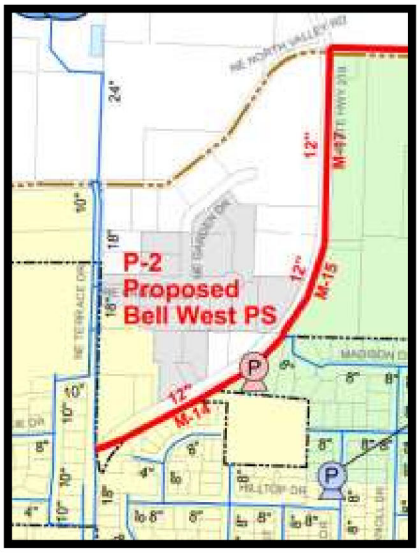


FIGURE 37 EXPAND WATERLINES FOR FUTURE DEVELOPMENT

Water Program

Redundant Supply

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$163,000	☒	Safety/Liability
		☒	Council Goals
2019/2020	$365,000	☐	Maintenance
		☐	Required per Regulation
Future Years	$3,091,000	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$3,619,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The City's current water supply is the well field on the south side of the Willamette River. To address supply vulnerability and long-term water resiliency, per the water system master plan the City should pursue another source north of the River. The redundant supply should have an approximate capacity of 2 million gallons per day. This project would include water rights, exploration, property acquisition and potentially the construction of a secondary treatment plant.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate revenue and SDC funds.

FIGURE 308 EXPLORING FUTURE WATER SUPPLY

Water Program

Seismic Resiliency Project

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$200,000	☒	Safety/Liability
		☒	Council Goals
N/A	N/A	☒	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$200,000*	☒	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project will evaluate the seismic resiliency of the entire water system, evaluate the seismic hazards of the existing water treatment plant, and using the latest seismic modeling for a Cascadia subduction zone earthquake. This will help the city's water system become more resilient in the case of major seismic event.

PROPOSED FUNDING SOURCES:

This will be paid for out of both water rate and SDC funds.

FIGURE 319 WATER TREATMENT FACILITY SEISMIC RESILIENCY

Water Program

Vittoria Square Fire Flow

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2019/2020	$147,000	☒	Safety/Liability
		☐	Council Goals
2020/2021	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$147,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The resent water master plan update revealed that this area has a fire flow and pressure deficiency under existing conditions and future growth. The installation of 600 lineal feet of 8" waterlines will address this deficiency.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate revenue and SDC funds.

FIGURE 329 EXPANDING WATERLINE TO ELIMINATE DEFICIENT WATER FLOW AND FOR FUTURE GROWTH

Water Program

W. Illinois Fire Flow

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2018/2019	$155,000	☒	Safety/Liability
		☐	Council Goals
2019/2020	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$165,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

The recent water system master plan update revealed that this area has a fire flow and pressure deficiency under existing conditions and future growth. The installation of an 8" waterline will address this deficiency.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate revenue and SDC funds.

FIGURE 33 EXPANDING WATERLINE TO ELIMINATE WATER DEFICIENCY AND FOR FUTURE GROWTH

Water Program

Water Rights Review, Reconfiguration and Water Conservation Plan

PROJECT SUMMARY SHEET

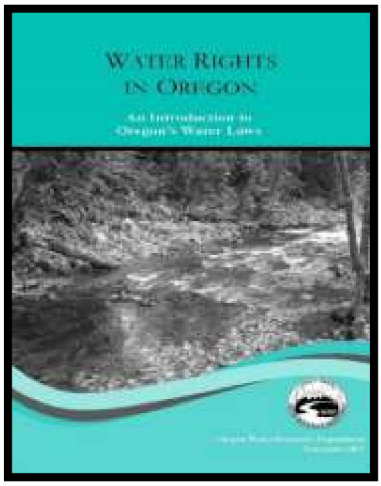
Fiscal Year	Costs	Criteria Met:	
2017/2018	25,000	☐	Safety/Liability
		☐	Council Goals
2018/2019	$100,000	☐	Maintenance
		☒	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$125,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project is intended to take a comprehensive view of our existing water rights, make sure they are correctly proportioned and reconfigure if necessary. The water right work will be used in our update of our required Water Conservation Plan the following year.

PROPOSED FUNDING SOURCES:

This will be paid for out of water rate and SDC funds.



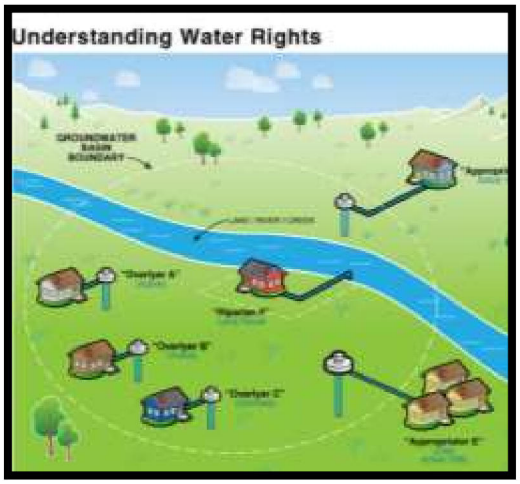


FIGURE 41 COMPREHENSIVE STUDY OF THE CITY'S EXISTING WATER RIGHTS

Water Program

Bell Road East Pump Station

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2022/2023	$725,000	☒	Safety/Liability
		☐	Council Goals
N/A	N/A	☐	Maintenance
		☒	Required per Regulation
Future Years	$725,000	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$1,450,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project in in the 2017 Water Master Plan and is needed as development occurs north of and along Zimri Drive.

PROPOSED FUNDING SOURCES:

This project will be funded by SDC funds.

FIGURE 342 WATERLINE

Water Program

Fire Flow

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2020/2021	$393,400	☒	Safety/Liability
		☐	Council Goals
2021/2022	$393,400	☒	Maintenance
		☐	Required per Regulation
Future Years	N/A	☐	Coordinates with Larger Project
		☒	Existing Capacity
Project Total	*$786,800*	☐	Cost Reduction
		☐	Future Capacity

PROJECT DESCRIPTION:

There are several more fire flow upgrades projects noted in the 2017 WaterMaster Plan. The priorities will be decided based on other projects and opportunities.

PROPOSED FUNDING SOURCES:

These projects will be funded by the SDC and water rate funds.

FIGURE 353 FIRE FLOW UPGRADES

Water Program

North College – North Terrace

PROJECT SUMMARY SHEET

Fiscal Year	Costs	Criteria Met:	
2021/2022	$433,000	☒	Safety/Liability
		☐	Council Goals
2018/2019	N/A	☐	Maintenance
		☐	Required per Regulation
Future Years	N/A	☒	Coordinates with Larger Project
		☐	Existing Capacity
Project Total	*$433,000*	☐	Cost Reduction
		☒	Future Capacity

PROJECT DESCRIPTION:

This project is a part of the Bell Road West Pump Station project.

PROPOSED FUNDING SOURCES:

This will be funded by system development charges.

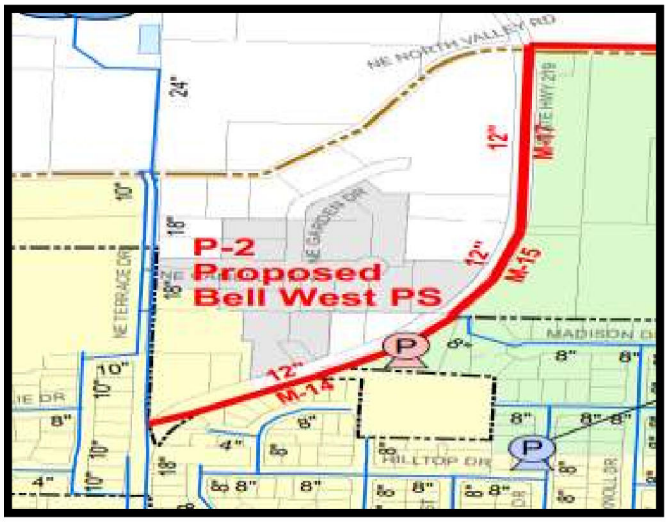


FIGURE 44 PUMP STATION

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order ___ No.	**Ordinance ___ No.**	**Resolution ___ No.**	**Motion ___**	**Information XX**
SUBJECT: 2014 Stormwater Master Plan Annual Review			**Contact Person (Preparer) for this Item: Doug Rux, Director Dept.: Community Development File No.:**	

RECOMMENDATION:

Information only.

EXECUTIVE SUMMARY:

The City of Newberg Engineering Services Department in FY 2012-2013 and 2013-2014 prepared an update to the 2001 Stormwater Master Plan. Brown and Caldwell were the consultants who worked with city staff on preparing the 2014 Stormwater Master Plan. The Newberg City Council adopted the plan by Resolution No. 2014-3155 on July 7, 2014 (Attachment 1). Oregon Administrative Rule (OAR) Chapter 660, Division 11 (660-011-0000) includes language in the Purpose Statement that a city or county must develop and adopt a public facility plan for areas within an urban growth boundary. It further indicates that a plan is to assure that urban development is guided and supported by types and levels of urban facilities and services appropriate for the needs. OAR 660-011-0005 has a definition of Public Facilities Plan that includes storm sewer and its associated subsets of major drainageways (major trunk lines, streams, ditches, pump stations and retention basins) and outfall locations.

The 2014 Stormwater Master Plan was prepared under a 20 year horizon to 2025 and is updated approximately every 10 years.

Oregon Revised Statutes and Oregon Administrative Rules govern the preparation of and amendments to stormwater master plans. Specifically Oregon Statewide Planning Goal 11 Public Facilities and Services, ORS 197.712(2)(e), and Oregon Administrative Rules Chapter 660 Division 11 Public Facilities Planning are the applicable statute, goals and rules.

For stormwater master plans the following are applicable provisions to be included:

OAR 660-011-0005(7) "Public Facility Systems"

(c) Storm sewer

(A) Major drainageways (major trunk lines, streams, ditches, pump stations and retention basins);

(B) Outfall locations.

The main objectives of this plan are as follows:

- Update the City's stormwater system's hydrologic and hydraulic models to evaluate system capacity.
- Develop an integrated stormwater system capital improvement program to address storm system

capacity needs and water quality.
- Evaluate stream channel conditions with respect to erosion and impacts from future development.
- Continue to comply with water quality regulations.
- Review the City's stormwater management program and make recommendations on activities and staffing where applicable.
- Identify implementation priorities and impacts to the program budget.
- Develop a Master Plan document that is useful and easy to read, reference, and update.

The 2014 Water System Master Plan is broken into the following sections:

1. Introduction
2. Study Area Characteristics
3. Stormwater System Capacity Evaluation
4. Stream Channel Vulnerability Assessment
5. Maintenance and Programmatic Evaluation
6. Integrated Management Strategy
7. Implementation Plan

Stormwater capital improvements are planned over the next 5 years based on the FY 17/18 Capital Improvement Plan which include:

E Columbia Drive - 2021/2022
N Elliott Road – 2019/2020

Staff has reviewed other master plans in relation to the Stormwater Master Plan. Public Works and Community Development staff coordinate to ensure that infrastructure such as water, wastewater, and transportation systems are in place or programmed to be improved when stormwater improvements are scheduled. Private development also improves the stormwater system when upgrades are necessary.

FISCAL IMPACT:

The current system development charge for stormwater is based on 2,877 square feet (1 EDU) of impervious surface. The charge is $358.64 per EDU. This charge generates approximately $40,000 per year to construct the projects in the Master Plan that are designated for future growth.

STRATEGIC ASSESSMENT (RELATE TO COUNCIL PRIORITIES FROM SEPTEMBER 2017):

The City Council by motion on March 21, 2016 adopted City Council Strategic Objectives. One of the adopted priorities was Project Planning. The priority states:

PROJECT PLANNING
In 3 years the council will have a schedule for reviewing of existing Master and Long Range plans. These will include acknowledgement of inter-departmental dependencies and demonstrate a mitigation of redundancy. The intent of this is to have a strategic approach for the Council to review existing plans in a scheduled manner to ensure that the original intentions and targets are being achieved. It is not intended that the council reviews the details of all the documents.

A schedule was prepared and shared with the City Council on March 4, 2017 outlining when various Master

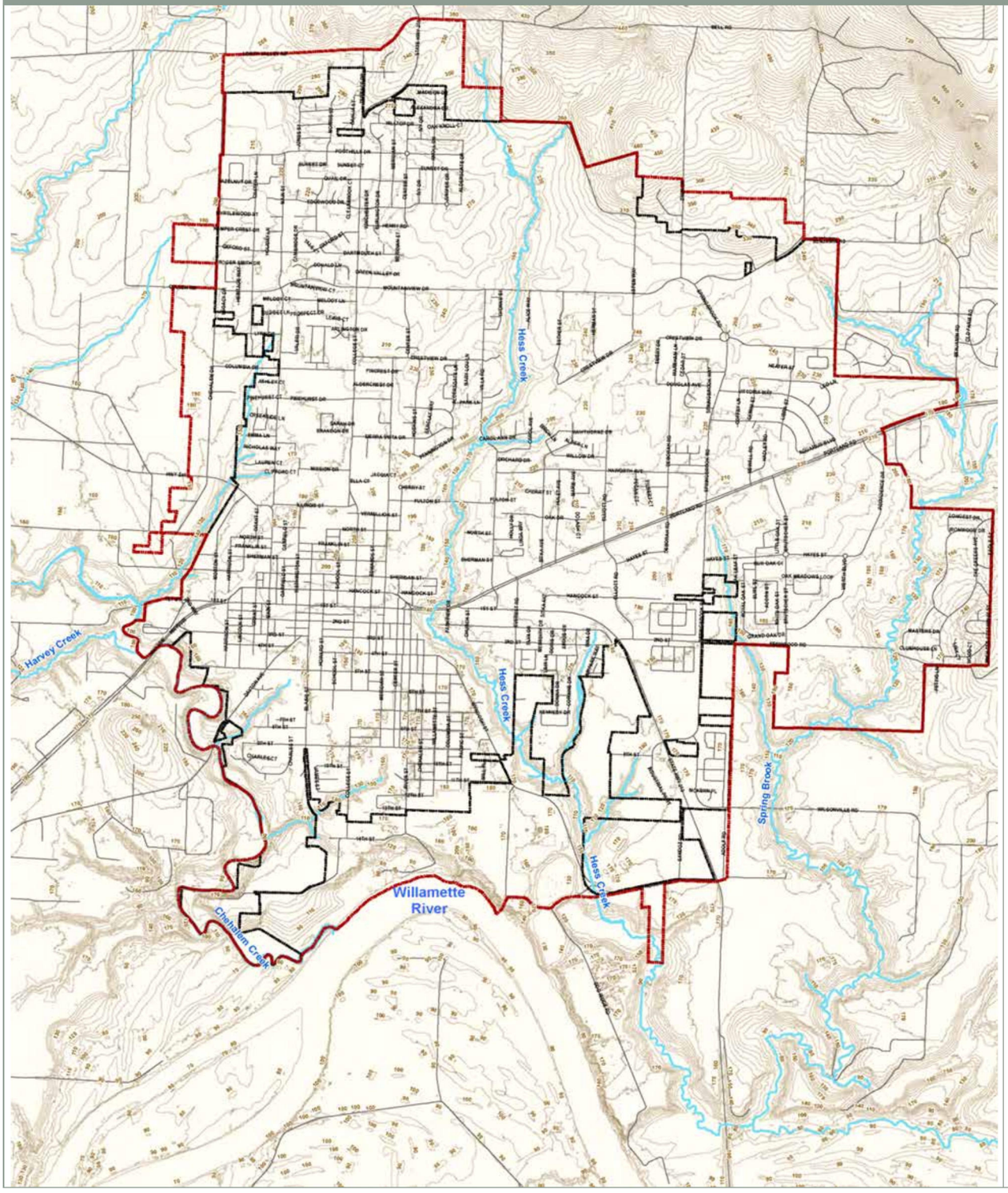
and Long Range plans would be brought before the City Council for review. This is the first year report on the 2014 Stormwater Master Plan.

Attachment: 1. 2014 Stormwater Master Plan

ATTACHMENT 1

Stormwater Master Plan

FINAL | **REPORT**



Prepared for:

City of Newberg, Oregon

Prepared by:

Brown and Caldwell

June 5, 2014

Brown AND Caldwell

150

Revised with Addendum #1 February 2, 2015

City of Newberg
Stormwater Master Plan

Prepared for
City of Newberg, Oregon
June 5, 2014

EXPIRES: 12/31/14

This document was prepared solely for the City of Newberg in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Newberg and Brown and Caldwell dated April 29, 2013. This document is governed by the specific scope of work authorized by the City of Newberg; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Newberg and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Brown AND Caldwell

6500 SW Macadam Avenue, Suite 200
Portland, OR 97239
Phone: 503.244.7005
Fax: 503.244.9095

Acknowledgements

Brown and Caldwell appreciates the assistance and constructive review comments given by the City of Newberg engineering, public works maintenance, operations, and planning staff in the preparation of this stormwater master plan update.

Specifically, the project team recognizes the following personnel for their efforts:

- Paul Chiu, PE, Newberg Engineering – Senior Engineer / Project Manager
- Jay Harris, PE, Newberg Engineering – City Engineer / Interim Public Works Director
- Russ Thomas, Newberg Public Works – Maintenance Superintendent
- Jan Wolf, Newberg Engineering – GIS Specialist
- Jason Wuertz, PE, Newberg Engineering – Associate Engineer
- Sonja Johnson, Newberg Public Works Operations – Environmental Specialist
- Barton Brierley, Newberg Planning and Building – Planning and Building Director

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List of Abbreviations

CIP	capital improvement project
City	City of Newberg
cfs	cubic feet per second
CRRC	Citizen Rate Review Committee
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	geographic information system
HDPE	high density polyethylene
H/H	hydrologic and hydraulic
IDDE	Illicit Discharge Detection and Elimination
LID	low impact development
Master Plan	stormwater master plan
MS4	Municipal Separate Storm Sewer System
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
Hwy 99W	Oregon Highway 99W
RCP	reinforced concrete pipe
SWMM	Surface Water Management Model
TMDL	Total Maximum Daily Load
UGB	urban growth boundary
URA	urban reserve area
WQ	water quality

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Executive Summary

In 2013, the City of Newberg (City) initiated development of a multi-objective Stormwater Master Plan (Master Plan) to provide a clear understanding of the existing stormwater system and provide a capital improvement project (CIP) program to address deficiencies in the system. The main objectives of this plan are as follows:

- Update the City's stormwater system's hydrologic and hydraulic models to evaluate system capacity.
- Develop an integrated stormwater system capital improvement program to address storm system capacity needs and water quality.
- Evaluate stream channel conditions with respect to erosion and impacts from future development.
- Continue to comply with water quality regulations.
- Review the City's stormwater management program and make recommendations on activities and staffing where applicable.
- Identify implementation priorities and impacts to the program budget.
- Develop a Master Plan document that is useful and easy to read, reference, and update.

Master Plan Technical Analyses

Development of the Master Plan involved four primary technical analyses to evaluate the stormwater infrastructure and programs.

Stormwater System Capacity Evaluation – Chapter 3 documents the development of a hydrologic and hydraulic model to simulate rainfall and runoff characteristics within Newberg. The model simulates stormwater flows through pipe networks, drainage ditches, and culverts to identify areas that are over capacity. The model considered both current conditions and the impacts of future development on stormwater flows. Stormwater infrastructure capacity concerns are presented in Table 3.7.

Problem Areas Survey – Surveys of City staff, compilation of public complaints, and review of past reports were used to identify additional problem areas within the stormwater infrastructure. The aim was to identify problem areas that would not be identified through hydraulic modeling, such as deteriorating pipes, frequent maintenance concerns, inadequate maintenance access, or underserved areas resulting in flooding. Problem areas are documented in Table 3.8.

Stream Channel Vulnerability Assessment – Field walks were conducted between October 15 and 17, 2013 to evaluate and assess existing and potential future channel conditions in the streams within Newberg. The City's existing stream channels are already well protected through development restrictions in the zoning code. Section 4.3 includes recommendations for small projects to address minor areas of erosion and adjustments to the City's stormwater design standards to reduce potential future channel impacts.

Maintenance and Program Evaluation – The City's stormwater management program was formed around addressing drainage capacity and flooding problems. In the last decade, the program has shifted to include addressing increased water quality regulations, such as the Total Maximum Daily Load (TMDL) program. Section 5 documents the current maintenance practices and programmatic activities within the City's stormwater management program and provides recommendations for maintenance and program enhancements.

Use of contents on this sheet is subject to the limitations specified at the end of this document.

Integrated Management Strategy

The recommendations in Chapter 6 present an integrated strategy of programs, projects, and maintenance activities to address stormwater management concerns. Recommendations include increasing staff by approximately 1.2 full-time equivalents (FTEs) to 6.60 FTEs within the stormwater program to support preventative maintenance activities and full implementation of the City's stormwater ordinance. Section 6 also identifies and recommends the following one-time projects and studies:

- Develop a Water Quality Sensitive O&M Manual at an estimated cost of $25,000.
- Conduct a System Development Charge (SDC) Rate Study at an estimated cost of $15,000.
- Plan for a future Stormwater Master Plan update in 2025 at an estimated cost of $250,000.

Capital Improvement Projects (CIPs) have been developed to address existing and predicted future conditions flooding problems, integrate water quality elements, and replace deteriorating pipe segments. The recommended CIP plan includes 15 specific projects (some divided into smaller phases) and two ongoing programs for annual pipe replacement and water quality retrofits. Section 6 documents the process used in developing the city-wide CIP plan.

Figure ES-1 shows the location of the proposed CIPs. Table ES-1 summarizes the identified CIPs, estimated costs, priority ranking, and an estimated timeline for implementation. Detailed cost estimates and scoring information are provided in Appendix D. As described in Section 7, highest priority has been given to projects that address safety and liability concerns. Short-term projects are targeted to be completed in the first 5 years of this Master Plan implementation, while the timing for mid-term and long-term projects will be dependent on available funding. Detailed fact sheets and planning level cost estimates for each CIP can be found in Appendix D.

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Table ES-1. CIP Prioritization and Implementation Timeline

Basin	CIP number	Project name	Cost, $	Prioritization score	Estimated timeline
Chehalem Creek	C-1	Blaine Street Improvements: Design	180,000	n/a[a]	Short-term
	C-1A	Highway 99W to 2nd Street Parking Lot Pipe Replacement	131,000	10.0	Short-term
	C-1B	S Blaine Street Pipe Replacement	384,000	9.0	Short-term
	C-1C	E 2nd Street to E 5th Street Pipe Decommissioning/Replacement	291,000	10.0	Short-term
	C-1D	E 6th and S Blaine Streets Pipe Replacement	176,000	6.5	Long-term
	C-2	S Center Street Improvements: Design	180,000	n/a[a]	Short-term
	C-2A	E 9th Street to S Center Street Pipe Decommissioning	294,000	10.5	Short-term
	C-2B	S Center, E 8th, and E 7th Streets Pipe Replacement	930,000	7.0	Long-term
	C-3	E Columbia Drive Improvements near Main Street	79,000	8.0	Mid-term
	C-4	Oxford Street Improvements	1,092,000	7.5	Mid-term
	C-5	N College Street Improvements, north of Foothills Drive	260,000	6.5	Long-term
	C-6	S River Street Improvements at E 11th Street	160,000	9.0	Short-term
	C-7	S College Street at Andrew Street Improvements	196,000	7.0	Long-term
	C-8	Dayton Avenue Green Streets	125,000	7.5	Mid-term
Hess Creek	H-1	N Elliot Road Improvements	239,000	5.5	Long-term[b]
	H-2	N Edwards Street Improvements from Vermillion to Sheridan	1,217,000	6.0	Long-term
	H-3	E 3rd Street Improvements: Design	142,000	n/a[a]	Long-term
	H-3A	S Church and E 1st Street Improvements	404,000	6.0	Long-term
	H-3B	E 3rd Street between S Everest Road and S Church Street	341,000	5.5	Long-term
	H-4	Villa Road Culvert Improvements	104,000	8.0	Mid-term[b]
Spring Brook	S-1	N Springbrook Road Improvements from Middlebrook to Haworth	777,000	6.5	Long-term[c]
	S-2	Libra Street Improvements at Vittoria Way	246,000	7.0	Long-term
City-wide	A-1	Stream Bank Protection Projects	190,000	8.0	Mid-term
		Total	8,137,000		

[a] *Design work for phased projects should be prioritized based on the highest scoring construction phase.*

[b] *Project to be constructed with roadway improvement project. Schedule dependent on transportation program priorities.*

[c] *Project to be designed and constructed with water and wastewater system improvements. Schedule based on joint priorities.*

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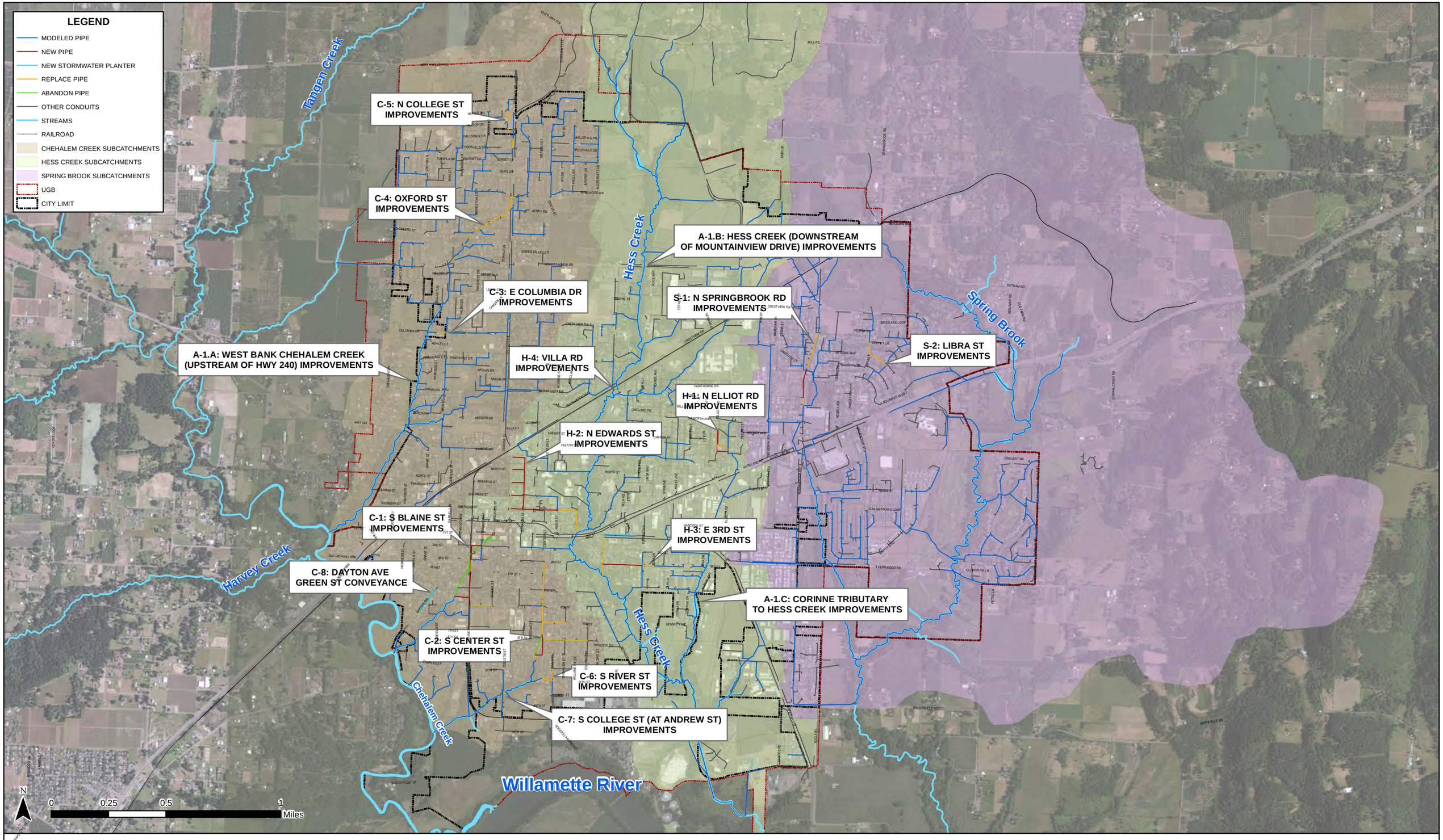

STORMWATER MASTER PLAN UPDATE

FIGURE ES-1. CAPITAL IMPROVEMENT PROJECTS

NEWBERG, OREGON

Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

JUNE 2014

Section 1

Introduction

This Stormwater Master Plan (Master Plan) documents the methods and results of stormwater system capacity and stormwater program evaluations for the Newberg study area. The study area for this Master Plan includes land within Newberg's urban growth boundary (UGB) and Yamhill County land upstream of the UGB that drains to tributaries of Chehalem Creek Tributary, Hess Creek, and Spring Brook. This section provides a summary of the need for the plan, the plan objectives, a description of the approach for preparing the plan, and a summary of how the plan is organized.

1.1 Need for the Plan

According to Portland State University's Population Research Center, Newberg's population was 22,580 on July 1, 2013. The Newberg Comprehensive Plan projects population to grow to 28,250 in 2020 and 32,213 in 2025. As projected growth continues to fill in the UGB, and the City plans for future expansion into the urban reserve areas, City staff must plan for such development in a way to maintain the character of the community. Stormwater master planning offers one mechanism to anticipate and address infrastructure and programmatic needs in conjunction with development and expansion.

The City will use this Master Plan as a tool to proactively address stormwater management with prioritized stormwater capital improvement projects (CIPs) that work in conjunction with the City's ongoing stormwater program that includes development standards addressing stormwater. This project provides an opportunity to expand upon the City's current planning approach to improve public safety, water quality, and aesthetic benefits while addressing storm drain capacity in several flood-prone areas.

Programmatic recommendations set forth in this plan will also address long-term management requirements under the City's Total Maximum Daily Load (TMDL) program with the Oregon Department of Environmental Quality (DEQ).

1.2 Plan Objectives

This multi-objective Master Plan addresses stormwater quantity control and current stormwater system capacity limitations. In conjunction with the development of the capital improvement program, a summary of recommendations to address water quality and long-term stream stabilization is provided. In summary, the main objectives of this plan are as follows:

- update the City's stormwater system hydrologic and hydraulic models to evaluate system capacity
- develop an integrated stormwater system capital improvement program to address storm system capacity needs and water quality
- evaluate stream channel conditions with respect to erosion and impacts from future development
- continue compliance with water quality regulations
- review the City's stormwater management program and make recommendations on activities and staffing where applicable
- identify implementation priorities and impacts to the program budget
- develop a Master Plan document that is useful and easy to read, reference, and update

Use of contents on this sheet is subject to the limitations specified on the title page of this document.

1.3 Approach

The approach for developing this Master Plan is summarized in Figure 1-1. This approach was developed to meet the City's stormwater management objectives and increase the understanding of the existing stormwater infrastructure. The data collection, evaluation, and improvement strategies were conducted as follows:

1. The City's storm drain geographic information system (GIS) data were reviewed and supplemental data were collected through field investigations. Existing water quantity and quality control facilities were also reviewed.
2. Collected data were used to develop the stormwater hydrologic and hydraulic (H/H) model and associated model attributes such as subcatchment drainage areas, land uses, soils, and topography.
3. City staff were interviewed to identify known drainage problem areas.
4. Alternatives were developed for improvements to the stormwater infrastructure.
5. Improvements were evaluated with City staff to determine the best alternatives for incorporation into both the future management program and the City's capital improvement program.
6. Project costs were developed, along with a proposed implementation timeline, consistent with anticipated program funding.
7. The approach was documented in this Master Plan to provide information in a clear and easy–to-use format.

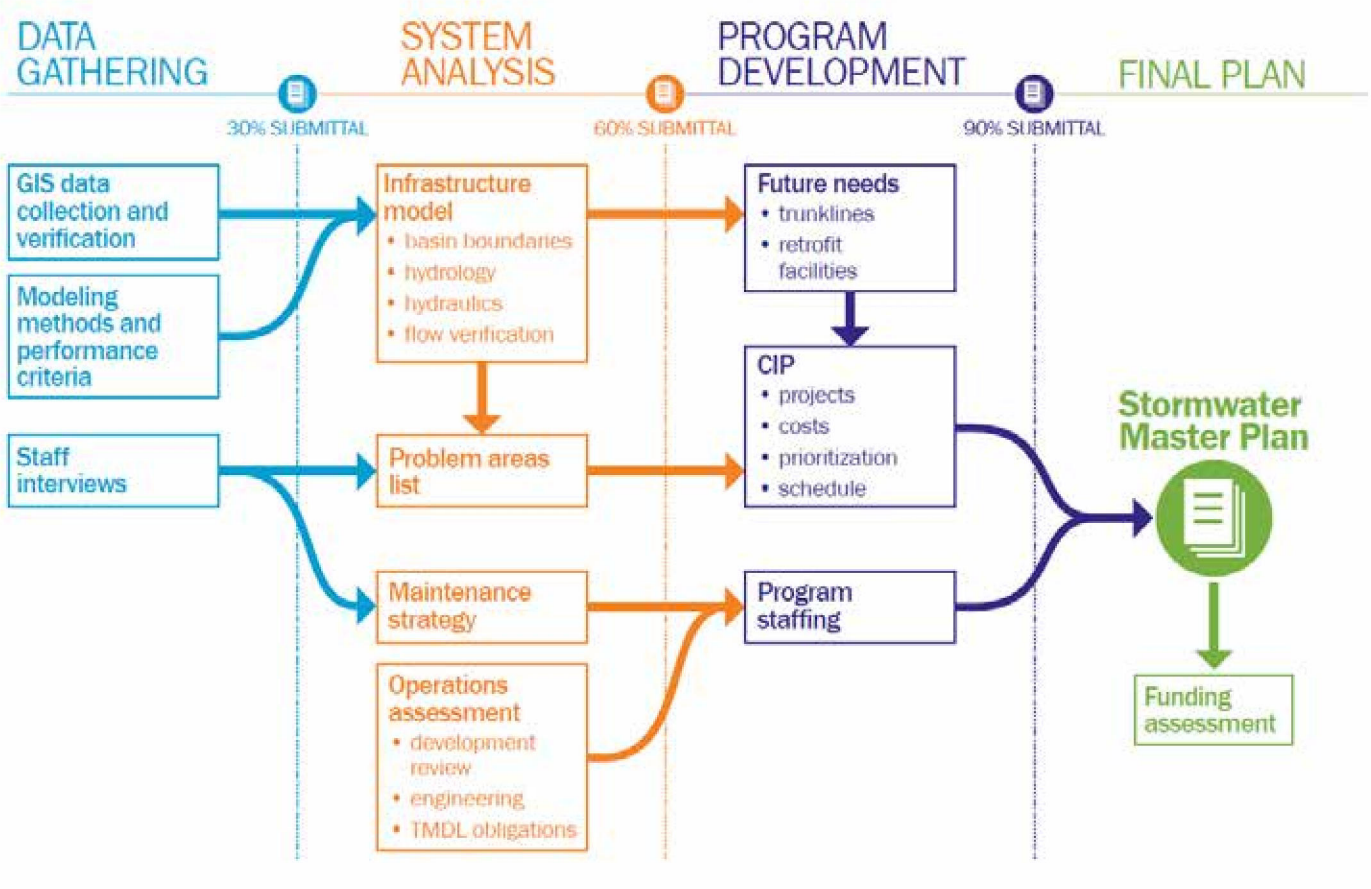

Figure 1-1. Stormwater master plan approach

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1.4 Plan Organization

This Master Plan is organized as follows:

- Section 2 includes a description of study area characteristics and associated mapping.
- Section 3 describes the methods used to conduct a storm system capacity evaluation including hydrologic and hydraulic modeling.
- Section 4 is a summary of the stream and natural area vulnerability assessment.
- Section 5 provides a review of the existing maintenance and programmatic management activities and identifies future program needs.
- Section 6 describes the methods and results of integrating the programmatic and capital measures to address the City's storm system capacity and water quality needs.
- Section 7 describes the recommended capital improvement project prioritization and implementation schedule to address storm system capacity and water quality.
- Appendices A through D provide supporting and technical information used in the development of the Master Plan document.

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Section 2

Study Area Characteristics

This section includes an overview of study area characteristics including location; topography; soils; land use; climate and rainfall; drainage system; and current stormwater quality conditions.

2.1 Location

The City of Newberg is located 25 miles southwest of Portland, Oregon, along the Oregon Highway 99W (Hwy 99W) corridor. Newberg is in northeast Yamhill County and is bordered by the Chehalem Mountains to the north and the Willamette River to the south.

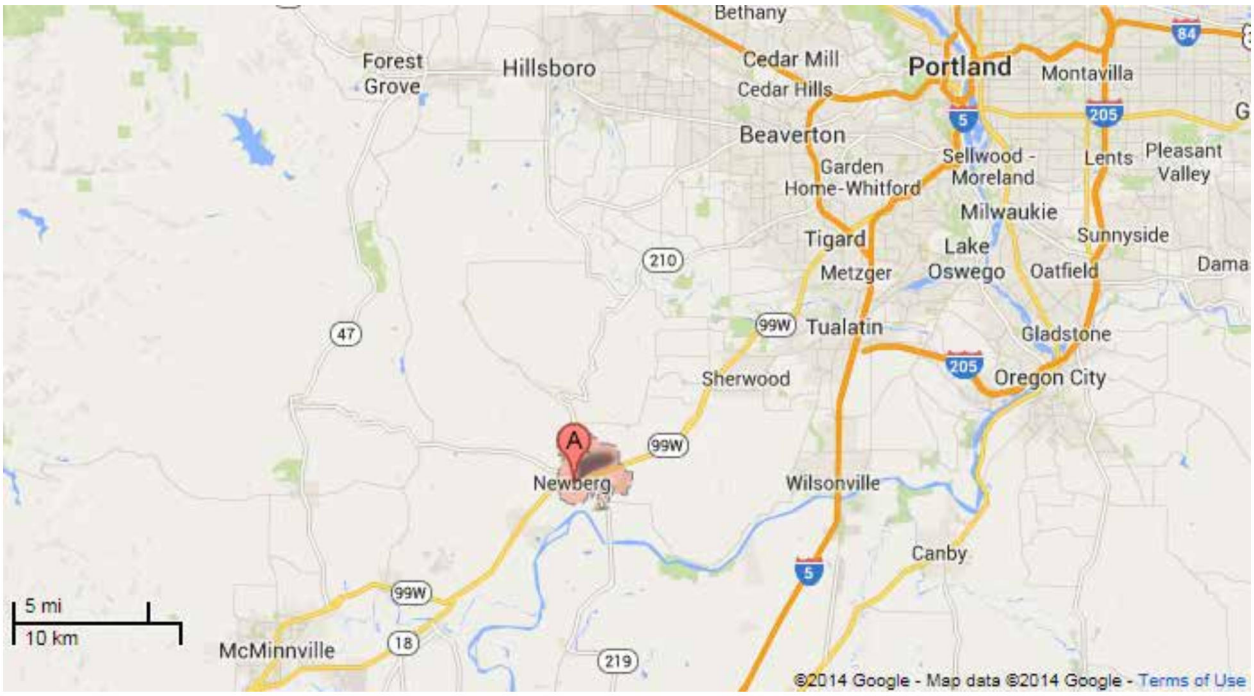

Figure 2-1. Vicinity map

The city is approximately 5.8 square miles and is drained by Chehalem Creek, Hess Creek, and Spring Brook. Chehalem Creek and Spring Brook drain to the Willamette River near River Mile 51.0 and River Mile 47.2, respectively. Hess Creek enters Spring Brook downstream of the city limits.

2.2 Topography

Topographic information was compiled using 2012 aerial imagery and LiDAR data on the North American Vertical Datum of 1988 (NAVD88). Anecdotal information from City staff and six field visits by Brown and Caldwell staff were used to supplement these data.

Newberg is located within the Willamette River Valley and gently slopes from the north down to the Willamette River to the south. The highest point within the city is located at elevation 456.3 and the

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lowest is near the Willamette River at elevation 62.2. The Hess Creek and Spring Brook watersheds extend into the mountains and flow through Newberg. Outside of the city, the watersheds extend up to elevations of 1,249.4 and 1,225.8, respectively. The creeks within the city flow from north to south and provide a natural drainage system throughout the city. The average slope within the city boundary ranges from 0.5 percent to 27.4 percent and averages approximately 5.6 percent. The average slope of Hess Creek passing through the center of the city from north to the south is approximately 1 percent. Figure 2-2 illustrates the city topography.

2.3 Soils

Soil classification is an important characteristic to consider when evaluating runoff flow rates and volumes. Soil types within the study area were identified using data from the Natural Resource Conservation Service Soil (NRCS) Survey. Soil information is based upon data obtained from the NRCS Web Soil Survey (2013) which publishes information from the 1974 publication from the U.S. Department of Agriculture Soil Conservation Service titled *Soil Survey of Yamhill Area, Oregon*.

Table 2-1 shows soil types, soil characteristics and distribution within the UGB according to the NRCS soil survey.

Table 2-1. Soil Characteristics

NRCS map unit name	NRCS map symbol	Hydrologic soil group	Percent coverage in UGB
Aloha silt loam	Ah	C	42.8
Amity silt loam	Am	D	8.3
Carlton silt loam, 0 to 7 Percent slopes	CaB	C	0.1
Carlton silt loam, 7 to 12 Percent slopes	CaC	C	0.1
Carlton silt loam, 12 to 20 percent slopes	CaD	C	0.1
Cloquato silt loam	Cm	B	0.0
Cove silty clay loam, thick surface	Cs	D	0.7
Dayton silt loam	Da	D	0.4
Dayton silt loam, thick surface	Dc	D	0.8
Hazelair silty clay loam, 2 to 7 percent slopes	HcB	D	0.5
Hazelair silty clay loam, 7 to 20 percent slopes	HcD	D	0.7
Jory clay loam, 2 to 7 percent slopes	JrB	B	0.7
Jory clay loam, 12 to 20 percent slopes	JrD	B	0.2
Jory clay loam, 20 to 30 percent slopes	JrE	B	0.0
Jory clay loam, 30 to 60 percent slopes	JRF	B	0.1
Laurelwood silt loam, 3 to 12 percent slopes	LuC	B	0.1
Laurelwood silt loam, 12 to 20 percent slopes	LuD	B	0.2
Nekia clay loam, 2 to 7 percent slopes	NcB	B	0.2
Nekia clay loam, 7 to 20 percent slopes	NcD	B	0.5
Panther silty clay loam, 4 to 20 percent slopes	PaD	D	0.0
Shale rock land	SH	D	0.0
Stony land	SL	A	0.3
Terrace escarpments	Te	C	6.0
Water	WATER	Water	0.0

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Table 2-1. Soil Characteristics			
NRCS map unit name	NRCS map symbol	Hydrologic soil group	Percent coverage in UGB
Wapato silty clay loam	Wc	D	3.0
Willakenzie silty clay loam, 2 to 12 percent slopes	WeC	C	0.3
Willakenzie silty clay loam, 12 to 20 percent slopes	WeD	C	0.1
Willakenzie silty clay loam, 20 to 30 percent slopes	WeE	C	0.0
Willamette silt loam, 0 to 3 percent slopes	WIA	B	0.8
Willakenzie silty clay loam, moderately shallow, 7 to 20 percent slopes	WkD	C	0.1
Woodburn silt loam, 0 to 7 percent slopes	WuB	C	28.0
Woodburn silt loam, 7 to 12 percent slopes	WuC	C	2.6
Woodburn silt loam, 12 to 20 percent slopes	WuD	C	2.4

The soils listed in Table 2-1 are illustrated within the study area in Figure 2-3.

2.4 Land Use

Newberg's 2010 population was reported by the U.S. Census Bureau to be 22,068. The City's Comprehensive Plan projects significant population growth over the next several decades, with the 2020 population projection at 28,250 and the 2030 population projection at 35,408. The city is largely developed within the current UGB, but does have some significant remaining vacant areas in the northeast portion of the city. Currently land use includes a mix of residential land use and industrial and commercial corridor along Hwy 99W.

The City's GIS department has measured and mapped existing impervious areas within the city limits. These include residential houses (roofs), and building footprints and pavement areas for commercial, industrial, and civic areas. The mapped pavement areas include parking lots, sidewalks, and paved paths. Public right of way was mapped based on tax lot information and is assumed to average 75 percent impervious.

Figure 2-4 shows the existing impervious areas mapped by the City's GIS department.

The Comprehensive Plan land use map was used to estimate and assign impervious area percentages applicable to future development conditions for hydrologic modeling. The Comprehensive Plan includes several special planning districts, including the Springbrook District and the Riverfront District. These areas are designated to provide a flexible development approach, allowing for a mixture of residential, hospitality/public, commercial, and industrial uses. Newberg's Urban Reserve Areas were discussed with the City and divided into three categories: Industrial, High-Density Residential, and Low-Density Residential. The City's comprehensive plan was used to assign future impervious percentages, as shown in Table 2-2. All vacant lands were assumed to be developed in the future condition land use scenario for modeling purposes.

Figure 2-5 shows the future conditions land use coverage within Newberg and the UGB.

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Table 2-2. Future Conditions Land Use Categories	
Future conditions land use (LU) classification	Impervious percentage, %
Commercial	85
Commercial (Riverfront)	85
Commercial (Specific Plan)	85
Springbrook District: Village	85
Springbrook District: Neighborhood Commercial	85
Springbrook District: Hospitality	85
Mixed Use	80
Mixed Use (Specific Plan)	80
Industrial	75
Industrial (Riverfront)	75
Industrial (Specific Plan)	75
Urban Reserve Area: Industrial	75
Springbrook District: Employment	75
High-Density Residential	70
High-Density Residential (Specific Plan)	70
Urban Reserve Area: High-Density Residential	70
Medium-Density Residential	60
Medium-Density Residential (Riverfront)	60
Medium-Density Residential (Specific Plan)	60
Springbrook District Mid-Rise Residential	60
Low-Density Residential	50
Low-Density Residential (6 du/ac)	50
Low-Density Residential (Riverfront)	50
Low-Density Residential (1A)	50
Low-Density Residential (Specific Plan)	50
Urban Reserve Area: Low-Density Residential	50
Springbrook District: Low-Density Residential	50
Urban Reserve Area: Multi-Use	40
Quasi-Public	40
Parks	10
Parks (Riverfront)	10

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2.5 Climate and Rainfall

The north Willamette valley experiences relatively warm, dry summers and mild wet winters. The Coast Range provides some shielding from Pacific Ocean storms. The following climate data is based on the Western Regional Climate Center historic record from 1928 to 2005 for McMinnville, Oregon (station 355384). The normal daily high temperatures range from approximately 83 degrees in August to 46 degrees in January. Normal daily low temperatures range from approximately 50 degrees in July to 33 degrees in January.

The average annual precipitation is approximately 41.8 inches with 6.7 inches of snowfall. Most of the precipitation in this area falls between the months of October and April; however, short, intense summertime storms contribute to the annual rainfall as well.

Reference: http://www.wrcc.dri.edu/summary/climsmor.html

2.6 Drainage System

The city's drainage system is defined by the three creeks running from north to south through the city. From west to east, the creeks include Chehalem Creek, Hess Creek, and Spring Brook. All of the creeks flow into the Willamette River, which is one of the Columbia River's primary tributaries.

The City maintains approximately 55 miles of conveyance system, either in closed storm pipes or open channels.

For the purposes of the modeling effort for this plan, subcatchments were delineated to capture drainage to City-owned 12-inch-diameter and larger storm drain piping and major open channel conveyances within the UGB. Inlet leads, pipes smaller than 12 inches in diameter, and pipes not owned by the City were not included in this effort.

Drainage areas for Hess Creek and Spring Brook were also delineated to capture the extent of their respective watersheds which extend beyond the UGB. The Hess Creek watershed extends north of the existing UGB to Mountain Top Road and is bound to the west by Chehalem Creek and to the east by Spring Brook. The drainage area for Spring Brook extends north of the existing UGB to Mountain Top Road and east of the UGB to NE Old Parrett Mountain Road and NE Kramien Road.

Figure 2-6 illustrates delineated subcatchments and the modeled pipe system on a citywide scale. More detailed mapping associated with system modeling is presented in Section 3.

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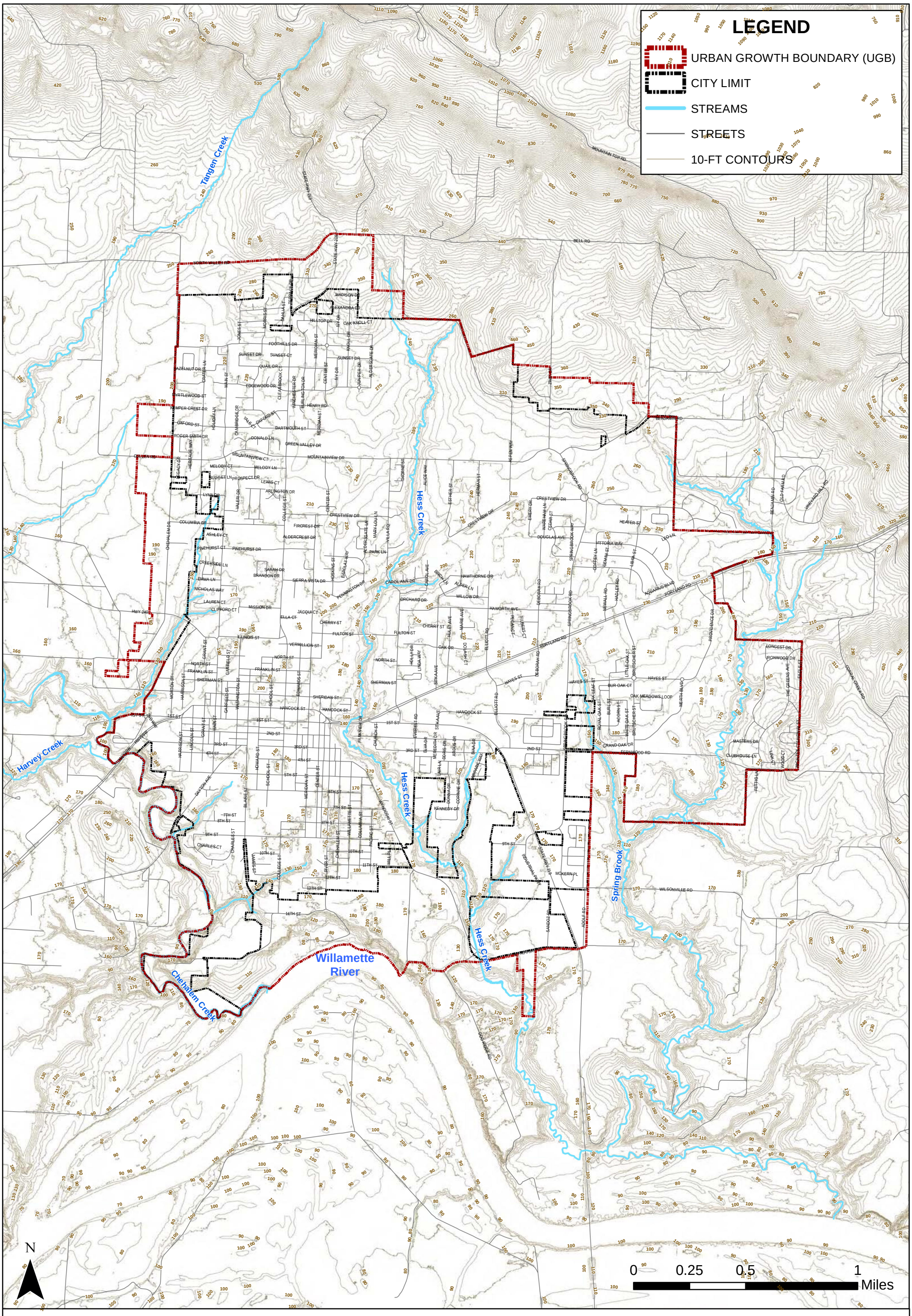


STORMWATER MASTER PLAN UPDATE

FIGURE 2-2. TOPOGRAPHIC MAP

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

MARCH 2014

LEGEND

HYDROLOGIC SOIL GROUP (HSG)

- A (HIGHEST INFILTRATION)
- B
- C
- D (LOWEST INFILTRATION)
- WATER
- URBAN GROWTH BOUNDARY (UGB)
- STREAMS
- STREETS

Tangen Creek
Hess Creek
Willamette River
Chehalem Creek
Spring Brook

N

0 0.25 0.5 1 Miles

STORMWATER MASTER PLAN UPDATE

FIGURE 2-3. SOILS MAP

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

MARCH 2014

LEGEND

IMPERVIOUS AREAS

- BUILDINGS
- HOMES
- PAVEMENT
- GENERAL ROW
- CITY CENTER/HWY 99 ROW
- TAXLOTS
- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMIT
- STREETS
- STREAMS

Tangen Creek
Hess Creek
Harvey Creek
Willamette River
Chehalem Creek
Spring Brook
N
0 0.25 0.5 1 Miles

STORMWATER MASTER PLAN UPDATE

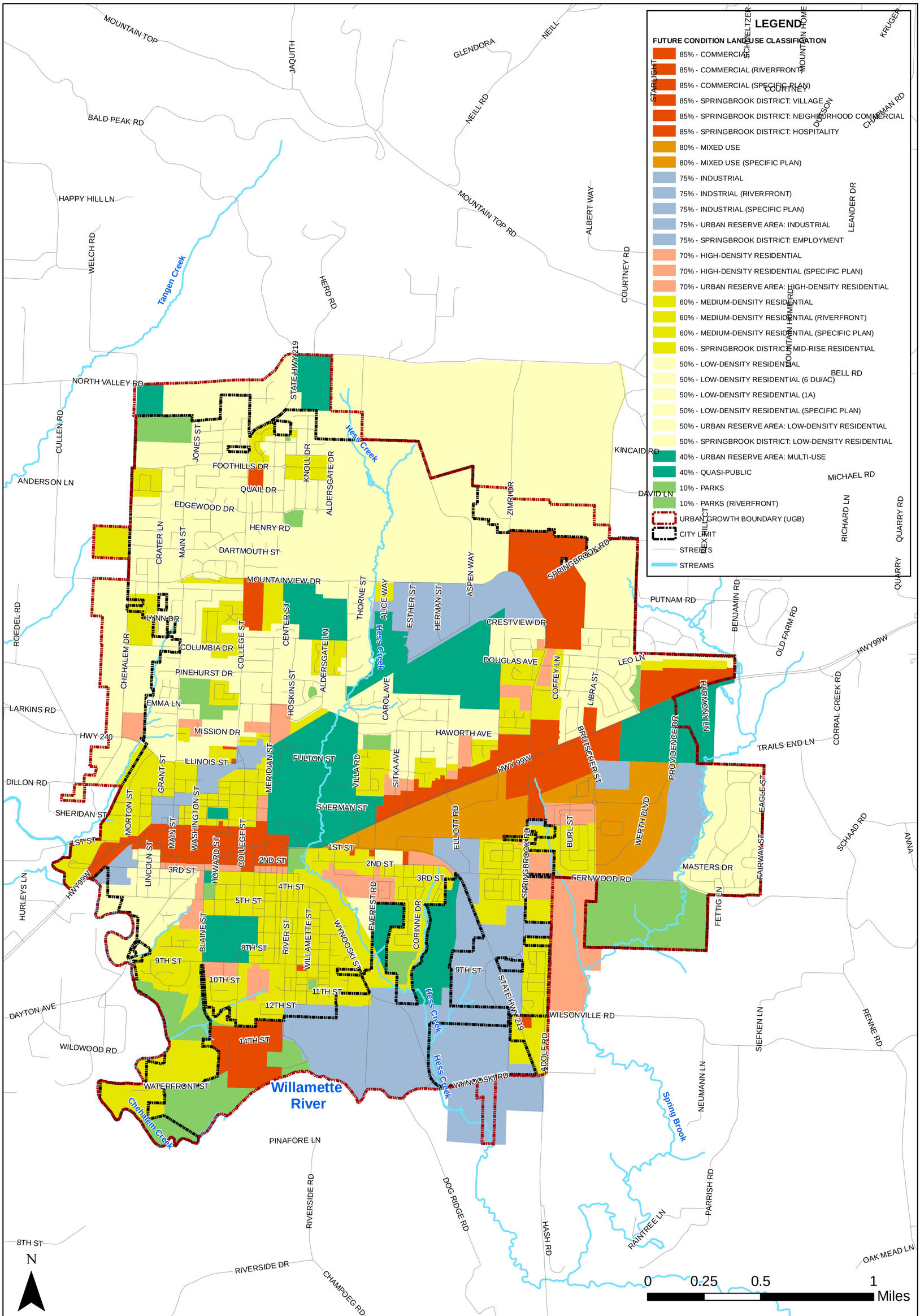
FIGURE 2-4. EXISTING IMPERVIOUS AREAS

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

MARCH 2014

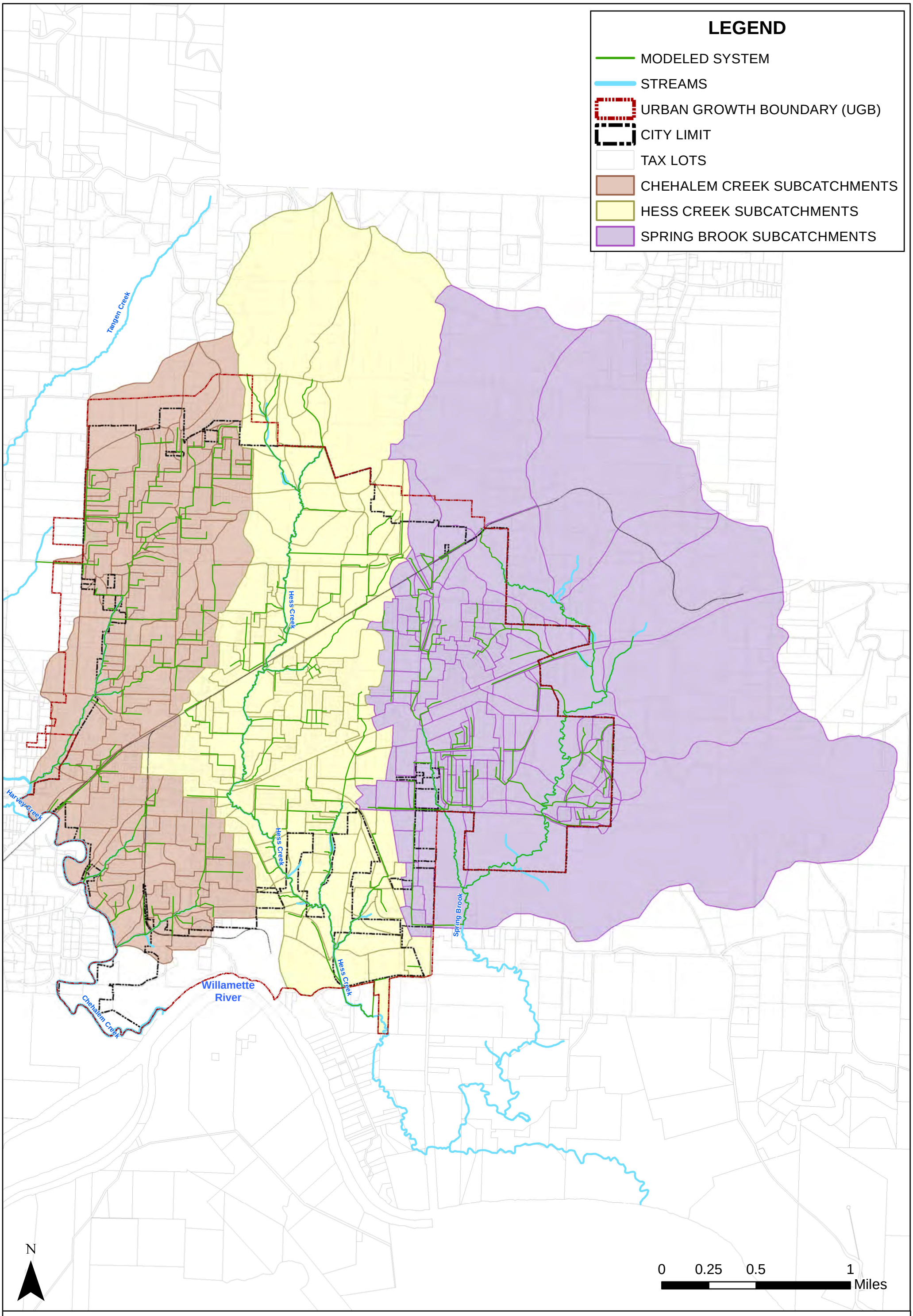


STORMWATER MASTER PLAN UPDATE

FIGURE 2-5. FUTURE CONDITIONS LAND USE

NEWBERG, OREGON

JUNE 2014



STORMWATER MASTER PLAN UPDATE

FIGURE 2-6. DRAINAGE SYSTEM AND STUDY AREA

NEWBERG, OREGON

FEBRUARY 2014

Section 3

Stormwater System Capacity Evaluation

To identify flooding problems and opportunities for CIPs, two primary methods of system evaluation were utilized. First, the City's public stormwater drainage system was evaluated using a hydrologic and hydraulic model to simulate the rainfall to runoff characteristics and route estimated flows through the City's conduits and channels. The stormwater drainage system was evaluated under both existing land use and future development scenarios. This section provides a description of the modeling methods used for the system capacity evaluation and provides a summary of results.

The second method of system evaluation was to identify drainage capacity and other infrastructure problems through discussions with City staff and a review of existing reports that document potential problems. The compilation of additional problem areas is documented in Section 3.5.

3.1 Model Development

Computational Hydraulics International's PC SWMM 2012, v. 5.0.022, was the software used to model the City's storm system. PC SWMM 2012 provides a graphical interface for the U.S. Environmental Protection Agency (EPA) SWMM5 engine. The PC SWMM interface is integrated with Esri ArcGIS. Files transferred to the City will be in EPA SWMM5 format, which may be used by the City for internal modeling and future updates after the completion of this Stormwater Master Plan (Master Plan).

The model of the City's storm drain system includes City-owned storm drainage pipes 12 inches and larger in diameter and major open-channel conveyances. Inlet leads, pipes smaller than 12 inches in diameter, and pipes not owned by the City were generally not included in this effort. System mapping completed for the model development is shown in Appendix A, which contains a key map at a 1" = 2,000' scale and seven full size system maps at a 1" = 500' scale.

The storm system model also includes limited channel modeling for the east branch of Chehalem Creek, Hess Creek and two branches of Spring Brook as shown on Figure 2-5. A Yamhill County Flood Study was developed in 1980 and includes models of Chehalem Creek and Hess Creek. However, as urbanization has significantly changed the creek systems since the development of these earlier models, current channel information was estimated from more recent LIDAR topographic information and verified through limited field work. Culvert and bridge data were incorporated from the City's geographic information system (GIS) and as-built maps.

Model development requires input of meteorological data, subcatchment hydrology, and surface water system hydraulic input parameters. Precipitation data, as design storms, were used to evaluate system capacity. Input parameters associated with subcatchment hydrology and surface water system hydraulics were developed through use of the City's GIS data. Gaps in City GIS data were filled using data from City field verifications and the 2001 Stormwater Master Plan.

3.1.1 Horizontal and Vertical Datum

All reported elevations and coordinates in this study are measured in feet and use the NAVD88 and the North American Datum of 1983 (NAD83) state plane coordinate system, respectively.

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A section of the City's storm-drain system GIS data were on the National Geodetic Vertical Datum of 1929 (NGVD29) prior to this project and were converted to NAVD88. The conversion from NAVD88 to NGVD29 is to subtract 3.415 feet.

3.1.2 Design Storms

Traditional design storms are synthetic rainfall events used to evaluate the capacity of storm drainage systems and design capital improvements for the desired level of capacity and flood protection.

Design storms evaluated for this study included the 2-year, 10-year, 25-year, and 100-year 24-hour duration design storms.

The rainfall depths for these design storms were based on isopluvial maps published in the NOAA Atlas 2, Volume X. The rainfall distribution for these design storms is based on the Soil and Conservation Service (SCS) 24-hour, Type IA distribution, which is applicable to western Oregon, Washington, and northwestern California. Table 3-1 lists the precipitation depths for each design storm used in the model.

Table 3-1. Design Storm Depths

Design storm event	Rainfall depth, inches
2-year, 24-hour	2.5
10-year, 24-hour	3.5
25-year, 24-hour	4.0
50-year, 24-hour	4.2

3.1.3 System Nomenclature

This master planning effort incorporated the same nomenclature as the City's GIS for all the different elements all the stormwater system. Most of the manholes in the system are labeled STMH followed by an identifier number. Most of the pipes within the system are identified with STGM followed by a unique number. For the modeling effort additional identifiers were created for the modeled creek system and to provide additional detail to the pipe system. Open channel reaches on the three main creeks were labeled with CC, HC, or SB followed by a number. These labels represent Chehalem Creek, Hess Creek and Spring Brook, respectively. Numbering was started at the lower reaches and numbers increased in the upstream direction. Tributaries were named CCT1 (Chehalem Creek Tributary 1) followed by a number. Additional nodes were included in the model as breaking points between reaches, at slope changes, and where manholes were discovered that were not part of the GIS inventory. These additional nodes were labeled with a J followed by a number.

Subcatchments or drainage basins were developed and each subcatchment was named according to the name of the drainage element that the subcatchment drained into. For example, the runoff from subcatchment SC_STMG128 would enter the system STMG128. The key map in Appendix A illustrates the location of the modeled elements within the study area. Detailed maps which include the location of the modeled elements, named subcatchments, and inlet nodes are also located in Appendix A.

3.1.4 Hydrologic Data

This section includes a summary of subcatchment delineations and model input parameters used to define the hydrologic characteristics of the subcatchments. Table 3-2 identifies and describes model attributes associated with subcatchments.

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Table 3-2. Subcatchment Model Attributes	
Attribute	Value
Name/Outlet	Identified by the storm drain element that has been identified according to the subcatchment inlet node
Area	Area of the subcatchment in acres
Width	Characteristic width of the overland flow path for sheet flow in feet
Slope	Average percent slope of the subcatchment
Imperv	Average percent of land area that is directly connected impervious area
Nimperv	Manning's *n* for overland flow over the impervious portion of the subcatchment (default value = 0.015)
Nperv	Manning's *n* for overland flow over the pervious portion of the subcatchment (default value = 0.030)
Dstore-Imperv	Depth of depression storage on the impervious portion of the subcatchment (default value = 0.05)
Dstore-Perv	Depth of depression storage on the pervious portion of the subcatchment (default value = 0.2)
ZeroImperv	Percent of the impervious area with no depression storage (default value = 25)
Routing	Runoff from pervious and impervious areas routes to a node within the storm drain system (value=OUTLET)
PctRouted	Percent runoff routed between subcatchments (default = 100)
Groundwater	Groundwater routing is not included (value=NO)
CurveNo	SCS pervious curve number calculated as an area-weighted average, based on the hydrologic soil group within each subcatchment

The curve number method was used to model runoff characteristics. PC SWMM utilizes a pervious curve number to calculate the infiltration for each sub-catchment. This method is documented in the U.S. EPA *Technical Release 55*.

The pervious curve number is based on the underlying soil type, as shown in Table 3-3.

Table 3-3. Pervious Curve Numbers				
Land Use	Hydrologic Soil Group (HSG)			
	A	B	C	D
Impervious	98	98	98	98
Open space/grass	39	61	74	80

For the existing conditions model, the percentage of impervious surface was estimated using the City's impervious surface and tax lot layers in GIS and spot-checking with aerial imagery. For the future conditions model, the percent impervious was assigned based on the assumed impervious percentages for each land use type from the Comprehensive Plan (See Table 2-2).

Appendix B, Table B-1, provides model parameters and peak flows for each subcatchment and modeled design storm. Table B-2, provides model parameters and runoff volumes for each subcatchment and modeled design storm.

3.1.5 Hydraulic Data

This section describes the model input parameters used to characterize the hydraulic characteristics of the system.

System hydraulics were based on GIS data provided by the City. Where needed, GIS data were supplemented with data from the 2001 Master Plan; as-built information and maps provided by the City; aerial imagery; and LIDAR topographic information. The City collected field survey data to validate invert

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and rim elevations and system geometry as part of this Master Plan process. Hydraulic components developed from these data and imported into the model included conduits and junctions. A description of hydraulic components is provided in the following sections.

3.1.5.1 Nodes

Model nodes include storm drain utility manholes, catch basins, and other relevant connection points or locations where a conduit change occurs. Model nodes have the attributes as listed in Table 3-4.

Table 3-4. Model Node Attributes

Attribute	Value
ID	Unique identifier
Invert elevation	Invert elevation of the node in feet.
Depth	Depth (feet) = Rim elevation – invert elevation.
Ponded area	Area available for ponding of water atop of the node after flooding occurs in square feet. Allows ponded water to be stored and subsequently returned to the drainage system when capacity exists.

Appendix B, Table B-2, provides model parameters and peak flows for each modeled node.

3.1.5.2 Conduits

Model conduits include pipes, culverts, and open channels. Model conduits have the model attributes as shown in Table 3-5.

Table 3-5. Model Conduit Attributes

Attribute	Value
ID	GIS Unique ID (when available)
Length	Length between upstream and downstream junctions in feet
Roughness	Manning's Roughness Coefficient: • Concrete Pipe: 0.013 • Corrugated Metal Pipe: 0.024 • Ductile Iron (DI): 0.013 • HDPE: 0.0125 • PVC: 0.0125 • Unknown: 0.013 • Open channel: 0.04 – 0.10
Cross-Section	Circular, trapezoidal, or irregular
Inlet Elevation	Elevation of conduit inlet in feet
Outlet Elevation	Elevation of conduit outlet in feet
Geom1	• Circular: diameter in feet • Trapezoidal: max depth in feet
Geom2	Trapezoidal: bottom width in feet
Geom3	Trapezoidal: left slope (horizontal/vertical)
Geom4	Trapezoidal: right slope (horizontal/vertical)
Barrels	One for single pipe, two or more for parallel pipes

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Table B-2 in Appendix B provides model parameters, 10-year recurrence interval peak flows, and the calculated hydraulic capacity for each modeled conduit.

3.1.5.3 Storage

No storage facilities were modeled because there were no in-line facilities located within the modeled system.

3.1.5.4 Outfalls

The study area includes 16 piped outfalls. Model outfalls have the attributes shown in Table 3-6.

Table 3-6. Outfall Model Attributes

Attribute	Value
Name	Unique identifier
Invert elevation	Invert elevation of the outfall in feet
Rim elevation	Ground surface elevation at the outfall in feet
Type	Type of outfall boundary condition; options used include: • FREE: Outfall stage is determined by minimum of critical flow depth and normal flow depth in the connecting conduit. • FIXED: Outfall stage is set to a fixed value equal to the top of the outfall pipe; this condition was selected for system evaluation and CIP sizing in systems draining to Chehalem Creek, Hess Creek, and Spring Brook.

3.2 Evaluation Criteria

Section 4 of the City's Standard Design Manual includes design requirements for storm drainage systems in Newberg. At the time of the SWMM model development, the City was using the *2010 Standard Design Manual*, so that manual was referenced for establishing the design standards for evaluating the capacity of the stormwater infrastructure. The existing and future storm drainage pipe network was evaluated for capacity based on the following conditions:

- Minor drainage system elements (streets, curbs, gutters, inlets, catch basins, and collector drains): capacity for the 10-year design storm
- Major laterals (laterals and collectors with less than 250 acres tributary area): capacity for the 10-year design storm
- Major trunk lines (trunk lines with greater than 250 acres of tributary area and drainage systems under arterial streets: capacity for the 50-year design storm
- Culverts on creek systems: capacity for the 50-year design storm

For the purpose of evaluating the capacity of the existing and future storm drainage infrastructure, flooding was defined as any surcharge over the rim elevation of a manhole or above the bank elevation of open channels. Minor flooding is defined as flooding that occurs for less than 2-hours during the peak 24-hour design storm. Major flooding is defined as flooding that occurs for more than 2-hours during the peak 24-hour design storm.

During the development of this Master Plan, the City was in the process of updating the Stormwater Design Standards. The proposed standards included a change to using the 25-year, 24-hour design storm for sizing stormwater pipes conveying water from drainage areas less than 250 acres in size. In order to plan for this change in the City's design standards, the proposed capital improvement projects (CIPs) for drainage areas less than 250 acres have been sized for the 25-year design storm. See Section 6 for additional information on proposed CIPs.

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3.3 Model Validation

Preliminary modeling results were reviewed with City staff during a project meeting in November 2013 and compared to known flooding problems reported by the City's maintenance crews. Anecdotal accounts of flooding were generally consistent with the locations where flooding occurs in the modeled system. In some cases, City staff report flooding problems due to sediment build-up or other field conditions (e.g. a grading problem that prevents adequate collection of runoff into the stormwater system) that are not reflected in the hydraulic model. These problems were documented for CIP development, but did not require a change in the hydraulic model.

Discussions with City staff lead to several minor adjustments to the modeled drainage system. Most notably, maintenance staff identified locations between Oxford Street and Meadowview Drive, where maintenance crews had addressed flooding problems through field adjustments to the drainage system that had not yet been documented in the City's GIS database. After adjusting the modeled system to reflect field conditions, the model validation was complete.

3.4 Model Results

PC SWMM (version 5.2.1318) was used to simulate the 2-year, 10-year, 25-year, and 50-year design storms for the current and future development conditions.

Results of the hydrologic/hydraulic (H/H) model simulations are tabulated in Appendix B (Table B-1 for hydrologic peak flow results and Table B-2 for hydraulic results). For reporting purposes, the hydrologic results reflect all simulated design storms, and the hydraulic results tables reflect just the 10-year flows, which were used to identify capacity deficiencies in most areas of the City. Hydraulic results for larger storm events are available in the electronic project files.

The hydrologic results table (Table B-1) is sorted by basin and subcatchment, and includes the subcatchment name, modeled inlet node ID, subcatchment area, curve number, impervious area, and associated design flow. The hydraulic results table (Table B-2) is sorted by system basin and conduit, and includes the conduit name, upstream and downstream node ID, length, size, invert and rim elevations, and existing and future 10-year peak flows and water surface elevations.

3.4.1 Initial Identification of Flooding Problems

Based on the hydraulic model results summarized in Table B-2, conduits experiencing backwater conditions that resulted in flooding of the upstream manhole were identified. Figures 3-1 and 3-2 illustrate predicted flooding for existing and future land use conditions.

The model results were reviewed with City staff in November, 2013. City staff provided comment and discussion about each identified modeled flooding area. Table 3-7 summarizes the identified flooding problem areas.

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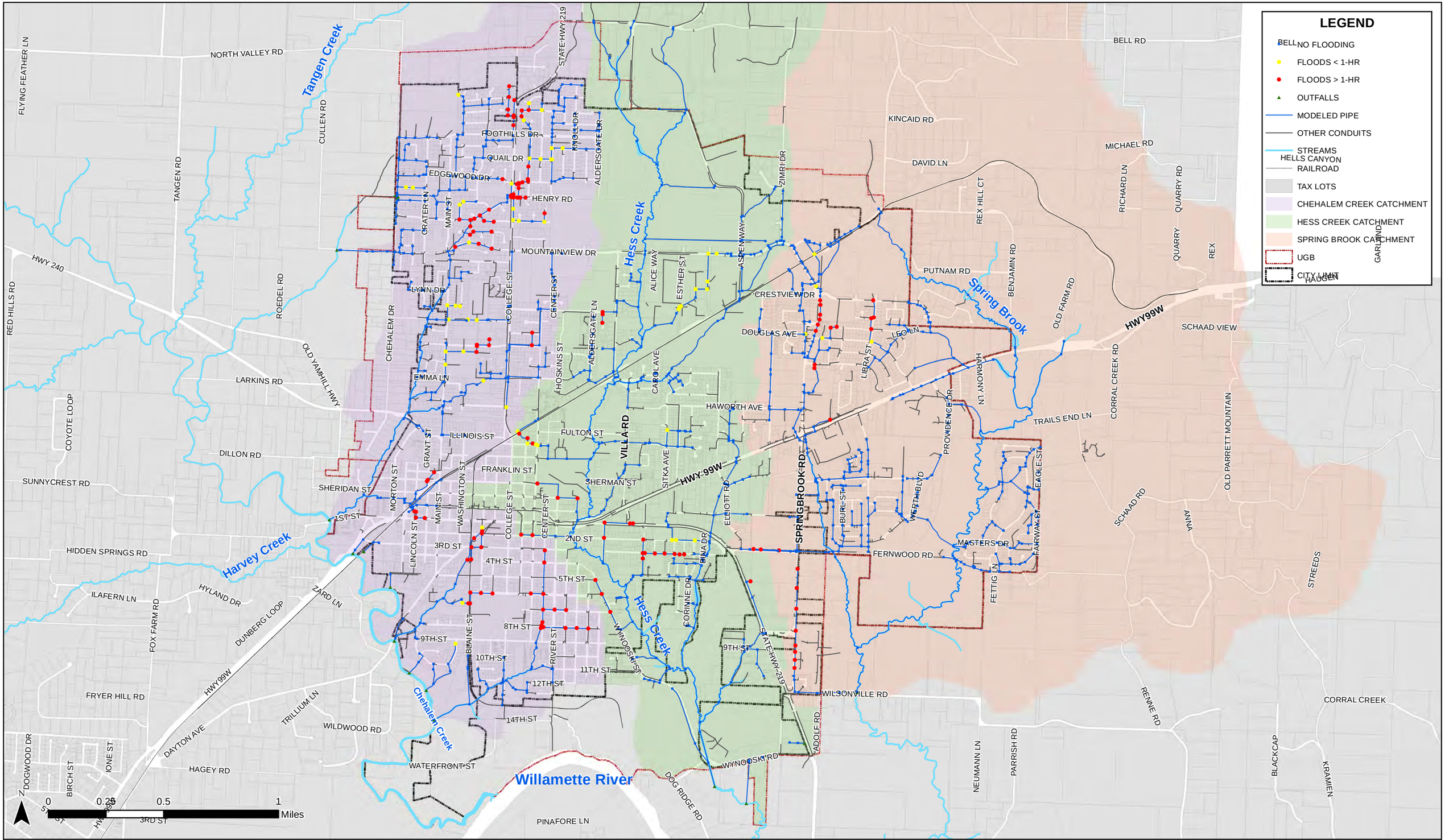
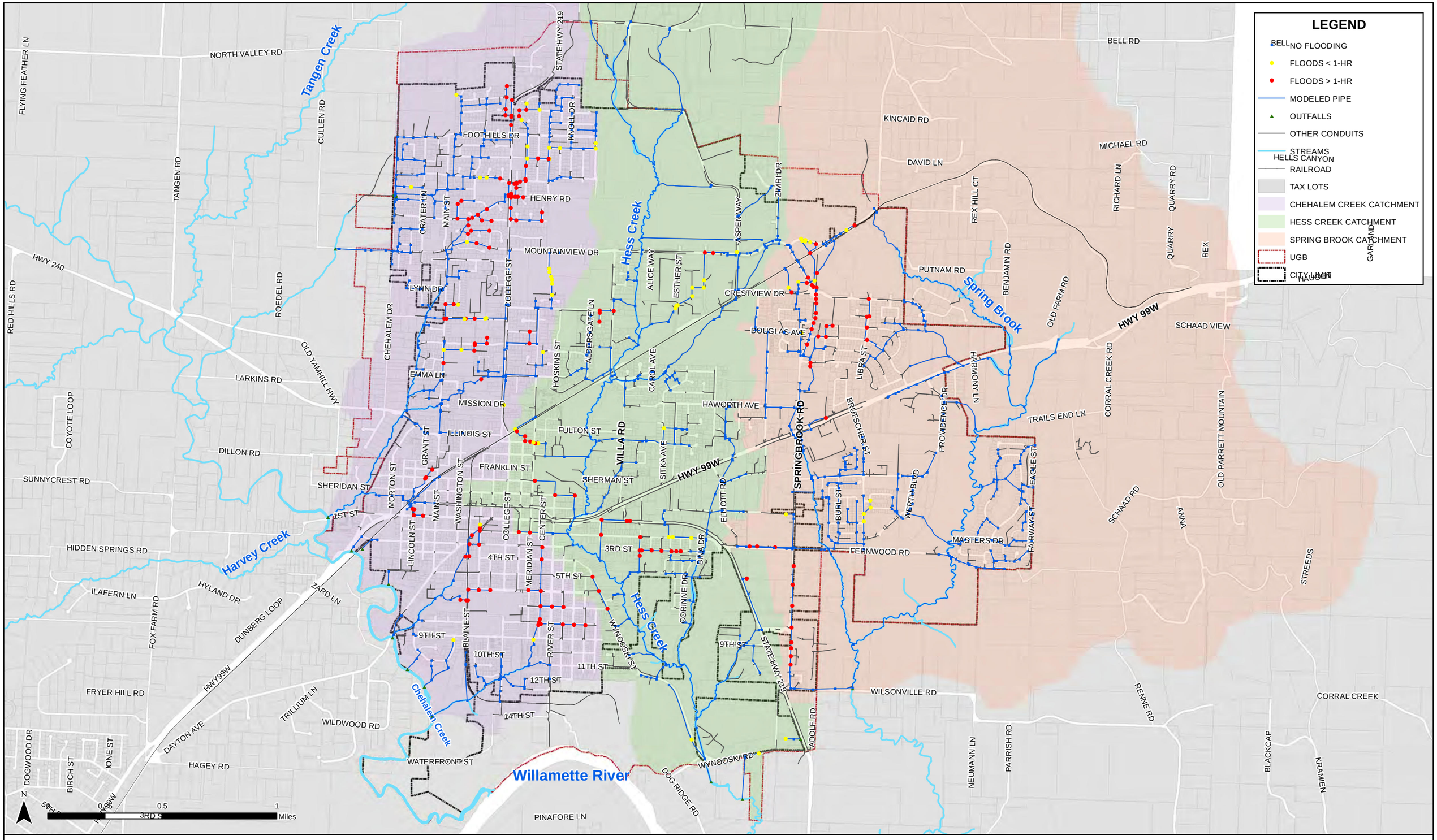


STORMWATER MASTER PLAN UPDATE

FIGURE 3-1. PREDICTED FLOODING: EXISTING LAND USE, 10-YR DESIGN STORM

NEWBERG, OREGON

JUNE 2014



STORMWATER MASTER PLAN UPDATE

FIGURE 3-2. PREDICTED FLOODING: FUTURE LAND USE, 10-YR DESIGN STORM

NEWBERG, OREGON

JUNE 2014

Table 3-7. Flooding Problem Areas

Location	Event(s) deficiency occurs	Problem description	Potential solution	Length of conveyance improvements, linear feet	Contributing drainage area, acres
Chehalem Creek					
South Blaine Street, between East 6th Street and East 7th Street	Existing and future 10-yr	Currently a reach of 12"-18" stormwater pipe runs through private property and under several houses. Flooding along E 6th St and S Blaine St occurs during the current and future conditions 10-year storm event.	Decommission the stormwater pipes which are in private property and add a 24" stormwater pipe along S Blaine St and a 12" pipe along E 1st St. Connect the stormwater system from E 6th St to S Blaine St to provide conveyance and storage. Upsize existing stormwater pipes to 24" and 18" to convey existing and future flows.	2,887	62.0
South Center Street, between East 3rd Street and East 9th Street	Existing and future 10-yr	Currently a reach of 21" stormwater pipe runs through private property and under several houses. Flooding along E 8th St, E 7th St, and S Center St occurs during the current and future conditions 10-year storm event.	Decommission the stormwater pipes which are on private property and add a 30" stormwater pipe along S Center St. Upsize existing stormwater pipes to 30", 24" and 18" to convey existing and future flows.	3,860	100.1
East Columbia Drive, west of North College Street	Existing and future 10-yr	Flow is currently limited by three undersized 18" pipes which restrict flow from larger-diameter upstream pipes. Hydraulic modeling shows overflow from manholes during the 10-year existing/future flow event. Downstream pipe segments are 24" diameter and have capacity for current and future 10-year flow event.	Upsize existing stormwater pipes to 24" to convey existing and future flows.	92	56.7
Oxford Street, between Winchester Drive and East Mountainview Drive	Existing and future 10-yr	Flow is currently restricted by fourteen undersized pipes. Flooding from manholes is shown to occur during the 10-year existing/future flow event. Pipe diameters increase and decrease in numerous places throughout this alignment. The City has installed some upsized pipes to address acute problems. This project provides a broader solution to provide long term capacity.	Upsize existing stormwater pipes to 36" to provide capacity for future flows.	1,860	167.4
North College Street and Dahlia Street, between Natalie Drive and Foothills Drive	Existing and future 10-yr	Flow is currently restricted by four undersized pipes during the current and future conditions 10-year storm event.	Upsize existing stormwater pipes to 24" to convey existing and future flows.	691	102.8
Hess Creek					
North Edwards Street, from Vermillion Street to East Sheridan Street	Existing and future 10-yr	The City has reported drainage problems along Vermillion St between N College St and the railroad. Currently a flat and undersized pipe discharges stormwater along the railroad tracks. This neighborhood has some bubblers at intersections, but does not have a defined connection to the public stormwater system.	Add a drainage system to convey flows from Vermillion St to the existing drainage system at E Sheridan St.	4,340	38.0
East 3rd Street and South Church Street	Existing and future 10-yr	Modeling shows flooding problems along E 3rd St and S Church St during the current and future conditions 10-year storm event.	Add a 24" stormwater pipe to connect the stormwater system from E 3rd St to S Church St to provide conveyance and storage. Upsize existing stormwater pipes to 30", 24" and 18", as estimated by modeling. Install stormwater planters (low impact development [LID]/green stormwater infrastructure design) along E 1st St to provide additional storage capacity and water quality improvements.	2,427	40.7
Villa Road, north of Carol Ann Drive	Frequent Flooding and Maintenance issues	The culvert on Hess Creek at Villa road is a mix of corrugated metal pipe (CMP) and concrete box culverts. This is an area of maintenance attention during large storm events to prevent flood waters from impeding traffic on Villa Road.	The existing culvert will be upsized from a 30" to a 60" culvert to convey current and future flows.	75	1,174.4
Spring Brook					
North Springbrook Road, north of Highway (Hwy) 99W	Existing and future 10-yr	Modeling shows flooding problems along N Springbrook Rd during the current and future conditions 10-year storm event. The upstream stormwater system along N Springbrook Rd was upgraded during installation of traffic improvements, but flows are constricted from a 30" pipe down to an 8"-12" section of pipe near Middlebrook Dr.	Upsize the stormwater pipes along N Springbrook Rd to 30" diameter and connect the system to the existing system to the south. The proposed pipe system is sized for both current and future flows.	1,735	55.9
Libra Street and Victoria Way	Existing and Future 10-yr	Modeling shows flooding problems along Libra St during the current and future conditions 10-year storm event. This system needs frequent maintenance to address silt accumulation.	Upsize existing stormwater pipes along Libra St to 18" to convey current and future flows.	804	14.4

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3.5 Reported Problem Areas

In addition to reviewing simulated problem areas identified through hydraulic modeling, other locations of drainage concerns were identified through the following methods:

- Engineering Problem Map – During the master plan kick-off period, maintenance and engineering staff developed a map of known problem areas throughout the City. Known problem areas include some of the capacity problems predicted through modeling and also problems that are the result of challenging maintenance conditions (i.e. areas with frequent need of leaf or sediment removal). The engineering problem map also includes locations where the piped stormwater system is located beneath private buildings. Relocating these pipes to public right-of-way is a high priority for the City.
- Maintenance Staff Questionnaires – All maintenance field staff completed problem area questionnaires to document drainage capacity and maintenance challenges they have observed during the course of their field duties.
- Citizen Report – City staff maintain records of drainage problems reported by citizen. The majority of the complaints are resolved through responsive maintenance visits to alleviate a blockage in the drainage network. Occasionally, a reported problem is indicative of a larger problem that needs to be addressed through infrastructure changes. During the master planning period one citizen report was included in the overall problem area list.
- 2001 Master Plan – the City's previous Stormwater Master Plan was completed in 2001, identifying 50 locations for potential stormwater capacity improvements. Since 2001, many of the project areas have been addressed through capital projects or resolved through other means, such as adjusted maintenance procedures or through reconstruction of the drainage system along Hwy 99W. Other projects are no longer required, as development patterns (and therefore flow rates) have shifted from what was assumed in the previous modeling. A detailed review of the 2001 Master Plan identified three remaining project areas that should be considered for inclusion in this Master Plan.

Table 3-8 includes a compilation of reported problem areas, sorted and numbered by drainage basin. In several cases, the same problem was reported by multiple sources. These overlaps are noted. The reported problem area locations are shown in Figure 3-3.

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Table 3-8. Reported Problem Areas

Identifier	Location	Problem description	Frequency/ duration	Source of information	Drainage basin	Model in this area	Notes
DP-C-1	Near 5th and Blaine Streets	Hollingsworth drain is CMP/concrete; has roots; is 30' deep, under houses, and failing. When it fails/plugs, all of downtown storm system fails.		City - engineering map	Chehalem	Model does not show flooding, but pipe is very deep (model says 25-20 feet).	Commonly reported on crew surveys.
DP-C-1	Hollingsworth Storm Line	12" storm line under 5th Street needs realignment.		maintenance questionnaire	Chehalem		
DP-C-1	Blaine/Hollingsworth	Failed pipe - 18" tin whistle.		maintenance questionnaire	Chehalem		Realign pipe.
DP-C-2	College Street north of railroad tracks	Inadequate storm system in LID; Roadside drainage ditches overtop and flood neighboring properties.		City - engineering map City - photos during flood event	Chehalem	Model shows minor (<2 hour) flooding in 10-year event.	City has capital improvement project in process for College Street.
DP-C-3	Creek downstream of Kemper Crest Drive	Downstream creek discharge blocked; causes Kemper Crest to back up.		City - engineering map	Chehalem	Model shows 10-year flooding around existing pond.	Also reported on crew surveys.
DP-C-3	Columbia and Kemper Crest	Street and intersection water backs up from ditch in county.	heavy rainfall	maintenance questionnaire	Chehalem		
DP-C-3	Columbia and Kemper Crest	Road and ditches flood	every rainfall	maintenance questionnaire	Chehalem		Needs debris removal on downstream farm property.
DP-C-4	Between 8th and 9th Streets near Center Street	Flat sloped pipe runs under house on private property; needs to be rerouted.		City - engineering map	Chehalem	Model shows 10-year flooding upstream of problem pipe.	
DP-C-5	Natural system crossing College Street, south of Andrew Street	Steep ravine; multiple pipe materials; potential to collapse and fail.		City - engineering map	Chehalem		Field visit needed?
DP-C-5	College Street south of Andrew Street	Existing pipe system under College Street is composed of multiple pipe materials, causing ongoing maintenance problems and concerns over long-term stability.	n/a	2001 Master Plan	Chehalem		City staff confirmed this problem needs attention.
DP-C-6	1st and Harrison Streets	Flooding in front of Subway.	every rainfall	maintenance questionnaire	Chehalem		No storm drain in this area?
DP-C-7	2nd and Main Streets	Street floods at Naps Thriftway parking lot driveway on 2nd Street.	heavy rainfall	maintenance questionnaire	Chehalem		No mapped drainage system in this area.
DP-C-8	Clifford Court	No information given.	every rainfall	maintenance questionnaire	Chehalem		
DP-C-9	9th and River Streets, southeast Corner	Roadway floods 10-12' radius around catch basin.	heavy rainfall	maintenance questionnaire	Chehalem		Suggestion to move catch basin and raise the corner bubbler, near, but not connected to, DP-C-4.
DP-C-9	S River Street and 11th Court	Two clay sewer tile pipe segments are deteriorating and require replacement. Replacement should be sized to convey future flows.	n/a	2001 Master Plan	Chehalem		City staff confirmed this problem needs attention.
DP-C-10	Between 1st and 2nd Streets at Howard Street	Storm drain pipe is under commercial building.	n/a	City - engineering map	Chehalem		
DP-C-11	Dayton Avenue near Johanna Court	Roadway drainage flows into driveways and causes minor damage of driveways and sidewalk. Report confirmed by maintenance staff.	1-2 times/year	citizen e-mail report	Chehalem		No drainage system in this area. Possible green street solution in existing planter strips.
DP-H-1	Elliot Road just north of Hwy 99W	This area does not have a drainage system, resulting in frequent ponding during storm events.	heavy rainfall	City - engineering map	Hess	Not modeled.	Drainage systems existing to east and west of Elliot; need easements to reach either.
DP-H-2	Vermillion Street between College Street and railroad tracks	Undersized and flat pipe discharges to tracks with no fall. (Note: GIS data do not show a pipe in this area.)		City - engineering map	Hess	Model shows 10-year flooding in adjacent system.	Most commonly reported problem; also reported on crew surveys. Maintenance suggestion to repave at College and Vermillion Streets
DP-H-2	College and Vermillion Streets	Intersection ponding	every rainfall	maintenance questionnaire	Hess		Recommends repaving.
DP-H-2	College and Vermillion Streets	Gravel street area floods.	heavy rainfall	maintenance questionnaire	Hess		
DP-H-3	Hess Creek at Hoover Park	Flooding during January 2012 storm event.		City - photos during storm event	Hess		Is Hoover Park part of the floodplain?
DP-H-3	Hoover Park	Trash, beaver dams, and people place debris in creek to slow the flow.	every rainfall	maintenance questionnaire	Hess		Needs frequent maintenance and public education regarding Hoover Park's natural floodplain.
DP-H-4	Hess Creek at Villa Road, near railroad tracks	Flooding during January 2012 storm event. Water constrained by culvert overtops roadway. Ongoing maintenance attention is needed to remove debris accumulated at culvert.		City - photos during storm event	Hess		
DP-H-4	Villa Road Culverts	Capacity improvement needed to upsize two existing culverts.		2001 Master Plan	Hess		Since 2001 Master Plan development, one of the two Villa Road culverts was replaced with a 60" culvert. Existing 30" culvert still needs replacement.

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Table 3-8. Reported Problem Areas

Identifier	Location	Problem description	Frequency/ duration	Source of information	Drainage basin	Model in this area	Notes
DP-H-5	College and Franklin Streets	Intersection ponding	every rainfall	maintenance questionnaire	Hess		Recommends repaving; no mapped drainage system at this intersection.
DP-H-5	College and Sherman Streets	Bubbler backs up	heavy rainfall	maintenance questionnaire	Hess		No mapped drainage system at this intersection
DP-H-6	Haworth Avenue between Elliot and Pecan Streets (near high school)	Flooding during January 2012 storm event. Flooding on/off of private property; standing water on roadway and onto school grounds.		City - photos during storm event	Spring Brook		Construction near high school has resolved Haworth drainage problems. No recent flooding observed.
DP-S-1	Crestview Drive east of Springbrook Road roundabout	8" DI culvert under gravel road; has nowhere to drain.		City - engineering map	Spring Brook	Small culvert not modeled.	
DP-S-2	Springbrook Road south of Crestview Drive roundabout	30" storm (from Mountainview Drive) drains into 8" storm (on Springbrook Road)		City - engineering map	Spring Brook	Model shows 10-year flooding along Springbrook Road.	
DP-S-3	Springbrook Road north of Crestview Drive roundabout	Area draining from the east goes into undersized pipe under Springbrook Road at this location.		City - engineering map	Spring Brook		
DP-S-4	Springbrook Road near 2nd Street	Flooding during January 2012 storm event.		City - photos during storm event	Spring Brook		Oregon Department of Transportation bypass project to replace Springbrook Road drainage system.
DP-S-5	Spring Brook at Golf Course	Flooding during January 2012 storm event.		City - photos during storm event	Spring Brook		Is the golf course part of the floodplain?
DP-S-6	Inlet at Mountainview Park (mobile home village)	Debris gets trapped against grate.		maintenance questionnaire	Spring Brook		Clean upstream - owned by Parks and Rec

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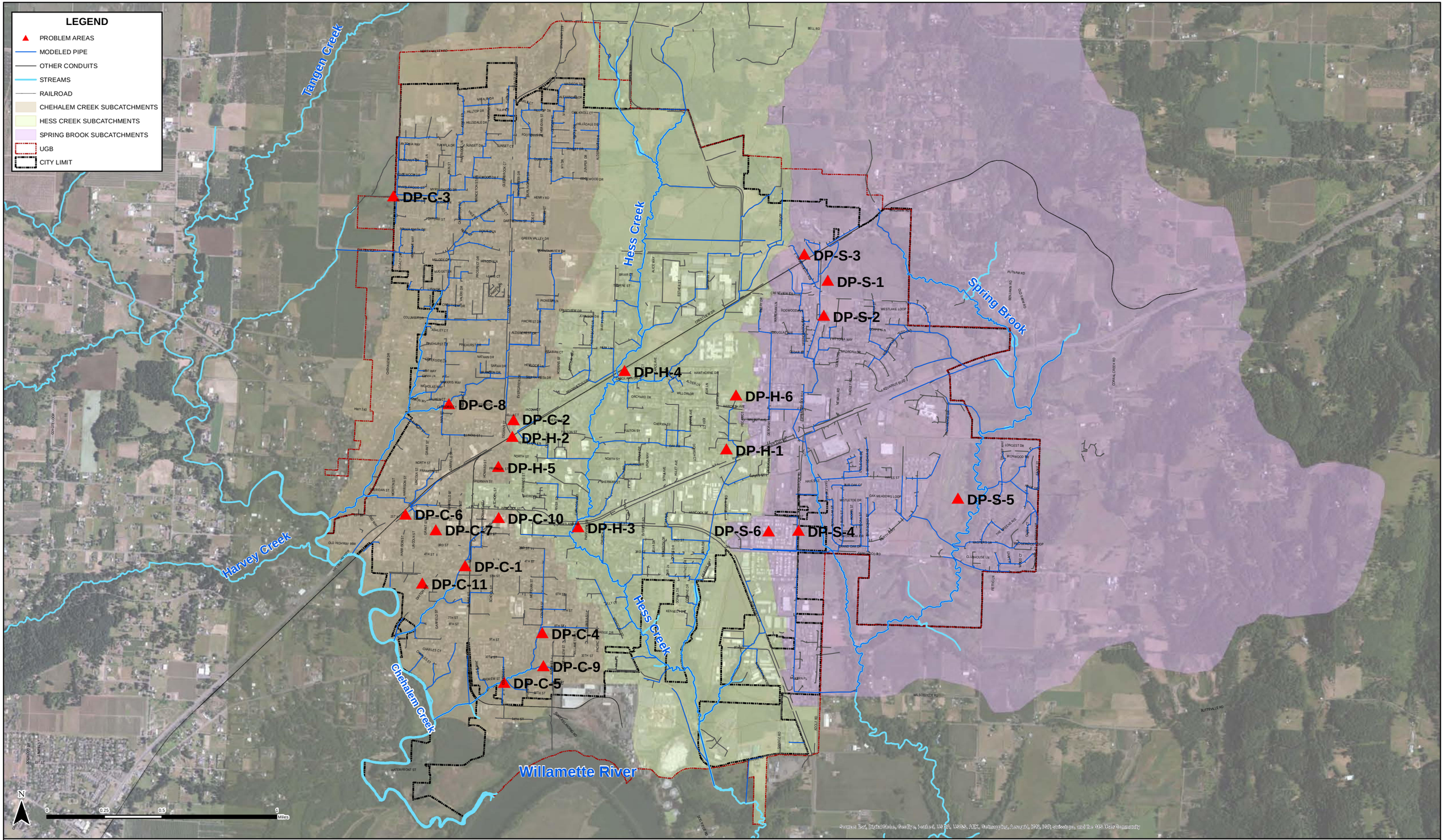

STORMWATER MASTER PLAN UPDATE

FIGURE 3-3. REPORTED STORMWATER SYSTEM PROBLEM AREAS

NEWBERG, OREGON

JUNE 2014

Section 4

Stream Channel Vulnerability Assessment

Section 4 documents the stream channel vulnerability assessment that was conducted to evaluate and assess existing and potential future channel conditions in the streams within Newberg. The field visits for this assessment occurred between October 15 and 17, 2013.

The primary objectives of the stream channel vulnerability assessment included the following:

- Assess existing physical channel conditions relative to the current flow regime and level of development.
- Identify existing problem areas, including areas of bank instability or excessive erosion.
- Assess the potential for future channel issues that could occur as a result of increased flows or watershed changes.

Figure 4-1 shows the location of mapped stream channels, floodplains, and stream corridor zoning within the City of Newberg.

4.1 Methods

The methodology used in this stream vulnerability assessment included:

1. review of existing documentation;
2. qualitative field assessment of selected stream channels within the City limits; and
3. comparison of hydrologic and hydraulic modeling results to observed channel morphology.

4.1.1 Data Review

Several data sources were reviewed prior to conducting the field assessment. The list of sources and description of contents is shown below.

City of Newberg Data – City staff occasionally walk stream channels within the city to assess water quality conditions and document outfall conditions. The City provided photos and data sheets to BC, documenting previously observed conditions. The City also provided photos of past flood events, documenting water elevations resulting from high flows. These data were reviewed relative to current data, and were used to augment the field data collected in October 2013, since not all stream channel reaches were walked within the timeframe allotted for this project.

George Fox University Data – George Fox University (GFU) students have been collecting data and conducting restoration projects in the reach of Hess Creek that runs through the GFU campus. The City provided BC with stream channel cross section data collected by the students. Additionally, Clyde Thomas, facility manager and stream restoration facilitator at GFU provided details on work that is being conducted on Hess Creek on the GFU campus.

City GIS Data – City GIS data were reviewed prior to conducting the stream visit, including the following:

- stormwater infrastructure
- zoning

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- streams and wetlands
- floodplains
- city boundary
- aerial photograph
- LiDAR imagery

Chehalem Watershed Assessment–The Yamhill Basin Council conducted a Chehalem Watershed Assessment in June 2001 through an Oregon Watershed Enhancement Board (OWEB) grant and local matching funds (Yamhill Basin Council. 2001). The Chehalem Watershed includes Chehalem Creek, Hess Creek, and Spring Brook. This document was reviewed specifically for information about the stream channels that are situated in Newberg, including Hess Creek, tributaries of Spring Brook, and a small tributary of Chehalem Creek. Regional geologic information was obtained from this report, as well as information on fish habitat and barriers, wetlands, and other watershed characteristics.

4.1.2 Field Assessment

A field assessment was conducted between October 15 and October 17, 2013, during a relatively dry period, with no measured rainfall in the previous 5 days. Approximately 3 miles of stream channel were walked, including portions of the following reaches, shown on Figure 4-1. The field assessment included the following reaches:

- Hess Creek
  - Upstream of Villa Road in the vicinity of Mountainview Drive (upper reach)
  - George Fox University (middle reach)
  - Hoover Park (middle reach)
  - Corinne Drive Tributary
  - Wynooski Street/Wastewater Treatment Plant (lower reach)
- Chehalem Creek Tributary
  - Upstream of Hwy 240 to Columbia Drive
  - Upstream of Sunnycrest Road
- Spring Brook
  - Benjamin Road and Lake Shore Drive reach (outside City limits)
  - West Tributary between Fred Meyer (Hayes Road) and Fernwood Road (West Tributary reach)

General observations of bank and bed materials, vegetation, erosion, general confinement, and outfalls were made. Photos were taken to document conditions, and occasional measurements of bankfull widths and depths were taken with a stadia rod (in tenths of feet). Latitude and longitude coordinates along with elevations were recorded using a hand-held GPS unit.

The field data and locations of photographs were recorded in a field notebook. Field notes were scanned, and data and photos were transferred to excel spreadsheets. These field notes are provided in Appendix C.

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LEGEND

- FLOODWAY
- 0.2 PCT ANNUAL CHANCE FLOOD HAZARD
- 0.1 PCT ANNUAL CHANCE FLOOD HAZARD
- STREAM CORRIDOR
- STREAMS
- RAILROAD
- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMITS
- TAX LOTS

Tangen Creek
Harvey Creek
Hess Creek
Spring Brook
Chehalem Creek
Willamette River
Corral Creek Rd
Section Observed
Section Walked
N
0 0.25 0.5 1 Miles

STORMWATER MASTER PLAN UPDATE

FIGURE 4-1. MAPPED STREAM CHANNELS, FLOODPLAINS, AND STREAM CORRIDOR ZONING

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

JUNE 2014
FEBRUARY 2014

4.1.3 Flow modeling

A PC-SWMM hydrologic and hydraulic model was constructed to evaluate existing and future stream flows based on predicted land use changes (described in Section 3). Existing conditions modeled flows were compared to observed channel morphology to evaluate patterns and potential morphological changes that might occur with increased flows as predicted in the future condition models.

4.2 Results

Descriptions of the general stream channel characteristics in the reaches observed during our field investigation are provided in Table 4-1 and with more detail in Appendix C. In general, the condition of stream channels within the city limits are variable and likely dependent on a number of factors including riparian conditions (i.e., width of riparian area and vegetation); stream channel gradient and valley confinement; land uses in the general vicinity; and stormwater outfall locations.

4.2.1 Geologic Conditions and Erosivity

The predominant geology of Hess Creek and the other tributaries within the city is Willamette silt (Yamhill Basin Council, 2001), lacustrine (lake) and fluvial (river) deposits consisting of unconsolidated and semi-consolidated silt, clay, sand and gravel. With the exception of the upper reaches of Hess Creek in the vicinity of Mountainview Drive, the bed and bank material of all of the stream channels that were walked consisted of silt and clay. Downstream of Mountainview Drive, conglomerate (mixed sand and small rounded gravel) was observed in the banks. Upstream of Mountainview Drive, bedrock (siltstone) was present in the streambed.

The geologic material for which these stream channels are situated are resistant to slumping and can result in nearly vertical banks. Erosion was observed downstream of culverts or outfalls where flow was concentrated. Outside of these predictable locations where flow is concentrated erosion was also observed in several reaches where blocks of silt have caved into the channel. This type of bank failure is most likely a result of destabilization from undercut banks, animal activity (burrows from mountain beavers or nutria), surface disturbance, or soil saturation. This type of erosion was observed most notably in the Chehalem Creek tributary upstream of Highway 240, the Crestview reach of Hess Creek upstream of the railroad, and the lower reach of Hess Creek near the confluence with the Corinne Drive Tributary.

4.2.1.1 Specific Problem Areas

Below are specific problem areas or poor conditions that were noted during our stream walks. These are locations where restoration, repair or maintenance projects should be considered.

4.2.1.1.1 Chehalem Tributary

- Hill slope failure upstream of Highway 240 on the west bank. Re-vegetation and stabilization would prevent future slumping.
- Beaver dam at Sheridan Road crossing (downstream of Highway 240). The beaver dam observed during our stream walk was removed; however, this location is likely prone to beaver activity and should be monitored to ensure beavers do not get re-established. The road fill above the culvert is at least 30 feet high, and a large storm event that coincides with a culvert blockage could have devastating consequences.

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Table 4-1. Summary of Stream Channel Characteristics

Stream	Segment	Location of modeled flow	Drainage area (acres)	2-year max total inflow (cfs)		Percent change	2-year unit discharge (cfs/acre)		Average bankfull width (ft)	Average bankfull depth (ft)	Average gradient (ft/ft)
				Existing	Future		Existing	Future			
Chehalem Tributary	North of Hwy 240	Creekside Lane and Creekside Court	329.5	42.5	45	5.56	0.13	0.14	8	4	0.016
	South of Hwy 240	West Sheridan Street (downstream side)	753	132.5	136.5	2.93	0.18	0.18	6	4	0.006
Hess Creek	North of Mountainview Drive	Edgewood Drive and Aldersgate Drive	946.5	56.2	62.5	10.08	0.06	0.07	9	3	0.008
	Mountainview Drive to Villa Road/Railroad	Crestview Drive	1,135.20	72.1	80.6	10.55	0.06	0.07	9	3	0.008
	Villa Road/Railroad to Hwy 99W	Fulton Street (downstream side)	1,451.10	100.2	110.7	9.49	0.07	0.08	10	3	0.005
	Hwy 99W to City Limit (near Wynooski Street)	Merlin Lane	1,861.70	174.4	181.8	4.07	0.09	0.10	11	2.5	0.002
Spring Brook	West Tributary, Hwy 99W to City Limit (Fernwood Road)	Hayes Street	358.4	74.4	80.6	7.69	0.21	0.22	7	3	0.012
	North of Hwy 99W near Benjamin Road	Benjamin Road	465.1	21.4	22.5	4.89	0.05	0.05	8	3	0.008

4.2.1.1.2 Hess Creek

- Upstream of Mountainview Drive, a stormwater ditch outfalls above Hess Creek on the hill slope. This discharge has resulted in extensive erosion at the outfall. Additional energy dissipation should be installed in this area, and consideration extending pipe directly to Hess Creek would help alleviate the hill slope erosion.
- In the reach above the railroad (Crestview), the stream has eroded material away from a sanitary sewer manhole that is now located in the stream channel. This manhole should be inspected for integrity and evaluated with respect to potential future impacts to channel migration and erosion.
- GFU has spent a lot of time and energy on the restoration of Hess Creek through the campus. Care should be taken to minimize changes to flow or hydraulics (such as Fulton Street culvert) that could negatively impact the restoration that has occurred.
- Significant erosion is occurring at the outfall location of the detention pond located on the Corinne Drive tributary to Hess Creek.

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4.2.1.1.3 General Problem Observations

- Erosion is occurring at numerous stormwater outfalls and culvert crossings throughout the city. Outfalls and culvert crossing should be designed with sufficient energy dissipation with a mix of material sizes or geotextile fabric to minimize erosion of the fine grained silt.
- Invasive vegetation species such as reed canary grass, blackberries, and nightshade are prevalent in all the stream reaches (except GFU where restoration work as occurred). There are many opportunities to improve riparian vegetation conditions along Hess Creek (especially in the lower reach) and other Newberg tributaries.

4.2.2 Channel Geomorphology

Channel dimensions were plotted against drainage area and modeled 2-year discharges to evaluate for potential relationships between channel shape and flow conditions.

There is a fairly good correlation of drainage area to bankfull channel width for the stream channels walked in October 2013 (Figure 4-2).

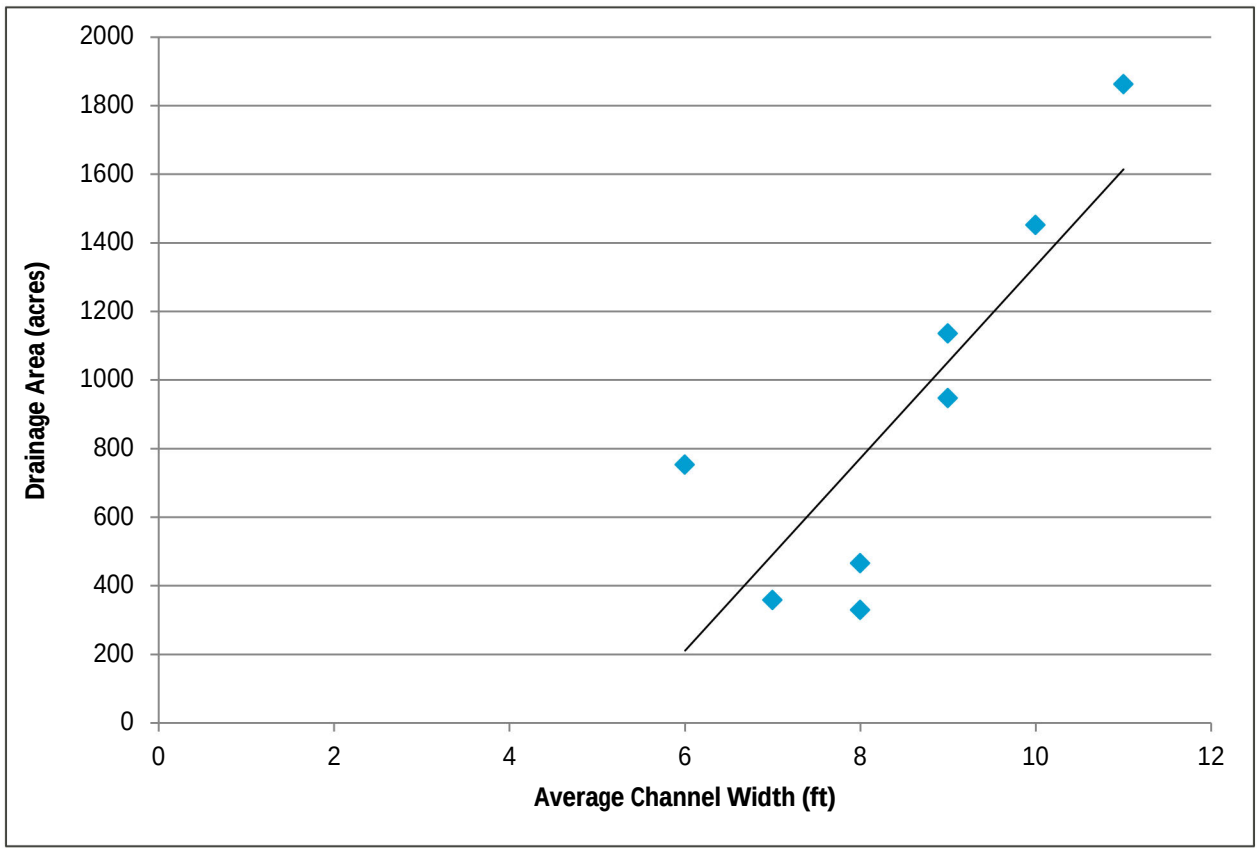

Figure 4-2. Drainage area versus channel width

However, a correlation was not found between discharge and stream channel width (Figure 4-3) or area (Figure 4-4).

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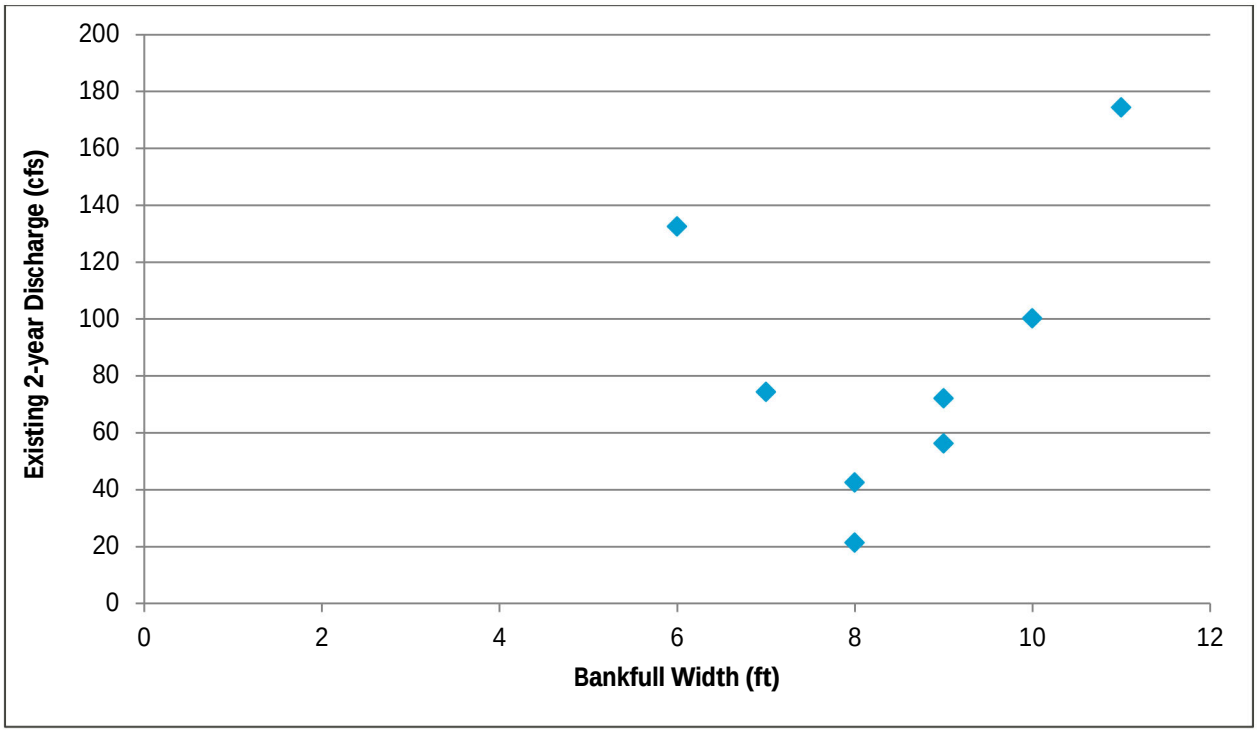

Figure 4-3. Existing 2-year discharge versus bankfull width

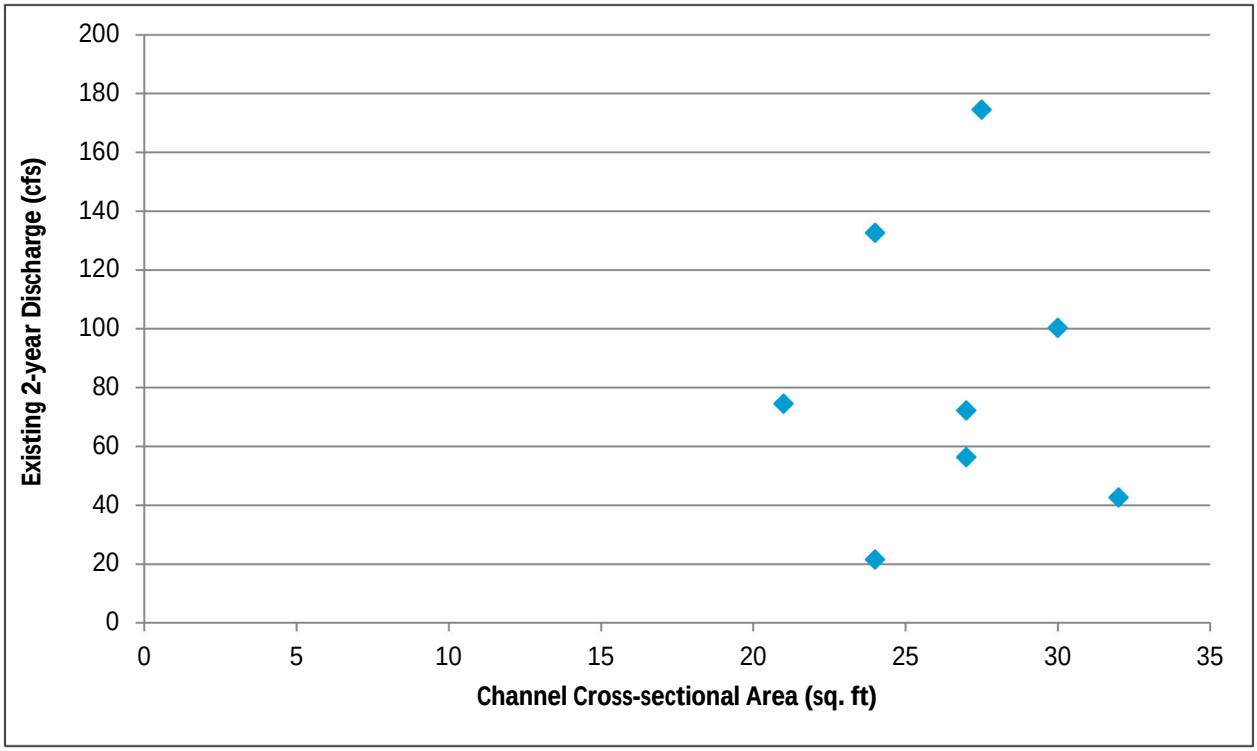

Figure 4-4. Existing 2-year discharge versus channel cross-sectional area

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Figures 4-3 and 4-4 indicate that other factors besides stream channel discharge are likely influencing the geomorphology of stream channels in Newberg. For instance, constrictions in the stream channels such as culvert crossings tend to dampen the impact of peak flows and resulting erosion in downstream reaches. Examples of this include the Fulton Street culvert upstream of GFU, and the Sheridan Street crossing on the Chehalem Tributary on the west side of the city. Additionally, wide floodplains for which stream channels have room to move, and where overbank flooding can occur without risk of damage to infrastructure also dampens the erosive effects of high stream flow discharges.

The stream channel section with the highest unit area discharge (0.21 cfs/acre) is the Spring Brook tributary downstream of Hayes Street. This reach of stream channel was in relatively good condition despite the high velocity discharges it experiences relative to the overall drainage area. This could be because there are retention/detention facilities upstream that were not included in the model, the fairly wide riparian area that consists of large trees and native vegetation, and the connection of the stream channel to its floodplain. Flow control or stormwater detention in other parts of the city could have positive effects for stream channel conditions as well.

The City has designated "stream corridor zoning," limiting the type and location of development near stream channels based on a study completed in 1995 to comply with statewide planning Goal 5, "Open Spaces, Scenic and Historic Areas, and Natural Resources." The stream corridor zoning coincides with the natural floodplain area of stream channels within the city limits, providing fairly wide and undeveloped riparian areas in some cases.

4.2.3 Future Conditions

The area of the city that is expected to further develop in the next several years is located north of Mountainview Drive where large agricultural properties will be converted to residential developments. Flow increases are predicted for the upper reaches of Hess Creek based on modeling results. These increases will be less apparent downstream because of hydraulic conditions in the middle reaches (culvert crossings, etc.). The reach that is most vulnerable to increased flows is upstream of the railroad tracks (Crestview), where erosion is already prevalent.

Based on the modeling effort, flow increases are also expected on the west tributary of Spring Brook, particularly as the Austin Property is developed.

Future development of the South Industrial Area is located outside (downstream) of the modeling limits for this Stormwater Master Plan. Design standards to protect streams evaluated in this study should be carried into the South Industrial Area to protect existing stream channels.

No future flooding in the open stream channels is predicted for the 10-year flows based on hydraulic modeling, however, stream channel erosion could occur if measures aren't taken to control flows, maintain wide riparian areas and open floodplains, or dissipate energy at outfall locations and culvert crossings.

4.3 Recommendations

The City has already taken steps that help alleviate channel erosivity by designating stream corridors for protection in the zoning code. Other measures that should be considered to reduce potential future channel impacts include the following:

- Encourage or require new development to maximize infiltration of stormwater runoff when soil conditions allow. The infiltration of stormwater runoff reduces the impact of increase flows on stream corridors and is critical to the reduction of the channel forming annual flow events.
- Require flow control measures for smaller storms for new development. The 24-hour synthetic storms used for sizing detention can be conservative and therefore the small channel forming flows

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are not addressed in the standards. Although this will not fully address all smaller storm events we recommend adding half the 2-year, 24-hour storm as a flow control storm in addition to the larger storms.

- Ensure culvert crossings, stormwater outfalls, and stream channel crossings (bridges) are designed and installed properly (e.g., aligned with stream flow and include energy dissipation) to minimize erosion downstream.
- Conduct regular field screenings of outfalls and other areas of previously observed erosion to document changes in bank conditions and identify locations for stream bank stability projects. Allocating at least one day per month for stream observation would allow City staff to visit areas of concern several times a year on a rotational basis.
- Vegetation does contribute to stream bank stability, and if invasive species such as reed canary grass are removed, replacement vegetation should be planted immediately.

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Section 5

Maintenance and Programmatic Evaluation

This section documents the City's stormwater program activities as they relate to maintenance of the stormwater infrastructure, water quality protection, engineering, and development review. In general, the activities are divided into two categories: maintenance activities are those conducted by the operations and maintenance staff; programmatic activities are those conducted by administrative and engineering staff. This section also includes an evaluation of the City's existing design standards related to stormwater management and a staffing analysis to identify the staff levels needed to implement the recommended stormwater related activities.

5.1 Stormwater Program History

The City's Public Works Department is responsible for implementing the stormwater management program to meet regulatory requirements. The Public Works Department includes staff that performs roles related to engineering, operations, and maintenance. All staff plays a role in maintaining water quality and managing stormwater runoff.

In 2001, the City adopted Ordinance 2571 that codified the stormwater management program (Newberg Municipal Code (NMC) 13.20 and 13.25). The ordinance included adoption of a stormwater management fee that applies to all properties with impervious surfaces within the City. The stormwater management fee enables the City to fund maintenance and engineering activities, as well as capital projects related to the stormwater infrastructure. The City's Citizens Rate Review Committee (CRRC) meets regularly to adjust the stormwater management fee, along with the fees related to other City utilities. In 2012, the City adopted Ordinance 2754 to update the stormwater management guidelines in NMC 13.25.

Historically, the City's stormwater management program was formed around addressing drainage capacity and flooding problems. In the last decade, the program has shifted to address increasing water quality regulations.

5.2 Regulatory Conditions

The City's current stormwater program has been expanded to address the regulatory requirements of the Total Maximum Daily Load (TMDL) program. Due to its size, Newberg is not currently subject to the National Pollutant Discharge Elimination System (NPDES) permitting requirements for the municipal separate storm sewer system.

5.2.1 Willamette River TMDL

In September 2006, the Willamette River was listed by DEQ and the United States Environmental Protection Agency (USEPA) as a 303(d) stream. Near Newberg, the parameters of concern are bacteria, mercury, and temperature. Additional pollutants, such as dissolved oxygen, turbidity, and toxics are identified as problematic for specific tributaries and portions of the Willamette River, but are not listed as concerns in areas covered by Newberg. In 2008, DEQ and the City agreed to a TMDL Implementation

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Plan to reduce pollutant loads and temperatures in Chehalem Creek, Hess Creek, and Spring Brook, all of which drain to the Willamette River.

The City's TMDL Implementation Plan includes six minimum measures:

- public education
- public involvement
- illicit discharge detection and elimination
- construction site stormwater control
- post-construction stormwater management
- pollution prevention in municipal operations

In March 2013, the City completed a 5-year review of activities from 2008 through 2012 related to the TMDL Implementation Plan and outlined strategies for the next 5-year cycle (2013-2017). The TMDL Implementation Plan remains the City's primary regulatory driver for stormwater management activities.

5.2.2 Future NPDES MS4 Program

In Oregon, DEQ has been delegated the authority from USEPA to implement the MS4 NPDES permitting program, including writing and issuing MS4 permits for municipal stormwater discharges. To date, NPDES MS4 permits have been issued to municipalities with populations greater than 50,000 and smaller communities within larger urbanized areas. Due to its location away from the urbanized areas, the City has not yet been required to obtain a NPDES MS4 Permit. However, if DEQ expands the current permit program to reach a larger number of communities, then Newberg could be subject to a NPDES MS4 permit.

The City's TMDL activities are generally aligned with typical NPDES permit requirements. Fulfilling TMDL obligations puts the City in a good position to comply with a future NPDES permit if DEQ expands the NPDES MS4 permitting program to regulate smaller cities.

5.3 Maintenance Program Review

This section provides an assessment of the resources currently available to maintain the City's stormwater collection system and provides recommendations for improved system operation and efficiency.

5.3.1 Current Activities

The City's stormwater maintenance program is primarily reactive. This assessment is based upon staff interviews and an analysis of the current maintenance program's structure and funding. For example, most inspections, cleaning, and repairs are performed as the result of problems reported by customers, or "hot spots" known to City staff. Typical stormwater maintenance activities are described below. Table 5-1 quantifies the last 5 years of stormwater system maintenance activities, as documented in the City's 2012 TMDL Annual Report.

Structure Inspection – The City currently uses inspections of catch basins, manholes, grates, and inlets primarily as an investigative tool to determine the cause of ponding and drainage problems. The current inspection program is mostly reactive since the inspections are not a part of a preventive maintenance program. In 2010, the City conducted a larger number of catch basin inspections, as part of an effort to locate and map the public infrastructure. However, in recent years, inspections have been limited to those areas where problems are reported.

Structure Cleaning – Catch basins are cleaned to address problems that are reported through customer complaints or that come to the attention of staff by other means. The maintenance staff also conduct preventative maintenance cleaning of several known "hot spots" that routinely have problems with

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sediment build-up. The City has been cleaning approximately 200 catch basins per year, which is equivalent to approximately five percent of the public system.

Storm Line Inspections –As with catch basin/manhole inspections, storm line inspections are used primarily as an investigative tool. In 2013, the City purchased a new CCTV vehicle with improved maneuverability and video capability. The new system will allow staff to observe the condition of storm lines as the camera is moving through the system, reducing the time spent reviewing video. The increased functionality is expected to increase storm line inspections that the maintenance crews can complete on an annual basis.

Storm Line Cleaning – Storm line cleaning is conducted in response to reported and known problem areas. Storm line cleaning has been greatly reduced since 2009 (from 18,800 feet in 2009 to less than 4,000 feet in 2012) due to staff reductions. Newer pipe systems in the city have been designed to be "self cleaning," with flow velocities pushing sediment downstream to adjacent catch basins. Most storm line cleaning is to address larger blockages, like rocks, trash, or debris and the associated built-up of sediment behind the blockage.

Ditch Cleaning – City staff occasionally clean and maintain conveyance ditches along roadsides and the railroad right-of-way in order to maintain flow paths to adjacent areas of the public drainage system. Ditch cleaning is typically on a limited basis, in areas adjacent to culverts.

Minor Repairs – Maintenance crews occasionally identify and repair minor structural problems with the stormwater infrastructure and install new structures to address minor flooding problems or replace aged infrastructure. The City currently budgets $35,000 per year for stormwater repair and $15,000 for pipe and materials. Additional staff and materials budget is needed to replace deteriorating infrastructure.

Stormwater Facility Maintenance – In response to the TMDL Implementation Plan, the City has been strengthening a program to inspect and clean stormwater facilities, including detention ponds. The City current has 10 public stormwater facilities and the number of facility inspections has steadily increased since the TMDL Implementation Plan was approved.

Street Sweeping – Street sweeping occurs on a rotational basis and the City has established a monthly sweeping schedule with an online map to notify residents when their neighborhood is scheduled for sweeping. The schedule plans for each zone to be swept eleven times per year, though weather and emergency maintenance needs occasionally impact the sweeping schedule. In 2012 the City purchased a vacuum sweeper to improve collection and efficiency. The City has been averaging over 4,000 curb miles swept per year with a debris collection rate of 0.24 cubic feet per mile.

Table 5-1. City of Newberg, Stormwater System Maintenance Activities

Activity	2009	2010	2011	2012
Catch basins inspected	-	1,919	72	171
Grates and inlets inspected	251	200	16	130
Catch basins cleaned	78	339	106	264
Storm line inspected, feet	5,691	1.844	4,853	325
Storm line cleaned, feet	18,807	4,581	4,961	3,718
Minor repairs	• 423 feet storm line • 21 structures	• 64 feet storm line • 21 structures	• 362 feet storm line • 4 structures	• 68 feet storm line • 3 structures
Stormwater facility inspection and cleaning	-	10	17	36
Street sweeping, curb miles	5,242	3,192	4,382	3,704

Note: Data from City of Newberg TMDL Implementation Plan, Annual Report 2012 and 5th Year Review (submitted: March 29, 2013).

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5.3.2 Maintenance Program Analysis

The City's current maintenance program is focused on addressing immediate needs and correcting high priority problems. With limited resources, the program has focused on street sweeping, as an opportunity to remove pollutants and sediment before they enter the stormwater conveyance system. The City has also made recent equipment purchases (Vactor sweeper and CCTV vehicle) that improve the efficiency of maintenance activities.

The City's inspection activities have decreased since 2010, due to staff reductions (see Section 5.6). Without a preventive maintenance inspection program to identify storm drain line conditions, defects can not be identified until they become severe enough to cause significant damage or reduction in capacity. A collection system that is operated from a primarily reactive management position will continue to degrade, resulting in an increase in the number of problems as the system ages. Additional challenges from this management approach include inability to plan and schedule work, inefficient use of resources, and a reduction in level of service to the community.

The City is strongly encouraged to move the maintenance program toward a more proactive, preventive maintenance approach, allowing the City to provide an increased level of service to the community at reasonable cost. Specific recommendations related to preventative maintenance are included in Section 5.7.1.

5.4 Programmatic Activity Review

The City's programmatic activities cover engineering, administration, and management activities to implement a successful stormwater management program. This section provides an assessment of the resources currently available to conduct programmatic activities.

5.4.1 Current Activities

Based on discussions with City staff, the City's programmatic efforts are generally focused on TMDL compliance, development review, capital project management, and stormwater fee administration. These activities are generally assigned to different staff members, though development review and capital project management are both assigned to the public works engineers.

TMDL Compliance – Many of the program activities conducted by City staff serve to satisfy requirements of the City's TMDL Implementation Plan. The City reports annually to DEQ on the progress toward meeting measureable goals related to public education, public involvement, illicit discharge detection and elimination, construction site runoff control, post construction stormwater runoff control, pollution prevention in municipal operations, and temperature management. In addition to the maintenance activities described in Section 5.3, the City conducts the following programmatic activities related to TMDL compliance:

- public outreach and education events
- storm drain stenciling
- public involvement in stormwater ordinance, design manual, and stormwater utility rate
- stormwater program website and citizen reporting
- illicit discharge complaint response
- household hazardous waste collection (in conjunction with Yamhill County)
- construction site inspections and erosion control enforcement
- development of stormwater ordinance and stormwater design standards
- stormwater plan review, inspection, and enforcement for new development

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- staff training
- stream corridor overlay and stream bank protection ordinance
- stream trees program

Most of the TMDL compliance activities (outside of maintenance and development review) are conducted by the City's Environmental Specialist, which is funded at 0.5 FTE from the stormwater program though the TMDL tasks are taking increasing time as the required programs are implemented. Additional details regarding these programs are included in the City's TMDL Implementation Plan and TMDL Annual Reports.

Development Review – City staff currently spend the equivalent of approximately 1.0 FTE completing development review activities, which include establishing engineering conditions following pre-application meetings, reviewing development submittals, and conducting inspections during and after construction. Development review activities and inspections cover both construction site erosion and sediment control and the post-construction stormwater facilities. Development review cost is shared by transportation and other departments, as it is most efficient for the engineering reviewer to evaluate all aspects of development submittals at one time.

Capital Project Management – Other than development review and customer response, the City's engineering staff spend the bulk of their time managing the City's CIP program. As staff resources have been reduced, most design work is now being completed through consultant contracts. City staff are performing less design work and focused more on managing consultants and contractors, which allows a fewer number of staff to oversee a larger number of projects.

Stormwater Fee Administration – Programmatic activities also include the administration of the City's stormwater utility fee, which funds the stormwater management program. The stormwater program currently funds 0.45 FTE in general administration.

5.4.2 Future Needs

The following future needs have been identified through evaluation of regulatory obligations, discussions with City staff, and comparison to similar sized stormwater programs in other Oregon cities.

GIS Mapping – In preparing for work on this Stormwater Master Plan (Master Plan), City staff identified data gaps in the City's existing GIS database. In particular, pipe and structure information has been entered into the system using two different vertical datums. A combination of field work and engineering judgment was used to resolve many of the data gaps while preparing the PC SWMM hydraulic model of the stormwater system. However, spot checks in the field continue to reveal areas where the field system and the GIS database are inconsistent. A regular schedule for ongoing field data collection would allow the City to continually improve the accuracy of the GIS database.

TMDL Implementation Activities – The City's current program to address TMDL requirements is well-organized. The City is taking proactive steps to evaluate the effectiveness of program components and make adjustments to the TMDL Implementation Plan through adaptive management. The City's program would benefit from the following enhancements which would improve the level of service for residents and enhance the water quality program related to TMDL compliance.

- Stormwater facility inspection (covered under maintenance discussion) – regular and ongoing inspections are needed to identify maintenance needs.
- Illicit Discharge education for City staff– the City has recently adopted new illicit discharge screening procedures. Public works staff are likely to encounter illicit discharges as they are conducting other activities around the City. One-time training is needed for all public works staff, so they will readily recognize the signs of a potential illicit discharge and understand the reporting procedures.

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- IDDE education for businesses– establishing a program to provide illicit discharge education for business owners is a preventative measure to reduce non-stormwater discharge to the drainage system.
- Private facility maintenance enforcement– The City's recently modified stormwater management municipal code (NMC 13.25.300) requires owners of private stormwater facilities to conduct and record annual facility inspections and perform necessary maintenance. An ongoing program is needed to track whether required activities have been completed and then follow-up with enforcement.
- Electronic database system– An electronic database system would assist the City with the handling of customer complaints, tracking calls, and tracking the City's response. An electronic database could also be used to track illicit discharge concerns logged by City field staff and the follow-up investigations and resolution.
- WQ Sensitive O&M Manual– Maintenance staff and the TMDL Implementation plan have identified the need for the City to develop standard operating procedures for maintenance activities that address water quality protection during regular maintenance. The SOPs should also include guidelines for performing inspections and maintenance of the stormwater system.

Monitoring Program – The City has considered the opportunity to establish an in-stream monitoring program that could track flows as well as water quality data. Flow data would be useful in evaluating changes in runoff rates as the watersheds develop. While not a current obligation, water quality monitoring may eventually be required as part of the City's TMDL Implementation Plan. Due to other immediate program needs and the significant resources that would be required, it is not currently recommended that the City pursue the establishment of an in-stream monitoring program. However, the City may re-evaluate monitoring needs during the future TMDL Implementation Plan 5-year reviews, the next of which will occur in 2017/2018.

Engineering Services – City staff performing development review and capital project management are currently meeting the demand for these services. No changes to the structure of these activities are recommended at this time. If the City sees a substantial increase in new development activity, staff levels should be adjusted accordingly to support the increased need for development review and construction inspection as well as the potential to construct additional capital projects through an increase in system development fees.

5.5 Development Standards Review

Consistent with TMDL implementation Plan requirements, the City adopted municipal code for stormwater management in 2012. NMC 13.25 addresses Erosion Control, Illicit Discharge Detection and Elimination, Stormwater Management (facility design, installation, and maintenance), and Enforcement and Penalties. Following code adoption, the City has been working to update the Standard Design Manual to include a comprehensive chapter to address stormwater requirements. Standard Design Manual, Section 4: Storm Drainage includes standards and submittal requirements for conveyance, water quantity, and water quality. Erosion and sediment control guidelines are outlined in a separate manual, adopted from Clean Water Services.

During the development of this Master Plan, two versions of the City's Standard Design Manual (2013 Draft and 2014 Draft) were reviewed with respect to TMDL obligations and recommendations from the stream channel vulnerability assessment. The review also considered regional and national trends in stormwater management.

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5.5.1 Design Standards Recommendations

Based on a review of regulatory programs, regional trends, and local stream conditions, the City may consider incorporating the following principles into the stormwater design standards:

- Consistent with regional trends, require water quality treatment for both new and replaced impervious areas when redevelopment occurs.
- Consistent with regional trends, establish a water quality design storm that is consistent with capturing 80% of the average annual runoff volume. In Newberg, the design volume would equate to approximately a 1-inch, 24-hour storm event.
- Based on the stream channel assessment, establish flow control requirements that include matching flows from post development to pre-development for a range of flows that includes one-half of the 2-year storm event.

The design standards review also included recommendations on formatting and editorial comments that were presented to the City in a separate memorandum. It is expected that the updated Standard Design Manual will be adopted in 2014.

5.6 Staffing Analysis

This section provides an assessment of the resources necessary to perform maintenance and programmatic activities to support the City's stormwater management program and address TMDL Implementation Plan obligations.

5.6.1 Current Maintenance and Program Staffing

The number of personnel available to the stormwater program has varied over the years. Table 5-2 lists the number of full time equivalent (FTE) positions within the stormwater program budget over the last several years. This table includes maintenance staffing, as well as engineering and administrative staff positions funded by the stormwater program.

Table 5-2. Historic FTE Levels

Group	Fiscal year			
	2010/11	2011/12	2012/13	2013/14
Stormwater administration	-	-	-	0.45
Stormwater engineering	0.91	0.89	2.25	1.65
Stormwater maintenance	4.40	3.65	3.75	3.28
Total	5.31	4.54	6.00	5.38

While a total of 5.38 FTEs has been funded for the 2013-2014 Stormwater Program, not all of these resources will be directly expended toward stormwater programs and maintenance. Maintenance staff are not designated into infrastructure-specific groups and instead respond to complaints across the City based on need. The engineering department operates the same way, with staff working in all aspects of public works.

The stormwater program began funding maintenance positions in the 2002/3 fiscal year. Maintenance staffing was at 2.83 FTE from 2004/5 through 2008/9 and 4.40 FTE in 2009/10 and 2010/11. However, maintenance staffing levels have decreased in recent years due to budget constraints, as shown in Table 5-3. At the same time, the extent of the public stormwater infrastructure has increased greatly over the last five years, increasing from 32.5 miles of conveyance pipe in 2008 to 58.4 miles in

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2013. The larger pipe network will require increased staff time for preventative inspections and follow-up maintenance.

5.6.2 Evaluation of Staffing Levels

Based on the above findings, it is recommended that additional resources be designated toward implementing Newberg's stormwater program. The recommended resource levels for the City's stormwater management programs and maintenance activities are based on a zero-based approach as described below.

The zero-based budgeting approach identifies the activities to be performed and then calculates the resources required to perform them. This approach follows the basic steps outlined below:

- Identify tasks for preventive and corrective maintenance.
- Identify tasks for programmatic activities and regulatory obligations.
- Establish program goals for major activities.
- Estimate production rates for specific activities based on city experience and industry standards.
- Calculate staff hours required to meet program goals.
- Compare calculated requirements with existing resources.

Table 5-3 summarizes the results of the zero-based approach for estimating staffing levels for stormwater management programs and maintenance. The maintenance frequencies and program activities are consistent with the recommendations included in Sections 5.3.2 and 5.4.2.

The effort required to address corrective maintenance activities is based on the City's current experience. It is anticipated that higher (than current) levels of corrective maintenance will be needed to address the backlog of work that has been generated as the City's pipe system continues to age without a preventative maintenance program in place. Once the preventive maintenance program is implemented and backlogged cleaning and repair work has been performed, the levels of certain corrective maintenance activities would likely decline. Likewise, the number of customer complaints may also be reduced.

The staffing requirements in Table 5-3 show a need to staff the stormwater program at 3.60 FTE for maintenance, 2.55 FTE for engineering, and 0.45 FTE for administration. This equates to 6.60 FTE, which is an increase of approximately 1.2 FTE over 2013/14 staff levels. The staffing increases are generally related to:

- Adding a preventative maintenance program (0.67 FTE)
- Increasing field time for engineering staff to map the stormwater system and implement the stormwater management code - responding to illicit discharge concerns, enforcing private facility maintenance requirements, and conducting ongoing stream channel observations (0.5 FTE).

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Table 5-3. Stormwater Management Maintenance and Program Staffing Requirements

Storm drainage system quantities	3,900 structures (catch basins, manholes, and inlets) 312,150 feet of storm lines 10 public stormwater facilities							
	Infrastructure units				Staffing plan			
	Percent per year	Frequency per year	Actual per year	Units	Production rate (units/day)	Crew size	Annual hours	Total FTEs[a]
Stormwater Maintenance Activities							6334	3.60
Inspections, structures	20	1	780	each	50	2	250	0.14
Inspections, storm lines, 12 inches and greater	20	1	48,500	feet	1000	2	776	0.44
Inspections, facilities	100	2	20	each	2	2	160	0.09
Cleaning, structures	10	1	380	each	8	2	760	0.43
Cleaning, storm lines	2	1	4,850	feet	200	2	388	0.22
Cleaning, facilities	100	1	10	each	1	2	160	0.09
Ditch Maintenance	-	-	1,000	Feet	200	2	80	0.05
Minor repairs, structures	-	-	10	each	1	3	240	0.14
Minor repairs, storm lines	-	-	10	locations	1	3	240	0.14
System replacement, structures[b]	-	-	6	each	0.5	3	288	0.16
System replacement, storm lines[b]	-	-	1000	feet	100	3	240	0.14
Miscellaneous investigations	-	-	40	each	2	1	160	0.09
Street sweeping	-		-	-	n/a	1	1760	1.00
Asset management and recordkeeping	-		-	-	8 hours/week	1	416	0.24
Maintenance management and planning	-	rotational	-	-	8 hours/week	1	416	0.24

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Table 5-3. Stormwater Management Maintenance and Program Staffing Requirements

Storm drainage system quantities	3,900 structures (catch basins, manholes, and inlets) 312,150 feet of storm lines 10 public stormwater facilities							
	Infrastructure units				Staffing plan			
	Percent per year	Frequency per year	Actual per year	Units	Production rate (units/day)	Crew size	Annual hours	Total FTEs[a]
Stormwater program activities							4484	2.55
TMDL implementation plan	-	ongoing	-	-	-	n/a	1760	1.00
Development review and inspection	-	ongoing	-	-	-	n/a	880	0.50
CIP program management	-	ongoing	-	-	-	n/a	880	0.50
Customer response	-	as needed	10	calls	8 hours/call	1	80	0.05
Staff training (all PW staff)	-	1	1	training	4 hours/year	40	160	0.09
GIS mapping, field work and office	-	monthly			2 days/month	2	384	0.22
Stream channel observations	-	monthly			1 day/month	1	96	0.05
Private facility maintenance enforcement	-	ongoing	-	-	12 hrs/month	1	144	0.08
Illicit discharge investigation and enforcement	-	as needed	5	Events	20 hrs/event	1	100	0.06
Stormwater Administration							792	0.45
Stormwater administration[c]	-	ongoing	-	-	-	n/a	792	0.45
Total							**11,628**	**6.60**

[a]Calculations of FTE are based on 1760 working hours per year, account for sick leave, vacation, holidays, training, and breaks not directly related to the work.

[b]System replacements are dependent on annual budget. The values in the table reflect an annual replacement budget of $100,000.

[c]Includes administration of the stormwater utility fee and general administration of the stormwater program such as the portion of the public works director paid by the stormwater program.

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Section 6

Integrated Management Strategy

This section provides a summary of recommendations to address future regulatory objectives and capital project recommendations to address existing storm system capacity deficiencies, future storm system needs, and water quality objectives.

Section 6.1 includes programmatic recommendations for maintenance activities, water quality programs, and staffing. The programmatic recommendations also include one-time projects that are needed to implement the stormwater management program. Section 6.2 focuses on the development of larger capital improvement projects (CIPs), integrated to address capacity and water quality concerns. Section 6.3 outlines several ongoing infrastructure expenses to replace aging infrastructure and enhance water quality through retrofits.

6.1 Programmatic Recommendations

The regulatory evaluation summarized in Section 5 assessed the ability of the City of Newberg's (City) stormwater program to meet Total Maximum Daily Load (TMDL) program requirements. A review of the City's Standard Design Manual (2013 Draft and 2014 Draft) was delivered as a separate memorandum. The City's stormwater program currently contains many of the elements of a successful and regulatory compliant program; therefore, the following recommendations include only minor adjustments and additions to the existing program.

6.1.1 Maintenance Recommendations

In addition to providing ongoing responsive maintenance to identified problem areas, the City is strongly encouraged to move the maintenance program toward a more proactive, preventive maintenance approach, to provide an increased level of service to the community at reasonable cost. Over time, as the condition of the system is documented, repairs made where required, and systems cleaned before they become problems, the number of customer service investigations should be reduced. With a fully functional preventive maintenance program, the long-term costs associated with future repairs, rehabilitation, and replacement will be minimized. Specific recommendations include the following:

- Establish a proactive inspection schedule to evaluate structures visually and record videos of storm lines. Routine inspections likely will result in more work orders for cleaning, based on inspection results. In addition to identifying maintenance needs, routine inspections can be used to meet illicit discharge screening requirements of the City's TMDL Implementation Plan. The recommended inspection plan includes the following:
  - Visual inspection (and cleaning as needed) of 20 percent of catch basins, manholes, and inlets each year
  - Video inspection of 20 percent of storm lines (12 inches in diameter and greater) each year. The City's video schedule would aim to cover higher risk storm lines (those in the downtown and older areas of Newberg) once every 3 years and the remainder of the city on a 6- to 8-year cycle. More frequent evaluation of older pipes is needed to identify deteriorating pipes that are in need of replacement.

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- Purchase electronic tablets that will allow field data entry of maintenance activities into a cartegraph system. This will save staff time that is currently spent transferring field records from paper notes into the electronic system.

6.1.2 Program Recommendations

The City's programmatic stormwater activities are on track to meet TMDL compliance obligations and to provide a responsive level of service for customer complaints, development review, and capital project management. In addition to continuing with current TMDL implementation activities, development review, and capital project management, the following recommendations would allow the City to improve understanding of the existing drainage infrastructure and enhance water quality related services.

- Allocate staff time for ongoing field data collection to improve the accuracy of the City's geographic information system (GIS) stormwater database. The suggested schedule is to have two staff members spend 1 day per month collecting field data. Importing data and making adjustments to the GIS database are expected to take another 8 to 16 hours per month.
- After mapping of the public system is complete, continue monthly GIS mapping activities to locate and document the type and condition of private stormwater management facilities. The City's stormwater management code now requires private owners to conduct and document regular facility maintenance. The City will need facility locations to contact property owners and enforce the municipal code. Mapping and tracking maintenance on private facilities may also allow the City to take credit for the water quality improvement from private facilities if TMDL benchmarking becomes a regulatory requirement for the City.
- Develop a Water Quality-Sensitive Operations and Maintenance (O&M) Manual (or standard operating procedures [SOP]), as required by the TMDL Implementation Plan. The SOPs can be developed using template documents available from regulatory agencies or by adopting an existing maintenance manual developed by another jurisdiction with similar obligations.
- Conduct annual training for all public works staff on TMDL-related topics. For 2014/2015, the training should be focused on illicit discharge identification and reporting. Future trainings could cover the updated stormwater design standards, the water quality maintenance manual, or other water quality-related topics.
- Establish programs to implement the stormwater code (NMC 13.25). These programs include illicit discharge investigation and response and private facility maintenance tracking.
- Conduct regular field screenings of outfalls and other areas of previously observed stream bank erosion to document changes in bank conditions and identify locations for stream bank stability projects. Allocating at least 1 day per month for stream observation would allow City staff to visit areas of concern several times a year on a rotational basis.
- Continue participation in watershed groups and professional associations to understand how monitoring data are being collected by other small communities and utilized by regulatory agencies. Observing regulatory trends among other Oregon jurisdictions will allow the City to evaluate the need for a stormwater monitoring program in the future.

6.1.3 Staffing Recommendations

Implementing the recommended stormwater program activities will require 6.60 total full-time equivalents (FTE) to support the stormwater program. This is an increase of approximately 1.2 FTE over 2013/2014 levels. Additional staffing would allow the City to implement a preventive maintenance program and increase water quality programs in compliance with the City's TMDL Implementation Plan. The analysis in Section 5.6 recommends funding approximately 3.6 FTE in Maintenance, 2.55 FTE in Engineering, and 0.45 FTE in Administration.

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6.1.4 Engineering Projects and Studies

The City's stormwater program would see benefits from funding several one-time engineering projects and studies that would support implementation of the stormwater program. Recommended engineering projects and studies include the following:

- Water Quality Sensitive O&M Manual – as described in Section 6.1.2.
- System Development Charge (SDC) Rate Study – This Stormwater Master Plan (Master Plan) includes a preliminary assessment of the City's current stormwater program funding (see Section 7.3). While stormwater utility rates are reviewed regularly by the City's Citizen's Rate Review Committee, the stormwater SDCs also may need to be adjusted to support the projects identified in this plan.
- Master Plan Update – This Master Plan is intended to identify stormwater management activities and projects over the next 10 to 15 years. As the projects in this Master Plan are completed and new developments are constructed, the City will need to complete a Master Plan Update.

Table 6-1 identifies the required funding and proposed schedule to implement engineering projects and studies.

Table 6-1. Engineering Projects and Studies

Project number	Program name	Total cost, $	Timeline
P-1	Water Quality Sensitive O&M Manual	25,000	2014/2015
P-2	SDC Rate Study Revision (one time)	15,000	2014/2015
P-3	Master Plan Update (one time)	250,000	2025

6.2 Integrated CIP Development

This section identifies the projects designed to address the problem areas identified in Section 3. Problem areas include capacity problems identified through SWMM modeling and shown on Figures 3-1 and 3-1 as well as reported problem areas listed in Table 3-10 and depicted on Figure 3-3. To the extent possible, CIPs were developed as integrated solutions to address multiple objectives (e.g., flood control with enhanced water quality treatment or pipe replacement/realignment with capacity improvement) or to address multiple drainage problem areas with a single, comprehensive project.

6.2.1 Project Identification

CIP locations were identified by reviewing the model results presented in Table 3-9 and the reported problem areas in Table 3-10. Field visits to reported and modeled problem areas were also used to evaluate surrounding conditions and potential solutions and to identify problem areas that could be grouped into a single project location.

Many of the reported problems have a clearly identifiable solution. Examples of this are pipes located under private property that require realignment (DP-C-1, DP-C-4, and DP-C-10), deteriorating pipes needing replacement in River Street (DP-C-9), and areas lacking existing infrastructure (DP-C2, DP-H-1, DP-H-2, and DP-H-5).

The SWMM model was utilized to evaluate potential solutions for identified capacity problems. Potential solutions included upsizing of existing pipes, expansion of infrastructure, or installation of additional storage features such as underground vaults or regional detention ponds. In most cases, capacity

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problems are related to short stretches of undersized pipes. Upsizing existing pipe is more cost effective than acquiring property to add detention storage at the flooding locations. In addition, the stream channel vulnerability assessment showed that the natural stream channels are generally stable under current flow and development conditions, which indicates that significant upstream detention storage is not needed for existing development. Future development areas may need to utilize regional storage systems to meet the City's stormwater design standards and prevent any further degradation.

Following these evaluations, a strategy meeting was conducted with City staff to review the problem areas and potential alternative solutions. Small improvements along the same pipe network were combined into larger projects that provide a longer term solution. To integrate development of the flood control and water quality CIPs, the identified capacity problem areas were reviewed to determine whether water quality facilities (such as a rain garden, stormwater planter, or green street design) could be sized and located to address the capacity problem or to provide treatment in addition to a upsized conveyance pipe. In areas where the capacity problem is a result of undersized trunklines, opportunities for adding additional water quality treatment were limited.

The resulting project list includes 15 capital projects, including small pipe and culvert replacements, larger realignments of existing drainage networks, and construction of new stormwater infrastructure in underserved neighborhoods.

6.2.2 Unit Cost Estimates

Unit cost information for construction elements of the CIP facilities was compiled using bid tabulations from recent local construction projects and *Site Work & Landscaping Cost Data* (RS Means, 2012) was referenced for additional work not covered by recent bid tabs. The unit costs were adjusted based on results of bids on recent City projects.

Preliminary CIP cost estimates are based on the unit cost information for construction elements plus a 30 percent contingency. Permitting, surveying and design, and construction administration costs are based on a general percentage of the total construction cost. Land acquisition costs are not included in the estimates.

Project unit costs and detailed cost estimates for each CIP are located in Appendix D. CIPs with multiple components contain a detailed cost estimate for each project component.

6.2.3 CIP Sizing and Conceptual Design

This section includes a summary of the CIP sizing and conceptual design criteria based on the type of system improvement proposed. System improvements include piping improvements, infiltration planter boxes for water quality, and bank stabilization and outfall protection for channel improvements. Proposed CIPs may reflect a combination of these system improvements.

Conveyance – Design criteria for new conveyance piping are based the City's September 2013 Draft Standard Design Manual. In most areas of the City, pipes were sized to convey the 25-year future conditions flow. In areas where the cumulative drainage area exceeds 250 acres, the 50-year future condition flow was the design standard.

Stormwater Planters and Rain Gardens – Infiltration planter boxes were sized according to available space in the existing planter strips. These water quality systems will be installed on an opportunistic basis, retrofitting existing streets that currently do not have water quality treatment measures. In most cases, an overflow system will need to be installed to allow for bypass of storm events that exceed the design capacity of the planter or rain garden. Bypass flows will be discharged into the existing conveyance system via gutter flow to the nearest catch basin or piped overflow to the nearest storm drain.

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6.2.4 CIP Project Summary

Table 6-2 includes a CIP designation, a problem description, and project description for each CIP. The CIPs are presented and numbered by each of the three basins. The following CIP designations are applicable:

- flood control (FC)
- improve drainage infrastructure network (IDIN)
- pipe replacement – location (PR-L)
- pipe replacement – material (PR-M)
- reduce maintenance frequency (RMF)
- structural integrity (SI)
- stream bank protection (SP)
- water quality (WC)

Figure 6-1 shows the location of each of the proposed CIPs. Detailed CIP fact sheets are provided in Appendix D and include additional conceptual design detail and a map locating the proposed system improvements. Appendix D also contains detailed cost estimates for each project. Section 7 provides a priority ranking of CIPs and the planned schedule for implementation.

6.3 Ongoing Capital Projects

The capital projects listed in Table 6-2 address specific infrastructure needs. The City's stormwater system also faces long term challenges related to asset management. The stormwater program would benefit by allocating funds each fiscal year to upgrade existing infrastructure and enhance water quality treatment. Two ongoing capital projects are recommended, as described below.

6.3.1 Annual Pipe Replacement Program

The City's stormwater infrastructure is a significant asset. Stormwater pipes typically have a design life of 50-100 years. The longevity of the infrastructure depends on many factors, including pipe material, installation methods, site conditions, traffic loads, and maintenance frequency. While a preventative maintenance program can extend the life of the pipe network, some areas of the City are still composed of clay tile pipe. Other areas are deteriorating and will need replacement as part of the City's asset management strategy.

The areas in greatest need of pipe replacement include pipes located under private residences and the deteriorating clay tile pipe in South River Street. These known problem areas will require significant capital projects, and have been included in the Table 6-2 CIP list. Future areas that require replacement would be identified through the preventative maintenance inspection program. An annual pipe replacement program would establish "system replacement" as an annually recurring capital project. This funding would allow the City to replace aging pipes and structures that show significant deterioration during preventive maintenance inspections.

Targeted pipe replacement can be completed by City maintenance crews or by contractors from the City's small works roster. This is a cost effective way to upgrade infrastructure without incurring the engineering and administrative costs that come with larger capital projects. Funding annual pipe replacement at $100,000 per year would allow the City to replace only a small percentage (less than one percent) of the total existing pipe each year. However, the annual pipe replacement program is an ongoing investment in asset management that will allow the City to address small needs before they grow into larger, more costly problems.

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6.3.2 Water Quality Retrofit Program

As with the Annual Pipe Replacement program, the Water Quality Retrofit Program would set aside funds each year to enhance water quality treatment as opportunities arise on other capital projects. It is recommended that the water quality retrofit program be funded at a rate of $50,000 per year.

In general, water quality retrofits take the form of rain gardens, stormwater planters, and other "green street" elements. These types of facilities provide localized water quality treatment to surface runoff. Infiltration is utilized to manage small flows. Underdrains and overflow piping convey peak flows to the stormwater conveyance system. Water quality retrofits are most cost effective when combined with another capital project. Transportation projects, such as road widening, traffic calming, and pedestrian/bike improvements all lend themselves well to incorporating water quality retrofit projects. Two projects – one on Springbrook Road and one on College Street – are currently underway to improve water quality and stormwater management in conjunction with transportation system upgrades. Having an annual fund for water quality retrofits gives the City the ability to capitalize on opportunities as they become available.

Figure 6-2 shows the two current project areas, as well as additional locations around the City, that may be considered for future water quality improvements. The locations were selected based on:

- Existing transportation/stormwater project locations. Examples include Springbrook Road and College Street.
- Proposed stormwater capital projects where water quality elements may be incorporated into the final design. Examples include Dayton Avenue (CIP C-8), River Street (C-6), Elliot Avenue (CIP H-1), and North/Franklin/Sherman/Sheridan Streets (CIP H-2).
- Locations that are not fully served by the existing stormwater infrastructure that look to have potential opportunities for the addition of planters or rain gardens within the existing right-of-way. Examples include 2nd Street, 3rd Street, Sitka Avenue, and Hulet Avenue. In these locations, the water quality retrofit project may need to replace existing landscaping or on-street parking areas. Coordination with local residents will be an important aspect of project evaluation and development.
- Locations where future development may bring roadway improvements that could incorporate water quality treatment. Examples include Crestview Drive east of Villa Road and Carter Lane between Hazelnut Drive and Kemper Crest Drive.

At $50,000 per year, the Water Quality Retrofit Program will not fund significant stand-alone projects. Rather, the funding should be utilized to enhance water quality in association with other capital projects. Funds from the Water Quality Retrofit Program could also be utilized as matching funds to secure grants for larger enhancement projects down the road.

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Table 6-2. Comprehensive CIP Summary

CIP number	CIP type	CIP name	Proposed CIP location	Event(s) deficiency occurs	Problem description	CIP description	Length of conveyance improvements, linear feet (LF)	Associated subcatchment	Contributing drainage area, acres	Estimated capital implementation cost total, $
Basin 1 - Chehalem Creek										
C-1	PR-L; SI; FC	S Blaine Street Improvements	S Blaine Street, between E 6th and E 7th Streets	Existing and future 10-year	Currently a reach of 12"-18" stormwater pipe runs through private property and under several houses. Flooding along E 6th and S Blaine Streets occurs during the current and future conditions 10-year storm events.	Decommission the stormwater pipes which are in private property and add a 24" stormwater pipe along S Blaine Street and a 12" pipe along E 1st Street. Connect the stormwater system from E 6th Street to S Blaine Street to provide conveyance and storage. Upsize existing stormwater pipes to 24" and 18" to convey existing and future flows.	2,887	SC_STMG1227, SC_STMG1215, SC_STMG121, SC_STMG1219, and SC_STMG1320	62.0	1,161,000
C-2	PR-L; SI; FC	S Center Street Improvements	S Center Street, between E 3rd and E 9th Streets	Existing and future 10-year	Currently a reach of 21" stormwater pipe runs through private property and under several houses. Flooding along E 8th, E 7th, and S Center Streets occurs during the current and future conditions 10-year storm events.	Decommission the stormwater pipes which are on private property and add a 30" stormwater pipe along S Center Street. Upsize existing stormwater pipes to 30", 24", and 18" to convey existing and future flows.	3,860	SC_STMG1245, SC_STMG128, SC_STMG1317, SC_STMG133, SC_STMG135, SC_STMG1310, SC_STMG1311, and SC_STMG1323	100.1	1,404,000
C-3	FC	E Columbia Drive Improvements	E Columbia Drive, west of N College Street	Existing and future 10-year	Flow is currently limited by three undersized 18" pipes which restrict flow from larger-diameter upstream pipes. Hydraulic modeling shows overflow from manholes during the 10-year existing/future flow event. Downstream pipe segments are 24" diameter and have capacity for current and future 10-year flow events.	Upsize existing stormwater pipes to 24" to convey existing and future flows.	92	SC_STMG0924, SC_J5064, SC_STMG1029, and SC_STMG0919	56.7	79,000
C-4	FC	Oxford Street Improvements	Oxford Street, between Winchester and E Mountainview Drives	Existing and future 10-year	Flow is currently restricted by 14 undersized pipes. Flooding from manholes is shown to occur during the 10-year existing/future flow event. Pipe diameters increase and decrease in numerous places throughout this alignment. The City has installed some upsized pipes to address acute problems. This project provides a wider solution to provide long term capacity.	Upsize existing stormwater pipes to 36" to provide capacity for future flows. Utilize existing structures where possible.	1,860	SC_STMG0765, SC_STMG0755, SC_STMG0714, SC_STMH072, SC_STMG0733, SC_STMH081, SC_STMG0721, SC_STMG0750, SC_STMG0744, SC_STMG0769, SC_STMG0768, SC_STMG077, SC_STMG0830, SC_STMG0860, SC_STMG0847, SC_STMG088, SC_STIG0837, SC_STMG0846, SC_STMG0814, SC_STMG085, SC_STMG0811, and SC_STMG082	167.4	1,092,000
C-5	FC	N College Street Improvements	N College and Dahlia Streets, between Natalie and Foothills Drives	Existing and future 10-year	Flow is currently restricted by four undersized pipes during the current and future conditions 10-year storm events.	Upsize existing stormwater pipes to 24" to convey existing and future flows.	691	SC_STMG0774, SC_STIG07112, SC_STMG0775, and STMG0772	102.8	260,000
C-6	PR-M	S River Street Improvements	S River Street and E 11th Court	No capacity issues	Carry-over project from the 2001 Stormwater Master Plan.	Two clay sewer tile pipe segments will be replaced with 18" pipe to convey existing and future flows.	507	SC_STMG1412 and SC_STMG1413	27.0	160,000
C-7	PR-M	S College Street at Andrew Street Improvements	S College Street, south of Andrew Street	No capacity issues	Existing pipe system under S College Street is composed of multiple pipe materials, causing maintenance problems and concerns over long term stability.	Replace two existing culverts with 130 LF of 48" culvert.	260	SC_STMG1245, SC_STMG1317, SC_STMG128, SC_STMG135, SC_STMG133, SC_STMG1311, SC_STMG1310, SC_STMG1323, SC_STMG138, SC_STMG1412, SC_STMG1413, SC_J-CCT1-07, SC_STMG142, SC_STMG143, SC_STMG149, and SC_J3498	171.5	196,000
C-8	FC; WC	Dayton Avenue Green Street Conveyance	Dayton Avenue, south of 5th Street in the vicinity of W Johanna Court	Not modeled	The City has reported drainage problems along Dayton Avenue near W Johanna Court. The resident at 606 NE Dayton Avenue has reported frequent driveway flooding driveway.	Add stormwater planters (low impact development (LID)/green stormwater infrastructure design) along Dayton Avenue to provide storage capacity and water quality improvements.	n/a	SC_STIF1324	13.4	196,000

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Table 6-2. Comprehensive CIP Summary

CIP number	CIP type	CIP name	Proposed CIP location	Event(s) deficiency occurs	Problem description	CIP description	Length of conveyance improvements, linear feet (LF)	Associated subcatchment	Contributing drainage area, acres	Estimated capital implementation cost total, $
Basin 2 – Hess Creek										
H-1	IDIN	N Elliot Road Improvements	N Elliot Road, north of Highway 99W	Not modeled	The City has reported drainage problems along N Elliot Road as the area does not have a public drainage system, resulting in frequent ponding during storm events.	Add a drainage system to convey flows from N Elliot Road to the existing system to the east. The proposed pipe system is sized to convey both current and future flows.	757	SC_STMI111 and SC_STII1179	17.8	239,000
H-2	IDIN; FC	N Edwards Street Improvements	N Edwards Street, from Vermillion Street to E Sheridan Street	Existing and future 10-year	The City has reported drainage problems along Vermillion Street between N College Street and the railroad tracks. Currently a flat and undersized pipe discharges stormwater along the railroad tracks. This neighborhood has some bubblers at intersections, but does not have a defined connection to the public stormwater system.	Add a drainage system to convey flows from Vermillion Street to the existing drainage system at E Sheridan Street. Proposed pipes are sized to convey both current and future flows.	4,340	SC_J-HC-18, SC_J4620, SC_J4818, and SC_J3628	38.0	1,217,000
H-3	FC; WC	E 3rd Street Improvements	E 3rd and S Church Streets	Existing and future 10-year	Modeling shows flooding problems along E 3rd and S Church Streets during the current and future conditions 10-year storm events.	Add a 24" stormwater pipe to connect the stormwater system from E 3rd Street to S Church Street to provide conveyance and storage. Upsize existing stormwater pipes to 30", 24", and 18", as determined by modeling. Install stormwater planters (LID/green stormwater infrastructure design) along E 1st Street to provide additional storage capacity and water quality improvements.	2,427	SC_STMH1253, SC_J4290, SC_STMH1233, and SC_STMH1223	40.7	887,000
H-4	PR-M; FC	Villa Road Improvements	Villa Road, north of Carol Ann Drive	No capacity issues	The culvert on Hess Creek at Villa road is a mix of corrugated metal pipe and concrete box culverts. This is an area of maintenance attention during large storm events to prevent flood waters from impeding traffic on Villa Road.	The existing culvert will be upsized from a 30" culvert to a 60" culvert to convey current and future flows.	75	SC_J-HC-31, SC_STIH107, SC_STMH0919, SC_STMH097, SC_STMH096, SC_STMH098, SC_STMH095, SC_STMH0911, SC_J4002, SC_J-HC-03, SC_J5480, SC_J-HC-34, SC_STMH1024, SC_J-HC-35, SC_J-HC-36, SC_STII0940, SC_J-HC-37, SC_J-HC-38, SC_STIH081, SC_J4956, SC_J-HC-39, SC_J-HC-40, SCa_J5090, SC_J5284, SC_J-HC-42, SC_J3938, SC_J4576, SCb_J5090, SCc_J5090, SC_J5324, SC_J-HC-43, and SC_J3936	1,174.4	104,000
Basin 3 – Spring Brook										
S-1	FC	N Springbrook Road Improvements	N Springbrook Road, north of Hwy 99W	Existing and future 10-year	Modeling shows flooding problems along N Springbrook Road during the current and future conditions 10-year storm event. The upstream stormwater system along N Springbrook Road was upgraded during installation of traffic improvements, but flows are constricted from a 30" pipe down to an 8" to 12" section of pipe near Middlebrook Drive.	Upsize the stormwater pipes along N Springbrook Road to 30" diameter and connect the system to the existing system to the south. The proposed pipe system is sized for both current and future flows.	1,735	SC_STII0965, SC_STII0975, SC_STII0990, SC_STII1030, and SC_STII1080	55.9	777,000
S-2	FC; RMF	Libra Street Improvements	Libra Street and Victoria Way	Existing and future 10-year	Modeling shows flooding problems along Libra Street during the current and future conditions 10-year storm event. This system needs frequent maintenance to address silt accumulation.	Upsize existing stormwater pipes along Libra Street to 18" to convey current and future flows.	804	SC_STII0988, SC_STIJ0911, and SC_STMJ1022	14.4	246,000
City-Wide										
A-1	SP	Stream Bank Protection Projects	Multiple locations	No capacity issues	Erosion of stream banks in locations near outfalls or high energy portions of the stream channels. Locations determined based on field observation.	Reconstruct storm drainage outfalls that are well placed along stream banks. Add bank protection and replant riparian areas.	n/a	n/a	n/a	190,000

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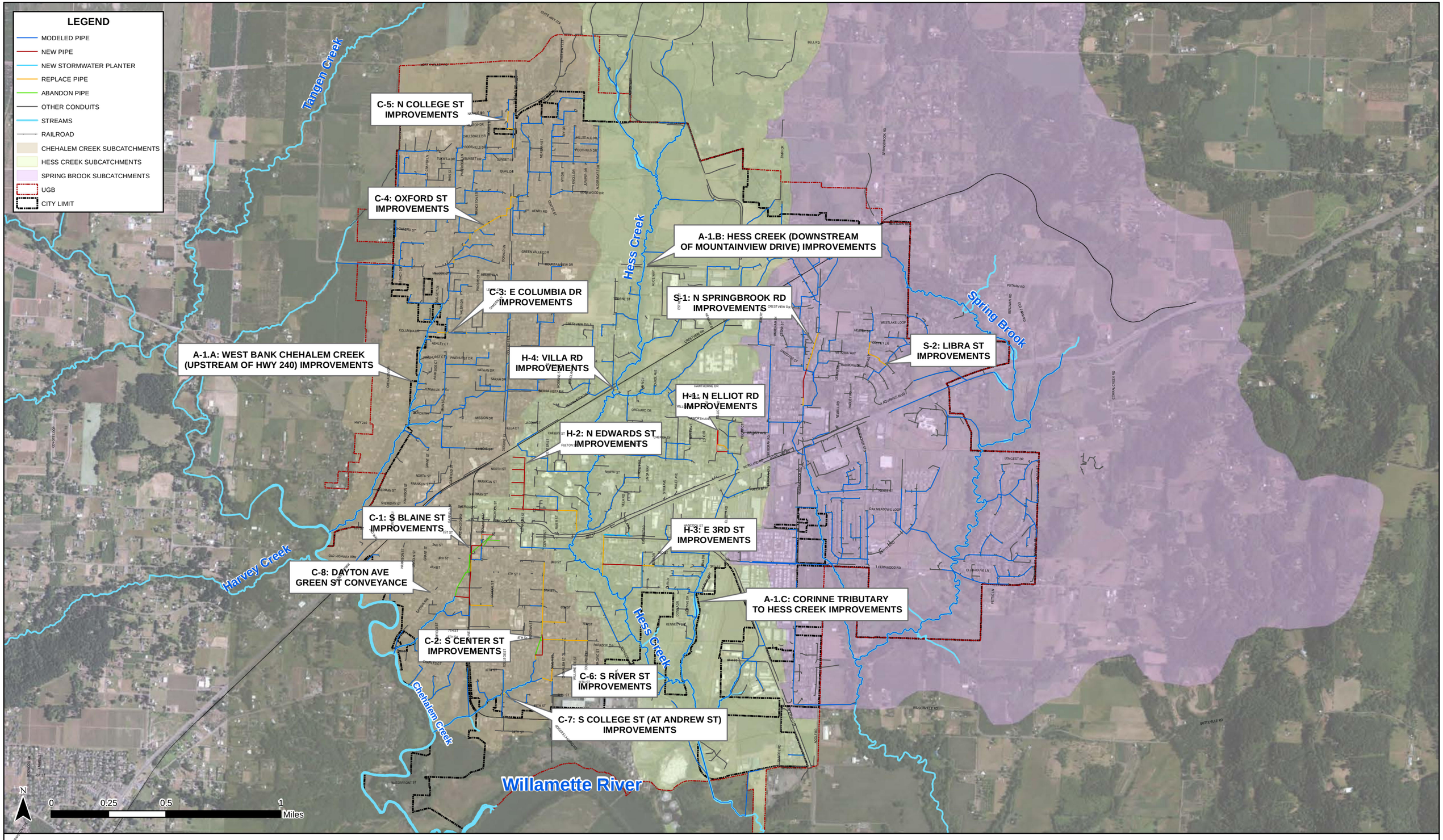


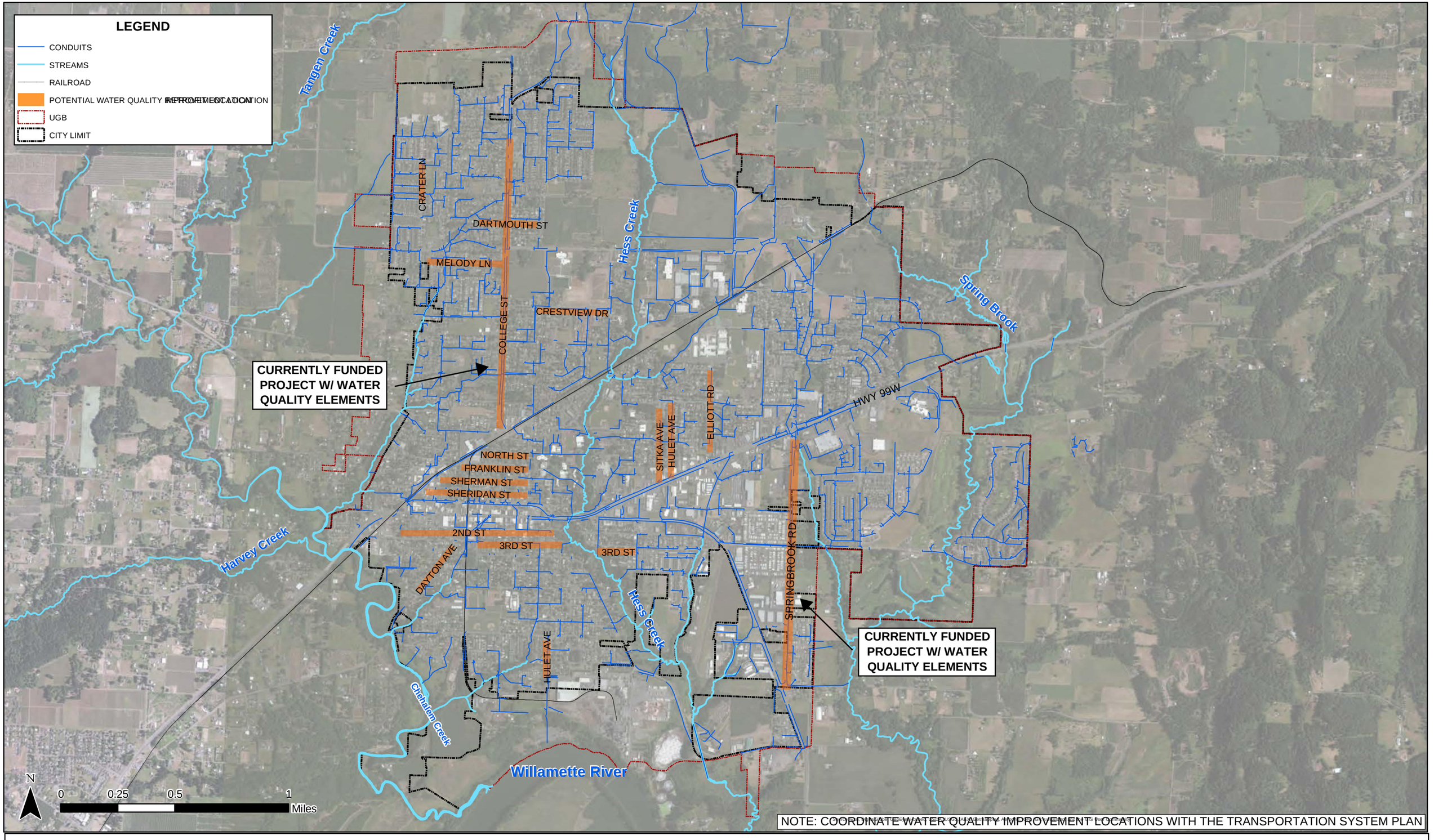
STORMWATER MASTER PLAN UPDATE

FIGURE 5-1. CAPITAL IMPROVEMENT PROJECTS

NEWBERG, OREGON

Source: DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

JUNE 2014



STORMWATER MASTER PLAN UPDATE

FIGURE 6-2. POTENTIAL WATER QUALITY IMPROVEMENT LOCATIONS

NEWBERG, OREGON

JUNE 2014

Section 7

Implementation Plan

This section presents a proposed implementation plan for the capital projects and program recommendations outlined in Chapter 6. The plan includes capital project prioritization, so that the City of Newberg (City) can budget for projects in 5-year increments. The City is not under regulatory obligations to complete stormwater-related capital projects. Instead, the implementation timeline is based on local priorities, which were established during the development of this Stormwater Master Plan (Master Plan). Following the capital project prioritization, Section 7.2 presents a financial analysis to evaluate the funding needed to implement this Master Plan.

7.1 Capital Improvement Project (CIP) Priority Evaluation

The capital projects presented in Section 6.2 represent a long term strategy to address flooding, capacity upgrades, stream bank stability, and water quality enhancements. Effective implementation of this Master Plan requires prioritizing projects and establishing a schedule for design and construction.

7.1.1 Prioritization Criteria

Two strategy meetings were conducted with City staff to review project alternatives and establish implementation priorities. A list of prioritization criteria was developed to align with local priorities. Each criterion was also assigned a weighting factor (WF), so that project prioritization will emphasize the issues of greatest concern. For example, the health and safety issue associated with structural stability of existing pipes is a top priority for City staff. Aging pipes located under existing buildings need to be moved into the public right-of-way and the existing pipes need to be decommissioned in a method that reduces the likelihood of a pipe failure.

Following are the CIP prioritization criteria used in this plan:

Safety/Liability – Does the project address safety concerns, structural stability, or other potential liability concerns for the City? (WF: 1.0)

Complexity – Can the project can be designed and constructed quickly or will it require significant attention to address challenging design or construction issues? (WF: 0.5)

Impact – Will the project benefit a large area of the city or is the problem limited to a few individual properties? (WF: 0.5)

Environmental Benefit – Are there direct water quality or habitat-related environmental benefits associated with the project? (WF: 0.5)

Long-Term Maintenance – Will the project increase or decrease the maintenance activities required by City staff? (WF: 1.0)

Sustainability/Livability – Will the project improve quality of life and provide a long-term solution that is aligned with community values? (WF: 0.5)

Cost is not listed as a prioritization criterion at this time. Instead, the City will use the prioritization criteria to identify top groups of project (i.e., projects to be constructed in the first 5 years, second 5 years, etc.). Project cost will then be used to schedule projects based on the funding available and long-term savings required to implement the preferred solution.

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The detailed scoring and weighting criteria are included in Appendix D.

7.1.2 CIP Prioritization

Based on the prioritization criteria, the City evaluated each of the proposed capital projects and calculated a total prioritization score. Higher scoring projects are of higher priority. The details of the scoring are presented in Appendix D. Table 7-1 provides the total prioritization score for reach project, along with an estimated timeline for implementing projects.

Table 7-1. CIP Prioritization and Implementation Timeline

Basin	CIP number	Project name	Cost, $	Prioritization score	Estimated timeline
Chehalem Creek	C-1	Blaine Street Improvements - Design	180,000	n/a[a]	Short-term
	C-1A	Highway 99W to 2nd Street Parking Lot Pipe Decommissioning/Replacement	131,000	10.0	Short-term
	C-1B	S Blaine Street Pipe Replacement	384,000	9.0	Short-term
	C-1C	E 2nd Street to E 5th Street Pipe Decommissioning/ Replacement	291,000	10.0	Short-term
	C-1D	E 6th and S Blaine Streets Pipe Replacement	176,000	6.5	Long-term
	C-2	S Center Street Improvements - Design	180,000	n/a[a]	Short-term
	C-2A	E 9th Street to S Center Street Pipe Decommissioning	294,000	10.5	Short-term
	C-2B	S Center, E 8th, and E 7th Streets Pipe Replacement	930,000	7.0	Long-term
	C-3	E Columbia Drive Improvements	79,000	8.0	Mid-term
	C-4	Oxford Street Improvements	1,092,000	7.5	Mid-term
	C-5	N College Street Improvements	260,000	6.5	Long-term
	C-6	S River Street Improvements	160,000	9.0	Short-term
	C-7	S College Street at Andrew Street Improvements	196,000	7.0	Long-term
	C-8	Dayton Avenue Green Streets	125,000	7.5	Mid-term
Hess Creek	H-1	N Elliot Road Improvements	239,000	5.5	Long-term[b]
	H-2	N Edwards Street Improvements	1,217,000	6.0	Long-term
	H-3	E 3rd Street Improvements - Design	142,000	n/a[a]	Long-term
	H-3A	S Church and E 1st Street Improvements	404,000	6.0	Long-term
	H-3B	E 3rd Street Improvements	341,000	5.5	Long-term
	H-4	Villa Road Improvements	104,000	8.0	Mid-term[c]
Spring Brook	S-1	N Springbrook Road Improvements	777,000	6.5	Long-term[c]
	S-2	Libra Street Improvements	246,000	7.0	Long-term
City-wide	A-1	Stream Bank Protection Projects	190,000	8.0	Mid-term
		Total	8,137,000		

[a] Design work for phased projects should be prioritized based on the highest scoring construction phase.

[b] Project to be constructed with roadway improvement project. Schedule dependent on transportation program priorities.

[c] Project to be designed and constructed with water and wastewater system improvements. Schedule based on joint priorities.

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Short-term projects that include the highest priority health and safety concerns are the highest priority, and will be the focus of construction over the next 5 or 6 years. Mid- and long-term projects will be constructed, depending on funding availability. Short-term priority projects include the following:

- C-1, C-1A, C-1B, and C-1C. Blaine Street Improvements (Design and the first three phases of construction)
- C-2 and C-2A. South Center Street Improvements (Design and the first phase of construction)
- C-6. South River Street Improvements

In addition to addressing the safety and liability concerns of having public infrastructure located under private structures, these seven projects will replace aging infrastructure and serve as part of the annual pipe replacement program recommended as part of the City's maintenance program.

Ultimately, the project schedule will be dependent on funding availability. In addition, some projects are dependent on the construction of other infrastructure, such as the need to replace the existing culvert under Villa Road when the roadway is widened (Project H-4). Stormwater projects that are affiliated with another infrastructure project will be scheduled as those projects are funded. This could adjust the schedule in which stormwater projects are completed.

7.2 Financial Analysis

This financial analysis is a preliminary assessment of the funding needed to implement the stormwater program recommendations and proposed capital funding. The assessment is based on stormwater program revenue sources available and proposed as of 2014. The City is not under regulatory obligations to complete the identified capital projects, so the implementation timeline may be adjusted to align with available funding.

7.2.1 Current Funding

The City's stormwater program is currently funded through two sources: the Stormwater Utility Fee and System Development Charges (SDCs) on new development. In the 2013/2014 budget, the City has projected revenue of $976,000 from the Stormwater Utility Fee, $42,000 from SDCs, and $7,400 in miscellaneous income, such as interest and development review fees.

In 2014, the stormwater utility rate is $7.30 per month per single family residential property. Other land uses (multifamily, commercial, industrial) pay $7.30 per month per equivalent residential unit, which is calculated based on the property's impervious area coverage. The stormwater rate structure includes an opportunity for rate payers to receive fee credits for performing stormwater management activities. Under Newberg Municipal Code 13.20.080 single family residences can receive credit for installing systems to infiltrate runoff onsite. Commercial, industrial, and multi-family property owners can apply for a rate credit in exchange for educating their employees or residents about runoff and water quality principles or installing stormwater facilities that exceed the City's current standards.

The City's Citizen Rate Review Committee (CRRC) meets regularly to evaluate future utility rates for stormwater, water, and wastewater utilities. Through the review process, stormwater utility rates have risen steadily to support increasing program costs. In 2014, the CRRC is considering a recommendation to raise stormwater utility rates by 9 percent to increase capital project funding to $250,000 per year.

SDCs are another source of capital project funding, though the portion of projects funded by SDCs must be tied to the future growth. CIP fact sheets in Appendix D document the percentage of each capital project that can be attributed to future growth, and therefore, the approximate percentage of the project that could be funded through SDCs.

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7.2.2 Personnel Services

For fiscal year 2013/2014, the stormwater management program is funding staff at 5.38 full-time equivalents (FTEs). Personnel services, which include salary, benefits, and other related expenses total $542,923.

Increasing the stormwater program staffing to 6.60 FTEs as recommended in Chapter 6 would increase the personnel services budget by approximately $125,000 per year. The CRRC is currently considering a recommendation to add 0.50 FTE to the stormwater program budget to support the preventive maintenance program. The City may consider future rate increases to fund an additional 0.70 FTE or evaluate an alternative (or delayed) schedule of implementing additional maintenance and stormwater related programs.

7.2.3 Capital Projects

The 2014 CRRC recommendation would fund $450,000 in capital projects in the first year, followed by $250,000 per year in future years. SDCs are expected to bring in an additional $100,000 to $150,000 per year, though those funds will need to be directed to growth-related projects.

At the proposed funding rate, the seven short-term projects identified in Table 7-1, which total $1.6 million, can be constructed in 5 years, along with completing the Water Quality Sensitive Operations and Maintenance Manual and the SDC Rate Study (identified as engineering projects P-1 and P-2). To expedite the completion of short-term capital projects, it is recommended that the ongoing capital projects (Annual Pipe Replacement and Water Quality Retrofit Program) be delayed until after the short-term projects are completed. The short-term capital projects address some of the greatest pipe replacement needs and will incorporate water quality elements, effectively meeting the goals of the two ongoing capital projects. As more capital project funds are identified, pipe replacement and water quality retrofits can be added to the annual capital project budget.

At the proposed funding rate, mid-term capital projects, which total $1.6 million would be completed in years 6 through 12. Long-term capital projects, which total $4.9 million would require an additional 15 years to complete.

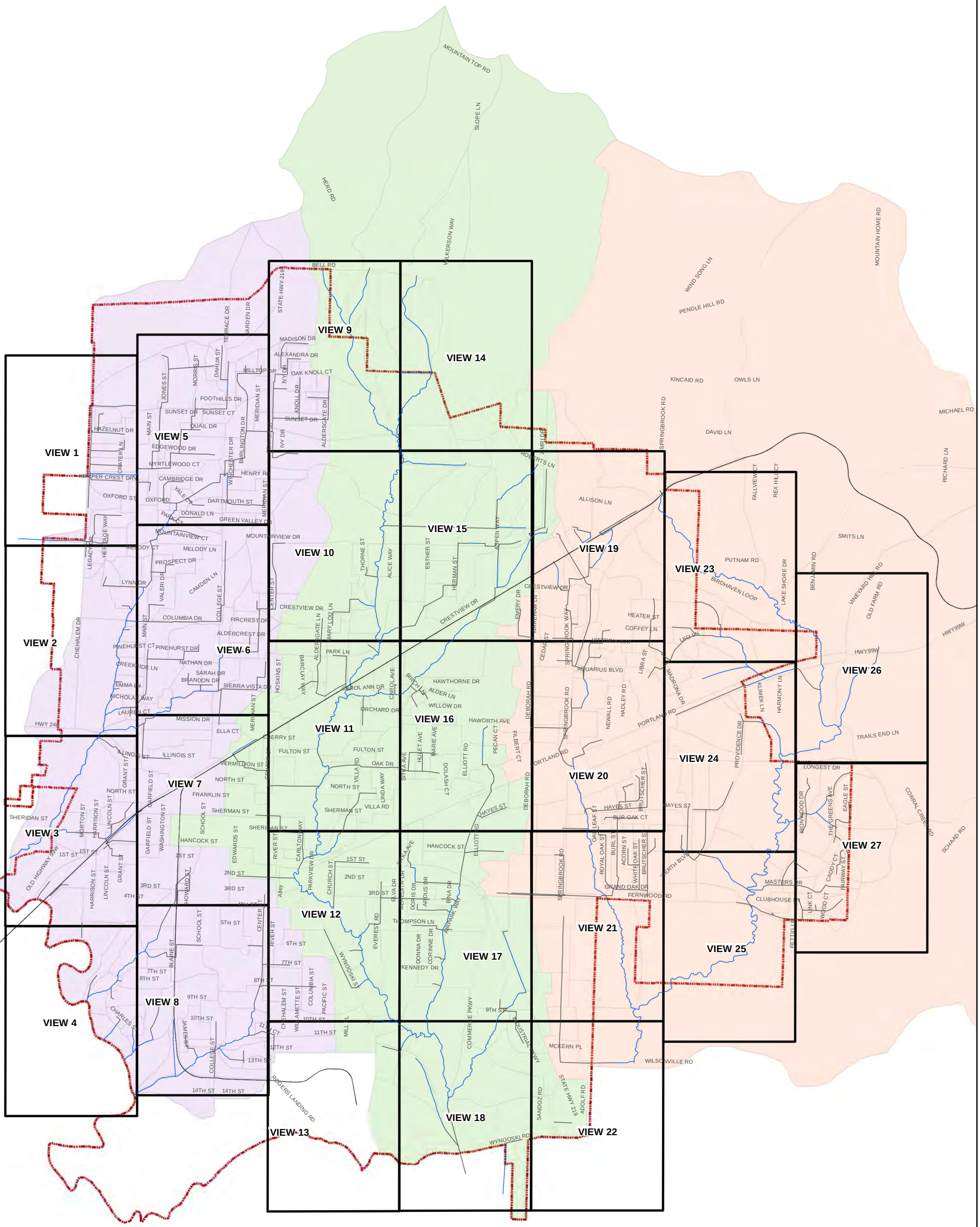
If additional funding is identified to support the stormwater program, the proposed capital projects could be completed on an expedited schedule. Additional funding could come in the form of increased utility revenue, SDCs collected from new development, grant funding, municipal bonds, or the formation of local improvement districts to fund specific projects. This Master Plan gives the City the flexibility to implement capital projects based on the available funding sources.

Use of contents on this sheet is subject to the limitations specified on the title page of this document.

Appendix A: Modeled Drainage System Maps

Use of contents on this sheet is subject to the limitations specified on the title page of this document.

KEY MAP



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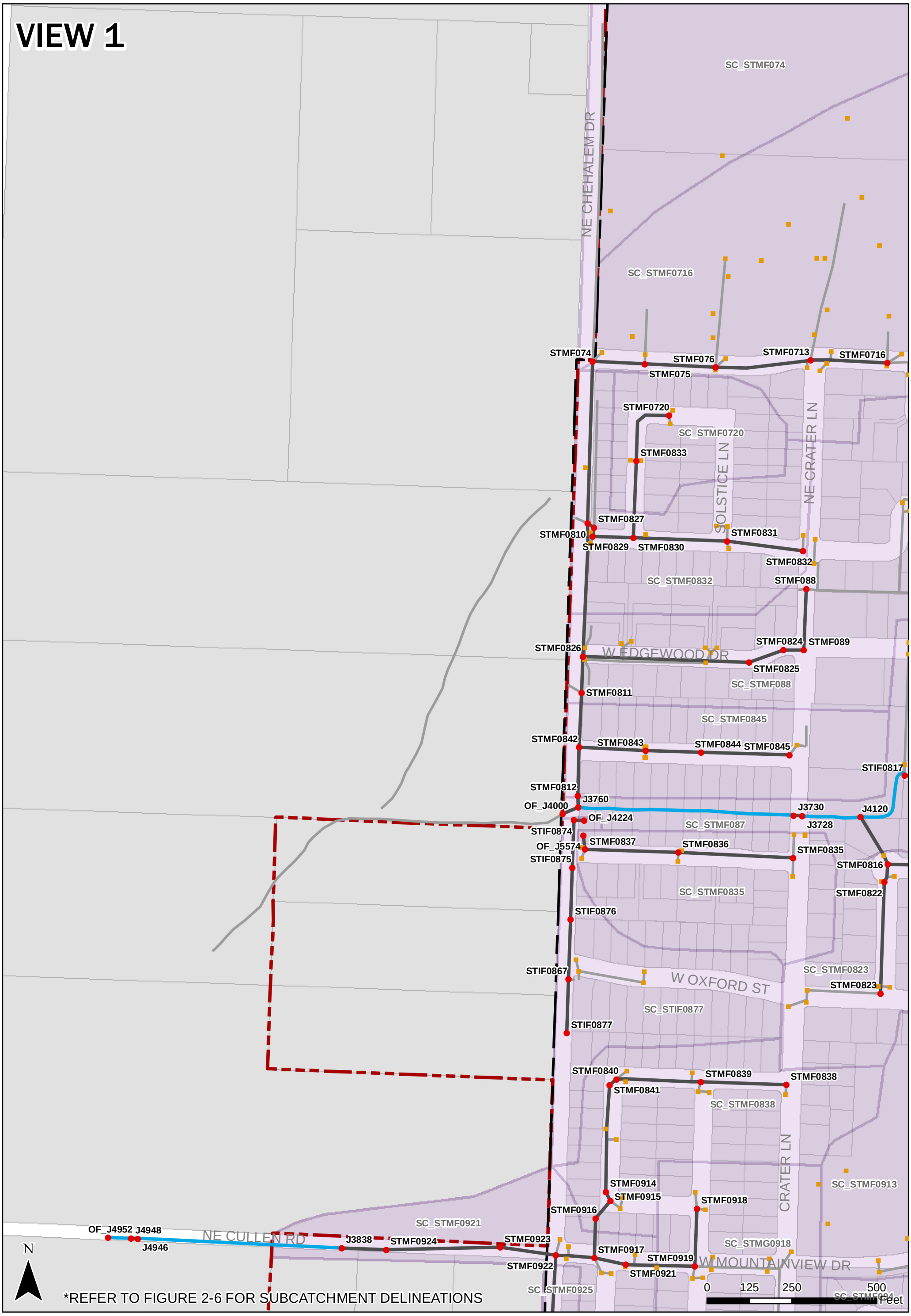
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
KEY MAP

- RAILROAD
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- MAP VIEW
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 1



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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 1

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 2

STMF0917
STMF0921
STMF0919
SC_STMF0913
SC_STMG0918
SC_STMF094
SC_STMF0921
STMF0925
SC_STMF0925
NE CRATER LN
NUGGET LN
SC_STMF0930
STMF0930
SC_STMF097
STMF0928
STMF097
LYNN DR
STMF0929
SC_STMF0927
SC_J-CCT3-15
STMF0927
J3990
J-CCT3-16
SC_STMF0932
J-CCT3-15
W COLUMBIA DR
J4362
J-CCT3-14
J-CCT3-13
STMF105
STMF106
SC_STMF105
NE BLUME LN
SC_J-CCT3-11
J-CCT3-12
J-CCT3-11
J-CCT3-10
J-CCT3-09
SC_J-CCT3-09
SC_J-CCT3-12
PARKSIDE LN
SC_STMF1022
J-CCT3-08
STMF1022
LEVI WAY
NE SALEM DR
J-CCT3-07
STMF1023
EMMA LN
SC_J-CCT3-05
SC_STMF1023
NE CHEHALEM DR
SC_STMF101
NE OLD YAMHILL HWY
J5386
STMF1014
SC_J-CCT3-06
STMF101
J-CCT3-06
STMF1013
SC_STMF1013
J3786
NE HWY 240
J-CCT3-05
SC_J3786
SC_J-CCT3-04
J-CCT3-04
SC_STIF1132
SC_J3646
N
0 125 250 500 Feet

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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 2

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 3

SC_J-CCT3-12
J-CCT3-04
SC_J3786
SC_J3646
STIF1135
STIF1138
STIF1134
STIF1133
STIF1132
SC_STIF1132
J-CCT3-03
NE HONEY LN
NE CHEHALEM DR
SC_J-CCT3-04
SC_J-CCT3-03
N GRANT ST
W NORTH ST
SC_J5304
MORTON ST
W FRANKLIN ST
J5304
NE CANYON LN
W SHERMAN ST
N HARRISON ST
W SHERMAN ST
J3688
STMF116
J5398
SC_J3688
W SHERIDAN ST
SC_J4818
STMF117
J-CCT3-02
STMF1224
STMF1222
STMF1225
J7
J5422
SC_STMF1223
STMF1223
SC_STMF1227
SC_STMF1217
STMF1227
STMF1226
STMF1219
STMF1217
STMF1221
STMF1220
STMF1218
STMF126
J5554
J9
J8
STIF1210
N MAIN ST
W 1ST ST
W 1ST ST
W 1ST ST
2ND WAY
STIF129
STIF1287
OF_J-CCT3-01
SC_J9
SC_STIF1287
SC_J-CCT3-01
W 2ND ST
SC_STMG1227
SC_STMF122
SC_J4058
STMF122
J4060
J4058
S LINCOLN ST
W 3RD ST
STMF121
OF_J5408
OF_J3954
S GRANT ST
SC_STIF1262
W 4TH ST
HWY 99W
HWY 99W
S HARRISON ST
S MAIN ST
SC_OF_J3682
W 5TH ST
STIF1262
SC_STIF1324
SC_J-CCT2-05
N
0 125 250 500 Feet
*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS

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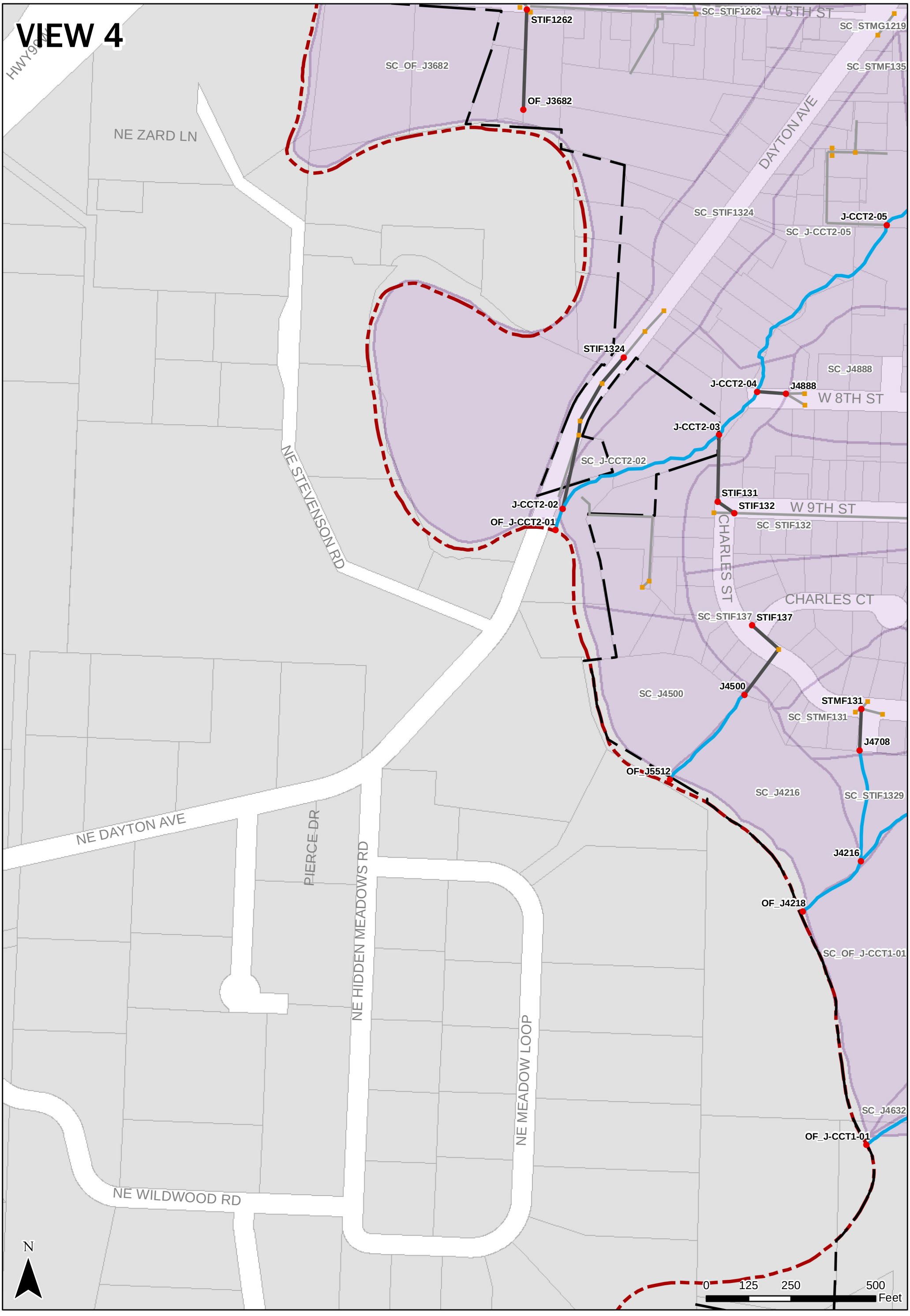
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 3

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 4



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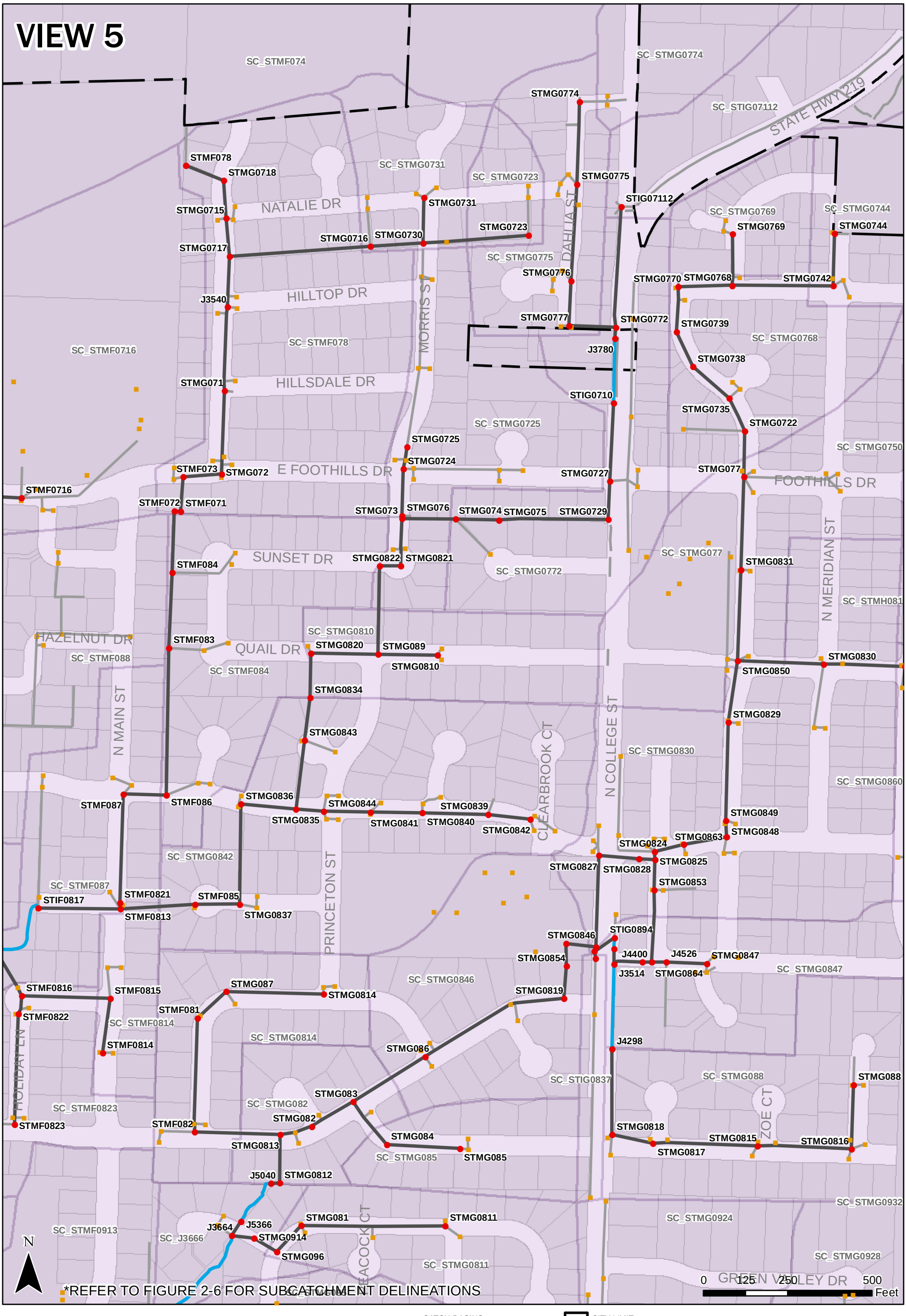
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 4

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 5



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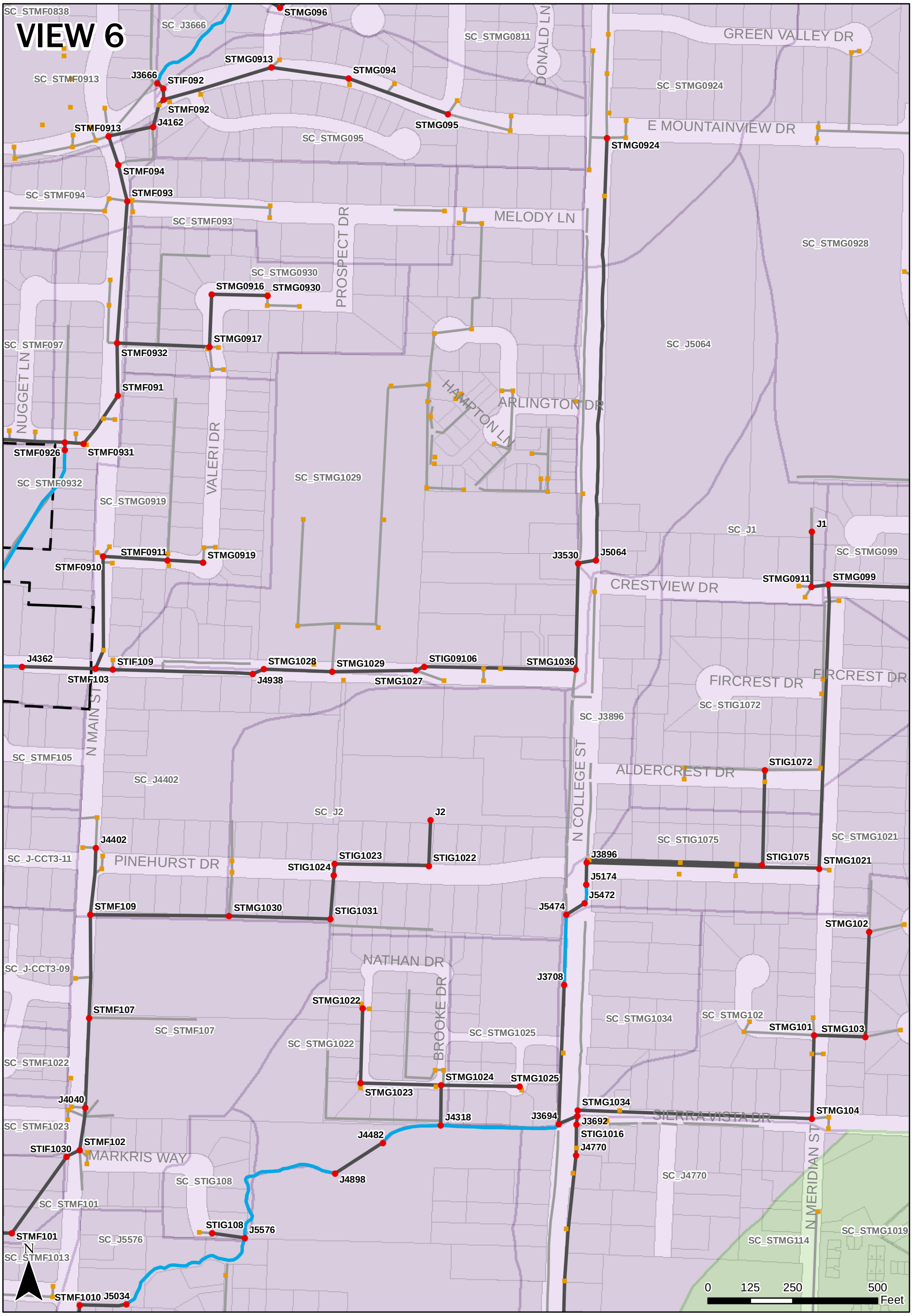
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 5

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 6



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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 6

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 7

STMF1010 J5034
STMF1012
STMF1011
J3786
CLIFFORD CT
SC_J3786
STMF113
J3646
SC_J3646
RENTFRO WAY
MISSION DR
SC_J5576
SC_J4770
J5220
SC_J5220
ELLA CT
DESKINS ST
SC_STMG114
N MERIDIAN ST
STMG114
J4784
SC_J-HC-24
J3628
J3630
SC_J3628
SC_J4068
FULTON ST
STMG115
STMF118
J4882
STMG1112
SC_STMG1112
VERMILLION ST
STIG1142
STIG1139
J4068
J4066
STMG112
J3872
SC_STMG112
STMG117
E NORTH ST
N GARFIELD ST
SC_J5304
N COLLEGE ST
N EDWARDS ST
E FRANKLIN ST
SC_J4818
SC_J4620
SC_J-HC-20
SC_J3688
J4818
J5398
N WASHINGTON ST
E SHERMAN ST
N SCHOOL ST
J4620
SC_STMG1228
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E SHERIDAN ST
SC_J-HC-18
STMF1217
E HANCOCK ST
N HOWARD ST
N CENTER ST
N MAIN ST
SC_STIF1287
BLAINE ST
E 1ST ST
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SC_STMG1227
E 2ND ST
S WASHINGTON ST
S BLAINE ST
STMG121
STMG1232
SC_STMG121
SC_STMG122
STMG122
STMG1223
SC_STIF1262
E 3RD ST
DAYTON AVE
STMG1227
STMG1226
S EDWARDS ST
S COLLEGE ST
S MERIDIAN ST
S CENTER ST
SC_STMG1245
STMG1245
SC_STIF1324
E 4TH ST
SC_STMG1219
STMG1218
STMG1219
S HOWARD ST
SC_STMG1320
SC_STMG1317
SC_STMG128
STMG128
N
0 125 250 500 Feet

CATCH BASINS
MODELED JUNCTIONS/MANHOLES
TAX LOTS
MODELED CONDUITS
MODELED OPEN CHANNELS
OTHER CONDUITS
CITY LIMIT
URBAN GROWTH BOUNDARY
CHEHALEM CREEK SUBCATCHMENTS
HESS CREEK SUBCATCHMENTS
SPRING BROOK SUBCATCHMENTS

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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 7

City of Newberg

VIEW 8

*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS

0 125 250 500 Feet

N

CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 8

JUNE 2014

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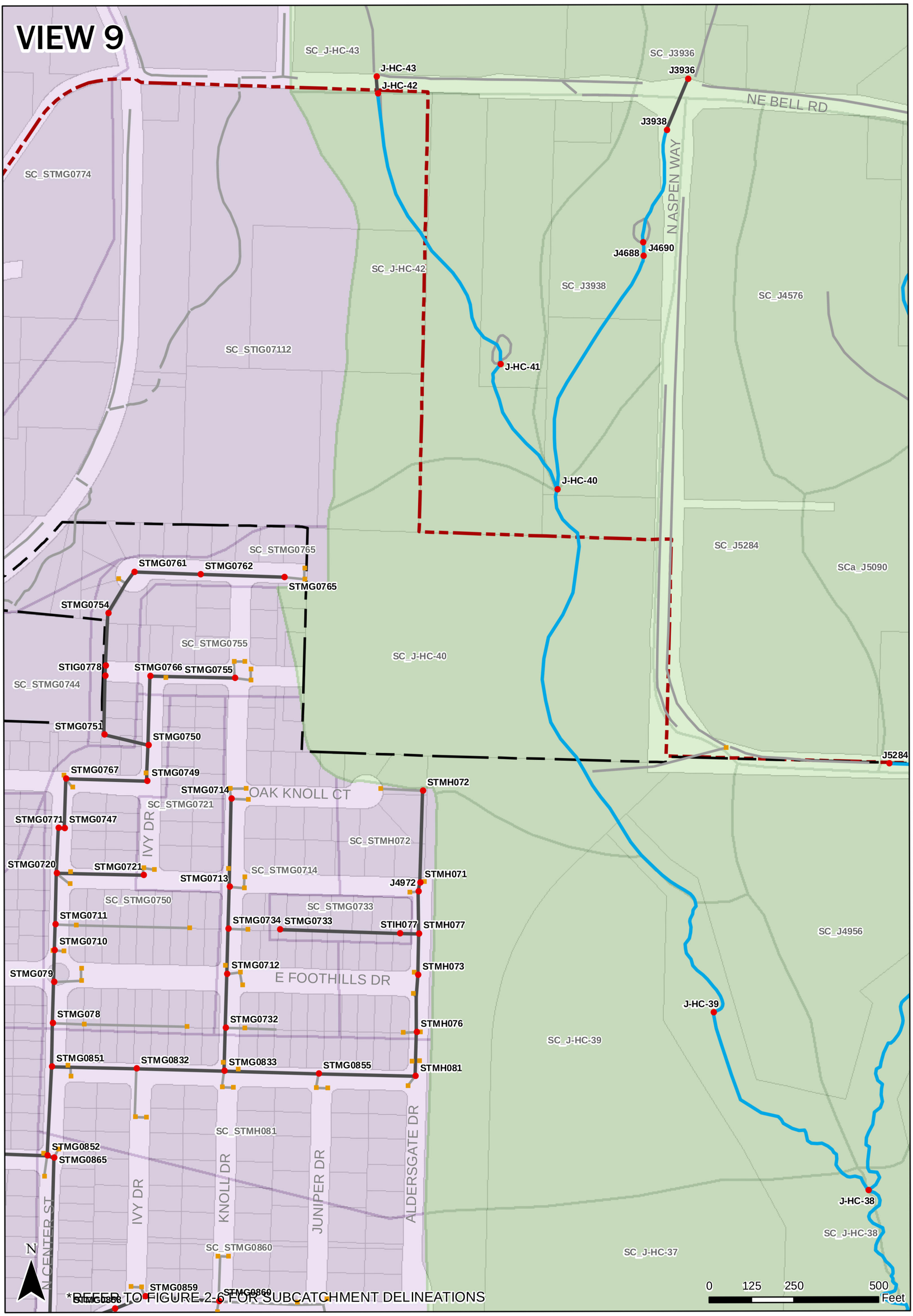
CATCH BASINS
MODELED JUNCTIONS/MANHOLES
TAX LOTS
MODELED CONDUITS
MODELED OPEN CHANNELS
OTHER CONDUITS
CITY LIMIT
URBAN GROWTH BOUNDARY
CHEHALEM CREEK SUBCATCHMENTS
HESS CREEK SUBCATCHMENTS
SPRING BROOK SUBCATCHMENTS

City of Newberg



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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 9

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 10

STMG0859
STMG0860
STMG0858
STMG0857
STMG0856
W EDGEWOOD DR
SC_STMG0860
SC_STMG0847
SC_STMG088
SC_STMG0932
SC_J-HC-38
J-HC-37
SC_J-HC-37
SC_J-HC-35
J-HC-36
SC_J-HC-36
J-HC-35
J-HC-34
E MOUNTAINVIEW DR
STMG0928
STMG0932
BRAMBLE CT
THORNE ST
N ALICE WAY
SC_STMG0928
STMG0933
SC_J-HC-34
STMG0934
SC_STMH095
STMH095
BRIAR CT
STMG0935
STMH094
VILLA RD
STMG0936
STMH093
J4042
J-HC-33
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STMG098
STMG097
SC_J4002
STMH0923
J4002
STMH0916
SC_J-HC-33
SC_STMG099
J-HC-32
STMG0910
CRESTVIEW DR
STMH0911
STMH0913
STMH0912
STMH091
HOSKINS ST
SC_STMH091
SC_STIG1072
STMH1024
SC_STMH0919
JOHNSON CT
SC_STMH1024
STMH1026
SC_STMH1021
SC_STMG1021
SC_STMH105
STMH106
SC_STIH107
STIH107
J-HC-31
SC_J-HC-31
N
0 125 250 500 Feet

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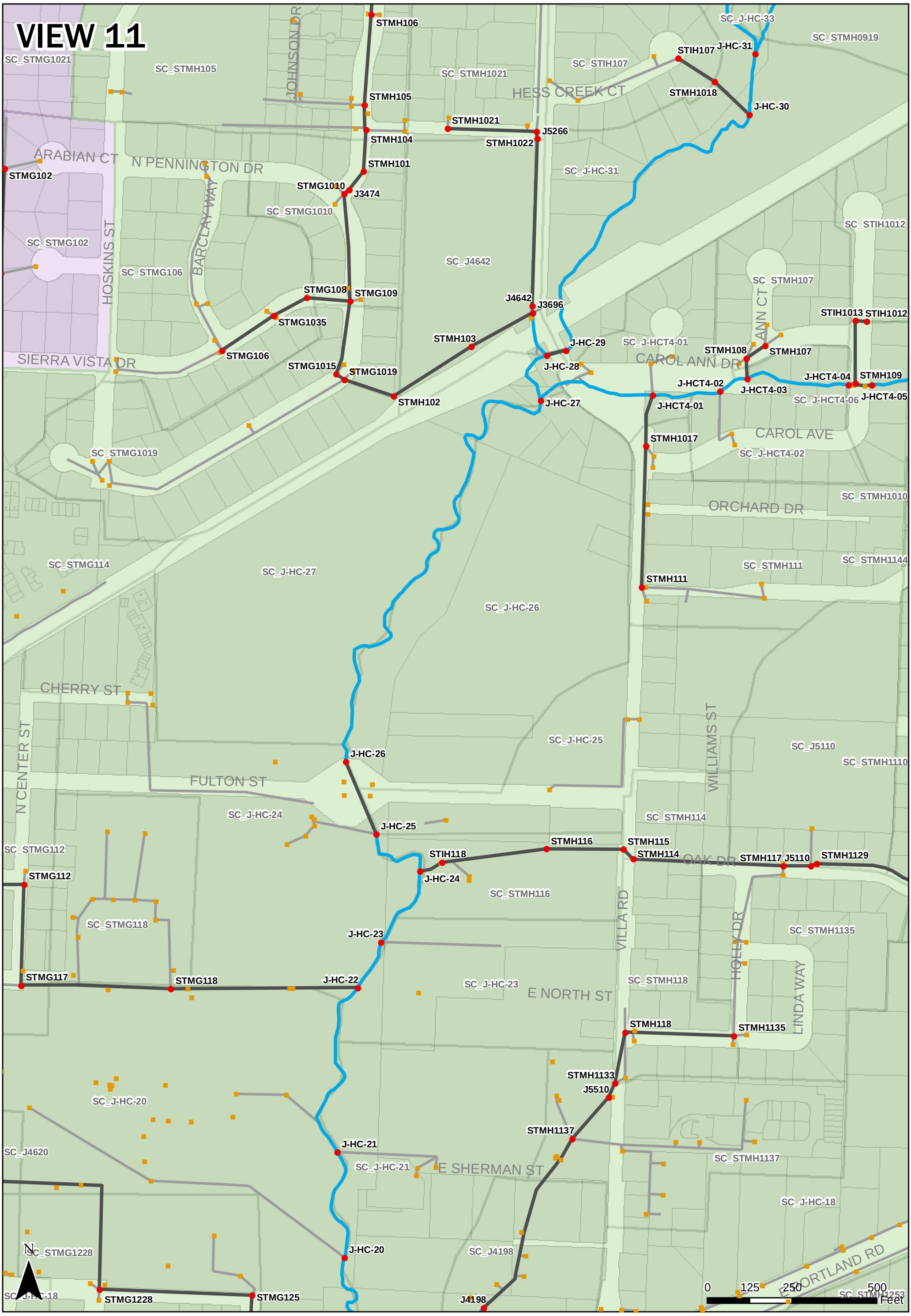
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 10

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 11



CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 11

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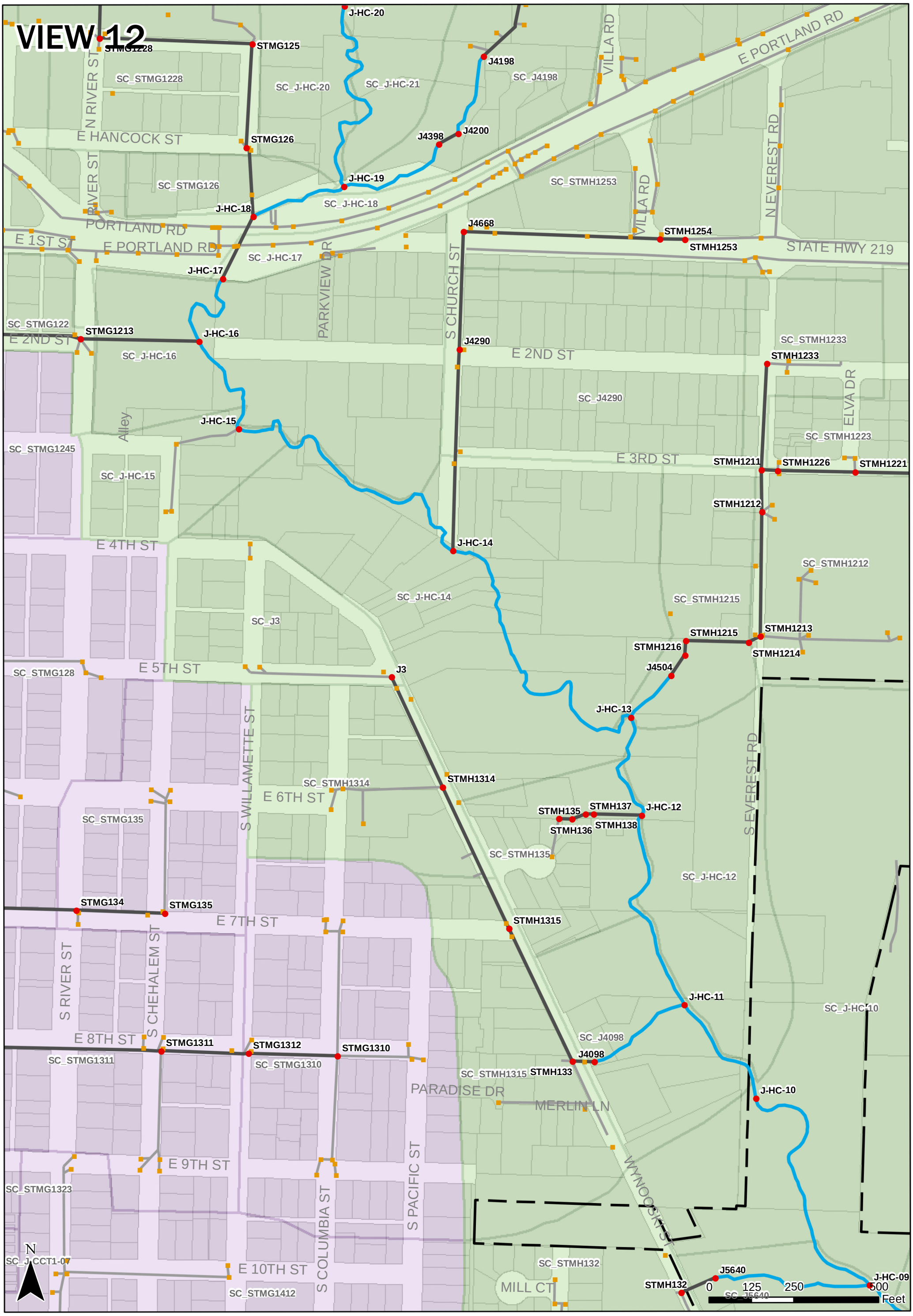
JUNE 2014

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 12



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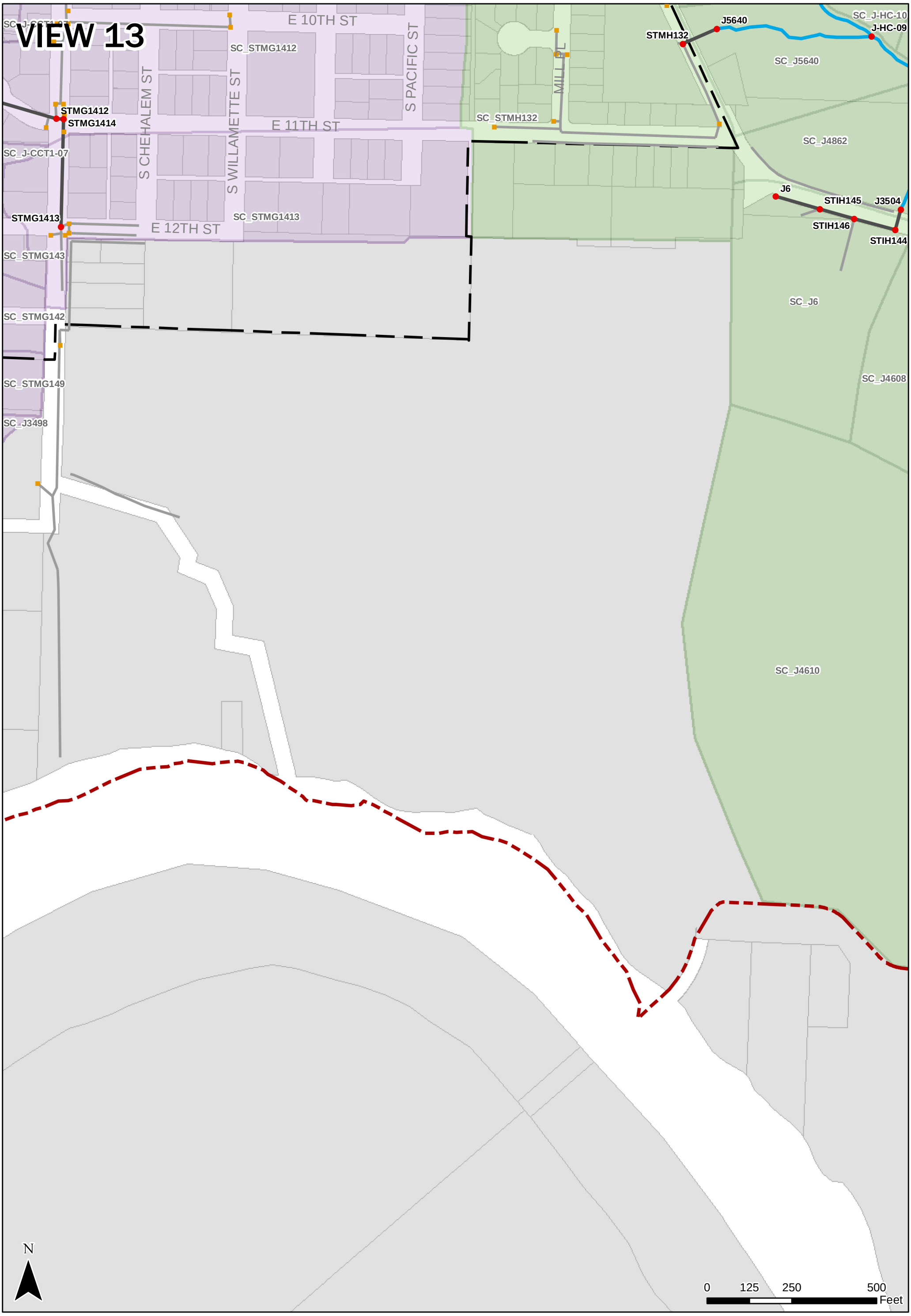
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 12

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 13



CATCH BASINS
MODELED JUNCTIONS/MANHOLES
TAX LOTS
MODELED CONDUITS
MODELED OPEN CHANNELS
OTHER CONDUITS
CITY LIMIT
URBAN GROWTH BOUNDARY
CHEHALEM CREEK SUBCATCHMENTS
HESS CREEK SUBCATCHMENTS
SPRING BROOK SUBCATCHMENTS

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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 13

City of Newberg

VIEW 14

SC_J3936
SC_J5324
J5324
J5326
NE BELL RD
SC_J4576
SCb_J5090
J4576
SCc_J5090
SCa_J5090
SC_J5284
J5284
J5090
J4956
N ASPEN WAY
SC_J-SB-16
SC_J4956
SC_J4554
SC_J4556
NE ROBERTS LN
SC_J-HC-38
SC_J-HC-37
SC_STIH081
N
0 125 250 500 Feet

*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS

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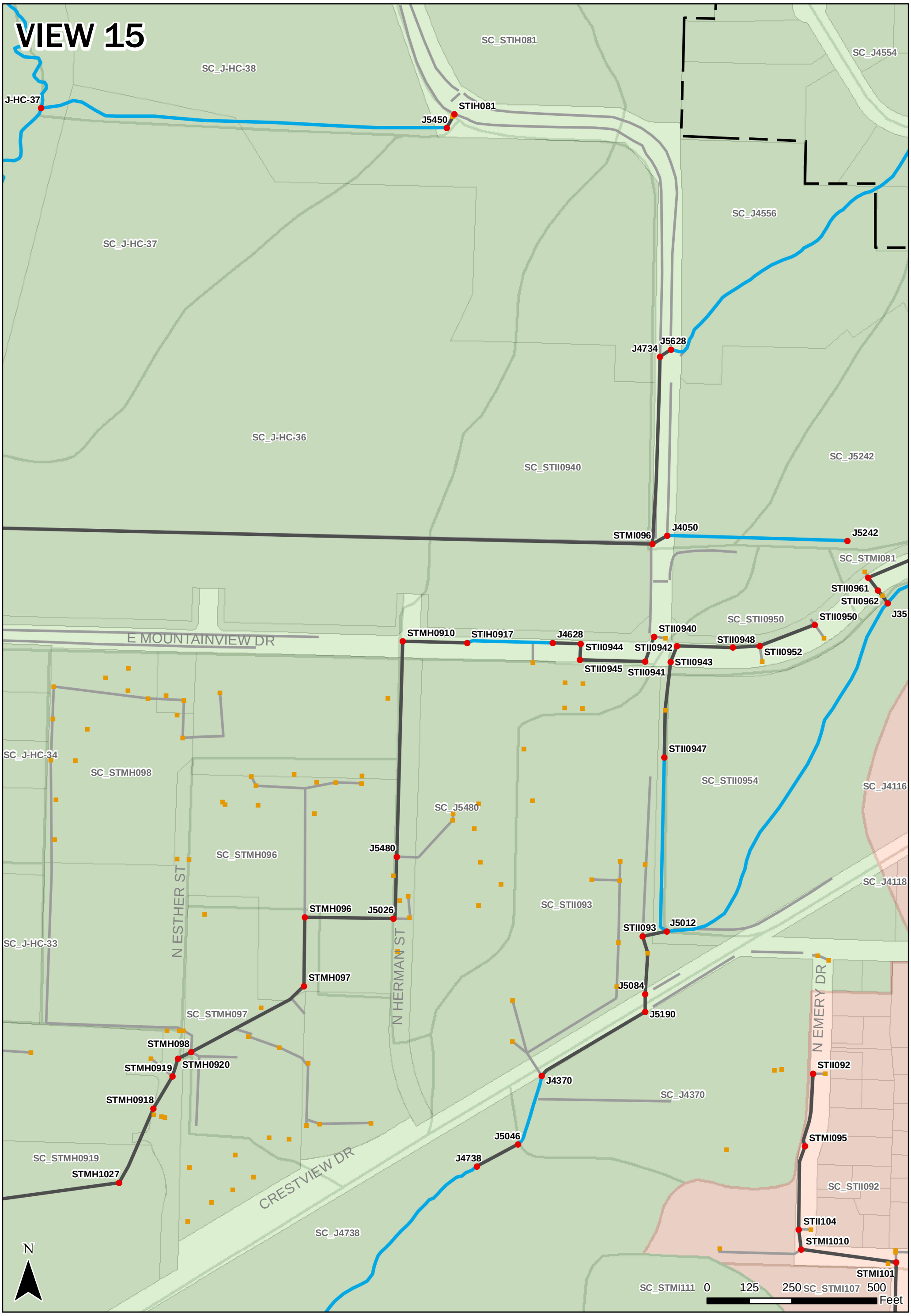
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 14

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 15



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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 15

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
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- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 16

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CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 16

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

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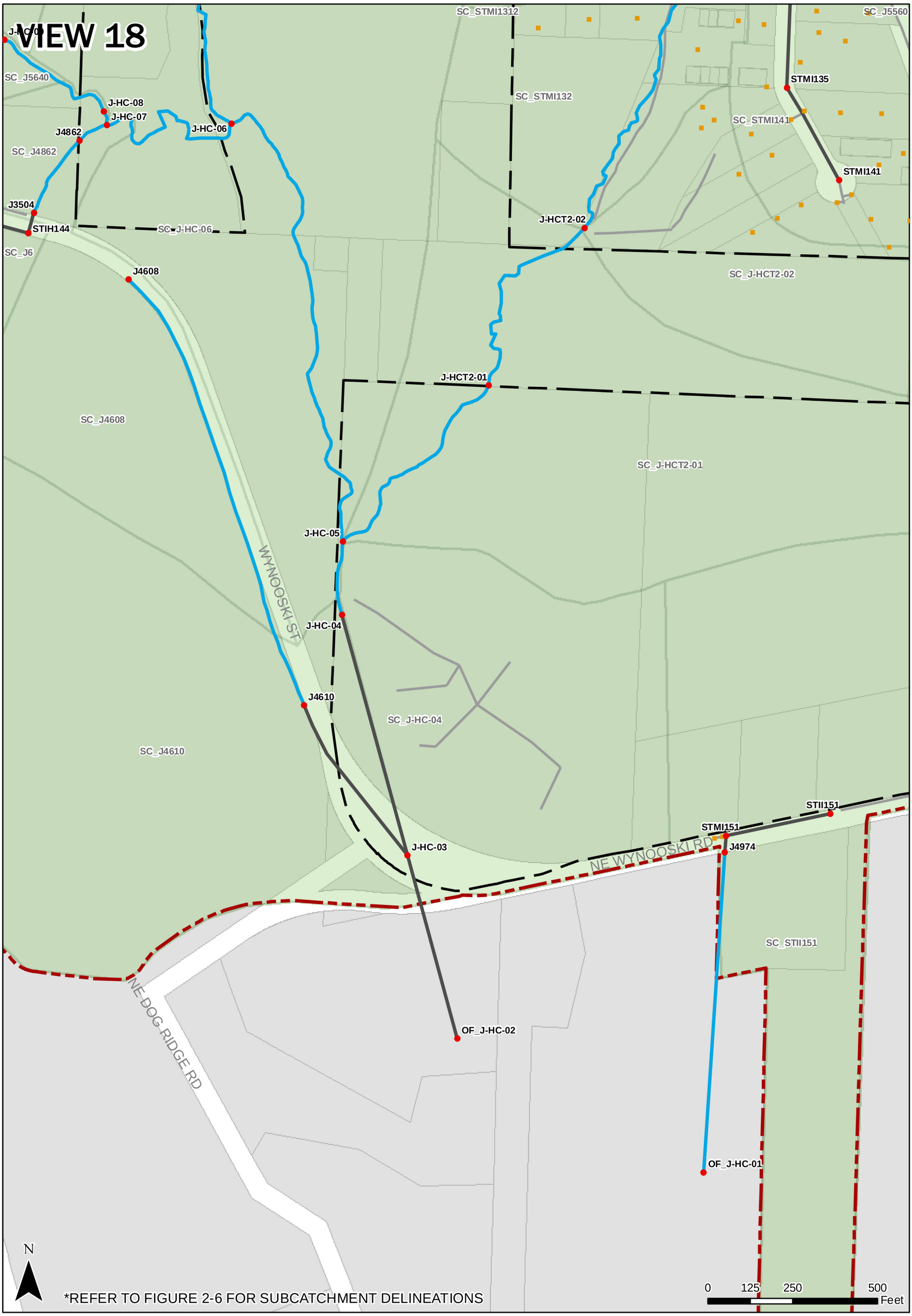
CITY OF NEWBERG
STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 17

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg



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STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 18

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 19

SC_J4554
J4554
J4556
STMI081
SC_J4556
NE ZIMRI DR
SC_J-SB-16
NE SPRINGBROOK RD
SC_STII09101
SC_STMI081
J-SB-16
J-SB-15
STIL085
SC_J5242
ALLISON LN
SC_STIJ081
STIJ081
STII081
STII09126
STII09125
STII09124
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STII09106
J5
STII09112
J4268
STII0965
STII0966
STII0967
STII0968
SC_STII0965
SC_J4268
STII0970
J4848
SC_J5236
STII0972
STII0975
SC_J4116
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STII0982
SC_STII0916
STII0928
SC_J4118
STII0916
SC_STII0975
STII0926
STII0983
STII0985
STII0988
J4114
STII0915
STII0986
STMI099
SC_J4370
J5124
STMI0910
E CRESTVIEW DR
STMI094
STII0990
SC_STIJ0916
STII0991
STIJ0911
WAREHAM LN
SC_STMI0910
STII0992
STMI093
SC_STII0990
SC_STII1033
DOGWOOD AVE
STMI092
STMI091
SC_STMI1023
SC_STMJ092
SC_STMJ1011
STII09100
SC_STII092
CEDAR ST
HEATER ST
STMJ092
STII10109
STMJ091
STMI1014
STMI1023
STII1030
SC_STMI1015
SC_STMI1013
SC_STMI1014
STII1034
STII1033
COFFEY LN
STMJ1022
SC_STII1030
STII1029
SC_STMJ1022
GEMINI ST
N
STMI101
STMI1013
STMI109
STMI105
SC_STMI1022
STII1050
STMI1015
J3524
SC_J3852
SC_STMJ104
0 125 250 500 Feet

*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS

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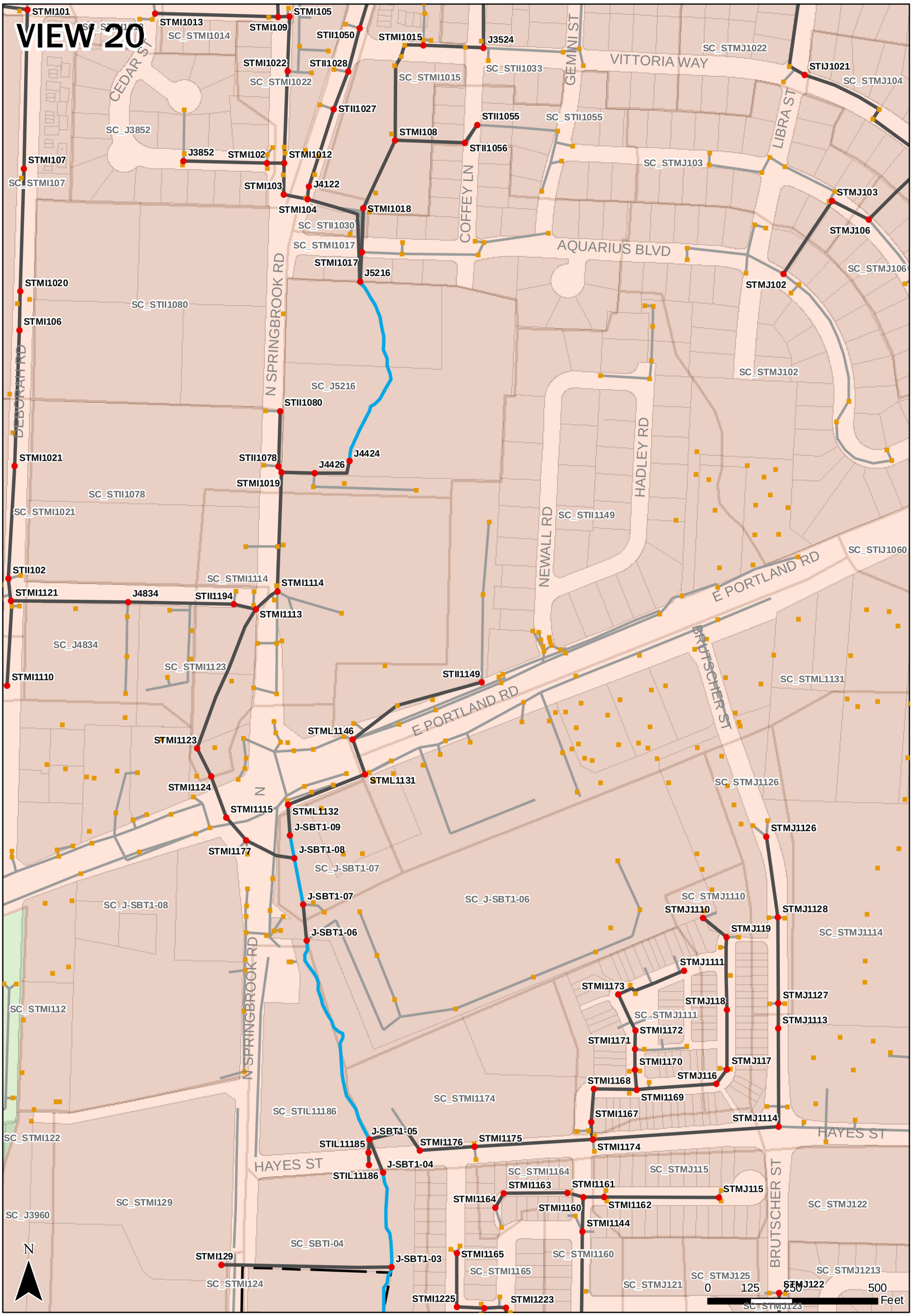
SWMM MODEL SYSTEM MAPPING
VIEW 19

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg



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SWMM MODEL SYSTEM MAPPING
VIEW 20

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
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- CITY LIMIT
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- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 21

STMI129
J-SBT1-03
SC_STMI1165
STMI1225
STMI1223
STMI1224
STMI1218
STMI1217
STMI1220
STMJ121
SC_STMJ121
SC_STMJ122
STMJ122
SC_STMJ125
SC_STMJ1213
STMJ1213
STMJ125
SC_STMI1160
STMJ1214
STMJ123
SC_STMI129
MISTLETOE DR
N SPRINGBROOK RD
ROYAL OAK ST
BURL ST
ACORN ST
WHITE OAK ST
SC_J3960
J3960
STMI124
J4292
SC_STMI1217
STMI1216
STMI1219
STMJ126
STMJ124
STMJ1212
SC_STMJ123
SC_STMJ126
SC_SBTI-04
SC_STMI124
SC_STMI1219
STMI1221
STMJ127
STMJ129
STMI1222
SC_STML1232
SC_STMI1233
STMI1215
STMJ1244
STMI1210
STMJ128
STMJ1210
STMI1211
STMI1212
STMI1233
J4150
STMI128
SC_STMI1212
E 2ND ST
STII1245
J-SBT1-02
STMI1214
STMJ1211
STMI1228
STMI1234
STMI1227
SC_STMI128
STMI1226
E FERNWOOD RD
SC_STMJ1211
J-SBT1-01
SC_STMI123
STMI123
STMI139
SC_STMI139
SC_J-SBT1-01
SC_J3612
STMI138
SC_J-SB-02
STMI137
SC_STMI137
SC_J5560
STII137
SC_J5562
J-SB-03
STII1359
N
SC_STMI1310
SC_J-SB-03
SC_STMI141
STMI1310
0 125 250 500
Feet

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- HESS CREEK SUBCATCHMENTS
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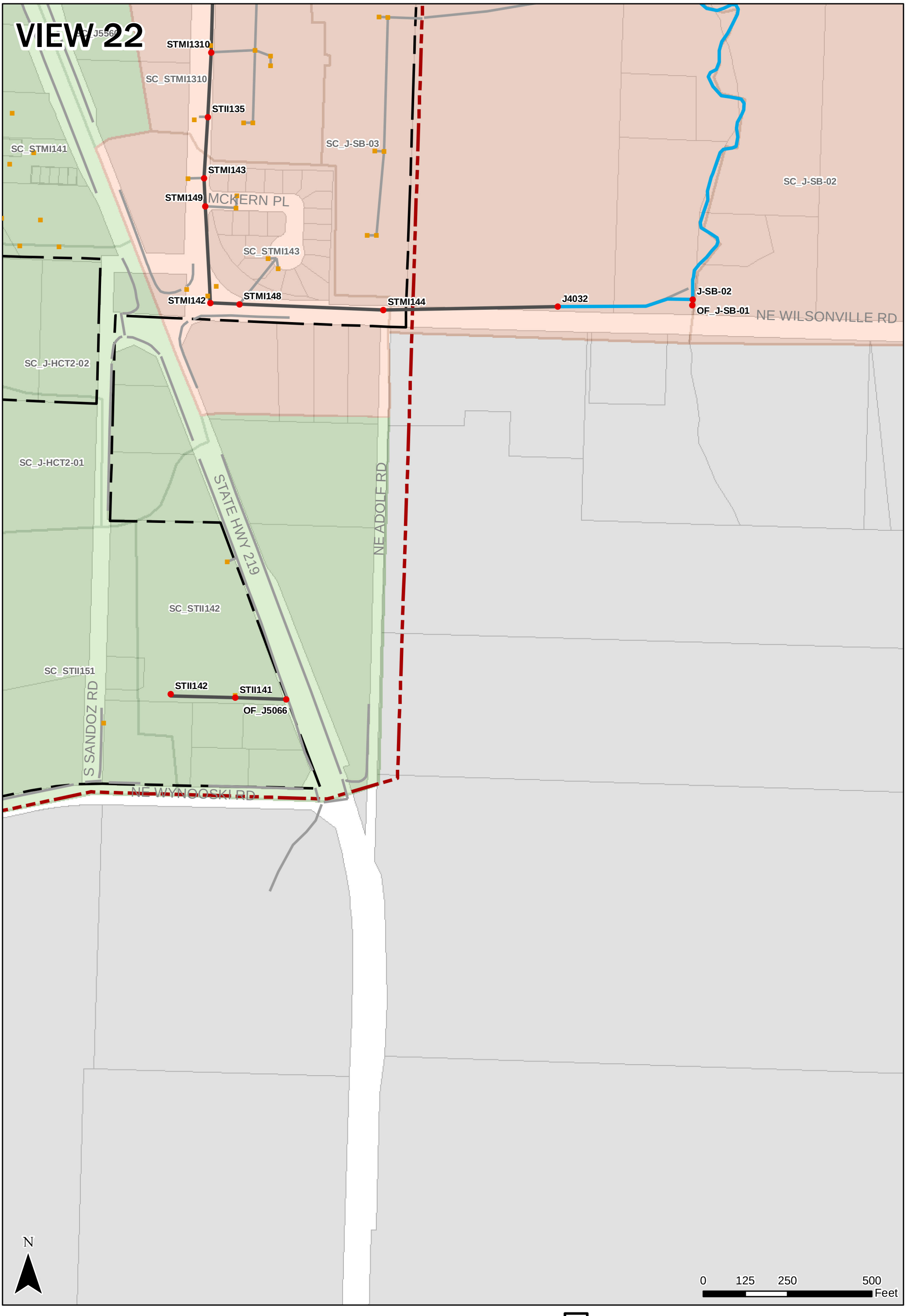
City of Newberg

VIEW 22



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STORMWATER MASTER PLAN UPDATE

SWMM MODEL SYSTEM MAPPING
VIEW 22

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
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- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 23

SC_J-SB-16
J-SB-15
NE BENJAMIN RD
NE FALLVIEW CT
REX HILL CT
NE
NE PUTNAM RD
SC_J-SB-13
J-SB-14
SC_J-SB-14
SC_STIJ0911
NE BIRDHAVEN LOOP
NE LAKE SHORE DR
J-SB-13
CRESTVIEW DR
STIJ0916
STIJ0917
STIJ0919
STIJ0923
SC_STIJ0916
STIJ0924
STIJ0927
SC_J-SB-12
SC_STMJ092
SC_STMJ1011
STIJ0915
NE BLUE HERON CT
STIJ10111
STIJ10112
STMJ1011
STMJ1013
STMJ1015
J5382
STIJ102
STMJ108
J5176
J5178
SC_STMJ1022
STMJ107
SC_J5178
SC_STMJ107
SC_J-SBT7-01
STMJ104
N
J3522
STMJ105
SC_J4092
SC_STMJ104
SC_STMJ103
SC_STMJ106
SC_J-SBT7-02
*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS
0 125 250 500 Feet

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VIEW 23

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VIEW 24

J3522
STMJ1070
SC_STMJ107
SC_J5178
SC_J-SBT7-01
J4094
STMJ106
SC_STMJ104
J-SBT7-01
E PORTLAND RD
J4284
SC_J-SBT7-02
SC_J4092
J4092
J-SBT7-02
SC_STMJ106
STIJ1070
J-SBT7-03
MADRONA DR
STIJ1069
STIJ1066
NE KLIMEK LN
NE HARMONY LN
AQUARIUS BLVD
STIJ1065
SC_STMJ102
STIJ1064
SC_STIJ1060
SC_STMJ1010
STIJ1062
STIJ1063
STMJ1010
STIJ1061
SC_J-SB-11
STIJ1060
STMJ1012
J-SBT5-01
SC_SBT5-01
SC_STML1131
STMJ1119
SC_J-SBT5-01
STMJ1120
SC_STMJ1121
STMJ1121
J-SB-08
SC_STMJ1114
STMJ1136
SC_STMJ1136
SC_STMJ1141
SC_STMJ1134
STMJ1132
STMJ1141
HAYES ST
STMJ1134
STMJ1135
STMJ1133
STMJ1142
SC_J-SB-07
SC_STMJ122
J-SB-07
STMJ1143
STMJ1138
STMJ1235
SC_STMJ1138
STMJ1217
SC_STMJ1217
STMJ1234
STMJ1215
SC_STMK1235
SC_J-SBT3-01
STMJ1231
STMJ1232
STMJ1216
STMJ1238
J4990
STMJ1236
STMJ1233
SC_STMJ1238
SC_STMJ1211
N
0 125 250 500 Feet

CATCH BASINS
MODELED JUNCTIONS/MANHOLES
TAX LOTS
MODELED CONDUITS
MODELED OPEN CHANNELS
OTHER CONDUITS
CITY LIMIT
URBAN GROWTH BOUNDARY
CHEHALEM CREEK SUBCATCHMENTS
HESS CREEK SUBCATCHMENTS
SPRING BROOK SUBCATCHMENTS

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SWMM MODEL SYSTEM MAPPING
VIEW 24

City of Newberg

VIEW 25

SC_STMJ1213
STMJ1216
STMJ1238
STMJ1232
STMJ1231
SC_STMJ1138
STMJ1236
STMJ1233
J-SBT3-01
STMJ1237
STMJ1239
SC_STMJ1238
SC_J-SBT3-01
SC_STMJ123
WERTH BLVD
SC_STMJ1211
SC_STMJ1218
E FERNWOOD RD
J-SB-05
STMJ1218
STMJ1220
STMJ1219
STMJ1222
J-SB-04
STMJ1223
STMJ1230
STIJ1234
STMJ1224
STMJ1225
STMK121
SC_STMK122
SC_STMK125
SC_STMJ1230
CLUBHOUSE LN
SC_J-SB-07
SC_STMK1235
STMK129
STMK128
STMK1210
SC_STMK1211
STMK127
SC_STMJ1226
STMJ1227
STMJ1228
STMJ1226
SC_STMK1212
J-SB-06
STMJ1242
STMJ1229
NE FETTIG LN
SC_J-SB-02

N

*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS

0 125 250 500 Feet

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SWMM MODEL SYSTEM MAPPING
VIEW 25

- CATCH BASINS
- MODELED JUNCTIONS/MANHOLES
- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
- CITY LIMIT
- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

City of Newberg

VIEW 26

NE BENJAMIN RD
OLD FARM RD
VINEYARD HILL RD
VINEYARD HILL RD
HWY99W
HWY99W
NE TRAILS END LN
NE CORRAL CREEK RD

SC_J-SB-13
SC_J-SB-12
SC_J-SBT6-02
SC_J-SBT7-01
SC_J-SBT7-02
SC_J-SB-11
SC_J-SBT6-01
SC_J-SB-10
SC_J-SBT6-01
SC_J-SB-09
SC_STMK1112

J-SB-12
J-SB-11
J-SBT7-01
J-SB-10
J-SB-09
J-SBT6-02
J-SBT6-01

N

0 125 250 500 Feet

*REFER TO FIGURE 2-6 FOR SUBCATCHMENT DELINEATIONS

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VIEW 26

- CATCH BASINS
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- TAX LOTS
- MODELED CONDUITS
- MODELED OPEN CHANNELS
- OTHER CONDUITS
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- URBAN GROWTH BOUNDARY
- CHEHALEM CREEK SUBCATCHMENTS
- HESS CREEK SUBCATCHMENTS
- SPRING BROOK SUBCATCHMENTS

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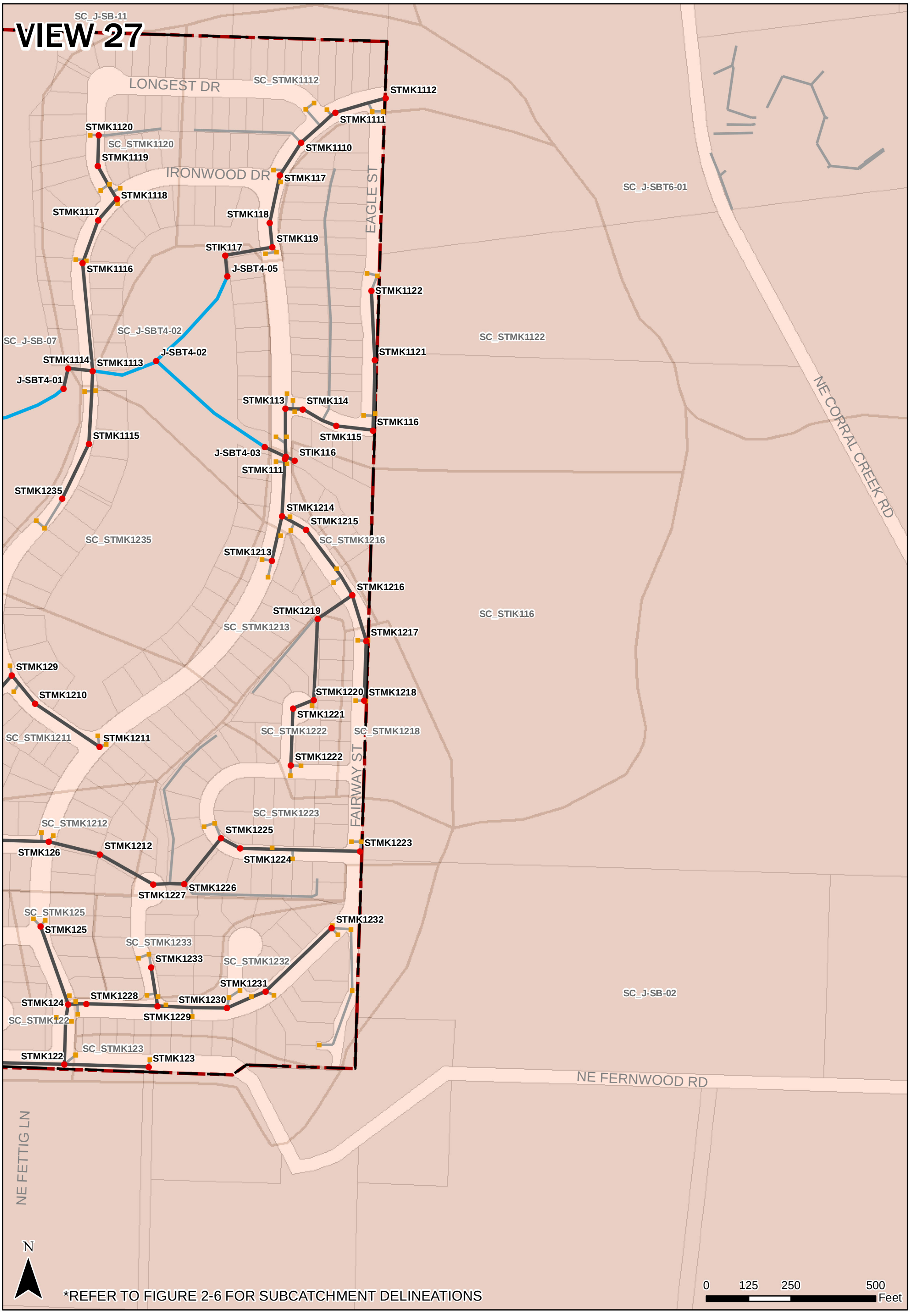
VIEW 27



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VIEW 27

- CATCH BASINS
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Appendix B: Hydrologic and Hydraulic Modeling Inputs/Results Tables

Use of contents on this sheet is subject to the limitations specified on the title page of this document.

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
CHEHALEM CREEK														
SC_J1	4.4	1.5	79.5	31.8	59.4	87%	0.8	1.4	1.8	1.9	1.2	1.9	2.2	2.4
SC_J2	15.5	2.9	79.5	40.6	51.5	27%	3.8	6.2	7.4	7.9	4.3	6.7	7.9	8.4
SC_J3498	8.4	2.0	79.0	19.7	84.8	330%	1.1	2.3	2.9	3.2	3.0	4.3	5.0	5.2
SC_J3646	10.7	1.7	79.0	27.9	50.7	82%	1.4	2.5	3.2	3.4	2.4	3.8	4.5	4.9
SC_J3666	3.0	7.3	79.0	38.4	50.0	30%	0.8	1.2	1.4	1.5	0.9	1.3	1.5	1.6
SC_J3688	6.5	4.3	79.0	78.4	78.4	0%	2.3	3.3	3.8	4.0	2.3	3.3	3.8	4.0
SC_J3786	7.1	3.4	79.0	26.9	50.0	86%	1.4	2.5	3.1	3.3	1.9	3.0	3.6	3.8
SC_J3896	3.8	3.0	79.0	57.1	57.1	0%	1.1	1.7	2.0	2.1	1.1	1.7	2.0	2.1
SC_J4058	6.9	4.8	79.0	70.6	73.7	4%	2.3	3.3	3.9	4.1	2.3	3.4	3.9	4.1
SC_J4216	3.5	23.5	81.9	10.0	14.3	43%	0.7	1.3	1.5	1.6	0.8	1.3	1.6	1.7
SC_J4402	8.8	3.6	79.7	42.9	49.5	15%	2.2	3.6	4.2	4.5	2.4	3.7	4.4	4.7
SC_J4500	3.3	16.9	81.4	13.5	30.5	126%	0.6	1.1	1.4	1.5	0.8	1.3	1.6	1.7
SC_J4632	19.4	1.2	79.0	24.7	33.9	37%	2.8	5.4	6.8	7.4	3.4	6.2	7.7	8.3
SC_J4770	10.1	2.3	79.0	40.4	52.2	29%	2.3	3.9	4.7	5.0	2.7	4.3	5.1	5.4
SC_J4818	25.4	2.7	79.0	66.4	66.4	0%	8.1	12.0	13.9	14.7	8.1	12.0	13.9	14.7
SC_J4888	8.6	2.6	79.0	56.9	60.0	5%	2.5	3.8	4.5	4.7	2.6	3.9	4.6	4.8
SC_J5064	11.2	2.0	79.0	22.2	78.9	255%	1.4	2.8	3.6	3.9	3.8	5.6	6.4	6.8
SC_J5220	7.0	2.7	79.0	50.6	62.9	24%	1.9	3.0	3.5	3.7	2.2	3.2	3.8	4.0
SC_J5304	11.9	3.6	79.0	61.3	61.7	1%	3.7	5.4	6.4	6.7	3.7	5.5	6.4	6.7
SC_J5576	18.4	2.8	79.6	48.1	48.1	0%	5.1	7.9	9.3	9.8	5.1	7.9	9.3	9.8
SC_J9	2.3	3.8	79.0	86.5	86.5	0%	0.9	1.2	1.4	1.5	0.9	1.2	1.4	1.5
SC_J-CCT1-02	17.0	3.1	79.0	12.0	54.6	355%	2.4	5.0	6.3	6.8	4.8	7.4	8.7	9.2
SC_J-CCT1-04	7.8	16.1	79.0	18.8	58.3	210%	1.6	2.7	3.3	3.5	2.4	3.5	4.1	4.4
SC_J-CCT1-07	11.8	7.4	79.0	45.5	66.4	46%	3.3	5.0	5.9	6.2	3.8	5.6	6.5	6.9
SC_J-CCT2-02	6.9	17.0	79.6	17.0	54.6	221%	1.4	2.4	2.9	3.1	2.1	3.1	3.6	3.8
SC_J-CCT2-05	8.2	2.8	79.0	22.0	52.8	140%	1.7	2.9	3.5	3.7	2.4	3.6	4.2	4.4
SC_J-CCT3-01	24.8	2.2	79.1	54.3	56.3	4%	7.0	10.8	12.8	13.5	7.2	11.0	12.9	13.7
SC_J-CCT3-03	22.4	7.5	79.0	43.9	56.5	29%	5.8	9.2	10.9	11.6	6.6	10.0	11.7	12.4
SC_J-CCT3-04	38.5	2.8	79.0	23.9	31.2	31%	6.4	12.3	15.2	16.4	7.4	13.4	16.3	17.5
SC_J-CCT3-05	26.9	3.0	79.6	15.4	30.0	95%	2.7	5.7	7.4	8.2	4.1	7.6	9.5	10.3
SC_J-CCT3-06	4.2	14.3	79.0	26.4	50.1	90%	1.0	1.6	1.9	2.0	1.2	1.8	2.1	2.3
SC_J-CCT3-09	4.1	3.7	79.0	45.4	50.0	10%	1.1	1.7	2.0	2.2	1.2	1.8	2.1	2.2
SC_J-CCT3-11	3.7	3.2	79.0	42.9	50.0	17%	1.0	1.5	1.8	1.9	1.0	1.6	1.9	2.0
SC_J-CCT3-12	35.8	3.3	80.4	20.5	54.1	164%	4.5	9.1	11.6	12.7	9.0	14.5	17.3	18.4
SC_J-CCT3-15	12.2	2.3	79.0	19.6	58.4	198%	1.4	2.8	3.6	3.9	3.2	5.0	6.0	6.3
SC_OF_J3682	32.2	2.7	79.3	21.5	53.8	150%	5.2	10.1	12.6	13.6	8.7	13.8	16.3	17.3
SC_OF_J-CCT1-01	12.2	9.6	78.9	22.5	24.9	11%	2.3	4.2	5.1	5.5	2.4	4.3	5.2	5.6
SC_STIF0877	5.9	2.5	79.2	55.2	55.2	0%	1.7	2.6	3.0	3.2	1.7	2.6	3.0	3.2
SC_STIF1132	6.9	4.8	79.0	49.7	57.3	15%	1.9	3.0	3.5	3.7	2.1	3.1	3.6	3.9
SC_STIF1262	22.5	3.2	79.0	62.3	62.3	0%	7.0	10.4	12.1	12.8	7.0	10.4	12.1	12.8
SC_STIF1287	8.7	3.8	79.0	90.1	90.1	0%	3.3	4.6	5.3	5.6	3.3	4.6	5.3	5.6
SC_STIF132	7.2	2.0	79.0	46.4	60.0	29%	1.8	3.0	3.5	3.8	2.2	3.3	3.8	4.0
SC_STIF1324	13.4	3.2	79.0	61.5	61.5	0%	4.1	6.1	7.2	7.6	4.1	6.1	7.2	7.6
SC_STIF1329	11.8	2.5	79.0	45.4	52.1	15%	2.9	4.8	5.7	6.0	3.2	5.0	5.9	6.3
SC_STIF137	5.3	2.7	79.0	49.4	60.0	21%	1.4	2.2	2.6	2.8	1.6	2.4	2.8	3.0
SC_STIG07112	49.8	11.7	78.5	20.7	32.6	57%	7.9	15.6	19.4	20.9	10.0	17.8	21.6	23.1

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STIG0837	1.2	3.5	79.0	62.4	62.4	0%	0.4	0.6	0.7	0.7	0.4	0.6	0.7	0.7
SC_STIG1072	10.4	7.9	80.6	47.6	50.0	5%	3.0	4.5	5.3	5.6	3.0	4.6	5.4	5.7
SC_STIG1075	4.6	3.1	80.9	47.3	50.0	6%	1.3	2.0	2.3	2.5	1.3	2.0	2.4	2.5
SC_STIG108	2.0	4.1	80.1	47.5	47.5	0%	0.6	0.9	1.0	1.1	0.6	0.9	1.0	1.1
SC_STIG1348	9.8	1.5	79.0	32.5	42.9	32%	2.0	3.5	4.3	4.6	2.3	3.9	4.6	4.9
SC_STMF0716	25.7	8.8	82.1	53.3	53.3	0%	7.4	11.4	13.5	14.3	7.4	11.4	13.5	14.3
SC_STMF0720	3.8	6.3	81.4	58.2	60.0	3%	1.2	1.8	2.1	2.2	1.2	1.8	2.1	2.2
SC_STMF074	99.3	27.4	79.3	14.5	28.4	96%	18.8	33.7	41.0	44.0	22.7	37.4	44.9	47.9
SC_STMF078	15.9	8.7	76.3	51.6	51.6	0%	4.4	6.7	7.9	8.4	4.4	6.7	7.9	8.4
SC_STMF0814	2.2	3.6	79.4	58.2	58.2	0%	0.7	1.0	1.2	1.3	0.7	1.0	1.2	1.3
SC_STMF0823	6.5	4.2	79.0	55.4	55.4	0%	1.9	2.9	3.4	3.6	1.9	2.9	3.4	3.6
SC_STMF0832	6.6	5.2	79.7	58.5	58.5	0%	2.0	3.0	3.5	3.7	2.0	3.0	3.5	3.7
SC_STMF0835	5.8	5.3	79.5	54.0	54.0	0%	1.7	2.6	3.0	3.2	1.7	2.6	3.0	3.2
SC_STMF0838	7.4	6.3	79.0	56.9	56.9	0%	2.2	3.3	3.9	4.1	2.2	3.3	3.9	4.1
SC_STMF084	8.8	2.8	79.3	50.3	50.3	0%	2.5	3.8	4.5	4.8	2.5	3.8	4.5	4.8
SC_STMF0845	5.8	3.5	81.6	49.2	50.0	2%	1.6	2.5	3.0	3.2	1.6	2.5	3.0	3.2
SC_STMF087	9.1	5.0	81.1	46.1	50.0	8%	2.6	4.0	4.7	5.0	2.7	4.1	4.8	5.0
SC_STMF088	14.7	4.9	79.1	49.7	50.0	1%	4.2	6.3	7.5	7.9	4.2	6.4	7.5	7.9
SC_STMF0913	8.6	2.5	79.0	54.7	54.7	0%	2.5	3.8	4.5	4.7	2.5	3.8	4.5	4.7
SC_STMF0921	6.6	3.8	79.6	42.3	42.3	0%	1.6	2.6	3.2	3.4	1.6	2.6	3.2	3.4
SC_STMF0925	2.7	4.8	80.0	38.7	57.1	48%	0.7	1.1	1.3	1.4	0.8	1.2	1.4	1.5
SC_STMF0927	3.8	2.7	79.0	21.1	54.3	157%	0.6	1.2	1.5	1.6	1.1	1.6	1.9	2.1
SC_STMF093	5.7	3.3	79.0	49.2	50.1	2%	1.6	2.4	2.8	3.0	1.6	2.4	2.9	3.0
SC_STMF0930	3.2	3.0	79.0	46.1	59.8	30%	0.8	1.3	1.6	1.7	1.0	1.5	1.7	1.8
SC_STMF0932	8.9	3.7	79.0	34.2	50.0	46%	2.1	3.4	4.1	4.4	2.5	3.8	4.5	4.8
SC_STMF094	3.2	6.3	79.0	52.5	52.5	0%	0.9	1.4	1.6	1.7	0.9	1.4	1.6	1.7
SC_STMF097	6.5	7.8	79.0	42.2	51.1	21%	1.7	2.7	3.2	3.4	1.9	2.8	3.3	3.5
SC_STMF101	2.2	3.0	79.6	29.7	50.0	68%	0.5	0.9	1.0	1.1	0.6	1.0	1.2	1.2
SC_STMF1013	2.0	4.0	79.0	55.5	55.5	0%	0.6	0.9	1.1	1.1	0.6	0.9	1.1	1.1
SC_STMF1022	2.6	3.1	79.0	52.2	52.2	0%	0.8	1.1	1.3	1.4	0.8	1.1	1.3	1.4
SC_STMF1023	2.4	3.1	79.7	42.1	50.0	19%	0.6	1.0	1.2	1.3	0.7	1.0	1.2	1.3
SC_STMF105	3.3	2.6	79.0	38.3	50.0	31%	0.8	1.3	1.6	1.7	0.9	1.4	1.7	1.8
SC_STMF107	10.7	1.5	80.4	46.9	46.9	0%	2.5	4.2	5.0	5.4	2.5	4.2	5.0	5.4
SC_STMF1217	12.4	3.0	79.0	78.6	78.6	0%	4.3	6.2	7.2	7.6	4.3	6.2	7.2	7.6
SC_STMF122	5.4	2.0	79.0	84.0	85.0	1%	1.9	2.8	3.2	3.4	2.0	2.8	3.2	3.4
SC_STMF1223	10.3	6.4	79.0	39.1	52.5	34%	2.6	4.2	4.9	5.2	3.0	4.5	5.3	5.6
SC_STMF1227	7.4	5.7	79.0	64.0	64.0	0%	2.3	3.4	4.0	4.2	2.3	3.4	4.0	4.2
SC_STMF131	2.8	3.4	79.0	49.7	58.2	17%	0.8	1.2	1.4	1.5	0.8	1.3	1.5	1.6
SC_STMF135	6.7	4.1	79.0	37.4	60.8	63%	1.5	2.6	3.1	3.3	2.0	3.0	3.5	3.8
SC_STMG0714	6.9	7.8	80.3	59.3	59.3	0%	2.1	3.2	3.7	3.9	2.1	3.2	3.7	3.9
SC_STMG0721	2.7	13.2	79.3	55.8	55.8	0%	0.8	1.2	1.4	1.5	0.8	1.2	1.4	1.5
SC_STMG0723	1.7	9.9	75.0	42.2	50.0	18%	0.4	0.7	0.8	0.8	0.4	0.7	0.8	0.9
SC_STMG0725	8.3	7.1	80.9	46.6	50.0	7%	2.3	3.5	4.2	4.4	2.4	3.6	4.3	4.5
SC_STMG0731	3.9	2.6	69.6	48.0	50.0	4%	0.9	1.5	1.7	1.9	0.9	1.5	1.8	1.9
SC_STMG0733	1.3	24.7	65.8	31.4	60.0	91%	0.2	0.4	0.5	0.5	0.4	0.6	0.6	0.7
SC_STMG0744	5.0	13.8	78.3	32.1	50.2	56%	1.1	1.9	2.2	2.4	1.4	2.1	2.5	2.7
SC_STMG0750	8.1	7.2	79.0	59.1	59.1	0%	2.5	3.7	4.3	4.6	2.5	3.7	4.3	4.6

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STMG0755	3.3	13.7	63.5	44.3	50.1	13%	0.6	1.1	1.4	1.4	0.7	1.2	1.4	1.5
SC_STMG0765	3.4	11.1	65.3	44.9	50.9	13%	0.7	1.2	1.5	1.5	0.8	1.3	1.5	1.6
SC_STMG0768	6.8	5.9	79.2	55.3	55.5	0%	2.0	3.0	3.6	3.8	2.0	3.0	3.6	3.8
SC_STMG0769	3.0	12.2	79.0	51.9	58.9	13%	0.9	1.3	1.6	1.7	0.9	1.4	1.6	1.7
SC_STMG077	10.5	5.1	79.0	61.6	62.5	1%	3.1	4.8	5.6	5.9	3.2	4.8	5.6	5.9
SC_STMG0772	9.3	5.0	81.0	49.6	54.1	9%	2.7	4.1	4.8	5.1	2.8	4.2	4.9	5.2
SC_STMG0774	38.5	11.3	78.7	22.0	29.7	35%	6.4	12.4	15.3	16.5	7.4	13.5	16.4	17.6
SC_STMG0775	5.1	10.0	78.3	45.2	50.0	11%	1.4	2.1	2.5	2.7	1.4	2.2	2.6	2.7
SC_STMG0810	5.3	7.1	80.9	48.8	50.0	2%	1.5	2.3	2.7	2.9	1.6	2.3	2.7	2.9
SC_STMG0811	6.3	5.8	79.0	57.1	57.1	0%	1.9	2.8	3.3	3.5	1.9	2.8	3.3	3.5
SC_STMG0814	6.3	3.8	79.0	48.8	50.0	2%	1.8	2.7	3.2	3.4	1.8	2.7	3.2	3.4
SC_STMG082	3.9	2.9	79.0	48.9	50.0	2%	1.1	1.7	2.0	2.1	1.1	1.7	2.0	2.1
SC_STMG0830	17.6	3.7	79.0	55.3	55.3	0%	5.1	7.8	9.1	9.7	5.1	7.8	9.1	9.7
SC_STMG0842	16.5	5.0	80.2	48.9	50.0	2%	4.8	7.2	8.5	9.0	4.8	7.2	8.5	9.0
SC_STMG0846	8.8	1.8	79.0	50.8	50.8	0%	2.4	3.7	4.4	4.7	2.4	3.7	4.4	4.7
SC_STMG0847	9.6	4.3	79.0	45.0	45.0	0%	2.5	4.0	4.7	5.0	2.5	4.0	4.7	5.0
SC_STMG085	3.9	3.5	79.0	45.6	50.0	10%	1.0	1.6	1.9	2.0	1.1	1.7	2.0	2.1
SC_STMG0860	16.8	6.4	79.2	47.2	47.2	0%	4.6	7.1	8.4	8.9	4.6	7.1	8.4	8.9
SC_STMG088	14.3	5.1	79.0	38.8	50.0	29%	3.5	5.7	6.8	7.2	4.0	6.1	7.2	7.7
SC_STMG0918	6.7	4.4	79.0	56.9	56.9	0%	2.0	3.0	3.5	3.7	2.0	3.0	3.5	3.7
SC_STMG0919	7.9	4.1	79.0	49.0	50.4	3%	2.2	3.4	4.0	4.2	2.2	3.4	4.0	4.2
SC_STMG0924	10.0	5.1	79.0	41.8	59.7	43%	2.6	4.1	4.8	5.1	3.1	4.5	5.3	5.6
SC_STMG0928	33.0	4.5	79.8	31.7	48.6	53%	7.9	12.8	15.3	16.3	9.3	14.2	16.8	17.8
SC_STMG0930	6.6	2.9	79.0	45.1	50.0	11%	1.7	2.7	3.2	3.4	1.8	2.8	3.3	3.5
SC_STMG0932	26.8	2.1	80.0	14.8	49.9	237%	4.1	8.3	10.3	11.1	7.2	11.4	13.5	14.3
SC_STMG095	9.3	6.8	79.0	51.5	53.8	4%	2.7	4.0	4.8	5.0	2.8	4.1	4.8	5.1
SC_STMG099	6.3	4.4	80.5	48.0	49.2	3%	1.8	2.7	3.2	3.4	1.8	2.7	3.2	3.4
SC_STMG102	13.7	4.2	79.0	46.7	50.7	9%	3.6	5.7	6.8	7.2	3.8	5.9	6.9	7.3
SC_STMG1021	3.8	4.7	79.0	40.4	50.0	24%	0.9	1.5	1.8	1.9	1.0	1.6	1.9	2.0
SC_STMG1022	7.2	2.9	80.1	37.2	41.6	12%	1.8	2.9	3.5	3.7	1.9	3.0	3.5	3.8
SC_STMG1025	4.1	1.7	81.1	53.5	56.2	5%	1.2	1.8	2.1	2.2	1.2	1.8	2.1	2.3
SC_STMG1029	27.6	3.8	80.0	54.2	57.1	5%	8.1	12.3	14.4	15.3	8.3	12.5	14.6	15.5
SC_STMG1034	4.8	2.7	80.6	42.0	50.1	19%	1.1	1.9	2.3	2.4	1.3	2.0	2.4	2.5
SC_STMG1112	18.6	2.0	79.0	67.2	67.2	0%	6.0	8.8	10.2	10.8	6.0	8.8	10.2	10.8
SC_STMG121	20.4	3.3	79.0	85.7	85.7	0%	7.4	10.6	12.2	12.8	7.4	10.6	12.2	12.8
SC_STMG1215	5.0	3.5	79.0	89.8	89.8	0%	1.9	2.6	3.0	3.2	1.9	2.6	3.0	3.2
SC_STMG1219	11.0	4.2	79.0	50.7	50.7	0%	3.1	4.8	5.6	5.9	3.1	4.8	5.6	5.9
SC_STMG1227	14.0	3.8	79.0	83.6	83.6	0%	5.0	7.2	8.3	8.7	5.0	7.2	8.3	8.7
SC_STMG1245	11.7	1.7	79.0	69.4	69.4	0%	3.8	5.6	6.5	6.9	3.8	5.6	6.5	6.9
SC_STMG128	15.8	1.9	79.0	69.0	69.0	0%	5.2	7.5	8.8	9.3	5.2	7.5	8.8	9.3
SC_STMG1310	15.4	1.9	79.0	63.1	63.1	0%	4.9	7.1	8.3	8.8	4.9	7.1	8.3	8.8
SC_STMG1311	12.8	3.2	79.0	64.5	64.5	0%	4.0	5.9	6.9	7.3	4.0	5.9	6.9	7.3
SC_STMG1317	9.6	3.2	79.0	63.9	63.9	0%	2.9	4.4	5.2	5.5	2.9	4.4	5.2	5.5
SC_STMG1320	11.7	2.3	79.0	65.0	65.0	0%	3.6	5.4	6.3	6.7	3.6	5.4	6.3	6.7
SC_STMG1323	7.9	3.9	79.0	56.7	57.7	2%	2.4	3.5	4.1	4.4	2.4	3.6	4.2	4.4
SC_STMG1325	3.9	2.9	79.0	54.6	65.9	21%	1.2	1.7	2.0	2.2	1.3	1.9	2.2	2.3
SC_STMG133	18.7	2.6	79.0	57.8	57.8	0%	5.6	8.4	9.8	10.4	5.6	8.4	9.8	10.4

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STMG135	8.2	2.6	79.0	68.9	68.9	0%	2.7	3.9	4.6	4.8	2.7	3.9	4.6	4.8
SC_STMG138	8.8	2.8	79.0	57.0	62.7	10%	2.6	3.9	4.6	4.9	2.7	4.1	4.8	5.0
SC_STMG1412	16.9	2.6	79.0	56.2	56.7	1%	5.0	7.5	8.8	9.3	5.0	7.5	8.8	9.4
SC_STMG1413	10.1	7.2	79.0	58.4	61.1	5%	3.1	4.6	5.4	5.7	3.1	4.6	5.4	5.7
SC_STMG142	2.8	3.7	79.0	41.5	60.0	45%	0.7	1.1	1.4	1.4	0.9	1.3	1.5	1.6
SC_STMG143	6.6	2.4	79.0	51.1	60.0	17%	1.8	2.8	3.3	3.6	2.0	3.0	3.5	3.7
SC_STMG144	7.8	7.1	79.0	59.4	62.1	5%	2.4	3.6	4.2	4.4	2.5	3.6	4.2	4.5
SC_STMG149	5.9	1.6	79.0	47.3	70.2	48%	1.3	2.2	2.6	2.8	1.8	2.7	3.2	3.4
SC_STMH072	4.2	21.1	72.3	56.4	56.4	0%	1.2	1.8	2.1	2.2	1.2	1.8	2.1	2.2
SC_STMH081	11.2	4.3	79.6	55.3	55.3	0%	3.3	5.0	5.8	6.2	3.3	5.0	5.8	6.2
HESS CREEK														
SC_J3	5.4	3.0	79.0	66.2	66.2	0%	1.7	2.5	3.0	3.1	1.7	2.5	3.0	3.1
SC_J3612	18.9	2.1	80.4	74.0	74.0	0%	6.5	9.4	10.9	11.5	6.5	9.4	10.9	11.5
SC_J3614	4.3	2.4	79.0	99.7	99.7	0%	1.7	2.4	2.7	2.9	1.7	2.4	2.7	2.9
SC_J3628	8.6	2.5	79.0	65.6	68.9	5%	2.7	4.0	4.7	4.9	2.8	4.1	4.8	5.0
SC_J3936	129.6	17.0	69.2	11.9	11.9	0%	10.0	24.5	33.4	36.9	10.0	24.5	33.4	36.9
SC_J3938	7.4	11.6	80.9	18.8	49.9	165%	1.5	2.6	3.2	3.4	2.1	3.2	3.8	4.1
SC_J4002	3.6	6.0	79.0	24.0	50.0	108%	0.7	1.2	1.5	1.6	1.0	1.5	1.8	1.9
SC_J4068	3.3	3.7	79.0	49.3	52.2	6%	0.9	1.4	1.6	1.7	0.9	1.4	1.7	1.8
SC_J4098	5.5	19.3	79.6	21.4	60.0	180%	1.2	2.0	2.4	2.6	1.7	2.5	3.0	3.1
SC_J4198	6.9	15.3	79.3	70.5	70.5	0%	2.3	3.4	3.9	4.1	2.3	3.4	3.9	4.1
SC_J4290	11.4	3.3	79.0	52.8	62.5	18%	3.2	4.9	5.8	6.2	3.5	5.2	6.1	6.5
SC_J4370	12.3	1.9	81.0	49.8	49.8	0%	3.3	5.3	6.2	6.6	3.3	5.3	6.2	6.6
SC_J4554	19.2	10.9	70.4	18.7	50.0	167%	1.6	3.4	4.5	4.9	4.0	6.5	7.9	8.4
SC_J4556	27.8	15.9	76.9	18.5	50.0	170%	4.3	8.6	10.7	11.5	7.3	11.5	13.6	14.5
SC_J4576	15.8	14.3	71.6	10.4	49.6	377%	1.5	3.4	4.6	5.0	3.6	6.1	7.2	7.7
SC_J4608	11.9	2.1	79.2	68.7	75.0	9%	3.8	5.6	6.5	6.9	4.0	5.8	6.8	7.1
SC_J4610	43.8	13.1	79.8	39.0	74.9	92%	10.9	17.6	21.0	22.3	15.0	21.7	25.1	26.5
SC_J4620	10.0	3.6	79.0	63.8	63.8	0%	3.1	4.6	5.4	5.7	3.1	4.6	5.4	5.7
SC_J4636	7.9	1.7	79.3	77.3	77.3	0%	2.7	4.0	4.6	4.8	2.7	4.0	4.6	4.8
SC_J4642	6.6	4.0	79.2	23.5	50.0	113%	1.1	2.2	2.7	2.9	1.7	2.8	3.3	3.5
SC_J4738	33.9	3.1	81.1	56.6	56.6	0%	9.6	14.9	17.6	18.7	9.6	14.9	17.6	18.7
SC_J4862	4.6	8.4	79.0	16.4	73.4	348%	0.9	1.6	1.9	2.1	1.6	2.3	2.6	2.8
SC_J4872	6.7	2.7	79.3	88.7	88.7	0%	2.5	3.5	4.0	4.3	2.5	3.5	4.0	4.3
SC_J4956	27.2	5.2	79.4	14.5	50.0	245%	3.6	7.5	9.6	10.4	6.9	11.2	13.3	14.2
SC_J5110	7.7	3.2	79.7	42.5	42.5	0%	1.8	3.1	3.7	3.9	1.8	3.1	3.7	3.9
SC_J5242	8.1	5.4	82.0	12.2	50.0	310%	0.9	1.9	2.4	2.6	2.0	3.2	3.8	4.1
SC_J5284	16.2	11.4	74.4	26.5	49.6	87%	2.7	5.2	6.4	6.9	4.0	6.5	7.7	8.2
SC_J5324	38.7	5.2	68.6	18.4	18.4	0%	3.2	7.3	9.8	10.8	3.2	7.3	9.8	10.8
SC_J5480	9.3	5.0	81.2	76.9	76.9	0%	3.3	4.7	5.4	5.7	3.3	4.7	5.4	5.7
SC_J5560	8.7	2.2	79.0	60.0	75.0	25%	2.6	3.9	4.6	4.8	2.9	4.3	5.0	5.2
SC_J5562	13.0	3.2	80.1	26.7	74.8	180%	2.7	4.7	5.7	6.1	4.4	6.4	7.4	7.9
SC_J5640	4.2	21.2	79.0	12.1	61.5	408%	0.8	1.4	1.7	1.8	1.3	1.9	2.3	2.4
SC_J6	6.8	1.6	79.0	79.0	79.0	0%	2.4	3.4	4.0	4.2	2.4	3.4	4.0	4.2
SC_J-HC-04	18.3	3.1	79.0	41.9	75.0	79%	4.0	6.8	8.3	8.8	6.1	8.9	10.4	11.0
SC_J-HC-06	44.7	6.8	79.7	11.3	50.3	345%	6.4	13.2	16.7	18.0	12.1	19.0	22.5	23.9
SC_J-HC-10	27.2	7.0	79.1	10.8	44.2	309%	3.5	7.3	9.3	10.2	6.4	10.7	12.8	13.7

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_J-HC-12	8.1	13.1	79.7	13.6	51.7	280%	1.3	2.5	3.2	3.4	2.3	3.5	4.1	4.4
SC_J-HC-14	19.3	13.9	80.1	28.3	62.8	122%	3.8	6.9	8.4	9.0	5.9	8.9	10.4	11.0
SC_J-HC-15	3.7	2.4	79.6	48.6	58.5	20%	1.0	1.6	1.9	2.0	1.1	1.7	2.0	2.1
SC_J-HC-16	12.8	2.0	80.1	35.0	48.0	37%	3.0	5.0	6.0	6.4	3.5	5.5	6.5	6.9
SC_J-HC-17	1.6	2.3	79.0	99.4	99.4	0%	0.7	0.9	1.0	1.1	0.7	0.9	1.0	1.1
SC_J-HC-18	64.4	3.6	79.1	76.7	76.7	0%	21.9	31.9	36.9	39.0	21.9	31.9	36.9	39.0
SC_J-HC-20	18.2	4.0	79.0	49.6	49.6	0%	4.9	7.7	9.1	9.7	4.9	7.7	9.1	9.7
SC_J-HC-21	10.1	7.4	79.5	44.9	44.9	0%	2.7	4.2	5.0	5.3	2.7	4.2	5.0	5.3
SC_J-HC-23	6.5	2.7	79.0	43.1	43.1	0%	1.5	2.5	3.0	3.2	1.5	2.5	3.0	3.2
SC_J-HC-24	13.8	3.1	79.0	53.4	53.4	0%	3.9	6.0	7.1	7.5	3.9	6.0	7.1	7.5
SC_J-HC-25	8.0	4.4	79.0	47.8	47.8	0%	2.1	3.3	3.9	4.2	2.1	3.3	3.9	4.2
SC_J-HC-26	14.6	3.5	79.0	28.7	41.3	44%	2.7	4.9	6.0	6.5	3.3	5.6	6.7	7.2
SC_J-HC-27	14.5	3.0	79.3	57.6	57.6	0%	4.3	6.5	7.6	8.1	4.3	6.5	7.6	8.1
SC_J-HC-31	12.0	12.7	80.0	28.9	43.9	52%	2.5	4.4	5.3	5.7	3.1	4.9	5.9	6.2
SC_J-HC-33	16.5	19.5	79.4	28.3	47.6	68%	3.9	6.3	7.5	8.0	4.7	7.1	8.3	8.8
SC_J-HC-34	10.1	5.8	80.4	25.3	59.7	136%	2.3	3.8	4.6	4.9	3.2	4.7	5.4	5.8
SC_J-HC-35	29.1	5.4	79.0	14.5	50.0	245%	4.2	8.7	10.9	11.8	7.7	12.2	14.5	15.4
SC_J-HC-36	40.0	5.7	79.3	15.1	50.7	236%	4.2	9.0	11.8	12.9	9.5	15.6	18.7	19.9
SC_J-HC-37	47.8	5.9	79.4	10.1	50.0	395%	4.4	9.7	12.7	13.9	11.1	18.2	21.9	23.4
SC_J-HC-38	19.4	8.9	80.4	12.1	50.0	313%	2.1	4.5	5.9	6.5	4.7	7.7	9.2	9.8
SC_J-HC-39	25.4	6.2	79.1	10.4	50.0	381%	2.6	5.7	7.5	8.2	6.1	10.0	12.0	12.8
SC_J-HC-40	27.0	11.5	77.2	14.7	49.6	237%	3.1	6.7	8.7	9.5	6.5	10.6	12.7	13.6
SC_J-HC-42	16.8	13.1	80.8	10.7	46.0	330%	2.3	4.8	6.1	6.6	4.2	6.9	8.2	8.8
SC_J-HC-43	180.7	19.3	70.3	12.9	12.9	0%	14.1	33.9	46.1	51.0	14.1	33.9	46.1	51.0
SC_J-HCT2-01	29.6	10.0	79.0	14.2	74.8	427%	4.0	8.4	10.6	11.5	9.9	14.5	16.8	17.8
SC_J-HCT2-02	15.6	3.8	79.0	27.2	72.3	166%	2.2	4.2	5.3	5.8	4.9	7.3	8.6	9.1
SC_J-HCT3-02	16.4	4.1	79.0	10.1	40.5	301%	1.7	3.8	4.9	5.4	3.4	5.9	7.2	7.7
SC_J-HCT4-01	3.7	4.6	79.0	57.8	57.8	0%	1.1	1.7	1.9	2.1	1.1	1.7	1.9	2.1
SC_J-HCT4-02	3.8	6.2	79.0	49.0	50.0	2%	1.1	1.6	1.9	2.0	1.1	1.7	1.9	2.1
SC_J-HCT4-06	2.8	15.9	79.3	40.5	50.0	23%	0.8	1.2	1.4	1.5	0.8	1.2	1.5	1.5
SC_STHI1043	4.4	3.2	80.4	51.2	51.2	0%	1.3	1.9	2.3	2.4	1.3	1.9	2.3	2.4
SC_STIH081	6.2	19.9	79.1	32.7	50.0	53%	1.4	2.4	2.8	3.0	1.7	2.7	3.1	3.3
SC_STIH1012	2.6	2.3	80.0	46.3	49.9	8%	0.7	1.1	1.3	1.4	0.7	1.1	1.3	1.4
SC_STIH1033	2.8	3.1	79.0	50.6	50.6	0%	0.8	1.2	1.4	1.5	0.8	1.2	1.4	1.5
SC_STIH1040	4.3	3.9	79.0	54.7	54.7	0%	1.3	1.9	2.2	2.4	1.3	1.9	2.2	2.4
SC_STIH107	4.4	5.1	79.0	46.2	50.0	8%	1.1	1.8	2.2	2.3	1.2	1.9	2.2	2.4
SC_STIH12182	5.7	3.9	79.0	98.0	98.0	0%	2.2	3.1	3.6	3.8	2.2	3.1	3.6	3.8
SC_STII093	12.8	3.3	81.0	71.7	74.2	3%	4.3	6.2	7.2	7.6	4.3	6.3	7.3	7.7
SC_STII0940	18.3	3.9	82.0	16.8	50.9	203%	1.9	3.8	4.9	5.4	4.3	6.8	8.2	8.8
SC_STII0950	3.2	2.4	79.4	32.0	56.2	76%	0.7	1.2	1.4	1.5	0.9	1.4	1.7	1.7
SC_STII0953	1.2	2.5	81.4	25.9	83.7	223%	0.2	0.4	0.5	0.5	0.4	0.6	0.7	0.7
SC_STII0954	12.6	3.1	80.9	12.3	75.0	510%	1.7	3.5	4.5	4.9	4.3	6.2	7.2	7.6
SC_STII1179	9.8	3.2	79.8	59.4	59.5	0%	3.0	4.5	5.2	5.5	3.0	4.5	5.2	5.5
SC_STII118	7.9	2.5	79.6	94.8	94.8	0%	3.0	4.3	4.9	5.1	3.0	4.3	4.9	5.1
SC_STII142	17.6	2.5	79.4	47.6	62.4	31%	4.7	7.4	8.8	9.3	5.5	8.1	9.5	10.0
SC_STII151	30.4	1.8	79.9	26.0	74.3	186%	4.2	8.0	10.2	11.0	9.8	14.5	16.9	17.9
SC_STMG1010	4.2	6.3	79.0	54.2	54.2	0%	1.2	1.9	2.2	2.3	1.2	1.9	2.2	2.3

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STMG1019	9.1	2.4	79.0	52.7	56.3	7%	2.5	3.9	4.6	4.9	2.6	4.0	4.7	5.0
SC_STMG106	9.3	6.1	81.1	49.1	49.1	0%	2.7	4.1	4.8	5.1	2.7	4.1	4.8	5.1
SC_STMG112	7.6	3.7	79.0	59.8	59.8	0%	2.3	3.5	4.0	4.3	2.3	3.5	4.0	4.3
SC_STMG114	12.6	3.4	79.0	61.4	67.0	9%	3.7	5.7	6.7	7.1	3.9	5.9	6.9	7.3
SC_STMG118	5.4	2.8	79.0	70.9	70.9	0%	1.8	2.6	3.0	3.2	1.8	2.6	3.0	3.2
SC_STMG122	9.6	4.1	79.0	93.9	93.9	0%	3.7	5.2	5.9	6.2	3.7	5.2	5.9	6.2
SC_STMG1228	9.3	3.1	79.0	70.1	70.1	0%	3.1	4.5	5.2	5.5	3.1	4.5	5.2	5.5
SC_STMG126	2.1	16.7	80.8	54.8	54.8	0%	0.7	1.0	1.1	1.2	0.7	1.0	1.1	1.2
SC_STMH091	6.6	4.8	79.0	63.3	63.3	0%	2.1	3.1	3.6	3.8	2.1	3.1	3.6	3.8
SC_STMH0911	27.1	3.8	79.0	29.6	43.1	46%	4.9	9.0	11.1	12.0	6.2	10.4	12.5	13.4
SC_STMH0919	18.0	5.8	79.4	45.2	47.4	5%	4.6	7.4	8.8	9.3	4.7	7.5	8.9	9.5
SC_STMH095	5.0	9.5	79.0	53.6	53.6	0%	1.5	2.2	2.6	2.8	1.5	2.2	2.6	2.8
SC_STMH096	7.5	8.7	81.3	96.1	96.1	0%	2.9	4.1	4.7	4.9	2.9	4.1	4.7	4.9
SC_STMH097	9.8	3.6	79.5	78.8	78.8	0%	3.4	4.9	5.7	6.0	3.4	4.9	5.7	6.0
SC_STMH098	15.0	3.9	79.1	61.8	74.9	21%	4.5	6.8	8.0	8.4	5.0	7.3	8.5	9.0
SC_STMH1010	4.9	9.7	81.3	50.7	50.7	0%	1.5	2.2	2.6	2.7	1.5	2.2	2.6	2.7
SC_STMH1021	5.3	3.5	79.0	40.5	56.4	39%	1.3	2.1	2.5	2.7	1.6	2.4	2.8	2.9
SC_STMH1024	2.1	2.5	79.0	57.8	60.0	4%	0.6	0.9	1.1	1.2	0.6	0.9	1.1	1.2
SC_STMH105	12.7	4.6	81.0	47.9	54.0	13%	3.3	5.3	6.3	6.7	3.6	5.5	6.5	6.9
SC_STMH107	4.0	4.6	79.0	47.6	50.0	5%	1.1	1.7	2.0	2.1	1.1	1.7	2.0	2.1
SC_STMH111	8.2	5.0	79.0	44.3	45.7	3%	2.1	3.4	4.0	4.3	2.2	3.4	4.0	4.3
SC_STMH1110	6.8	2.7	80.1	51.2	51.2	0%	2.0	3.0	3.5	3.8	2.0	3.0	3.5	3.8
SC_STMH1116	7.5	2.7	79.3	51.1	59.3	16%	2.1	3.2	3.8	4.1	2.3	3.4	4.0	4.2
SC_STMH1125	7.8	4.1	79.2	51.5	51.5	0%	2.2	3.4	4.0	4.2	2.2	3.4	4.0	4.2
SC_STMH1135	7.1	3.2	79.7	55.1	60.8	10%	2.1	3.2	3.7	3.9	2.2	3.3	3.8	4.1
SC_STMH1137	7.4	2.8	79.7	74.6	74.6	0%	2.5	3.7	4.2	4.5	2.5	3.7	4.2	4.5
SC_STMH114	1.9	2.7	79.0	43.5	59.3	36%	0.5	0.8	0.9	1.0	0.6	0.8	1.0	1.0
SC_STMH1144	10.9	5.9	79.5	52.7	52.7	0%	3.2	4.8	5.7	6.0	3.2	4.8	5.7	6.0
SC_STMH116	3.7	3.8	79.0	68.2	68.2	0%	1.2	1.8	2.0	2.2	1.2	1.8	2.0	2.2
SC_STMH118	4.1	3.0	80.1	51.2	58.7	15%	1.1	1.8	2.1	2.2	1.2	1.9	2.2	2.3
SC_STMH1212	7.7	2.7	79.0	65.0	68.7	6%	2.5	3.6	4.2	4.5	2.5	3.7	4.3	4.5
SC_STMH1215	4.8	3.0	79.0	45.4	62.8	38%	1.2	1.9	2.3	2.5	1.4	2.2	2.6	2.7
SC_STMH1223	8.8	1.6	79.0	57.7	58.2	1%	2.5	3.9	4.5	4.8	2.5	3.9	4.6	4.8
SC_STMH1229	5.8	4.4	79.4	58.1	60.2	4%	1.8	2.6	3.1	3.3	1.8	2.7	3.1	3.3
SC_STMH1233	3.6	2.1	79.0	67.8	67.8	0%	1.2	1.7	2.0	2.1	1.2	1.7	2.0	2.1
SC_STMH1238	5.9	3.7	79.0	57.3	59.5	4%	1.8	2.7	3.1	3.3	1.8	2.7	3.1	3.3
SC_STMH1242	4.4	4.1	79.0	64.9	64.9	0%	1.4	2.0	2.4	2.5	1.4	2.0	2.4	2.5
SC_STMH1248	9.7	3.3	79.0	26.3	55.3	110%	2.2	3.6	4.3	4.6	2.9	4.3	5.1	5.4
SC_STMH1252	1.5	6.3	79.0	60.9	60.9	0%	0.5	0.7	0.8	0.9	0.5	0.7	0.8	0.9
SC_STMH1253	16.9	1.7	79.0	90.3	90.3	0%	6.4	9.0	10.3	10.9	6.4	9.0	10.3	10.9
SC_STMH127	11.1	5.0	79.6	72.5	76.8	6%	3.7	5.4	6.3	6.6	3.8	5.5	6.4	6.7
SC_STMH128	20.4	2.4	79.5	78.8	79.9	1%	7.1	10.2	11.9	12.5	7.2	10.3	11.9	12.6
SC_STMH1311	6.6	1.4	79.0	48.5	59.7	23%	1.8	2.8	3.3	3.5	2.0	3.0	3.5	3.7
SC_STMH1313	5.9	2.3	79.0	31.8	59.8	88%	1.3	2.2	2.7	2.8	1.8	2.7	3.1	3.3
SC_STMH1314	7.1	2.3	79.0	67.9	67.9	0%	2.3	3.4	3.9	4.2	2.3	3.4	3.9	4.2
SC_STMH1315	8.3	1.5	79.0	35.5	60.0	69%	1.5	2.7	3.3	3.6	2.3	3.6	4.2	4.5
SC_STMH132	13.3	4.7	79.0	53.9	60.0	11%	3.9	5.8	6.9	7.3	4.1	6.1	7.1	7.5

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STMH135	4.9	14.7	80.5	30.7	60.0	95%	1.1	1.9	2.2	2.4	1.5	2.2	2.6	2.8
SC_STMI081	13.6	7.8	77.4	37.1	62.5	68%	2.3	4.1	5.0	5.4	3.7	5.7	6.7	7.2
SC_STMI111	40.4	3.3	80.0	41.0	47.0	15%	8.9	15.2	18.3	19.6	9.8	16.1	19.2	20.5
SC_STMI112	6.0	2.2	79.6	91.7	91.7	0%	2.3	3.2	3.7	3.9	2.3	3.2	3.7	3.9
SC_STMI122	19.2	2.5	79.3	80.7	80.7	0%	6.8	9.7	11.2	11.8	6.8	9.7	11.2	11.8
SC_STMI1312	18.5	1.4	80.2	23.7	69.5	193%	2.1	3.9	5.0	5.4	5.4	8.2	9.6	10.2
SC_STMI132	11.6	25.4	79.1	53.1	71.4	34%	3.5	5.2	6.0	6.4	3.9	5.7	6.6	6.9
SC_STMI141	11.3	2.1	79.0	87.1	87.1	0%	4.1	5.9	6.8	7.1	4.1	5.9	6.8	7.1
SCa_J5090	14.1	12.8	70.5	14.9	49.4	232%	1.1	2.7	3.7	4.1	3.0	5.1	6.1	6.6
SCb_J5090	13.6	16.2	74.2	10.0	49.9	399%	1.2	2.8	3.7	4.1	3.1	5.2	6.2	6.6
SCc_J5090	360.5	22.2	69.2	11.9	26.0	118%	23.8	59.7	80.1	89.3	41.5	83.6	108.1	117.9
SPRING BROOK														
SC_J3852	5.7	3.0	79.0	50.0	60.1	20%	1.6	2.5	2.9	3.1	1.8	2.6	3.0	3.2
SC_J3960	6.5	2.1	81.7	19.1	75.0	293%	1.2	2.2	2.7	2.9	2.2	3.2	3.8	4.0
SC_J4092	21.5	4.3	80.2	17.1	66.7	290%	2.6	5.4	7.0	7.6	6.5	9.9	11.6	12.3
SC_J4116	6.8	3.6	79.0	17.1	75.0	339%	0.9	1.9	2.4	2.6	2.3	3.3	3.9	4.1
SC_J4118	5.9	1.7	79.0	26.5	71.0	168%	1.0	1.9	2.3	2.5	1.9	2.8	3.3	3.5
SC_J4268	13.1	3.1	78.3	22.9	75.7	231%	2.2	4.2	5.2	5.6	4.4	6.4	7.5	7.9
SC_J4834	4.1	3.4	79.7	93.3	93.3	0%	1.6	2.2	2.5	2.7	1.6	2.2	2.5	2.7
SC_J5178	16.5	5.3	80.9	15.4	52.2	239%	2.3	4.7	6.0	6.5	4.4	7.0	8.3	8.8
SC_J5216	9.4	3.4	80.7	14.4	61.6	328%	1.3	2.7	3.5	3.8	2.8	4.3	5.0	5.3
SC_J5236	6.3	4.2	82.4	17.4	85.0	389%	1.1	2.1	2.6	2.8	2.3	3.3	3.8	4.0
SC_J-SB-02	970.6	4.5	73.1	12.5	12.5	0%	58.3	131.6	179.1	199.7	58.3	131.6	179.1	199.7
SC_J-SB-03	35.2	8.3	78.5	31.5	64.3	104%	7.6	13.1	15.7	16.8	11.0	16.3	19.0	20.1
SC_J-SB-07	55.2	11.4	79.7	13.8	67.2	387%	7.4	15.4	19.6	21.3	17.3	25.9	30.2	32.0
SC_J-SB-11	67.5	3.7	79.8	12.2	21.6	77%	9.1	18.8	23.9	26.0	10.8	21.2	26.4	28.5
SC_J-SB-12	137.5	16.6	75.1	13.1	13.1	0%	14.9	33.2	43.2	47.2	14.9	33.2	43.2	47.2
SC_J-SB-13	513.0	20.1	71.7	13.8	13.8	0%	35.1	84.4	112.7	124.9	35.1	84.4	112.7	124.9
SC_J-SB-14	113.3	8.1	79.7	18.0	23.2	29%	19.4	37.2	45.9	49.4	21.4	39.2	47.8	51.3
SC_J-SB-16	465.1	9.8	71.0	13.4	26.0	94%	28.7	64.0	87.1	97.1	51.8	94.0	120.3	131.4
SC_J-SBT1-01	58.4	3.5	76.7	11.9	66.5	459%	5.9	12.9	17.1	18.8	17.3	26.4	30.9	32.8
SC_J-SBT1-06	12.9	2.9	79.6	86.2	86.2	0%	4.7	6.7	7.8	8.2	4.7	6.7	7.8	8.2
SC_J-SBT1-07	2.3	6.6	79.0	53.7	85.0	58%	0.7	1.0	1.2	1.3	0.8	1.2	1.4	1.4
SC_J-SBT1-08	26.3	1.9	79.5	78.6	84.3	7%	9.2	13.2	15.3	16.1	9.5	13.6	15.7	16.5
SC_J-SBT3-01	26.7	7.4	80.9	11.7	75.8	548%	4.1	8.3	10.4	11.2	9.2	13.3	15.4	16.3
SC_J-SBT4-02	6.3	6.2	81.3	19.8	50.0	153%	1.3	2.3	2.8	3.0	1.8	2.8	3.3	3.5
SC_J-SBT5-01	9.3	9.9	79.4	10.0	40.5	305%	1.4	2.8	3.5	3.8	2.3	3.7	4.4	4.7
SC_J-SBT6-01	380.8	13.1	71.6	13.6	13.6	0%	29.7	70.8	95.5	105.7	29.7	70.8	95.5	105.7
SC_J-SBT6-02	219.1	12.4	71.8	18.4	18.4	0%	20.4	46.1	61.0	67.0	20.4	46.1	61.0	67.0
SC_J-SBT7-01	16.5	5.9	79.7	10.4	67.1	545%	1.8	3.8	4.9	5.4	5.0	7.6	8.9	9.5
SC_J-SBT7-02	7.4	20.8	79.5	75.0	75.0	0%	2.5	3.7	4.2	4.5	2.5	3.7	4.2	4.5
SC_SBT5-01	19.7	11.8	80.1	53.7	53.7	0%	5.9	8.8	10.3	10.9	5.9	8.8	10.3	10.9
SC_SBTI-04	23.3	7.1	79.0	15.3	67.2	339%	3.5	7.1	8.9	9.6	7.4	11.0	12.8	13.5
SC_STII09101	36.1	4.8	77.4	24.8	64.7	161%	4.8	9.3	11.9	12.9	10.3	15.8	18.7	19.8
SC_STII0916	2.9	3.4	83.3	52.7	75.0	42%	0.9	1.3	1.6	1.7	1.0	1.5	1.7	1.8
SC_STII092	9.8	4.2	79.0	43.8	47.1	8%	2.6	4.0	4.8	5.1	2.7	4.1	4.9	5.2
SC_STII0965	2.7	2.5	79.0	41.5	82.4	99%	0.6	1.1	1.3	1.4	1.0	1.4	1.6	1.7

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STII0975	4.6	2.0	81.8	39.2	83.6	113%	1.2	1.9	2.3	2.4	1.7	2.4	2.7	2.9
SC_STII0990	3.3	3.4	79.0	41.5	82.2	98%	0.8	1.3	1.6	1.7	1.2	1.7	1.9	2.0
SC_STII1030	2.2	2.1	82.9	70.8	70.8	0%	0.7	1.1	1.2	1.3	0.7	1.1	1.2	1.3
SC_STII1033	22.8	6.2	80.3	29.2	72.1	147%	4.8	8.4	10.1	10.8	7.6	11.1	12.9	13.6
SC_STII1055	3.5	2.9	80.4	50.0	52.7	5%	1.0	1.5	1.8	1.9	1.0	1.6	1.8	2.0
SC_STII1078	7.5	2.8	81.7	59.4	60.1	1%	2.4	3.5	4.1	4.3	2.4	3.5	4.1	4.3
SC_STII1080	10.0	2.0	79.5	79.9	79.9	0%	3.5	5.0	5.8	6.2	3.5	5.0	5.8	6.2
SC_STII1149	19.2	3.0	79.0	64.9	64.9	0%	6.0	8.9	10.4	11.0	6.0	8.9	10.4	11.0
SC_STIJ081	16.3	15.3	77.6	24.4	78.9	223%	2.7	5.3	6.5	7.0	5.6	8.1	9.4	9.9
SC_STIJ0911	18.2	3.5	80.1	12.4	64.2	418%	2.6	5.4	6.8	7.3	5.6	8.5	9.9	10.5
SC_STIJ0916	13.9	4.4	79.4	28.9	28.9	0%	3.2	5.3	6.3	6.7	3.2	5.3	6.3	6.7
SC_STIJ1060	6.6	1.8	79.0	88.1	88.1	0%	2.5	3.5	4.0	4.2	2.5	3.5	4.0	4.2
SC_STIK116	17.9	13.8	69.4	11.3	13.2	17%	1.3	3.2	4.4	4.9	1.4	3.4	4.6	5.1
SC_STIL11186	4.3	13.8	79.0	35.9	84.9	136%	1.0	1.7	2.0	2.1	1.6	2.2	2.5	2.7
SC_STMI0910	10.8	3.7	80.4	48.3	54.8	13%	2.8	4.5	5.3	5.7	3.0	4.7	5.6	5.9
SC_STMI1013	3.4	1.9	79.0	54.8	54.8	0%	1.0	1.5	1.8	1.9	1.0	1.5	1.8	1.9
SC_STMI1014	4.3	3.9	81.4	55.9	55.9	0%	1.3	2.0	2.3	2.5	1.3	2.0	2.3	2.5
SC_STMI1015	5.1	1.7	81.9	65.0	69.5	7%	1.7	2.4	2.8	3.0	1.7	2.5	2.9	3.1
SC_STMI1017	6.7	3.8	80.9	57.1	57.1	0%	2.1	3.1	3.6	3.8	2.1	3.1	3.6	3.8
SC_STMI1021	7.5	5.8	80.6	54.5	54.5	0%	2.3	3.4	4.0	4.2	2.3	3.4	4.0	4.2
SC_STMI1022	3.2	3.1	82.7	71.0	71.0	0%	1.1	1.6	1.9	2.0	1.1	1.6	1.9	2.0
SC_STMI1023	2.3	3.6	81.0	43.4	58.7	35%	0.6	1.0	1.1	1.2	0.7	1.0	1.2	1.3
SC_STMI107	10.9	3.0	79.0	60.5	60.5	0%	3.3	5.0	5.8	6.2	3.3	5.0	5.8	6.2
SC_STMI1110	6.0	3.9	80.1	60.9	61.7	1%	1.9	2.8	3.3	3.5	1.9	2.8	3.3	3.5
SC_STMI1114	8.1	2.1	80.0	93.4	93.4	0%	3.1	4.4	5.0	5.3	3.1	4.4	5.0	5.3
SC_STMI1123	2.1	2.4	81.2	50.9	83.1	63%	0.6	0.9	1.1	1.2	0.8	1.1	1.3	1.3
SC_STMI1160	2.8	3.6	83.6	59.0	66.5	13%	0.9	1.3	1.6	1.7	1.0	1.4	1.6	1.7
SC_STMI1164	1.1	2.6	79.2	59.9	70.0	17%	0.3	0.5	0.6	0.6	0.4	0.5	0.6	0.6
SC_STMI1165	2.9	4.8	79.1	67.5	69.5	3%	1.0	1.4	1.6	1.7	1.0	1.4	1.6	1.7
SC_STMI1174	7.5	3.2	79.9	28.5	78.2	174%	1.3	2.4	3.0	3.3	2.6	3.8	4.4	4.6
SC_STMI1212	3.7	3.4	80.2	59.0	60.4	2%	1.1	1.7	2.0	2.1	1.2	1.7	2.0	2.1
SC_STMI1217	4.3	4.9	79.7	61.9	61.9	0%	1.4	2.0	2.3	2.5	1.4	2.0	2.3	2.5
SC_STMI1219	5.4	3.3	83.4	58.4	60.0	3%	1.7	2.6	3.0	3.2	1.8	2.6	3.0	3.2
SC_STMI123	11.0	1.4	79.6	59.7	62.8	5%	3.2	4.9	5.8	6.1	3.3	5.0	5.9	6.2
SC_STMI1233	7.4	2.8	79.0	76.6	76.6	0%	2.6	3.7	4.3	4.5	2.6	3.7	4.3	4.5
SC_STMI124	4.0	2.3	79.1	71.2	71.2	0%	1.4	2.0	2.3	2.4	1.4	2.0	2.3	2.4
SC_STMI125	7.5	2.4	79.0	81.5	81.5	0%	2.7	3.8	4.4	4.7	2.7	3.8	4.4	4.7
SC_STMI128	1.7	2.0	78.2	60.7	67.8	12%	0.5	0.8	0.9	1.0	0.6	0.8	1.0	1.0
SC_STMI129	10.9	3.9	82.4	59.6	80.0	34%	3.3	5.0	5.9	6.2	3.9	5.6	6.4	6.8
SC_STMI1310	7.7	3.2	79.1	61.4	65.2	6%	2.4	3.6	4.2	4.4	2.5	3.6	4.2	4.5
SC_STMI137	5.9	2.9	79.3	57.7	68.9	19%	1.7	2.6	3.1	3.3	1.9	2.8	3.3	3.4
SC_STMI139	13.0	2.4	79.3	73.2	73.2	0%	4.3	6.3	7.3	7.7	4.3	6.3	7.3	7.7
SC_STMI143	11.2	2.2	79.0	37.8	67.8	79%	2.8	4.5	5.3	5.7	3.7	5.3	6.2	6.6
SC_STMJ092	7.2	4.6	80.0	48.8	50.0	2%	2.1	3.1	3.7	3.9	2.1	3.2	3.7	3.9
SC_STMJ1010	1.5	7.0	82.5	57.0	57.0	0%	0.5	0.7	0.8	0.9	0.5	0.7	0.8	0.9
SC_STMJ1011	7.3	4.9	80.5	50.9	50.9	0%	2.2	3.2	3.8	4.0	2.2	3.2	3.8	4.0
SC_STMJ102	14.3	3.5	81.6	54.9	56.0	2%	4.4	6.5	7.6	8.1	4.4	6.5	7.7	8.1

Table B-1. Hydrologic Input Data and Peak Flow Results

Subcatchment Name	Area (acre)	Average Slope (%)	Pervious Curve Number	Impervious Area (%)			Subcatchment Peak Flow (cfs)							
							Existing Land Use Scenario				Future Land Use Scenario			
				Existing Land Use	Future Land Use	Percent Increase	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm	2-yr, 24-hr Design Storm	10-yr, 24-hr Design Storm	25-yr, 24-hr Design Storm	50-yr, 24-hr Design Storm
SC_STMJ1022	7.1	4.2	84.0	50.3	50.3	0%	2.2	3.3	3.8	4.1	2.2	3.3	3.8	4.1
SC_STMJ103	5.0	2.3	83.4	51.1	51.1	0%	1.5	2.3	2.7	2.8	1.5	2.3	2.7	2.8
SC_STMJ104	8.5	3.1	81.6	48.0	49.7	4%	2.4	3.7	4.4	4.6	2.5	3.8	4.4	4.7
SC_STMJ106	3.7	3.4	83.8	46.8	50.0	7%	1.1	1.7	2.0	2.1	1.1	1.7	2.0	2.1
SC_STMJ107	5.9	3.6	82.9	44.3	49.2	11%	1.7	2.6	3.1	3.3	1.8	2.7	3.1	3.3
SC_STMJ1110	2.6	2.1	83.5	70.9	81.2	15%	0.9	1.3	1.5	1.6	1.0	1.4	1.6	1.7
SC_STMJ1111	4.6	1.0	79.8	61.4	80.2	31%	1.4	2.1	2.5	2.6	1.6	2.3	2.7	2.8
SC_STMJ1114	18.2	4.1	81.6	60.8	78.3	29%	5.6	8.4	9.9	10.4	6.4	9.2	10.7	11.2
SC_STMJ1121	11.2	5.4	79.0	19.6	46.5	137%	1.4	3.0	3.8	4.2	2.6	4.3	5.2	5.5
SC_STMJ1126	3.0	4.2	79.0	68.7	81.7	19%	1.0	1.4	1.7	1.8	1.1	1.5	1.8	1.8
SC_STMJ1134	7.4	2.1	79.0	44.2	80.0	81%	2.0	3.1	3.6	3.9	2.6	3.8	4.3	4.6
SC_STMJ1136	10.5	2.4	79.7	42.0	80.0	90%	2.7	4.3	5.1	5.4	3.7	5.3	6.1	6.5
SC_STMJ1138	8.1	3.7	79.3	38.2	80.0	109%	1.8	3.1	3.7	4.0	2.9	4.1	4.7	5.0
SC_STMJ1141	7.8	4.9	83.9	23.0	75.5	228%	1.6	2.8	3.4	3.7	2.7	3.9	4.6	4.8
SC_STMJ115	2.8	3.3	79.4	57.3	70.0	22%	0.8	1.3	1.5	1.6	0.9	1.3	1.6	1.7
SC_STMJ121	4.0	3.5	84.0	56.3	62.5	11%	1.3	1.9	2.2	2.3	1.3	1.9	2.2	2.4
SC_STMJ1211	6.3	1.8	82.3	29.9	77.8	160%	1.3	2.2	2.7	2.9	2.2	3.2	3.7	3.9
SC_STMJ1213	4.5	4.4	84.0	57.1	80.0	40%	1.5	2.1	2.5	2.7	1.6	2.3	2.7	2.8
SC_STMJ1217	4.2	5.2	84.0	60.6	80.0	32%	1.4	2.0	2.3	2.5	1.5	2.2	2.5	2.6
SC_STMJ1218	6.6	4.0	79.6	46.5	72.3	55%	1.5	2.5	3.0	3.2	2.1	3.2	3.7	3.9
SC_STMJ122	5.3	10.5	81.4	79.1	79.1	0%	1.9	2.7	3.1	3.3	1.9	2.7	3.1	3.3
SC_STMJ1226	8.2	7.8	80.4	33.9	51.6	52%	2.1	3.3	3.9	4.2	2.4	3.6	4.3	4.5
SC_STMJ123	9.0	2.4	84.0	48.5	75.3	55%	2.6	4.0	4.7	5.0	3.2	4.6	5.3	5.6
SC_STMJ1230	3.4	4.7	79.0	49.1	50.0	2%	1.0	1.5	1.7	1.8	1.0	1.5	1.7	1.8
SC_STMJ1238	8.2	1.2	83.6	25.0	80.0	220%	1.6	2.9	3.5	3.8	2.9	4.2	4.9	5.1
SC_STMJ125	1.7	4.6	84.0	42.6	66.2	55%	0.5	0.7	0.9	0.9	0.6	0.8	0.9	1.0
SC_STMJ126	4.9	4.0	84.0	62.3	62.3	0%	1.6	2.3	2.7	2.9	1.6	2.3	2.7	2.9
SC_STMK1112	9.3	7.8	74.1	26.7	36.7	37%	1.8	3.2	3.8	4.1	2.1	3.4	4.1	4.4
SC_STMK1120	7.3	2.2	77.5	40.4	49.6	23%	1.7	2.8	3.4	3.6	1.9	3.0	3.6	3.8
SC_STMK1122	24.3	17.7	72.5	18.8	21.0	12%	3.0	6.6	8.4	9.1	3.1	6.8	8.6	9.3
SC_STMK1211	8.2	7.0	78.0	46.7	50.0	7%	2.3	3.4	4.1	4.3	2.3	3.5	4.1	4.4
SC_STMK1212	4.0	3.4	79.0	48.8	50.0	2%	1.1	1.7	2.0	2.1	1.1	1.7	2.0	2.1
SC_STMK1213	2.3	6.1	70.3	51.8	51.8	0%	0.6	0.9	1.1	1.2	0.6	0.9	1.1	1.2
SC_STMK1216	1.4	12.9	74.7	63.2	63.2	0%	0.5	0.7	0.8	0.8	0.5	0.7	0.8	0.8
SC_STMK1218	3.2	15.3	58.3	27.0	27.0	0%	0.3	0.7	1.0	1.0	0.3	0.7	1.0	1.0
SC_STMK122	4.5	4.6	79.0	56.3	56.3	0%	1.4	2.0	2.4	2.5	1.4	2.0	2.4	2.5
SC_STMK1222	2.6	14.7	59.7	46.6	50.0	7%	0.5	0.9	1.1	1.2	0.5	1.0	1.1	1.2
SC_STMK1223	6.6	8.0	64.9	42.7	44.2	4%	1.2	2.3	2.7	2.9	1.3	2.3	2.8	3.0
SC_STMK123	2.7	21.7	74.5	38.9	38.9	0%	0.7	1.1	1.2	1.3	0.7	1.1	1.2	1.3
SC_STMK1232	6.8	20.6	70.8	44.5	44.5	0%	1.6	2.6	3.1	3.3	1.6	2.6	3.1	3.3
SC_STMK1233	2.8	8.9	75.7	47.8	50.0	5%	0.8	1.1	1.4	1.4	0.8	1.2	1.4	1.5
SC_STMK1235	8.7	7.6	78.1	27.0	50.0	85%	1.6	2.9	3.6	3.8	2.3	3.6	4.3	4.5
SC_STMK125	1.7	5.3	79.0	55.4	55.4	0%	0.5	0.8	0.9	0.9	0.5	0.8	0.9	0.9
SC_STML1131	13.9	4.0	79.0	88.1	88.1	0%	5.2	7.3	8.4	8.9	5.2	7.3	8.4	8.9
SC_STML1232	10.1	0.5	79.0	78.5	78.5	0%	3.5	5.1	5.9	6.2	3.5	5.1	5.9	6.2

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
CHEHALEM CREEK																	
C2	J1	STMG0911	163	12'' DIA	0.7%	203.00	201.80	210.7	208.1	203.5	202.9	203.6	203.0	3.1	1.4	1.9	--
C3	STMF126	J5554	59	12'' DIA	2.3%	166.02	164.69	170.4	170.5	166.7	165.2	166.7	165.2	5.4	3.9	3.9	--
C5	J9	STMF126	119	12'' DIA	1.3%	167.60	166.02	171.8	170.4	168.0	166.7	168.0	166.7	4.2	1.2	1.2	--
C6	J4162	STMF0913	134	30'' DIA	6.6%	199.00	190.20	202.0	203.4	199.7	191.6	199.7	191.6	105.3	15.8	16.1	--
CCT1-01	J-CCT1-02	OF_J-CCT1-01	913	Irregular Channel	2.6%	100.00	76.00	150.0	90.0	101.6	77.6	101.7	77.7		64.3	71.1	--
CCT1-02	J-CCT1-03	J-CCT1-02	594	Irregular Channel	2.0%	112.00	100.00	162.0	150.0	113.3	101.6	113.4	101.7		54.7	58.0	--
CCT1-03	J-CCT1-04	J-CCT1-03	335	Irregular Channel	2.7%	121.00	112.00	160.0	162.0	122.6	113.3	122.6	113.4		52.2	54.6	--
CCT1-04	J-CCT1-06	J-CCT1-05	688	Irregular Channel	1.1%	129.31	121.50	139.3	123.4	130.8	128.1	130.8	128.4		46.4	47.1	--
CCT1-05	J-CCT1-07	J-CCT1-06	61	Irregular Channel	1.1%	130.00	129.31	132.0	139.3	131.2	130.8	131.3	130.8		34.9	35.3	--
CCT2-01	J-CCT2-02	OF_J-CCT2-01	67	Irregular Channel	4.5%	100.00	97.00	109.0	109.0	101.0	100.0	101.0	100.0		48.7	51.1	--
CCT2-02	J-CCT2-03	J-CCT2-02	539	Irregular Channel	1.3%	107.00	100.00	150.0	109.0	109.1	101.0	109.1	101.0		40.3	42.0	--
CCT2-03	J-CCT2-04	J-CCT2-03	176	Irregular Channel	9.1%	123.00	107.00	173.0	150.0	124.1	109.1	124.1	109.1		37.4	38.8	--
CCT2-04	J-CCT2-05	J-CCT2-04	694	Irregular Channel	1.2%	131.00	123.00	156.0	173.0	132.8	124.1	132.8	124.1		33.8	35.1	--
CCT2-05	J-CCT2-06	J-CCT2-05	167	Irregular Channel	1.5%	133.50	131.00	158.5	156.0	134.7	132.8	134.7	132.8		31.1	31.7	--
CCT2-06	STMF135	J-CCT2-06	477	Irregular Channel	2.4%	145.00	133.50	161.6	158.5	146.1	134.7	146.1	134.7		23.4	23.8	--
CCT3-01	J-CCT3-02	OF_J-CCT3-01	1161	Irregular Channel	1.1%	112.00	99.00	152.0	140.0	115.5	101.9	115.6	102.0		210.7	231.6	--
CCT3-02	J-CCT3-03	J-CCT3-02	1460	Irregular Channel	0.5%	120.00	112.00	160.0	152.0	122.6	115.5	122.7	115.6		181.5	202.0	--
CCT3-03	J-CCT3-04	J-CCT3-03	644	Irregular Channel	1.2%	128.00	120.00	148.0	160.0	130.1	122.6	130.2	122.7		173.0	192.8	--
CCT3-04	J-CCT3-06	J-CCT3-05	319	Irregular Channel	2.5%	138.00	130.00	148.0	150.0	139.9	133.6	140.0	133.8		85.5	97.5	--
CCT3-05	J-CCT3-07	J-CCT3-06	571	Irregular Channel	1.2%	145.00	138.00	155.0	148.0	147.4	139.9	147.5	140.0		70.5	81.7	--
CCT3-06	J-CCT3-08	J-CCT3-07	149	Irregular Channel	2.0%	148.00	145.00	158.0	155.0	150.0	147.4	150.1	147.5		69.5	80.7	--
CCT3-07	J-CCT3-09	J-CCT3-08	303	Irregular Channel	2.6%	156.00	148.00	166.0	158.0	157.9	150.0	158.0	150.1		68.4	79.7	--
CCT3-08	J-CCT3-10	J-CCT3-09	215	Irregular Channel	1.9%	160.00	156.00	170.0	166.0	162.0	157.9	162.2	158.0		66.8	78.0	--
CCT3-09	J-CCT3-13	J-CCT3-12	393	Irregular Channel	1.4%	168.45	162.90	171.5	167.4	170.1	165.3	170.2	165.6		56.7	62.8	--
CCT3-10	J-CCT3-14	J-CCT3-13	188	Irregular Channel	1.4%	171.10	168.45	176.5	171.5	172.7	170.1	172.8	170.2		55.6	61.5	--
CCT3T1-01	STMF1224	J-CCT3-02	370	Irregular Channel	4.6%	129.10	112.00	152.6	152.0	130.5	115.5	130.6	115.6		30.8	31.2	--
CCT3T2-01	J3786	J-CCT3-05	752	Irregular Channel	1.8%	143.50	130.00	163.5	150.0	145.4	133.6	145.4	133.8		67.6	72.7	--
CCT3T3-01	J5386	J-CCT3-06	411	Irregular Channel	2.9%	150.00	138.00	170.0	148.0	150.8	139.9	150.8	140.0		13.7	14.2	--
HWY240_1	J-CCT3-05	J-CCT3-04	195	Irregular Channel	1.0%	130.00	128.00	150.0	148.0	133.6	130.1	133.8	130.2		158.5	177.3	--
STGM1012	STMF088	STMF089	181	15'' DIA	2.3%	204.24	200.13	209.7	205.3	205.0	200.9	205.0	200.9	10.1	6.3	6.4	--
STGM1017	STMG1029	STMG1028	201	36'' DIA	2.9%	190.30	184.50	194.4	194.6	195.6	195.5	199.2	199.0	115.6	19.0	22.5	Existing 10-yr
STGM1021	STMG078	STMG0851	129	18'' DIA	3.3%	242.40	238.10	247.2	242.8	243.4	242.9	243.6	243.2	19.9	7.2	7.4	--
STGM1039	STMG1245	STMG128	279	12'' DIA	0.5%	166.00	164.50	174.1	172.6	204.1	200.8	204.1	200.8	2.6	5.6	5.6	Existing 10-yr
STGM104	STMG0766	STMG0750	204	12'' DIA	8.1%	300.47	284.09	305.8	290.0	300.7	284.6	300.7	284.6	10.2	1.1	1.2	--
STGM1067	STMG0712	STMG0732	159	12'' DIA	3.2%	256.00	250.90	261.6	255.1	256.5	251.4	256.5	251.4	6.6	3.2	3.2	--
STGM1085	STMG1317	STMG1316	292	12'' DIA	2.8%	167.41	162.00	171.9	169.4	197.7	195.7	197.7	195.7	6.0	4.4	4.4	Existing 10-yr
STGM1091	STMF0845	STMF0844	260	12'' DIA	1.9%	197.68	192.85	201.8	196.7	198.2	196.7	198.2	196.7	5.0	2.5	2.5	--
STGM1093	STMG1310	STMG1312	262	15'' DIA	0.5%	164.50	163.10	169.9	169.4	191.9	190.0	191.9	190.0	4.7	7.1	7.1	Existing 10-yr
STGM1136	J4060	OF_J5408	313	12'' DIA	0.8%	153.98	151.48	163.0	158.3	154.9	152.3	154.9	152.3	3.2	3.3	3.4	--
STGM1139	STMF0832	STMF0831	225	12'' DIA	1.4%	203.44	200.29	210.0	206.6	204.1	201.6	204.1	201.6	4.4	3.0	3.0	--
STGM1148	STMG0718	STMG0715	113	12'' DIA	2.4%	256.68	254.03	270.1	260.1	260.0	254.8	260.2	254.8	5.7	6.7	6.7	--
STGM1156	STMG1413	STMG1414	317	18'' DIA	0.3%	162.00	161.00	170.3	168.8	163.0	161.4	163.0	161.4	5.9	4.6	4.6	--
STGM118	J3990	J-CCT3-16	123	1' H, 1'BW, 1 SS Channel	6.3%	182.00	174.28	187.0	179.1	182.3	175.5	182.3	175.5	12.1	1.2	1.6	--
STGM1182	STMF107	J4040	266	15'' DIA	1.8%	177.24	172.53	182.2	177.5	183.0	173.5	183.6	173.6	8.6	12.1	12.5	Existing 10-yr
STGM1192	STMF1011	STMF1012	29	33'' DIA	4.8%	150.89	149.35	166.6	166.1	152.2	150.7	152.3	150.8	116.2	54.6	57.9	--
STGM1212	J3692	J3694	60	18'' DIA	0.8%	185.00	184.50	191.9	187.4	187.6	186.5	188.3	186.6	9.6	14.4	15.3	--
STGM1223	STMG103	STMG101	152	12'' DIA	3.8%	194.51	188.80	205.6	200.0	195.2	189.9	195.2	189.9	7.0	5.7	5.9	--
STGM1234	J4400	J3514	87	12'' DIA	3.1%	227.50	224.80	230.9	227.3	233.0	228.3	233.2	228.5	6.5	9.1	9.1	Existing 10-yr
STGM1242	J5474	J3708	207	Irregular Channel	1.0%	187.00	185.00	191.8	190.0	188.5	188.3	188.8	188.7		33.6	38.1	--
STGM1249	STIF1138	J-CCT3-04	352	12'' DIA	0.9%	168.00	128.00	171.8	148.0	168.7	130.1	168.8	130.2	3.3	3.0	3.1	--
STGM1261	STMG0772	J3780	34	15'' DIA	3.5%	244.30	243.10	247.5	246.5	253.4	248.1	255.3	249.2	12.2	27.9	30.4	Existing 10-yr
STGM1273	J-CCT3-11	J-CCT3-10	67	42'' DIA	0.6%	160.41	160.00	169.0	170.0	163.2	162.0	163.6	162.2	42.5	66.8	78.0	--
STGM1276	STMF0814	STMF0815	163	12'' DIA	0.3%	205.00	204.50	211.0	212.1	205.5	204.9	205.5	204.9	2.0	1.0	1.0	--
STGM1303	STMF083	STMF086	437	24'' DIA	1.6%	218.19	211.36	225.5	217.3	219.1	212.4	219.1	212.4	28.6	12.6	12.7	--
STGM1309	STMG0811	STMG081	426	12'' DIA	1.6%	210.91	204.25	215.9	210.0	216.2	216.0	216.8	216.6	4.4	2.8	2.8	Existing 10-yr
STGM1325	STMG077	STMG0831	274	18'' DIA	1.1%	241.00	238.07	246.6	243.1	242.2	243.1	242.3	243.1	11.3	10.1	10.2	--
STGM1326	STMG0935	STMG0936	75	24'' DIA	1.5%	211.30	210.16	221.5	221.0	217.5	217.0	222.7	221.9	29.3	20.8	25.2	Future 10-yr
STGM1327	STIF132	STIF131	60	15'' DIA	0.2%	151.50	151.40	157.4	157.4	152.2	151.7	152.2	151.7	2.6	3.0	3.3	--
STGM1333	STMG135	STMG134	261	12'' DIA	0.3%	159.50	158.70	170.2	169.4	193.9	192.6	194.0	192.6	2.0	3.9	3.9	Existing 10-yr
STGM1335	J3694	J4318	354	Irregular Channel	1.1%	184.50	180.00	187.4	183.0	186.5	182.1	186.6	183.0		46.8	52.4	--
STGM1339	STMG1326	J4142	231	12'' DIA	3.5%	158.10	150.00	165.6	155.7	163.6	150.6	164.3	150.6	6.7	7.8	8.0	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM1340	J4946	J4948	19	18'' DIA	0.5%	171.50	171.40	173.5	173.8	172.8	172.0	172.8	172.0	7.6	10.0	10.1	--
STGM1342	J3780	STIG0710	192	Irregular Channel	2.0%	243.10	239.30	246.5	243.0	248.1	247.6	249.2	248.7		29.3	30.2	Existing 10-yr
STGM1356	STMG0859	STMG0858	97	15'' DIA	0.9%	245.36	244.49	250.6	250.3	246.5	245.6	248.5	247.4	6.4	7.1	7.1	--
STGM1370	STMG0744	STMG0742	156	12'' DIA	3.6%	262.97	257.32	268.2	262.5	263.3	262.5	263.4	262.5	7.1	1.9	2.1	--
STGM1372	STMG0860	STMG0859	218	15'' DIA	2.3%	250.40	245.36	256.1	250.6	251.2	246.5	251.2	248.5	10.2	7.1	7.1	--
STGM1380	STMG0850	STMG0829	185	36'' DIA	0.7%	229.13	227.89	237.3	235.1	238.1	237.4	238.3	237.7	54.6	40.9	41.1	Existing 10-yr
STGM1384	STIG0778	STMG0751	174	12'' DIA	2.2%	290.53	286.67	297.0	289.9	290.9	287.0	290.9	287.0	5.5	1.3	1.3	--
STGM140	STMG1036	STIG09106	446	21'' DIA	1.1%	201.00	196.30	204.9	198.4	201.8	197.1	202.0	199.4	17.0	6.8	10.0	--
STGM1417	J3700	J-CCT1-03	114	Irregular Channel	19.7%	140.00	112.00	152.0	162.0	140.4	113.3	140.4	113.4		3.6	3.6	--
STGM1431	J4938	STIF109	413	24'' DIA	0.7%	184.00	181.10	195.8	190.6	195.4	191.8	197.7	194.2	19.0	18.3	21.1	Future 10-yr
STGM1435	STMG0729	STMG075	323	24'' DIA	0.8%	232.43	229.78	242.9	234.3	234.9	231.3	235.4	231.3	20.6	23.2	24.4	--
STGM1455	STMG0831	STMG0850	270	18'' DIA	3.3%	238.07	229.13	243.1	237.3	243.1	238.1	243.1	238.3	19.8	10.1	10.2	--
STGM1483	STMG094	STMG0913	231	12'' DIA	0.7%	204.63	203.01	209.1	207.9	210.7	208.2	210.9	208.4	3.0	3.9	4.0	Existing 10-yr
STGM1485	STMF0910	STMF103	335	12'' DIA	1.5%	186.00	181.00	191.0	190.5	192.8	190.3	194.6	192.3	4.4	3.5	3.2	Existing 10-yr
STGM149	STMF0716	STMF0713	227	21'' DIA	1.5%	207.75	204.26	213.2	207.9	208.7	205.2	208.7	205.2	19.7	11.4	11.4	--
STGM1492	STMF089	STMF0824	60	18'' DIA	1.5%	200.13	199.23	205.3	204.5	200.9	200.0	200.9	200.0	13.5	6.3	6.4	--
STGM1494	STMF094	STMF093	110	36'' DIA	0.8%	189.97	189.10	200.2	198.1	191.1	190.3	191.2	190.3	60.3	19.0	19.2	--
STGM1500	STIG0890	STMG0845	14	18'' DIA	0.2%	219.93	219.90	226.2	225.8	227.4	227.3	227.6	227.5	4.9	15.6	15.5	Existing 10-yr
STGM1524	STMF0932	STMF091	155	36'' DIA	0.7%	185.81	184.65	193.0	190.4	187.3	185.7	187.3	185.8	57.9	27.2	27.9	--
STGM1532	J3664	J3666	375	Irregular Channel	0.1%	200.30	200.00	205.2	203.9	216.0	216.0	216.5	216.5		38.2	38.2	Existing 10-yr
STGM1534	STMF078	STMG0718	121	12'' DIA	1.8%	258.86	256.68	262.9	270.1	262.9	260.0	262.9	260.2	5.0	6.7	6.7	--
STGM1540	STMF0825	STMF0826	490	18'' DIA	1.3%	198.00	191.54	202.9	199.3	198.8	195.2	198.8	195.6	12.4	6.3	6.4	--
STGM1544	STMG0835	STMG0836	164	33'' DIA	1.4%	212.96	210.60	218.4	215.4	214.4	212.3	214.4	212.3	63.0	33.4	34.4	--
STGM1548	STMG084	STMG083	161	15'' DIA	0.6%	209.23	208.26	215.2	214.8	217.9	217.9	218.3	218.3	5.0	1.7	1.7	Existing 10-yr
STGM156	STMG147	STIG1416	8	12'' DIA	171.4%	128.19	121.28	143.8	144.1	128.4	124.8	128.5	125.0	44.3	4.4	7.0	--
STGM1563	STMG128	STMG1316	719	18'' DIA	0.3%	164.50	162.00	172.6	169.4	200.8	195.7	200.8	195.7	6.2	12.1	12.1	Existing 10-yr
STGM1576	STMF0843	STMF0842	196	12'' DIA	0.6%	191.98	190.80	195.5	196.4	195.5	193.3	195.5	193.4	2.9	2.5	2.5	--
STGM1601	STMF1217	STMF1218	228	18'' DIA	2.9%	175.00	168.49	183.8	176.9	175.6	169.1	175.6	169.1	17.8	6.2	6.2	--
STGM1602	STMG071	STMG072	247	18'' DIA	1.3%	226.07	222.75	230.4	225.9	227.0	224.0	227.0	224.0	12.2	8.8	8.9	--
STGM1604	STMF074	STMF0810	478	36'' DIA	0.5%	199.28	196.84	202.6	201.4	201.5	198.6	201.7	198.8	47.8	45.0	48.8	--
STGM1606	STMG1412	STMG136	220	18'' DIA	1.7%	158.80	155.05	168.7	163.8	160.0	155.7	160.0	155.7	13.7	12.1	12.2	--
STGM1615	STMF1227	STMF1226	53	36'' DIA	1.2%	158.04	157.40	166.0	165.5	159.3	158.7	159.3	158.7	74.2	26.7	26.7	--
STGM163	J4948	OF_J4952	68	Irregular Channel	2.8%	171.40	169.50	173.8	171.5	172.0	170.0	172.0	170.0		12.0	12.0	--
STGM1631	STMF0826	STMF0811	108	36'' DIA	0.2%	191.54	191.30	199.3	199.9	195.2	194.5	195.6	194.7	31.5	56.0	59.8	--
STGM1638	J4526	STMG0864	43	12'' DIA	7.4%	229.40	226.19	230.9	231.2	235.0	234.6	235.2	234.9	10.0	3.8	3.8	Existing 10-yr
STGM1641	J4120	J3728	173	Irregular Channel	2.0%	199.00	195.50	203.0	202.3	202.1	202.0	202.2	202.2		51.4	52.3	--
STGM1645	J4634	J3932	39	12'' DIA	6.7%	162.60	160.00	166.5	165.0	163.1	160.7	163.2	160.7	9.6	5.4	6.2	--
STGM1656	STMG1321	STMG1319	250	10'' DIA	0.5%	165.57	164.32	171.9	169.5	189.2	181.3	190.3	182.5	1.6	4.7	4.6	Existing 10-yr
STGM166	STMG0845	STMG0846	88	24'' DIA	0.5%	219.90	219.50	225.8	228.6	227.3	224.7	227.5	224.9	15.2	41.2	41.1	Existing 10-yr
STGM1663	STMF0926	J-CCT3-18	23	36'' DIA	3.5%	180.78	180.00	185.8	185.0	181.9	181.2	181.9	181.2	125.0	33.9	34.9	--
STGM1672	STMG0727	STMG0729	114	27'' DIA	2.0%	234.70	232.43	238.6	242.9	235.9	234.9	236.1	235.4	43.8	23.0	24.4	--
STGM1679	STIF137	J4500	273	12'' DIA	1.5%	150.10	146.00	158.8	152.1	150.7	146.3	150.7	146.3	4.4	2.2	2.4	--
STGM1702	STMF0831	STMF0830	276	12'' DIA	0.4%	200.29	199.12	206.6	203.4	201.6	200.0	201.6	200.0	2.4	3.0	3.0	--
STGM171	STMG102	STMG103	310	12'' DIA	1.7%	199.76	194.51	210.1	205.6	210.1	195.2	210.1	195.2	4.6	5.7	5.9	--
STGM1718	STIF0876	STIF0875	154	12'' DIA	0.7%	191.96	190.90	195.5	194.3	192.7	191.3	192.7	191.3	3.1	2.6	2.6	--
STGM1727	STMF0821	STMF0813	19	24'' DIA	7.4%	205.66	204.29	212.5	212.5	206.5	205.9	206.5	205.9	61.2	16.5	16.7	--
STGM173	STMG0916	STMG0917	154	12'' DIA	0.9%	191.69	190.30	198.8	197.6	192.4	190.9	192.4	190.9	3.4	2.7	2.8	--
STGM1740	STMG143	STMG145	183	12'' DIA	0.4%	160.47	159.65	167.0	166.4	161.6	160.4	161.7	160.4	2.4	2.8	3.0	--
STGM1741	STMF0824	STMF0825	108	18'' DIA	1.1%	199.23	198.00	204.5	202.9	200.0	198.8	200.0	198.8	11.7	6.3	6.4	--
STGM1769	STMG133	STMG132	300	18'' DIA	0.1%	157.92	157.50	167.3	165.5	191.3	180.7	191.3	180.7	3.9	20.8	20.8	Existing 10-yr
STGM1778	STMG0731	STMG0730	134	12'' DIA	4.2%	268.21	262.62	273.7	266.8	268.5	263.3	268.5	263.3	7.7	1.5	1.5	--
STGM1799	STMG097	STMG0910	200	24'' DIA	0.9%	204.55	202.75	212.8	215.7	210.2	204.3	212.4	204.4	11.6	20.8	24.6	--
STGM18	J4040	STMF102	127	18'' DIA	2.0%	172.53	169.96	177.5	175.0	173.5	171.4	173.6	171.4	14.9	11.9	12.3	--
STGM1815	STMG085	STMG084	217	15'' DIA	0.8%	211.01	209.23	216.5	215.2	218.0	217.9	218.3	218.3	5.9	1.6	1.7	Existing 10-yr
STGM1828	STMG0714	STMG0713	261	12'' DIA	5.9%	295.85	280.50	300.4	284.9	296.3	280.8	296.3	280.8	9.1	3.2	3.2	--
STGM1830	STIF1290	STMF126	13	8'' DIA	12.0%	167.61	166.02	170.7	170.4	168.0	166.7	168.0	166.7	4.2	2.9	2.9	--
STGM1831	J4058	J4060	128	12'' DIA	0.8%	155.00	153.98	162.3	163.0	155.9	154.9	155.9	154.9	3.2	3.3	3.4	--
STGM1834	J5472	J5474	63	33'' DIA	0.8%	187.50	187.00	192.4	191.8	189.2	188.5	189.4	188.8	46.7	33.6	38.1	--
STGM1838	STMG0717	J3540	151	12'' DIA	6.3%	249.02	239.50	252.1	242.8	249.8	240.4	249.8	240.4	9.0	8.8	8.9	--
STGM1854	J4298	J3514	252	Irregular Channel	0.0%	224.90	224.80	227.9	227.3	228.3	228.3	228.5	228.5		5.4	5.8	Existing 10-yr
STGM1858	STMF1022	J-CCT3-08	145	15'' DIA	5.7%	160.25	148.00	171.4	158.0	160.5	150.0	160.5	150.1	16.3	1.1	1.1	--
STGM186	STMG0813	STMG0812	145	33'' DIA	2.4%	204.50	201.10	210.7	210.0	217.1	216.1	217.4	216.7	43.9	48.7	48.6	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM1861	STMF097	STMF0926	435	15'' DIA	1.4%	190.32	180.78	196.5	185.8	191.0	181.9	191.0	181.9	8.0	4.0	4.3	--
STGM1868	STMG0742	STMG0768	300	12'' DIA	2.6%	257.32	249.66	262.5	253.5	262.5	259.4	262.5	260.9	6.0	1.9	2.1	--
STGM1872	STMG1232	STMG1218	543	12'' DIA	0.7%	165.59	161.72	172.2	168.3	175.2	173.7	175.2	173.7	3.0	2.8	2.8	Existing 10-yr
STGM1876	J7	J5554	294	12'' DIA	2.6%	172.43	164.69	175.3	170.5	175.4	165.2	175.4	165.2	5.8	11.9	11.9	Existing 10-yr
STGM1879	STMG1218	STMF135	635	18'' DIA	2.6%	161.72	145.00	168.3	161.6	173.7	146.1	173.7	146.1	17.0	21.8	21.8	Existing 10-yr
STGM1882	STIG1416	J-CCT1-04	42	24'' DIA	0.7%	121.28	121.00	144.1	160.0	124.8	122.6	125.0	122.6	18.5	50.1	52.1	--
STGM1885	STMF0812	J3760	35	36'' DIA	10.8%	189.70	185.90	195.7	192.5	190.9	189.7	191.0	189.8	216.7	58.5	63.6	--
STGM1895	STMG0864	J4400	28	12'' DIA	-4.6%	226.19	227.50	231.2	230.9	234.6	233.0	234.9	233.2	8.0	9.2	9.3	Existing 10-yr
STGM1902	STMF103	J4362	216	18'' DIA	0.8%	181.00	179.30	190.5	185.4	190.3	180.3	192.3	180.4	9.3	21.3	23.6	Future 10-yr
STGM1922	STMG0724	STMG076	138	18'' DIA	1.1%	228.95	227.40	233.0	231.5	229.6	227.7	229.6	227.7	11.0	3.5	3.6	--
STGM1942	STMF0713	STMF076	281	27'' DIA	1.1%	204.26	201.20	207.9	205.0	205.2	202.2	205.2	202.2	32.6	11.4	11.4	--
STGM1952	STMG075	STMG074	129	24'' DIA	1.3%	229.78	228.10	234.3	233.7	231.3	229.5	231.3	229.5	25.9	23.0	24.4	--
STGM1959	J5064	J3530	53	18'' DIA	1.0%	217.53	217.00	219.0	219.0	218.4	217.5	218.7	217.7	10.4	6.8	10.1	--
STGM196	STIF0867	STIF0876	176	12'' DIA	0.6%	193.06	191.96	196.9	195.5	193.8	192.7	193.8	192.7	2.9	2.6	2.6	--
STGM1964	J4142	J-CCT2-06	266	Irregular Channel	6.2%	150.00	133.50	155.7	158.5	150.6	134.7	150.6	134.7		7.8	8.0	--
STGM1971	STMG138	STMG1411	284	12'' DIA	1.5%	159.96	155.62	168.3	163.9	160.8	156.1	160.8	156.1	4.4	3.9	4.1	--
STGM1972	STMF0929	STMF097	35	12'' DIA	6.0%	192.41	190.32	196.7	196.5	192.7	191.0	192.7	191.0	8.9	1.3	1.5	--
STGM1993	STMF073	STMF071	102	18'' DIA	1.2%	221.91	220.65	224.4	225.8	222.9	222.3	223.0	222.3	11.6	8.8	8.9	--
STGM200	J4770	STIG1016	90	18'' DIA	0.4%	185.50	185.10	191.7	190.8	188.3	187.8	190.5	188.4	7.0	6.9	7.5	--
STGM2013	STMG0852	STMG0830	242	27'' DIA	1.0%	234.17	231.75	239.1	238.0	241.6	240.3	241.8	240.5	32.0	24.1	24.2	Existing 10-yr
STGM2016	STMF0815	STMF0816	263	12'' DIA	0.5%	204.50	203.09	212.1	208.7	204.9	203.6	204.9	203.6	2.7	1.0	1.0	--
STGM2021-A	J4898	J5576	466	Irregular Channel	1.0%	172.38	167.50	180.5	172.0	174.3	169.1	174.3	169.1		47.8	50.9	--
STGM2021-B	J5576	J5034	464	Irregular Channel	2.6%	167.50	154.93	172.0	166.7	169.1	157.5	169.1	157.9		54.7	58.1	--
STGM2046	J4632	J4634	252	Irregular Channel	0.4%	163.50	162.60	166.2	166.5	164.3	163.1	164.4	163.2		5.4	6.2	--
STGM2055	STMG146	J5354	65	15'' DIA	6.1%	157.00	153.00	163.5	163.0	157.4	153.4	157.4	153.5	15.9	4.0	4.3	--
STGM2057	STMG1322	STMG1323	59	18'' DIA	0.2%	157.40	157.30	165.5	165.4	178.0	175.9	178.0	175.9	4.3	19.7	19.7	Existing 10-yr
STGM2064	STMG0818	J4298	254	18'' DIA	0.2%	225.36	224.90	228.6	227.9	228.7	228.3	228.9	228.5	4.5	5.4	5.8	Existing 10-yr
STGM2078	STMG074	STMG073	160	27'' DIA	1.2%	228.10	226.20	233.7	231.3	229.5	227.6	229.5	227.6	33.9	23.0	24.4	--
STGM2082	STMG0833	STMG0832	259	18'' DIA	2.5%	247.00	240.50	252.5	245.3	247.9	245.3	247.9	245.3	17.5	10.3	10.5	--
STGM2095	J4818	J5398	137	18'' DIA	0.7%	176.00	175.00	188.5	183.8	178.9	175.7	179.1	175.7	9.0	12.0	12.0	--
STGM2101	STMG096	STMG0914	79	12'' DIA	2.1%	202.94	201.30	210.5	208.5	216.0	216.0	216.6	216.6	5.1	2.9	2.9	Existing 10-yr
STGM2108	STIG1024	STIG1031	130	12'' DIA	0.0%	187.02	187.00	189.4	190.4	194.7	192.1	196.6	193.8	0.4	5.1	5.4	Existing 10-yr
STGM2135	STMG0767	STMG0747	146	15'' DIA	3.0%	265.52	261.20	270.7	265.5	266.2	261.8	266.2	261.8	11.6	6.0	6.2	--
STGM2147	J4362	J-CCT3-14	213	Irregular Channel	3.9%	179.30	171.10	185.4	176.5	180.3	172.7	180.4	172.8		21.3	23.5	--
STGM2160	J3708	J3694	410	33'' DIA	0.1%	185.00	184.50	190.0	187.4	188.3	186.5	188.7	186.6	18.4	33.6	37.8	--
STGM2165	STMF0915	STMF0916	66	15'' DIA	0.7%	192.18	191.75	205.6	207.3	192.9	192.3	192.9	192.3	5.4	3.3	3.3	--
STGM2167	STMF0829	STMF0827	26	15'' DIA	1.2%	198.35	198.03	201.9	201.5	199.1	198.5	199.1	198.6	7.4	4.8	4.8	--
STGM2210	J3530	STMG1036	314	18'' DIA	5.1%	217.00	201.00	219.0	204.9	217.5	201.8	217.7	202.0	25.1	6.8	10.0	--
STGM2213	STMG0853	STMG0864	213	18'' DIA	-0.8%	224.49	226.19	229.1	231.2	235.2	234.6	235.5	234.9	9.8	5.8	5.9	Existing 10-yr
STGM2219	STIF1135	STIF1138	58	12'' DIA	0.5%	168.60	168.00	173.0	171.8	169.5	168.7	169.5	168.8	2.6	3.0	3.1	--
STGM2237	STMF084	STMF083	223	21'' DIA	0.2%	218.62	218.19	225.3	225.5	220.9	219.1	221.0	219.1	7.0	12.6	12.7	--
STGM2269	STMG0865	STMG0852	21	18'' DIA	4.2%	235.06	234.17	239.5	239.1	241.7	241.6	241.9	241.8	22.2	7.0	7.1	Existing 10-yr
STGM2271	STMG0822	STMG089	262	27'' DIA	1.0%	224.48	221.73	229.2	226.5	226.0	223.4	226.0	223.4	31.9	24.9	26.2	--
STGM2277	STMF0911	STMF0910	191	12'' DIA	0.5%	186.90	186.00	194.2	191.0	194.4	192.8	195.9	194.6	2.4	3.4	3.3	Existing 10-yr
STGM2280	STMG1023	STMG1024	237	15'' DIA	0.6%	182.09	180.74	187.1	186.8	182.9	182.6	185.5	183.5	5.1	2.9	3.0	--
STGM2281	STMG095	STMG094	311	12'' DIA	-0.1%	204.18	204.63	209.3	209.1	214.3	210.7	214.6	210.9	1.4	4.0	4.1	Existing 10-yr
STGM2290	STMG0776	STMG0777	132	36'' DIA	2.2%	248.31	245.36	256.2	250.9	265.9	265.9	269.3	269.2	102.3	11.5	12.1	Existing 10-yr
STGM2311	STMG0851	STMG0852	262	24'' DIA	1.5%	238.10	234.17	242.8	239.1	242.9	241.6	243.2	241.8	29.0	17.5	17.7	Existing 10-yr
STGM2358	STMG0814	STMG087	290	12'' DIA	1.4%	218.02	213.97	221.3	217.3	218.8	217.5	218.8	217.8	4.2	2.7	2.7	--
STGM2371	STMF0816	J4120	160	15'' DIA	2.6%	203.09	199.00	208.7	203.0	203.6	202.1	203.6	202.2	10.8	3.9	3.9	--
STGM2383	STMF0924	J3838	131	18'' DIA	1.0%	183.64	182.30	193.3	191.2	184.8	183.1	184.8	183.1	11.1	10.0	10.2	--
STGM2390	J4888	J-CCT2-04	85	12'' DIA	25.4%	144.00	123.00	146.0	173.0	144.3	124.1	144.3	124.1	18.1	3.8	3.9	--
STGM2405	STMG0749	STMG0767	239	15'' DIA	4.5%	276.33	265.52	282.8	270.7	276.9	266.2	276.9	266.2	14.3	6.0	6.2	--
STGM2406	J5304	STMF116	225	12'' DIA	0.4%	174.00	173.10	182.4	179.5	194.4	190.1	194.5	190.2	2.3	5.4	5.5	Existing 10-yr
STGM2407	STMG089	STMG0820	199	33'' DIA	0.6%	221.73	220.62	226.5	225.4	223.4	221.7	223.4	221.7	39.3	26.3	27.6	--
STGM2430	STMG1219	STMG1218	82	18'' DIA	0.6%	162.20	161.72	169.2	168.3	176.5	173.7	176.5	173.7	8.0	20.4	20.4	Existing 10-yr
STGM2438	STMF0842	STMF0812	142	36'' DIA	0.8%	190.80	189.70	196.4	195.7	193.3	190.9	193.4	191.0	58.5	58.5	62.3	--
STGM244	STMF0811	STMF0842	161	36'' DIA	0.3%	191.30	190.80	199.9	196.4	194.5	193.3	194.7	193.4	37.1	56.0	59.8	--
STGM2443	J4482	J4898	168	24'' DIA	2.4%	176.38	172.38	180.8	180.5	181.8	174.3	182.9	174.3	34.9	51.2	55.2	Existing 10-yr
STGM245	J3516	STIG0894	33	Irregular Channel	3.3%	224.36	223.30	227.2	226.8	227.9	227.9	228.1	228.1		15.2	14.5	Existing 10-yr
STGM2457	STMG0827	STMG0845	271	24'' DIA	0.6%	221.54	219.90	231.5	225.8	232.8	227.3	233.1	227.5	17.4	33.1	33.2	Existing 10-yr
STGM2463	STMF0927	J3990	133	12'' DIA	0.5%	182.71	182.00	188.5	187.0	183.2	182.3	183.3	182.3	2.7	1.2	1.6	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM2468	STMG0847	J4526	120	12'' DIA	0.5%	229.97	229.40	233.3	230.9	236.1	235.0	236.3	235.2	2.6	4.0	4.0	Existing 10-yr
STGM2486	STMG098	STMG097	102	18'' DIA	0.8%	205.33	204.55	214.9	212.8	214.2	210.2	218.0	212.4	9.2	20.8	24.7	Future 10-yr
STGM2489	STMG0821	STMG0822	63	33'' DIA	0.5%	224.82	224.48	229.7	229.2	226.4	226.0	226.5	226.0	38.8	24.9	26.2	--
STGM2499	J3728	J3730	26	18'' DIA	2.7%	195.50	194.80	202.3	202.4	202.0	196.6	202.2	196.6	17.4	48.3	48.9	--
STGM2506	J2	STIG1022	135	12'' DIA	0.3%	188.89	188.47	193.9	191.4	204.1	201.1	207.4	203.9	2.0	6.2	6.7	Existing 10-yr
STGM252	STMG0710	STMG079	94	18'' DIA	2.7%	247.10	244.55	248.1	252.0	247.8	245.3	247.8	245.3	18.1	7.2	7.4	--
STGM2536	STMF117	J5422	122	18'' DIA	0.1%	167.22	167.05	170.0	168.8	168.5	167.7	168.5	167.7	3.9	7.6	7.6	--
STGM2549	STMG0720	STMG0711	152	12'' DIA	4.2%	256.47	250.10	261.2	254.9	257.3	250.9	257.3	251.0	7.6	7.2	7.4	--
STGM2556	STMF0810	STMF0826	392	36'' DIA	1.4%	196.84	191.54	201.4	199.3	198.6	195.2	198.8	195.6	77.6	49.7	53.5	--
STGM2591	STIG0777	STIG0778	30	10'' DIA	0.6%	290.71	290.53	296.5	297.0	291.2	290.9	291.2	290.9	1.8	1.2	1.3	--
STGM2595	STMG0747	STMG0771	18	15'' DIA	3.3%	261.20	260.62	265.5	265.4	261.8	261.3	261.8	261.3	12.3	6.0	6.2	--
STGM2596	STMG099	STMG1021	837	33'' DIA	1.1%	201.50	192.00	208.6	202.6	202.8	193.7	202.9	193.9	56.4	24.8	29.1	--
STGM2605	STMG121	STMG1226	321	12'' DIA	0.6%	167.00	165.13	172.7	171.9	208.7	184.6	208.6	184.5	2.7	10.6	10.6	Existing 10-yr
STGM2635	STIF1287	STIF129	206	12'' DIA	1.0%	171.84	169.71	174.6	172.8	211.2	209.8	211.2	209.8	3.6	4.6	4.6	Existing 10-yr
STGM2656	STMF0922	STMF0923	166	18'' DIA	0.9%	188.07	186.61	199.2	197.6	189.3	187.8	189.3	187.8	10.2	10.0	10.2	--
STGM2669	STMF0720	STMF0833	216	12'' DIA	0.8%	202.21	200.47	204.2	202.5	202.7	201.0	202.7	201.0	3.4	1.8	1.8	--
STGM2676	STMG1210	STMG1232	248	12'' DIA	0.6%	167.05	165.59	173.7	172.2	175.9	175.2	175.9	175.2	2.7	2.8	2.8	Existing 10-yr
STGM2681	STMG0722	STMG077	137	12'' DIA	1.1%	242.48	241.00	248.2	246.6	247.0	242.2	247.0	242.3	3.8	5.5	5.7	--
STGM2686	STMF113	STMF1012	137	33'' DIA	5.1%	160.38	149.35	168.7	166.1	161.0	150.7	161.0	150.8	125.6	11.3	12.5	--
STGM2687	STMG1227	STMG1219	279	18'' DIA	0.6%	163.82	162.20	170.6	169.2	182.7	176.5	182.6	176.5	8.0	16.3	16.3	Existing 10-yr
STGM2689b	J5554	STMF1220	53	24'' DIA	7.7%	164.69	160.62	170.5	172.3	165.2	161.5	165.2	161.5	64.5	9.7	9.7	--
STGM2690	STMG0725	STMG0724	66	12'' DIA	2.2%	230.43	228.95	233.8	233.0	231.0	229.6	231.0	229.6	5.4	3.5	3.6	--
STGM2693	STMF134	J4894	171	12'' DIA	1.5%	146.60	144.10	152.3	150.5	151.3	144.4	152.3	144.4	4.3	4.8	5.0	--
STGM2699	STMF0813	STIF0817	243	36'' DIA	1.7%	204.29	200.10	212.5	207.3	205.9	202.1	205.9	202.3	87.4	49.9	51.2	--
STGM2705	STIF1132	STIF1133	73	12'' DIA	0.7%	172.10	171.50	177.9	175.3	172.9	172.2	172.9	172.2	2.9	3.0	3.1	--
STGM2710	J5034	STMF1010	137	33'' DIA	0.8%	154.93	153.57	166.7	166.9	157.5	155.1	157.9	155.2	48.8	54.7	58.1	--
STGM2711	STMG0738	STMG0735	143	12'' DIA	1.1%	245.09	243.49	250.3	249.5	250.4	248.1	251.1	249.5	3.9	5.5	5.7	Existing 10-yr
STGM272	STMF0844	STMF0843	164	12'' DIA	0.5%	192.85	191.98	196.7	195.5	196.7	195.5	196.7	195.5	2.7	2.5	2.5	--
STGM2735	STMF1220	STMF1221	94	36'' DIA	1.5%	160.62	159.23	172.3	166.8	161.5	160.5	161.5	160.5	79.4	15.9	15.9	--
STGM2737	STMG1022	STMG1023	220	15'' DIA	0.6%	183.41	182.09	188.6	187.1	184.1	182.9	184.1	185.5	5.2	2.9	3.0	--
STGM275	STMF075	STMF074	155	36'' DIA	0.6%	200.16	199.28	203.5	202.6	201.5	201.5	201.7	201.7	50.3	11.4	11.4	--
STGM2759	STMG0832	STMG0851	250	21'' DIA	1.0%	240.50	238.10	245.3	242.8	245.3	242.9	245.3	243.2	15.6	10.3	10.4	--
STGM276	STMG0828	STMG0827	120	24'' DIA	0.8%	222.44	221.54	232.2	231.5	235.4	232.8	235.6	233.1	19.6	33.2	33.3	Existing 10-yr
STGM2761	STIF1262	OF_J3682	296	12'' DIA	19.3%	145.18	93.00	154.2	123.8	149.6	93.6	149.6	93.6	15.7	10.4	10.4	--
STGM2763	STMG081	STMG096	106	12'' DIA	1.2%	204.25	202.94	210.0	210.5	216.0	216.0	216.6	216.6	4.0	3.0	2.9	Existing 10-yr
STGM277	STMG0853	STMG0825	91	18'' DIA	1.7%	224.49	222.92	229.1	229.9	235.2	235.5	235.5	235.7	14.4	5.8	5.9	Existing 10-yr
STGM2776	STMG1316	STMG133	357	18'' DIA	1.1%	162.00	157.92	169.4	167.3	195.7	191.3	195.7	191.3	11.2	13.2	13.2	Existing 10-yr
STGM2786	J4402	STMF109	199	12'' DIA	0.6%	182.41	181.25	190.8	186.3	189.3	186.3	188.7	186.3	2.7	3.6	3.7	--
STGM2791	STMG0765	STMG0762	247	12'' DIA	0.5%	340.04	338.85	345.6	344.1	340.6	339.1	340.6	339.1	2.5	1.2	1.3	--
STGM2796	STMF0836	STMF0837	275	12'' DIA	1.8%	192.16	187.20	195.8	193.7	192.7	187.7	192.7	187.7	5.0	2.6	2.6	--
STGM2798	STMF0830	STMF0829	120	15'' DIA	0.6%	199.12	198.35	203.4	201.9	200.0	199.1	200.0	199.1	5.4	4.8	4.8	--
STGM2801	STMG0855	STMG0833	279	15'' DIA	2.2%	253.08	247.00	266.7	252.5	253.9	247.9	253.9	247.9	9.9	7.2	7.3	--
STGM2827	STMG136	J-CCT1-06	286	21'' DIA	8.8%	155.05	129.31	163.8	139.3	155.7	130.8	155.7	130.8	46.5	12.1	12.2	--
STGM2829	STMG079	STMG078	121	18'' DIA	1.8%	244.55	242.40	252.0	247.2	245.3	243.4	245.3	243.6	14.5	7.2	7.4	--
STGM2842	STMG0819	STMG086	457	33'' DIA	1.3%	218.34	212.42	223.2	217.4	221.6	219.0	221.9	219.3	60.0	44.7	44.7	--
STGM2845	STMF0823	STMF0822	328	12'' DIA	0.3%	204.32	203.22	210.5	208.7	207.0	204.0	206.7	204.0	2.2	2.9	2.9	--
STGM2847	STMF072	STMF084	183	18'' DIA	0.9%	220.30	218.62	226.0	225.3	222.2	220.9	222.2	221.0	10.0	8.8	8.9	--
STGM2848	STMG0810	STMG089	175	15'' DIA	1.4%	224.14	221.73	227.4	226.5	224.6	223.4	224.6	223.4	7.5	2.3	2.3	--
STGM2857	STMG0771	STMG0720	133	15'' DIA	3.1%	260.62	256.47	265.4	261.2	261.3	257.3	261.3	257.3	11.3	6.0	6.2	--
STGM2903	STIG1022	STIG1023	278	12'' DIA	0.5%	188.47	187.20	191.4	189.5	201.1	195.4	203.9	197.4	2.4	5.8	6.2	Existing 10-yr
STGM2904	STMG0711	STMG0710	76	12'' DIA	3.9%	250.10	247.10	254.9	248.1	250.9	247.8	251.0	247.8	7.4	7.2	7.4	--
STGM2909	J-CCT1-05	STIG1416	88	24'' DIA	0.3%	121.50	121.28	123.4	144.1	128.1	124.8	128.4	125.0	11.3	50.2	51.2	Existing 10-yr
STGM2941	STMH071	J4972	26	12'' DIA	6.1%	269.29	268.10	275.6	274.5	270.0	268.4	270.0	268.4	8.9	1.8	1.8	--
STGM2961	STMF0913	STMF094	89	36'' DIA	0.3%	190.20	189.97	203.4	200.2	191.6	191.1	191.6	191.2	34.0	17.3	17.5	--
STGM2969	J3896	J5174	65	33'' DIA	1.1%	188.70	188.00	196.0	193.5	190.4	189.9	190.5	190.0	55.1	33.6	38.1	--
STGM2972	STIF1324	J-CCT2-02	493	12'' DIA	8.1%	140.00	100.00	149.5	109.0	140.6	101.0	140.6	101.0	10.2	6.1	6.1	--
STGM2973	STIF1133	STIF1134	98	12'' DIA	1.0%	171.50	170.40	175.3	174.7	172.2	171.1	172.2	171.1	3.6	3.0	3.1	--
STGM298	STMG0715	STMG0717	113	12'' DIA	4.4%	254.03	249.02	260.1	252.1	254.8	249.8	254.8	249.8	7.8	6.7	6.7	--
STGM2982	J3688	STMF117	467	12'' DIA	1.2%	172.98	167.22	177.1	170.0	189.6	168.5	189.6	168.5	4.0	7.9	7.9	Existing 10-yr
STGM2988	STMG0924	J5064	1248	24'' DIA	0.0%	218.00	217.53	223.8	219.0	219.5	218.4	219.5	218.7	4.4	4.1	4.5	--
STGM2992	STMG0721	STMG0720	257	12'' DIA	3.0%	264.20	256.47	270.5	261.2	264.5	257.3	264.5	257.3	6.2	1.2	1.2	--
STGM2996	STMF0837	OF_J5574	42	15'' DIA	0.9%	187.20	186.80	193.7	194.0	187.7	187.3	187.7	187.3	6.6	2.6	2.6	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM2997	STMF0925	STMF0922	297	12'' DIA	0.7%	190.26	188.07	197.5	199.2	190.7	189.3	190.7	189.3	3.1	1.1	1.2	--
STGM2999	STMG144	STMG141	261	12'' DIA	1.2%	157.50	154.32	164.0	162.3	158.3	154.9	158.3	154.9	3.9	3.6	3.6	--
STGM3000	STMG0854	STMG0819	96	27'' DIA	1.0%	219.30	218.34	224.2	223.2	223.4	221.6	223.6	221.9	30.8	44.7	44.7	--
STGM3028	STIF0877	STIF0867	159	12'' DIA	0.8%	194.40	193.06	199.1	196.9	195.1	193.8	195.1	193.8	3.4	2.6	2.6	--
STGM3029	STIG1348	STIG1349	39	12'' DIA	2.1%	162.33	161.50	167.7	168.1	173.8	172.5	175.1	173.7	5.2	6.7	7.0	Existing 10-yr
STGM3038	STMF122	STMF121	303	12'' DIA	1.0%	154.00	151.00	156.6	153.0	154.7	151.3	154.7	151.3	3.5	2.8	2.8	--
STGM3044	STMF0840	STMF0839	249	12'' DIA	-1.1%	194.68	197.51	203.5	207.1	195.3	198.2	195.3	198.2	3.9	3.3	3.3	--
STGM3052	STMG1226	STMG1227	225	18'' DIA	0.6%	165.13	163.82	171.9	170.6	184.6	182.7	184.5	182.6	8.0	9.9	9.9	Existing 10-yr
STGM3091	STMF1222	STMF1223	295	36'' DIA	1.2%	148.10	144.70	164.3	158.2	149.5	145.3	149.5	145.3	72.1	26.7	26.7	--
STGM3105	J3540	STMG071	248	12'' DIA	5.4%	239.50	226.07	242.8	230.4	240.4	227.0	240.4	227.0	8.3	8.8	8.9	--
STGM3119	STMF105	STMF106	84	12'' DIA	2.1%	172.00	170.20	182.8	178.7	172.4	170.5	172.4	170.5	5.2	1.3	1.4	--
STGM3122	STMG0932	STMG0928	232	24'' DIA	1.6%	223.75	220.00	232.5	230.8	224.5	221.6	231.3	229.4	29.4	8.3	11.4	--
STGM3132	STMF1225	STMF1222	254	36'' DIA	3.5%	156.96	148.10	165.6	164.3	157.9	149.5	157.9	149.5	127.1	26.7	26.7	--
STGM3139	J5354	J-CCT1-05	243	Irregular Channel	13.1%	153.00	121.50	163.0	123.4	153.4	128.1	153.5	128.4		4.0	4.3	--
STGM3141	STMF1023	J-CCT3-07	109	12'' DIA	9.9%	160.80	145.00	169.1	155.0	161.0	147.4	161.0	147.5	12.4	1.0	1.0	--
STGM3150	STMG1021	J3896	685	33'' DIA	0.5%	192.00	188.70	202.6	196.0	193.7	190.4	193.9	190.5	36.9	26.3	30.7	--
STGM3164	J4972	STMH077	125	12'' DIA	4.6%	268.10	262.39	274.5	267.5	268.4	262.8	268.4	262.8	8.1	1.8	1.8	--
STGM3167	STMG1411	STMG1410	227	12'' DIA	8.1%	155.62	137.22	163.9	145.7	156.1	137.5	156.1	137.5	10.1	3.9	4.1	--
STGM3173	STMG0843	STMG0835	205	33'' DIA	0.5%	214.07	212.96	219.4	218.4	215.7	214.4	215.8	214.4	38.7	26.3	27.6	--
STGM3180	J5422	STMF1221	150	Irregular Channel	5.2%	167.05	159.23	168.8	166.8	167.7	160.5	167.7	160.5		7.6	7.6	--
STGM32	STMG0817	STMG0818	123	15'' DIA	0.6%	226.04	225.36	229.1	228.6	229.4	228.7	229.7	228.9	4.8	5.5	5.9	Existing 10-yr
STGM320	STMG0713	STMG0734	124	12'' DIA	14.7%	280.50	262.50	284.9	270.8	280.8	262.9	280.8	262.9	14.4	3.2	3.2	--
STGM3203	STMG0917	STMF0932	273	12'' DIA	1.6%	190.30	185.81	197.6	193.0	190.9	187.3	190.9	187.3	4.6	2.7	2.8	--
STGM3207	STMG0825	STMG0828	47	36'' DIA	1.0%	222.92	222.44	229.9	232.2	235.5	235.4	235.7	235.6	67.8	39.1	39.3	Existing 10-yr
STGM3214	STMG086	STMG083	252	33'' DIA	1.7%	212.42	208.26	217.4	214.8	219.0	217.9	219.3	218.3	67.8	44.4	44.4	Existing 10-yr
STGM3224	STMG141	J3700	203	12'' DIA	2.1%	154.32	140.00	162.3	152.0	154.9	140.4	154.9	140.4	5.2	3.6	3.6	--
STGM3236	STMG0913	STMF092	331	12'' DIA	1.1%	203.01	199.23	207.9	203.2	208.2	206.1	208.4	206.3	3.8	3.8	3.8	Existing 10-yr
STGM3252	J3498	STMG149	242	12'' DIA	0.8%	159.00	157.06	166.5	162.2	159.6	157.6	166.5	157.7	3.2	2.3	4.3	--
STGM3264	STMG0723	STMG0730	312	12'' DIA	0.5%	264.31	262.62	268.0	266.8	264.6	263.3	264.7	263.3	2.7	0.7	0.7	--
STGM3268	STMG0848	STMG0863	130	36'' DIA	0.8%	225.02	223.96	231.3	229.5	236.3	235.8	236.5	236.1	60.7	39.7	39.9	Existing 10-yr
STGM3276	STIF109	STMF103	51	18'' DIA	0.2%	181.10	181.00	190.6	190.5	191.8	190.3	194.2	192.3	4.6	18.3	20.8	Existing 10-yr
STGM3292	STMF0822	STMF0816	55	12'' DIA	0.2%	203.22	203.09	208.7	208.7	204.0	203.6	204.0	203.6	1.8	2.9	2.9	--
STGM3293	STMG0837	STMF085	132	33'' DIA	0.5%	208.00	207.36	215.0	212.4	210.0	208.7	210.0	208.8	36.7	33.4	34.4	--
STGM3314	STMG0846	STMG0854	67	27'' DIA	0.3%	219.50	219.30	228.6	224.2	224.7	223.4	224.9	223.6	16.9	44.7	44.7	--
STGM3315	STMF082	STMG0813	255	15'' DIA	1.2%	207.57	204.50	212.1	210.7	217.1	217.1	217.5	217.4	7.1	2.7	2.8	Existing 10-yr
STGM3319	STMG0858	STMG0857	120	15'' DIA	2.3%	244.49	241.70	250.3	247.5	245.6	244.6	247.4	246.0	10.2	7.1	7.2	--
STGM3330	STIF0875	STIF0874	140	12'' DIA	2.9%	190.90	186.57	194.3	194.6	191.3	187.3	191.3	187.3	6.3	2.6	2.6	--
STGM3334	STIF131	J-CCT2-03	197	15'' DIA	23.2%	151.40	107.00	157.4	150.0	151.7	109.1	151.7	109.1	29.7	3.0	3.3	--
STGM3369	STMG1323	STMG1324	360	21'' DIA	0.1%	157.30	157.00	165.4	166.0	175.9	166.0	175.9	166.0	4.6	31.4	31.4	Existing 10-yr
STGM3379	STIG1349	STMG1325	138	12'' DIA	0.5%	161.50	160.87	168.1	166.8	172.5	167.8	173.7	168.7	2.4	6.6	6.8	Existing 10-yr
STGM3386	STMG0910	STMG099	312	33'' DIA	0.4%	202.75	201.50	215.7	208.6	204.3	202.8	204.4	202.9	33.5	20.8	24.6	--
STGM339	STMF116	J3688	32	12'' DIA	0.4%	173.10	172.98	179.5	177.1	190.1	189.6	190.2	189.6	2.2	5.0	5.1	Existing 10-yr
STGM3399	STMF109	STMF107	303	18'' DIA	1.3%	181.25	177.24	186.3	182.2	186.3	183.0	186.3	183.6	11.8	7.9	8.3	--
STGM3402	STMG0768	STMG0770	161	12'' DIA	2.4%	249.66	245.78	253.5	251.1	259.4	255.8	260.9	256.9	5.8	6.2	6.4	Existing 10-yr
STGM3411	STMH072	STMH071	271	12'' DIA	8.5%	292.30	269.29	302.0	275.6	292.6	270.0	292.6	270.0	11.1	1.8	1.8	--
STGM3426	STMG0856	STMG0865	499	18'' DIA	0.9%	239.74	235.06	247.0	239.5	243.7	241.7	244.9	241.9	10.6	7.0	7.1	--
STGM3439	STMF101	STMF1014	93	18'' DIA	2.7%	154.80	152.30	170.5	171.4	155.8	153.3	155.8	153.3	17.2	13.1	13.7	--
STGM3444	STMG145	STMG146	267	15'' DIA	1.0%	159.65	157.00	166.4	163.5	160.4	157.4	160.4	157.4	6.4	4.0	4.3	--
STGM3465	J5366	J3664	51	27'' DIA	0.2%	200.41	200.30	205.4	205.2	216.1	216.0	216.7	216.5	14.4	45.4	44.1	Existing 10-yr
STGM348	STMG0844	STMG0835	82	12'' DIA	4.3%	216.50	212.96	220.3	218.4	217.3	214.4	217.3	214.4	7.4	7.1	7.1	--
STGM3489	J-CCT3-12	J-CCT3-11	107	42'' DIA	2.3%	162.90	160.41	167.4	169.0	165.3	163.2	165.6	163.6	83.7	65.4	76.6	--
STGM3497	STMG0732	STMG0833	127	12'' DIA	3.1%	250.90	247.00	255.1	252.5	251.4	247.9	251.4	247.9	6.4	3.2	3.2	--
STGM3518	J3646	STMF113	49	21'' DIA	2.4%	161.58	160.38	173.8	168.7	162.4	161.0	162.5	161.0	24.6	11.3	12.6	--
STGM3520_1	J5398	J7	526	Irregular Channel	0.5%	175.00	172.43	183.8	175.3	175.7	175.4	175.7	175.4		12.0	12.0	--
STGM3524	STMF071	STMF072	19	18'' DIA	1.9%	220.65	220.30	225.8	226.0	222.3	222.2	222.3	222.2	14.4	8.8	8.9	--
STGM3527	STMG1025	STMG1024	231	15'' DIA	0.6%	182.10	180.74	187.5	186.8	182.7	182.6	183.5	183.5	5.2	1.8	1.8	--
STGM3535	J3666	STIF092	23	12'' DIA	3.1%	200.00	199.28	203.9	202.8	216.0	211.9	216.5	212.3	6.3	24.7	24.8	Existing 10-yr
STGM3545	STMG088	STMG0816	191	12'' DIA	0.2%	236.00	235.61	238.8	238.1	243.9	239.3	245.7	240.4	1.6	5.7	6.1	Existing 10-yr
STGM3553	STMG0863	STMG0824	88	36'' DIA	0.8%	223.96	223.21	229.5	230.3	235.8	235.5	236.1	235.8	61.3	39.4	39.6	Existing 10-yr
STGM3561	STMH081	STMG0855	285	15'' DIA	0.4%	254.22	253.08	260.1	266.7	260.1	253.9	260.1	253.9	4.2	7.2	7.3	--
STGM3587	STIG0894	STIG0890	73	18'' DIA	4.6%	223.30	219.93	226.8	226.2	227.9	227.4	228.1	227.6	22.6	15.1	14.6	Existing 10-yr
STGM3596	STMG0839	STMG0840	194	12'' DIA	1.8%	230.00	226.50	237.2	230.2	235.6	230.1	236.1	230.2	5.0	7.2	7.2	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM3607	STMF0840	STMF0841	27	15'' DIA	1.4%	194.68	194.31	203.5	203.2	195.3	195.1	195.3	195.1	7.9	3.3	3.3	--
STGM3611	STMG149	STMG147	283	12'' DIA	10.2%	157.06	128.19	162.2	143.8	157.6	128.4	157.7	128.5	11.4	4.4	7.0	--
STGM3615	J5220	J4770	571	12'' DIA	0.4%	188.00	185.50	192.5	191.7	192.5	188.3	192.8	190.5	2.4	3.0	3.2	Future 10-yr
STGM3618	STMF1010	STMF1011	89	33'' DIA	2.7%	153.57	150.89	166.9	166.6	155.1	152.2	155.2	152.3	88.1	54.6	57.9	--
STGM3619	STMG0716	STMG0717	418	12'' DIA	3.0%	261.67	249.02	267.9	252.1	262.1	249.8	262.1	249.8	6.4	2.1	2.2	--
STGM3634	STMF106	J-CCT3-13	38	12'' DIA	3.2%	170.20	168.45	178.7	171.5	170.5	170.1	170.5	170.2	6.2	1.3	1.4	--
STGM3636	STMF121	OF_J3954	100	12'' DIA	19.3%	151.00	132.00	153.0	135.0	151.3	132.3	151.3	132.3	15.3	2.8	2.8	--
STGM3642	STMF0931	STMF0926	55	36'' DIA	0.3%	180.95	180.78	188.9	185.8	182.7	181.9	182.8	181.9	37.3	27.2	27.8	--
STGM3652	STMG0761	STMG0754	144	12'' DIA	11.2%	324.00	307.92	329.7	315.2	324.2	308.1	324.2	308.1	12.2	1.2	1.3	--
STGM3665	STMF0916	STMF0917	117	15'' DIA	2.1%	191.75	189.31	207.3	200.0	192.3	190.3	192.3	190.3	9.7	3.3	3.3	--
STGM3703	STMG0750	STMG0749	107	15'' DIA	7.3%	284.09	276.33	290.0	282.8	284.6	276.9	284.6	276.9	18.2	6.0	6.2	--
STGM3710	STIG1016	J3692	26	18'' DIA	0.4%	185.10	185.00	190.8	191.9	187.8	187.6	188.4	188.3	6.5	6.9	7.5	--
STGM3722	STMG0777	STMG0772	139	12'' DIA	0.8%	245.36	244.30	250.9	247.5	265.9	253.4	269.2	255.3	3.2	11.3	11.9	Existing 10-yr
STGM3724	STMF091	STMF0931	174	36'' DIA	2.1%	184.65	180.95	190.4	188.9	185.7	182.7	185.8	182.8	97.1	27.2	27.9	--
STGM3732	STMF0917	STMF0922	114	18'' DIA	1.1%	189.31	188.07	200.0	199.2	190.3	189.3	190.3	189.3	11.5	9.0	9.0	--
STGM3734	STMF093	STMF0932	419	36'' DIA	0.8%	189.10	185.81	198.1	193.0	190.3	187.3	190.3	187.3	58.6	21.1	21.3	--
STGM3741	STMF0930	STMF0928	184	12'' DIA	1.8%	198.17	194.94	203.4	200.0	198.5	195.4	198.5	195.4	4.9	1.3	1.5	--
STGM375	STIG1031	STMG1030	298	12'' DIA	1.3%	187.00	183.05	190.4	188.1	192.1	188.1	193.8	188.1	4.1	5.0	5.3	Existing 10-yr
STGM3766	STMG0733	STIH077	354	12'' DIA	0.9%	268.14	264.96	274.9	271.4	268.4	265.1	268.4	265.1	3.5	0.4	0.6	--
STGM3768	STMF102	STIF1030	43	18'' DIA	0.6%	169.96	169.70	175.0	174.7	171.4	170.5	171.4	170.5	8.2	11.9	12.3	--
STGM3769	STMG0834	STMG0843	128	33'' DIA	2.4%	217.11	214.07	223.7	219.4	218.2	215.7	218.2	215.8	82.2	26.3	27.6	--
STGM3778_a	J-CCT3-18	J-CCT3-16	440	Irregular Channel	1.3%	180.00	174.28	185.0	179.1	181.2	175.5	181.2	175.5		31.2	32.2	--
STGM3778_b	J-CCT3-16	J-CCT3-15	195	Irregular Channel	1.5%	174.28	171.40	179.1	176.3	175.5	173.5	175.5	173.7		32.3	33.7	--
STGM3780	STIF0817	J4120	231	Irregular Channel	0.5%	200.10	199.00	207.3	203.0	202.1	202.1	202.3	202.2		49.8	51.1	--
STGM3781	STIG0837	STIG0890	21	12'' DIA	9.7%	222.00	219.93	226.2	226.2	227.4	227.4	227.6	227.6	10.6	0.6	0.6	Existing 10-yr
STGM3785	STIG1075	J3896	525	12'' DIA	0.3%	190.14	188.70	198.9	196.0	204.5	190.4	205.0	190.5	1.9	6.2	6.3	Existing 10-yr
STGM3808	STMG1325	STMG1326	88	12'' DIA	3.2%	160.87	158.10	166.8	165.6	167.8	163.6	168.7	164.3	6.3	7.9	8.1	Existing 10-yr
STGM3835	STMG1034	J3692	17	18'' DIA	0.6%	185.10	185.00	191.3	191.9	187.8	187.6	188.3	188.3	8.0	7.6	7.8	--
STGM3838	STMG1215	STMG1210	87	12'' DIA	2.0%	168.80	167.05	175.4	173.7	176.2	175.9	176.2	175.9	5.1	2.6	2.6	Existing 10-yr
STGM3846	STMG1312	STMG1311	258	15'' DIA	0.3%	163.10	162.20	169.4	168.1	190.0	188.2	190.0	188.2	3.8	6.3	6.3	Existing 10-yr
STGM3861	STMG1324	J4572	112	18'' DIA	6.3%	157.00	150.00	166.0	163.6	166.0	151.1	166.0	151.1	26.3	31.3	31.3	--
STGM3871	STMH077	STMH073	122	12'' DIA	4.4%	262.39	257.00	267.5	261.5	262.8	259.7	262.8	260.1	7.9	2.2	2.3	--
STGM3883	STMG0919	STMF0911	104	12'' DIA	0.9%	187.81	186.90	195.8	194.2	195.8	194.4	196.7	195.9	3.3	3.4	3.4	Future 10-yr
STGM3886	STMG076	STMG073	9	27'' DIA	13.2%	227.40	226.20	231.5	231.3	227.7	227.6	227.7	227.6	117.7	3.5	3.6	--
STGM3894	STMG0937	STMG098	259	24'' DIA	1.3%	208.73	205.33	219.4	214.9	216.2	214.2	220.8	218.0	27.0	20.8	24.9	Future 10-yr
STGM3901	STMG0933	STMG0934	88	24'' DIA	1.5%	214.11	212.83	224.4	223.2	219.1	218.4	224.9	223.9	28.5	20.8	25.6	Future 10-yr
STGM3905	STMF1226	STMF1225	39	36'' DIA	1.1%	157.40	156.96	165.5	165.6	158.7	157.9	158.7	157.9	70.3	26.7	26.7	--
STGM3908	STMF1221	STMF1227	135	36'' DIA	0.9%	159.23	158.04	166.8	166.0	160.5	159.3	160.5	159.3	63.0	23.3	23.3	--
STGM3911	STMG0762	STMG0761	196	12'' DIA	7.6%	338.85	324.00	344.1	329.7	339.1	324.2	339.1	324.2	10.2	1.2	1.3	--
STGM3920	STMG1027	STMG1029	247	33'' DIA	1.8%	195.00	190.30	198.2	194.4	195.6	195.6	199.3	199.2	68.1	6.8	10.2	Future 10-yr
STGM3930	STMF1223	STMF1224	73	36'' DIA	21.9%	144.70	129.10	158.2	152.6	145.3	130.5	145.3	130.6	308.0	30.8	31.2	--
STGM3936	STMG132	STMG1322	78	18'' DIA	0.1%	157.50	157.40	165.5	165.5	180.7	178.0	180.7	178.0	3.8	19.7	19.7	Existing 10-yr
STGM3945	STMF1219	STMF1220	92	33'' DIA	2.5%	162.89	160.62	172.6	172.3	163.4	161.5	163.4	161.5	88.9	6.2	6.2	--
STGM3974	STMF087	STMF0821	322	24'' DIA	1.4%	210.00	205.66	215.1	212.5	211.2	206.5	211.2	206.5	26.3	16.5	16.7	--
STGM4013	STMG1315	STMG1323	65	15'' DIA	3.1%	162.00	157.30	166.1	165.4	177.3	175.9	177.3	175.9	11.3	9.9	9.9	Existing 10-yr
STGM4016	STMG101	STMG104	246	18'' DIA	0.4%	188.80	187.90	200.0	200.8	189.9	188.8	189.9	188.9	6.3	5.7	5.9	--
STGM402	STMF081	STMF082	340	12'' DIA	1.4%	212.38	207.57	217.1	212.1	217.4	217.1	217.7	217.5	4.2	2.7	2.7	Existing 10-yr
STGM4043	J3932	J-CCT1-02	815	Irregular Channel	2.5%	160.00	100.00	165.0	150.0	160.7	101.6	160.7	101.7		5.4	6.2	--
STGM4047	STMG0815	STMG0817	311	15'' DIA	1.8%	231.50	226.04	235.5	229.1	232.3	229.4	232.4	229.7	8.5	5.5	5.9	--
STGM4059	STMF0838	STMF0839	252	12'' DIA	2.4%	203.44	197.51	213.2	207.1	204.0	198.2	204.0	198.2	5.7	3.3	3.3	--
STGM406	STIF0874	OF_J4224	31	12'' DIA	0.6%	186.57	186.40	194.6	194.0	187.3	187.1	187.3	187.1	2.7	2.6	2.6	--
STGM4119	STMG0739	STMG0738	113	12'' DIA	0.2%	245.30	245.09	250.5	250.3	252.9	250.4	253.8	251.1	1.6	5.5	5.8	Existing 10-yr
STGM4127	STMG0775	STMG0776	287	12'' DIA	3.7%	259.00	248.31	264.7	256.2	293.0	265.9	299.5	269.3	7.2	12.6	13.5	Existing 10-yr
STGM4138	STMG0930	STMG0916	166	12'' DIA	2.3%	195.50	191.69	203.4	198.8	196.0	192.4	196.0	192.4	5.4	2.7	2.8	--
STGM414	STMF0914	STMF0915	30	15'' DIA	1.4%	192.61	192.18	205.4	205.6	193.2	192.9	193.2	192.9	8.1	3.3	3.3	--
STGM4140	STMF076	STMF075	208	36'' DIA	0.5%	201.20	200.16	205.0	203.5	202.2	201.5	202.2	201.7	47.5	11.4	11.4	--
STGM4141	STMH076	STMH081	129	12'' DIA	1.0%	255.50	254.22	259.7	260.1	259.7	260.1	259.7	260.1	3.7	2.2	2.3	--
STGM4149	STMF092	J4162	88	15'' DIA	0.3%	199.23	199.00	203.2	202.0	206.1	199.7	206.3	199.7	3.3	15.8	16.1	Existing 10-yr
STGM415	STMF0918	STMF0919	170	12'' DIA	1.0%	200.20	198.53	208.1	209.2	200.9	199.0	200.9	199.0	3.7	3.0	3.0	--
STGM4158	J4708	J4216	332	Irregular Channel	11.1%	146.50	110.00	152.6	114.3	146.6	110.3	146.6	110.4		1.2	1.3	--
STGM4160	STMG0914	J3664	67	12'' DIA	0.4%	201.30	200.30	208.5	205.2	216.0	216.0	216.6	216.5	2.4	2.9	2.9	Existing 10-yr
STGM4167	J-CCT3-15	J-CCT3-14	31	24'' DIA	1.0%	171.40	171.10	176.3	176.5	173.5	172.7	173.7	172.8	22.3	35.0	38.5	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM4170	STMG0751	STMG0750	133	12'' DIA	1.9%	286.67	284.09	289.9	290.0	287.0	284.6	287.0	284.6	5.1	1.2	1.3	--
STGM4172	J4216	OF_J4218	232	Irregular Channel	8.6%	110.00	90.00	114.3	94.0	110.3	90.4	110.4	90.4		7.2	7.6	--
STGM4177	STMF0841	STMF0914	315	15'' DIA	0.5%	194.31	192.61	203.2	205.4	195.1	193.2	195.1	193.2	4.9	3.3	3.3	--
STGM4199	STMG1028	J4938	35	18'' DIA	1.4%	184.50	184.00	194.6	195.8	195.5	195.4	199.0	197.7	12.6	18.5	21.4	Existing 10-yr
STGM420	STMG082	STMG0813	97	36'' DIA	1.6%	206.02	204.50	211.3	210.7	217.3	217.1	217.7	217.4	84.2	46.6	46.5	Existing 10-yr
STGM4201	STMG0824	STMG0825	24	36'' DIA	1.2%	223.21	222.92	230.3	229.9	235.5	235.5	235.8	235.7	73.7	39.2	39.4	Existing 10-yr
STGM4204	STMG0857	STMG0856	84	15'' DIA	2.3%	241.70	239.74	247.5	247.0	244.6	243.7	246.0	244.9	10.2	7.0	7.1	--
STGM4212	STIH077	STMH077	56	12'' DIA	4.6%	264.96	262.39	271.4	267.5	265.1	262.8	265.1	262.8	8.4	0.4	0.6	--
STGM4215	STMG0812	J5040	26	33'' DIA	0.4%	201.10	201.00	210.0	207.7	216.1	216.1	216.7	216.7	17.8	48.3	48.3	Existing 10-yr
STGM4226	STIF1030	STMF101	278	18'' DIA	5.4%	169.70	154.80	174.7	170.5	170.5	155.8	170.5	155.8	24.1	13.7	14.0	--
STGM4234	J4500	OF_J5512	337	Irregular Channel	19.2%	146.00	82.50	152.1	84.0	146.3	82.8	146.3	82.8		3.4	3.7	--
STGM4268	STMG0911	STMG099	50	12'' DIA	0.6%	201.80	201.50	208.1	208.6	202.9	202.8	203.0	202.9	2.8	1.4	1.9	--
STGM427	STMH073	STMH076	169	12'' DIA	0.9%	257.00	255.50	261.5	259.7	259.7	259.7	260.1	259.7	3.5	2.2	2.3	--
STGM4276	STMF131	J4708	122	12'' DIA	0.3%	146.92	146.50	155.4	152.6	147.5	146.6	147.5	146.6	2.1	1.2	1.3	--
STGM4284	J3730	J3760	636	Irregular Channel	1.4%	194.80	185.90	202.4	192.5	196.6	189.7	196.6	189.8		48.3	48.9	--
STGM4289	STMG0769	STMG0768	152	12'' DIA	3.0%	254.21	249.66	259.5	253.5	259.6	259.4	261.0	260.9	6.3	1.3	1.4	Existing 10-yr
STGM4293	J4318	J4482	186	Irregular Channel	2.0%	180.00	176.38	183.0	180.8	182.1	181.8	183.0	182.9		51.3	57.5	Future 10-yr
STGM43	J3760	OF_J4000	50	36'' DIA	0.8%	185.90	185.50	192.5	188.5	189.7	188.5	189.8	188.5	59.7	105.8	110.1	--
STGM4305	STIG07112	STMG0772	358	15'' DIA	3.1%	255.04	244.30	258.7	247.5	270.9	253.4	278.5	255.3	11.3	15.6	17.8	Existing 10-yr
STGM4306	STMF0928	STMF0929	312	12'' DIA	0.8%	194.94	192.41	200.0	196.7	195.4	192.7	195.4	192.7	3.3	1.3	1.5	--
STGM4320	STMG104	STMG1034	690	21'' DIA	0.4%	187.90	185.10	200.8	191.3	188.8	187.8	188.9	188.3	10.1	5.7	5.9	--
STGM4322	STMG0730	STMG0716	157	12'' DIA	0.6%	262.62	261.67	266.8	267.9	263.3	262.1	263.3	262.1	2.9	2.1	2.2	--
STGM4418	STMG0774	STMG0775	245	12'' DIA	1.0%	261.43	259.00	268.4	264.7	311.4	293.0	320.2	299.5	3.7	12.4	13.5	Existing 10-yr
STGM442	STMG0820	STMG0834	133	33'' DIA	2.7%	220.62	217.11	225.4	223.7	221.7	218.2	221.7	218.2	84.9	26.3	27.6	--
STGM443	STIG0710	STMG0727	231	18'' DIA	2.0%	239.30	234.70	243.0	238.6	247.6	235.9	248.7	236.1	14.9	32.5	28.1	Existing 10-yr
STGM4468	J4882	STMF118	25	18'' DIA	1.2%	175.58	175.28	185.8	186.4	176.5	176.0	176.5	176.0	11.9	8.8	8.8	--
STGM447	STMF0827	STMF0810	22	18'' DIA	5.4%	198.03	196.84	201.5	201.4	198.5	198.6	198.6	198.8	25.2	4.8	4.8	--
STGM4474	STIF129	STIF1210	139	6'' DIA	0.6%	169.71	168.92	172.8	171.3	209.8	172.2	209.8	172.2	0.4	3.7	3.7	Existing 10-yr
STGM4476	STIF1210	J8	39	12'' DIA	-0.2%	168.92	169.00	171.3	171.4	172.2	172.0	172.2	172.0	1.7	2.9	2.9	Existing 10-yr
STGM464	STMG083	STMG082	143	33'' DIA	1.6%	208.26	206.02	214.8	211.3	217.9	217.3	218.3	217.7	66.1	45.4	45.3	Existing 10-yr
STGM485	STIF1329	STMF134	504	12'' DIA	1.5%	154.00	146.60	163.2	152.3	163.2	151.3	163.2	152.3	4.3	4.8	5.0	--
STGM486	STMG0849	STMG0848	49	36'' DIA	0.8%	225.39	225.02	231.0	231.3	236.4	236.3	236.7	236.5	58.3	40.0	40.2	Existing 10-yr
STGM498	STMG0770	STMG0739	134	12'' DIA	0.4%	245.78	245.30	251.1	250.5	255.8	252.9	256.9	253.8	2.2	5.8	6.0	Existing 10-yr
STGM5	STMG0755	STMG0766	249	12'' DIA	6.0%	315.40	300.47	318.8	305.8	315.6	300.7	315.7	300.7	9.3	1.1	1.2	--
STGM516	STMG1311	STMG1315	511	15'' DIA	0.0%	162.20	162.00	168.1	166.1	188.2	177.3	188.2	177.3	1.3	11.2	11.2	Existing 10-yr
STGM52	STMG1319	STIG1348	243	10'' DIA	0.8%	164.32	162.33	169.5	167.7	181.3	173.8	182.5	175.1	2.0	4.0	3.9	Existing 10-yr
STGM533	STMG0816	STMG0815	279	12'' DIA	1.5%	235.61	231.50	238.1	235.5	239.3	232.3	240.4	232.4	4.3	5.6	6.0	Existing 10-yr
STGM539	STMF085	STMF0813	222	36'' DIA	1.4%	207.36	204.29	212.4	212.5	208.7	205.9	208.8	205.9	77.9	34.9	36.1	--
STGM541	STMF086	STMF087	128	24'' DIA	1.1%	211.36	210.00	217.3	215.1	212.4	211.2	212.4	211.2	23.3	12.6	12.7	--
STGM543	STMG0841	STMG0844	138	12'' DIA	2.8%	220.30	216.50	223.9	220.3	223.9	217.3	223.9	217.3	6.2	7.1	7.1	--
STGM555	STIF1134	STIF1135	158	12'' DIA	1.1%	170.40	168.60	174.7	173.0	171.1	169.5	171.1	169.5	3.7	3.0	3.1	--
STGM567	STMF1014	J5386	133	24'' DIA	1.7%	152.30	150.00	171.4	170.0	153.3	150.8	153.3	150.8	29.8	13.7	14.2	--
STGM575	STMG087	STMF081	116	12'' DIA	1.4%	213.97	212.38	217.3	217.1	217.5	217.4	217.8	217.7	4.2	2.7	2.7	Existing 10-yr
STGM583	STMG1112	J4882	512	18'' DIA	1.2%	181.88	175.58	189.4	185.8	182.8	176.5	182.8	176.5	12.0	8.8	8.8	--
STGM592	STMF0919	STMF0921	205	12'' DIA	3.8%	198.53	190.78	209.2	201.7	199.0	193.1	199.0	192.9	7.1	3.0	3.0	--
STGM602	STIG108	J5576	98	12'' DIA	0.8%	168.30	167.50	174.5	172.0	169.1	169.1	169.2	169.1	3.3	0.9	0.9	--
STGM609	STMG1030	STMF109	410	15'' DIA	0.4%	183.05	181.25	188.1	186.3	188.1	186.3	188.1	186.3	4.3	5.3	5.6	--
STGM612	STMF0835	STMF0836	338	12'' DIA	1.1%	195.93	192.16	201.8	195.8	196.5	192.7	196.5	192.7	3.9	2.6	2.6	--
STGM618	STMG1024	J4318	120	15'' DIA	0.6%	180.74	180.00	186.8	183.0	182.6	182.1	183.5	183.0	5.3	4.6	4.8	--
STGM633	STMG0830	STMG0850	255	27'' DIA	1.0%	231.75	229.13	238.0	237.3	240.3	238.1	240.5	238.3	32.7	31.4	31.5	Existing 10-yr
STGM65	STMG0836	STMG0837	297	33'' DIA	0.9%	210.60	208.00	215.4	215.0	212.3	210.0	212.3	210.0	49.9	33.4	34.4	--
STGM66	STMG0934	STMG0935	107	24'' DIA	1.4%	212.83	211.30	223.2	221.5	218.4	217.5	223.9	222.7	28.1	20.8	25.3	Future 10-yr
STGM685	STMG1320	STMG1321	264	10'' DIA	0.3%	166.40	165.57	173.9	171.9	198.8	189.2	199.6	190.3	1.2	5.4	5.4	Existing 10-yr
STGM694	J8	STIF1290	64	8'' DIA	2.2%	169.00	167.61	171.4	170.7	172.0	168.0	172.0	168.0	1.9	2.9	2.9	Existing 10-yr
STGM70	STMG0840	STMG0841	155	12'' DIA	4.0%	226.50	220.30	230.2	223.9	230.1	223.9	230.2	223.9	7.4	7.2	7.2	--
STGM725	STMG0829	STMG0849	291	36'' DIA	0.9%	227.89	225.39	235.1	231.0	237.4	236.4	237.7	236.7	61.5	40.4	40.6	Existing 10-yr
STGM738	STMF118	J3646	477	18'' DIA	2.9%	175.28	161.58	186.4	173.8	176.0	162.4	176.0	162.5	17.9	8.8	8.8	--
STGM741	STMG142	STMG145	48	12'' DIA	0.8%	160.03	159.65	166.8	166.4	160.5	160.4	160.5	160.4	3.2	1.1	1.3	--
STGM742	STMG072	STMF073	114	18'' DIA	0.7%	222.75	221.91	225.9	224.4	224.0	222.9	224.0	223.0	8.8	8.8	8.9	--
STGM751	J5040	J5366	153	Irregular Channel	0.4%	201.00	200.41	207.7	205.4	216.1	216.1	216.7	216.7		48.2	48.1	Existing 10-yr
STGM753	STMG1414	STMG1412	21	18'' DIA	10.6%	161.00	158.80	168.8	168.7	161.4	160.0	161.4	160.0	35.2	4.6	4.6	--
STGM755	STMG0735	STMG0722	107	12'' DIA	0.9%	243.49	242.48	249.5	248.2	248.1	247.0	249.5	247.0	3.6	5.5	5.7	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM779	STIG09106	STMG1027	27	21'' DIA	1.1%	196.30	195.00	198.4	198.2	197.1	195.6	199.4	199.3	17.4	6.8	10.0	Future 10-yr
STGM78	STMG073	STMG0821	140	33'' DIA	1.0%	226.20	224.82	231.3	229.7	227.6	226.4	227.6	226.5	52.9	24.9	26.2	--
STGM8	STMF1012	J3786	98	33'' DIA	6.0%	149.35	143.50	166.1	163.5	150.7	145.4	150.8	145.4	130.3	65.1	69.8	--
STGM800	STIF092	STMF092	34	12'' DIA	0.1%	199.28	199.23	202.8	203.2	211.9	206.1	212.3	206.3	1.4	14.9	15.2	Existing 10-yr
STGM831	STMF0921	STMF0917	94	12'' DIA	1.6%	190.78	189.31	201.7	200.0	193.1	190.3	192.9	190.3	4.6	5.6	5.6	--
STGM833	STMF1218	STMF1219	230	24'' DIA	2.4%	168.49	162.89	176.9	172.6	169.1	163.4	169.1	163.4	34.6	6.2	6.2	--
STGM865	STMF0923	STMF0924	336	18'' DIA	0.9%	186.61	183.64	197.6	193.3	187.8	184.8	187.8	184.8	10.3	10.0	10.2	--
STGM868	STMG0734	STMG0712	133	12'' DIA	4.9%	262.50	256.00	270.8	261.6	262.9	256.5	262.9	256.5	8.1	3.2	3.2	--
STGM870	STMF1013	STMF1014	181	12'' DIA	4.2%	159.85	152.30	174.7	171.4	160.1	153.3	160.1	153.3	7.5	0.9	0.9	--
STGM890	STMG0842	STMG0839	126	12'' DIA	0.7%	230.83	230.00	235.9	237.2	239.4	235.6	239.7	236.1	3.0	7.2	7.2	Existing 10-yr
STGM893	J4894	J4216	517	Irregular Channel	6.6%	144.10	110.00	150.5	114.3	144.4	110.3	144.4	110.4		4.8	5.0	--
STGM915	J5174	J5472	57	Irregular Channel	0.9%	188.00	187.50	193.5	192.4	189.9	189.2	190.0	189.4		33.6	38.1	--
STGM916	STMG1410	STIG1416	58	12'' DIA	28.8%	137.22	121.28	145.7	144.1	137.5	124.8	137.5	125.0	18.8	3.9	4.1	--
STGM929	STIG1072	STIG1075	282	12'' DIA	1.0%	193.00	190.14	199.2	198.9	208.2	204.5	208.9	205.0	3.6	4.5	4.6	Existing 10-yr
STGM938	J4572	J-CCT1-07	510	Irregular Channel	3.9%	150.00	130.00	163.6	132.0	151.1	131.2	151.1	131.3		31.3	31.3	--
STGM939	STMG134	STMG133	270	12'' DIA	0.3%	158.70	157.92	169.4	167.3	192.6	191.3	192.6	191.3	1.9	3.1	3.1	Existing 10-yr
STGM958	STIG1023	STIG1024	33	12'' DIA	0.5%	187.20	187.02	189.5	189.4	195.4	194.7	197.4	196.6	2.6	5.3	5.7	Existing 10-yr
STGM959	STMG0928	STMG0933	364	24'' DIA	1.6%	220.00	214.11	230.8	224.4	221.6	219.1	229.4	224.9	30.1	21.0	25.6	--
STGM961	STMG0754	STIG0777	155	12'' DIA	11.2%	307.92	290.71	315.2	296.5	308.1	291.2	308.1	291.2	12.2	1.2	1.3	--
STGM963	J3838	J4946	603	Irregular Channel	1.8%	182.30	171.50	191.2	173.5	183.1	172.8	183.1	172.8		10.0	10.1	--
STGM970	STMG0936	STMG0937	97	24'' DIA	1.5%	210.16	208.73	221.0	219.4	217.0	216.2	221.9	220.8	28.5	20.8	25.0	Future 10-yr
STGM975	STMF0833	STMF0830	226	12'' DIA	0.6%	200.47	199.12	202.5	203.4	201.0	200.0	201.0	200.0	2.9	1.8	1.8	--
STGM987	J3514	J3516	46	18'' DIA	1.0%	224.80	224.36	227.3	227.2	228.3	227.9	228.5	228.1	10.3	11.6	11.8	Existing 10-yr
HESS CREEK																	
C1	STMG1213	J-HC-16	349	12'' DIA	12.0%	167.50	126.00	174.0	147.0	167.9	129.1	167.9	129.3	12.2	4.8	4.8	--
C9	J4872	STII11281	413	36'' DIA	0.5%	204.00	201.50	212.1	211.5	205.4	203.0	205.5	203.1	48.4	22.8	23.4	--
HC-02	J-HC-05	J-HC-04	219	Irregular Channel	0.5%	101.00	100.00	160.0	145.0	105.6	105.6	106.6	106.6		476.7	590.1	--
HC-03	J-HC-06	J-HC-05	1465	Irregular Channel	0.3%	105.00	101.00	145.0	160.0	111.0	105.6	110.9	106.6		436.5	541.0	--
HC-04	J-HC-07	J-HC-06	624	Irregular Channel	0.0%	105.30	105.00	140.0	145.0	111.0	111.0	110.9	110.9		382.9	471.7	--
HC-05	J-HC-08	J-HC-07	44	Irregular Channel	0.2%	105.40	105.30	140.0	140.0	111.0	111.0	110.9	110.9		379.5	466.1	--
HC-06	J-HC-09	J-HC-08	394	Irregular Channel	0.9%	109.00	105.40	145.0	140.0	111.3	111.0	111.4	110.9		379.6	466.4	--
HC-07	J-HC-10	J-HC-09	805	Irregular Channel	0.3%	111.50	109.00	155.0	145.0	114.5	111.3	114.6	111.4		376.5	462.1	--
HC-08	J-HC-11	J-HC-10	373	Irregular Channel	0.3%	112.50	111.50	119.0	155.0	115.2	114.5	115.4	114.6		371.5	455.7	--
HC-09	J-HC-12	J-HC-11	640	Irregular Channel	0.5%	115.43	112.50	140.0	119.0	120.1	115.2	120.3	115.4		365.0	448.4	--
HC-10	J-HC-13	J-HC-12	342	Irregular Channel	0.5%	117.00	115.43	140.0	140.0	121.5	120.1	121.7	120.3		362.8	445.5	--
HC-11	J-HC-14	J-HC-13	998	Irregular Channel	0.4%	120.50	117.00	150.0	140.0	125.2	121.5	125.5	121.7		355.8	437.9	--
HC-12	J-HC-15	J-HC-14	941	Irregular Channel	0.5%	125.00	120.50	140.0	150.0	127.7	125.2	128.0	125.5		343.1	424.1	--
HC-13	J-HC-16	J-HC-15	339	Irregular Channel	0.3%	126.00	125.00	147.0	140.0	129.1	127.7	129.3	128.0		343.0	430.4	--
HC-14	J-HC-17	J-HC-16	331	Irregular Channel	0.3%	127.00	126.00	160.0	147.0	130.0	129.1	130.4	129.3		362.6	473.1	--
HC-15	J-HC-19	J-HC-18	293	Irregular Channel	0.3%	129.00	128.00	155.0	154.7	134.0	133.2	134.4	133.7		314.1	391.0	--
HC-16	J-HC-20	J-HC-19	752	Irregular Channel	0.6%	133.80	129.00	143.8	155.0	138.5	134.0	139.0	134.4		307.9	384.4	--
HC-17	J-HC-21	J-HC-20	348	Irregular Channel	0.6%	136.00	133.80	146.0	143.8	140.7	138.5	141.2	139.0		303.8	380.0	--
HC-18	J-HC-22	J-HC-21	569	Irregular Channel	0.2%	137.00	136.00	147.0	146.0	143.0	140.7	143.6	141.2		301.6	377.6	--
HC-19	J-HC-23	J-HC-22	155	Irregular Channel	0.5%	137.76	137.00	147.8	147.0	143.2	143.0	143.7	143.6		296.1	372.0	--
HC-20	J-HC-24	J-HC-23	255	Irregular Channel	0.5%	139.00	137.76	149.0	147.8	143.6	143.2	144.2	143.7		295.0	370.9	--
HC-21	J-HC-25	J-HC-24	236	Irregular Channel	0.1%	139.30	139.00	160.0	149.0	143.8	143.6	144.3	144.2		280.9	355.2	--
HC-22	J-HC-27	J-HC-26	1573	Irregular Channel	0.7%	151.50	140.40	170.0	146.1	154.9	144.8	155.1	145.5		280.4	354.8	--
HC-23	J-HC-28	J-HC-27	179	Irregular Channel	0.2%	151.80	151.50	170.0	170.0	155.9	154.9	156.2	155.1		247.9	317.1	--
HC-24	J-HC-30	J-HC-29	1069	Irregular Channel	0.8%	162.00	153.50	180.0	160.0	166.7	156.5	166.8	156.9		232.4	299.8	--
HC-25	J-HC-31	J-HC-30	181	Irregular Channel	1.4%	164.50	162.00	180.0	180.0	168.1	166.7	168.4	166.8		232.6	299.2	--
HC-26	J-HC-32	J-HC-31	822	Irregular Channel	0.3%	167.00	164.50	180.0	180.0	168.9	168.1	169.1	168.4		209.0	270.5	--
HC-27	J-HC-33	J-HC-32	583	Irregular Channel	0.3%	169.00	167.00	195.0	180.0	170.5	168.9	170.7	169.1		200.3	260.3	--
HC-28	J-HC-34	J-HC-33	755	Irregular Channel	1.1%	177.00	169.00	190.0	195.0	180.8	170.5	181.0	170.7		195.5	253.5	--
HC-29	J-HC-36	J-HC-35	356	Irregular Channel	0.5%	180.50	178.70	187.0	185.2	184.1	181.7	184.3	182.1		187.0	241.4	--
HC-30	J-HC-37	J-HC-36	1760	Irregular Channel	0.9%	196.00	180.50	220.0	187.0	199.0	184.1	199.3	184.3		175.5	228.4	--
HC-31	J-HC-38	J-HC-37	691	Irregular Channel	1.1%	203.50	196.00	230.0	220.0	207.1	199.0	207.4	199.3		164.7	210.7	--
HC-32	J-HC-39	J-HC-38	785	Irregular Channel	3.3%	229.60	203.50	245.0	230.0	231.5	207.1	231.6	207.4		76.2	86.1	--
HC-33	J-HC-40	J-HC-39	1818	Irregular Channel	3.5%	294.00	229.60	330.0	245.0	295.8	231.5	295.9	231.6		71.8	78.1	--
HCT1-01	J4974	OF_J-HC-01	946	Irregular Channel	6.9%	156.40	91.70	163.4	155.0	156.7	91.9	156.7	92.0		8.4	14.5	--
HCT2-01	J-HCT2-01	J-HC-05	680	Irregular Channel	0.9%	107.00	101.00	165.0	160.0	108.5	105.6	108.7	106.6		47.2	63.3	--
HCT2-02	J-HCT2-02	J-HCT2-01	688	Irregular Channel	1.9%	120.00	107.00	160.0	165.0	121.2	108.5	121.3	108.7		39.2	49.0	--
HCT2-03	J-HCT2-03	J-HCT2-02	834	Irregular Channel	2.5%	141.00	120.00	160.0	160.0	142.1	121.2	142.2	121.3		35.1	41.7	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
HCT3-01	J-HCT3-01	J-HC-06	1106	Irregular Channel	2.5%	132.64	105.00	165.0	145.0	133.9	111.0	133.9	110.9		80.2	84.9	--
HCT3-02	J-HCT3-02	J-HCT3-01	567	Irregular Channel	2.5%	146.80	132.64	155.0	165.0	147.7	133.9	147.7	133.9		78.2	82.5	--
HCT3-03	J-HCT3-03	J-HCT3-02	570	Irregular Channel	1.4%	155.00	146.80	165.0	155.0	155.7	147.7	155.7	147.7		71.8	73.8	--
HCT3-04	J-HCT3-04	J-HCT3-03	376	Irregular Channel	1.4%	160.40	155.00	165.0	165.0	163.6	155.7	163.6	155.7		65.7	66.9	--
HCT3-05	J-HCT3-05	J-HCT3-04	128	Irregular Channel	1.5%	162.30	160.40	170.0	165.0	165.1	163.6	165.1	163.6		63.7	64.8	--
HCT3-06	J-HCT3-06	J-HCT3-05	146	Irregular Channel	1.4%	164.40	162.30	170.0	170.0	167.2	165.1	167.2	165.1		63.0	64.1	--
HCT3-07	J-HCT3-08	J-HCT3-07	271	Irregular Channel	2.1%	170.20	164.60	175.0	173.0	171.6	167.6	171.7	167.6		60.6	61.5	--
HCT4_01	J-HCT4-01	J-HC-27	359	Irregular Channel	3.2%	163.00	151.50	185.0	170.0	164.4	154.9	164.4	155.1		40.3	40.9	--
HCT4-02	J-HCT4-02	J-HCT4-01	204	Irregular Channel	1.7%	166.40	163.00	188.4	185.0	167.5	164.4	167.5	164.4		35.4	35.9	--
HCT4-03	J-HCT4-03	J-HCT4-02	93	Irregular Channel	1.7%	168.00	166.40	190.0	188.4	169.6	167.5	169.6	167.5		33.8	34.3	--
HCT4-04	J-HCT4-04	J-HCT4-03	310	Irregular Channel	2.5%	175.60	168.00	195.0	190.0	177.0	169.6	177.0	169.6		32.1	32.6	--
HCT4-05	J-HCT4-06	J-HCT4-05	263	Irregular Channel	3.2%	185.00	176.50	195.0	188.8	186.3	177.7	186.4	177.7		31.1	31.5	--
HCT5-01	STMH1026	J-HC-31	480	Irregular Channel	1.6%	172.00	164.50	187.5	180.0	173.2	168.1	173.2	168.4		28.7	29.3	--
HCT6-01	J4956	J-HC-38	1558	Irregular Channel	2.3%	240.00	203.50	254.2	230.0	241.6	207.1	241.8	207.4		84.7	118.2	--
STGM1000	STMH1312	J-HCT3-01	120	12'' DIA	12.6%	147.62	132.64	162.4	165.0	147.9	133.9	147.9	133.9	12.9	2.2	2.7	--
STGM1002	STMH108	J-HCT4-03	61	12'' DIA	33.0%	187.00	168.00	196.1	190.0	187.2	169.6	187.2	169.6	20.9	1.7	1.7	--
STGM1018	STMH1223	STMH1230	108	12'' DIA	0.2%	172.94	172.72	177.0	176.7	184.0	183.3	184.2	183.4	1.7	3.9	3.9	Existing 10-yr
STGM1044	J4068	J4066	42	12'' DIA	0.2%	186.10	186.00	192.4	192.0	192.8	192.7	192.9	192.8	1.8	3.3	3.3	Existing 10-yr
STGM1060	STMH1245	J-HCT3-04	157	15'' DIA	3.6%	166.12	160.40	172.5	165.0	166.5	163.6	166.5	163.6	12.8	2.0	2.0	--
STGM1068	STMH1133	J5510	46	18'' DIA	1.7%	181.30	180.53	188.4	188.5	181.9	181.2	181.9	181.2	13.7	4.9	5.1	--
STGM107	STMG112	STMG117	297	12'' DIA	0.2%	185.51	185.00	194.4	192.3	192.2	186.1	192.3	186.1	1.5	5.1	5.1	--
STGM1114	STMH1252	J-HCT3-05	39	12'' DIA	3.9%	163.82	162.30	169.6	170.0	165.2	165.1	165.2	165.1	7.5	0.7	0.7	--
STGM1142	J3762	J4234	25	18'' DIA	0.8%	187.40	187.20	195.6	195.7	188.4	188.1	188.4	188.1	9.5	7.5	7.5	--
STGM1150	STMH091	STMH106	385	15'' DIA	0.6%	199.87	197.65	209.1	208.4	200.6	198.2	200.6	198.2	4.9	3.1	3.1	--
STGM1173	STMI1311	J4160	152	24'' DIA	4.6%	154.39	147.33	162.6	154.4	154.8	148.2	154.9	148.3	48.6	3.9	8.2	--
STGM1204	STMH1017	J-HCT4-01	153	12'' DIA	9.5%	192.51	163.00	194.6	185.0	192.9	164.4	192.9	164.4	10.9	3.4	3.4	--
STGM1226	STMI121	STMH128	273	27'' DIA	2.1%	179.45	173.60	189.9	186.6	180.2	176.2	180.2	176.3	46.1	9.7	9.7	--
STGM1229	STIH1040	STMH1011	234	12'' DIA	5.1%	211.00	199.00	218.0	207.8	211.3	199.4	211.3	199.4	8.0	1.9	1.9	--
STGM1260	STMH137	STMH138	23	12'' DIA	56.6%	136.08	124.75	148.3	138.8	136.3	125.1	136.3	125.1	26.4	1.9	2.2	--
STGM128	STIH146	STIH144	126	12'' DIA	2.3%	163.62	160.75	166.2	165.5	164.2	161.3	164.2	161.3	5.4	3.4	3.4	--
STGM129	STMH0910	J5480	635	15'' DIA	0.1%	229.00	228.10	242.2	240.3	242.2	241.7	243.0	242.4	2.4	5.6	6.4	Existing 10-yr
STGM1294	STII0962	J35	46	18'' DIA	0.4%	254.00	253.80	261.7	256.7	254.8	254.1	255.0	254.2	7.2	4.0	5.7	--
STGM1312	STMH096	STMH097	203	15'' DIA	0.5%	224.00	223.00	237.9	232.9	237.9	232.6	238.4	233.5	4.5	11.5	11.6	Future 10-yr
STGM1313	STMH1112	J4918	119	21'' DIA	0.6%	202.70	202.00	211.0	207.5	203.3	203.0	203.3	203.0	12.0	3.4	3.4	--
STGM1330	J4554	J4556	48	15'' DIA	2.1%	312.00	310.00	319.7	318.9	312.5	310.4	312.8	310.4	9.3	3.4	6.5	--
STGM1334	STMH1129	J5110	19	24'' DIA	2.7%	193.00	192.50	197.9	197.6	193.9	193.5	193.9	193.5	36.9	14.4	14.6	--
STGM1345	STMG118	J-HC-22	551	12'' DIA	8.1%	183.75	137.00	188.9	147.0	184.4	143.0	184.4	143.6	10.5	7.7	7.7	--
STGM1350	J3696	J-HC-28	139	Irregular Channel	3.3%	156.53	151.80	166.6	170.0	157.1	155.9	157.1	156.2		22.4	23.6	--
STGM1358	STMI111	J5444	18	18'' DIA	1.1%	212.62	212.42	219.8	219.8	215.4	215.0	215.7	215.3	11.1	15.2	16.1	--
STGM1362	J-HC-42	J-HC-41	911	Irregular Channel	4.3%	344.20	304.90	351.7	309.3	345.4	306.0	345.4	306.0		38.7	40.8	--
STGM1382	STMH1226	STMH1211	48	12'' DIA	1.0%	169.99	169.52	173.7	174.7	178.3	178.0	178.4	178.2	3.7	3.6	3.6	Existing 10-yr
STGM139	STIH144	J3504	63	18'' DIA	1.2%	160.75	160.00	165.5	164.3	161.3	160.4	161.3	160.4	11.5	3.4	3.4	--
STGM1393	J3504	J4862	255	Irregular Channel	15.9%	160.00	120.00	164.3	130.0	160.4	120.5	160.4	120.5		3.4	3.4	--
STGM1397	STMH1110	STMH1126	363	12'' DIA	0.4%	200.50	199.00	204.3	205.7	204.3	200.0	204.3	200.0	2.3	3.3	3.8	Future 10-yr
STGM1418	STMI1122	STMI1141	101	24'' DIA	0.5%	204.90	204.40	212.9	215.1	206.6	205.8	206.6	205.8	15.9	19.3	19.9	--
STGM143	STMG126	J-HC-18	212	12'' DIA	16.5%	163.00	128.00	172.1	154.7	163.5	133.2	163.5	133.7	14.4	7.8	7.8	--
STGM1476	STMH097	STMH098	388	18'' DIA	2.2%	223.00	214.50	232.9	223.9	232.6	224.6	233.5	225.8	15.6	15.3	15.2	Future 10-yr
STGM1480	J4042	J-HC-33	68	24'' DIA	10.3%	176.00	169.00	204.0	195.0	176.2	170.5	176.2	170.7	74.0	2.2	2.2	--
STGM1484	J4918	STMH1144	39	21'' DIA	0.8%	202.00	201.70	207.5	207.2	203.0	203.0	203.0	203.0	14.1	3.4	3.4	--
STGM1508	J-HC-41	J-HC-40	436	Irregular Channel	2.5%	304.90	294.00	309.3	330.0	306.0	295.8	306.0	295.9		38.5	40.6	--
STGM1528	STII0961	STII0962	48	18'' DIA	1.0%	254.48	254.00	261.9	261.7	255.1	254.8	255.3	255.0	10.9	4.0	5.7	--
STGM1533	STMH0923	J4002	159	36'' DIA	4.1%	189.37	182.80	198.7	191.9	189.9	183.6	189.9	183.6	138.7	8.3	9.2	--
STGM1575	J3474	STMG1010	20	21'' DIA	0.5%	189.28	189.18	201.5	201.5	190.4	190.2	190.4	190.2	11.1	8.3	8.6	--
STGM1579	J3612	J3614	93	12'' DIA	1.1%	174.00	172.00	178.0	178.3	180.4	173.0	180.4	173.0	3.7	9.4	9.4	Existing 10-yr
STGM1598	STMH136	STMH137	43	12'' DIA	33.9%	149.85	136.08	162.9	148.3	150.1	136.3	150.1	136.3	20.6	1.9	2.2	--
STGM1652	STMH1310	J-HCT3-02	117	12'' DIA	0.3%	147.10	146.80	159.9	155.0	148.3	147.7	148.4	147.7	1.9	2.8	3.0	--
STGM167	STMI1141	J4872	36	24'' DIA	1.1%	204.40	204.00	215.1	212.1	205.8	205.4	205.8	205.5	23.8	19.3	19.9	--
STGM1685	STMH1022	J5266	21	12'' DIA	2.5%	186.19	185.66	193.1	193.0	186.6	185.9	186.6	185.9	5.6	2.1	2.4	--
STGM1690	STII0944	J4628	83	12'' DIA	4.8%	246.13	242.10	252.4	252.5	246.6	242.5	246.8	243.2	8.2	3.8	6.9	--
STGM1713	J5640	J-HC-09	473	Irregular Channel	10.5%	158.50	109.00	164.0	145.0	159.1	111.3	159.2	111.4		7.2	8.0	--
STGM1719	STII0947	J5012	523	Irregular Channel	2.7%	248.11	234.00	252.1	240.5	248.4	236.3	248.4	236.8		1.2	1.4	--
STGM1720	STIH081	J5450	46	12'' DIA	12.7%	286.77	280.00	288.5	288.9	287.1	280.3	287.1	280.3	13.1	2.4	2.7	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM1726	J5084	J5190	53	12'' DIA	3.4%	233.00	231.20	238.3	238.3	233.6	231.8	233.6	231.9	6.6	3.8	4.2	--
STGM1763	STMH1220	STMH1221	226	12'' DIA	0.4%	171.26	170.42	176.3	174.9	181.1	179.7	181.2	179.8	2.3	3.5	3.3	Existing 10-yr
STGM1768	STIH118	J-HC-24	72	18'' DIA	36.1%	163.50	139.00	170.0	149.0	164.1	143.6	164.1	144.2	62.2	19.9	20.2	--
STGM177	STMH1248	J-HCT3-03	183	15'' DIA	3.2%	160.76	155.00	169.6	165.0	161.2	155.7	161.3	155.7	12.0	3.6	4.3	--
STGM1793	STMH1231	J-HCT3-09	111	42'' DIA	1.0%	171.56	170.50	179.7	177.1	173.4	171.8	173.5	171.8	98.8	55.3	56.3	--
STGM1814	J4160	STMI132	90	42'' DIA	4.0%	147.33	143.41	154.4	162.1	148.2	144.7	148.3	144.9	201.1	24.2	30.2	--
STGM1859	STMI117	STMI114	548	33'' DIA	1.1%	194.00	185.80	208.9	195.9	195.2	187.1	195.2	187.2	56.9	22.8	23.4	--
STGM1860	STMI113	J3762	44	18'' DIA	0.9%	187.80	187.40	195.2	195.6	188.8	188.4	188.8	188.4	10.1	7.5	7.5	--
STGM1862	J-HC-18	J-HC-17	203	72'' DIA	0.5%	128.00	127.00	154.7	160.0	133.2	130.0	133.7	130.4	296.8	337.3	419.7	--
STGM1864	STII0957	STII0961	216	15'' DIA	1.0%	256.62	254.48	263.3	261.9	257.3	255.1	257.5	255.3	6.4	4.0	5.7	--
STGM1867	J-HCT4-05	J-HCT4-04	69	48'' DIA	1.3%	176.50	175.60	188.8	195.0	177.7	177.0	177.7	177.0	163.6	31.1	31.5	--
STGM1908	STMH1239	STMH1240	279	18'' DIA	0.6%	164.09	162.29	170.2	167.9	164.7	162.9	164.7	162.9	8.8	2.7	2.7	--
STGM192	STMH1228	J-HCT3-06	72	12'' DIA	1.5%	165.50	164.40	173.4	170.0	167.6	167.2	167.7	167.2	4.4	2.6	2.7	--
STGM1925	STIH1038	STMH1010	86	12'' DIA	5.5%	197.70	193.00	205.3	206.2	198.0	193.9	198.0	193.9	8.3	1.9	1.9	--
STGM193	J5190	J4370	360	24'' DIA	0.7%	231.20	228.80	238.3	234.8	231.8	229.9	231.9	230.0	18.3	3.8	4.2	--
STGM194	STMH093	J4042	167	12'' DIA	11.6%	195.22	176.00	204.4	204.0	195.5	176.2	195.5	176.2	12.3	2.2	2.2	--
STGM1956	STMH1314	STMH1315	461	10'' DIA	1.1%	163.00	158.10	169.9	169.3	196.6	183.9	200.1	187.7	2.2	4.9	4.8	Existing 10-yr
STGM1958	STMI1140	STMI1122	39	24'' DIA	0.6%	205.14	204.90	210.6	212.9	206.9	206.6	206.9	206.6	17.7	19.3	19.9	--
STGM1992-A	J4668	J4290	348	12'' DIA	0.6%	164.65	162.40	173.3	169.9	190.1	180.0	191.1	181.1	2.9	6.7	6.7	Existing 10-yr
STGM1992-B	J4290	J-HC-14	595	12'' DIA	3.9%	162.40	120.50	169.9	150.0	180.0	125.2	181.1	125.5	7.1	10.3	10.5	Existing 10-yr
STGM2041	STMH105	STMH104	76	21'' DIA	2.9%	194.00	191.80	201.1	199.5	194.7	192.6	194.7	192.6	26.9	8.4	8.6	--
STGM2096_1	STMH1027	STMH1026	384	24'' DIA	5.1%	191.50	172.00	205.8	187.5	192.6	173.2	192.6	173.2	51.3	28.7	29.3	--
STGM2096_2	STMH0918	STMH1027	241	18'' DIA	5.1%	203.70	191.50	214.4	205.8	212.4	192.6	213.1	192.6	23.5	28.7	29.3	--
STGM2096_3	STMH0919	STMH0918	109	18'' DIA	5.0%	209.20	203.70	217.9	214.4	220.5	212.4	221.5	213.1	23.5	29.0	29.4	Existing 10-yr
STGM2103	STMI132	J-HCT2-03	100	33'' DIA	2.1%	143.41	141.00	162.1	160.0	144.7	142.1	144.9	142.2	76.4	35.1	41.7	--
STGM2111	J4002	J-HC-32	378	Irregular Channel	4.2%	182.80	167.00	191.9	180.0	183.6	168.9	183.6	169.1		9.4	10.4	--
STGM2132	STMH1010	STIH1036	163	15'' DIA	1.8%	193.00	190.00	206.2	197.3	193.9	191.3	193.9	191.3	8.8	7.2	7.2	--
STGM2173	STMH1144	STMH1110	252	12'' DIA	0.5%	201.70	200.50	207.2	204.3	203.0	204.3	203.0	204.3	2.5	8.2	8.4	--
STGM218	STIH107	STMH1018	127	12'' DIA	17.6%	185.07	163.00	192.2	189.4	185.3	167.0	185.3	167.1	15.2	1.8	1.9	--
STGM2180	STMH1213	STMH1214	39	15'' DIA	2.6%	161.30	160.30	169.8	168.3	162.1	161.2	162.1	161.2	10.4	7.0	7.0	--
STGM219	STMH1212	STMH1213	367	12'' DIA	1.9%	168.22	161.30	173.3	169.8	176.4	162.1	176.6	162.1	4.9	7.2	7.3	Existing 10-yr
STGM2191	STMH135	STMH136	40	12'' DIA	20.3%	157.70	149.85	165.3	162.9	157.9	150.1	158.0	150.1	15.4	1.9	2.2	--
STGM2194	STMH1128	STMH1127	153	15'' DIA	2.2%	203.80	200.50	216.9	212.7	204.3	201.8	204.3	201.9	9.5	3.2	3.4	--
STGM2205	STMH098	STMH0920	43	18'' DIA	5.8%	214.50	212.00	223.9	221.4	224.6	222.8	225.8	223.9	25.5	21.9	22.3	Existing 10-yr
STGM2215	J5266	J4642	492	24'' DIA	5.8%	185.66	157.20	193.0	168.2	185.9	157.5	185.9	157.5	53.0	2.1	2.4	--
STGM2226	STMH132	J5640	109	12'' DIA	5.1%	154.52	158.50	164.7	164.0	164.6	159.1	164.7	159.2	8.0	5.8	6.1	--
STGM2240	STMH118	STMH1133	153	18'' DIA	1.6%	184.00	181.30	189.9	188.4	184.6	181.9	184.6	181.9	13.4	4.9	5.1	--
STGM228	J5484	J3588	295	Irregular Channel	0.6%	211.80	209.90	218.5	215.2	213.1	211.2	213.1	211.4		15.2	16.1	--
STGM2288	J4282	J5560	878	Irregular Channel	0.5%	169.70	165.00	174.0	168.9	170.6	166.4	170.6	166.4		11.7	11.7	--
STGM2291	STMH125	J4636	54	18'' DIA	2.2%	177.69	176.50	185.8	183.6	178.2	177.8	178.2	177.8	15.7	3.1	3.1	--
STGM2308	STIH0917	STMH0910	190	18'' DIA	0.5%	230.00	229.00	242.0	242.2	242.3	242.2	243.2	243.0	7.6	3.8	6.3	Existing 10-yr
STGM231	J3	STMH1314	357	10'' DIA	0.3%	164.00	163.00	169.8	169.9	198.4	196.6	201.8	200.1	1.2	2.5	2.5	Existing 10-yr
STGM2313	STMH1243	STMH1244	299	12'' DIA	0.6%	168.94	167.19	173.5	172.6	169.6	167.9	169.6	167.9	2.8	2.0	2.0	--
STGM2326	STMH1021	STMH1022	263	12'' DIA	2.5%	192.77	186.19	200.1	193.1	193.2	186.6	193.2	186.6	5.6	2.1	2.4	--
STGM233	STMH1018	J-HC-30	141	12'' DIA	0.7%	163.00	162.00	189.4	180.0	167.0	166.7	167.1	166.8	3.0	1.8	1.9	--
STGM2342	J4504	J-HC-13	173	Irregular Channel	17.3%	146.42	117.00	159.2	140.0	147.2	121.5	147.3	121.7		8.9	9.2	--
STGM2361_a	J-HC-04	J-HC-03	735	96'' DIA	0.4%	100.00	97.20	145.0	168.5	105.6	102.8	106.6	103.6	564.0	468.3	576.4	--
STGM2361_b	J-HC-03	OF_J-HC-02	560	96'' DIA	0.4%	97.20	95.00	168.5	104.0	102.8	100.6	103.6	101.1	572.4	475.1	579.2	--
STGM2366	STMH115	STMH116	227	27'' DIA	0.8%	186.02	184.21	200.7	195.5	187.4	185.3	187.4	185.3	27.5	18.2	18.4	--
STGM24	J4556	J5628	1004	Irregular Channel	4.5%	310.00	264.50	318.9	271.1	310.4	267.6	310.4	268.7		12.0	18.0	--
STGM241	J3630	STMG115	239	33'' DIA	0.2%	187.50	187.00	191.1	192.7	193.0	193.1	193.1	193.0	23.9	9.5	9.0	Existing 10-yr
STGM2425	STMH101	J3474	68	21'' DIA	0.9%	189.90	189.28	200.2	201.5	190.9	190.4	190.9	190.4	15.2	8.3	8.6	--
STGM2439	STMH095	STMH094	86	12'' DIA	0.7%	196.44	195.80	204.9	204.5	197.1	196.4	197.1	196.4	3.1	2.2	2.2	--
STGM2442	J4608	J4610	1371	Irregular Channel	0.1%	101.00	100.00	163.5	156.6	103.3	103.3	104.0	156.6		10.2	54.9	--
STGM2451	STMI0911	STII0955	80	15'' DIA	2.1%	259.63	257.95	264.5	263.9	260.2	258.6	260.3	258.7	9.6	4.1	5.7	--
STGM2459	STIH12139	STMH1224	90	15'' DIA	0.3%	173.26	172.96	178.7	180.0	178.7	180.0	178.7	180.0	3.7	7.5	7.5	--
STGM2478	J4398	J-HC-19	342	Irregular Channel	3.5%	141.00	129.00	160.6	155.0	141.7	134.0	141.7	134.4		11.9	12.1	--
STGM2497	STMH1315	STMH133	433	10'' DIA	1.1%	158.10	153.50	169.3	163.4	183.9	154.2	187.7	154.2	2.3	6.3	6.9	Existing 10-yr
STGM2498	STII11135	STMI117	37	24'' DIA	2.7%	198.00	194.00	211.4	208.9	199.1	195.2	199.2	195.2	37.3	22.8	23.4	--
STGM2500	J5110	STMH117	81	24'' DIA	2.2%	192.50	190.68	197.6	195.9	193.5	192.1	193.5	192.1	33.5	17.4	17.6	--
STGM2515	STMH104	STMH101	122	21'' DIA	1.6%	191.80	189.90	199.5	200.2	192.6	190.9	192.6	190.9	19.9	8.3	8.6	--
STGM2516	STMH1014	STMH1010	65	15'' DIA	6.9%	197.45	193.00	207.5	206.2	197.8	193.9	197.8	193.9	16.5	3.1	3.1	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM2530	J4642	J3696	21	Irregular Channel	3.3%	157.20	156.53	168.2	166.6	157.5	157.1	157.5	157.1		4.3	5.1	--
STGM2534	STMI151	J4974	49	15'' DIA	0.8%	156.80	156.40	164.7	163.4	158.0	156.7	160.4	156.7	5.9	8.0	14.5	--
STGM2535	STMG117	STMG118	441	18'' DIA	0.3%	185.00	183.75	192.3	188.9	186.1	184.4	186.1	184.4	5.6	5.1	5.1	--
STGM2558	J4576	J5090	1209	Irregular Channel	5.7%	313.00	244.00	319.3	260.8	313.2	245.6	313.2	246.0		10.7	13.2	--
STGM2566	STMI114	STMH129	334	33'' DIA	1.5%	185.80	180.81	195.9	192.2	187.1	182.0	187.2	182.1	64.2	30.2	30.8	--
STGM2577	STMH109	J-HCT4-04	20	12'' DIA	52.3%	185.00	175.60	193.1	195.0	185.1	177.0	185.1	177.0	27.0	1.1	1.1	--
STGM2584	STMH1222	STMH1220	227	12'' DIA	0.4%	172.10	171.26	176.3	176.3	182.5	181.1	182.7	181.2	2.3	3.4	3.4	Existing 10-yr
STGM2587	STMH1242	STMH1243	114	12'' DIA	0.9%	169.93	168.94	174.2	173.5	170.5	169.6	170.5	169.6	3.5	2.0	2.0	--
STGM2598	J3588	STII1179	307	Irregular Channel	0.7%	209.90	205.36	215.2	212.9	211.2	207.2	211.4	207.3		15.1	16.0	--
STGM2644	STMH0912	STMH0911	54	12'' DIA	5.9%	204.00	200.85	211.5	211.6	222.0	222.0	228.3	228.3	8.9	1.5	1.7	Existing 10-yr
STGM2658	J5562	J4160	454	Irregular Channel	3.7%	164.00	147.33	171.1	154.4	165.0	148.2	165.0	148.3		20.3	22.0	--
STGM2660	STMH1227	J-HCT3-09	345	15'' DIA	0.3%	171.54	170.50	180.9	177.1	180.9	171.8	180.9	171.8	3.5	5.5	5.5	--
STGM2680	STII0941	STII0945	192	12'' DIA	2.7%	252.00	246.63	258.1	252.5	252.6	247.7	256.6	249.2	6.1	3.8	6.8	--
STGM2704	STII0940	STII0941	78	12'' DIA	0.9%	252.88	252.00	259.1	258.1	253.8	252.6	259.1	256.6	3.5	3.8	6.8	--
STGM2730	STII118	STII116	200	18'' DIA	0.9%	190.63	188.91	202.3	198.4	191.6	190.0	191.6	190.0	9.7	7.5	7.5	--
STGM2732	STMH1013	STMH1014	123	12'' DIA	6.0%	204.80	197.45	214.2	207.5	205.1	197.8	205.1	197.8	8.5	1.2	1.2	--
STGM2734	STMG114	J4784	79	18'' DIA	1.3%	191.00	190.00	197.1	195.9	193.2	193.0	193.4	193.2	11.9	5.7	5.9	--
STGM2743	J-HC-26	J-HC-25	232	78'' DIA	0.5%	140.40	139.30	146.1	160.0	144.8	143.8	145.5	144.3	362.4	282.5	357.8	--
STGM2754	J3936	J3938	164	18'' DIA	6.7%	398.00	387.00	415.0	397.0	399.1	388.0	399.1	388.0	27.2	24.5	24.5	--
STGM2778	STMI131	STMI132	236	18'' DIA	3.6%	151.80	143.41	167.5	162.1	152.4	144.7	152.4	144.9	20.3	5.9	5.9	--
STGM28	J4200	J4398	66	18'' DIA	18.5%	153.00	141.00	155.5	160.6	153.5	141.7	153.5	141.7	45.8	11.9	12.1	--
STGM2830	STII093	J5084	172	12'' DIA	0.3%	233.50	233.00	240.0	238.3	236.0	233.6	236.4	233.6	1.9	6.2	6.3	--
STGM2831	J4734	STMI096	552	12'' DIA	1.3%	264.00	256.00	268.3	258.7	266.9	256.6	268.0	256.7	4.0	4.7	4.9	--
STGM285	STIH1033	STMH1015	113	12'' DIA	3.5%	209.00	205.00	215.9	216.2	209.3	205.5	209.3	205.5	6.6	1.2	1.2	--
STGM286	STMI141	STMI135	312	18'' DIA	0.7%	154.90	152.82	167.6	166.1	155.8	154.0	155.8	154.0	8.9	5.9	5.9	--
STGM2874	STIH12182	STIH12125	196	15'' DIA	0.5%	179.31	178.25	187.1	181.7	180.1	179.0	180.1	179.0	4.6	3.1	3.1	--
STGM2917	J5012	STII093	74	12'' DIA	0.7%	234.00	233.50	240.5	240.0	236.3	236.0	236.8	236.4	2.9	11.0	15.9	--
STGM2928	STMH0911	STMH0913	319	12'' DIA	1.6%	200.85	195.61	211.6	206.5	222.0	206.0	228.3	208.4	4.8	9.0	10.4	Existing 10-yr
STGM2953	STII141	OF_J5066	152	18'' DIA	0.2%	167.21	166.90	173.9	174.0	169.1	168.4	170.3	168.4	4.9	7.4	8.1	--
STGM2979	STMH133	J4098	66	15'' DIA	2.3%	153.50	152.00	163.4	157.4	154.2	152.4	154.2	152.4	9.7	5.6	6.0	--
STGM2985	STMH114	STMH115	40	24'' DIA	1.8%	186.75	186.02	200.8	200.7	187.9	187.4	187.9	187.4	30.3	18.2	18.4	--
STGM2986	J4862	J-HC-07	94	Irregular Channel	15.8%	120.00	105.30	130.0	140.0	120.5	111.0	120.5	110.9		5.0	5.7	--
STGM2998	STMH107	STMH108	67	12'' DIA	7.0%	191.68	187.00	199.5	196.1	192.0	187.2	192.0	187.2	9.3	1.7	1.7	--
STGM3054	STMG1010	STMG109	317	18'' DIA	1.4%	189.18	184.62	201.5	199.7	190.2	185.9	190.2	185.9	12.6	10.5	10.8	--
STGM3056	STII116	STMI113	161	18'' DIA	0.7%	188.91	187.80	198.4	195.2	190.0	188.8	190.0	188.8	8.7	7.5	7.5	--
STGM3060	STMI081	STIL085	648	12'' DIA	4.6%	305.96	276.09	310.7	280.1	306.5	276.6	306.6	276.7	7.9	4.1	5.7	--
STGM3072	STMI1312	STMI1311	168	21'' DIA	1.7%	157.19	154.39	167.1	162.6	157.7	154.8	158.0	154.9	20.5	3.9	8.2	--
STGM311	J4198	J4200	251	Irregular Channel	2.8%	160.00	153.00	165.7	155.5	160.5	153.5	160.5	153.5		11.9	12.1	--
STGM3123	J5284	J5090	622	Irregular Channel	1.3%	252.00	244.00	280.7	260.8	252.7	245.6	252.8	246.0		5.2	6.5	--
STGM3128	J5628	J4734	39	12'' DIA	1.3%	264.50	264.00	271.1	268.3	267.6	266.9	268.7	268.0	4.0	11.8	17.9	--
STGM3138	STMH1313	STMH1312	49	12'' DIA	11.7%	153.35	147.62	163.3	162.4	153.6	147.9	153.7	147.9	12.9	2.2	2.7	--
STGM3166	STMI122	STMI121	491	24'' DIA	0.5%	182.11	179.45	192.6	189.9	183.3	180.2	183.3	180.2	16.7	9.7	9.7	--
STGM3183	STII0956	STII0957	79	15'' DIA	0.7%	257.19	256.62	263.8	263.3	258.0	257.3	258.2	257.5	5.7	4.0	5.7	--
STGM319	STII0955	STII0956	38	15'' DIA	2.0%	257.95	257.19	263.9	263.8	258.6	258.0	258.7	258.2	9.2	4.0	5.7	--
STGM3202	J4690	J-HC-40	763	Irregular Channel	8.1%	355.60	294.00	362.6	330.0	356.3	295.8	356.3	295.9		27.0	27.6	--
STGM3225	STII0948	STII0942	165	18'' DIA	0.5%	251.09	250.05	259.8	260.6	251.5	250.4	251.5	250.5	7.7	1.2	1.4	--
STGM3238	STII142	STII141	197	15'' DIA	0.2%	167.62	167.21	172.1	173.9	171.5	169.1	172.1	170.3	3.1	7.4	8.1	Future 10-yr
STGM3239	STII151	STMI151	314	18'' DIA	0.8%	159.50	156.80	167.6	164.7	160.6	158.0	167.6	160.4	9.4	8.0	14.5	--
STGM3242	STMG1015	STMG1019	29	24'' DIA	14.1%	181.87	177.80	191.3	190.8	182.4	178.9	182.4	178.9	83.9	14.3	14.5	--
STGM3263	STII0952	STII0948	79	18'' DIA	0.5%	251.69	251.09	259.1	259.8	252.1	251.5	252.1	251.5	7.7	1.2	1.4	--
STGM3271	J-HC-43	J-HC-42	49	18'' DIA	4.3%	348.30	344.20	365.0	351.7	352.8	345.4	352.8	345.4	21.7	33.9	33.9	--
STGM3278	STMH0916	STMH0923	40	12'' DIA	9.4%	193.13	189.37	199.8	198.7	193.8	189.9	193.8	189.9	11.4	8.3	9.2	--
STGM329	STMH106	STMH105	266	15'' DIA	1.4%	197.65	194.00	208.4	201.1	198.2	194.7	198.2	194.7	7.6	3.1	3.1	--
STGM3290	STMH1221	STMH1226	228	12'' DIA	0.2%	170.42	169.99	174.9	173.7	179.7	178.3	179.8	178.4	1.6	3.7	3.4	Existing 10-yr
STGM3325	J5324	J5326	46	12'' DIA	5.5%	436.50	434.00	460.0	439.5	437.3	434.3	437.3	434.3	8.3	7.3	7.3	--
STGM3337	STMH1137	J4198	581	18'' DIA	2.9%	177.67	160.00	185.0	165.7	178.4	160.5	178.4	160.5	17.9	8.6	8.8	--
STGM3381	STMI096	J-HC-36	2189	18'' DIA	3.4%	256.00	180.50	258.7	187.0	256.6	184.1	256.7	184.3	19.6	6.3	7.6	--
STGM3389	STII11281	STII11135	84	24'' DIA	1.2%	201.50	198.00	211.5	211.4	203.0	199.1	203.1	199.2	24.7	22.8	23.4	--
STGM3407	STIH1013	STMH109	184	12'' DIA	9.0%	201.50	185.00	209.0	193.1	201.7	185.1	201.7	185.1	10.8	1.2	1.2	--
STGM3431	STMH1215	STMH1216	41	15'' DIA	1.9%	157.22	156.42	163.5	162.7	158.2	156.9	158.3	157.0	8.9	8.9	9.2	--
STGM3432	J5026	STMH096	261	15'' DIA	0.8%	226.00	224.00	239.1	237.9	240.0	237.9	240.7	238.4	5.7	8.6	8.8	Existing 10-yr
STGM3445	STMI135	STMI131	340	18'' DIA	0.3%	152.82	151.80	166.1	167.5	154.0	152.4	154.0	152.4	6.0	5.9	5.9	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM3453	STMH1116	STMH1128	185	12'' DIA	5.1%	213.23	203.80	216.3	216.9	213.7	204.3	213.7	204.3	8.1	3.2	3.4	--
STGM3474	J5046	J4738	138	24'' DIA	1.4%	228.00	226.00	234.2	234.5	228.8	227.0	228.8	227.0	27.6	8.8	9.3	--
STGM351	J4636	STIH12139	376	Irregular Channel	0.9%	176.50	173.26	183.6	178.7	177.8	178.7	177.8	178.7		7.1	7.1	--
STGM3528	J4620	STMG1228	786	12'' DIA	0.5%	176.30	172.00	186.6	183.2	203.6	195.4	203.6	195.4	2.6	4.6	4.6	Existing 10-yr
STGM3539	STMG1223	STMG1213	526	12'' DIA	0.5%	170.31	167.50	176.1	174.0	180.2	167.9	180.2	167.9	2.6	5.0	5.0	Existing 10-yr
STGM3548	STMH1311	STMH1310	114	12'' DIA	6.6%	154.60	147.10	165.6	159.9	155.0	148.3	155.0	148.4	9.7	2.8	3.0	--
STGM355	STMH1230	STMH1222	116	12'' DIA	0.5%	172.72	172.10	176.7	176.3	183.3	182.5	183.4	182.7	2.7	3.6	3.6	Existing 10-yr
STGM3558	STMI112	STII118	164	18'' DIA	1.1%	192.35	190.63	203.9	202.3	192.9	191.6	192.9	191.6	10.7	3.2	3.2	--
STGM3568	J4234	STMI114	34	18'' DIA	1.0%	187.20	185.80	195.7	195.9	188.1	187.1	188.1	187.2	10.7	7.5	7.5	--
STGM3572	STMH1126	STMH1129	386	24'' DIA	1.6%	199.00	193.00	205.7	197.9	200.0	193.9	200.0	193.9	28.2	14.4	14.6	--
STGM3599	STIG1139	J4068	81	12'' DIA	0.5%	186.50	186.10	191.5	192.4	192.8	192.8	192.9	192.9	2.6	2.9	3.0	Existing 10-yr
STGM3602	STMH1224	STMH1227	430	15'' DIA	0.3%	172.96	171.54	180.0	180.9	180.0	180.9	180.0	180.9	3.7	5.5	5.5	--
STGM3610	STIL085	STMI0911	413	15'' DIA	4.0%	276.09	259.63	280.1	264.5	276.6	260.2	276.7	260.3	13.5	4.1	5.7	--
STGM3620	STII0942	STII0943	51	18'' DIA	0.5%	250.05	249.57	260.6	260.1	250.4	250.0	250.5	250.0	8.2	1.2	1.4	--
STGM3629	J3614	J4282	389	Irregular Channel	0.6%	172.00	169.70	178.3	174.0	173.0	170.6	173.0	170.6		11.7	11.7	--
STGM3680	J4784	J3628	466	Irregular Channel	0.4%	190.00	188.00	195.9	194.3	193.0	194.3	193.2	194.3		56.3	61.0	--
STGM3682	STIH1036	J-HCT4-06	63	27'' DIA	7.9%	190.00	185.00	197.3	195.0	191.3	186.3	191.3	186.4	47.5	29.9	30.3	--
STGM37	STMH1135	STMH118	320	15'' DIA	0.5%	185.80	184.00	193.2	189.9	186.6	184.6	186.6	184.6	4.4	3.2	3.3	--
STGM3704	STMG115	STIG1142	121	12'' DIA	0.4%	187.00	186.50	192.7	192.4	193.1	192.8	193.0	192.9	2.3	6.7	6.7	Existing 10-yr
STGM3712	STMH116	STIH118	310	18'' DIA	6.7%	184.21	163.50	195.5	170.0	185.3	164.1	185.3	164.1	27.2	19.9	20.2	--
STGM3729	J4098	J-HC-11	325	Irregular Channel	12.3%	152.00	112.50	157.4	119.0	152.4	115.2	152.4	115.4		7.1	8.1	--
STGM3730	J5510	STMH1137	162	18'' DIA	1.8%	180.53	177.67	188.5	185.0	181.2	178.4	181.2	178.4	14.1	4.9	5.1	--
STGM3756	J4370	J5046	214	Irregular Channel	0.4%	228.80	228.00	234.8	234.2	229.9	228.8	230.0	228.8		8.9	9.3	--
STGM3759	STMG125	STMG126	306	12'' DIA	1.3%	166.96	163.00	177.0	172.1	177.9	163.5	177.9	163.5	4.1	7.1	7.1	Existing 10-yr
STGM3771	STMH102	STMH103	272	24'' DIA	1.7%	174.70	169.99	182.3	181.1	175.9	170.9	175.9	170.9	29.7	18.1	18.5	--
STGM3809	STIH145	STIH146	105	12'' DIA	-0.3%	163.35	163.62	167.1	166.2	165.5	164.2	165.6	164.2	1.8	3.4	3.4	--
STGM3810	STMH1254	J4668	579	12'' DIA	0.8%	169.50	164.65	176.8	173.3	208.0	190.1	208.6	191.1	3.3	8.2	8.2	Existing 10-yr
STGM383	STMH1011	STIH1038	54	12'' DIA	2.4%	199.00	197.70	207.8	205.3	199.4	198.0	199.4	198.0	5.6	1.9	1.9	--
STGM3836	J3938	J4688	349	Irregular Channel	8.6%	387.00	357.00	397.0	364.2	388.0	358.2	388.0	358.2		27.1	27.7	--
STGM3848	STMG122	STMG1223	261	12'' DIA	0.5%	171.50	170.31	177.4	176.1	185.2	180.2	185.2	180.2	2.4	5.2	5.2	Existing 10-yr
STGM3855	J4628	STIH0917	253	Irregular Channel	4.8%	242.10	230.00	252.5	242.0	242.5	242.3	243.2	243.2		3.8	6.8	--
STGM3862	J4688	J4690	40	Irregular Channel	3.5%	357.00	355.60	364.2	362.6	358.2	356.3	358.2	356.3		27.1	27.7	--
STGM3868	J6	STIH145	135	12'' DIA	0.5%	164.00	163.35	169.4	167.1	166.7	165.5	166.9	165.6	2.5	3.4	3.4	--
STGM3906	STMH094	STMH093	78	12'' DIA	0.7%	195.80	195.22	204.5	204.4	196.4	195.5	196.4	195.5	3.0	2.2	2.2	--
STGM3923	STMH1124	STMH1112	28	21'' DIA	2.1%	203.30	202.70	211.4	211.0	203.8	203.3	203.8	203.3	22.5	3.4	3.4	--
STGM3927	STMG1228	STMG125	449	12'' DIA	1.1%	172.00	166.96	183.2	177.0	195.4	177.9	195.4	177.9	3.8	8.1	8.1	Existing 10-yr
STGM3952	J4738	J4740	1597	Irregular Channel	2.0%	226.00	194.00	234.5	202.9	227.0	195.6	227.0	195.6		23.7	24.1	--
STGM3954	STMH103	J3696	206	21'' DIA	6.5%	169.99	156.53	181.1	166.6	170.9	157.1	170.9	157.1	40.3	18.1	18.5	--
STGM396	STIH1035	STIH1036	38	27'' DIA	2.3%	190.90	190.00	197.0	197.3	192.6	191.3	192.6	191.3	25.8	22.9	23.3	--
STGM3971	J4050	STMI096	50	18'' DIA	2.0%	258.00	256.00	262.3	258.7	258.4	256.6	258.5	256.7	15.0	1.8	3.1	--
STGM3990	STMG108	STMG109	128	21'' DIA	3.0%	188.50	184.62	199.3	199.7	189.0	185.9	189.0	185.9	27.5	4.2	4.2	--
STGM4004	STMH129	STMH128	444	36'' DIA	1.6%	180.81	173.60	192.2	186.6	182.0	176.2	182.1	176.3	86.2	30.2	30.8	--
STGM4009	STII0943	STII0947	281	18'' DIA	0.5%	249.57	248.11	260.1	252.1	250.0	248.4	250.0	248.4	7.7	1.2	1.4	--
STGM4036	STII0950	STII0952	174	18'' DIA	0.5%	252.77	251.69	260.3	259.1	253.2	252.1	253.2	252.1	7.7	1.2	1.4	--
STGM407	J5480	J5026	184	15'' DIA	1.1%	228.10	226.00	240.3	239.1	241.7	240.0	242.4	240.7	6.9	8.4	8.6	Existing 10-yr
STGM4082	J4740	STIH1035	116	27'' DIA	2.7%	194.00	190.90	202.9	197.0	195.6	192.6	195.6	192.6	27.3	23.5	24.0	--
STGM4085	STMG106	STMG1035	184	18'' DIA	0.5%	190.00	189.00	200.6	197.3	190.8	189.8	190.8	189.8	7.7	4.1	4.1	--
STGM4187	STIH1012	STIH1013	35	12'' DIA	0.3%	201.60	201.50	209.0	209.0	202.1	201.7	202.1	201.7	1.9	1.1	1.1	--
STGM4198	STMH0913	STMH0916	214	12'' DIA	1.2%	195.61	193.13	206.5	199.8	206.0	193.8	208.4	193.8	4.0	8.3	9.3	Future 10-yr
STGM4205	STMH0920	STMH0919	55	18'' DIA	5.1%	212.00	209.20	221.4	217.9	222.8	220.5	223.9	221.5	23.8	21.9	22.2	Existing 10-yr
STGM4217	J5242	J4050	531	Irregular Channel	0.4%	260.00	258.00	262.2	262.3	260.3	258.4	260.4	258.5		1.9	3.2	--
STGM4228	J-HC-35	J-HC-34	88	60'' DIA	1.9%	178.70	177.00	185.2	190.0	181.7	180.8	182.1	181.0	364.5	193.2	250.1	--
STGM4240	J4610	J-HC-03	540	24'' DIA	0.2%	100.00	97.20	156.6	168.5	103.3	102.8	156.6	103.6	9.7	18.7	48.3	--
STGM425	STMH128	STMH127	415	42'' DIA	0.1%	173.60	173.13	186.6	181.8	176.2	174.6	176.3	174.6	33.8	50.0	50.8	--
STGM4250	J3872	STMG112	167	12'' DIA	0.2%	185.80	185.51	193.2	194.4	192.6	192.2	193.2	192.3	1.5	2.9	3.0	--
STGM4256	STMH1127	STMH1126	268	21'' DIA	0.6%	200.50	199.00	212.7	205.7	201.8	200.0	201.9	200.0	11.8	11.2	11.5	--
STGM4274	STMH127	STMH1231	81	48'' DIA	1.9%	173.13	171.56	181.8	179.7	174.6	173.4	174.6	173.5	197.6	55.3	56.3	--
STGM4279	STII0953	STII0954	78	18'' DIA	1.3%	260.00	259.00	263.3	261.0	260.2	259.3	260.2	259.3	13.3	0.4	0.6	--
STGM428	STMH1241	J-HCT3-03	132	18'' DIA	5.3%	161.94	155.00	167.6	165.0	162.3	155.7	162.3	155.7	24.0	2.7	2.7	--
STGM4297	STMH1214	STMH1215	185	15'' DIA	1.7%	160.30	157.22	168.3	163.5	161.2	158.2	161.2	158.3	8.3	7.0	7.0	--
STGM4325	STMH1244	STMH1245	195	12'' DIA	0.5%	167.19	166.12	172.6	172.5	167.9	166.5	167.9	166.5	2.8	2.0	2.0	--
STGM4334	STMH1024	STMH0912	207	12'' DIA	0.5%	205.02	204.00	212.8	211.5	222.1	222.0	228.4	228.3	2.6	1.0	1.2	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM4460	J3628	J3630	62	12'' DIA	0.8%	188.00	187.50	194.3	191.1	194.3	193.0	194.3	193.1	3.2	63.1	68.1	Existing 10-yr
STGM461	STMG1019	STMH102	153	24'' DIA	2.0%	177.80	174.70	190.8	182.3	178.9	175.9	178.9	175.9	32.4	18.1	18.5	--
STGM480	J5560	J5562	66	18'' DIA	1.5%	165.00	164.00	168.9	171.1	166.4	165.0	166.4	165.0	12.9	15.6	15.9	--
STGM496	STMH1240	STMH1241	57	18'' DIA	0.6%	162.29	161.94	167.9	167.6	162.9	162.3	162.9	162.3	8.5	2.7	2.7	--
STGM522	STMG1035	STMG108	111	18'' DIA	0.5%	189.00	188.50	197.3	199.3	189.8	189.0	189.8	189.0	7.1	4.1	4.1	--
STGM525	STMH1253	STMH1254	74	12'' DIA	1.8%	170.83	169.50	177.3	176.8	210.7	208.0	211.3	208.6	4.8	9.0	9.0	Existing 10-yr
STGM526	STMH1015	STMH1013	50	12'' DIA	0.4%	205.00	204.80	216.2	214.2	205.5	205.1	205.5	205.1	2.2	1.2	1.2	--
STGM545	STMH1125	STMH1124	106	21'' DIA	3.2%	206.69	203.30	211.6	211.4	207.1	203.8	207.1	203.8	28.1	3.4	3.4	--
STGM546	STMH1144	STMH1127	360	21'' DIA	0.3%	201.70	200.50	207.2	212.7	203.0	201.8	203.0	201.9	9.2	8.2	8.4	--
STGM551	STII1179	STMI1140	50	24'' DIA	0.4%	205.36	205.14	212.9	210.6	207.2	206.9	207.3	206.9	15.0	19.3	19.9	--
STGM610	J5444	J5484	87	18'' DIA	0.7%	212.42	211.80	219.8	218.5	215.0	213.1	215.3	213.1	8.9	15.2	16.1	--
STGM614	STMH111	STMH1017	416	12'' DIA	1.4%	198.50	192.51	201.8	194.6	199.2	192.9	199.3	192.9	4.3	3.4	3.4	--
STGM615	J5450	J-HC-37	1211	Irregular Channel	7.0%	280.00	196.00	288.9	220.0	280.3	199.0	280.3	199.3		2.4	2.7	--
STGM619	STMH1211	STMH1212	125	12'' DIA	1.0%	169.52	168.22	174.7	173.3	178.0	176.4	178.2	176.6	3.6	5.5	5.0	Existing 10-yr
STGM630	STII0945	STII0944	48	12'' DIA	0.6%	246.63	246.13	252.5	252.4	247.7	246.6	249.2	246.8	2.9	3.8	6.8	--
STGM658	J-HCT3-09	J-HCT3-08	49	24'' DIA	0.6%	170.50	170.20	177.1	175.0	171.8	171.6	171.8	171.7	89.1	60.6	61.5	--
STGM674	STMH1229	STMH1228	221	12'' DIA	1.5%	168.72	165.50	176.6	173.4	169.3	167.6	169.3	167.7	4.5	2.6	2.7	--
STGM712	STIG1142	STIG1139	115	12'' DIA	0.0%	186.50	186.50	192.4	191.5	192.8	192.8	192.9	192.9	0.1	2.9	3.0	Existing 10-yr
STGM727	STMH138	J-HC-12	142	12'' DIA	6.6%	124.75	115.43	138.8	140.0	125.1	120.1	125.1	120.3	9.7	1.9	2.2	--
STGM734	J-HCT3-07	J-HCT3-06	45	36'' DIA	0.4%	164.60	164.40	173.0	170.0	167.6	167.2	167.6	167.2	44.5	60.6	61.5	--
STGM74	J5090	J4956	96	36'' DIA	4.2%	244.00	240.00	260.8	254.2	245.6	241.6	246.0	241.8	136.8	79.6	113.0	--
STGM748	STMH1216	J4504	72	15'' DIA	13.9%	156.42	146.42	162.7	159.2	156.9	147.2	157.0	147.3	23.9	8.9	9.2	--
STGM761_a	STII0954	J35	321	Irregular Channel	1.6%	259.00	253.80	261.0	256.7	259.3	254.1	259.3	254.2		3.9	6.8	--
STGM761_b	J35	J5012	1225	Irregular Channel	1.6%	253.80	234.00	256.7	240.5	254.1	236.3	254.2	236.8		8.1	12.9	--
STGM793	J4066	STIG11113	27	12'' DIA	0.4%	186.00	185.90	192.0	192.8	192.7	192.7	192.8	192.8	2.3	3.2	3.2	Existing 10-yr
STGM855	J5326	J4576	942	Irregular Channel	13.0%	434.00	313.00	439.5	319.3	434.3	313.2	434.3	313.2		7.3	7.3	--
STGM857	STMH117	STMH114	443	24'' DIA	0.9%	190.68	186.75	195.9	200.8	192.1	187.9	192.1	187.9	21.3	17.4	17.6	--
STGM900	STMH1233	STMH1211	313	15'' DIA	0.4%	170.71	169.52	177.2	174.7	178.1	178.0	178.3	178.2	4.0	2.0	2.0	Existing 10-yr
STGM910	STIG11113	J3872	49	12'' DIA	0.2%	185.90	185.80	192.8	193.2	192.7	192.6	192.8	193.2	1.7	3.1	3.2	--
STGM937	STIH12125	STMH125	90	15'' DIA	0.6%	178.25	177.69	181.7	185.8	179.0	178.2	179.0	178.2	5.1	3.1	3.1	--
STGM952	STIH1043	STMH1014	82	12'' DIA	8.0%	204.00	197.45	210.2	207.5	204.3	197.8	204.3	197.8	10.2	1.9	1.9	--
STGM962	STMH1238	STMH1239	206	15'' DIA	0.5%	165.13	164.09	170.5	170.2	165.8	164.7	165.8	164.7	4.8	2.7	2.7	--
STGM98	STMG109	STMG1015	220	21'' DIA	1.2%	184.62	181.87	199.7	191.3	185.9	182.4	185.9	182.4	17.6	14.3	14.5	--
VILLA_CULVERT_1	J-HC-29	J-HC-28	59	30'' DIA	2.9%	153.50	151.80	160.0	170.0	156.5	155.9	156.9	156.2	69.9	234.7	300.4	--
VILLA_CULVERT_2	J-HC-29	J-HC-28	58	60'' DIA	2.9%	153.50	151.80	160.0	170.0	156.5	155.9	156.9	156.2	450.5	234.7	300.4	--
SPRING BROOK																	
C4	J5	J4848	282	Irregular Channel	1.3%	247.57	244.00	255.0	250.9	251.0	250.9	255.0	253.4		15.6	45.7	Future 10-yr
C52	J4990	STMJ1236	76	Irregular Channel	2.5%	167.85	165.95	179.0	178.4	168.0	166.6	168.0	166.7		2.0	2.2	--
HAYES_CULVERT	J-SBT1-05	J-SBT1-04	105	72'' DIA	2.7%	157.40	154.61	180.0	180.0	159.6	157.6	159.7	157.7	379.1	106.2	112.5	--
SB-00	J-SB-02	OF_J-SB-01	16	Irregular Channel	6.8%	106.10	105.00	130.0	165.0	109.0	108.2	109.2	108.4		616.3	671.8	--
SB-01	J-SB-03	J-SB-02	1345	Irregular Channel	0.2%	108.60	106.10	140.0	130.0	114.6	109.0	114.8	109.2		520.4	566.4	--
SB-02	J-SB-04	J-SB-03	4551	Irregular Channel	0.2%	115.90	108.60	125.0	140.0	121.4	114.6	121.4	114.8		409.2	437.7	--
SB-03	J-SB-06	J-SB-05	437	Irregular Channel	0.4%	119.00	117.10	125.0	125.0	122.5	122.1	122.7	122.2		425.7	454.9	--
SB-04	J-SB-07	J-SB-06	2465	Irregular Channel	0.3%	126.60	119.00	150.0	125.0	131.9	122.5	131.9	122.7		372.3	403.6	--
SB-05	J-SB-08	J-SB-07	2409	Irregular Channel	0.3%	134.00	126.60	160.0	150.0	139.5	131.9	139.6	131.9		347.1	369.5	--
SB-06	J-SB-09	J-SB-08	1627	Irregular Channel	0.3%	139.00	134.00	165.0	160.0	142.9	139.5	143.0	139.6		341.8	367.6	--
SB-07	J-SB-10	J-SB-09	1031	Irregular Channel	1.1%	150.00	139.00	155.0	165.0	152.9	142.9	153.2	143.0		240.1	269.4	--
SB-08	J-SB-11	J-SB-10	537	Irregular Channel	0.2%	151.00	150.00	153.2	155.0	154.9	152.9	155.0	153.2		198.5	221.0	Existing 10-yr
SB-09	J-SB-13	J-SB-12	2247	Irregular Channel	1.1%	177.00	152.70	185.0	156.3	179.4	157.9	179.5	158.6		177.3	210.0	--
SB-10	J-SB-14	J-SB-13	2491	Irregular Channel	1.9%	224.00	177.00	235.0	185.0	225.5	179.4	225.7	179.5		98.2	132.2	--
SB-11	J-SB-15	J-SB-14	1149	Irregular Channel	3.2%	260.20	224.00	270.0	235.0	261.4	225.5	261.5	225.7		64.0	94.0	--
SBT1-01	J-SBT1-01	J-SB-03	2512	Irregular Channel	1.2%	137.80	108.60	150.0	140.0	140.3	114.6	140.4	114.8		147.8	165.4	--
SBT1-02	J-SBT1-03	J-SBT1-02	1576	Irregular Channel	0.9%	152.20	138.80	175.0	152.6	155.2	145.9	155.3	146.8		118.1	128.9	--
SBT1-03	J-SBT1-04	J-SBT1-03	284	Irregular Channel	0.8%	154.61	152.20	180.0	175.0	157.6	155.2	157.7	155.3		113.2	123.4	--
SBT1-04	J-SBT1-06	J-SBT1-05	645	Irregular Channel	2.9%	176.00	157.40	185.0	180.0	178.2	159.6	178.2	159.7		89.0	92.2	--
SBT1-05	J-SBT1-08	J-SBT1-07	139	Irregular Channel	1.4%	182.00	180.00	199.2	197.0	182.7	181.4	182.7	181.4		81.4	84.4	--
SBT1-06	J-SBT1-09	J-SBT1-08	68	Irregular Channel	4.3%	188.95	182.00	196.5	199.2	189.2	182.7	189.2	182.7		15.8	15.8	--
SBT2-01	STMJ1242	J-SB-06	236	Irregular Channel	7.3%	136.14	119.00	145.0	125.0	136.5	122.5	136.5	122.7		10.7	11.2	--
SBT3-01	J-SBT3-01	J-SB-06	874	Irregular Channel	3.3%	147.70	119.00	160.0	125.0	148.5	122.5	148.6	122.7		26.2	36.7	--
SBT4-01	J-SBT4-01	J-SB-07	283	Irregular Channel	4.9%	140.54	126.60	145.0	150.0	141.2	131.9	141.2	131.9		21.4	21.4	--
SBT4-02	J-SBT4-02	STMK1113	198	Irregular Channel	-0.2%	153.60	154.00	157.0	167.8	155.5	155.2	155.7	155.6		18.3	19.5	--
SBT4-03	J-SBT4-03	J-SBT4-02	411	Irregular Channel	1.9%	161.31	153.60	170.0	157.0	161.9	155.5	161.9	155.7		13.0	13.5	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
SBT4-04	J-SBT4-05	J-SBT4-02	329	Irregular Channel	4.3%	167.77	153.60	173.0	157.0	168.0	155.5	168.0	155.7		3.5	3.9	--
SBT5-01	J-SBT5-01	J-SB-08	860	Irregular Channel	4.1%	169.20	134.00	180.0	160.0	169.8	139.5	169.8	139.6		15.2	17.4	--
SBT6-01	J-SBT6-01	J-SB-09	1563	Irregular Channel	0.3%	143.00	139.00	160.0	165.0	144.0	142.9	144.0	143.0		116.3	116.3	--
SBT7-01	J-SBT7-01	J-SB-10	684	Irregular Channel	2.6%	168.00	150.00	170.0	155.0	169.0	152.9	169.0	153.2		43.8	49.7	--
SBT7-02	J-SBT7-03	J-SBT7-02	382	Irregular Channel	4.4%	189.88	173.00	193.6	179.5	190.3	175.0	190.3	175.0		3.5	3.5	--
SPRINGBROOK_CULVERT	J-SB-16	J-SB-15	113	36'' DIA	6.0%	267.00	260.20	272.2	270.0	268.3	261.4	268.7	261.5	164.2	64.0	94.0	--
STGM1004	J5124	STMI0910	143	12'' DIA	2.8%	233.00	229.00	235.4	235.6	233.8	232.6	236.5	235.3	6.0	3.6	5.6	Future 10-yr
STGM1013	STMJ1136	STMJ1132	488	18'' DIA	0.6%	178.62	175.66	191.8	181.2	179.4	176.3	179.5	176.4	8.6	4.3	5.3	--
STGM1026	STMI1218	STMI1217	124	12'' DIA	1.6%	180.87	178.84	187.2	185.2	181.2	179.5	181.2	179.5	4.7	1.4	1.4	--
STGM1031	STMK1216	STMK1215	237	12'' DIA	12.7%	204.42	174.52	215.4	185.0	204.7	174.9	204.7	174.9	13.5	2.3	2.3	--
STGM1034	STMJ092	STMJ091	61	12'' DIA	0.3%	222.67	222.46	232.5	232.9	252.2	250.2	267.8	264.8	2.1	7.2	9.9	Existing 10-yr
STGM1040	STII0983	STII0916	198	21'' DIA	0.8%	232.30	230.80	238.3	236.9	237.1	234.6	238.8	237.3	13.9	14.6	15.0	Future 10-yr
STGM1043	STMJ1228	STMJ1229	80	15'' DIA	5.3%	142.40	138.19	152.3	150.4	143.2	139.0	143.2	139.0	15.5	10.7	11.2	--
STGM1064	STMI095	STII104	249	15'' DIA	-0.1%	232.85	233.15	244.0	239.5	238.6	233.9	236.9	233.9	2.2	4.0	4.1	--
STGM1074	STMJ1134	STMJ1135	247	15'' DIA	5.1%	184.75	172.13	193.7	184.2	185.1	173.3	185.2	173.5	15.4	3.1	3.8	--
STGM1080	STMI091	STMI1014	252	21'' DIA	1.1%	220.03	217.26	229.9	225.1	223.4	218.9	226.9	223.1	16.6	21.1	21.6	--
STGM1083	STII1033	STII1034	141	12'' DIA	1.1%	224.79	223.24	227.9	226.1	239.9	233.7	260.3	249.2	3.7	8.4	11.1	Existing 10-yr
STGM1099	STII0967	STII0968	33	12'' DIA	2.9%	255.36	254.20	261.6	260.1	255.6	254.5	255.7	254.5	6.3	1.1	1.4	--
STGM1105	STMK117	STMK118	144	12'' DIA	2.6%	173.50	169.71	180.8	178.2	174.0	170.3	174.0	170.3	6.1	3.2	3.4	--
STGM1126	J3524	STMI1015	178	15'' DIA	1.9%	217.58	213.55	225.1	221.8	223.5	221.8	231.6	227.9	9.0	7.4	9.7	Future 10-yr
STGM1130	STII10109	STII1030	119	12'' DIA	1.9%	223.00	220.80	231.7	229.4	237.8	237.1	241.3	240.7	4.8	4.4	5.5	Existing 10-yr
STGM1144	STMK1120	STMK1119	91	12'' DIA	5.8%	172.58	167.33	180.2	175.6	173.0	167.9	173.0	167.9	8.9	2.8	3.0	--
STGM1194	STMJ1219	STMJ1220	59	12'' DIA	3.0%	127.73	125.95	133.3	134.1	128.2	126.6	128.2	126.6	6.4	2.5	3.2	--
STGM1206	STMI1013	STMI109	362	21'' DIA	1.6%	222.05	216.25	230.4	223.3	222.5	218.4	222.5	222.7	10.8	1.5	1.5	--
STGM1211	STMI106	STMI1021	401	21'' DIA	2.6%	222.18	211.58	225.8	215.2	222.9	212.5	222.9	212.5	25.6	9.0	9.1	--
STGM1213	STII1056	STMI108	206	12'' DIA	1.6%	213.00	209.79	220.4	221.0	216.9	216.9	219.7	219.7	4.5	1.6	1.6	--
STGM1231	STII0988	STMI099	66	30'' DIA	0.5%	228.75	228.23	239.6	241.7	237.8	237.8	241.3	241.4	29.4	3.2	4.2	Future 10-yr
STGM1241	J-SB-12	J-SB-11	185	48'' DIA	0.9%	152.70	151.00	156.3	153.2	157.9	154.9	158.6	155.0	137.3	204.3	231.2	Existing 10-yr
STGM1265	J5216	J4424	585	Irregular Channel	0.7%	206.00	202.00	211.3	204.8	216.6	203.1	218.9	203.4		48.9	52.2	Existing 10-yr
STGM1277	STMK1110	STMK117	115	12'' DIA	3.7%	177.71	173.50	187.2	180.8	178.2	174.0	178.2	174.0	7.2	3.2	3.4	--
STGM1287	STII09103	STII09106	123	18'' DIA	1.1%	250.92	249.39	259.4	257.7	252.0	252.2	259.4	257.8	11.4	9.3	18.1	Future 10-yr
STGM1289	J4834	STII1194	312	24'' DIA	1.0%	197.00	193.95	209.4	202.5	198.3	195.7	198.3	195.9	22.5	17.3	17.4	--
STGM1305	STMJ1121	STMJ1120	211	12'' DIA	0.7%	186.07	184.60	195.3	193.0	186.9	185.3	189.3	185.4	3.1	3.0	4.3	--
STGM1306	STMJ1127	STMJ1113	74	15'' DIA	2.3%	208.87	207.14	213.0	211.5	209.2	207.4	209.2	207.4	10.1	1.4	1.5	--
STGM1321	STML1131	STML1132	245	27'' DIA	1.8%	194.81	190.42	207.4	202.9	195.8	191.4	195.8	191.4	41.6	15.8	15.8	--
STGM133	STII09106	J5	144	18'' DIA	1.3%	249.39	247.57	257.7	255.0	252.2	251.0	257.8	255.0	12.3	9.3	17.7	Future 10-yr
STGM1348	STMJ1222	STMJ1220	110	18'' DIA	6.8%	133.40	125.95	138.2	134.1	134.0	126.6	134.0	126.6	28.0	9.0	9.0	--
STGM1359	J5382	J5178	136	Irregular Channel	7.1%	214.65	205.00	219.1	210.4	214.9	205.5	214.9	205.5		5.3	5.3	--
STGM1360	STMJ1010	STMJ1012	157	12'' DIA	2.5%	185.18	181.23	193.3	191.5	185.4	181.6	185.4	181.7	5.9	0.7	0.7	--
STGM14	STMK116	STMK115	109	12'' DIA	5.6%	179.68	173.64	190.1	181.5	180.3	174.2	180.4	174.2	8.7	6.6	6.8	--
STGM1405	STMK1223	STMK1224	353	12'' DIA	5.4%	263.91	244.69	272.9	253.2	264.3	245.0	264.3	245.0	8.5	2.3	2.3	--
STGM1422	STMK1119	STMK1118	113	12'' DIA	1.7%	167.33	165.41	175.6	174.1	167.9	165.9	167.9	166.0	4.6	2.8	3.0	--
STGM1444	STMJ1229	STMJ1242	39	15'' DIA	5.3%	138.19	136.14	150.4	145.0	139.0	136.5	139.0	136.5	15.5	10.7	11.2	--
STGM1460	STMJ1126	STMJ1128	241	12'' DIA	2.0%	219.30	214.51	223.5	218.8	219.7	214.9	219.7	214.9	5.3	1.4	1.5	--
STGM1504	STII0990	STII0991	106	30'' DIA	0.5%	227.59	226.87	238.2	235.7	237.8	237.8	241.3	241.3	30.5	4.6	5.8	Future 10-yr
STGM1581	STMK119	STIK117	141	15'' DIA	0.3%	168.40	167.96	177.3	175.0	169.3	168.7	169.3	168.8	3.8	3.1	3.4	--
STGM1593	J4848	STII0913	499	12'' DIA	1.8%	244.00	235.00	250.9	243.0	250.9	238.1	253.4	241.5	4.8	17.2	41.6	Existing 10-yr
STGM1611	STMI1177	J-SBT1-08	153	42'' DIA	2.0%	185.02	182.00	201.0	199.2	186.6	182.7	186.6	182.7	142.9	52.9	55.1	--
STGM1627	STMI1168	STMI1167	98	15'' DIA	1.2%	194.76	193.54	202.0	199.4	195.4	194.2	195.4	194.5	7.4	3.4	3.7	--
STGM1637	STMJ1216	J4990	84	18'' DIA	5.1%	172.18	167.85	179.1	179.0	172.5	168.0	172.5	168.0	25.0	2.0	2.2	--
STGM1646	J3668	STII0913	55	21'' DIA	0.9%	235.50	235.00	241.6	243.0	237.5	238.1	241.7	241.5	15.0	12.6	16.3	Future 10-yr
STGM1647	STMJ1239	STMJ1233	158	36'' DIA	0.8%	160.72	159.41	175.8	172.3	161.7	160.5	161.9	160.7	33.2	7.6	10.3	--
STGM1650	STMK124	STMK122	179	18'' DIA	0.5%	164.12	163.17	169.3	171.4	164.9	164.0	164.9	164.0	8.0	4.5	4.5	--
STGM1667	STMI1171	STMI1170	62	12'' DIA	1.1%	197.53	196.84	203.5	202.7	198.1	197.4	198.1	197.4	3.9	2.1	2.3	--
STGM17	STMJ128	STMI1212	450	33'' DIA	0.5%	167.85	165.74	175.6	175.9	169.1	166.9	169.2	167.0	37.9	15.9	17.8	--
STGM1701	STMI094	STMI093	256	21'' DIA	1.2%	226.07	223.04	236.0	232.8	231.8	227.6	234.6	230.7	18.0	21.1	21.6	--
STGM1739	J-SBT4-04	J-SBT4-03	68	33'' DIA	3.3%	163.59	161.31	171.9	170.0	164.3	161.9	164.3	161.9	100.2	13.1	13.5	--
STGM1742	STMK123	STMK122	248	12'' DIA	6.2%	178.61	163.17	184.0	171.4	178.8	164.0	178.8	164.0	9.5	1.1	1.1	--
STGM1757	STII0915	STMI0910	87	21'' DIA	0.8%	229.70	229.00	236.6	235.6	233.2	232.6	236.0	235.3	14.3	15.1	15.4	--
STGM1784	STMI099	STII0990	90	30'' DIA	0.5%	228.23	227.59	241.7	238.2	237.8	237.8	241.4	241.3	29.5	3.2	4.5	--
STGM1822	STMJ1235	STMJ1234	228	24'' DIA	1.7%	170.33	166.39	176.9	173.8	171.1	167.2	171.2	167.3	30.6	10.4	13.1	--
STGM1824	STMJ105	J3522	28	15'' DIA	0.3%	212.09	212.00	221.3	221.6	216.1	213.8	216.4	213.9	3.7	18.3	19.2	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM1893	STMK1224	STMK1225	64	12'' DIA	8.2%	244.69	239.49	253.2	249.0	245.0	239.8	245.0	239.8	10.4	2.3	2.3	--
STGM1917	STII09125	STII09124	140	15'' DIA	0.3%	248.36	247.94	254.3	253.5	249.8	249.0	252.2	249.3	3.7	5.3	7.9	--
STGM1943	STMJ1210	STMJ128	156	21'' DIA	0.6%	168.84	167.85	174.5	175.6	170.1	169.1	170.2	169.2	13.1	11.0	12.7	--
STGM1946	STMK1232	STMK1231	271	12'' DIA	10.7%	248.53	219.71	252.9	228.0	248.8	220.0	248.8	220.0	12.3	2.6	2.6	--
STGM1948_a	J5178	J4094	903	Irregular Channel	2.2%	205.00	185.00	210.4	190.0	205.5	185.4	205.5	185.5		37.7	40.9	--
STGM1948_b	J4094	J4284	257	Irregular Channel	3.9%	185.00	174.80	190.0	184.9	185.4	179.6	185.5	180.5		42.1	52.9	--
STGM1949	STMI1017	J5216	86	24'' DIA	0.6%	206.55	206.00	215.3	211.3	216.6	216.6	219.0	218.9	18.1	13.9	15.6	Existing 10-yr
STGM1954	STMI1222	STMI1212	231	18'' DIA	3.0%	172.59	165.74	178.7	175.9	173.2	166.9	173.2	167.0	18.8	5.6	5.8	--
STGM1965	STMI1012	STMI103	93	27'' DIA	0.4%	211.40	210.80	219.9	220.7	218.5	217.6	219.8	219.2	20.3	29.5	30.0	--
STGM197	STMK1117	STMK1116	135	15'' DIA	1.3%	164.26	162.55	173.2	171.6	164.8	163.0	164.8	163.0	7.6	2.8	3.0	--
STGM1978	STII09111	STII09112	77	18'' DIA	0.5%	247.51	247.12	252.8	253.4	248.4	247.7	248.7	247.8	7.8	5.3	7.9	--
STGM1994	STII104	STMI1010	59	15'' DIA	0.8%	233.15	232.65	239.5	240.0	233.9	233.4	233.9	233.4	5.9	4.0	4.1	--
STGM2002	STMI1215	STMI1210	123	18'' DIA	1.2%	170.24	168.81	177.1	175.7	170.8	169.2	170.8	169.2	12.0	3.4	3.4	--
STGM201	STMI1113	STMI1123	445	36'' DIA	0.8%	193.31	189.65	203.0	206.2	195.5	191.5	195.5	191.6	60.5	52.0	54.1	--
STGM203	STMJ1213	STMJ1214	166	12'' DIA	1.1%	180.53	178.72	185.1	183.1	181.4	181.2	185.1	183.1	3.8	2.1	2.3	--
STGM2032	STMI128	STII1245	602	24'' DIA	2.2%	173.00	160.00	180.2	167.7	174.0	161.1	174.0	161.2	34.3	16.1	17.2	--
STGM2036	STMK1121	STMK116	208	12'' DIA	5.1%	190.20	179.68	198.3	190.1	190.9	180.3	190.9	180.4	8.4	6.6	6.8	--
STGM2043	STMJ1143	STMJ1238	499	24'' DIA	1.4%	176.00	168.99	184.3	178.5	176.4	169.4	176.5	169.5	28.0	2.8	3.9	--
STGM2050	STMK115	STMK114	111	12'' DIA	7.6%	173.64	165.22	181.5	172.5	174.2	166.0	174.2	166.0	10.2	6.6	6.8	--
STGM2060	STMI1214	J-SBT1-02	124	24'' DIA	15.0%	157.09	138.80	166.7	152.6	157.8	145.9	157.9	146.8	91.6	26.6	28.6	--
STGM2072	STMI1160	STMI1144	101	15'' DIA	0.6%	187.86	187.23	195.0	193.5	188.5	187.8	188.6	187.8	5.3	3.1	3.2	--
STGM2081	STMJ103	STMJ106	121	21'' DIA	0.3%	213.12	212.77	221.6	222.2	217.8	217.1	219.0	218.2	8.5	8.8	8.8	--
STGM2099	J5236	J4848	331	12'' DIA	2.1%	252.00	244.00	258.6	250.9	252.5	250.9	258.6	253.4	5.1	2.1	3.3	--
STGM210	STMI109	STMI105	34	33'' DIA	3.1%	216.25	215.20	223.3	223.5	218.4	223.5	222.7	223.5	93.8	25.5	26.0	--
STGM2106	STMK1228	STMK124	54	18'' DIA	3.7%	166.09	164.12	170.3	169.3	166.5	164.9	166.5	164.9	20.7	3.7	3.8	--
STGM2113	STIK116	J-SBT4-04	29	33'' DIA	3.3%	164.54	163.59	173.0	171.9	164.9	164.3	164.9	164.3	108.0	3.2	3.4	--
STGM2171	STMJ104	STMJ107	332	36'' DIA	0.4%	211.50	210.16	221.3	224.1	213.1	212.0	213.1	212.1	41.5	22.0	23.0	--
STGM2217	STMJ122	STMJ123	421	12'' DIA	1.6%	183.38	176.80	188.7	182.2	183.9	181.1	184.1	182.2	4.6	2.7	2.7	--
STGM2225	STMJ125	STMJ126	496	12'' DIA	1.5%	181.17	173.71	186.0	178.9	181.4	174.4	181.5	174.4	4.6	0.7	0.8	--
STGM223	STMI107	STMI1020	361	18'' DIA	0.9%	226.24	223.16	230.9	227.0	227.4	224.3	227.4	224.3	9.8	9.0	9.1	--
STGM2230	STMI1167	STMI1174	51	18'' DIA	1.2%	193.54	192.91	199.4	198.4	194.2	194.3	194.5	194.5	12.3	3.4	3.7	--
STGM2234	STMK1211	STMK1210	229	12'' DIA	8.4%	188.97	169.93	197.2	178.4	189.4	170.4	189.4	170.4	10.7	3.4	3.5	--
STGM2235	STMI1023	STMI1014	127	12'' DIA	1.9%	219.69	217.26	226.2	225.1	220.0	218.9	223.2	223.1	5.0	1.0	1.0	--
STGM2255	STMK125	STMK124	244	12'' DIA	2.2%	169.53	164.12	176.2	169.3	169.8	164.9	169.8	164.9	5.4	0.8	0.8	--
STGM2295	STMI1225	STMI1224	82	12'' DIA	0.6%	182.19	181.67	187.1	186.6	182.7	182.1	182.7	182.1	2.9	1.4	1.4	--
STGM2304-A	STMJ129	STMJ1244	147	18'' DIA	1.3%	171.98	170.00	177.0	175.9	172.9	171.0	173.0	171.1	12.7	8.8	9.6	--
STGM2304-B	STMJ1244	STMJ1210	113	18'' DIA	1.0%	170.00	168.84	175.9	174.5	171.0	170.1	171.1	170.2	11.1	8.8	9.6	--
STGM2380	STMI1161	STMI1160	48	12'' DIA	1.1%	188.40	187.86	195.6	195.0	188.6	188.5	188.6	188.6	4.1	0.5	0.5	--
STGM239	STMK1220	STMK1219	240	12'' DIA	13.6%	242.37	210.12	254.9	227.5	242.6	210.4	242.6	210.4	13.0	0.9	1.0	--
STGM2399	STII0986	STII0988	78	24'' DIA	0.5%	229.64	228.75	238.5	239.6	237.8	237.8	241.3	241.3	16.2	3.3	4.2	Future 10-yr
STGM2412	STMI1175	STMI1176	162	21'' DIA	6.5%	188.72	178.28	194.8	184.9	189.5	179.2	189.5	179.3	42.4	15.7	18.1	--
STGM2429	STMJ1215	STMJ1216	73	15'' DIA	0.9%	172.85	172.18	178.9	179.1	173.3	172.5	173.4	172.5	6.5	2.0	2.2	--
STGM2476	STMJ106	STMJ105	253	24'' DIA	0.3%	212.77	212.09	222.2	221.3	217.1	216.1	218.2	216.4	11.7	10.4	10.5	--
STGM2543	STMK1215	STMK1214	82	12'' DIA	5.4%	174.52	170.13	185.0	179.9	174.9	170.6	174.9	170.6	8.5	2.3	2.3	--
STGM2593	STMK114	STMK113	51	18'' DIA	1.5%	165.22	164.46	172.5	171.4	166.0	165.5	166.0	165.5	12.7	6.6	6.8	--
STGM2621	STMJ1211	STMJ1210	112	15'' DIA	0.4%	169.30	168.84	173.6	174.5	170.2	170.1	170.4	170.2	4.3	2.2	3.2	--
STGM2622	STII1028	STII1027	118	12'' DIA	1.9%	213.20	211.00	223.1	220.4	219.1	218.4	221.9	221.0	4.9	3.2	3.2	--
STGM2654	STMJ1237	STMJ1239	64	24'' DIA	3.7%	163.11	160.72	175.8	175.8	163.7	161.7	163.8	161.9	42.4	7.6	10.3	--
STGM2662	STII092	STMI095	217	15'' DIA	0.4%	233.85	232.85	240.6	244.0	238.4	238.6	239.3	236.9	4.2	4.0	4.1	--
STGM2664	STMI137	STII137	342	18'' DIA	0.3%	162.42	161.23	174.0	173.1	182.2	179.2	183.7	180.6	6.2	10.1	10.1	Existing 10-yr
STGM2666	STMK1118	STMK1117	83	15'' DIA	1.4%	165.41	164.26	174.1	173.2	165.9	164.8	166.0	164.8	7.9	2.8	3.0	--
STGM2682	J3960	STMI124	180	12'' DIA	0.9%	182.33	180.75	189.0	187.5	182.9	182.8	189.0	184.7	3.3	2.2	3.2	--
STGM2694	J4270	J3668	872	Irregular Channel	0.8%	243.00	235.50	250.6	241.6	243.9	237.5	244.0	241.7		9.4	14.3	--
STGM2707	STMI1165	STMI1225	159	12'' DIA	0.6%	183.22	182.19	188.7	187.1	183.7	182.7	183.7	182.7	3.0	1.4	1.4	--
STGM2709	STMI149	STMI142	287	21'' DIA	0.2%	158.85	158.20	172.2	173.6	170.5	167.7	171.9	168.8	7.5	15.7	16.4	--
STGM2715	STII09124	STII09111	110	18'' DIA	0.3%	247.94	247.51	253.5	252.8	249.0	248.4	249.3	248.7	6.0	5.3	7.9	--
STGM2729	STII1029	STII1050	119	8'' DIA	1.9%	217.94	215.72	225.7	223.6	227.1	220.0	230.5	222.9	1.6	3.3	3.4	Existing 10-yr
STGM2731	STMJ1022	STIJ1021	321	12'' DIA	1.1%	219.49	215.79	227.5	223.2	241.8	223.5	252.0	227.0	3.8	8.7	10.4	Existing 10-yr
STGM274	STMJ1230	STIJ1234	40	12'' DIA	0.6%	160.57	160.31	162.7	164.6	161.1	160.5	161.1	160.5	3.0	1.5	1.5	--
STGM2755	STMI1172	STMI1171	54	12'' DIA	1.2%	198.19	197.53	204.6	203.5	198.7	198.1	198.7	198.1	4.1	2.1	2.3	--
STGM2771	J3852	STMI102	247	15'' DIA	2.2%	218.54	213.03	225.6	219.9	219.0	218.6	219.6	219.8	9.8	2.5	2.6	--
STGM2785	STMI1216	STMI1215	312	15'' DIA	1.6%	175.24	170.24	180.9	177.1	175.8	170.8	175.8	170.8	8.6	3.4	3.4	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM281	STIJ1066	STIJ1069	175	12'' DIA	2.0%	198.06	194.56	206.5	202.2	198.7	195.1	198.7	195.1	5.3	3.5	3.5	--
STGM2811	STMJ1217	STMJ1215	189	15'' DIA	0.6%	173.99	172.85	182.2	178.9	174.5	173.3	174.6	173.4	5.3	2.0	2.2	--
STGM2823	STMK1222	STMK1221	169	12'' DIA	8.6%	259.18	244.72	269.4	256.0	259.4	245.0	259.4	245.0	11.4	0.9	1.0	--
STGM2828	J-SBT6-02	J-SBT6-01	306	48'' DIA	0.1%	143.40	143.00	170.0	160.0	146.1	144.0	146.1	144.0	36.8	46.1	46.1	--
STGM283	STII0975	STII0977	122	18'' DIA	1.0%	242.11	240.65	251.0	247.7	242.6	241.0	242.7	241.4	10.9	3.0	3.8	--
STGM2832	STMI148	STMI144	427	21'' DIA	0.2%	157.99	156.95	174.8	174.6	167.4	167.7	167.9	170.9	7.8	15.7	16.4	--
STGM2834	STMI1144	STMI1220	427	15'' DIA	1.4%	187.23	181.41	193.5	186.3	187.8	182.0	187.8	182.0	7.9	3.1	3.2	--
STGM2839	STMI1021	STII102	332	21'' DIA	2.2%	211.58	204.20	215.2	212.6	212.5	205.9	212.5	205.9	23.7	12.3	12.4	--
STGM2844	STIK117	J-SBT4-05	62	15'' DIA	0.3%	167.96	167.77	175.0	173.0	168.7	168.0	168.8	168.0	3.7	3.2	3.5	--
STGM2861	STIJ1060	STIJ1061	30	12'' DIA	2.3%	223.73	222.82	229.6	231.0	224.3	223.5	224.3	223.5	5.7	3.5	3.5	--
STGM2863	STMJ1226	STMJ1227	268	15'' DIA	5.0%	159.59	146.32	170.0	156.3	160.4	147.1	160.4	147.1	14.9	10.7	11.2	--
STGM2864	STMJ119	STMJ118	214	15'' DIA	1.9%	207.67	203.56	214.5	210.4	208.0	203.9	208.0	203.9	9.4	1.3	1.4	--
STGM2866	STMI1123	STMI1124	92	36'' DIA	1.3%	189.65	188.46	206.2	204.7	191.5	190.3	191.6	190.4	75.6	52.9	55.1	--
STGM2871	STMK1214	STMK111	169	15'' DIA	3.2%	170.13	164.77	179.9	172.0	170.6	165.1	170.6	165.1	11.9	3.2	3.3	--
STGM2880	STII102	STMI1121	66	18'' DIA	0.5%	204.20	203.84	212.6	212.6	205.9	204.8	205.9	204.8	7.8	12.3	12.4	--
STGM2885	STMJ117	STMJ116	53	15'' DIA	2.1%	199.99	198.86	206.8	205.8	200.3	199.2	200.3	199.2	10.1	1.3	1.4	--
STGM2889	STMI1164	STMI1163	49	12'' DIA	1.1%	190.45	189.92	194.9	196.2	190.7	190.2	190.7	190.2	3.8	0.5	0.5	--
STGM2899	STMK121	STMJ1225	199	21'' DIA	1.3%	160.93	158.36	166.7	166.7	161.7	159.1	161.7	159.1	18.8	7.5	7.5	--
STGM2905	STII09100	STII10109	112	30'' DIA	1.6%	224.82	223.00	233.6	231.7	237.8	237.8	241.3	241.3	54.8	4.7	6.5	Existing 10-yr
STGM2906	STII1030	STII1029	150	8'' DIA	1.9%	220.80	217.94	229.4	225.7	237.1	227.1	240.7	230.5	1.7	3.9	4.3	Existing 10-yr
STGM2936	STII0982	STII0985	199	24'' DIA	1.1%	232.49	230.09	240.2	237.4	237.8	237.8	241.4	241.3	25.2	3.0	4.0	Future 10-yr
STGM2965	STMI1219	STMI1221	220	18'' DIA	1.2%	176.01	173.35	181.1	179.0	176.7	174.0	176.8	174.0	12.0	5.6	5.8	--
STGM297	STII0977	STII0980	99	18'' DIA	3.4%	240.65	236.84	247.7	244.0	241.0	237.8	241.4	241.4	19.7	3.0	3.8	--
STGM2971	STMK1112	STMK1111	155	12'' DIA	12.4%	210.00	190.91	218.6	200.0	210.3	191.3	210.4	191.3	13.1	3.2	3.4	--
STGM2977	STIJ1234	STMJ1224	28	10'' DIA	15.7%	160.31	155.98	164.6	163.9	160.5	156.6	160.5	156.6	9.1	1.5	1.5	--
STGM3022	J5176	J5178	186	Irregular Channel	2.2%	209.16	205.00	215.7	210.4	210.3	205.5	210.3	205.5		27.8	28.8	--
STGM3031	STMJ121	STMJ1212	310	12'' DIA	0.9%	179.24	176.56	184.6	181.1	179.8	177.0	179.8	177.0	3.4	1.9	1.9	--
STGM3039	STMJ124	STMJ129	260	15'' DIA	1.1%	174.83	171.98	180.0	177.0	180.0	172.9	180.0	173.0	7.0	8.8	9.6	--
STGM304	STIJ1021	STMJ105	483	15'' DIA	0.8%	215.79	212.09	223.2	221.3	223.5	216.1	227.0	216.4	5.6	8.5	10.0	Existing 10-yr
STGM3068	STMK129	STMK128	184	12'' DIA	0.6%	163.14	162.01	171.9	171.6	166.1	164.7	166.8	165.1	2.9	3.4	3.5	--
STGM3110	STMK1114	J-SBT4-01	62	15'' DIA	6.2%	144.32	140.54	160.0	145.0	148.9	141.2	148.9	141.2	16.7	21.4	21.4	--
STGM3131	STIJ102	STMJ108	32	18'' DIA	20.6%	216.00	209.51	223.9	224.4	216.3	211.6	216.3	211.6	46.3	3.2	3.2	--
STGM3134	STIJ1063	STIJ1064	251	12'' DIA	2.4%	218.91	212.68	227.3	221.3	219.5	213.3	219.5	213.3	5.8	3.5	3.5	--
STGM314	STII1055	STII1056	64	12'' DIA	0.8%	213.50	213.00	221.1	220.4	216.9	216.9	219.7	219.7	3.2	1.5	1.6	--
STGM3145	STMJ107	STMJ108	192	36'' DIA	0.3%	210.16	209.51	224.1	224.4	212.0	211.6	212.1	211.6	35.6	24.6	25.6	--
STGM3147	STMJ1012	J-SBT5-01	293	18'' DIA	4.1%	181.23	169.20	191.5	180.0	181.6	169.8	181.7	169.8	21.6	3.7	5.0	--
STGM3149	STMI123	STMI139	437	12'' DIA	0.2%	166.55	165.23	177.3	177.1	202.9	197.9	204.3	199.4	1.8	4.9	5.0	Existing 10-yr
STGM3159	STII1027	J4122	239	12'' DIA	0.6%	211.00	209.50	220.4	220.1	218.4	217.4	221.0	219.3	2.8	3.2	3.2	Future 10-yr
STGM3172	STII1194	STMI1113	66	24'' DIA	1.0%	193.95	193.31	202.5	203.0	195.7	195.5	195.9	195.5	22.1	17.3	17.4	--
STGM3176	STII0913	STII0928	170	21'' DIA	0.8%	235.00	233.70	243.0	240.5	238.1	238.5	241.5	240.5	13.8	14.4	15.2	--
STGM3189	STMK1235	STMK1115	181	15'' DIA	0.5%	156.63	155.74	167.2	169.2	157.3	156.4	157.4	156.4	4.7	2.9	3.6	--
STGM3192	STMI093	STMI092	113	24'' DIA	2.0%	223.04	220.75	232.8	229.0	227.6	224.5	230.7	227.9	17.4	21.1	21.6	--
STGM3193	STMJ123	STMJ124	178	15'' DIA	1.1%	176.80	174.83	182.2	180.0	181.1	180.0	182.2	180.0	7.1	8.8	9.6	--
STGM321	STII1359	STMI1310	184	18'' DIA	0.2%	160.75	160.30	173.2	172.6	178.0	176.3	179.3	177.7	5.2	10.1	10.3	Existing 10-yr
STGM3212	STMJ118	STMJ117	176	15'' DIA	2.0%	203.56	199.99	210.4	206.8	203.9	200.3	203.9	200.3	9.4	1.3	1.4	--
STGM3216	STMK1213	STMK1214	135	12'' DIA	8.1%	180.96	170.13	190.3	179.9	181.2	170.6	181.2	170.6	10.2	0.9	0.9	--
STGM323	STMI1170	STMI1169	59	15'' DIA	0.9%	196.84	196.34	202.7	203.3	197.4	196.9	197.4	197.0	6.2	2.1	2.3	--
STGM3243	STMI1173	STMI1172	117	12'' DIA	1.0%	199.33	198.19	206.7	204.6	199.9	198.7	199.9	198.7	3.6	2.1	2.3	--
STGM3260	STII09104	STII09103	36	18'' DIA	2.4%	252.46	250.92	259.5	259.4	253.3	252.0	259.6	259.4	17.0	9.3	18.3	Future 10-yr
STGM3282	STMK118	STMK119	73	12'' DIA	1.8%	169.71	168.40	178.2	177.3	170.3	169.3	170.3	169.3	5.0	3.2	3.4	--
STGM3283	STMI1220	STMI1219	379	15'' DIA	1.4%	181.41	176.01	186.3	181.1	182.0	176.7	182.0	176.8	8.1	3.1	3.2	--
STGM3285	J3522	STMJ104	164	27'' DIA	0.3%	212.00	211.50	221.6	221.3	213.8	213.1	213.9	213.1	17.1	18.3	19.2	--
STGM3287	STIL11185	J-SBT1-05	38	12'' DIA	29.5%	171.70	157.40	179.0	180.0	171.9	159.6	171.9	159.7	20.9	1.7	2.2	--
STGM3296	STMJ091	STMJ1022	261	12'' DIA	1.1%	222.46	219.49	232.9	227.5	250.2	241.8	264.8	252.0	3.8	6.5	8.4	Existing 10-yr
STGM3324	STMJ1135	STMJ1138	317	24'' DIA	0.2%	172.13	171.55	184.2	178.2	173.3	172.4	173.5	172.5	10.0	7.3	9.1	--
STGM3339	STMI144	J4032	517	21'' DIA	0.4%	156.95	155.00	174.6	160.0	167.7	155.6	170.9	155.6	9.7	15.7	16.4	--
STGM334	STII1080	STII1078	163	12'' DIA	1.9%	207.16	204.07	213.2	210.1	211.7	205.8	211.8	205.8	4.9	5.0	5.0	--
STGM3344	STII135	STMI143	182	18'' DIA	0.2%	159.82	159.08	172.7	173.0	173.7	171.4	175.0	172.8	5.2	12.5	12.7	Existing 10-yr
STGM3345	STMI129	J-SBT1-03	501	12'' DIA	4.0%	185.00	152.20	194.2	175.0	185.6	155.2	185.7	155.3	7.2	5.0	5.6	--
STGM3346	STMJ1227	STMJ1228	80	15'' DIA	4.9%	146.32	142.40	156.3	152.3	147.1	143.2	147.1	143.2	14.9	10.7	11.2	--
STGM3352	STII1034	J3524	242	12'' DIA	2.3%	223.24	217.58	226.1	225.1	233.7	223.5	249.2	231.6	5.4	7.7	10.4	Existing 10-yr
STGM3365	STII1050	STII1028	133	12'' DIA	1.9%	215.72	213.20	223.6	223.1	220.0	219.1	222.9	221.9	4.9	3.2	3.2	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM3370	STMI1211	STMI1214	138	24'' DIA	5.8%	165.11	157.09	175.9	166.7	166.1	157.8	166.2	157.9	56.5	26.6	28.6	--
STGM3371	STMK1210	STMK129	108	12'' DIA	6.3%	169.93	163.14	178.4	171.9	170.4	166.1	170.4	166.8	9.3	3.4	3.5	--
STGM3442	STMJ1231	STMJ1232	65	33'' DIA	0.7%	165.26	164.80	172.5	173.1	166.2	165.4	166.3	165.4	45.2	10.4	13.1	--
STGM3452	STMK1217	STMK1216	141	12'' DIA	12.1%	221.37	204.42	232.0	215.4	221.5	204.7	221.5	204.7	12.3	0.7	0.7	--
STGM3457	STMI1121	J4834	345	24'' DIA	2.0%	203.84	197.00	212.6	209.4	204.8	198.3	204.8	198.3	32.1	15.1	15.2	--
STGM3459	J-SBT1-02	J-SBT1-01	132	36'' DIA	0.8%	138.80	137.80	152.6	150.0	145.9	140.3	146.8	140.4	58.2	159.1	174.1	--
STGM346	STMI1110	STMI1121	250	15'' DIA	1.2%	206.93	203.84	213.9	212.6	207.5	204.8	207.5	204.8	7.2	2.8	2.8	--
STGM3464	STII081	STII09126	157	12'' DIA	0.8%	249.94	248.74	258.0	255.8	254.4	250.6	260.2	255.8	3.2	5.3	8.0	Future 10-yr
STGM3469	STMI142	STMI148	86	21'' DIA	0.2%	158.20	157.99	173.6	174.8	167.7	167.4	168.8	167.9	7.8	15.7	16.4	--
STGM3490	STII0992	STII09100	234	30'' DIA	0.5%	226.18	224.82	235.1	233.6	237.8	237.8	241.3	241.3	29.6	4.6	6.0	Existing 10-yr
STGM3512	STMI1162	STMI1160	62	12'' DIA	1.9%	189.01	187.86	193.9	195.0	189.4	188.5	189.4	188.6	5.0	1.3	1.3	--
STGM352	STII1245	STMI1226	77	24'' DIA	1.3%	160.00	159.00	167.7	169.0	161.1	159.5	161.2	159.6	26.9	16.1	17.2	--
STGM3521	J4292	J4150	661	18'' DIA	0.7%	179.90	175.00	185.1	180.5	180.6	175.6	180.7	175.7	9.0	4.2	5.2	--
STGM3546	STIJ081	STII081	220	12'' DIA	1.3%	253.03	249.94	261.1	258.0	259.5	254.4	270.4	260.2	4.3	5.3	8.1	Future 10-yr
STGM3550	STMJ1113	STMJ1114	290	15'' DIA	3.5%	207.14	196.97	211.5	204.9	207.4	198.0	207.4	198.1	12.9	1.4	1.5	--
STGM3551	STMK1221	STMK1220	66	12'' DIA	3.6%	244.72	242.37	256.0	254.9	245.0	242.6	245.0	242.6	7.0	0.9	1.0	--
STGM356	STMI124	J4292	104	12'' DIA	0.8%	180.75	179.90	187.5	185.1	182.8	180.6	184.7	180.7	3.2	4.2	5.2	--
STGM3560	J4268	J4270	219	Irregular Channel	0.9%	245.00	243.00	251.0	250.6	245.6	243.9	245.7	244.0		9.5	14.4	--
STGM3563	STMI1020	STMI106	115	18'' DIA	0.9%	223.16	222.18	227.0	225.8	224.3	222.9	224.3	222.9	9.7	9.0	9.1	--
STGM3595	STMI126	STMI127	24	12'' DIA	2.9%	175.00	174.30	181.6	180.1	176.2	175.1	176.2	175.1	6.1	7.5	7.5	--
STGM3598	STMJ1013	STMJ1015	121	15'' DIA	0.5%	219.30	218.73	228.0	223.7	220.0	219.3	220.0	219.3	4.6	3.2	3.2	--
STGM3617	STMK1113	STMK1114	73	15'' DIA	13.4%	154.00	144.32	167.8	160.0	155.2	148.9	155.6	148.9	24.5	21.7	22.0	--
STGM3624	STII0966	STII0967	54	12'' DIA	0.5%	255.84	255.36	261.7	261.6	256.3	255.6	256.4	255.7	2.7	1.1	1.4	--
STGM3631	STMJ127	STMJ128	263	18'' DIA	0.9%	170.29	167.85	176.7	175.6	171.0	169.1	171.0	169.2	10.5	4.9	5.1	--
STGM3637	STMJ1224	STMJ1223	237	18'' DIA	7.0%	155.98	139.50	163.9	145.0	156.6	140.1	156.6	140.1	28.9	9.0	9.0	--
STGM3638	STMK122	STMK121	208	21'' DIA	1.1%	163.17	160.93	171.4	166.7	164.0	161.7	164.0	161.7	17.1	7.5	7.6	--
STGM3651	STMI105	STMI1022	162	27'' DIA	0.7%	215.20	214.00	223.5	223.0	223.5	221.7	223.5	221.7	26.6	30.0	26.8	--
STGM3656	STMJ1128	STMJ1127	254	12'' DIA	2.2%	214.51	208.87	218.8	213.0	214.9	209.2	214.9	209.2	5.5	1.4	1.5	--
STGM3668	STMK1225	STMK1226	174	12'' DIA	18.3%	239.49	208.13	249.0	221.2	239.8	208.4	239.8	208.4	16.4	2.3	2.3	--
STGM3669	STMI1014	STMI109	288	33'' DIA	0.4%	217.26	216.25	225.1	223.3	218.9	218.4	223.1	222.7	31.2	24.0	24.5	--
STGM3674	J4424	J4426	132	42'' DIA	1.1%	202.00	200.50	204.8	207.0	203.1	201.7	203.4	202.0	106.0	24.4	40.6	--
STGM3678	STMI1169	STMI1168	126	15'' DIA	1.3%	196.34	194.76	203.3	202.0	196.9	195.4	197.0	195.4	7.4	3.4	3.7	--
STGM3689	STMI1310	STII135	191	18'' DIA	0.2%	160.30	159.82	172.6	172.7	176.3	173.7	177.7	175.0	5.1	12.3	12.5	Existing 10-yr
STGM3690	STML1146	STML1131	109	12'' DIA	2.8%	197.83	194.81	206.0	207.4	202.5	195.8	202.6	195.8	5.9	8.5	8.5	--
STGM3714	STIJ1069	STIJ1070	160	12'' DIA	2.4%	194.56	190.71	202.2	198.4	195.1	191.4	195.1	191.4	5.8	3.5	3.5	--
STGM3715	STMK126	STMJ1226	356	12'' DIA	4.7%	176.34	159.59	185.7	170.0	176.8	160.4	176.8	160.4	8.0	4.0	4.0	--
STGM3717	STMI108	STMI1018	221	21'' DIA	0.6%	209.79	208.30	221.0	219.3	216.9	216.7	219.7	219.2	12.0	10.8	12.6	--
STGM3728	STMK1226	STMK1227	92	12'' DIA	15.8%	208.13	193.74	221.2	207.5	208.4	194.1	208.4	194.1	14.3	2.3	2.3	--
STGM3752	STMK113	J-SBT4-04	142	18'' DIA	0.6%	164.46	163.59	171.4	171.9	165.5	164.3	165.5	164.3	8.3	6.6	6.8	--
STGM3779	STII1149	STML1146	422	12'' DIA	1.3%	203.31	197.83	211.4	206.0	226.2	202.5	226.2	202.6	4.1	8.9	8.9	Existing 10-yr
STGM3789	STMK128	STMK127	202	12'' DIA	0.7%	162.01	160.59	171.6	170.3	164.7	162.4	165.1	162.8	3.1	3.4	3.5	--
STGM3792	STMI102	STMI1012	50	15'' DIA	1.7%	213.03	211.40	219.9	219.9	218.6	218.5	219.8	219.8	8.4	2.5	2.6	--
STGM3804	STIJ1064	STIJ1065	199	12'' DIA	2.3%	212.68	207.91	221.3	216.5	213.3	208.5	213.3	208.5	5.6	3.5	3.5	--
STGM3819	STMK1230	STMK1229	205	12'' DIA	10.0%	209.01	188.72	216.0	195.1	209.3	189.1	209.3	189.1	11.8	2.6	2.6	--
STGM3824	J-SB-05	J-SB-04	141	84'' DIA	0.9%	117.10	115.90	125.0	125.0	122.1	121.4	122.2	121.4	585.8	405.9	434.2	--
STGM3827	STMK1116	STMK1113	320	15'' DIA	2.7%	162.55	154.00	171.6	167.8	163.0	155.2	163.0	155.6	10.9	2.8	3.0	--
STGM3829	STMK1212	STMK126	156	12'' DIA	4.9%	183.98	176.34	198.0	185.7	184.5	176.8	184.5	176.8	8.1	4.0	4.0	--
STGM3850	STMI1174	STMI1175	350	21'' DIA	1.2%	192.91	188.72	198.4	194.8	194.3	189.5	194.5	189.5	18.0	15.7	18.9	--
STGM3851	STMK1111	STMK1110	134	12'' DIA	9.9%	190.91	177.71	200.0	187.2	191.3	178.2	191.3	178.2	11.7	3.2	3.4	--
STGM3873	STMK111	J-SBT4-04	7	15'' DIA	16.6%	164.77	163.59	172.0	171.9	165.1	164.3	165.1	164.3	26.8	3.2	3.3	--
STGM3882	STMI1022	STMI1012	271	27'' DIA	0.7%	214.00	211.40	223.0	219.9	221.7	218.5	221.7	219.8	25.3	27.1	27.4	--
STGM391	STMI1114	STMI1113	84	42'' DIA	0.8%	194.00	193.31	203.0	203.0	195.7	195.5	195.8	195.5	91.6	34.8	41.8	--
STGM3914	STMJ1011	STMJ1013	220	12'' DIA	0.5%	220.37	219.30	229.5	228.0	221.8	220.0	221.8	220.0	2.6	3.2	3.2	--
STGM3915	STMK1231	STMK1230	124	12'' DIA	8.7%	219.71	209.01	228.0	216.0	220.0	209.3	220.0	209.3	10.8	2.6	2.6	--
STGM392	STII1078	STMI1019	20	12'' DIA	3.9%	204.07	199.50	210.1	209.3	205.8	200.7	205.8	200.9	7.1	8.5	8.6	--
STGM3924	STMI104	J5216	352	60'' DIA	0.8%	209.30	206.00	220.3	211.3	217.2	216.6	219.0	218.9	231.4	32.6	32.7	--
STGM3926	STMI1019	STMI1114	351	42'' DIA	1.6%	199.50	194.00	209.3	203.0	200.7	195.7	200.9	195.8	128.5	30.9	40.3	--
STGM3931	STMI1176	J-SBT1-05	183	21'' DIA	3.4%	178.28	157.40	184.9	180.0	179.2	159.6	179.3	159.7	30.1	15.7	18.1	--
STGM3943	STMI1224	STMI1223	63	12'' DIA	0.7%	181.67	181.20	186.6	187.9	182.1	181.6	182.1	181.6	3.2	1.4	1.4	--
STGM3951	STII0926	STII0915	98	21'' DIA	0.7%	230.40	229.70	236.9	236.6	234.0	233.2	236.9	236.0	13.4	15.1	15.4	--
STGM3955	STMJ1214	STMJ123	210	15'' DIA	0.9%	178.72	176.80	183.1	182.2	181.2	181.1	183.1	182.2	6.5	2.2	2.4	--
STGM3989	STMK1218	STMK1217	177	12'' DIA	15.0%	247.63	221.37	257.8	232.0	247.8	221.5	247.8	221.5	14.8	0.7	0.7	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM3997	STMI139	STMI138	487	15'' DIA	0.3%	165.23	163.98	177.1	175.6	197.9	190.1	199.4	191.5	3.3	10.2	10.2	Existing 10-yr
STGM4001	J4116	J4118	54	24'' DIA	0.9%	242.00	241.50	247.5	246.1	242.4	242.1	242.6	242.2	20.9	1.9	3.3	--
STGM4020	STMJ1119	STMJ1012	268	15'' DIA	0.9%	183.51	181.23	193.4	191.5	184.2	181.6	184.3	181.7	6.2	3.0	4.3	--
STGM4021	STIJ1062	STIJ1063	74	12'' DIA	1.2%	220.00	218.91	228.4	227.3	220.7	219.5	220.7	219.5	4.1	3.5	3.5	--
STGM4022	STMJ1114	STMI1174	548	21'' DIA	0.7%	196.97	192.91	204.9	198.4	198.0	194.3	198.1	194.5	14.3	9.9	10.7	--
STGM4063	STMJ102	STMJ103	259	18'' DIA	0.3%	213.81	213.12	221.6	221.6	221.5	217.8	221.0	219.0	5.4	6.5	6.5	--
STGM4067	STMI1115	STMI1177	89	36'' DIA	2.0%	186.78	185.02	204.2	201.0	188.4	186.6	188.4	186.6	94.4	52.9	55.1	--
STGM4076	STMI1210	STMI1211	97	18'' DIA	3.8%	168.81	165.11	175.7	175.9	169.2	166.1	169.2	166.2	20.9	3.4	3.4	--
STGM408	STMI0910	STMI094	43	21'' DIA	6.8%	229.00	226.07	235.6	236.0	232.6	231.8	235.3	234.6	41.3	21.1	21.6	--
STGM4081	STII0928	STII0983	186	21'' DIA	0.8%	233.70	232.30	240.5	238.3	238.5	237.1	240.5	238.8	14.3	14.5	15.0	--
STGM4090	J4118	J4114	433	Irregular Channel	1.7%	241.50	234.00	246.1	239.2	242.1	234.9	242.2	239.2		3.7	6.2	--
STGM4122	J4092	J4094	929	Irregular Channel	1.4%	202.00	185.00	209.3	190.0	202.6	185.4	202.9	185.5		5.4	9.9	--
STGM4123	STMI092	STMI091	69	27'' DIA	1.0%	220.75	220.03	229.0	229.9	224.5	223.4	227.9	226.9	17.1	21.1	21.6	--
STGM4128	STIL11186	STIL11185	36	12'' DIA	2.2%	172.50	171.70	179.0	179.0	172.9	171.9	173.0	171.9	5.6	1.7	2.2	--
STGM413	STMJ116	STMI1169	235	15'' DIA	1.1%	198.86	196.34	205.8	203.3	199.2	196.9	199.2	197.0	6.9	1.3	1.4	--
STGM4173	STMJ1110	STMJ119	90	15'' DIA	2.8%	210.16	207.67	216.1	214.5	210.5	208.0	210.5	208.0	11.0	1.3	1.4	--
STGM4181	STMJ1111	STMI1173	212	12'' DIA	1.8%	203.20	199.33	210.5	206.7	203.7	199.9	203.7	199.9	5.0	2.1	2.3	--
STGM4222	STMJ108	J5176	336	36'' DIA	0.1%	209.51	209.16	224.4	215.7	211.6	210.3	211.6	210.3	23.0	27.8	28.8	--
STGM4239	STMJ1142	STMJ1143	264	24'' DIA	2.2%	181.80	176.00	196.2	184.3	182.2	176.4	182.3	176.5	35.0	2.8	3.9	--
STGM4243	STMI1226	J-SBT1-02	108	24'' DIA	19.1%	159.00	138.80	169.0	152.6	159.5	145.9	159.6	146.8	100.8	16.1	17.2	--
STGM4253	STII0972	STII0975	63	15'' DIA	1.3%	243.16	242.11	251.4	251.0	243.5	242.6	243.5	242.7	7.1	1.1	1.4	--
STGM4314	STMJ1015	STIJ102	135	12'' DIA	2.0%	218.73	216.00	223.7	223.9	219.3	216.3	219.3	216.3	5.1	3.2	3.2	--
STGM4327	STMJ1133	STMJ1135	216	24'' DIA	1.3%	174.87	172.13	180.8	184.2	175.4	173.3	175.5	173.5	26.7	4.3	5.3	--
STGM4335	J4426	STMI1019	97	42'' DIA	1.0%	200.50	199.50	207.0	209.3	201.7	200.7	202.0	200.9	101.5	24.4	37.3	--
STGM434	STMK127	STMJ1226	168	12'' DIA	0.6%	160.59	159.59	170.3	170.0	162.4	160.4	162.8	160.4	2.9	3.4	3.5	--
STGM4360	STMJ1236	STMJ1237	122	24'' DIA	2.3%	165.95	163.11	178.4	175.8	166.6	163.7	166.7	163.8	34.7	7.7	10.3	--
STGM4372	STIJ0916	STIJ0917	44	15'' DIA	0.5%	226.92	226.69	235.6	236.0	227.9	227.6	227.9	227.6	4.8	5.3	5.3	--
STGM4376	STIJ0917	STIJ0919	193	15'' DIA	0.7%	226.69	225.32	236.0	235.2	227.6	226.1	227.6	226.1	5.7	5.3	5.3	--
STGM4395	STIJ0919	STIJ0923	80	15'' DIA	1.3%	225.32	224.31	235.2	232.9	226.1	224.9	226.1	224.9	7.5	5.3	5.3	--
STGM4396	STIJ0923	STIJ0924	106	15'' DIA	2.8%	224.31	221.30	232.9	230.6	224.9	221.9	224.9	221.9	11.2	5.3	5.3	--
STGM440	STMK1219	STMK1216	126	12'' DIA	4.5%	210.12	204.42	227.5	215.4	210.4	204.7	210.4	204.7	7.6	0.9	1.0	--
STGM4400	STIJ0924	STIJ0927	90	15'' DIA	2.3%	221.30	219.25	230.6	228.3	221.9	219.9	221.9	219.9	10.1	5.3	5.3	--
STGM4405	STIJ0927	STIJ0915	120	15'' DIA	2.4%	219.25	216.42	228.3	225.1	219.9	217.4	219.9	217.4	10.3	5.3	5.3	--
STGM4406	STIJ0915	STIJ10111	124	15'' DIA	0.7%	216.42	215.60	225.1	221.9	217.4	216.6	217.4	216.6	5.5	5.3	5.3	--
STGM4407	STIJ10111	STIJ10112	38	15'' DIA	0.8%	215.60	215.31	221.9	221.9	216.6	216.3	216.6	216.3	5.6	5.3	5.3	--
STGM4408	STIJ10112	J5382	111	15'' DIA	0.6%	215.31	214.65	221.9	219.1	216.3	214.9	216.3	214.9	5.1	5.3	5.3	--
STGM4459	STII09112	J4268	78	21'' DIA	2.7%	247.12	245.00	253.4	251.0	247.7	245.6	247.8	245.7	26.4	5.4	8.5	--
STGM4465	J4122	STMI104	37	12'' DIA	0.5%	209.50	209.30	220.1	220.3	217.4	217.2	219.3	219.0	2.6	3.2	3.2	--
STGM448	STMK1227	STMK1212	180	12'' DIA	5.4%	193.74	183.98	207.5	198.0	194.1	184.5	194.1	184.5	8.5	2.3	2.3	--
STGM4509	STMI1227	STMI127	12	18'' DIA	0.9%	174.40	174.30	180.5	180.1	175.2	175.1	175.2	175.1	9.8	3.8	3.8	--
STGM4510	STMI1234	STMI1227	138	18'' DIA	0.4%	175.00	174.40	181.6	180.5	175.8	175.2	175.8	175.2	6.9	3.8	3.8	--
STGM4512	STMI1228	STMI1234	293	18'' DIA	0.5%	176.50	175.00	183.0	181.6	177.2	175.8	177.2	175.8	7.8	3.8	3.8	--
STGM4514	STMI1229	STMI1228	646	18'' DIA	0.5%	179.71	176.50	185.4	183.0	180.5	177.2	180.5	177.2	7.6	3.8	3.8	--
STGM4517	J4	STML1232	171	12'' DIA	0.3%	179.71	179.20	184.2	183.3	197.3	197.3	197.3	197.2	2.0	1.0	1.2	Existing 10-yr
STGM452	STML1132	J-SBT1-09	90	30'' DIA	1.6%	190.42	188.95	202.9	196.5	191.4	189.2	191.4	189.2	52.6	15.8	15.8	--
STGM4524	STML1232	STMI1233	417	12'' DIA	0.3%	179.20	178.00	183.3	182.9	197.3	191.7	197.2	191.7	2.0	5.1	5.1	Existing 10-yr
STGM4525	STMI1233	STMI126	383	12'' DIA	0.8%	178.00	175.00	182.9	181.6	191.7	176.2	191.7	176.2	3.3	7.9	7.9	Existing 10-yr
STGM4542	STMI138	STMI137	500	15'' DIA	0.3%	163.98	162.42	175.6	174.0	190.1	182.2	191.5	183.7	3.2	8.8	8.8	Existing 10-yr
STGM4556	STII137	STII1359	138	18'' DIA	0.3%	161.23	160.75	173.1	173.2	179.2	178.0	180.6	179.3	6.2	9.9	10.0	Existing 10-yr
STGM487	STMI1212	STMI1211	56	33'' DIA	1.1%	165.74	165.11	175.9	175.9	166.9	166.1	167.0	166.2	58.0	23.2	25.2	--
STGM493	STIJ1061	STIJ1062	180	12'' DIA	1.5%	222.82	220.00	231.0	228.4	223.5	220.7	223.5	220.7	4.5	3.5	3.5	--
STGM501	STMJ1234	STMJ1231	117	33'' DIA	1.0%	166.39	165.26	173.8	172.5	167.2	166.2	167.3	166.3	52.0	10.4	13.1	--
STGM504	STMK1122	STMK1121	204	12'' DIA	3.2%	196.81	190.20	204.2	198.3	197.7	190.9	197.7	190.9	6.7	6.6	6.8	--
STGM523	STMI101	STMI107	468	15'' DIA	0.9%	230.23	226.24	234.6	230.9	231.0	227.4	231.0	227.4	6.0	4.0	4.1	--
STGM527	STIJ1070	J-SBT7-03	83	15'' DIA	1.0%	190.71	189.88	198.4	193.6	191.4	190.3	191.4	190.3	6.7	3.5	3.5	--
STGM528	STII0980	STII0982	188	24'' DIA	2.2%	236.84	232.49	244.0	240.2	237.8	237.8	241.4	241.4	36.9	3.0	3.8	--
STGM547	STII09101	STII09104	106	18'' DIA	0.5%	253.18	252.46	261.0	259.5	254.6	253.3	261.2	259.6	7.6	9.3	15.8	Future 10-yr
STGM55	STMI125	STMI1229	203	15'' DIA	0.3%	180.40	179.71	186.3	185.4	181.4	180.5	181.4	180.5	3.8	3.8	3.8	--
STGM554	STII0991	STII0992	98	30'' DIA	0.5%	226.87	226.18	235.7	235.1	237.8	237.8	241.3	241.3	30.5	4.6	5.9	Existing 10-yr
STGM56	STMJ1120	STMJ1119	162	15'' DIA	0.7%	184.60	183.51	193.0	193.4	185.3	184.2	185.4	184.3	5.5	3.0	4.3	--
STGM578	STMK1233	STMK1229	116	12'' DIA	0.8%	189.66	188.72	196.5	195.1	190.1	189.1	190.1	189.1	3.4	1.1	1.2	--
STGM580	STMJ1238	STMJ1236	55	24'' DIA	5.5%	168.99	165.95	178.5	178.4	169.4	166.6	169.5	166.7	51.5	5.7	8.1	--

Table B-2. Hydraulic Model Parameters and Results

Conduit ID	Up and Downstream Model Node		Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
	US	DS				US	DS	US	DS	US	DS	US	DS				
STGM585	STMK1115	STMK1113	215	15'' DIA	0.8%	155.74	154.00	169.2	167.8	156.4	155.2	156.4	155.6	6.1	2.9	3.6	--
STGM6	J-SBT1-07	J-SBT1-06	107	60'' DIA	3.8%	180.00	176.00	197.0	185.0	181.4	178.2	181.4	178.2	514.9	82.4	85.6	--
STGM608	STMJ1223	STMJ1222	95	18'' DIA	6.4%	139.50	133.40	145.0	138.2	140.1	134.0	140.1	134.0	28.0	9.0	9.0	--
STGM621	STMK1229	STMK1228	210	15'' DIA	10.8%	188.72	166.09	195.1	170.3	189.1	166.5	189.1	166.5	21.9	3.7	3.8	--
STGM623	STMI1223	STMI1218	27	12'' DIA	1.2%	181.20	180.87	187.9	187.2	181.6	181.2	181.6	181.2	4.0	1.4	1.4	--
STGM627	J4284	J-SBT7-02	143	24'' DIA	0.4%	174.80	173.00	184.9	179.5	179.6	175.0	180.5	175.0	14.6	42.0	51.6	--
STGM646	STIJ1065	STIJ1066	369	12'' DIA	2.6%	207.91	198.06	216.5	206.5	208.5	198.7	208.5	198.7	6.0	3.5	3.5	--
STGM692	STMI1010	STMI101	283	15'' DIA	0.9%	232.65	230.23	240.0	234.6	233.4	231.0	233.4	231.0	6.0	4.0	4.1	--
STGM693	STMJ115	STMI1162	339	12'' DIA	0.6%	190.96	189.01	195.5	193.9	191.5	189.4	191.5	189.4	2.8	1.3	1.3	--
STGM72	STII0965	STII0966	36	12'' DIA	0.7%	256.31	255.84	262.6	261.7	256.7	256.3	256.8	256.4	3.1	1.1	1.4	--
STGM735	STMJ1232	STMJ1233	111	33'' DIA	4.8%	164.80	159.41	173.1	172.3	165.4	160.5	165.4	160.7	115.4	10.4	13.1	--
STGM736	STMJ1225	STMJ1224	175	21'' DIA	1.4%	158.36	155.98	166.7	163.9	159.1	156.6	159.1	156.6	19.3	7.5	7.5	--
STGM737	STMJ1233	J-SBT3-01	355	36'' DIA	3.3%	159.41	147.70	172.3	160.0	160.5	148.5	160.7	148.6	66.7	18.0	23.4	--
STGM746	STII0985	STII0986	52	24'' DIA	0.5%	230.09	229.64	237.4	238.5	237.8	237.8	241.3	241.3	16.3	3.3	4.2	Existing 10-yr
STGM757	J4150	STMI128	60	12'' DIA	3.3%	175.00	173.00	180.5	180.2	175.6	174.0	175.7	174.0	6.5	4.2	5.2	--
STGM760	STMI143	STMI149	83	21'' DIA	0.3%	159.08	158.85	173.0	172.2	171.4	170.5	172.8	171.9	8.3	15.7	16.4	--
STGM767	STMI127	STMI128	64	24'' DIA	2.0%	174.30	173.00	180.1	180.2	175.1	174.0	175.1	174.0	32.1	11.2	11.2	--
STGM773	STII0968	STII0970	113	12'' DIA	3.9%	254.20	249.55	260.1	256.0	254.5	249.8	254.5	249.9	7.1	1.1	1.4	--
STGM777	STMI1124	STMI1115	130	36'' DIA	1.3%	188.46	186.78	204.7	204.2	190.3	188.4	190.4	188.4	75.6	52.9	55.1	--
STGM794	STMJ1132	STMJ1133	149	24'' DIA	0.5%	175.66	174.87	181.2	180.8	176.3	175.4	176.4	175.5	17.1	4.3	5.3	--
STGM796	STMJ1220	J-SB-04	36	21'' DIA	7.1%	125.95	115.90	134.1	125.0	126.6	121.4	126.6	121.4	42.4	11.5	12.1	--
STGM822	STMI103	STMI104	72	36'' DIA	0.8%	210.80	209.30	220.7	220.3	217.6	217.2	219.2	219.0	61.4	29.5	29.8	--
STGM824	STII09126	STII09125	128	15'' DIA	0.3%	248.74	248.36	255.8	254.3	250.6	249.8	255.8	252.2	3.7	5.3	7.9	--
STGM825	STMI1018	STMI1017	130	24'' DIA	1.3%	208.30	206.55	219.3	215.3	216.7	216.6	219.2	219.0	25.8	10.8	12.6	--
STGM835	STMJ1218	STMJ1219	253	12'' DIA	3.1%	135.56	127.73	144.3	133.3	136.0	128.2	136.1	128.2	6.6	2.5	3.2	--
STGM856	STMI1163	STMI1161	187	12'' DIA	0.8%	189.92	188.40	196.2	195.6	190.2	188.6	190.2	188.6	3.3	0.5	0.5	--
STGM866	STMI1015	STMI108	340	15'' DIA	1.0%	213.55	209.79	221.8	221.0	221.8	216.9	227.9	219.7	6.6	9.5	11.5	Future 10-yr
STGM876	STIJ0911	STMJ092	400	12'' DIA	2.5%	232.75	222.67	239.7	232.5	258.6	252.2	279.1	267.8	5.7	5.4	8.5	Existing 10-yr
STGM885	STMJ1141	STMJ1142	95	24'' DIA	2.3%	184.00	181.80	198.1	196.2	184.4	182.2	184.5	182.3	35.1	2.8	3.9	--
STGM886	STMI1221	STMI1222	45	18'' DIA	1.7%	173.35	172.59	179.0	178.7	174.0	173.2	174.0	173.2	14.1	5.6	5.8	--
STGM901	J-SBT7-02	J-SBT7-01	590	Irregular Channel	0.8%	173.00	168.00	179.5	170.0	175.0	169.0	175.0	169.0		40.2	43.9	--
STGM91	STMI1217	STMI1216	431	15'' DIA	0.8%	178.84	175.24	185.2	180.9	179.5	175.8	179.5	175.8	6.1	3.4	3.4	--
STGM921	STMJ126	STMJ127	220	15'' DIA	1.6%	173.71	170.29	178.9	176.7	174.4	171.0	174.4	171.0	8.4	4.9	5.1	--
STGM943	STII0970	STII0972	210	12'' DIA	2.4%	249.55	243.16	256.0	251.4	249.8	243.5	249.9	243.5	5.6	1.1	1.4	--
STGM946	STMJ1212	STMJ126	217	12'' DIA	1.3%	176.56	173.71	181.1	178.9	177.0	174.4	177.0	174.4	4.2	1.9	1.9	--
STGM953	STMJ1138	STMJ1235	85	24'' DIA	1.4%	171.55	170.33	178.2	176.9	172.4	171.1	172.5	171.2	28.1	10.4	13.1	--
STGM973	J4114	J5124	122	12'' DIA	0.8%	234.00	233.00	239.2	235.4	234.9	233.8	239.2	236.5	3.2	3.7	6.1	--
STGM984	STII0916	STII0926	51	21'' DIA	0.8%	230.80	230.40	236.9	236.9	234.6	234.0	237.3	236.9	14.0	15.1	15.4	Future 10-yr
STGM988	J4032	J-SB-02	404	Irregular Channel	11.2%	155.00	106.10	160.0	130.0	155.6	109.0	155.6	109.2		15.7	16.4	--

MEMORANDUM

ENGINEERING SERVICES DEPARTMENT
P.O. Box 970 • 414 E. First Street • Newberg, Oregon 97132 • Tel 503.537.1240

SUBJECT: **Addendum for the Stormwater Master Plan 2014**
DATE: February 2, 2015

To make the adopted Stormwater Master Plan (2014 edition) more user friendly, the following attachments are added:

- Table B-2, sorted by the Upstream Node names. Note that the table is still arranged into 3 sections – Chehalem starting on Page 1, Hess on Page 8, and Spring Brook on Page 13. (Note: Table B-2 in the original master plan was sorted by the Conduit ID.) Please insert to Appendix B.

- Supplemental map for CIP C-1, showing the proposed pipe sizes.
  Please insert to the fact sheets in Appendix D.

Thank you.

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
CHEHALEM CREEK																	
J1	STMG0911	C2	163	12'' DIA	0.7%	203.00	201.80	210.7	208.1	203.5	202.9	203.6	203.0	3.1	1.4	1.9	--
J2	STIG1022	STGM2506	135	12'' DIA	0.3%	188.89	188.47	193.9	191.4	204.1	201.1	207.4	203.9	2.0	6.2	6.7	Existing 10-yr
J3498	STMG149	STGM3252	242	12'' DIA	0.8%	159.00	157.06	166.5	162.2	159.6	157.6	166.5	157.7	3.2	2.3	4.3	--
J3514	J3516	STGM987	46	18'' DIA	1.0%	224.80	224.36	227.3	227.2	228.3	227.9	228.5	228.1	10.3	11.6	11.8	Existing 10-yr
J3516	STIG0894	STGM245	33	Irregular Channel	3.3%	224.36	223.30	227.2	226.8	227.9	227.9	228.1	228.1		15.2	14.5	Existing 10-yr
J3530	STMG1036	STGM2210	314	18'' DIA	5.1%	217.00	201.00	219.0	204.9	217.5	201.8	217.7	202.0	25.1	6.8	10.0	--
J3540	STMG071	STGM3105	248	12'' DIA	5.4%	239.50	226.07	242.8	230.4	240.4	227.0	240.4	227.0	8.3	8.8	8.9	--
J3646	STMF113	STGM3518	49	21'' DIA	2.4%	161.58	160.38	173.8	168.7	162.4	161.0	162.5	161.0	24.6	11.3	12.6	--
J3664	J3666	STGM1532	375	Irregular Channel	0.1%	200.30	200.00	205.2	203.9	216.0	216.0	216.5	216.5		38.2	38.2	Existing 10-yr
J3666	STIF092	STGM3535	23	12'' DIA	3.1%	200.00	199.28	203.9	202.8	216.0	211.9	216.5	212.3	6.3	24.7	24.8	Existing 10-yr
J3688	STMF117	STGM2982	467	12'' DIA	1.2%	172.98	167.22	177.1	170.0	189.6	168.5	189.6	168.5	4.0	7.9	7.9	Existing 10-yr
J3692	J3694	STGM1212	60	18'' DIA	0.8%	185.00	184.50	191.9	187.4	187.6	186.5	188.3	186.6	9.6	14.4	15.3	--
J3694	J4318	STGM1335	354	Irregular Channel	1.1%	184.50	180.00	187.4	183.0	186.5	182.1	186.6	183.0		46.8	52.4	--
J3700	J-CCT1-03	STGM1417	114	Irregular Channel	19.7%	140.00	112.00	152.0	162.0	140.4	113.3	140.4	113.4		3.6	3.6	--
J3708	J3694	STGM2160	410	33'' DIA	0.1%	185.00	184.50	190.0	187.4	188.3	186.5	188.7	186.6	18.4	33.6	37.8	--
J3728	J3730	STGM2499	26	18'' DIA	2.7%	195.50	194.80	202.3	202.4	202.0	196.6	202.2	196.6	17.4	48.3	48.9	--
J3730	J3760	STGM4284	636	Irregular Channel	1.4%	194.80	185.90	202.4	192.5	196.6	189.7	196.6	189.8		48.3	48.9	--
J3760	OF_J4000	STGM43	50	36'' DIA	0.8%	185.90	185.50	192.5	188.5	189.7	188.5	189.8	188.5	59.7	105.8	110.1	--
J3780	STIG0710	STGM1342	192	Irregular Channel	2.0%	243.10	239.30	246.5	243.0	248.1	247.6	249.2	248.7		29.3	30.2	Existing 10-yr
J3786	J-CCT3-05	CCT3T2-01	752	Irregular Channel	1.8%	143.50	130.00	163.5	150.0	145.4	133.6	145.4	133.8		67.6	72.7	--
J3838	J4946	STGM963	603	Irregular Channel	1.8%	182.30	171.50	191.2	173.5	183.1	172.8	183.1	172.8		10.0	10.1	--
J3896	J5174	STGM2969	65	33'' DIA	1.1%	188.70	188.00	196.0	193.5	190.4	189.9	190.5	190.0	55.1	33.6	38.1	--
J3932	J-CCT1-02	STGM4043	815	Irregular Channel	2.5%	160.00	100.00	165.0	150.0	160.7	101.6	160.7	101.7		5.4	6.2	--
J3990	J-CCT3-16	STGM118	123	1' H, 1'BW, 1 SS Channel	6.3%	182.00	174.28	187.0	179.1	182.3	175.5	182.3	175.5	12.1	1.2	1.6	--
J4040	STMF102	STGM18	127	18'' DIA	2.0%	172.53	169.96	177.5	175.0	173.5	171.4	173.6	171.4	14.9	11.9	12.3	--
J4058	J4060	STGM1831	128	12'' DIA	0.8%	155.00	153.98	162.3	163.0	155.9	154.9	155.9	154.9	3.2	3.3	3.4	--
J4060	OF_J5408	STGM1136	313	12'' DIA	0.8%	153.98	151.48	163.0	158.3	154.9	152.3	154.9	152.3	3.2	3.3	3.4	--
J4120	J3728	STGM1641	173	Irregular Channel	2.0%	199.00	195.50	203.0	202.3	202.1	202.0	202.2	202.2		51.4	52.3	--
J4142	J-CCT2-06	STGM1964	266	Irregular Channel	6.2%	150.00	133.50	155.7	158.5	150.6	134.7	150.6	134.7		7.8	8.0	--
J4162	STMF0913	C6	134	30'' DIA	6.6%	199.00	190.20	202.0	203.4	199.7	191.6	199.7	191.6	105.3	15.8	16.1	--
J4216	OF_J4218	STGM4172	232	Irregular Channel	8.6%	110.00	90.00	114.3	94.0	110.3	90.4	110.4	90.4		7.2	7.6	--
J4298	J3514	STGM1854	252	Irregular Channel	0.0%	224.90	224.80	227.9	227.3	228.3	228.3	228.5	228.5		5.4	5.8	Existing 10-yr
J4318	J4482	STGM4293	186	Irregular Channel	2.0%	180.00	176.38	183.0	180.8	182.1	181.8	183.0	182.9		51.3	57.5	Future 10-yr
J4362	J-CCT3-14	STGM2147	213	Irregular Channel	3.9%	179.30	171.10	185.4	176.5	180.3	172.7	180.4	172.8		21.3	23.5	--
J4400	J3514	STGM1234	87	12'' DIA	3.1%	227.50	224.80	230.9	227.3	233.0	228.3	233.2	228.5	6.5	9.1	9.1	Existing 10-yr
J4402	STMF109	STGM2786	199	12'' DIA	0.6%	182.41	181.25	190.8	186.3	189.3	186.3	188.7	186.3	2.7	3.6	3.7	--
J4482	J4898	STGM2443	168	24'' DIA	2.4%	176.38	172.38	180.8	180.5	181.8	174.3	182.9	174.3	34.9	51.2	55.2	Existing 10-yr
J4500	OF_J5512	STGM4234	337	Irregular Channel	19.2%	146.00	82.50	152.1	84.0	146.3	82.8	146.3	82.8		3.4	3.7	--
J4526	STMG0864	STGM1638	43	12'' DIA	7.4%	229.40	226.19	230.9	231.2	235.0	234.6	235.2	234.9	10.0	3.8	3.8	Existing 10-yr
J4572	J-CCT1-07	STGM938	510	Irregular Channel	3.9%	150.00	130.00	163.6	132.0	151.1	131.2	151.1	131.3		31.3	31.3	--
J4632	J4634	STGM2046	252	Irregular Channel	0.4%	163.50	162.60	166.2	166.5	164.3	163.1	164.4	163.2		5.4	6.2	--
J4634	J3932	STGM1645	39	12'' DIA	6.7%	162.60	160.00	166.5	165.0	163.1	160.7	163.2	160.7	9.6	5.4	6.2	--
J4708	J4216	STGM4158	332	Irregular Channel	11.1%	146.50	110.00	152.6	114.3	146.6	110.3	146.6	110.4		1.2	1.3	--
J4770	STIG1016	STGM200	90	18'' DIA	0.4%	185.50	185.10	191.7	190.8	188.3	187.8	190.5	188.4	7.0	6.9	7.5	--
J4818	J5398	STGM2095	137	18'' DIA	0.7%	176.00	175.00	188.5	183.8	178.9	175.7	179.1	175.7	9.0	12.0	12.0	--
J4882	STMF118	STGM4468	25	18'' DIA	1.2%	175.58	175.28	185.8	186.4	176.5	176.0	176.5	176.0	11.9	8.8	8.8	--
J4888	J-CCT2-04	STGM2390	85	12'' DIA	25.4%	144.00	123.00	146.0	173.0	144.3	124.1	144.3	124.1	18.1	3.8	3.9	--
J4894	J4216	STGM893	517	Irregular Channel	6.6%	144.10	110.00	150.5	114.3	144.4	110.3	144.4	110.4		4.8	5.0	--
J4898	J5576	STGM2021-A	466	Irregular Channel	1.0%	172.38	167.50	180.5	172.0	174.3	169.1	174.3	169.1		47.8	50.9	--
J4938	STIF109	STGM1431	413	24'' DIA	0.7%	184.00	181.10	195.8	190.6	195.4	191.8	197.7	194.2	19.0	18.3	21.1	Future 10-yr
J4946	J4948	STGM1340	19	18'' DIA	0.5%	171.50	171.40	173.5	173.8	172.8	172.0	172.8	172.0	7.6	10.0	10.1	--
J4948	OF_J4952	STGM163	68	Irregular Channel	2.8%	171.40	169.50	173.8	171.5	172.0	170.0	172.0	170.0		12.0	12.0	--
J4972	STMH077	STGM3164	125	12'' DIA	4.6%	268.10	262.39	274.5	267.5	268.4	262.8	268.4	262.8	8.1	1.8	1.8	--
J5034	STMF1010	STGM2710	137	33'' DIA	0.8%	154.93	153.57	166.7	166.9	157.5	155.1	157.9	155.2	48.8	54.7	58.1	--
J5040	J5366	STGM751	153	Irregular Channel	0.4%	201.00	200.41	207.7	205.4	216.1	216.1	216.7	216.7		48.2	48.1	Existing 10-yr
J5064	J3530	STGM1959	53	18'' DIA	1.0%	217.53	217.00	219.0	219.0	218.4	217.5	218.7	217.7	10.4	6.8	10.1	--
J5174	J5472	STGM915	57	Irregular Channel	0.9%	188.00	187.50	193.5	192.4	189.9	189.2	190.0	189.4		33.6	38.1	--
J5220	J4770	STGM3615	571	12'' DIA	0.4%	188.00	185.50	192.5	191.7	192.5	188.3	192.8	190.5	2.4	3.0	3.2	Future 10-yr
J5304	STMF116	STGM2406	225	12'' DIA	0.4%	174.00	173.10	182.4	179.5	194.4	190.1	194.5	190.2	2.3	5.4	5.5	Existing 10-yr
J5354	J-CCT1-05	STGM3139	243	Irregular Channel	13.1%	153.00	121.50	163.0	123.4	153.4	128.1	153.5	128.4		4.0	4.3	--
J5366	J3664	STGM3465	51	27'' DIA	0.2%	200.41	200.30	205.4	205.2	216.1	216.0	216.7	216.5	14.4	45.4	44.1	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
J5386	J-CCT3-06	CCT3T3-01	411	Irregular Channel	2.9%	150.00	138.00	170.0	148.0	150.8	139.9	150.8	140.0		13.7	14.2	--
J5398	J7	STGM3520_1	526	Irregular Channel	0.5%	175.00	172.43	183.8	175.3	175.7	175.4	175.7	175.4		12.0	12.0	--
J5422	STMF1221	STGM3180	150	Irregular Channel	5.2%	167.05	159.23	168.8	166.8	167.7	160.5	167.7	160.5		7.6	7.6	--
J5472	J5474	STGM1834	63	33'' DIA	0.8%	187.50	187.00	192.4	191.8	189.2	188.5	189.4	188.8	46.7	33.6	38.1	--
J5474	J3708	STGM1242	207	Irregular Channel	1.0%	187.00	185.00	191.8	190.0	188.5	188.3	188.8	188.7		33.6	38.1	--
J5554	STMF1220	STGM2689b	53	24'' DIA	7.7%	164.69	160.62	170.5	172.3	165.2	161.5	165.2	161.5	64.5	9.7	9.7	--
J5576	J5034	STGM2021-B	464	Irregular Channel	2.6%	167.50	154.93	172.0	166.7	169.1	157.5	169.1	157.9		54.7	58.1	--
J7	J5554	STGM1876	294	12'' DIA	2.6%	172.43	164.69	175.3	170.5	175.4	165.2	175.4	165.2	5.8	11.9	11.9	Existing 10-yr
J8	STIF1290	STGM694	64	8'' DIA	2.2%	169.00	167.61	171.4	170.7	172.0	168.0	172.0	168.0	1.9	2.9	2.9	Existing 10-yr
J9	STMF126	C5	119	12'' DIA	1.3%	167.60	166.02	171.8	170.4	168.0	166.7	168.0	166.7	4.2	1.2	1.2	--
J-CCT1-02	OF_J-CCT1-01	CCT1-01	913	Irregular Channel	2.6%	100.00	76.00	150.0	90.0	101.6	77.6	101.7	77.7		64.3	71.1	--
J-CCT1-03	J-CCT1-02	CCT1-02	594	Irregular Channel	2.0%	112.00	100.00	162.0	150.0	113.3	101.6	113.4	101.7		54.7	58.0	--
J-CCT1-04	J-CCT1-03	CCT1-03	335	Irregular Channel	2.7%	121.00	112.00	160.0	162.0	122.6	113.3	122.6	113.4		52.2	54.6	--
J-CCT1-05	STIG1416	STGM2909	88	24'' DIA	0.3%	121.50	121.28	123.4	144.1	128.1	124.8	128.4	125.0	11.3	50.2	51.2	Existing 10-yr
J-CCT1-06	J-CCT1-05	CCT1-04	688	Irregular Channel	1.1%	129.31	121.50	139.3	123.4	130.8	128.1	130.8	128.4		46.4	47.1	--
J-CCT1-07	J-CCT1-06	CCT1-05	61	Irregular Channel	1.1%	130.00	129.31	132.0	139.3	131.2	130.8	131.3	130.8		34.9	35.3	--
J-CCT2-02	OF_J-CCT2-01	CCT2-01	67	Irregular Channel	4.5%	100.00	97.00	109.0	109.0	101.0	100.0	101.0	100.0		48.7	51.1	--
J-CCT2-03	J-CCT2-02	CCT2-02	539	Irregular Channel	1.3%	107.00	100.00	150.0	109.0	109.1	101.0	109.1	101.0		40.3	42.0	--
J-CCT2-04	J-CCT2-03	CCT2-03	176	Irregular Channel	9.1%	123.00	107.00	173.0	150.0	124.1	109.1	124.1	109.1		37.4	38.8	--
J-CCT2-05	J-CCT2-04	CCT2-04	694	Irregular Channel	1.2%	131.00	123.00	156.0	173.0	132.8	124.1	132.8	124.1		33.8	35.1	--
J-CCT2-06	J-CCT2-05	CCT2-05	167	Irregular Channel	1.5%	133.50	131.00	158.5	156.0	134.7	132.8	134.7	132.8		31.1	31.7	--
J-CCT3-02	OF_J-CCT3-01	CCT3-01	1161	Irregular Channel	1.1%	112.00	99.00	152.0	140.0	115.5	101.9	115.6	102.0		210.7	231.6	--
J-CCT3-03	J-CCT3-02	CCT3-02	1460	Irregular Channel	0.5%	120.00	112.00	160.0	152.0	122.6	115.5	122.7	115.6		181.5	202.0	--
J-CCT3-04	J-CCT3-03	CCT3-03	644	Irregular Channel	1.2%	128.00	120.00	148.0	160.0	130.1	122.6	130.2	122.7		173.0	192.8	--
J-CCT3-05	J-CCT3-04	HWY240_1	195	Irregular Channel	1.0%	130.00	128.00	150.0	148.0	133.6	130.1	133.8	130.2		158.5	177.3	--
J-CCT3-06	J-CCT3-05	CCT3-04	319	Irregular Channel	2.5%	138.00	130.00	148.0	150.0	139.9	133.6	140.0	133.8		85.5	97.5	--
J-CCT3-07	J-CCT3-06	CCT3-05	571	Irregular Channel	1.2%	145.00	138.00	155.0	148.0	147.4	139.9	147.5	140.0		70.5	81.7	--
J-CCT3-08	J-CCT3-07	CCT3-06	149	Irregular Channel	2.0%	148.00	145.00	158.0	155.0	150.0	147.4	150.1	147.5		69.5	80.7	--
J-CCT3-09	J-CCT3-08	CCT3-07	303	Irregular Channel	2.6%	156.00	148.00	166.0	158.0	157.9	150.0	158.0	150.1		68.4	79.7	--
J-CCT3-10	J-CCT3-09	CCT3-08	215	Irregular Channel	1.9%	160.00	156.00	170.0	166.0	162.0	157.9	162.2	158.0		66.8	78.0	--
J-CCT3-11	J-CCT3-10	STGM1273	67	42'' DIA	0.6%	160.41	160.00	169.0	170.0	163.2	162.0	163.6	162.2	42.5	66.8	78.0	--
J-CCT3-12	J-CCT3-11	STGM3489	107	42'' DIA	2.3%	162.90	160.41	167.4	169.0	165.3	163.2	165.6	163.6	83.7	65.4	76.6	--
J-CCT3-13	J-CCT3-12	CCT3-09	393	Irregular Channel	1.4%	168.45	162.90	171.5	167.4	170.1	165.3	170.2	165.6		56.7	62.8	--
J-CCT3-14	J-CCT3-13	CCT3-10	188	Irregular Channel	1.4%	171.10	168.45	176.5	171.5	172.7	170.1	172.8	170.2		55.6	61.5	--
J-CCT3-15	J-CCT3-14	STGM4167	31	24'' DIA	1.0%	171.40	171.10	176.3	176.5	173.5	172.7	173.7	172.8	22.3	35.0	38.5	--
J-CCT3-16	J-CCT3-15	STGM3778_b	195	Irregular Channel	1.5%	174.28	171.40	179.1	176.3	175.5	173.5	175.5	173.7		32.3	33.7	--
J-CCT3-18	J-CCT3-16	STGM3778_a	440	Irregular Channel	1.3%	180.00	174.28	185.0	179.1	181.2	175.5	181.2	175.5		31.2	32.2	--
STIF0817	J4120	STGM3780	231	Irregular Channel	0.5%	200.10	199.00	207.3	203.0	202.1	202.1	202.3	202.2		49.8	51.1	--
STIF0867	STIF0876	STGM196	176	12'' DIA	0.6%	193.06	191.96	196.9	195.5	193.8	192.7	193.8	192.7	2.9	2.6	2.6	--
STIF0874	OF_J4224	STGM406	31	12'' DIA	0.6%	186.57	186.40	194.6	194.0	187.3	187.1	187.3	187.1	2.7	2.6	2.6	--
STIF0875	STIF0874	STGM3330	140	12'' DIA	2.9%	190.90	186.57	194.3	194.6	191.3	187.3	191.3	187.3	6.3	2.6	2.6	--
STIF0876	STIF0875	STGM1718	154	12'' DIA	0.7%	191.96	190.90	195.5	194.3	192.7	191.3	192.7	191.3	3.1	2.6	2.6	--
STIF0877	STIF0867	STGM3028	159	12'' DIA	0.8%	194.40	193.06	199.1	196.9	195.1	193.8	195.1	193.8	3.4	2.6	2.6	--
STIF092	STMF092	STGM800	34	12'' DIA	0.1%	199.28	199.23	202.8	203.2	211.9	206.1	212.3	206.3	1.4	14.9	15.2	Existing 10-yr
STIF1030	STMF101	STGM4226	278	18'' DIA	5.4%	169.70	154.80	174.7	170.5	170.5	155.8	170.5	155.8	24.1	13.7	14.0	--
STIF109	STMF103	STGM3276	51	18'' DIA	0.2%	181.10	181.00	190.6	190.5	191.8	190.3	194.2	192.3	4.6	18.3	20.8	Existing 10-yr
STIF1132	STIF1133	STGM2705	73	12'' DIA	0.7%	172.10	171.50	177.9	175.3	172.9	172.2	172.9	172.2	2.9	3.0	3.1	--
STIF1133	STIF1134	STGM2973	98	12'' DIA	1.0%	171.50	170.40	175.3	174.7	172.2	171.1	172.2	171.1	3.6	3.0	3.1	--
STIF1134	STIF1135	STGM555	158	12'' DIA	1.1%	170.40	168.60	174.7	173.0	171.1	169.5	171.1	169.5	3.7	3.0	3.1	--
STIF1135	STIF1138	STGM2219	58	12'' DIA	0.5%	168.60	168.00	173.0	171.8	169.5	168.7	169.5	168.8	2.6	3.0	3.1	--
STIF1138	J-CCT3-04	STGM1249	352	12'' DIA	0.9%	168.00	128.00	171.8	148.0	168.7	130.1	168.8	130.2	3.3	3.0	3.1	--
STIF1210	J8	STGM4476	39	12'' DIA	-0.2%	168.92	169.00	171.3	171.4	172.2	172.0	172.2	172.0	1.7	2.9	2.9	Existing 10-yr
STIF1262	OF_J3682	STGM2761	296	12'' DIA	19.3%	145.18	93.00	154.2	123.8	149.6	93.6	149.6	93.6	15.7	10.4	10.4	--
STIF1287	STIF129	STGM2635	206	12'' DIA	1.0%	171.84	169.71	174.6	172.8	211.2	209.8	211.2	209.8	3.6	4.6	4.6	Existing 10-yr
STIF129	STIF1210	STGM4474	139	6'' DIA	0.6%	169.71	168.92	172.8	171.3	209.8	172.2	209.8	172.2	0.4	3.7	3.7	Existing 10-yr
STIF1290	STMF126	STGM1830	13	8'' DIA	12.0%	167.61	166.02	170.7	170.4	168.0	166.7	168.0	166.7	4.2	2.9	2.9	--
STIF131	J-CCT2-03	STGM3334	197	15'' DIA	23.2%	151.40	107.00	157.4	150.0	151.7	109.1	151.7	109.1	29.7	3.0	3.3	--
STIF132	STIF131	STGM1327	60	15'' DIA	0.2%	151.50	151.40	157.4	157.4	152.2	151.7	152.2	151.7	2.6	3.0	3.3	--
STIF1324	J-CCT2-02	STGM2972	493	12'' DIA	8.1%	140.00	100.00	149.5	109.0	140.6	101.0	140.6	101.0	10.2	6.1	6.1	--
STIF1329	STMF134	STGM485	504	12'' DIA	1.5%	154.00	146.60	163.2	152.3	163.2	151.3	163.2	152.3	4.3	4.8	5.0	--
STIF137	J4500	STGM1679	273	12'' DIA	1.5%	150.10	146.00	158.8	152.1	150.7	146.3	150.7	146.3	4.4	2.2	2.4	--
STIG0710	STMG0727	STGM443	231	18'' DIA	2.0%	239.30	234.70	243.0	238.6	247.6	235.9	248.7	236.1	14.9	32.5	28.1	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STIG07112	STMG0772	STGM4305	358	15'' DIA	3.1%	255.04	244.30	258.7	247.5	270.9	253.4	278.5	255.3	11.3	15.6	17.8	Existing 10-yr
STIG0777	STIG0778	STGM2591	30	10'' DIA	0.6%	290.71	290.53	296.5	297.0	291.2	290.9	291.2	290.9	1.8	1.2	1.3	--
STIG0778	STMG0751	STGM1384	174	12'' DIA	2.2%	290.53	286.67	297.0	289.9	290.9	287.0	290.9	287.0	5.5	1.3	1.3	--
STIG0837	STIG0890	STGM3781	21	12'' DIA	9.7%	222.00	219.93	226.2	226.2	227.4	227.4	227.6	227.6	10.6	0.6	0.6	Existing 10-yr
STIG0890	STMG0845	STGM1500	14	18'' DIA	0.2%	219.93	219.90	226.2	225.8	227.4	227.3	227.6	227.5	4.9	15.6	15.5	Existing 10-yr
STIG0894	STIG0890	STGM3587	73	18'' DIA	4.6%	223.30	219.93	226.8	226.2	227.9	227.4	228.1	227.6	22.6	15.1	14.6	Existing 10-yr
STIG09106	STMG1027	STGM779	27	21'' DIA	1.1%	196.30	195.00	198.4	198.2	197.1	195.6	199.4	199.3	17.4	6.8	10.0	Future 10-yr
STIG1016	J3692	STGM3710	26	18'' DIA	0.4%	185.10	185.00	190.8	191.9	187.8	187.6	188.4	188.3	6.5	6.9	7.5	--
STIG1022	STIG1023	STGM2903	278	12'' DIA	0.5%	188.47	187.20	191.4	189.5	201.1	195.4	203.9	197.4	2.4	5.8	6.2	Existing 10-yr
STIG1023	STIG1024	STGM958	33	12'' DIA	0.5%	187.20	187.02	189.5	189.4	195.4	194.7	197.4	196.6	2.6	5.3	5.7	Existing 10-yr
STIG1024	STIG1031	STGM2108	130	12'' DIA	0.0%	187.02	187.00	189.4	190.4	194.7	192.1	196.6	193.8	0.4	5.1	5.4	Existing 10-yr
STIG1031	STMG1030	STGM375	298	12'' DIA	1.3%	187.00	183.05	190.4	188.1	192.1	188.1	193.8	188.1	4.1	5.0	5.3	Existing 10-yr
STIG1072	STIG1075	STGM929	282	12'' DIA	1.0%	193.00	190.14	199.2	198.9	208.2	204.5	208.9	205.0	3.6	4.5	4.6	Existing 10-yr
STIG1075	J3896	STGM3785	525	12'' DIA	0.3%	190.14	188.70	198.9	196.0	204.5	190.4	205.0	190.5	1.9	6.2	6.3	Existing 10-yr
STIG108	J5576	STGM602	98	12'' DIA	0.8%	168.30	167.50	174.5	172.0	169.1	169.1	169.2	169.1	3.3	0.9	0.9	--
STIG1348	STIG1349	STGM3029	39	12'' DIA	2.1%	162.33	161.50	167.7	168.1	173.8	172.5	175.1	173.7	5.2	6.7	7.0	Existing 10-yr
STIG1349	STMG1325	STGM3379	138	12'' DIA	0.5%	161.50	160.87	168.1	166.8	172.5	167.8	173.7	168.7	2.4	6.6	6.8	Existing 10-yr
STIG1416	J-CCT1-04	STGM1882	42	24'' DIA	0.7%	121.28	121.00	144.1	160.0	124.8	122.6	125.0	122.6	18.5	50.1	52.1	--
STIH077	STMH077	STGM4212	56	12'' DIA	4.6%	264.96	262.39	271.4	267.5	265.1	262.8	265.1	262.8	8.4	0.4	0.6	--
STMF071	STMF072	STGM3524	19	18'' DIA	1.9%	220.65	220.30	225.8	226.0	222.3	222.2	222.3	222.2	14.4	8.8	8.9	--
STMF0713	STMF076	STGM1942	281	27'' DIA	1.1%	204.26	201.20	207.9	205.0	205.2	202.2	205.2	202.2	32.6	11.4	11.4	--
STMF0716	STMF0713	STGM149	227	21'' DIA	1.5%	207.75	204.26	213.2	207.9	208.7	205.2	208.7	205.2	19.7	11.4	11.4	--
STMF072	STMF084	STGM2847	183	18'' DIA	0.9%	220.30	218.62	226.0	225.3	222.2	220.9	222.2	221.0	10.0	8.8	8.9	--
STMF0720	STMF0833	STGM2669	216	12'' DIA	0.8%	202.21	200.47	204.2	202.5	202.7	201.0	202.7	201.0	3.4	1.8	1.8	--
STMF073	STMF071	STGM1993	102	18'' DIA	1.2%	221.91	220.65	224.4	225.8	222.9	222.3	223.0	222.3	11.6	8.8	8.9	--
STMF074	STMF0810	STGM1604	478	36'' DIA	0.5%	199.28	196.84	202.6	201.4	201.5	198.6	201.7	198.8	47.8	45.0	48.8	--
STMF075	STMF074	STGM275	155	36'' DIA	0.6%	200.16	199.28	203.5	202.6	201.5	201.5	201.7	201.7	50.3	11.4	11.4	--
STMF076	STMF075	STGM4140	208	36'' DIA	0.5%	201.20	200.16	205.0	203.5	202.2	201.5	202.2	201.7	47.5	11.4	11.4	--
STMF078	STMG0718	STGM1534	121	12'' DIA	1.8%	258.86	256.68	262.9	270.1	262.9	260.0	262.9	260.2	5.0	6.7	6.7	--
STMF081	STMF082	STGM402	340	12'' DIA	1.4%	212.38	207.57	217.1	212.1	217.4	217.1	217.7	217.5	4.2	2.7	2.7	Existing 10-yr
STMF0810	STMF0826	STGM2556	392	36'' DIA	1.4%	196.84	191.54	201.4	199.3	198.6	195.2	198.8	195.6	77.6	49.7	53.5	--
STMF0811	STMF0842	STGM244	161	36'' DIA	0.3%	191.30	190.80	199.9	196.4	194.5	193.3	194.7	193.4	37.1	56.0	59.8	--
STMF0812	J3760	STGM1885	35	36'' DIA	10.8%	189.70	185.90	195.7	192.5	190.9	189.7	191.0	189.8	216.7	58.5	63.6	--
STMF0813	STIF0817	STGM2699	243	36'' DIA	1.7%	204.29	200.10	212.5	207.3	205.9	202.1	205.9	202.3	87.4	49.9	51.2	--
STMF0814	STMF0815	STGM1276	163	12'' DIA	0.3%	205.00	204.50	211.0	212.1	205.5	204.9	205.5	204.9	2.0	1.0	1.0	--
STMF0815	STMF0816	STGM2016	263	12'' DIA	0.5%	204.50	203.09	212.1	208.7	204.9	203.6	204.9	203.6	2.7	1.0	1.0	--
STMF0816	J4120	STGM2371	160	15'' DIA	2.6%	203.09	199.00	208.7	203.0	203.6	202.1	203.6	202.2	10.8	3.9	3.9	--
STMF082	STMG0813	STGM3315	255	15'' DIA	1.2%	207.57	204.50	212.1	210.7	217.1	217.1	217.5	217.4	7.1	2.7	2.8	Existing 10-yr
STMF0821	STMF0813	STGM1727	19	24'' DIA	7.4%	205.66	204.29	212.5	212.5	206.5	205.9	206.5	205.9	61.2	16.5	16.7	--
STMF0822	STMF0816	STGM3292	55	12'' DIA	0.2%	203.22	203.09	208.7	208.7	204.0	203.6	204.0	203.6	1.8	2.9	2.9	--
STMF0823	STMF0822	STGM2845	328	12'' DIA	0.3%	204.32	203.22	210.5	208.7	207.0	204.0	206.7	204.0	2.2	2.9	2.9	--
STMF0824	STMF0825	STGM1741	108	18'' DIA	1.1%	199.23	198.00	204.5	202.9	200.0	198.8	200.0	198.8	11.7	6.3	6.4	--
STMF0825	STMF0826	STGM1540	490	18'' DIA	1.3%	198.00	191.54	202.9	199.3	198.8	195.2	198.8	195.6	12.4	6.3	6.4	--
STMF0826	STMF0811	STGM1631	108	36'' DIA	0.2%	191.54	191.30	199.3	199.9	195.2	194.5	195.6	194.7	31.5	56.0	59.8	--
STMF0827	STMF0810	STGM447	22	18'' DIA	5.4%	198.03	196.84	201.5	201.4	198.5	198.6	198.6	198.8	25.2	4.8	4.8	--
STMF0829	STMF0827	STGM2167	26	15'' DIA	1.2%	198.35	198.03	201.9	201.5	199.1	198.5	199.1	198.6	7.4	4.8	4.8	--
STMF083	STMF086	STGM1303	437	24'' DIA	1.6%	218.19	211.36	225.5	217.3	219.1	212.4	219.1	212.4	28.6	12.6	12.7	--
STMF0830	STMF0829	STGM2798	120	15'' DIA	0.6%	199.12	198.35	203.4	201.9	200.0	199.1	200.0	199.1	5.4	4.8	4.8	--
STMF0831	STMF0830	STGM1702	276	12'' DIA	0.4%	200.29	199.12	206.6	203.4	201.6	200.0	201.6	200.0	2.4	3.0	3.0	--
STMF0832	STMF0831	STGM1139	225	12'' DIA	1.4%	203.44	200.29	210.0	206.6	204.1	201.6	204.1	201.6	4.4	3.0	3.0	--
STMF0833	STMF0830	STGM975	226	12'' DIA	0.6%	200.47	199.12	202.5	203.4	201.0	200.0	201.0	200.0	2.9	1.8	1.8	--
STMF0835	STMF0836	STGM612	338	12'' DIA	1.1%	195.93	192.16	201.8	195.8	196.5	192.7	196.5	192.7	3.9	2.6	2.6	--
STMF0836	STMF0837	STGM2796	275	12'' DIA	1.8%	192.16	187.20	195.8	193.7	192.7	187.7	192.7	187.7	5.0	2.6	2.6	--
STMF0837	OF_J5574	STGM2996	42	15'' DIA	0.9%	187.20	186.80	193.7	194.0	187.7	187.3	187.7	187.3	6.6	2.6	2.6	--
STMF0838	STMF0839	STGM4059	252	12'' DIA	2.4%	203.44	197.51	213.2	207.1	204.0	198.2	204.0	198.2	5.7	3.3	3.3	--
STMF084	STMF083	STGM2237	223	21'' DIA	0.2%	218.62	218.19	225.3	225.5	220.9	219.1	221.0	219.1	7.0	12.6	12.7	--
STMF0840	STMF0839	STGM3044	249	12'' DIA	-1.1%	194.68	197.51	203.5	207.1	195.3	198.2	195.3	198.2	3.9	3.3	3.3	--
STMF0840	STMF0841	STGM3607	27	15'' DIA	1.4%	194.68	194.31	203.5	203.2	195.3	195.1	195.3	195.1	7.9	3.3	3.3	--
STMF0841	STMF0914	STGM4177	315	15'' DIA	0.5%	194.31	192.61	203.2	205.4	195.1	193.2	195.1	193.2	4.9	3.3	3.3	--
STMF0842	STMF0812	STGM2438	142	36'' DIA	0.8%	190.80	189.70	196.4	195.7	193.3	190.9	193.4	191.0	58.5	58.5	62.3	--
STMF0843	STMF0842	STGM1576	196	12'' DIA	0.6%	191.98	190.80	195.5	196.4	195.5	193.3	195.5	193.4	2.9	2.5	2.5	--
STMF0844	STMF0843	STGM272	164	12'' DIA	0.5%	192.85	191.98	196.7	195.5	196.7	195.5	196.7	195.5	2.7	2.5	2.5	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMF0845	STMF0844	STGM1091	260	12'' DIA	1.9%	197.68	192.85	201.8	196.7	198.2	196.7	198.2	196.7	5.0	2.5	2.5	--
STMF085	STMF0813	STGM539	222	36'' DIA	1.4%	207.36	204.29	212.4	212.5	208.7	205.9	208.8	205.9	77.9	34.9	36.1	--
STMF086	STMF087	STGM541	128	24'' DIA	1.1%	211.36	210.00	217.3	215.1	212.4	211.2	212.4	211.2	23.3	12.6	12.7	--
STMF087	STMF0821	STGM3974	322	24'' DIA	1.4%	210.00	205.66	215.1	212.5	211.2	206.5	211.2	206.5	26.3	16.5	16.7	--
STMF088	STMF089	STGM1012	181	15'' DIA	2.3%	204.24	200.13	209.7	205.3	205.0	200.9	205.0	200.9	10.1	6.3	6.4	--
STMF089	STMF0824	STGM1492	60	18'' DIA	1.5%	200.13	199.23	205.3	204.5	200.9	200.0	200.9	200.0	13.5	6.3	6.4	--
STMF091	STMF0931	STGM3724	174	36'' DIA	2.1%	184.65	180.95	190.4	188.9	185.7	182.7	185.8	182.8	97.1	27.2	27.9	--
STMF0910	STMF103	STGM1485	335	12'' DIA	1.5%	186.00	181.00	191.0	190.5	192.8	190.3	194.6	192.3	4.4	3.5	3.2	Existing 10-yr
STMF0911	STMF0910	STGM2277	191	12'' DIA	0.5%	186.90	186.00	194.2	191.0	194.4	192.8	195.9	194.6	2.4	3.4	3.3	Existing 10-yr
STMF0913	STMF094	STGM2961	89	36'' DIA	0.3%	190.20	189.97	203.4	200.2	191.6	191.1	191.6	191.2	34.0	17.3	17.5	--
STMF0914	STMF0915	STGM414	30	15'' DIA	1.4%	192.61	192.18	205.4	205.6	193.2	192.9	193.2	192.9	8.1	3.3	3.3	--
STMF0915	STMF0916	STGM2165	66	15'' DIA	0.7%	192.18	191.75	205.6	207.3	192.9	192.3	192.9	192.3	5.4	3.3	3.3	--
STMF0916	STMF0917	STGM3665	117	15'' DIA	2.1%	191.75	189.31	207.3	200.0	192.3	190.3	192.3	190.3	9.7	3.3	3.3	--
STMF0917	STMF0922	STGM3732	114	18'' DIA	1.1%	189.31	188.07	200.0	199.2	190.3	189.3	190.3	189.3	11.5	9.0	9.0	--
STMF0918	STMF0919	STGM415	170	12'' DIA	1.0%	200.20	198.53	208.1	209.2	200.9	199.0	200.9	199.0	3.7	3.0	3.0	--
STMF0919	STMF0921	STGM592	205	12'' DIA	3.8%	198.53	190.78	209.2	201.7	199.0	193.1	199.0	192.9	7.1	3.0	3.0	--
STMF092	J4162	STGM4149	88	15'' DIA	0.3%	199.23	199.00	203.2	202.0	206.1	199.7	206.3	199.7	3.3	15.8	16.1	Existing 10-yr
STMF0921	STMF0917	STGM831	94	12'' DIA	1.6%	190.78	189.31	201.7	200.0	193.1	190.3	192.9	190.3	4.6	5.6	5.6	--
STMF0922	STMF0923	STGM2656	166	18'' DIA	0.9%	188.07	186.61	199.2	197.6	189.3	187.8	189.3	187.8	10.2	10.0	10.2	--
STMF0923	STMF0924	STGM865	336	18'' DIA	0.9%	186.61	183.64	197.6	193.3	187.8	184.8	187.8	184.8	10.3	10.0	10.2	--
STMF0924	J3838	STGM2383	131	18'' DIA	1.0%	183.64	182.30	193.3	191.2	184.8	183.1	184.8	183.1	11.1	10.0	10.2	--
STMF0925	STMF0922	STGM2997	297	12'' DIA	0.7%	190.26	188.07	197.5	199.2	190.7	189.3	190.7	189.3	3.1	1.1	1.2	--
STMF0926	J-CCT3-18	STGM1663	23	36'' DIA	3.5%	180.78	180.00	185.8	185.0	181.9	181.2	181.9	181.2	125.0	33.9	34.9	--
STMF0927	J3990	STGM2463	133	12'' DIA	0.5%	182.71	182.00	188.5	187.0	183.2	182.3	183.3	182.3	2.7	1.2	1.6	--
STMF0928	STMF0929	STGM4306	312	12'' DIA	0.8%	194.94	192.41	200.0	196.7	195.4	192.7	195.4	192.7	3.3	1.3	1.5	--
STMF0929	STMF097	STGM1972	35	12'' DIA	6.0%	192.41	190.32	196.7	196.5	192.7	191.0	192.7	191.0	8.9	1.3	1.5	--
STMF093	STMF0932	STGM3734	419	36'' DIA	0.8%	189.10	185.81	198.1	193.0	190.3	187.3	190.3	187.3	58.6	21.1	21.3	--
STMF0930	STMF0928	STGM3741	184	12'' DIA	1.8%	198.17	194.94	203.4	200.0	198.5	195.4	198.5	195.4	4.9	1.3	1.5	--
STMF0931	STMF0926	STGM3642	55	36'' DIA	0.3%	180.95	180.78	188.9	185.8	182.7	181.9	182.8	181.9	37.3	27.2	27.8	--
STMF0932	STMF091	STGM1524	155	36'' DIA	0.7%	185.81	184.65	193.0	190.4	187.3	185.7	187.3	185.8	57.9	27.2	27.9	--
STMF094	STMF093	STGM1494	110	36'' DIA	0.8%	189.97	189.10	200.2	198.1	191.1	190.3	191.2	190.3	60.3	19.0	19.2	--
STMF097	STMF0926	STGM1861	435	15'' DIA	1.4%	190.32	180.78	196.5	185.8	191.0	181.9	191.0	181.9	8.0	4.0	4.3	--
STMF101	STMF1014	STGM3439	93	18'' DIA	2.7%	154.80	152.30	170.5	171.4	155.8	153.3	155.8	153.3	17.2	13.1	13.7	--
STMF1010	STMF1011	STGM3618	89	33'' DIA	2.7%	153.57	150.89	166.9	166.6	155.1	152.2	155.2	152.3	88.1	54.6	57.9	--
STMF1011	STMF1012	STGM1192	29	33'' DIA	4.8%	150.89	149.35	166.6	166.1	152.2	150.7	152.3	150.8	116.2	54.6	57.9	--
STMF1012	J3786	STGM8	98	33'' DIA	6.0%	149.35	143.50	166.1	163.5	150.7	145.4	150.8	145.4	130.3	65.1	69.8	--
STMF1013	STMF1014	STGM870	181	12'' DIA	4.2%	159.85	152.30	174.7	171.4	160.1	153.3	160.1	153.3	7.5	0.9	0.9	--
STMF1014	J5386	STGM567	133	24'' DIA	1.7%	152.30	150.00	171.4	170.0	153.3	150.8	153.3	150.8	29.8	13.7	14.2	--
STMF102	STIF1030	STGM3768	43	18'' DIA	0.6%	169.96	169.70	175.0	174.7	171.4	170.5	171.4	170.5	8.2	11.9	12.3	--
STMF1022	J-CCT3-08	STGM1858	145	15'' DIA	5.7%	160.25	148.00	171.4	158.0	160.5	150.0	160.5	150.1	16.3	1.1	1.1	--
STMF1023	J-CCT3-07	STGM3141	109	12'' DIA	9.9%	160.80	145.00	169.1	155.0	161.0	147.4	161.0	147.5	12.4	1.0	1.0	--
STMF103	J4362	STGM1902	216	18'' DIA	0.8%	181.00	179.30	190.5	185.4	190.3	180.3	192.3	180.4	9.3	21.3	23.6	Future 10-yr
STMF105	STMF106	STGM3119	84	12'' DIA	2.1%	172.00	170.20	182.8	178.7	172.4	170.5	172.4	170.5	5.2	1.3	1.4	--
STMF106	J-CCT3-13	STGM3634	38	12'' DIA	3.2%	170.20	168.45	178.7	171.5	170.5	170.1	170.5	170.2	6.2	1.3	1.4	--
STMF107	J4040	STGM1182	266	15'' DIA	1.8%	177.24	172.53	182.2	177.5	183.0	173.5	183.6	173.6	8.6	12.1	12.5	Existing 10-yr
STMF109	STMF107	STGM3399	303	18'' DIA	1.3%	181.25	177.24	186.3	182.2	186.3	183.0	186.3	183.6	11.8	7.9	8.3	--
STMF113	STMF1012	STGM2686	137	33'' DIA	5.1%	160.38	149.35	168.7	166.1	161.0	150.7	161.0	150.8	125.6	11.3	12.5	--
STMF116	J3688	STGM339	32	12'' DIA	0.4%	173.10	172.98	179.5	177.1	190.1	189.6	190.2	189.6	2.2	5.0	5.1	Existing 10-yr
STMF117	J5422	STGM2536	122	18'' DIA	0.1%	167.22	167.05	170.0	168.8	168.5	167.7	168.5	167.7	3.9	7.6	7.6	--
STMF118	J3646	STGM738	477	18'' DIA	2.9%	175.28	161.58	186.4	173.8	176.0	162.4	176.0	162.5	17.9	8.8	8.8	--
STMF121	OF_J3954	STGM3636	100	12'' DIA	19.3%	151.00	132.00	153.0	135.0	151.3	132.3	151.3	132.3	15.3	2.8	2.8	--
STMF1217	STMF1218	STGM1601	228	18'' DIA	2.9%	175.00	168.49	183.8	176.9	175.6	169.1	175.6	169.1	17.8	6.2	6.2	--
STMF1218	STMF1219	STGM833	230	24'' DIA	2.4%	168.49	162.89	176.9	172.6	169.1	163.4	169.1	163.4	34.6	6.2	6.2	--
STMF1219	STMF1220	STGM3945	92	33'' DIA	2.5%	162.89	160.62	172.6	172.3	163.4	161.5	163.4	161.5	88.9	6.2	6.2	--
STMF122	STMF121	STGM3038	303	12'' DIA	1.0%	154.00	151.00	156.6	153.0	154.7	151.3	154.7	151.3	3.5	2.8	2.8	--
STMF1220	STMF1221	STGM2735	94	36'' DIA	1.5%	160.62	159.23	172.3	166.8	161.5	160.5	161.5	160.5	79.4	15.9	15.9	--
STMF1221	STMF1227	STGM3908	135	36'' DIA	0.9%	159.23	158.04	166.8	166.0	160.5	159.3	160.5	159.3	63.0	23.3	23.3	--
STMF1222	STMF1223	STGM3091	295	36'' DIA	1.2%	148.10	144.70	164.3	158.2	149.5	145.3	149.5	145.3	72.1	26.7	26.7	--
STMF1223	STMF1224	STGM3930	73	36'' DIA	21.9%	144.70	129.10	158.2	152.6	145.3	130.5	145.3	130.6	308.0	30.8	31.2	--
STMF1224	J-CCT3-02	CCT3T1-01	370	Irregular Channel	4.6%	129.10	112.00	152.6	152.0	130.5	115.5	130.6	115.6		30.8	31.2	--
STMF1225	STMF1222	STGM3132	254	36'' DIA	3.5%	156.96	148.10	165.6	164.3	157.9	149.5	157.9	149.5	127.1	26.7	26.7	--
STMF1226	STMF1225	STGM3905	39	36'' DIA	1.1%	157.40	156.96	165.5	165.6	158.7	157.9	158.7	157.9	70.3	26.7	26.7	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMF1227	STMF1226	STGM1615	53	36'' DIA	1.2%	158.04	157.40	166.0	165.5	159.3	158.7	159.3	158.7	74.2	26.7	26.7	--
STMF126	J5554	C3	59	12'' DIA	2.3%	166.02	164.69	170.4	170.5	166.7	165.2	166.7	165.2	5.4	3.9	3.9	--
STMF131	J4708	STGM4276	122	12'' DIA	0.3%	146.92	146.50	155.4	152.6	147.5	146.6	147.5	146.6	2.1	1.2	1.3	--
STMF134	J4894	STGM2693	171	12'' DIA	1.5%	146.60	144.10	152.3	150.5	151.3	144.4	152.3	144.4	4.3	4.8	5.0	--
STMF135	J-CCT2-06	CCT2-06	477	Irregular Channel	2.4%	145.00	133.50	161.6	158.5	146.1	134.7	146.1	134.7		23.4	23.8	--
STMG071	STMG072	STGM1602	247	18'' DIA	1.3%	226.07	222.75	230.4	225.9	227.0	224.0	227.0	224.0	12.2	8.8	8.9	--
STMG0710	STMG079	STGM252	94	18'' DIA	2.7%	247.10	244.55	248.1	252.0	247.8	245.3	247.8	245.3	18.1	7.2	7.4	--
STMG0711	STMG0710	STGM2904	76	12'' DIA	3.9%	250.10	247.10	254.9	248.1	250.9	247.8	251.0	247.8	7.4	7.2	7.4	--
STMG0712	STMG0732	STGM1067	159	12'' DIA	3.2%	256.00	250.90	261.6	255.1	256.5	251.4	256.5	251.4	6.6	3.2	3.2	--
STMG0713	STMG0734	STGM320	124	12'' DIA	14.7%	280.50	262.50	284.9	270.8	280.8	262.9	280.8	262.9	14.4	3.2	3.2	--
STMG0714	STMG0713	STGM1828	261	12'' DIA	5.9%	295.85	280.50	300.4	284.9	296.3	280.8	296.3	280.8	9.1	3.2	3.2	--
STMG0715	STMG0717	STGM298	113	12'' DIA	4.4%	254.03	249.02	260.1	252.1	254.8	249.8	254.8	249.8	7.8	6.7	6.7	--
STMG0716	STMG0717	STGM3619	418	12'' DIA	3.0%	261.67	249.02	267.9	252.1	262.1	249.8	262.1	249.8	6.4	2.1	2.2	--
STMG0717	J3540	STGM1838	151	12'' DIA	6.3%	249.02	239.50	252.1	242.8	249.8	240.4	249.8	240.4	9.0	8.8	8.9	--
STMG0718	STMG0715	STGM1148	113	12'' DIA	2.4%	256.68	254.03	270.1	260.1	260.0	254.8	260.2	254.8	5.7	6.7	6.7	--
STMG072	STMF073	STGM742	114	18'' DIA	0.7%	222.75	221.91	225.9	224.4	224.0	222.9	224.0	223.0	8.8	8.8	8.9	--
STMG0720	STMG0711	STGM2549	152	12'' DIA	4.2%	256.47	250.10	261.2	254.9	257.3	250.9	257.3	251.0	7.6	7.2	7.4	--
STMG0721	STMG0720	STGM2992	257	12'' DIA	3.0%	264.20	256.47	270.5	261.2	264.5	257.3	264.5	257.3	6.2	1.2	1.2	--
STMG0722	STMG077	STGM2681	137	12'' DIA	1.1%	242.48	241.00	248.2	246.6	247.0	242.2	247.0	242.3	3.8	5.5	5.7	--
STMG0723	STMG0730	STGM3264	312	12'' DIA	0.5%	264.31	262.62	268.0	266.8	264.6	263.3	264.7	263.3	2.7	0.7	0.7	--
STMG0724	STMG076	STGM1922	138	18'' DIA	1.1%	228.95	227.40	233.0	231.5	229.6	227.7	229.6	227.7	11.0	3.5	3.6	--
STMG0725	STMG0724	STGM2690	66	12'' DIA	2.2%	230.43	228.95	233.8	233.0	231.0	229.6	231.0	229.6	5.4	3.5	3.6	--
STMG0727	STMG0729	STGM1672	114	27'' DIA	2.0%	234.70	232.43	238.6	242.9	235.9	234.9	236.1	235.4	43.8	23.0	24.4	--
STMG0729	STMG075	STGM1435	323	24'' DIA	0.8%	232.43	229.78	242.9	234.3	234.9	231.3	235.4	231.3	20.6	23.2	24.4	--
STMG073	STMG0821	STGM78	140	33'' DIA	1.0%	226.20	224.82	231.3	229.7	227.6	226.4	227.6	226.5	52.9	24.9	26.2	--
STMG0730	STMG0716	STGM4322	157	12'' DIA	0.6%	262.62	261.67	266.8	267.9	263.3	262.1	263.3	262.1	2.9	2.1	2.2	--
STMG0731	STMG0730	STGM1778	134	12'' DIA	4.2%	268.21	262.62	273.7	266.8	268.5	263.3	268.5	263.3	7.7	1.5	1.5	--
STMG0732	STMG0833	STGM3497	127	12'' DIA	3.1%	250.90	247.00	255.1	252.5	251.4	247.9	251.4	247.9	6.4	3.2	3.2	--
STMG0733	STIH077	STGM3766	354	12'' DIA	0.9%	268.14	264.96	274.9	271.4	268.4	265.1	268.4	265.1	3.5	0.4	0.6	--
STMG0734	STMG0712	STGM868	133	12'' DIA	4.9%	262.50	256.00	270.8	261.6	262.9	256.5	262.9	256.5	8.1	3.2	3.2	--
STMG0735	STMG0722	STGM755	107	12'' DIA	0.9%	243.49	242.48	249.5	248.2	248.1	247.0	249.5	247.0	3.6	5.5	5.7	--
STMG0738	STMG0735	STGM2711	143	12'' DIA	1.1%	245.09	243.49	250.3	249.5	250.4	248.1	251.1	249.5	3.9	5.5	5.7	Existing 10-yr
STMG0739	STMG0738	STGM4119	113	12'' DIA	0.2%	245.30	245.09	250.5	250.3	252.9	250.4	253.8	251.1	1.6	5.5	5.8	Existing 10-yr
STMG074	STMG073	STGM2078	160	27'' DIA	1.2%	228.10	226.20	233.7	231.3	229.5	227.6	229.5	227.6	33.9	23.0	24.4	--
STMG0742	STMG0768	STGM1868	300	12'' DIA	2.6%	257.32	249.66	262.5	253.5	262.5	259.4	262.5	260.9	6.0	1.9	2.1	--
STMG0744	STMG0742	STGM1370	156	12'' DIA	3.6%	262.97	257.32	268.2	262.5	263.3	262.5	263.4	262.5	7.1	1.9	2.1	--
STMG0747	STMG0771	STGM2595	18	15'' DIA	3.3%	261.20	260.62	265.5	265.4	261.8	261.3	261.8	261.3	12.3	6.0	6.2	--
STMG0749	STMG0767	STGM2405	239	15'' DIA	4.5%	276.33	265.52	282.8	270.7	276.9	266.2	276.9	266.2	14.3	6.0	6.2	--
STMG075	STMG074	STGM1952	129	24'' DIA	1.3%	229.78	228.10	234.3	233.7	231.3	229.5	231.3	229.5	25.9	23.0	24.4	--
STMG0750	STMG0749	STGM3703	107	15'' DIA	7.3%	284.09	276.33	290.0	282.8	284.6	276.9	284.6	276.9	18.2	6.0	6.2	--
STMG0751	STMG0750	STGM4170	133	12'' DIA	1.9%	286.67	284.09	289.9	290.0	287.0	284.6	287.0	284.6	5.1	1.2	1.3	--
STMG0754	STIG0777	STGM961	155	12'' DIA	11.2%	307.92	290.71	315.2	296.5	308.1	291.2	308.1	291.2	12.2	1.2	1.3	--
STMG0755	STMG0766	STGM5	249	12'' DIA	6.0%	315.40	300.47	318.8	305.8	315.6	300.7	315.7	300.7	9.3	1.1	1.2	--
STMG076	STMG073	STGM3886	9	27'' DIA	13.2%	227.40	226.20	231.5	231.3	227.7	227.6	227.7	227.6	117.7	3.5	3.6	--
STMG0761	STMG0754	STGM3652	144	12'' DIA	11.2%	324.00	307.92	329.7	315.2	324.2	308.1	324.2	308.1	12.2	1.2	1.3	--
STMG0762	STMG0761	STGM3911	196	12'' DIA	7.6%	338.85	324.00	344.1	329.7	339.1	324.2	339.1	324.2	10.2	1.2	1.3	--
STMG0765	STMG0762	STGM2791	247	12'' DIA	0.5%	340.04	338.85	345.6	344.1	340.6	339.1	340.6	339.1	2.5	1.2	1.3	--
STMG0766	STMG0750	STGM104	204	12'' DIA	8.1%	300.47	284.09	305.8	290.0	300.7	284.6	300.7	284.6	10.2	1.1	1.2	--
STMG0767	STMG0747	STGM2135	146	15'' DIA	3.0%	265.52	261.20	270.7	265.5	266.2	261.8	266.2	261.8	11.6	6.0	6.2	--
STMG0768	STMG0770	STGM3402	161	12'' DIA	2.4%	249.66	245.78	253.5	251.1	259.4	255.8	260.9	256.9	5.8	6.2	6.4	Existing 10-yr
STMG0769	STMG0768	STGM4289	152	12'' DIA	3.0%	254.21	249.66	259.5	253.5	259.6	259.4	261.0	260.9	6.3	1.3	1.4	Existing 10-yr
STMG077	STMG0831	STGM1325	274	18'' DIA	1.1%	241.00	238.07	246.6	243.1	242.2	243.1	242.3	243.1	11.3	10.1	10.2	--
STMG0770	STMG0739	STGM498	134	12'' DIA	0.4%	245.78	245.30	251.1	250.5	255.8	252.9	256.9	253.8	2.2	5.8	6.0	Existing 10-yr
STMG0771	STMG0720	STGM2857	133	15'' DIA	3.1%	260.62	256.47	265.4	261.2	261.3	257.3	261.3	257.3	11.3	6.0	6.2	--
STMG0772	J3780	STGM1261	34	15'' DIA	3.5%	244.30	243.10	247.5	246.5	253.4	248.1	255.3	249.2	12.2	27.9	30.4	Existing 10-yr
STMG0774	STMG0775	STGM4418	245	12'' DIA	1.0%	261.43	259.00	268.4	264.7	311.4	293.0	320.2	299.5	3.7	12.4	13.5	Existing 10-yr
STMG0775	STMG0776	STGM4127	287	12'' DIA	3.7%	259.00	248.31	264.7	256.2	293.0	265.9	299.5	269.3	7.2	12.6	13.5	Existing 10-yr
STMG0776	STMG0777	STGM2290	132	36'' DIA	2.2%	248.31	245.36	256.2	250.9	265.9	265.9	269.3	269.2	102.3	11.5	12.1	Existing 10-yr
STMG0777	STMG0772	STGM3722	139	12'' DIA	0.8%	245.36	244.30	250.9	247.5	265.9	253.4	269.2	255.3	3.2	11.3	11.9	Existing 10-yr
STMG078	STMG0851	STGM1021	129	18'' DIA	3.3%	242.40	238.10	247.2	242.8	243.4	242.9	243.6	243.2	19.9	7.2	7.4	--
STMG079	STMG078	STGM2829	121	18'' DIA	1.8%	244.55	242.40	252.0	247.2	245.3	243.4	245.3	243.6	14.5	7.2	7.4	--
STMG081	STMG096	STGM2763	106	12'' DIA	1.2%	204.25	202.94	210.0	210.5	216.0	216.0	216.6	216.6	4.0	3.0	2.9	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMG0810	STMG089	STGM2848	175	15'' DIA	1.4%	224.14	221.73	227.4	226.5	224.6	223.4	224.6	223.4	7.5	2.3	2.3	--
STMG0811	STMG081	STGM1309	426	12'' DIA	1.6%	210.91	204.25	215.9	210.0	216.2	216.0	216.8	216.6	4.4	2.8	2.8	Existing 10-yr
STMG0812	J5040	STGM4215	26	33'' DIA	0.4%	201.10	201.00	210.0	207.7	216.1	216.1	216.7	216.7	17.8	48.3	48.3	Existing 10-yr
STMG0813	STMG0812	STGM186	145	33'' DIA	2.4%	204.50	201.10	210.7	210.0	217.1	216.1	217.4	216.7	43.9	48.7	48.6	Existing 10-yr
STMG0814	STMG087	STGM2358	290	12'' DIA	1.4%	218.02	213.97	221.3	217.3	218.8	217.5	218.8	217.8	4.2	2.7	2.7	--
STMG0815	STMG0817	STGM4047	311	15'' DIA	1.8%	231.50	226.04	235.5	229.1	232.3	229.4	232.4	229.7	8.5	5.5	5.9	--
STMG0816	STMG0815	STGM533	279	12'' DIA	1.5%	235.61	231.50	238.1	235.5	239.3	232.3	240.4	232.4	4.3	5.6	6.0	Existing 10-yr
STMG0817	STMG0818	STGM32	123	15'' DIA	0.6%	226.04	225.36	229.1	228.6	229.4	228.7	229.7	228.9	4.8	5.5	5.9	Existing 10-yr
STMG0818	J4298	STGM2064	254	18'' DIA	0.2%	225.36	224.90	228.6	227.9	228.7	228.3	228.9	228.5	4.5	5.4	5.8	Existing 10-yr
STMG0819	STMG086	STGM2842	457	33'' DIA	1.3%	218.34	212.42	223.2	217.4	221.6	219.0	221.9	219.3	60.0	44.7	44.7	--
STMG082	STMG0813	STGM420	97	36'' DIA	1.6%	206.02	204.50	211.3	210.7	217.3	217.1	217.7	217.4	84.2	46.6	46.5	Existing 10-yr
STMG0820	STMG0834	STGM442	133	33'' DIA	2.7%	220.62	217.11	225.4	223.7	221.7	218.2	221.7	218.2	84.9	26.3	27.6	--
STMG0821	STMG0822	STGM2489	63	33'' DIA	0.5%	224.82	224.48	229.7	229.2	226.4	226.0	226.5	226.0	38.8	24.9	26.2	--
STMG0822	STMG089	STGM2271	262	27'' DIA	1.0%	224.48	221.73	229.2	226.5	226.0	223.4	226.0	223.4	31.9	24.9	26.2	--
STMG0824	STMG0825	STGM4201	24	36'' DIA	1.2%	223.21	222.92	230.3	229.9	235.5	235.5	235.8	235.7	73.7	39.2	39.4	Existing 10-yr
STMG0825	STMG0828	STGM3207	47	36'' DIA	1.0%	222.92	222.44	229.9	232.2	235.5	235.4	235.7	235.6	67.8	39.1	39.3	Existing 10-yr
STMG0827	STMG0845	STGM2457	271	24'' DIA	0.6%	221.54	219.90	231.5	225.8	232.8	227.3	233.1	227.5	17.4	33.1	33.2	Existing 10-yr
STMG0828	STMG0827	STGM276	120	24'' DIA	0.8%	222.44	221.54	232.2	231.5	235.4	232.8	235.6	233.1	19.6	33.2	33.3	Existing 10-yr
STMG0829	STMG0849	STGM725	291	36'' DIA	0.9%	227.89	225.39	235.1	231.0	237.4	236.4	237.7	236.7	61.5	40.4	40.6	Existing 10-yr
STMG083	STMG082	STGM464	143	33'' DIA	1.6%	208.26	206.02	214.8	211.3	217.9	217.3	218.3	217.7	66.1	45.4	45.3	Existing 10-yr
STMG0830	STMG0850	STGM633	255	27'' DIA	1.0%	231.75	229.13	238.0	237.3	240.3	238.1	240.5	238.3	32.7	31.4	31.5	Existing 10-yr
STMG0831	STMG0850	STGM1455	270	18'' DIA	3.3%	238.07	229.13	243.1	237.3	243.1	238.1	243.1	238.3	19.8	10.1	10.2	--
STMG0832	STMG0851	STGM2759	250	21'' DIA	1.0%	240.50	238.10	245.3	242.8	245.3	242.9	245.3	243.2	15.6	10.3	10.4	--
STMG0833	STMG0832	STGM2082	259	18'' DIA	2.5%	247.00	240.50	252.5	245.3	247.9	245.3	247.9	245.3	17.5	10.3	10.5	--
STMG0834	STMG0843	STGM3769	128	33'' DIA	2.4%	217.11	214.07	223.7	219.4	218.2	215.7	218.2	215.8	82.2	26.3	27.6	--
STMG0835	STMG0836	STGM1544	164	33'' DIA	1.4%	212.96	210.60	218.4	215.4	214.4	212.3	214.4	212.3	63.0	33.4	34.4	--
STMG0836	STMG0837	STGM65	297	33'' DIA	0.9%	210.60	208.00	215.4	215.0	212.3	210.0	212.3	210.0	49.9	33.4	34.4	--
STMG0837	STMF085	STGM3293	132	33'' DIA	0.5%	208.00	207.36	215.0	212.4	210.0	208.7	210.0	208.8	36.7	33.4	34.4	--
STMG0839	STMG0840	STGM3596	194	12'' DIA	1.8%	230.00	226.50	237.2	230.2	235.6	230.1	236.1	230.2	5.0	7.2	7.2	--
STMG084	STMG083	STGM1548	161	15'' DIA	0.6%	209.23	208.26	215.2	214.8	217.9	217.9	218.3	218.3	5.0	1.7	1.7	Existing 10-yr
STMG0840	STMG0841	STGM70	155	12'' DIA	4.0%	226.50	220.30	230.2	223.9	230.1	223.9	230.2	223.9	7.4	7.2	7.2	--
STMG0841	STMG0844	STGM543	138	12'' DIA	2.8%	220.30	216.50	223.9	220.3	223.9	217.3	223.9	217.3	6.2	7.1	7.1	--
STMG0842	STMG0839	STGM890	126	12'' DIA	0.7%	230.83	230.00	235.9	237.2	239.4	235.6	239.7	236.1	3.0	7.2	7.2	Existing 10-yr
STMG0843	STMG0835	STGM3173	205	33'' DIA	0.5%	214.07	212.96	219.4	218.4	215.7	214.4	215.8	214.4	38.7	26.3	27.6	--
STMG0844	STMG0835	STGM348	82	12'' DIA	4.3%	216.50	212.96	220.3	218.4	217.3	214.4	217.3	214.4	7.4	7.1	7.1	--
STMG0845	STMG0846	STGM166	88	24'' DIA	0.5%	219.90	219.50	225.8	228.6	227.3	224.7	227.5	224.9	15.2	41.2	41.1	Existing 10-yr
STMG0846	STMG0854	STGM3314	67	27'' DIA	0.3%	219.50	219.30	228.6	224.2	224.7	223.4	224.9	223.6	16.9	44.7	44.7	--
STMG0847	J4526	STGM2468	120	12'' DIA	0.5%	229.97	229.40	233.3	230.9	236.1	235.0	236.3	235.2	2.6	4.0	4.0	Existing 10-yr
STMG0848	STMG0863	STGM3268	130	36'' DIA	0.8%	225.02	223.96	231.3	229.5	236.3	235.8	236.5	236.1	60.7	39.7	39.9	Existing 10-yr
STMG0849	STMG0848	STGM486	49	36'' DIA	0.8%	225.39	225.02	231.0	231.3	236.4	236.3	236.7	236.5	58.3	40.0	40.2	Existing 10-yr
STMG085	STMG084	STGM1815	217	15'' DIA	0.8%	211.01	209.23	216.5	215.2	218.0	217.9	218.3	218.3	5.9	1.6	1.7	Existing 10-yr
STMG0850	STMG0829	STGM1380	185	36'' DIA	0.7%	229.13	227.89	237.3	235.1	238.1	237.4	238.3	237.7	54.6	40.9	41.1	Existing 10-yr
STMG0851	STMG0852	STGM2311	262	24'' DIA	1.5%	238.10	234.17	242.8	239.1	242.9	241.6	243.2	241.8	29.0	17.5	17.7	Existing 10-yr
STMG0852	STMG0830	STGM2013	242	27'' DIA	1.0%	234.17	231.75	239.1	238.0	241.6	240.3	241.8	240.5	32.0	24.1	24.2	Existing 10-yr
STMG0853	STMG0864	STGM2213	213	18'' DIA	-0.8%	224.49	226.19	229.1	231.2	235.2	234.6	235.5	234.9	9.8	5.8	5.9	Existing 10-yr
STMG0853	STMG0825	STGM277	91	18'' DIA	1.7%	224.49	222.92	229.1	229.9	235.2	235.5	235.5	235.7	14.4	5.8	5.9	Existing 10-yr
STMG0854	STMG0819	STGM3000	96	27'' DIA	1.0%	219.30	218.34	224.2	223.2	223.4	221.6	223.6	221.9	30.8	44.7	44.7	--
STMG0855	STMG0833	STGM2801	279	15'' DIA	2.2%	253.08	247.00	266.7	252.5	253.9	247.9	253.9	247.9	9.9	7.2	7.3	--
STMG0856	STMG0865	STGM3426	499	18'' DIA	0.9%	239.74	235.06	247.0	239.5	243.7	241.7	244.9	241.9	10.6	7.0	7.1	--
STMG0857	STMG0856	STGM4204	84	15'' DIA	2.3%	241.70	239.74	247.5	247.0	244.6	243.7	246.0	244.9	10.2	7.0	7.1	--
STMG0858	STMG0857	STGM3319	120	15'' DIA	2.3%	244.49	241.70	250.3	247.5	245.6	244.6	247.4	246.0	10.2	7.1	7.2	--
STMG0859	STMG0858	STGM1356	97	15'' DIA	0.9%	245.36	244.49	250.6	250.3	246.5	245.6	248.5	247.4	6.4	7.1	7.1	--
STMG086	STMG083	STGM3214	252	33'' DIA	1.7%	212.42	208.26	217.4	214.8	219.0	217.9	219.3	218.3	67.8	44.4	44.4	Existing 10-yr
STMG0860	STMG0859	STGM1372	218	15'' DIA	2.3%	250.40	245.36	256.1	250.6	251.2	246.5	251.2	248.5	10.2	7.1	7.1	--
STMG0863	STMG0824	STGM3553	88	36'' DIA	0.8%	223.96	223.21	229.5	230.3	235.8	235.5	236.1	235.8	61.3	39.4	39.6	Existing 10-yr
STMG0864	J4400	STGM1895	28	12'' DIA	-4.6%	226.19	227.50	231.2	230.9	234.6	233.0	234.9	233.2	8.0	9.2	9.3	Existing 10-yr
STMG0865	STMG0852	STGM2269	21	18'' DIA	4.2%	235.06	234.17	239.5	239.1	241.7	241.6	241.9	241.8	22.2	7.0	7.1	Existing 10-yr
STMG087	STMF081	STGM575	116	12'' DIA	1.4%	213.97	212.38	217.3	217.1	217.5	217.4	217.8	217.7	4.2	2.7	2.7	Existing 10-yr
STMG088	STMG0816	STGM3545	191	12'' DIA	0.2%	236.00	235.61	238.8	238.1	243.9	239.3	245.7	240.4	1.6	5.7	6.1	Existing 10-yr
STMG089	STMG0820	STGM2407	199	33'' DIA	0.6%	221.73	220.62	226.5	225.4	223.4	221.7	223.4	221.7	39.3	26.3	27.6	--
STMG0910	STMG099	STGM3386	312	33'' DIA	0.4%	202.75	201.50	215.7	208.6	204.3	202.8	204.4	202.9	33.5	20.8	24.6	--
STMG0911	STMG099	STGM4268	50	12'' DIA	0.6%	201.80	201.50	208.1	208.6	202.9	202.8	203.0	202.9	2.8	1.4	1.9	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMG0913	STMF092	STGM3236	331	12'' DIA	1.1%	203.01	199.23	207.9	203.2	208.2	206.1	208.4	206.3	3.8	3.8	3.8	Existing 10-yr
STMG0914	J3664	STGM4160	67	12'' DIA	0.4%	201.30	200.30	208.5	205.2	216.0	216.0	216.6	216.5	2.4	2.9	2.9	Existing 10-yr
STMG0916	STMG0917	STGM173	154	12'' DIA	0.9%	191.69	190.30	198.8	197.6	192.4	190.9	192.4	190.9	3.4	2.7	2.8	--
STMG0917	STMF0932	STGM3203	273	12'' DIA	1.6%	190.30	185.81	197.6	193.0	190.9	187.3	190.9	187.3	4.6	2.7	2.8	--
STMG0919	STMF0911	STGM3883	104	12'' DIA	0.9%	187.81	186.90	195.8	194.2	195.8	194.4	196.7	195.9	3.3	3.4	3.4	Future 10-yr
STMG0924	J5064	STGM2988	1248	24'' DIA	0.0%	218.00	217.53	223.8	219.0	219.5	218.4	219.5	218.7	4.4	4.1	4.5	--
STMG0928	STMG0933	STGM959	364	24'' DIA	1.6%	220.00	214.11	230.8	224.4	221.6	219.1	229.4	224.9	30.1	21.0	25.6	--
STMG0930	STMG0916	STGM4138	166	12'' DIA	2.3%	195.50	191.69	203.4	198.8	196.0	192.4	196.0	192.4	5.4	2.7	2.8	--
STMG0932	STMG0928	STGM3122	232	24'' DIA	1.6%	223.75	220.00	232.5	230.8	224.5	221.6	231.3	229.4	29.4	8.3	11.4	--
STMG0933	STMG0934	STGM3901	88	24'' DIA	1.5%	214.11	212.83	224.4	223.2	219.1	218.4	224.9	223.9	28.5	20.8	25.6	Future 10-yr
STMG0934	STMG0935	STGM66	107	24'' DIA	1.4%	212.83	211.30	223.2	221.5	218.4	217.5	223.9	222.7	28.1	20.8	25.3	Future 10-yr
STMG0935	STMG0936	STGM1326	75	24'' DIA	1.5%	211.30	210.16	221.5	221.0	217.5	217.0	222.7	221.9	29.3	20.8	25.2	Future 10-yr
STMG0936	STMG0937	STGM970	97	24'' DIA	1.5%	210.16	208.73	221.0	219.4	217.0	216.2	221.9	220.8	28.5	20.8	25.0	Future 10-yr
STMG0937	STMG098	STGM3894	259	24'' DIA	1.3%	208.73	205.33	219.4	214.9	216.2	214.2	220.8	218.0	27.0	20.8	24.9	Future 10-yr
STMG094	STMG0913	STGM1483	231	12'' DIA	0.7%	204.63	203.01	209.1	207.9	210.7	208.2	210.9	208.4	3.0	3.9	4.0	Existing 10-yr
STMG095	STMG094	STGM2281	311	12'' DIA	-0.1%	204.18	204.63	209.3	209.1	214.3	210.7	214.6	210.9	1.4	4.0	4.1	Existing 10-yr
STMG096	STMG0914	STGM2101	79	12'' DIA	2.1%	202.94	201.30	210.5	208.5	216.0	216.0	216.6	216.6	5.1	2.9	2.9	Existing 10-yr
STMG097	STMG0910	STGM1799	200	24'' DIA	0.9%	204.55	202.75	212.8	215.7	210.2	204.3	212.4	204.4	11.6	20.8	24.6	--
STMG098	STMG097	STGM2486	102	18'' DIA	0.8%	205.33	204.55	214.9	212.8	214.2	210.2	218.0	212.4	9.2	20.8	24.7	Future 10-yr
STMG099	STMG1021	STGM2596	837	33'' DIA	1.1%	201.50	192.00	208.6	202.6	202.8	193.7	202.9	193.9	56.4	24.8	29.1	--
STMG101	STMG104	STGM4016	246	18'' DIA	0.4%	188.80	187.90	200.0	200.8	189.9	188.8	189.9	188.9	6.3	5.7	5.9	--
STMG102	STMG103	STGM171	310	12'' DIA	1.7%	199.76	194.51	210.1	205.6	210.1	195.2	210.1	195.2	4.6	5.7	5.9	--
STMG1021	J3896	STGM3150	685	33'' DIA	0.5%	192.00	188.70	202.6	196.0	193.7	190.4	193.9	190.5	36.9	26.3	30.7	--
STMG1022	STMG1023	STGM2737	220	15'' DIA	0.6%	183.41	182.09	188.6	187.1	184.1	182.9	184.1	185.5	5.2	2.9	3.0	--
STMG1023	STMG1024	STGM2280	237	15'' DIA	0.6%	182.09	180.74	187.1	186.8	182.9	182.6	185.5	183.5	5.1	2.9	3.0	--
STMG1024	J4318	STGM618	120	15'' DIA	0.6%	180.74	180.00	186.8	183.0	182.6	182.1	183.5	183.0	5.3	4.6	4.8	--
STMG1025	STMG1024	STGM3527	231	15'' DIA	0.6%	182.10	180.74	187.5	186.8	182.7	182.6	183.5	183.5	5.2	1.8	1.8	--
STMG1027	STMG1029	STGM3920	247	33'' DIA	1.8%	195.00	190.30	198.2	194.4	195.6	195.6	199.3	199.2	68.1	6.8	10.2	Future 10-yr
STMG1028	J4938	STGM4199	35	18'' DIA	1.4%	184.50	184.00	194.6	195.8	195.5	195.4	199.0	197.7	12.6	18.5	21.4	Existing 10-yr
STMG1029	STMG1028	STGM1017	201	36'' DIA	2.9%	190.30	184.50	194.4	194.6	195.6	195.5	199.2	199.0	115.6	19.0	22.5	Existing 10-yr
STMG103	STMG101	STGM1223	152	12'' DIA	3.8%	194.51	188.80	205.6	200.0	195.2	189.9	195.2	189.9	7.0	5.7	5.9	--
STMG1030	STMF109	STGM609	410	15'' DIA	0.4%	183.05	181.25	188.1	186.3	188.1	186.3	188.1	186.3	4.3	5.3	5.6	--
STMG1034	J3692	STGM3835	17	18'' DIA	0.6%	185.10	185.00	191.3	191.9	187.8	187.6	188.3	188.3	8.0	7.6	7.8	--
STMG1036	STIG09106	STGM140	446	21'' DIA	1.1%	201.00	196.30	204.9	198.4	201.8	197.1	202.0	199.4	17.0	6.8	10.0	--
STMG104	STMG1034	STGM4320	690	21'' DIA	0.4%	187.90	185.10	200.8	191.3	188.8	187.8	188.9	188.3	10.1	5.7	5.9	--
STMG1112	J4882	STGM583	512	18'' DIA	1.2%	181.88	175.58	189.4	185.8	182.8	176.5	182.8	176.5	12.0	8.8	8.8	--
STMG121	STMG1226	STGM2605	321	12'' DIA	0.6%	167.00	165.13	172.7	171.9	208.7	184.6	208.6	184.5	2.7	10.6	10.6	Existing 10-yr
STMG1210	STMG1232	STGM2676	248	12'' DIA	0.6%	167.05	165.59	173.7	172.2	175.9	175.2	175.9	175.2	2.7	2.8	2.8	Existing 10-yr
STMG1215	STMG1210	STGM3838	87	12'' DIA	2.0%	168.80	167.05	175.4	173.7	176.2	175.9	176.2	175.9	5.1	2.6	2.6	Existing 10-yr
STMG1218	STMF135	STGM1879	635	18'' DIA	2.6%	161.72	145.00	168.3	161.6	173.7	146.1	173.7	146.1	17.0	21.8	21.8	Existing 10-yr
STMG1219	STMG1218	STGM2430	82	18'' DIA	0.6%	162.20	161.72	169.2	168.3	176.5	173.7	176.5	173.7	8.0	20.4	20.4	Existing 10-yr
STMG1226	STMG1227	STGM3052	225	18'' DIA	0.6%	165.13	163.82	171.9	170.6	184.6	182.7	184.5	182.6	8.0	9.9	9.9	Existing 10-yr
STMG1227	STMG1219	STGM2687	279	18'' DIA	0.6%	163.82	162.20	170.6	169.2	182.7	176.5	182.6	176.5	8.0	16.3	16.3	Existing 10-yr
STMG1232	STMG1218	STGM1872	543	12'' DIA	0.7%	165.59	161.72	172.2	168.3	175.2	173.7	175.2	173.7	3.0	2.8	2.8	Existing 10-yr
STMG1245	STMG128	STGM1039	279	12'' DIA	0.5%	166.00	164.50	174.1	172.6	204.1	200.8	204.1	200.8	2.6	5.6	5.6	Existing 10-yr
STMG128	STMG1316	STGM1563	719	18'' DIA	0.3%	164.50	162.00	172.6	169.4	200.8	195.7	200.8	195.7	6.2	12.1	12.1	Existing 10-yr
STMG1310	STMG1312	STGM1093	262	15'' DIA	0.5%	164.50	163.10	169.9	169.4	191.9	190.0	191.9	190.0	4.7	7.1	7.1	Existing 10-yr
STMG1311	STMG1315	STGM516	511	15'' DIA	0.0%	162.20	162.00	168.1	166.1	188.2	177.3	188.2	177.3	1.3	11.2	11.2	Existing 10-yr
STMG1312	STMG1311	STGM3846	258	15'' DIA	0.3%	163.10	162.20	169.4	168.1	190.0	188.2	190.0	188.2	3.8	6.3	6.3	Existing 10-yr
STMG1315	STMG1323	STGM4013	65	15'' DIA	3.1%	162.00	157.30	166.1	165.4	177.3	175.9	177.3	175.9	11.3	9.9	9.9	Existing 10-yr
STMG1316	STMG133	STGM2776	357	18'' DIA	1.1%	162.00	157.92	169.4	167.3	195.7	191.3	195.7	191.3	11.2	13.2	13.2	Existing 10-yr
STMG1317	STMG1316	STGM1085	292	12'' DIA	2.8%	167.41	162.00	171.9	169.4	197.7	195.7	197.7	195.7	6.0	4.4	4.4	Existing 10-yr
STMG1319	STIG1348	STGM52	243	10'' DIA	0.8%	164.32	162.33	169.5	167.7	181.3	173.8	182.5	175.1	2.0	4.0	3.9	Existing 10-yr
STMG132	STMG1322	STGM3936	78	18'' DIA	0.1%	157.50	157.40	165.5	165.5	180.7	178.0	180.7	178.0	3.8	19.7	19.7	Existing 10-yr
STMG1320	STMG1321	STGM685	264	10'' DIA	0.3%	166.40	165.57	173.9	171.9	198.8	189.2	199.6	190.3	1.2	5.4	5.4	Existing 10-yr
STMG1321	STMG1319	STGM1656	250	10'' DIA	0.5%	165.57	164.32	171.9	169.5	189.2	181.3	190.3	182.5	1.6	4.7	4.6	Existing 10-yr
STMG1322	STMG1323	STGM2057	59	18'' DIA	0.2%	157.40	157.30	165.5	165.4	178.0	175.9	178.0	175.9	4.3	19.7	19.7	Existing 10-yr
STMG1323	STMG1324	STGM3369	360	21'' DIA	0.1%	157.30	157.00	165.4	166.0	175.9	166.0	175.9	166.0	4.6	31.4	31.4	Existing 10-yr
STMG1324	J4572	STGM3861	112	18'' DIA	6.3%	157.00	150.00	166.0	163.6	166.0	151.1	166.0	151.1	26.3	31.3	31.3	--
STMG1325	STMG1326	STGM3808	88	12'' DIA	3.2%	160.87	158.10	166.8	165.6	167.8	163.6	168.7	164.3	6.3	7.9	8.1	Existing 10-yr
STMG1326	J4142	STGM1339	231	12'' DIA	3.5%	158.10	150.00	165.6	155.7	163.6	150.6	164.3	150.6	6.7	7.8	8.0	--
STMG133	STMG132	STGM1769	300	18'' DIA	0.1%	157.92	157.50	167.3	165.5	191.3	180.7	191.3	180.7	3.9	20.8	20.8	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMG134	STMG133	STGM939	270	12'' DIA	0.3%	158.70	157.92	169.4	167.3	192.6	191.3	192.6	191.3	1.9	3.1	3.1	Existing 10-yr
STMG135	STMG134	STGM1333	261	12'' DIA	0.3%	159.50	158.70	170.2	169.4	193.9	192.6	194.0	192.6	2.0	3.9	3.9	Existing 10-yr
STMG136	J-CCT1-06	STGM2827	286	21'' DIA	8.8%	155.05	129.31	163.8	139.3	155.7	130.8	155.7	130.8	46.5	12.1	12.2	--
STMG138	STMG1411	STGM1971	284	12'' DIA	1.5%	159.96	155.62	168.3	163.9	160.8	156.1	160.8	156.1	4.4	3.9	4.1	--
STMG141	J3700	STGM3224	203	12'' DIA	2.1%	154.32	140.00	162.3	152.0	154.9	140.4	154.9	140.4	5.2	3.6	3.6	--
STMG1410	STIG1416	STGM916	58	12'' DIA	28.8%	137.22	121.28	145.7	144.1	137.5	124.8	137.5	125.0	18.8	3.9	4.1	--
STMG1411	STMG1410	STGM3167	227	12'' DIA	8.1%	155.62	137.22	163.9	145.7	156.1	137.5	156.1	137.5	10.1	3.9	4.1	--
STMG1412	STMG136	STGM1606	220	18'' DIA	1.7%	158.80	155.05	168.7	163.8	160.0	155.7	160.0	155.7	13.7	12.1	12.2	--
STMG1413	STMG1414	STGM1156	317	18'' DIA	0.3%	162.00	161.00	170.3	168.8	163.0	161.4	163.0	161.4	5.9	4.6	4.6	--
STMG1414	STMG1412	STGM753	21	18'' DIA	10.6%	161.00	158.80	168.8	168.7	161.4	160.0	161.4	160.0	35.2	4.6	4.6	--
STMG142	STMG145	STGM741	48	12'' DIA	0.8%	160.03	159.65	166.8	166.4	160.5	160.4	160.5	160.4	3.2	1.1	1.3	--
STMG143	STMG145	STGM1740	183	12'' DIA	0.4%	160.47	159.65	167.0	166.4	161.6	160.4	161.7	160.4	2.4	2.8	3.0	--
STMG144	STMG141	STGM2999	261	12'' DIA	1.2%	157.50	154.32	164.0	162.3	158.3	154.9	158.3	154.9	3.9	3.6	3.6	--
STMG145	STMG146	STGM3444	267	15'' DIA	1.0%	159.65	157.00	166.4	163.5	160.4	157.4	160.4	157.4	6.4	4.0	4.3	--
STMG146	J5354	STGM2055	65	15'' DIA	6.1%	157.00	153.00	163.5	163.0	157.4	153.4	157.4	153.5	15.9	4.0	4.3	--
STMG147	STIG1416	STGM156	8	12'' DIA	171.4%	128.19	121.28	143.8	144.1	128.4	124.8	128.5	125.0	44.3	4.4	7.0	--
STMG149	STMG147	STGM3611	283	12'' DIA	10.2%	157.06	128.19	162.2	143.8	157.6	128.4	157.7	128.5	11.4	4.4	7.0	--
STMH071	J4972	STGM2941	26	12'' DIA	6.1%	269.29	268.10	275.6	274.5	270.0	268.4	270.0	268.4	8.9	1.8	1.8	--
STMH072	STMH071	STGM3411	271	12'' DIA	8.5%	292.30	269.29	302.0	275.6	292.6	270.0	292.6	270.0	11.1	1.8	1.8	--
STMH073	STMH076	STGM427	169	12'' DIA	0.9%	257.00	255.50	261.5	259.7	259.7	259.7	260.1	259.7	3.5	2.2	2.3	--
STMH076	STMH081	STGM4141	129	12'' DIA	1.0%	255.50	254.22	259.7	260.1	259.7	260.1	259.7	260.1	3.7	2.2	2.3	--
STMH077	STMH073	STGM3871	122	12'' DIA	4.4%	262.39	257.00	267.5	261.5	262.8	259.7	262.8	260.1	7.9	2.2	2.3	--
STMH081	STMG0855	STGM3561	285	15'' DIA	0.4%	254.22	253.08	260.1	266.7	260.1	253.9	260.1	253.9	4.2	7.2	7.3	--
HESS CREEK																	
J3	STMH1314	STGM231	357	10'' DIA	0.3%	164.00	163.00	169.8	169.9	198.4	196.6	201.8	200.1	1.2	2.5	2.5	Existing 10-yr
J3474	STMG1010	STGM1575	20	21'' DIA	0.5%	189.28	189.18	201.5	201.5	190.4	190.2	190.4	190.2	11.1	8.3	8.6	--
J35	J5012	STGM761_b	1225	Irregular Channel	1.6%	253.80	234.00	256.7	240.5	254.1	236.3	254.2	236.8		8.1	12.9	--
J3504	J4862	STGM1393	255	Irregular Channel	15.9%	160.00	120.00	164.3	130.0	160.4	120.5	160.4	120.5		3.4	3.4	--
J3588	STII1179	STGM2598	307	Irregular Channel	0.7%	209.90	205.36	215.2	212.9	211.2	207.2	211.4	207.3		15.1	16.0	--
J3612	J3614	STGM1579	93	12'' DIA	1.1%	174.00	172.00	178.0	178.3	180.4	173.0	180.4	173.0	3.7	9.4	9.4	Existing 10-yr
J3614	J4282	STGM3629	389	Irregular Channel	0.6%	172.00	169.70	178.3	174.0	173.0	170.6	173.0	170.6		11.7	11.7	--
J3628	J3630	STGM4460	62	12'' DIA	0.8%	188.00	187.50	194.3	191.1	194.3	193.0	194.3	193.1	3.2	63.1	68.1	Existing 10-yr
J3630	STMG115	STGM241	239	33'' DIA	0.2%	187.50	187.00	191.1	192.7	193.0	193.1	193.1	193.0	23.9	9.5	9.0	Existing 10-yr
J3696	J-HC-28	STGM1350	139	Irregular Channel	3.3%	156.53	151.80	166.6	170.0	157.1	155.9	157.1	156.2		22.4	23.6	--
J3762	J4234	STGM1142	25	18'' DIA	0.8%	187.40	187.20	195.6	195.7	188.4	188.1	188.4	188.1	9.5	7.5	7.5	--
J3872	STMG112	STGM4250	167	12'' DIA	0.2%	185.80	185.51	193.2	194.4	192.6	192.2	193.2	192.3	1.5	2.9	3.0	--
J3936	J3938	STGM2754	164	18'' DIA	6.7%	398.00	387.00	415.0	397.0	399.1	388.0	399.1	388.0	27.2	24.5	24.5	--
J3938	J4688	STGM3836	349	Irregular Channel	8.6%	387.00	357.00	397.0	364.2	388.0	358.2	388.0	358.2		27.1	27.7	--
J4002	J-HC-32	STGM2111	378	Irregular Channel	4.2%	182.80	167.00	191.9	180.0	183.6	168.9	183.6	169.1		9.4	10.4	--
J4042	J-HC-33	STGM1480	68	24'' DIA	10.3%	176.00	169.00	204.0	195.0	176.2	170.5	176.2	170.7	74.0	2.2	2.2	--
J4050	STMI096	STGM3971	50	18'' DIA	2.0%	258.00	256.00	262.3	258.7	258.4	256.6	258.5	256.7	15.0	1.8	3.1	--
J4066	STIG11113	STGM793	27	12'' DIA	0.4%	186.00	185.90	192.0	192.8	192.7	192.7	192.8	192.8	2.3	3.2	3.2	Existing 10-yr
J4068	J4066	STGM1044	42	12'' DIA	0.2%	186.10	186.00	192.4	192.0	192.8	192.7	192.9	192.8	1.8	3.3	3.3	Existing 10-yr
J4098	J-HC-11	STGM3729	325	Irregular Channel	12.3%	152.00	112.50	157.4	119.0	152.4	115.2	152.4	115.4		7.1	8.1	--
J4160	STMI132	STGM1814	90	42'' DIA	4.0%	147.33	143.41	154.4	162.1	148.2	144.7	148.3	144.9	201.1	24.2	30.2	--
J4198	J4200	STGM311	251	Irregular Channel	2.8%	160.00	153.00	165.7	155.5	160.5	153.5	160.5	153.5		11.9	12.1	--
J4200	J4398	STGM28	66	18'' DIA	18.5%	153.00	141.00	155.5	160.6	153.5	141.7	153.5	141.7	45.8	11.9	12.1	--
J4234	STMI114	STGM3568	34	18'' DIA	1.0%	187.20	185.80	195.7	195.9	188.1	187.1	188.1	187.2	10.7	7.5	7.5	--
J4282	J5560	STGM2288	878	Irregular Channel	0.5%	169.70	165.00	174.0	168.9	170.6	166.4	170.6	166.4		11.7	11.7	--
J4290	J-HC-14	STGM1992-B	595	12'' DIA	3.9%	162.40	120.50	169.9	150.0	180.0	125.2	181.1	125.5	7.1	10.3	10.5	Existing 10-yr
J4370	J5046	STGM3756	214	Irregular Channel	0.4%	228.80	228.00	234.8	234.2	229.9	228.8	230.0	228.8		8.9	9.3	--
J4398	J-HC-19	STGM2478	342	Irregular Channel	3.5%	141.00	129.00	160.6	155.0	141.7	134.0	141.7	134.4		11.9	12.1	--
J4504	J-HC-13	STGM2342	173	Irregular Channel	17.3%	146.42	117.00	159.2	140.0	147.2	121.5	147.3	121.7		8.9	9.2	--
J4554	J4556	STGM1330	48	15'' DIA	2.1%	312.00	310.00	319.7	318.9	312.5	310.4	312.8	310.4	9.3	3.4	6.5	--
J4556	J5628	STGM24	1004	Irregular Channel	4.5%	310.00	264.50	318.9	271.1	310.4	267.6	310.4	268.7		12.0	18.0	--
J4576	J5090	STGM2558	1209	Irregular Channel	5.7%	313.00	244.00	319.3	260.8	313.2	245.6	313.2	246.0		10.7	13.2	--
J4608	J4610	STGM2442	1371	Irregular Channel	0.1%	101.00	100.00	163.5	156.6	103.3	103.3	104.0	156.6		10.2	54.9	--
J4610	J-HC-03	STGM4240	540	24'' DIA	0.2%	100.00	97.20	156.6	168.5	103.3	102.8	156.6	103.6	9.7	18.7	48.3	--
J4620	STMG1228	STGM3528	786	12'' DIA	0.5%	176.30	172.00	186.6	183.2	203.6	195.4	203.6	195.4	2.6	4.6	4.6	Existing 10-yr
J4628	STIH0917	STGM3855	253	Irregular Channel	4.8%	242.10	230.00	252.5	242.0	242.5	242.3	243.2	243.2		3.8	6.8	--
J4636	STIH12139	STGM351	376	Irregular Channel	0.9%	176.50	173.26	183.6	178.7	177.8	178.7	177.8	178.7		7.1	7.1	--
J4642	J3696	STGM2530	21	Irregular Channel	3.3%	157.20	156.53	168.2	166.6	157.5	157.1	157.5	157.1		4.3	5.1	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
J4668	J4290	STGM1992-A	348	12'' DIA	0.6%	164.65	162.40	173.3	169.9	190.1	180.0	191.1	181.1	2.9	6.7	6.7	Existing 10-yr
J4688	J4690	STGM3862	40	Irregular Channel	3.5%	357.00	355.60	364.2	362.6	358.2	356.3	358.2	356.3		27.1	27.7	--
J4690	J-HC-40	STGM3202	763	Irregular Channel	8.1%	355.60	294.00	362.6	330.0	356.3	295.8	356.3	295.9		27.0	27.6	--
J4734	STMI096	STGM2831	552	12'' DIA	1.3%	264.00	256.00	268.3	258.7	266.9	256.6	268.0	256.7	4.0	4.7	4.9	--
J4738	J4740	STGM3952	1597	Irregular Channel	2.0%	226.00	194.00	234.5	202.9	227.0	195.6	227.0	195.6		23.7	24.1	--
J4740	STIH1035	STGM4082	116	27'' DIA	2.7%	194.00	190.90	202.9	197.0	195.6	192.6	195.6	192.6	27.3	23.5	24.0	--
J4784	J3628	STGM3680	466	Irregular Channel	0.4%	190.00	188.00	195.9	194.3	193.0	194.3	193.2	194.3		56.3	61.0	--
J4862	J-HC-07	STGM2986	94	Irregular Channel	15.8%	120.00	105.30	130.0	140.0	120.5	111.0	120.5	110.9		5.0	5.7	--
J4872	STII11281	C9	413	36'' DIA	0.5%	204.00	201.50	212.1	211.5	205.4	203.0	205.5	203.1	48.4	22.8	23.4	--
J4918	STMH1144	STGM1484	39	21'' DIA	0.8%	202.00	201.70	207.5	207.2	203.0	203.0	203.0	203.0	14.1	3.4	3.4	--
J4956	J-HC-38	HCT6-01	1558	Irregular Channel	2.3%	240.00	203.50	254.2	230.0	241.6	207.1	241.8	207.4		84.7	118.2	--
J4974	OF_J-HC-01	HCT1-01	946	Irregular Channel	6.9%	156.40	91.70	163.4	155.0	156.7	91.9	156.7	92.0		8.4	14.5	--
J5012	STII093	STGM2917	74	12'' DIA	0.7%	234.00	233.50	240.5	240.0	236.3	236.0	236.8	236.4	2.9	11.0	15.9	--
J5026	STMH096	STGM3432	261	15'' DIA	0.8%	226.00	224.00	239.1	237.9	240.0	237.9	240.7	238.4	5.7	8.6	8.8	Existing 10-yr
J5046	J4738	STGM3474	138	24'' DIA	1.4%	228.00	226.00	234.2	234.5	228.8	227.0	228.8	227.0	27.6	8.8	9.3	--
J5084	J5190	STGM1726	53	12'' DIA	3.4%	233.00	231.20	238.3	238.3	233.6	231.8	233.6	231.9	6.6	3.8	4.2	--
J5090	J4956	STGM74	96	36'' DIA	4.2%	244.00	240.00	260.8	254.2	245.6	241.6	246.0	241.8	136.8	79.6	113.0	--
J5110	STMH117	STGM2500	81	24'' DIA	2.2%	192.50	190.68	197.6	195.9	193.5	192.1	193.5	192.1	33.5	17.4	17.6	--
J5190	J4370	STGM193	360	24'' DIA	0.7%	231.20	228.80	238.3	234.8	231.8	229.9	231.9	230.0	18.3	3.8	4.2	--
J5242	J4050	STGM4217	531	Irregular Channel	0.4%	260.00	258.00	262.2	262.3	260.3	258.4	260.4	258.5		1.9	3.2	--
J5266	J4642	STGM2215	492	24'' DIA	5.8%	185.66	157.20	193.0	168.2	185.9	157.5	185.9	157.5	53.0	2.1	2.4	--
J5284	J5090	STGM3123	622	Irregular Channel	1.3%	252.00	244.00	280.7	260.8	252.7	245.6	252.8	246.0		5.2	6.5	--
J5324	J5326	STGM3325	46	12'' DIA	5.5%	436.50	434.00	460.0	439.5	437.3	434.3	437.3	434.3	8.3	7.3	7.3	--
J5326	J4576	STGM855	942	Irregular Channel	13.0%	434.00	313.00	439.5	319.3	434.3	313.2	434.3	313.2		7.3	7.3	--
J5444	J5484	STGM610	87	18'' DIA	0.7%	212.42	211.80	219.8	218.5	215.0	213.1	215.3	213.1	8.9	15.2	16.1	--
J5450	J-HC-37	STGM615	1211	Irregular Channel	7.0%	280.00	196.00	288.9	220.0	280.3	199.0	280.3	199.3		2.4	2.7	--
J5480	J5026	STGM407	184	15'' DIA	1.1%	228.10	226.00	240.3	239.1	241.7	240.0	242.4	240.7	6.9	8.4	8.6	Existing 10-yr
J5484	J3588	STGM228	295	Irregular Channel	0.6%	211.80	209.90	218.5	215.2	213.1	211.2	213.1	211.4		15.2	16.1	--
J5510	STMH1137	STGM3730	162	18'' DIA	1.8%	180.53	177.67	188.5	185.0	181.2	178.4	181.2	178.4	14.1	4.9	5.1	--
J5560	J5562	STGM480	66	18'' DIA	1.5%	165.00	164.00	168.9	171.1	166.4	165.0	166.4	165.0	12.9	15.6	15.9	--
J5562	J4160	STGM2658	454	Irregular Channel	3.7%	164.00	147.33	171.1	154.4	165.0	148.2	165.0	148.3		20.3	22.0	--
J5628	J4734	STGM3128	39	12'' DIA	1.3%	264.50	264.00	271.1	268.3	267.6	266.9	268.7	268.0	4.0	11.8	17.9	--
J5640	J-HC-09	STGM1713	473	Irregular Channel	10.5%	158.50	109.00	164.0	145.0	159.1	111.3	159.2	111.4		7.2	8.0	--
J6	STIH145	STGM3868	135	12'' DIA	0.5%	164.00	163.35	169.4	167.1	166.7	165.5	166.9	165.6	2.5	3.4	3.4	--
J-HC-03	OF_J-HC-02	STGM2361_b	560	96'' DIA	0.4%	97.20	95.00	168.5	104.0	102.8	100.6	103.6	101.1	572.4	475.1	579.2	--
J-HC-04	J-HC-03	STGM2361_a	735	96'' DIA	0.4%	100.00	97.20	145.0	168.5	105.6	102.8	106.6	103.6	564.0	468.3	576.4	--
J-HC-05	J-HC-04	HC-02	219	Irregular Channel	0.5%	101.00	100.00	160.0	145.0	105.6	105.6	106.6	106.6		476.7	590.1	--
J-HC-06	J-HC-05	HC-03	1465	Irregular Channel	0.3%	105.00	101.00	145.0	160.0	111.0	105.6	110.9	106.6		436.5	541.0	--
J-HC-07	J-HC-06	HC-04	624	Irregular Channel	0.0%	105.30	105.00	140.0	145.0	111.0	111.0	110.9	110.9		382.9	471.7	--
J-HC-08	J-HC-07	HC-05	44	Irregular Channel	0.2%	105.40	105.30	140.0	140.0	111.0	111.0	110.9	110.9		379.5	466.1	--
J-HC-09	J-HC-08	HC-06	394	Irregular Channel	0.9%	109.00	105.40	145.0	140.0	111.3	111.0	111.4	110.9		379.6	466.4	--
J-HC-10	J-HC-09	HC-07	805	Irregular Channel	0.3%	111.50	109.00	155.0	145.0	114.5	111.3	114.6	111.4		376.5	462.1	--
J-HC-11	J-HC-10	HC-08	373	Irregular Channel	0.3%	112.50	111.50	119.0	155.0	115.2	114.5	115.4	114.6		371.5	455.7	--
J-HC-12	J-HC-11	HC-09	640	Irregular Channel	0.5%	115.43	112.50	140.0	119.0	120.1	115.2	120.3	115.4		365.0	448.4	--
J-HC-13	J-HC-12	HC-10	342	Irregular Channel	0.5%	117.00	115.43	140.0	140.0	121.5	120.1	121.7	120.3		362.8	445.5	--
J-HC-14	J-HC-13	HC-11	998	Irregular Channel	0.4%	120.50	117.00	150.0	140.0	125.2	121.5	125.5	121.7		355.8	437.9	--
J-HC-15	J-HC-14	HC-12	941	Irregular Channel	0.5%	125.00	120.50	140.0	150.0	127.7	125.2	128.0	125.5		343.1	424.1	--
J-HC-16	J-HC-15	HC-13	339	Irregular Channel	0.3%	126.00	125.00	147.0	140.0	129.1	127.7	129.3	128.0		343.0	430.4	--
J-HC-17	J-HC-16	HC-14	331	Irregular Channel	0.3%	127.00	126.00	160.0	147.0	130.0	129.1	130.4	129.3		362.6	473.1	--
J-HC-18	J-HC-17	STGM1862	203	72'' DIA	0.5%	128.00	127.00	154.7	160.0	133.2	130.0	133.7	130.4	296.8	337.3	419.7	--
J-HC-19	J-HC-18	HC-15	293	Irregular Channel	0.3%	129.00	128.00	155.0	154.7	134.0	133.2	134.4	133.7		314.1	391.0	--
J-HC-20	J-HC-19	HC-16	752	Irregular Channel	0.6%	133.80	129.00	143.8	155.0	138.5	134.0	139.0	134.4		307.9	384.4	--
J-HC-21	J-HC-20	HC-17	348	Irregular Channel	0.6%	136.00	133.80	146.0	143.8	140.7	138.5	141.2	139.0		303.8	380.0	--
J-HC-22	J-HC-21	HC-18	569	Irregular Channel	0.2%	137.00	136.00	147.0	146.0	143.0	140.7	143.6	141.2		301.6	377.6	--
J-HC-23	J-HC-22	HC-19	155	Irregular Channel	0.5%	137.76	137.00	147.8	147.0	143.2	143.0	143.7	143.6		296.1	372.0	--
J-HC-24	J-HC-23	HC-20	255	Irregular Channel	0.5%	139.00	137.76	149.0	147.8	143.6	143.2	144.2	143.7		295.0	370.9	--
J-HC-25	J-HC-24	HC-21	236	Irregular Channel	0.1%	139.30	139.00	160.0	149.0	143.8	143.6	144.3	144.2		280.9	355.2	--
J-HC-26	J-HC-25	STGM2743	232	78'' DIA	0.5%	140.40	139.30	146.1	160.0	144.8	143.8	145.5	144.3	362.4	282.5	357.8	--
J-HC-27	J-HC-26	HC-22	1573	Irregular Channel	0.7%	151.50	140.40	170.0	146.1	154.9	144.8	155.1	145.5		280.4	354.8	--
J-HC-28	J-HC-27	HC-23	179	Irregular Channel	0.2%	151.80	151.50	170.0	170.0	155.9	154.9	156.2	155.1		247.9	317.1	--
J-HC-29	J-HC-28	VILLA_CULVERT_1	59	30'' DIA	2.9%	153.50	151.80	160.0	170.0	156.5	155.9	156.9	156.2	69.9	234.7	300.4	--
J-HC-29	J-HC-28	VILLA_CULVERT_2	58	60'' DIA	2.9%	153.50	151.80	160.0	170.0	156.5	155.9	156.9	156.2	450.5	234.7	300.4	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
J-HC-30	J-HC-29	HC-24	1069	Irregular Channel	0.8%	162.00	153.50	180.0	160.0	166.7	156.5	166.8	156.9		232.4	299.8	--
J-HC-31	J-HC-30	HC-25	181	Irregular Channel	1.4%	164.50	162.00	180.0	180.0	168.1	166.7	168.4	166.8		232.6	299.2	--
J-HC-32	J-HC-31	HC-26	822	Irregular Channel	0.3%	167.00	164.50	180.0	180.0	168.9	168.1	169.1	168.4		209.0	270.5	--
J-HC-33	J-HC-32	HC-27	583	Irregular Channel	0.3%	169.00	167.00	195.0	180.0	170.5	168.9	170.7	169.1		200.3	260.3	--
J-HC-34	J-HC-33	HC-28	755	Irregular Channel	1.1%	177.00	169.00	190.0	195.0	180.8	170.5	181.0	170.7		195.5	253.5	--
J-HC-35	J-HC-34	STGM4228	88	60'' DIA	1.9%	178.70	177.00	185.2	190.0	181.7	180.8	182.1	181.0	364.5	193.2	250.1	--
J-HC-36	J-HC-35	HC-29	356	Irregular Channel	0.5%	180.50	178.70	187.0	185.2	184.1	181.7	184.3	182.1		187.0	241.4	--
J-HC-37	J-HC-36	HC-30	1760	Irregular Channel	0.9%	196.00	180.50	220.0	187.0	199.0	184.1	199.3	184.3		175.5	228.4	--
J-HC-38	J-HC-37	HC-31	691	Irregular Channel	1.1%	203.50	196.00	230.0	220.0	207.1	199.0	207.4	199.3		164.7	210.7	--
J-HC-39	J-HC-38	HC-32	785	Irregular Channel	3.3%	229.60	203.50	245.0	230.0	231.5	207.1	231.6	207.4		76.2	86.1	--
J-HC-40	J-HC-39	HC-33	1818	Irregular Channel	3.5%	294.00	229.60	330.0	245.0	295.8	231.5	295.9	231.6		71.8	78.1	--
J-HC-41	J-HC-40	STGM1508	436	Irregular Channel	2.5%	304.90	294.00	309.3	330.0	306.0	295.8	306.0	295.9		38.5	40.6	--
J-HC-42	J-HC-41	STGM1362	911	Irregular Channel	4.3%	344.20	304.90	351.7	309.3	345.4	306.0	345.4	306.0		38.7	40.8	--
J-HC-43	J-HC-42	STGM3271	49	18'' DIA	4.3%	348.30	344.20	365.0	351.7	352.8	345.4	352.8	345.4	21.7	33.9	33.9	--
J-HCT2-01	J-HC-05	HCT2-01	680	Irregular Channel	0.9%	107.00	101.00	165.0	160.0	108.5	105.6	108.7	106.6		47.2	63.3	--
J-HCT2-02	J-HCT2-01	HCT2-02	688	Irregular Channel	1.9%	120.00	107.00	160.0	165.0	121.2	108.5	121.3	108.7		39.2	49.0	--
J-HCT2-03	J-HCT2-02	HCT2-03	834	Irregular Channel	2.5%	141.00	120.00	160.0	160.0	142.1	121.2	142.2	121.3		35.1	41.7	--
J-HCT3-01	J-HC-06	HCT3-01	1106	Irregular Channel	2.5%	132.64	105.00	165.0	145.0	133.9	111.0	133.9	110.9		80.2	84.9	--
J-HCT3-02	J-HCT3-01	HCT3-02	567	Irregular Channel	2.5%	146.80	132.64	155.0	165.0	147.7	133.9	147.7	133.9		78.2	82.5	--
J-HCT3-03	J-HCT3-02	HCT3-03	570	Irregular Channel	1.4%	155.00	146.80	165.0	155.0	155.7	147.7	155.7	147.7		71.8	73.8	--
J-HCT3-04	J-HCT3-03	HCT3-04	376	Irregular Channel	1.4%	160.40	155.00	165.0	165.0	163.6	155.7	163.6	155.7		65.7	66.9	--
J-HCT3-05	J-HCT3-04	HCT3-05	128	Irregular Channel	1.5%	162.30	160.40	170.0	165.0	165.1	163.6	165.1	163.6		63.7	64.8	--
J-HCT3-06	J-HCT3-05	HCT3-06	146	Irregular Channel	1.4%	164.40	162.30	170.0	170.0	167.2	165.1	167.2	165.1		63.0	64.1	--
J-HCT3-07	J-HCT3-06	STGM734	45	36'' DIA	0.4%	164.60	164.40	173.0	170.0	167.6	167.2	167.6	167.2	44.5	60.6	61.5	--
J-HCT3-08	J-HCT3-07	HCT3-07	271	Irregular Channel	2.1%	170.20	164.60	175.0	173.0	171.6	167.6	171.7	167.6		60.6	61.5	--
J-HCT3-09	J-HCT3-08	STGM658	49	24'' DIA	0.6%	170.50	170.20	177.1	175.0	171.8	171.6	171.8	171.7	89.1	60.6	61.5	--
J-HCT4-01	J-HC-27	HCT4_01	359	Irregular Channel	3.2%	163.00	151.50	185.0	170.0	164.4	154.9	164.4	155.1		40.3	40.9	--
J-HCT4-02	J-HCT4-01	HCT4-02	204	Irregular Channel	1.7%	166.40	163.00	188.4	185.0	167.5	164.4	167.5	164.4		35.4	35.9	--
J-HCT4-03	J-HCT4-02	HCT4-03	93	Irregular Channel	1.7%	168.00	166.40	190.0	188.4	169.6	167.5	169.6	167.5		33.8	34.3	--
J-HCT4-04	J-HCT4-03	HCT4-04	310	Irregular Channel	2.5%	175.60	168.00	195.0	190.0	177.0	169.6	177.0	169.6		32.1	32.6	--
J-HCT4-05	J-HCT4-04	STGM1867	69	48'' DIA	1.3%	176.50	175.60	188.8	195.0	177.7	177.0	177.7	177.0	163.6	31.1	31.5	--
J-HCT4-06	J-HCT4-05	HCT4-05	263	Irregular Channel	3.2%	185.00	176.50	195.0	188.8	186.3	177.7	186.4	177.7		31.1	31.5	--
STIG11113	J3872	STGM910	49	12'' DIA	0.2%	185.90	185.80	192.8	193.2	192.7	192.6	192.8	193.2	1.7	3.1	3.2	--
STIG1139	J4068	STGM3599	81	12'' DIA	0.5%	186.50	186.10	191.5	192.4	192.8	192.8	192.9	192.9	2.6	2.9	3.0	Existing 10-yr
STIG1142	STIG1139	STGM712	115	12'' DIA	0.0%	186.50	186.50	192.4	191.5	192.8	192.8	192.9	192.9	0.1	2.9	3.0	Existing 10-yr
STIH081	J5450	STGM1720	46	12'' DIA	12.7%	286.77	280.00	288.5	288.9	287.1	280.3	287.1	280.3	13.1	2.4	2.7	--
STIH0917	STMH0910	STGM2308	190	18'' DIA	0.5%	230.00	229.00	242.0	242.2	242.3	242.2	243.2	243.0	7.6	3.8	6.3	Existing 10-yr
STIH1012	STIH1013	STGM4187	35	12'' DIA	0.3%	201.60	201.50	209.0	209.0	202.1	201.7	202.1	201.7	1.9	1.1	1.1	--
STIH1013	STMH109	STGM3407	184	12'' DIA	9.0%	201.50	185.00	209.0	193.1	201.7	185.1	201.7	185.1	10.8	1.2	1.2	--
STIH1033	STMH1015	STGM285	113	12'' DIA	3.5%	209.00	205.00	215.9	216.2	209.3	205.5	209.3	205.5	6.6	1.2	1.2	--
STIH1035	STIH1036	STGM396	38	27'' DIA	2.3%	190.90	190.00	197.0	197.3	192.6	191.3	192.6	191.3	25.8	22.9	23.3	--
STIH1036	J-HCT4-06	STGM3682	63	27'' DIA	7.9%	190.00	185.00	197.3	195.0	191.3	186.3	191.3	186.4	47.5	29.9	30.3	--
STIH1038	STMH1010	STGM1925	86	12'' DIA	5.5%	197.70	193.00	205.3	206.2	198.0	193.9	198.0	193.9	8.3	1.9	1.9	--
STIH1040	STMH1011	STGM1229	234	12'' DIA	5.1%	211.00	199.00	218.0	207.8	211.3	199.4	211.3	199.4	8.0	1.9	1.9	--
STIH1043	STMH1014	STGM952	82	12'' DIA	8.0%	204.00	197.45	210.2	207.5	204.3	197.8	204.3	197.8	10.2	1.9	1.9	--
STIH107	STMH1018	STGM218	127	12'' DIA	17.6%	185.07	163.00	192.2	189.4	185.3	167.0	185.3	167.1	15.2	1.8	1.9	--
STIH118	J-HC-24	STGM1768	72	18'' DIA	36.1%	163.50	139.00	170.0	149.0	164.1	143.6	164.1	144.2	62.2	19.9	20.2	--
STIH12125	STMH125	STGM937	90	15'' DIA	0.6%	178.25	177.69	181.7	185.8	179.0	178.2	179.0	178.2	5.1	3.1	3.1	--
STIH12139	STMH1224	STGM2459	90	15'' DIA	0.3%	173.26	172.96	178.7	180.0	178.7	180.0	178.7	180.0	3.7	7.5	7.5	--
STIH12182	STIH12125	STGM2874	196	15'' DIA	0.5%	179.31	178.25	187.1	181.7	180.1	179.0	180.1	179.0	4.6	3.1	3.1	--
STIH144	J3504	STGM139	63	18'' DIA	1.2%	160.75	160.00	165.5	164.3	161.3	160.4	161.3	160.4	11.5	3.4	3.4	--
STIH145	STIH146	STGM3809	105	12'' DIA	-0.3%	163.35	163.62	167.1	166.2	165.5	164.2	165.6	164.2	1.8	3.4	3.4	--
STIH146	STIH144	STGM128	126	12'' DIA	2.3%	163.62	160.75	166.2	165.5	164.2	161.3	164.2	161.3	5.4	3.4	3.4	--
STII093	J5084	STGM2830	172	12'' DIA	0.3%	233.50	233.00	240.0	238.3	236.0	233.6	236.4	233.6	1.9	6.2	6.3	--
STII0940	STII0941	STGM2704	78	12'' DIA	0.9%	252.88	252.00	259.1	258.1	253.8	252.6	259.1	256.6	3.5	3.8	6.8	--
STII0941	STII0945	STGM2680	192	12'' DIA	2.7%	252.00	246.63	258.1	252.5	252.6	247.7	256.6	249.2	6.1	3.8	6.8	--
STII0942	STII0943	STGM3620	51	18'' DIA	0.5%	250.05	249.57	260.6	260.1	250.4	250.0	250.5	250.0	8.2	1.2	1.4	--
STII0943	STII0947	STGM4009	281	18'' DIA	0.5%	249.57	248.11	260.1	252.1	250.0	248.4	250.0	248.4	7.7	1.2	1.4	--
STII0944	J4628	STGM1690	83	12'' DIA	4.8%	246.13	242.10	252.4	252.5	246.6	242.5	246.8	243.2	8.2	3.8	6.9	--
STII0945	STII0944	STGM630	48	12'' DIA	0.6%	246.63	246.13	252.5	252.4	247.7	246.6	249.2	246.8	2.9	3.8	6.8	--
STII0947	J5012	STGM1719	523	Irregular Channel	2.7%	248.11	234.00	252.1	240.5	248.4	236.3	248.4	236.8		1.2	1.4	--
STII0948	STII0942	STGM3225	165	18'' DIA	0.5%	251.09	250.05	259.8	260.6	251.5	250.4	251.5	250.5	7.7	1.2	1.4	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STII0950	STII0952	STGM4036	174	18'' DIA	0.5%	252.77	251.69	260.3	259.1	253.2	252.1	253.2	252.1	7.7	1.2	1.4	--
STII0952	STII0948	STGM3263	79	18'' DIA	0.5%	251.69	251.09	259.1	259.8	252.1	251.5	252.1	251.5	7.7	1.2	1.4	--
STII0953	STII0954	STGM4279	78	18'' DIA	1.3%	260.00	259.00	263.3	261.0	260.2	259.3	260.2	259.3	13.3	0.4	0.6	--
STII0954	J35	STGM761_a	321	Irregular Channel	1.6%	259.00	253.80	261.0	256.7	259.3	254.1	259.3	254.2		3.9	6.8	--
STII0955	STII0956	STGM319	38	15'' DIA	2.0%	257.95	257.19	263.9	263.8	258.6	258.0	258.7	258.2	9.2	4.0	5.7	--
STII0956	STII0957	STGM3183	79	15'' DIA	0.7%	257.19	256.62	263.8	263.3	258.0	257.3	258.2	257.5	5.7	4.0	5.7	--
STII0957	STII0961	STGM1864	216	15'' DIA	1.0%	256.62	254.48	263.3	261.9	257.3	255.1	257.5	255.3	6.4	4.0	5.7	--
STII0961	STII0962	STGM1528	48	18'' DIA	1.0%	254.48	254.00	261.9	261.7	255.1	254.8	255.3	255.0	10.9	4.0	5.7	--
STII0962	J35	STGM1294	46	18'' DIA	0.4%	254.00	253.80	261.7	256.7	254.8	254.1	255.0	254.2	7.2	4.0	5.7	--
STII11135	STMI117	STGM2498	37	24'' DIA	2.7%	198.00	194.00	211.4	208.9	199.1	195.2	199.2	195.2	37.3	22.8	23.4	--
STII11281	STII11135	STGM3389	84	24'' DIA	1.2%	201.50	198.00	211.5	211.4	203.0	199.1	203.1	199.2	24.7	22.8	23.4	--
STII116	STMI113	STGM3056	161	18'' DIA	0.7%	188.91	187.80	198.4	195.2	190.0	188.8	190.0	188.8	8.7	7.5	7.5	--
STII1179	STMI1140	STGM551	50	24'' DIA	0.4%	205.36	205.14	212.9	210.6	207.2	206.9	207.3	206.9	15.0	19.3	19.9	--
STII118	STII116	STGM2730	200	18'' DIA	0.9%	190.63	188.91	202.3	198.4	191.6	190.0	191.6	190.0	9.7	7.5	7.5	--
STII141	OF_J5066	STGM2953	152	18'' DIA	0.2%	167.21	166.90	173.9	174.0	169.1	168.4	170.3	168.4	4.9	7.4	8.1	--
STII142	STII141	STGM3238	197	15'' DIA	0.2%	167.62	167.21	172.1	173.9	171.5	169.1	172.1	170.3	3.1	7.4	8.1	Future 10-yr
STII151	STMI151	STGM3239	314	18'' DIA	0.8%	159.50	156.80	167.6	164.7	160.6	158.0	167.6	160.4	9.4	8.0	14.5	--
STIL085	STMI0911	STGM3610	413	15'' DIA	4.0%	276.09	259.63	280.1	264.5	276.6	260.2	276.7	260.3	13.5	4.1	5.7	--
STMG1010	STMG109	STGM3054	317	18'' DIA	1.4%	189.18	184.62	201.5	199.7	190.2	185.9	190.2	185.9	12.6	10.5	10.8	--
STMG1015	STMG1019	STGM3242	29	24'' DIA	14.1%	181.87	177.80	191.3	190.8	182.4	178.9	182.4	178.9	83.9	14.3	14.5	--
STMG1019	STMH102	STGM461	153	24'' DIA	2.0%	177.80	174.70	190.8	182.3	178.9	175.9	178.9	175.9	32.4	18.1	18.5	--
STMG1035	STMG108	STGM522	111	18'' DIA	0.5%	189.00	188.50	197.3	199.3	189.8	189.0	189.8	189.0	7.1	4.1	4.1	--
STMG106	STMG1035	STGM4085	184	18'' DIA	0.5%	190.00	189.00	200.6	197.3	190.8	189.8	190.8	189.8	7.7	4.1	4.1	--
STMG108	STMG109	STGM3990	128	21'' DIA	3.0%	188.50	184.62	199.3	199.7	189.0	185.9	189.0	185.9	27.5	4.2	4.2	--
STMG109	STMG1015	STGM98	220	21'' DIA	1.2%	184.62	181.87	199.7	191.3	185.9	182.4	185.9	182.4	17.6	14.3	14.5	--
STMG112	STMG117	STGM107	297	12'' DIA	0.2%	185.51	185.00	194.4	192.3	192.2	186.1	192.3	186.1	1.5	5.1	5.1	--
STMG114	J4784	STGM2734	79	18'' DIA	1.3%	191.00	190.00	197.1	195.9	193.2	193.0	193.4	193.2	11.9	5.7	5.9	--
STMG115	STIG1142	STGM3704	121	12'' DIA	0.4%	187.00	186.50	192.7	192.4	193.1	192.8	193.0	192.9	2.3	6.7	6.7	Existing 10-yr
STMG117	STMG118	STGM2535	441	18'' DIA	0.3%	185.00	183.75	192.3	188.9	186.1	184.4	186.1	184.4	5.6	5.1	5.1	--
STMG118	J-HC-22	STGM1345	551	12'' DIA	8.1%	183.75	137.00	188.9	147.0	184.4	143.0	184.4	143.6	10.5	7.7	7.7	--
STMG1213	J-HC-16	C1	349	12'' DIA	12.0%	167.50	126.00	174.0	147.0	167.9	129.1	167.9	129.3	12.2	4.8	4.8	--
STMG122	STMG1223	STGM3848	261	12'' DIA	0.5%	171.50	170.31	177.4	176.1	185.2	180.2	185.2	180.2	2.4	5.2	5.2	Existing 10-yr
STMG1223	STMG1213	STGM3539	526	12'' DIA	0.5%	170.31	167.50	176.1	174.0	180.2	167.9	180.2	167.9	2.6	5.0	5.0	Existing 10-yr
STMG1228	STMG125	STGM3927	449	12'' DIA	1.1%	172.00	166.96	183.2	177.0	195.4	177.9	195.4	177.9	3.8	8.1	8.1	Existing 10-yr
STMG125	STMG126	STGM3759	306	12'' DIA	1.3%	166.96	163.00	177.0	172.1	177.9	163.5	177.9	163.5	4.1	7.1	7.1	Existing 10-yr
STMG126	J-HC-18	STGM143	212	12'' DIA	16.5%	163.00	128.00	172.1	154.7	163.5	133.2	163.5	133.7	14.4	7.8	7.8	--
STMH091	STMH106	STGM1150	385	15'' DIA	0.6%	199.87	197.65	209.1	208.4	200.6	198.2	200.6	198.2	4.9	3.1	3.1	--
STMH0910	J5480	STGM129	635	15'' DIA	0.1%	229.00	228.10	242.2	240.3	242.2	241.7	243.0	242.4	2.4	5.6	6.4	Existing 10-yr
STMH0911	STMH0913	STGM2928	319	12'' DIA	1.6%	200.85	195.61	211.6	206.5	222.0	206.0	228.3	208.4	4.8	9.0	10.4	Existing 10-yr
STMH0912	STMH0911	STGM2644	54	12'' DIA	5.9%	204.00	200.85	211.5	211.6	222.0	222.0	228.3	228.3	8.9	1.5	1.7	Existing 10-yr
STMH0913	STMH0916	STGM4198	214	12'' DIA	1.2%	195.61	193.13	206.5	199.8	206.0	193.8	208.4	193.8	4.0	8.3	9.3	Future 10-yr
STMH0916	STMH0923	STGM3278	40	12'' DIA	9.4%	193.13	189.37	199.8	198.7	193.8	189.9	193.8	189.9	11.4	8.3	9.2	--
STMH0918	STMH1027	STGM2096_2	241	18'' DIA	5.1%	203.70	191.50	214.4	205.8	212.4	192.6	213.1	192.6	23.5	28.7	29.3	--
STMH0919	STMH0918	STGM2096_3	109	18'' DIA	5.0%	209.20	203.70	217.9	214.4	220.5	212.4	221.5	213.1	23.5	29.0	29.4	Existing 10-yr
STMH0920	STMH0919	STGM4205	55	18'' DIA	5.1%	212.00	209.20	221.4	217.9	222.8	220.5	223.9	221.5	23.8	21.9	22.2	Existing 10-yr
STMH0923	J4002	STGM1533	159	36'' DIA	4.1%	189.37	182.80	198.7	191.9	189.9	183.6	189.9	183.6	138.7	8.3	9.2	--
STMH093	J4042	STGM194	167	12'' DIA	11.6%	195.22	176.00	204.4	204.0	195.5	176.2	195.5	176.2	12.3	2.2	2.2	--
STMH094	STMH093	STGM3906	78	12'' DIA	0.7%	195.80	195.22	204.5	204.4	196.4	195.5	196.4	195.5	3.0	2.2	2.2	--
STMH095	STMH094	STGM2439	86	12'' DIA	0.7%	196.44	195.80	204.9	204.5	197.1	196.4	197.1	196.4	3.1	2.2	2.2	--
STMH096	STMH097	STGM1312	203	15'' DIA	0.5%	224.00	223.00	237.9	232.9	237.9	232.6	238.4	233.5	4.5	11.5	11.6	Future 10-yr
STMH097	STMH098	STGM1476	388	18'' DIA	2.2%	223.00	214.50	232.9	223.9	232.6	224.6	233.5	225.8	15.6	15.3	15.2	Future 10-yr
STMH098	STMH0920	STGM2205	43	18'' DIA	5.8%	214.50	212.00	223.9	221.4	224.6	222.8	225.8	223.9	25.5	21.9	22.3	Existing 10-yr
STMH101	J3474	STGM2425	68	21'' DIA	0.9%	189.90	189.28	200.2	201.5	190.9	190.4	190.9	190.4	15.2	8.3	8.6	--
STMH1010	STIH1036	STGM2132	163	15'' DIA	1.8%	193.00	190.00	206.2	197.3	193.9	191.3	193.9	191.3	8.8	7.2	7.2	--
STMH1011	STIH1038	STGM383	54	12'' DIA	2.4%	199.00	197.70	207.8	205.3	199.4	198.0	199.4	198.0	5.6	1.9	1.9	--
STMH1013	STMH1014	STGM2732	123	12'' DIA	6.0%	204.80	197.45	214.2	207.5	205.1	197.8	205.1	197.8	8.5	1.2	1.2	--
STMH1014	STMH1010	STGM2516	65	15'' DIA	6.9%	197.45	193.00	207.5	206.2	197.8	193.9	197.8	193.9	16.5	3.1	3.1	--
STMH1015	STMH1013	STGM526	50	12'' DIA	0.4%	205.00	204.80	216.2	214.2	205.5	205.1	205.5	205.1	2.2	1.2	1.2	--
STMH1017	J-HCT4-01	STGM1204	153	12'' DIA	9.5%	192.51	163.00	194.6	185.0	192.9	164.4	192.9	164.4	10.9	3.4	3.4	--
STMH1018	J-HC-30	STGM233	141	12'' DIA	0.7%	163.00	162.00	189.4	180.0	167.0	166.7	167.1	166.8	3.0	1.8	1.9	--
STMH102	STMH103	STGM3771	272	24'' DIA	1.7%	174.70	169.99	182.3	181.1	175.9	170.9	175.9	170.9	29.7	18.1	18.5	--
STMH1021	STMH1022	STGM2326	263	12'' DIA	2.5%	192.77	186.19	200.1	193.1	193.2	186.6	193.2	186.6	5.6	2.1	2.4	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMH1022	J5266	STGM1685	21	12'' DIA	2.5%	186.19	185.66	193.1	193.0	186.6	185.9	186.6	185.9	5.6	2.1	2.4	--
STMH1024	STMH0912	STGM4334	207	12'' DIA	0.5%	205.02	204.00	212.8	211.5	222.1	222.0	228.4	228.3	2.6	1.0	1.2	Existing 10-yr
STMH1026	J-HC-31	HCT5-01	480	Irregular Channel	1.6%	172.00	164.50	187.5	180.0	173.2	168.1	173.2	168.4		28.7	29.3	--
STMH1027	STMH1026	STGM2096_1	384	24'' DIA	5.1%	191.50	172.00	205.8	187.5	192.6	173.2	192.6	173.2	51.3	28.7	29.3	--
STMH103	J3696	STGM3954	206	21'' DIA	6.5%	169.99	156.53	181.1	166.6	170.9	157.1	170.9	157.1	40.3	18.1	18.5	--
STMH104	STMH101	STGM2515	122	21'' DIA	1.6%	191.80	189.90	199.5	200.2	192.6	190.9	192.6	190.9	19.9	8.3	8.6	--
STMH105	STMH104	STGM2041	76	21'' DIA	2.9%	194.00	191.80	201.1	199.5	194.7	192.6	194.7	192.6	26.9	8.4	8.6	--
STMH106	STMH105	STGM329	266	15'' DIA	1.4%	197.65	194.00	208.4	201.1	198.2	194.7	198.2	194.7	7.6	3.1	3.1	--
STMH107	STMH108	STGM2998	67	12'' DIA	7.0%	191.68	187.00	199.5	196.1	192.0	187.2	192.0	187.2	9.3	1.7	1.7	--
STMH108	J-HCT4-03	STGM1002	61	12'' DIA	33.0%	187.00	168.00	196.1	190.0	187.2	169.6	187.2	169.6	20.9	1.7	1.7	--
STMH109	J-HCT4-04	STGM2577	20	12'' DIA	52.3%	185.00	175.60	193.1	195.0	185.1	177.0	185.1	177.0	27.0	1.1	1.1	--
STMH111	STMH1017	STGM614	416	12'' DIA	1.4%	198.50	192.51	201.8	194.6	199.2	192.9	199.3	192.9	4.3	3.4	3.4	--
STMH1110	STMH1126	STGM1397	363	12'' DIA	0.4%	200.50	199.00	204.3	205.7	204.3	200.0	204.3	200.0	2.3	3.3	3.8	Future 10-yr
STMH1112	J4918	STGM1313	119	21'' DIA	0.6%	202.70	202.00	211.0	207.5	203.3	203.0	203.3	203.0	12.0	3.4	3.4	--
STMH1116	STMH1128	STGM3453	185	12'' DIA	5.1%	213.23	203.80	216.3	216.9	213.7	204.3	213.7	204.3	8.1	3.2	3.4	--
STMH1124	STMH1112	STGM3923	28	21'' DIA	2.1%	203.30	202.70	211.4	211.0	203.8	203.3	203.8	203.3	22.5	3.4	3.4	--
STMH1125	STMH1124	STGM545	106	21'' DIA	3.2%	206.69	203.30	211.6	211.4	207.1	203.8	207.1	203.8	28.1	3.4	3.4	--
STMH1126	STMH1129	STGM3572	386	24'' DIA	1.6%	199.00	193.00	205.7	197.9	200.0	193.9	200.0	193.9	28.2	14.4	14.6	--
STMH1127	STMH1126	STGM4256	268	21'' DIA	0.6%	200.50	199.00	212.7	205.7	201.8	200.0	201.9	200.0	11.8	11.2	11.5	--
STMH1128	STMH1127	STGM2194	153	15'' DIA	2.2%	203.80	200.50	216.9	212.7	204.3	201.8	204.3	201.9	9.5	3.2	3.4	--
STMH1129	J5110	STGM1334	19	24'' DIA	2.7%	193.00	192.50	197.9	197.6	193.9	193.5	193.9	193.5	36.9	14.4	14.6	--
STMH1133	J5510	STGM1068	46	18'' DIA	1.7%	181.30	180.53	188.4	188.5	181.9	181.2	181.9	181.2	13.7	4.9	5.1	--
STMH1135	STMH118	STGM37	320	15'' DIA	0.5%	185.80	184.00	193.2	189.9	186.6	184.6	186.6	184.6	4.4	3.2	3.3	--
STMH1137	J4198	STGM3337	581	18'' DIA	2.9%	177.67	160.00	185.0	165.7	178.4	160.5	178.4	160.5	17.9	8.6	8.8	--
STMH114	STMH115	STGM2985	40	24'' DIA	1.8%	186.75	186.02	200.8	200.7	187.9	187.4	187.9	187.4	30.3	18.2	18.4	--
STMH1144	STMH1110	STGM2173	252	12'' DIA	0.5%	201.70	200.50	207.2	204.3	203.0	204.3	203.0	204.3	2.5	8.2	8.4	--
STMH1144	STMH1127	STGM546	360	21'' DIA	0.3%	201.70	200.50	207.2	212.7	203.0	201.8	203.0	201.9	9.2	8.2	8.4	--
STMH115	STMH116	STGM2366	227	27'' DIA	0.8%	186.02	184.21	200.7	195.5	187.4	185.3	187.4	185.3	27.5	18.2	18.4	--
STMH116	STIH118	STGM3712	310	18'' DIA	6.7%	184.21	163.50	195.5	170.0	185.3	164.1	185.3	164.1	27.2	19.9	20.2	--
STMH117	STMH114	STGM857	443	24'' DIA	0.9%	190.68	186.75	195.9	200.8	192.1	187.9	192.1	187.9	21.3	17.4	17.6	--
STMH118	STMH1133	STGM2240	153	18'' DIA	1.6%	184.00	181.30	189.9	188.4	184.6	181.9	184.6	181.9	13.4	4.9	5.1	--
STMH1211	STMH1212	STGM619	125	12'' DIA	1.0%	169.52	168.22	174.7	173.3	178.0	176.4	178.2	176.6	3.6	5.5	5.0	Existing 10-yr
STMH1212	STMH1213	STGM219	367	12'' DIA	1.9%	168.22	161.30	173.3	169.8	176.4	162.1	176.6	162.1	4.9	7.2	7.3	Existing 10-yr
STMH1213	STMH1214	STGM2180	39	15'' DIA	2.6%	161.30	160.30	169.8	168.3	162.1	161.2	162.1	161.2	10.4	7.0	7.0	--
STMH1214	STMH1215	STGM4297	185	15'' DIA	1.7%	160.30	157.22	168.3	163.5	161.2	158.2	161.2	158.3	8.3	7.0	7.0	--
STMH1215	STMH1216	STGM3431	41	15'' DIA	1.9%	157.22	156.42	163.5	162.7	158.2	156.9	158.3	157.0	8.9	8.9	9.2	--
STMH1216	J4504	STGM748	72	15'' DIA	13.9%	156.42	146.42	162.7	159.2	156.9	147.2	157.0	147.3	23.9	8.9	9.2	--
STMH1220	STMH1221	STGM1763	226	12'' DIA	0.4%	171.26	170.42	176.3	174.9	181.1	179.7	181.2	179.8	2.3	3.5	3.3	Existing 10-yr
STMH1221	STMH1226	STGM3290	228	12'' DIA	0.2%	170.42	169.99	174.9	173.7	179.7	178.3	179.8	178.4	1.6	3.7	3.4	Existing 10-yr
STMH1222	STMH1220	STGM2584	227	12'' DIA	0.4%	172.10	171.26	176.3	176.3	182.5	181.1	182.7	181.2	2.3	3.4	3.4	Existing 10-yr
STMH1223	STMH1230	STGM1018	108	12'' DIA	0.2%	172.94	172.72	177.0	176.7	184.0	183.3	184.2	183.4	1.7	3.9	3.9	Existing 10-yr
STMH1224	STMH1227	STGM3602	430	15'' DIA	0.3%	172.96	171.54	180.0	180.9	180.0	180.9	180.0	180.9	3.7	5.5	5.5	--
STMH1226	STMH1211	STGM1382	48	12'' DIA	1.0%	169.99	169.52	173.7	174.7	178.3	178.0	178.4	178.2	3.7	3.6	3.6	Existing 10-yr
STMH1227	J-HCT3-09	STGM2660	345	15'' DIA	0.3%	171.54	170.50	180.9	177.1	180.9	171.8	180.9	171.8	3.5	5.5	5.5	--
STMH1228	J-HCT3-06	STGM192	72	12'' DIA	1.5%	165.50	164.40	173.4	170.0	167.6	167.2	167.7	167.2	4.4	2.6	2.7	--
STMH1229	STMH1228	STGM674	221	12'' DIA	1.5%	168.72	165.50	176.6	173.4	169.3	167.6	169.3	167.7	4.5	2.6	2.7	--
STMH1230	STMH1222	STGM355	116	12'' DIA	0.5%	172.72	172.10	176.7	176.3	183.3	182.5	183.4	182.7	2.7	3.6	3.6	Existing 10-yr
STMH1231	J-HCT3-09	STGM1793	111	42'' DIA	1.0%	171.56	170.50	179.7	177.1	173.4	171.8	173.5	171.8	98.8	55.3	56.3	--
STMH1233	STMH1211	STGM900	313	15'' DIA	0.4%	170.71	169.52	177.2	174.7	178.1	178.0	178.3	178.2	4.0	2.0	2.0	Existing 10-yr
STMH1238	STMH1239	STGM962	206	15'' DIA	0.5%	165.13	164.09	170.5	170.2	165.8	164.7	165.8	164.7	4.8	2.7	2.7	--
STMH1239	STMH1240	STGM1908	279	18'' DIA	0.6%	164.09	162.29	170.2	167.9	164.7	162.9	164.7	162.9	8.8	2.7	2.7	--
STMH1240	STMH1241	STGM496	57	18'' DIA	0.6%	162.29	161.94	167.9	167.6	162.9	162.3	162.9	162.3	8.5	2.7	2.7	--
STMH1241	J-HCT3-03	STGM428	132	18'' DIA	5.3%	161.94	155.00	167.6	165.0	162.3	155.7	162.3	155.7	24.0	2.7	2.7	--
STMH1242	STMH1243	STGM2587	114	12'' DIA	0.9%	169.93	168.94	174.2	173.5	170.5	169.6	170.5	169.6	3.5	2.0	2.0	--
STMH1243	STMH1244	STGM2313	299	12'' DIA	0.6%	168.94	167.19	173.5	172.6	169.6	167.9	169.6	167.9	2.8	2.0	2.0	--
STMH1244	STMH1245	STGM4325	195	12'' DIA	0.5%	167.19	166.12	172.6	172.5	167.9	166.5	167.9	166.5	2.8	2.0	2.0	--
STMH1245	J-HCT3-04	STGM1060	157	15'' DIA	3.6%	166.12	160.40	172.5	165.0	166.5	163.6	166.5	163.6	12.8	2.0	2.0	--
STMH1248	J-HCT3-03	STGM177	183	15'' DIA	3.2%	160.76	155.00	169.6	165.0	161.2	155.7	161.3	155.7	12.0	3.6	4.3	--
STMH125	J4636	STGM2291	54	18'' DIA	2.2%	177.69	176.50	185.8	183.6	178.2	177.8	178.2	177.8	15.7	3.1	3.1	--
STMH1252	J-HCT3-05	STGM1114	39	12'' DIA	3.9%	163.82	162.30	169.6	170.0	165.2	165.1	165.2	165.1	7.5	0.7	0.7	--
STMH1253	STMH1254	STGM525	74	12'' DIA	1.8%	170.83	169.50	177.3	176.8	210.7	208.0	211.3	208.6	4.8	9.0	9.0	Existing 10-yr
STMH1254	J4668	STGM3810	579	12'' DIA	0.8%	169.50	164.65	176.8	173.3	208.0	190.1	208.6	191.1	3.3	8.2	8.2	Existing 10-yr

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMH127	STMH1231	STGM4274	81	48'' DIA	1.9%	173.13	171.56	181.8	179.7	174.6	173.4	174.6	173.5	197.6	55.3	56.3	--
STMH128	STMH127	STGM425	415	42'' DIA	0.1%	173.60	173.13	186.6	181.8	176.2	174.6	176.3	174.6	33.8	50.0	50.8	--
STMH129	STMH128	STGM4004	444	36'' DIA	1.6%	180.81	173.60	192.2	186.6	182.0	176.2	182.1	176.3	86.2	30.2	30.8	--
STMH1310	J-HCT3-02	STGM1652	117	12'' DIA	0.3%	147.10	146.80	159.9	155.0	148.3	147.7	148.4	147.7	1.9	2.8	3.0	--
STMH1311	STMH1310	STGM3548	114	12'' DIA	6.6%	154.60	147.10	165.6	159.9	155.0	148.3	155.0	148.4	9.7	2.8	3.0	--
STMH1312	J-HCT3-01	STGM1000	120	12'' DIA	12.6%	147.62	132.64	162.4	165.0	147.9	133.9	147.9	133.9	12.9	2.2	2.7	--
STMH1313	STMH1312	STGM3138	49	12'' DIA	11.7%	153.35	147.62	163.3	162.4	153.6	147.9	153.7	147.9	12.9	2.2	2.7	--
STMH1314	STMH1315	STGM1956	461	10'' DIA	1.1%	163.00	158.10	169.9	169.3	196.6	183.9	200.1	187.7	2.2	4.9	4.8	Existing 10-yr
STMH1315	STMH133	STGM2497	433	10'' DIA	1.1%	158.10	153.50	169.3	163.4	183.9	154.2	187.7	154.2	2.3	6.3	6.9	Existing 10-yr
STMH132	J5640	STGM2226	109	12'' DIA	5.1%	154.52	158.50	164.7	164.0	164.6	159.1	164.7	159.2	8.0	5.8	6.1	--
STMH133	J4098	STGM2979	66	15'' DIA	2.3%	153.50	152.00	163.4	157.4	154.2	152.4	154.2	152.4	9.7	5.6	6.0	--
STMH135	STMH136	STGM2191	40	12'' DIA	20.3%	157.70	149.85	165.3	162.9	157.9	150.1	158.0	150.1	15.4	1.9	2.2	--
STMH136	STMH137	STGM1598	43	12'' DIA	33.9%	149.85	136.08	162.9	148.3	150.1	136.3	150.1	136.3	20.6	1.9	2.2	--
STMH137	STMH138	STGM1260	23	12'' DIA	56.6%	136.08	124.75	148.3	138.8	136.3	125.1	136.3	125.1	26.4	1.9	2.2	--
STMH138	J-HC-12	STGM727	142	12'' DIA	6.6%	124.75	115.43	138.8	140.0	125.1	120.1	125.1	120.3	9.7	1.9	2.2	--
STMI081	STIL085	STGM3060	648	12'' DIA	4.6%	305.96	276.09	310.7	280.1	306.5	276.6	306.6	276.7	7.9	4.1	5.7	--
STMI0911	STII0955	STGM2451	80	15'' DIA	2.1%	259.63	257.95	264.5	263.9	260.2	258.6	260.3	258.7	9.6	4.1	5.7	--
STMI096	J-HC-36	STGM3381	2189	18'' DIA	3.4%	256.00	180.50	258.7	187.0	256.6	184.1	256.7	184.3	19.6	6.3	7.6	--
STMI111	J5444	STGM1358	18	18'' DIA	1.1%	212.62	212.42	219.8	219.8	215.4	215.0	215.7	215.3	11.1	15.2	16.1	--
STMI112	STII118	STGM3558	164	18'' DIA	1.1%	192.35	190.63	203.9	202.3	192.9	191.6	192.9	191.6	10.7	3.2	3.2	--
STMI1122	STMI1141	STGM1418	101	24'' DIA	0.5%	204.90	204.40	212.9	215.1	206.6	205.8	206.6	205.8	15.9	19.3	19.9	--
STMI113	J3762	STGM1860	44	18'' DIA	0.9%	187.80	187.40	195.2	195.6	188.8	188.4	188.8	188.4	10.1	7.5	7.5	--
STMI114	STMH129	STGM2566	334	33'' DIA	1.5%	185.80	180.81	195.9	192.2	187.1	182.0	187.2	182.1	64.2	30.2	30.8	--
STMI1140	STMI1122	STGM1958	39	24'' DIA	0.6%	205.14	204.90	210.6	212.9	206.9	206.6	206.9	206.6	17.7	19.3	19.9	--
STMI1141	J4872	STGM167	36	24'' DIA	1.1%	204.40	204.00	215.1	212.1	205.8	205.4	205.8	205.5	23.8	19.3	19.9	--
STMI117	STMI114	STGM1859	548	33'' DIA	1.1%	194.00	185.80	208.9	195.9	195.2	187.1	195.2	187.2	56.9	22.8	23.4	--
STMI121	STMH128	STGM1226	273	27'' DIA	2.1%	179.45	173.60	189.9	186.6	180.2	176.2	180.2	176.3	46.1	9.7	9.7	--
STMI122	STMI121	STGM3166	491	24'' DIA	0.5%	182.11	179.45	192.6	189.9	183.3	180.2	183.3	180.2	16.7	9.7	9.7	--
STMI131	STMI132	STGM2778	236	18'' DIA	3.6%	151.80	143.41	167.5	162.1	152.4	144.7	152.4	144.9	20.3	5.9	5.9	--
STMI1311	J4160	STGM1173	152	24'' DIA	4.6%	154.39	147.33	162.6	154.4	154.8	148.2	154.9	148.3	48.6	3.9	8.2	--
STMI1312	STMI1311	STGM3072	168	21'' DIA	1.7%	157.19	154.39	167.1	162.6	157.7	154.8	158.0	154.9	20.5	3.9	8.2	--
STMI132	J-HCT2-03	STGM2103	100	33'' DIA	2.1%	143.41	141.00	162.1	160.0	144.7	142.1	144.9	142.2	76.4	35.1	41.7	--
STMI135	STMI131	STGM3445	340	18'' DIA	0.3%	152.82	151.80	166.1	167.5	154.0	152.4	154.0	152.4	6.0	5.9	5.9	--
STMI141	STMI135	STGM286	312	18'' DIA	0.7%	154.90	152.82	167.6	166.1	155.8	154.0	155.8	154.0	8.9	5.9	5.9	--
STMI151	J4974	STGM2534	49	15'' DIA	0.8%	156.80	156.40	164.7	163.4	158.0	156.7	160.4	156.7	5.9	8.0	14.5	--
SPRING BROOK																	
J3522	STMJ104	STGM3285	164	27'' DIA	0.3%	212.00	211.50	221.6	221.3	213.8	213.1	213.9	213.1	17.1	18.3	19.2	--
J3524	STMI1015	STGM1126	178	15'' DIA	1.9%	217.58	213.55	225.1	221.8	223.5	221.8	231.6	227.9	9.0	7.4	9.7	Future 10-yr
J3668	STII0913	STGM1646	55	21'' DIA	0.9%	235.50	235.00	241.6	243.0	237.5	238.1	241.7	241.5	15.0	12.6	16.3	Future 10-yr
J3852	STMI102	STGM2771	247	15'' DIA	2.2%	218.54	213.03	225.6	219.9	219.0	218.6	219.6	219.8	9.8	2.5	2.6	--
J3960	STMI124	STGM2682	180	12'' DIA	0.9%	182.33	180.75	189.0	187.5	182.9	182.8	189.0	184.7	3.3	2.2	3.2	--
J4	STML1232	STGM4517	171	12'' DIA	0.3%	179.71	179.20	184.2	183.3	197.3	197.3	197.3	197.2	2.0	1.0	1.2	Existing 10-yr
J4032	J-SB-02	STGM988	404	Irregular Channel	11.2%	155.00	106.10	160.0	130.0	155.6	109.0	155.6	109.2		15.7	16.4	--
J4092	J4094	STGM4122	929	Irregular Channel	1.4%	202.00	185.00	209.3	190.0	202.6	185.4	202.9	185.5		5.4	9.9	--
J4094	J4284	STGM1948_b	257	Irregular Channel	3.9%	185.00	174.80	190.0	184.9	185.4	179.6	185.5	180.5		42.1	52.9	--
J4114	J5124	STGM973	122	12'' DIA	0.8%	234.00	233.00	239.2	235.4	234.9	233.8	239.2	236.5	3.2	3.7	6.1	--
J4116	J4118	STGM4001	54	24'' DIA	0.9%	242.00	241.50	247.5	246.1	242.4	242.1	242.6	242.2	20.9	1.9	3.3	--
J4118	J4114	STGM4090	433	Irregular Channel	1.7%	241.50	234.00	246.1	239.2	242.1	234.9	242.2	239.2		3.7	6.2	--
J4122	STMI104	STGM4465	37	12'' DIA	0.5%	209.50	209.30	220.1	220.3	217.4	217.2	219.3	219.0	2.6	3.2	3.2	--
J4150	STMI128	STGM757	60	12'' DIA	3.3%	175.00	173.00	180.5	180.2	175.6	174.0	175.7	174.0	6.5	4.2	5.2	--
J4268	J4270	STGM3560	219	Irregular Channel	0.9%	245.00	243.00	251.0	250.6	245.6	243.9	245.7	244.0		9.5	14.4	--
J4270	J3668	STGM2694	872	Irregular Channel	0.8%	243.00	235.50	250.6	241.6	243.9	237.5	244.0	241.7		9.4	14.3	--
J4284	J-SBT7-02	STGM627	143	24'' DIA	0.4%	174.80	173.00	184.9	179.5	179.6	175.0	180.5	175.0	14.6	42.0	51.6	--
J4292	J4150	STGM3521	661	18'' DIA	0.7%	179.90	175.00	185.1	180.5	180.6	175.6	180.7	175.7	9.0	4.2	5.2	--
J4424	J4426	STGM3674	132	42'' DIA	1.1%	202.00	200.50	204.8	207.0	203.1	201.7	203.4	202.0	106.0	24.4	40.6	--
J4426	STMI1019	STGM4335	97	42'' DIA	1.0%	200.50	199.50	207.0	209.3	201.7	200.7	202.0	200.9	101.5	24.4	37.3	--
J4834	STII1194	STGM1289	312	24'' DIA	1.0%	197.00	193.95	209.4	202.5	198.3	195.7	198.3	195.9	22.5	17.3	17.4	--
J4848	STII0913	STGM1593	499	12'' DIA	1.8%	244.00	235.00	250.9	243.0	250.9	238.1	253.4	241.5	4.8	17.2	41.6	Existing 10-yr
J4990	STMJ1236	C52	76	Irregular Channel	2.5%	167.85	165.95	179.0	178.4	168.0	166.6	168.0	166.7		2.0	2.2	--
J5	J4848	C4	282	Irregular Channel	1.3%	247.57	244.00	255.0	250.9	251.0	250.9	255.0	253.4		15.6	45.7	Future 10-yr
J5124	STMI0910	STGM1004	143	12'' DIA	2.8%	233.00	229.00	235.4	235.6	233.8	232.6	236.5	235.3	6.0	3.6	5.6	Future 10-yr
J5176	J5178	STGM3022	186	Irregular Channel	2.2%	209.16	205.00	215.7	210.4	210.3	205.5	210.3	205.5		27.8	28.8	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
J5178	J4094	STGM1948_a	903	Irregular Channel	2.2%	205.00	185.00	210.4	190.0	205.5	185.4	205.5	185.5		37.7	40.9	--
J5216	J4424	STGM1265	585	Irregular Channel	0.7%	206.00	202.00	211.3	204.8	216.6	203.1	218.9	203.4		48.9	52.2	Existing 10-yr
J5236	J4848	STGM2099	331	12'' DIA	2.1%	252.00	244.00	258.6	250.9	252.5	250.9	258.6	253.4	5.1	2.1	3.3	--
J5382	J5178	STGM1359	136	Irregular Channel	7.1%	214.65	205.00	219.1	210.4	214.9	205.5	214.9	205.5		5.3	5.3	--
J-SB-02	OF_J-SB-01	SB-00	16	Irregular Channel	6.8%	106.10	105.00	130.0	165.0	109.0	108.2	109.2	108.4		616.3	671.8	--
J-SB-03	J-SB-02	SB-01	1345	Irregular Channel	0.2%	108.60	106.10	140.0	130.0	114.6	109.0	114.8	109.2		520.4	566.4	--
J-SB-04	J-SB-03	SB-02	4551	Irregular Channel	0.2%	115.90	108.60	125.0	140.0	121.4	114.6	121.4	114.8		409.2	437.7	--
J-SB-05	J-SB-04	STGM3824	141	84'' DIA	0.9%	117.10	115.90	125.0	125.0	122.1	121.4	122.2	121.4	585.8	405.9	434.2	--
J-SB-06	J-SB-05	SB-03	437	Irregular Channel	0.4%	119.00	117.10	125.0	125.0	122.5	122.1	122.7	122.2		425.7	454.9	--
J-SB-07	J-SB-06	SB-04	2465	Irregular Channel	0.3%	126.60	119.00	150.0	125.0	131.9	122.5	131.9	122.7		372.3	403.6	--
J-SB-08	J-SB-07	SB-05	2409	Irregular Channel	0.3%	134.00	126.60	160.0	150.0	139.5	131.9	139.6	131.9		347.1	369.5	--
J-SB-09	J-SB-08	SB-06	1627	Irregular Channel	0.3%	139.00	134.00	165.0	160.0	142.9	139.5	143.0	139.6		341.8	367.6	--
J-SB-10	J-SB-09	SB-07	1031	Irregular Channel	1.1%	150.00	139.00	155.0	165.0	152.9	142.9	153.2	143.0		240.1	269.4	--
J-SB-11	J-SB-10	SB-08	537	Irregular Channel	0.2%	151.00	150.00	153.2	155.0	154.9	152.9	155.0	153.2		198.5	221.0	Existing 10-yr
J-SB-12	J-SB-11	STGM1241	185	48'' DIA	0.9%	152.70	151.00	156.3	153.2	157.9	154.9	158.6	155.0	137.3	204.3	231.2	Existing 10-yr
J-SB-13	J-SB-12	SB-09	2247	Irregular Channel	1.1%	177.00	152.70	185.0	156.3	179.4	157.9	179.5	158.6		177.3	210.0	--
J-SB-14	J-SB-13	SB-10	2491	Irregular Channel	1.9%	224.00	177.00	235.0	185.0	225.5	179.4	225.7	179.5		98.2	132.2	--
J-SB-15	J-SB-14	SB-11	1149	Irregular Channel	3.2%	260.20	224.00	270.0	235.0	261.4	225.5	261.5	225.7		64.0	94.0	--
J-SB-16	J-SB-15	SPRINGBROOK_CULVERT	113	36'' DIA	6.0%	267.00	260.20	272.2	270.0	268.3	261.4	268.7	261.5	164.2	64.0	94.0	--
J-SBT1-01	J-SB-03	SBT1-01	2512	Irregular Channel	1.2%	137.80	108.60	150.0	140.0	140.3	114.6	140.4	114.8		147.8	165.4	--
J-SBT1-02	J-SBT1-01	STGM3459	132	36'' DIA	0.8%	138.80	137.80	152.6	150.0	145.9	140.3	146.8	140.4	58.2	159.1	174.1	--
J-SBT1-03	J-SBT1-02	SBT1-02	1576	Irregular Channel	0.9%	152.20	138.80	175.0	152.6	155.2	145.9	155.3	146.8		118.1	128.9	--
J-SBT1-04	J-SBT1-03	SBT1-03	284	Irregular Channel	0.8%	154.61	152.20	180.0	175.0	157.6	155.2	157.7	155.3		113.2	123.4	--
J-SBT1-05	J-SBT1-04	HAYES_CULVERT	105	72'' DIA	2.7%	157.40	154.61	180.0	180.0	159.6	157.6	159.7	157.7	379.1	106.2	112.5	--
J-SBT1-06	J-SBT1-05	SBT1-04	645	Irregular Channel	2.9%	176.00	157.40	185.0	180.0	178.2	159.6	178.2	159.7		89.0	92.2	--
J-SBT1-07	J-SBT1-06	STGM6	107	60'' DIA	3.8%	180.00	176.00	197.0	185.0	181.4	178.2	181.4	178.2	514.9	82.4	85.6	--
J-SBT1-08	J-SBT1-07	SBT1-05	139	Irregular Channel	1.4%	182.00	180.00	199.2	197.0	182.7	181.4	182.7	181.4		81.4	84.4	--
J-SBT1-09	J-SBT1-08	SBT1-06	68	Irregular Channel	4.3%	188.95	182.00	196.5	199.2	189.2	182.7	189.2	182.7		15.8	15.8	--
J-SBT3-01	J-SB-06	SBT3-01	874	Irregular Channel	3.3%	147.70	119.00	160.0	125.0	148.5	122.5	148.6	122.7		26.2	36.7	--
J-SBT4-01	J-SB-07	SBT4-01	283	Irregular Channel	4.9%	140.54	126.60	145.0	150.0	141.2	131.9	141.2	131.9		21.4	21.4	--
J-SBT4-02	STMK1113	SBT4-02	198	Irregular Channel	-0.2%	153.60	154.00	157.0	167.8	155.5	155.2	155.7	155.6		18.3	19.5	--
J-SBT4-03	J-SBT4-02	SBT4-03	411	Irregular Channel	1.9%	161.31	153.60	170.0	157.0	161.9	155.5	161.9	155.7		13.0	13.5	--
J-SBT4-04	J-SBT4-03	STGM1739	68	33'' DIA	3.3%	163.59	161.31	171.9	170.0	164.3	161.9	164.3	161.9	100.2	13.1	13.5	--
J-SBT4-05	J-SBT4-02	SBT4-04	329	Irregular Channel	4.3%	167.77	153.60	173.0	157.0	168.0	155.5	168.0	155.7		3.5	3.9	--
J-SBT5-01	J-SB-08	SBT5-01	860	Irregular Channel	4.1%	169.20	134.00	180.0	160.0	169.8	139.5	169.8	139.6		15.2	17.4	--
J-SBT6-01	J-SB-09	SBT6-01	1563	Irregular Channel	0.3%	143.00	139.00	160.0	165.0	144.0	142.9	144.0	143.0		116.3	116.3	--
J-SBT6-02	J-SBT6-01	STGM2828	306	48'' DIA	0.1%	143.40	143.00	170.0	160.0	146.1	144.0	146.1	144.0	36.8	46.1	46.1	--
J-SBT7-01	J-SB-10	SBT7-01	684	Irregular Channel	2.6%	168.00	150.00	170.0	155.0	169.0	152.9	169.0	153.2		43.8	49.7	--
J-SBT7-02	J-SBT7-01	STGM901	590	Irregular Channel	0.8%	173.00	168.00	179.5	170.0	175.0	169.0	175.0	169.0		40.2	43.9	--
J-SBT7-03	J-SBT7-02	SBT7-02	382	Irregular Channel	4.4%	189.88	173.00	193.6	179.5	190.3	175.0	190.3	175.0		3.5	3.5	--
STII081	STII09126	STGM3464	157	12'' DIA	0.8%	249.94	248.74	258.0	255.8	254.4	250.6	260.2	255.8	3.2	5.3	8.0	Future 10-yr
STII09100	STII10109	STGM2905	112	30'' DIA	1.6%	224.82	223.00	233.6	231.7	237.8	237.8	241.3	241.3	54.8	4.7	6.5	Existing 10-yr
STII09101	STII09104	STGM547	106	18'' DIA	0.5%	253.18	252.46	261.0	259.5	254.6	253.3	261.2	259.6	7.6	9.3	15.8	Future 10-yr
STII09103	STII09106	STGM1287	123	18'' DIA	1.1%	250.92	249.39	259.4	257.7	252.0	252.2	259.4	257.8	11.4	9.3	18.1	Future 10-yr
STII09104	STII09103	STGM3260	36	18'' DIA	2.4%	252.46	250.92	259.5	259.4	253.3	252.0	259.6	259.4	17.0	9.3	18.3	Future 10-yr
STII09106	J5	STGM133	144	18'' DIA	1.3%	249.39	247.57	257.7	255.0	252.2	251.0	257.8	255.0	12.3	9.3	17.7	Future 10-yr
STII09111	STII09112	STGM1978	77	18'' DIA	0.5%	247.51	247.12	252.8	253.4	248.4	247.7	248.7	247.8	7.8	5.3	7.9	--
STII09112	J4268	STGM4459	78	21'' DIA	2.7%	247.12	245.00	253.4	251.0	247.7	245.6	247.8	245.7	26.4	5.4	8.5	--
STII09124	STII09111	STGM2715	110	18'' DIA	0.3%	247.94	247.51	253.5	252.8	249.0	248.4	249.3	248.7	6.0	5.3	7.9	--
STII09125	STII09124	STGM1917	140	15'' DIA	0.3%	248.36	247.94	254.3	253.5	249.8	249.0	252.2	249.3	3.7	5.3	7.9	--
STII09126	STII09125	STGM824	128	15'' DIA	0.3%	248.74	248.36	255.8	254.3	250.6	249.8	255.8	252.2	3.7	5.3	7.9	--
STII0913	STII0928	STGM3176	170	21'' DIA	0.8%	235.00	233.70	243.0	240.5	238.1	238.5	241.5	240.5	13.8	14.4	15.2	--
STII0915	STMI0910	STGM1757	87	21'' DIA	0.8%	229.70	229.00	236.6	235.6	233.2	232.6	236.0	235.3	14.3	15.1	15.4	--
STII0916	STII0926	STGM984	51	21'' DIA	0.8%	230.80	230.40	236.9	236.9	234.6	234.0	237.3	236.9	14.0	15.1	15.4	Future 10-yr
STII092	STMI095	STGM2662	217	15'' DIA	0.4%	233.85	232.85	240.6	244.0	238.4	238.6	239.3	236.9	4.2	4.0	4.1	--
STII0926	STII0915	STGM3951	98	21'' DIA	0.7%	230.40	229.70	236.9	236.6	234.0	233.2	236.9	236.0	13.4	15.1	15.4	--
STII0928	STII0983	STGM4081	186	21'' DIA	0.8%	233.70	232.30	240.5	238.3	238.5	237.1	240.5	238.8	14.3	14.5	15.0	--
STII0965	STII0966	STGM72	36	12'' DIA	0.7%	256.31	255.84	262.6	261.7	256.7	256.3	256.8	256.4	3.1	1.1	1.4	--
STII0966	STII0967	STGM3624	54	12'' DIA	0.5%	255.84	255.36	261.7	261.6	256.3	255.6	256.4	255.7	2.7	1.1	1.4	--
STII0967	STII0968	STGM1099	33	12'' DIA	2.9%	255.36	254.20	261.6	260.1	255.6	254.5	255.7	254.5	6.3	1.1	1.4	--
STII0968	STII0970	STGM773	113	12'' DIA	3.9%	254.20	249.55	260.1	256.0	254.5	249.8	254.5	249.9	7.1	1.1	1.4	--
STII0970	STII0972	STGM943	210	12'' DIA	2.4%	249.55	243.16	256.0	251.4	249.8	243.5	249.9	243.5	5.6	1.1	1.4	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STII0972	STII0975	STGM4253	63	15'' DIA	1.3%	243.16	242.11	251.4	251.0	243.5	242.6	243.5	242.7	7.1	1.1	1.4	--
STII0975	STII0977	STGM283	122	18'' DIA	1.0%	242.11	240.65	251.0	247.7	242.6	241.0	242.7	241.4	10.9	3.0	3.8	--
STII0977	STII0980	STGM297	99	18'' DIA	3.4%	240.65	236.84	247.7	244.0	241.0	237.8	241.4	241.4	19.7	3.0	3.8	--
STII0980	STII0982	STGM528	188	24'' DIA	2.2%	236.84	232.49	244.0	240.2	237.8	237.8	241.4	241.4	36.9	3.0	3.8	--
STII0982	STII0985	STGM2936	199	24'' DIA	1.1%	232.49	230.09	240.2	237.4	237.8	237.8	241.4	241.3	25.2	3.0	4.0	Future 10-yr
STII0983	STII0916	STGM1040	198	21'' DIA	0.8%	232.30	230.80	238.3	236.9	237.1	234.6	238.8	237.3	13.9	14.6	15.0	Future 10-yr
STII0985	STII0986	STGM746	52	24'' DIA	0.5%	230.09	229.64	237.4	238.5	237.8	237.8	241.3	241.3	16.3	3.3	4.2	Existing 10-yr
STII0986	STII0988	STGM2399	78	24'' DIA	0.5%	229.64	228.75	238.5	239.6	237.8	237.8	241.3	241.3	16.2	3.3	4.2	Future 10-yr
STII0988	STMI099	STGM1231	66	30'' DIA	0.5%	228.75	228.23	239.6	241.7	237.8	237.8	241.3	241.4	29.4	3.2	4.2	Future 10-yr
STII0990	STII0991	STGM1504	106	30'' DIA	0.5%	227.59	226.87	238.2	235.7	237.8	237.8	241.3	241.3	30.5	4.6	5.8	Future 10-yr
STII0991	STII0992	STGM554	98	30'' DIA	0.5%	226.87	226.18	235.7	235.1	237.8	237.8	241.3	241.3	30.5	4.6	5.9	Existing 10-yr
STII0992	STII09100	STGM3490	234	30'' DIA	0.5%	226.18	224.82	235.1	233.6	237.8	237.8	241.3	241.3	29.6	4.6	6.0	Existing 10-yr
STII10109	STII1030	STGM1130	119	12'' DIA	1.9%	223.00	220.80	231.7	229.4	237.8	237.1	241.3	240.7	4.8	4.4	5.5	Existing 10-yr
STII102	STMI1121	STGM2880	66	18'' DIA	0.5%	204.20	203.84	212.6	212.6	205.9	204.8	205.9	204.8	7.8	12.3	12.4	--
STII1027	J4122	STGM3159	239	12'' DIA	0.6%	211.00	209.50	220.4	220.1	218.4	217.4	221.0	219.3	2.8	3.2	3.2	Future 10-yr
STII1028	STII1027	STGM2622	118	12'' DIA	1.9%	213.20	211.00	223.1	220.4	219.1	218.4	221.9	221.0	4.9	3.2	3.2	--
STII1029	STII1050	STGM2729	119	8'' DIA	1.9%	217.94	215.72	225.7	223.6	227.1	220.0	230.5	222.9	1.6	3.3	3.4	Existing 10-yr
STII1030	STII1029	STGM2906	150	8'' DIA	1.9%	220.80	217.94	229.4	225.7	237.1	227.1	240.7	230.5	1.7	3.9	4.3	Existing 10-yr
STII1033	STII1034	STGM1083	141	12'' DIA	1.1%	224.79	223.24	227.9	226.1	239.9	233.7	260.3	249.2	3.7	8.4	11.1	Existing 10-yr
STII1034	J3524	STGM3352	242	12'' DIA	2.3%	223.24	217.58	226.1	225.1	233.7	223.5	249.2	231.6	5.4	7.7	10.4	Existing 10-yr
STII104	STMI1010	STGM1994	59	15'' DIA	0.8%	233.15	232.65	239.5	240.0	233.9	233.4	233.9	233.4	5.9	4.0	4.1	--
STII1050	STII1028	STGM3365	133	12'' DIA	1.9%	215.72	213.20	223.6	223.1	220.0	219.1	222.9	221.9	4.9	3.2	3.2	--
STII1055	STII1056	STGM314	64	12'' DIA	0.8%	213.50	213.00	221.1	220.4	216.9	216.9	219.7	219.7	3.2	1.5	1.6	--
STII1056	STMI108	STGM1213	206	12'' DIA	1.6%	213.00	209.79	220.4	221.0	216.9	216.9	219.7	219.7	4.5	1.6	1.6	--
STII1078	STMI1019	STGM392	20	12'' DIA	3.9%	204.07	199.50	210.1	209.3	205.8	200.7	205.8	200.9	7.1	8.5	8.6	--
STII1080	STII1078	STGM334	163	12'' DIA	1.9%	207.16	204.07	213.2	210.1	211.7	205.8	211.8	205.8	4.9	5.0	5.0	--
STII1149	STML1146	STGM3779	422	12'' DIA	1.3%	203.31	197.83	211.4	206.0	226.2	202.5	226.2	202.6	4.1	8.9	8.9	Existing 10-yr
STII1194	STMI1113	STGM3172	66	24'' DIA	1.0%	193.95	193.31	202.5	203.0	195.7	195.5	195.9	195.5	22.1	17.3	17.4	--
STII1245	STMI1226	STGM352	77	24'' DIA	1.3%	160.00	159.00	167.7	169.0	161.1	159.5	161.2	159.6	26.9	16.1	17.2	--
STII135	STMI143	STGM3344	182	18'' DIA	0.2%	159.82	159.08	172.7	173.0	173.7	171.4	175.0	172.8	5.2	12.5	12.7	Existing 10-yr
STII1359	STMI1310	STGM321	184	18'' DIA	0.2%	160.75	160.30	173.2	172.6	178.0	176.3	179.3	177.7	5.2	10.1	10.3	Existing 10-yr
STII137	STII1359	STGM4556	138	18'' DIA	0.3%	161.23	160.75	173.1	173.2	179.2	178.0	180.6	179.3	6.2	9.9	10.0	Existing 10-yr
STIJ081	STII081	STGM3546	220	12'' DIA	1.3%	253.03	249.94	261.1	258.0	259.5	254.4	270.4	260.2	4.3	5.3	8.1	Future 10-yr
STIJ0911	STMJ092	STGM876	400	12'' DIA	2.5%	232.75	222.67	239.7	232.5	258.6	252.2	279.1	267.8	5.7	5.4	8.5	Existing 10-yr
STIJ0915	STIJ10111	STGM4406	124	15'' DIA	0.7%	216.42	215.60	225.1	221.9	217.4	216.6	217.4	216.6	5.5	5.3	5.3	--
STIJ0916	STIJ0917	STGM4372	44	15'' DIA	0.5%	226.92	226.69	235.6	236.0	227.9	227.6	227.9	227.6	4.8	5.3	5.3	--
STIJ0917	STIJ0919	STGM4376	193	15'' DIA	0.7%	226.69	225.32	236.0	235.2	227.6	226.1	227.6	226.1	5.7	5.3	5.3	--
STIJ0919	STIJ0923	STGM4395	80	15'' DIA	1.3%	225.32	224.31	235.2	232.9	226.1	224.9	226.1	224.9	7.5	5.3	5.3	--
STIJ0923	STIJ0924	STGM4396	106	15'' DIA	2.8%	224.31	221.30	232.9	230.6	224.9	221.9	224.9	221.9	11.2	5.3	5.3	--
STIJ0924	STIJ0927	STGM4400	90	15'' DIA	2.3%	221.30	219.25	230.6	228.3	221.9	219.9	221.9	219.9	10.1	5.3	5.3	--
STIJ0927	STIJ0915	STGM4405	120	15'' DIA	2.4%	219.25	216.42	228.3	225.1	219.9	217.4	219.9	217.4	10.3	5.3	5.3	--
STIJ10111	STIJ10112	STGM4407	38	15'' DIA	0.8%	215.60	215.31	221.9	221.9	216.6	216.3	216.6	216.3	5.6	5.3	5.3	--
STIJ10112	J5382	STGM4408	111	15'' DIA	0.6%	215.31	214.65	221.9	219.1	216.3	214.9	216.3	214.9	5.1	5.3	5.3	--
STIJ102	STMJ108	STGM3131	32	18'' DIA	20.6%	216.00	209.51	223.9	224.4	216.3	211.6	216.3	211.6	46.3	3.2	3.2	--
STIJ1021	STMJ105	STGM304	483	15'' DIA	0.8%	215.79	212.09	223.2	221.3	223.5	216.1	227.0	216.4	5.6	8.5	10.0	Existing 10-yr
STIJ1060	STIJ1061	STGM2861	30	12'' DIA	2.3%	223.73	222.82	229.6	231.0	224.3	223.5	224.3	223.5	5.7	3.5	3.5	--
STIJ1061	STIJ1062	STGM493	180	12'' DIA	1.5%	222.82	220.00	231.0	228.4	223.5	220.7	223.5	220.7	4.5	3.5	3.5	--
STIJ1062	STIJ1063	STGM4021	74	12'' DIA	1.2%	220.00	218.91	228.4	227.3	220.7	219.5	220.7	219.5	4.1	3.5	3.5	--
STIJ1063	STIJ1064	STGM3134	251	12'' DIA	2.4%	218.91	212.68	227.3	221.3	219.5	213.3	219.5	213.3	5.8	3.5	3.5	--
STIJ1064	STIJ1065	STGM3804	199	12'' DIA	2.3%	212.68	207.91	221.3	216.5	213.3	208.5	213.3	208.5	5.6	3.5	3.5	--
STIJ1065	STIJ1066	STGM646	369	12'' DIA	2.6%	207.91	198.06	216.5	206.5	208.5	198.7	208.5	198.7	6.0	3.5	3.5	--
STIJ1066	STIJ1069	STGM281	175	12'' DIA	2.0%	198.06	194.56	206.5	202.2	198.7	195.1	198.7	195.1	5.3	3.5	3.5	--
STIJ1069	STIJ1070	STGM3714	160	12'' DIA	2.4%	194.56	190.71	202.2	198.4	195.1	191.4	195.1	191.4	5.8	3.5	3.5	--
STIJ1070	J-SBT7-03	STGM527	83	15'' DIA	1.0%	190.71	189.88	198.4	193.6	191.4	190.3	191.4	190.3	6.7	3.5	3.5	--
STIJ1234	STMJ1224	STGM2977	28	10'' DIA	15.7%	160.31	155.98	164.6	163.9	160.5	156.6	160.5	156.6	9.1	1.5	1.5	--
STIK116	J-SBT4-04	STGM2113	29	33'' DIA	3.3%	164.54	163.59	173.0	171.9	164.9	164.3	164.9	164.3	108.0	3.2	3.4	--
STIK117	J-SBT4-05	STGM2844	62	15'' DIA	0.3%	167.96	167.77	175.0	173.0	168.7	168.0	168.8	168.0	3.7	3.2	3.5	--
STIL11185	J-SBT1-05	STGM3287	38	12'' DIA	29.5%	171.70	157.40	179.0	180.0	171.9	159.6	171.9	159.7	20.9	1.7	2.2	--
STIL11186	STIL11185	STGM4128	36	12'' DIA	2.2%	172.50	171.70	179.0	179.0	172.9	171.9	173.0	171.9	5.6	1.7	2.2	--
STMI091	STMI1014	STGM1080	252	21'' DIA	1.1%	220.03	217.26	229.9	225.1	223.4	218.9	226.9	223.1	16.6	21.1	21.6	--
STMI0910	STMI094	STGM408	43	21'' DIA	6.8%	229.00	226.07	235.6	236.0	232.6	231.8	235.3	234.6	41.3	21.1	21.6	--
STMI092	STMI091	STGM4123	69	27'' DIA	1.0%	220.75	220.03	229.0	229.9	224.5	223.4	227.9	226.9	17.1	21.1	21.6	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMI093	STMI092	STGM3192	113	24'' DIA	2.0%	223.04	220.75	232.8	229.0	227.6	224.5	230.7	227.9	17.4	21.1	21.6	--
STMI094	STMI093	STGM1701	256	21'' DIA	1.2%	226.07	223.04	236.0	232.8	231.8	227.6	234.6	230.7	18.0	21.1	21.6	--
STMI095	STII104	STGM1064	249	15'' DIA	-0.1%	232.85	233.15	244.0	239.5	238.6	233.9	236.9	233.9	2.2	4.0	4.1	--
STMI099	STII0990	STGM1784	90	30'' DIA	0.5%	228.23	227.59	241.7	238.2	237.8	237.8	241.4	241.3	29.5	3.2	4.5	--
STMI101	STMI107	STGM523	468	15'' DIA	0.9%	230.23	226.24	234.6	230.9	231.0	227.4	231.0	227.4	6.0	4.0	4.1	--
STMI1010	STMI101	STGM692	283	15'' DIA	0.9%	232.65	230.23	240.0	234.6	233.4	231.0	233.4	231.0	6.0	4.0	4.1	--
STMI1012	STMI103	STGM1965	93	27'' DIA	0.4%	211.40	210.80	219.9	220.7	218.5	217.6	219.8	219.2	20.3	29.5	30.0	--
STMI1013	STMI109	STGM1206	362	21'' DIA	1.6%	222.05	216.25	230.4	223.3	222.5	218.4	222.5	222.7	10.8	1.5	1.5	--
STMI1014	STMI109	STGM3669	288	33'' DIA	0.4%	217.26	216.25	225.1	223.3	218.9	218.4	223.1	222.7	31.2	24.0	24.5	--
STMI1015	STMI108	STGM866	340	15'' DIA	1.0%	213.55	209.79	221.8	221.0	221.8	216.9	227.9	219.7	6.6	9.5	11.5	Future 10-yr
STMI1017	J5216	STGM1949	86	24'' DIA	0.6%	206.55	206.00	215.3	211.3	216.6	216.6	219.0	218.9	18.1	13.9	15.6	Existing 10-yr
STMI1018	STMI1017	STGM825	130	24'' DIA	1.3%	208.30	206.55	219.3	215.3	216.7	216.6	219.2	219.0	25.8	10.8	12.6	--
STMI1019	STMI1114	STGM3926	351	42'' DIA	1.6%	199.50	194.00	209.3	203.0	200.7	195.7	200.9	195.8	128.5	30.9	40.3	--
STMI102	STMI1012	STGM3792	50	15'' DIA	1.7%	213.03	211.40	219.9	219.9	218.6	218.5	219.8	219.8	8.4	2.5	2.6	--
STMI1020	STMI106	STGM3563	115	18'' DIA	0.9%	223.16	222.18	227.0	225.8	224.3	222.9	224.3	222.9	9.7	9.0	9.1	--
STMI1021	STII102	STGM2839	332	21'' DIA	2.2%	211.58	204.20	215.2	212.6	212.5	205.9	212.5	205.9	23.7	12.3	12.4	--
STMI1022	STMI1012	STGM3882	271	27'' DIA	0.7%	214.00	211.40	223.0	219.9	221.7	218.5	221.7	219.8	25.3	27.1	27.4	--
STMI1023	STMI1014	STGM2235	127	12'' DIA	1.9%	219.69	217.26	226.2	225.1	220.0	218.9	223.2	223.1	5.0	1.0	1.0	--
STMI103	STMI104	STGM822	72	36'' DIA	0.8%	210.80	209.30	220.7	220.3	217.6	217.2	219.2	219.0	61.4	29.5	29.8	--
STMI104	J5216	STGM3924	352	60'' DIA	0.8%	209.30	206.00	220.3	211.3	217.2	216.6	219.0	218.9	231.4	32.6	32.7	--
STMI105	STMI1022	STGM3651	162	27'' DIA	0.7%	215.20	214.00	223.5	223.0	223.5	221.7	223.5	221.7	26.6	30.0	26.8	--
STMI106	STMI1021	STGM1211	401	21'' DIA	2.6%	222.18	211.58	225.8	215.2	222.9	212.5	222.9	212.5	25.6	9.0	9.1	--
STMI107	STMI1020	STGM223	361	18'' DIA	0.9%	226.24	223.16	230.9	227.0	227.4	224.3	227.4	224.3	9.8	9.0	9.1	--
STMI108	STMI1018	STGM3717	221	21'' DIA	0.6%	209.79	208.30	221.0	219.3	216.9	216.7	219.7	219.2	12.0	10.8	12.6	--
STMI109	STMI105	STGM210	34	33'' DIA	3.1%	216.25	215.20	223.3	223.5	218.4	223.5	222.7	223.5	93.8	25.5	26.0	--
STMI1110	STMI1121	STGM346	250	15'' DIA	1.2%	206.93	203.84	213.9	212.6	207.5	204.8	207.5	204.8	7.2	2.8	2.8	--
STMI1113	STMI1123	STGM201	445	36'' DIA	0.8%	193.31	189.65	203.0	206.2	195.5	191.5	195.5	191.6	60.5	52.0	54.1	--
STMI1114	STMI1113	STGM391	84	42'' DIA	0.8%	194.00	193.31	203.0	203.0	195.7	195.5	195.8	195.5	91.6	34.8	41.8	--
STMI1115	STMI1177	STGM4067	89	36'' DIA	2.0%	186.78	185.02	204.2	201.0	188.4	186.6	188.4	186.6	94.4	52.9	55.1	--
STMI1121	J4834	STGM3457	345	24'' DIA	2.0%	203.84	197.00	212.6	209.4	204.8	198.3	204.8	198.3	32.1	15.1	15.2	--
STMI1123	STMI1124	STGM2866	92	36'' DIA	1.3%	189.65	188.46	206.2	204.7	191.5	190.3	191.6	190.4	75.6	52.9	55.1	--
STMI1124	STMI1115	STGM777	130	36'' DIA	1.3%	188.46	186.78	204.7	204.2	190.3	188.4	190.4	188.4	75.6	52.9	55.1	--
STMI1144	STMI1220	STGM2834	427	15'' DIA	1.4%	187.23	181.41	193.5	186.3	187.8	182.0	187.8	182.0	7.9	3.1	3.2	--
STMI1160	STMI1144	STGM2072	101	15'' DIA	0.6%	187.86	187.23	195.0	193.5	188.5	187.8	188.6	187.8	5.3	3.1	3.2	--
STMI1161	STMI1160	STGM2380	48	12'' DIA	1.1%	188.40	187.86	195.6	195.0	188.6	188.5	188.6	188.6	4.1	0.5	0.5	--
STMI1162	STMI1160	STGM3512	62	12'' DIA	1.9%	189.01	187.86	193.9	195.0	189.4	188.5	189.4	188.6	5.0	1.3	1.3	--
STMI1163	STMI1161	STGM856	187	12'' DIA	0.8%	189.92	188.40	196.2	195.6	190.2	188.6	190.2	188.6	3.3	0.5	0.5	--
STMI1164	STMI1163	STGM2889	49	12'' DIA	1.1%	190.45	189.92	194.9	196.2	190.7	190.2	190.7	190.2	3.8	0.5	0.5	--
STMI1165	STMI1225	STGM2707	159	12'' DIA	0.6%	183.22	182.19	188.7	187.1	183.7	182.7	183.7	182.7	3.0	1.4	1.4	--
STMI1167	STMI1174	STGM2230	51	18'' DIA	1.2%	193.54	192.91	199.4	198.4	194.2	194.3	194.5	194.5	12.3	3.4	3.7	--
STMI1168	STMI1167	STGM1627	98	15'' DIA	1.2%	194.76	193.54	202.0	199.4	195.4	194.2	195.4	194.5	7.4	3.4	3.7	--
STMI1169	STMI1168	STGM3678	126	15'' DIA	1.3%	196.34	194.76	203.3	202.0	196.9	195.4	197.0	195.4	7.4	3.4	3.7	--
STMI1170	STMI1169	STGM323	59	15'' DIA	0.9%	196.84	196.34	202.7	203.3	197.4	196.9	197.4	197.0	6.2	2.1	2.3	--
STMI1171	STMI1170	STGM1667	62	12'' DIA	1.1%	197.53	196.84	203.5	202.7	198.1	197.4	198.1	197.4	3.9	2.1	2.3	--
STMI1172	STMI1171	STGM2755	54	12'' DIA	1.2%	198.19	197.53	204.6	203.5	198.7	198.1	198.7	198.1	4.1	2.1	2.3	--
STMI1173	STMI1172	STGM3243	117	12'' DIA	1.0%	199.33	198.19	206.7	204.6	199.9	198.7	199.9	198.7	3.6	2.1	2.3	--
STMI1174	STMI1175	STGM3850	350	21'' DIA	1.2%	192.91	188.72	198.4	194.8	194.3	189.5	194.5	189.5	18.0	15.7	18.9	--
STMI1175	STMI1176	STGM2412	162	21'' DIA	6.5%	188.72	178.28	194.8	184.9	189.5	179.2	189.5	179.3	42.4	15.7	18.1	--
STMI1176	J-SBT1-05	STGM3931	183	21'' DIA	3.4%	178.28	157.40	184.9	180.0	179.2	159.6	179.3	159.7	30.1	15.7	18.1	--
STMI1177	J-SBT1-08	STGM1611	153	42'' DIA	2.0%	185.02	182.00	201.0	199.2	186.6	182.7	186.6	182.7	142.9	52.9	55.1	--
STMI1210	STMI1211	STGM4076	97	18'' DIA	3.8%	168.81	165.11	175.7	175.9	169.2	166.1	169.2	166.2	20.9	3.4	3.4	--
STMI1211	STMI1214	STGM3370	138	24'' DIA	5.8%	165.11	157.09	175.9	166.7	166.1	157.8	166.2	157.9	56.5	26.6	28.6	--
STMI1212	STMI1211	STGM487	56	33'' DIA	1.1%	165.74	165.11	175.9	175.9	166.9	166.1	167.0	166.2	58.0	23.2	25.2	--
STMI1214	J-SBT1-02	STGM2060	124	24'' DIA	15.0%	157.09	138.80	166.7	152.6	157.8	145.9	157.9	146.8	91.6	26.6	28.6	--
STMI1215	STMI1210	STGM2002	123	18'' DIA	1.2%	170.24	168.81	177.1	175.7	170.8	169.2	170.8	169.2	12.0	3.4	3.4	--
STMI1216	STMI1215	STGM2785	312	15'' DIA	1.6%	175.24	170.24	180.9	177.1	175.8	170.8	175.8	170.8	8.6	3.4	3.4	--
STMI1217	STMI1216	STGM91	431	15'' DIA	0.8%	178.84	175.24	185.2	180.9	179.5	175.8	179.5	175.8	6.1	3.4	3.4	--
STMI1218	STMI1217	STGM1026	124	12'' DIA	1.6%	180.87	178.84	187.2	185.2	181.2	179.5	181.2	179.5	4.7	1.4	1.4	--
STMI1219	STMI1221	STGM2965	220	18'' DIA	1.2%	176.01	173.35	181.1	179.0	176.7	174.0	176.8	174.0	12.0	5.6	5.8	--
STMI1220	STMI1219	STGM3283	379	15'' DIA	1.4%	181.41	176.01	186.3	181.1	182.0	176.7	182.0	176.8	8.1	3.1	3.2	--
STMI1221	STMI1222	STGM886	45	18'' DIA	1.7%	173.35	172.59	179.0	178.7	174.0	173.2	174.0	173.2	14.1	5.6	5.8	--
STMI1222	STMI1212	STGM1954	231	18'' DIA	3.0%	172.59	165.74	178.7	175.9	173.2	166.9	173.2	167.0	18.8	5.6	5.8	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMI1223	STMI1218	STGM623	27	12'' DIA	1.2%	181.20	180.87	187.9	187.2	181.6	181.2	181.6	181.2	4.0	1.4	1.4	--
STMI1224	STMI1223	STGM3943	63	12'' DIA	0.7%	181.67	181.20	186.6	187.9	182.1	181.6	182.1	181.6	3.2	1.4	1.4	--
STMI1225	STMI1224	STGM2295	82	12'' DIA	0.6%	182.19	181.67	187.1	186.6	182.7	182.1	182.7	182.1	2.9	1.4	1.4	--
STMI1226	J-SBT1-02	STGM4243	108	24'' DIA	19.1%	159.00	138.80	169.0	152.6	159.5	145.9	159.6	146.8	100.8	16.1	17.2	--
STMI1227	STMI127	STGM4509	12	18'' DIA	0.9%	174.40	174.30	180.5	180.1	175.2	175.1	175.2	175.1	9.8	3.8	3.8	--
STMI1228	STMI1234	STGM4512	293	18'' DIA	0.5%	176.50	175.00	183.0	181.6	177.2	175.8	177.2	175.8	7.8	3.8	3.8	--
STMI1229	STMI1228	STGM4514	646	18'' DIA	0.5%	179.71	176.50	185.4	183.0	180.5	177.2	180.5	177.2	7.6	3.8	3.8	--
STMI123	STMI139	STGM3149	437	12'' DIA	0.2%	166.55	165.23	177.3	177.1	202.9	197.9	204.3	199.4	1.8	4.9	5.0	Existing 10-yr
STMI1233	STMI126	STGM4525	383	12'' DIA	0.8%	178.00	175.00	182.9	181.6	191.7	176.2	191.7	176.2	3.3	7.9	7.9	Existing 10-yr
STMI1234	STMI1227	STGM4510	138	18'' DIA	0.4%	175.00	174.40	181.6	180.5	175.8	175.2	175.8	175.2	6.9	3.8	3.8	--
STMI124	J4292	STGM356	104	12'' DIA	0.8%	180.75	179.90	187.5	185.1	182.8	180.6	184.7	180.7	3.2	4.2	5.2	--
STMI125	STMI1229	STGM55	203	15'' DIA	0.3%	180.40	179.71	186.3	185.4	181.4	180.5	181.4	180.5	3.8	3.8	3.8	--
STMI126	STMI127	STGM3595	24	12'' DIA	2.9%	175.00	174.30	181.6	180.1	176.2	175.1	176.2	175.1	6.1	7.5	7.5	--
STMI127	STMI128	STGM767	64	24'' DIA	2.0%	174.30	173.00	180.1	180.2	175.1	174.0	175.1	174.0	32.1	11.2	11.2	--
STMI128	STII1245	STGM2032	602	24'' DIA	2.2%	173.00	160.00	180.2	167.7	174.0	161.1	174.0	161.2	34.3	16.1	17.2	--
STMI129	J-SBT1-03	STGM3345	501	12'' DIA	4.0%	185.00	152.20	194.2	175.0	185.6	155.2	185.7	155.3	7.2	5.0	5.6	--
STMI1310	STII135	STGM3689	191	18'' DIA	0.2%	160.30	159.82	172.6	172.7	176.3	173.7	177.7	175.0	5.1	12.3	12.5	Existing 10-yr
STMI137	STII137	STGM2664	342	18'' DIA	0.3%	162.42	161.23	174.0	173.1	182.2	179.2	183.7	180.6	6.2	10.1	10.1	Existing 10-yr
STMI138	STMI137	STGM4542	500	15'' DIA	0.3%	163.98	162.42	175.6	174.0	190.1	182.2	191.5	183.7	3.2	8.8	8.8	Existing 10-yr
STMI139	STMI138	STGM3997	487	15'' DIA	0.3%	165.23	163.98	177.1	175.6	197.9	190.1	199.4	191.5	3.3	10.2	10.2	Existing 10-yr
STMI142	STMI148	STGM3469	86	21'' DIA	0.2%	158.20	157.99	173.6	174.8	167.7	167.4	168.8	167.9	7.8	15.7	16.4	--
STMI143	STMI149	STGM760	83	21'' DIA	0.3%	159.08	158.85	173.0	172.2	171.4	170.5	172.8	171.9	8.3	15.7	16.4	--
STMI144	J4032	STGM3339	517	21'' DIA	0.4%	156.95	155.00	174.6	160.0	167.7	155.6	170.9	155.6	9.7	15.7	16.4	--
STMI148	STMI144	STGM2832	427	21'' DIA	0.2%	157.99	156.95	174.8	174.6	167.4	167.7	167.9	170.9	7.8	15.7	16.4	--
STMI149	STMI142	STGM2709	287	21'' DIA	0.2%	158.85	158.20	172.2	173.6	170.5	167.7	171.9	168.8	7.5	15.7	16.4	--
STMJ091	STMJ1022	STGM3296	261	12'' DIA	1.1%	222.46	219.49	232.9	227.5	250.2	241.8	264.8	252.0	3.8	6.5	8.4	Existing 10-yr
STMJ092	STMJ091	STGM1034	61	12'' DIA	0.3%	222.67	222.46	232.5	232.9	252.2	250.2	267.8	264.8	2.1	7.2	9.9	Existing 10-yr
STMJ1010	STMJ1012	STGM1360	157	12'' DIA	2.5%	185.18	181.23	193.3	191.5	185.4	181.6	185.4	181.7	5.9	0.7	0.7	--
STMJ1011	STMJ1013	STGM3914	220	12'' DIA	0.5%	220.37	219.30	229.5	228.0	221.8	220.0	221.8	220.0	2.6	3.2	3.2	--
STMJ1012	J-SBT5-01	STGM3147	293	18'' DIA	4.1%	181.23	169.20	191.5	180.0	181.6	169.8	181.7	169.8	21.6	3.7	5.0	--
STMJ1013	STMJ1015	STGM3598	121	15'' DIA	0.5%	219.30	218.73	228.0	223.7	220.0	219.3	220.0	219.3	4.6	3.2	3.2	--
STMJ1015	STIJ102	STGM4314	135	12'' DIA	2.0%	218.73	216.00	223.7	223.9	219.3	216.3	219.3	216.3	5.1	3.2	3.2	--
STMJ102	STMJ103	STGM4063	259	18'' DIA	0.3%	213.81	213.12	221.6	221.6	221.5	217.8	221.0	219.0	5.4	6.5	6.5	--
STMJ1022	STIJ1021	STGM2731	321	12'' DIA	1.1%	219.49	215.79	227.5	223.2	241.8	223.5	252.0	227.0	3.8	8.7	10.4	Existing 10-yr
STMJ103	STMJ106	STGM2081	121	21'' DIA	0.3%	213.12	212.77	221.6	222.2	217.8	217.1	219.0	218.2	8.5	8.8	8.8	--
STMJ104	STMJ107	STGM2171	332	36'' DIA	0.4%	211.50	210.16	221.3	224.1	213.1	212.0	213.1	212.1	41.5	22.0	23.0	--
STMJ105	J3522	STGM1824	28	15'' DIA	0.3%	212.09	212.00	221.3	221.6	216.1	213.8	216.4	213.9	3.7	18.3	19.2	--
STMJ106	STMJ105	STGM2476	253	24'' DIA	0.3%	212.77	212.09	222.2	221.3	217.1	216.1	218.2	216.4	11.7	10.4	10.5	--
STMJ107	STMJ108	STGM3145	192	36'' DIA	0.3%	210.16	209.51	224.1	224.4	212.0	211.6	212.1	211.6	35.6	24.6	25.6	--
STMJ108	J5176	STGM4222	336	36'' DIA	0.1%	209.51	209.16	224.4	215.7	211.6	210.3	211.6	210.3	23.0	27.8	28.8	--
STMJ1110	STMJ119	STGM4173	90	15'' DIA	2.8%	210.16	207.67	216.1	214.5	210.5	208.0	210.5	208.0	11.0	1.3	1.4	--
STMJ1111	STMI1173	STGM4181	212	12'' DIA	1.8%	203.20	199.33	210.5	206.7	203.7	199.9	203.7	199.9	5.0	2.1	2.3	--
STMJ1113	STMJ1114	STGM3550	290	15'' DIA	3.5%	207.14	196.97	211.5	204.9	207.4	198.0	207.4	198.1	12.9	1.4	1.5	--
STMJ1114	STMI1174	STGM4022	548	21'' DIA	0.7%	196.97	192.91	204.9	198.4	198.0	194.3	198.1	194.5	14.3	9.9	10.7	--
STMJ1119	STMJ1012	STGM4020	268	15'' DIA	0.9%	183.51	181.23	193.4	191.5	184.2	181.6	184.3	181.7	6.2	3.0	4.3	--
STMJ1120	STMJ1119	STGM56	162	15'' DIA	0.7%	184.60	183.51	193.0	193.4	185.3	184.2	185.4	184.3	5.5	3.0	4.3	--
STMJ1121	STMJ1120	STGM1305	211	12'' DIA	0.7%	186.07	184.60	195.3	193.0	186.9	185.3	189.3	185.4	3.1	3.0	4.3	--
STMJ1126	STMJ1128	STGM1460	241	12'' DIA	2.0%	219.30	214.51	223.5	218.8	219.7	214.9	219.7	214.9	5.3	1.4	1.5	--
STMJ1127	STMJ1113	STGM1306	74	15'' DIA	2.3%	208.87	207.14	213.0	211.5	209.2	207.4	209.2	207.4	10.1	1.4	1.5	--
STMJ1128	STMJ1127	STGM3656	254	12'' DIA	2.2%	214.51	208.87	218.8	213.0	214.9	209.2	214.9	209.2	5.5	1.4	1.5	--
STMJ1132	STMJ1133	STGM794	149	24'' DIA	0.5%	175.66	174.87	181.2	180.8	176.3	175.4	176.4	175.5	17.1	4.3	5.3	--
STMJ1133	STMJ1135	STGM4327	216	24'' DIA	1.3%	174.87	172.13	180.8	184.2	175.4	173.3	175.5	173.5	26.7	4.3	5.3	--
STMJ1134	STMJ1135	STGM1074	247	15'' DIA	5.1%	184.75	172.13	193.7	184.2	185.1	173.3	185.2	173.5	15.4	3.1	3.8	--
STMJ1135	STMJ1138	STGM3324	317	24'' DIA	0.2%	172.13	171.55	184.2	178.2	173.3	172.4	173.5	172.5	10.0	7.3	9.1	--
STMJ1136	STMJ1132	STGM1013	488	18'' DIA	0.6%	178.62	175.66	191.8	181.2	179.4	176.3	179.5	176.4	8.6	4.3	5.3	--
STMJ1138	STMJ1235	STGM953	85	24'' DIA	1.4%	171.55	170.33	178.2	176.9	172.4	171.1	172.5	171.2	28.1	10.4	13.1	--
STMJ1141	STMJ1142	STGM885	95	24'' DIA	2.3%	184.00	181.80	198.1	196.2	184.4	182.2	184.5	182.3	35.1	2.8	3.9	--
STMJ1142	STMJ1143	STGM4239	264	24'' DIA	2.2%	181.80	176.00	196.2	184.3	182.2	176.4	182.3	176.5	35.0	2.8	3.9	--
STMJ1143	STMJ1238	STGM2043	499	24'' DIA	1.4%	176.00	168.99	184.3	178.5	176.4	169.4	176.5	169.5	28.0	2.8	3.9	--
STMJ115	STMI1162	STGM693	339	12'' DIA	0.6%	190.96	189.01	195.5	193.9	191.5	189.4	191.5	189.4	2.8	1.3	1.3	--
STMJ116	STMI1169	STGM413	235	15'' DIA	1.1%	198.86	196.34	205.8	203.3	199.2	196.9	199.2	197.0	6.9	1.3	1.4	--
STMJ117	STMJ116	STGM2885	53	15'' DIA	2.1%	199.99	198.86	206.8	205.8	200.3	199.2	200.3	199.2	10.1	1.3	1.4	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMJ118	STMJ117	STGM3212	176	15'' DIA	2.0%	203.56	199.99	210.4	206.8	203.9	200.3	203.9	200.3	9.4	1.3	1.4	--
STMJ119	STMJ118	STGM2864	214	15'' DIA	1.9%	207.67	203.56	214.5	210.4	208.0	203.9	208.0	203.9	9.4	1.3	1.4	--
STMJ121	STMJ1212	STGM3031	310	12'' DIA	0.9%	179.24	176.56	184.6	181.1	179.8	177.0	179.8	177.0	3.4	1.9	1.9	--
STMJ1210	STMJ128	STGM1943	156	21'' DIA	0.6%	168.84	167.85	174.5	175.6	170.1	169.1	170.2	169.2	13.1	11.0	12.7	--
STMJ1211	STMJ1210	STGM2621	112	15'' DIA	0.4%	169.30	168.84	173.6	174.5	170.2	170.1	170.4	170.2	4.3	2.2	3.2	--
STMJ1212	STMJ126	STGM946	217	12'' DIA	1.3%	176.56	173.71	181.1	178.9	177.0	174.4	177.0	174.4	4.2	1.9	1.9	--
STMJ1213	STMJ1214	STGM203	166	12'' DIA	1.1%	180.53	178.72	185.1	183.1	181.4	181.2	185.1	183.1	3.8	2.1	2.3	--
STMJ1214	STMJ123	STGM3955	210	15'' DIA	0.9%	178.72	176.80	183.1	182.2	181.2	181.1	183.1	182.2	6.5	2.2	2.4	--
STMJ1215	STMJ1216	STGM2429	73	15'' DIA	0.9%	172.85	172.18	178.9	179.1	173.3	172.5	173.4	172.5	6.5	2.0	2.2	--
STMJ1216	J4990	STGM1637	84	18'' DIA	5.1%	172.18	167.85	179.1	179.0	172.5	168.0	172.5	168.0	25.0	2.0	2.2	--
STMJ1217	STMJ1215	STGM2811	189	15'' DIA	0.6%	173.99	172.85	182.2	178.9	174.5	173.3	174.6	173.4	5.3	2.0	2.2	--
STMJ1218	STMJ1219	STGM835	253	12'' DIA	3.1%	135.56	127.73	144.3	133.3	136.0	128.2	136.1	128.2	6.6	2.5	3.2	--
STMJ1219	STMJ1220	STGM1194	59	12'' DIA	3.0%	127.73	125.95	133.3	134.1	128.2	126.6	128.2	126.6	6.4	2.5	3.2	--
STMJ122	STMJ123	STGM2217	421	12'' DIA	1.6%	183.38	176.80	188.7	182.2	183.9	181.1	184.1	182.2	4.6	2.7	2.7	--
STMJ1220	J-SB-04	STGM796	36	21'' DIA	7.1%	125.95	115.90	134.1	125.0	126.6	121.4	126.6	121.4	42.4	11.5	12.1	--
STMJ1222	STMJ1220	STGM1348	110	18'' DIA	6.8%	133.40	125.95	138.2	134.1	134.0	126.6	134.0	126.6	28.0	9.0	9.0	--
STMJ1223	STMJ1222	STGM608	95	18'' DIA	6.4%	139.50	133.40	145.0	138.2	140.1	134.0	140.1	134.0	28.0	9.0	9.0	--
STMJ1224	STMJ1223	STGM3637	237	18'' DIA	7.0%	155.98	139.50	163.9	145.0	156.6	140.1	156.6	140.1	28.9	9.0	9.0	--
STMJ1225	STMJ1224	STGM736	175	21'' DIA	1.4%	158.36	155.98	166.7	163.9	159.1	156.6	159.1	156.6	19.3	7.5	7.5	--
STMJ1226	STMJ1227	STGM2863	268	15'' DIA	5.0%	159.59	146.32	170.0	156.3	160.4	147.1	160.4	147.1	14.9	10.7	11.2	--
STMJ1227	STMJ1228	STGM3346	80	15'' DIA	4.9%	146.32	142.40	156.3	152.3	147.1	143.2	147.1	143.2	14.9	10.7	11.2	--
STMJ1228	STMJ1229	STGM1043	80	15'' DIA	5.3%	142.40	138.19	152.3	150.4	143.2	139.0	143.2	139.0	15.5	10.7	11.2	--
STMJ1229	STMJ1242	STGM1444	39	15'' DIA	5.3%	138.19	136.14	150.4	145.0	139.0	136.5	139.0	136.5	15.5	10.7	11.2	--
STMJ123	STMJ124	STGM3193	178	15'' DIA	1.1%	176.80	174.83	182.2	180.0	181.1	180.0	182.2	180.0	7.1	8.8	9.6	--
STMJ1230	STIJ1234	STGM274	40	12'' DIA	0.6%	160.57	160.31	162.7	164.6	161.1	160.5	161.1	160.5	3.0	1.5	1.5	--
STMJ1231	STMJ1232	STGM3442	65	33'' DIA	0.7%	165.26	164.80	172.5	173.1	166.2	165.4	166.3	165.4	45.2	10.4	13.1	--
STMJ1232	STMJ1233	STGM735	111	33'' DIA	4.8%	164.80	159.41	173.1	172.3	165.4	160.5	165.4	160.7	115.4	10.4	13.1	--
STMJ1233	J-SBT3-01	STGM737	355	36'' DIA	3.3%	159.41	147.70	172.3	160.0	160.5	148.5	160.7	148.6	66.7	18.0	23.4	--
STMJ1234	STMJ1231	STGM501	117	33'' DIA	1.0%	166.39	165.26	173.8	172.5	167.2	166.2	167.3	166.3	52.0	10.4	13.1	--
STMJ1235	STMJ1234	STGM1822	228	24'' DIA	1.7%	170.33	166.39	176.9	173.8	171.1	167.2	171.2	167.3	30.6	10.4	13.1	--
STMJ1236	STMJ1237	STGM4360	122	24'' DIA	2.3%	165.95	163.11	178.4	175.8	166.6	163.7	166.7	163.8	34.7	7.7	10.3	--
STMJ1237	STMJ1239	STGM2654	64	24'' DIA	3.7%	163.11	160.72	175.8	175.8	163.7	161.7	163.8	161.9	42.4	7.6	10.3	--
STMJ1238	STMJ1236	STGM580	55	24'' DIA	5.5%	168.99	165.95	178.5	178.4	169.4	166.6	169.5	166.7	51.5	5.7	8.1	--
STMJ1239	STMJ1233	STGM1647	158	36'' DIA	0.8%	160.72	159.41	175.8	172.3	161.7	160.5	161.9	160.7	33.2	7.6	10.3	--
STMJ124	STMJ129	STGM3039	260	15'' DIA	1.1%	174.83	171.98	180.0	177.0	180.0	172.9	180.0	173.0	7.0	8.8	9.6	--
STMJ1242	J-SB-06	SBT2-01	236	Irregular Channel	7.3%	136.14	119.00	145.0	125.0	136.5	122.5	136.5	122.7		10.7	11.2	--
STMJ1244	STMJ1210	STGM2304-B	113	18'' DIA	1.0%	170.00	168.84	175.9	174.5	171.0	170.1	171.1	170.2	11.1	8.8	9.6	--
STMJ125	STMJ126	STGM2225	496	12'' DIA	1.5%	181.17	173.71	186.0	178.9	181.4	174.4	181.5	174.4	4.6	0.7	0.8	--
STMJ126	STMJ127	STGM921	220	15'' DIA	1.6%	173.71	170.29	178.9	176.7	174.4	171.0	174.4	171.0	8.4	4.9	5.1	--
STMJ127	STMJ128	STGM3631	263	18'' DIA	0.9%	170.29	167.85	176.7	175.6	171.0	169.1	171.0	169.2	10.5	4.9	5.1	--
STMJ128	STMI1212	STGM17	450	33'' DIA	0.5%	167.85	165.74	175.6	175.9	169.1	166.9	169.2	167.0	37.9	15.9	17.8	--
STMJ129	STMJ1244	STGM2304-A	147	18'' DIA	1.3%	171.98	170.00	177.0	175.9	172.9	171.0	173.0	171.1	12.7	8.8	9.6	--
STMK111	J-SBT4-04	STGM3873	7	15'' DIA	16.6%	164.77	163.59	172.0	171.9	165.1	164.3	165.1	164.3	26.8	3.2	3.3	--
STMK1110	STMK117	STGM1277	115	12'' DIA	3.7%	177.71	173.50	187.2	180.8	178.2	174.0	178.2	174.0	7.2	3.2	3.4	--
STMK1111	STMK1110	STGM3851	134	12'' DIA	9.9%	190.91	177.71	200.0	187.2	191.3	178.2	191.3	178.2	11.7	3.2	3.4	--
STMK1112	STMK1111	STGM2971	155	12'' DIA	12.4%	210.00	190.91	218.6	200.0	210.3	191.3	210.4	191.3	13.1	3.2	3.4	--
STMK1113	STMK1114	STGM3617	73	15'' DIA	13.4%	154.00	144.32	167.8	160.0	155.2	148.9	155.6	148.9	24.5	21.7	22.0	--
STMK1114	J-SBT4-01	STGM3110	62	15'' DIA	6.2%	144.32	140.54	160.0	145.0	148.9	141.2	148.9	141.2	16.7	21.4	21.4	--
STMK1115	STMK1113	STGM585	215	15'' DIA	0.8%	155.74	154.00	169.2	167.8	156.4	155.2	156.4	155.6	6.1	2.9	3.6	--
STMK1116	STMK1113	STGM3827	320	15'' DIA	2.7%	162.55	154.00	171.6	167.8	163.0	155.2	163.0	155.6	10.9	2.8	3.0	--
STMK1117	STMK1116	STGM197	135	15'' DIA	1.3%	164.26	162.55	173.2	171.6	164.8	163.0	164.8	163.0	7.6	2.8	3.0	--
STMK1118	STMK1117	STGM2666	83	15'' DIA	1.4%	165.41	164.26	174.1	173.2	165.9	164.8	166.0	164.8	7.9	2.8	3.0	--
STMK1119	STMK1118	STGM1422	113	12'' DIA	1.7%	167.33	165.41	175.6	174.1	167.9	165.9	167.9	166.0	4.6	2.8	3.0	--
STMK1120	STMK1119	STGM1144	91	12'' DIA	5.8%	172.58	167.33	180.2	175.6	173.0	167.9	173.0	167.9	8.9	2.8	3.0	--
STMK1121	STMK116	STGM2036	208	12'' DIA	5.1%	190.20	179.68	198.3	190.1	190.9	180.3	190.9	180.4	8.4	6.6	6.8	--
STMK1122	STMK1121	STGM504	204	12'' DIA	3.2%	196.81	190.20	204.2	198.3	197.7	190.9	197.7	190.9	6.7	6.6	6.8	--
STMK113	J-SBT4-04	STGM3752	142	18'' DIA	0.6%	164.46	163.59	171.4	171.9	165.5	164.3	165.5	164.3	8.3	6.6	6.8	--
STMK114	STMK113	STGM2593	51	18'' DIA	1.5%	165.22	164.46	172.5	171.4	166.0	165.5	166.0	165.5	12.7	6.6	6.8	--
STMK115	STMK114	STGM2050	111	12'' DIA	7.6%	173.64	165.22	181.5	172.5	174.2	166.0	174.2	166.0	10.2	6.6	6.8	--
STMK116	STMK115	STGM14	109	12'' DIA	5.6%	179.68	173.64	190.1	181.5	180.3	174.2	180.4	174.2	8.7	6.6	6.8	--
STMK117	STMK118	STGM1105	144	12'' DIA	2.6%	173.50	169.71	180.8	178.2	174.0	170.3	174.0	170.3	6.1	3.2	3.4	--
STMK118	STMK119	STGM3282	73	12'' DIA	1.8%	169.71	168.40	178.2	177.3	170.3	169.3	170.3	169.3	5.0	3.2	3.4	--

Table B-2. Hydraulic Model Parameters and Results

Up and Downstream Model Node		Conduit ID	Length (ft)	Size/Type H = Height, BW = Bottom Width, SS = Side Slope (H:V)	Slope (%)	Invert Elevation (ft)		Ground Elevation (ft)		Exst 10 yr Max Water Surface		Fut 10 yr Max Water Surface		Capacity (cfs)	Exst 10 yr Max Flow (cfs)	Fut 10 yr Max Flow (cfs)	When Flooding (Max WSE > Ground Elevation)
US	DS					US	DS	US	DS	US	DS	US	DS				
STMK119	STIK117	STGM1581	141	15'' DIA	0.3%	168.40	167.96	177.3	175.0	169.3	168.7	169.3	168.8	3.8	3.1	3.4	--
STMK121	STMJ1225	STGM2899	199	21'' DIA	1.3%	160.93	158.36	166.7	166.7	161.7	159.1	161.7	159.1	18.8	7.5	7.5	--
STMK1210	STMK129	STGM3371	108	12'' DIA	6.3%	169.93	163.14	178.4	171.9	170.4	166.1	170.4	166.8	9.3	3.4	3.5	--
STMK1211	STMK1210	STGM2234	229	12'' DIA	8.4%	188.97	169.93	197.2	178.4	189.4	170.4	189.4	170.4	10.7	3.4	3.5	--
STMK1212	STMK126	STGM3829	156	12'' DIA	4.9%	183.98	176.34	198.0	185.7	184.5	176.8	184.5	176.8	8.1	4.0	4.0	--
STMK1213	STMK1214	STGM3216	135	12'' DIA	8.1%	180.96	170.13	190.3	179.9	181.2	170.6	181.2	170.6	10.2	0.9	0.9	--
STMK1214	STMK111	STGM2871	169	15'' DIA	3.2%	170.13	164.77	179.9	172.0	170.6	165.1	170.6	165.1	11.9	3.2	3.3	--
STMK1215	STMK1214	STGM2543	82	12'' DIA	5.4%	174.52	170.13	185.0	179.9	174.9	170.6	174.9	170.6	8.5	2.3	2.3	--
STMK1216	STMK1215	STGM1031	237	12'' DIA	12.7%	204.42	174.52	215.4	185.0	204.7	174.9	204.7	174.9	13.5	2.3	2.3	--
STMK1217	STMK1216	STGM3452	141	12'' DIA	12.1%	221.37	204.42	232.0	215.4	221.5	204.7	221.5	204.7	12.3	0.7	0.7	--
STMK1218	STMK1217	STGM3989	177	12'' DIA	15.0%	247.63	221.37	257.8	232.0	247.8	221.5	247.8	221.5	14.8	0.7	0.7	--
STMK1219	STMK1216	STGM440	126	12'' DIA	4.5%	210.12	204.42	227.5	215.4	210.4	204.7	210.4	204.7	7.6	0.9	1.0	--
STMK122	STMK121	STGM3638	208	21'' DIA	1.1%	163.17	160.93	171.4	166.7	164.0	161.7	164.0	161.7	17.1	7.5	7.6	--
STMK1220	STMK1219	STGM239	240	12'' DIA	13.6%	242.37	210.12	254.9	227.5	242.6	210.4	242.6	210.4	13.0	0.9	1.0	--
STMK1221	STMK1220	STGM3551	66	12'' DIA	3.6%	244.72	242.37	256.0	254.9	245.0	242.6	245.0	242.6	7.0	0.9	1.0	--
STMK1222	STMK1221	STGM2823	169	12'' DIA	8.6%	259.18	244.72	269.4	256.0	259.4	245.0	259.4	245.0	11.4	0.9	1.0	--
STMK1223	STMK1224	STGM1405	353	12'' DIA	5.4%	263.91	244.69	272.9	253.2	264.3	245.0	264.3	245.0	8.5	2.3	2.3	--
STMK1224	STMK1225	STGM1893	64	12'' DIA	8.2%	244.69	239.49	253.2	249.0	245.0	239.8	245.0	239.8	10.4	2.3	2.3	--
STMK1225	STMK1226	STGM3668	174	12'' DIA	18.3%	239.49	208.13	249.0	221.2	239.8	208.4	239.8	208.4	16.4	2.3	2.3	--
STMK1226	STMK1227	STGM3728	92	12'' DIA	15.8%	208.13	193.74	221.2	207.5	208.4	194.1	208.4	194.1	14.3	2.3	2.3	--
STMK1227	STMK1212	STGM448	180	12'' DIA	5.4%	193.74	183.98	207.5	198.0	194.1	184.5	194.1	184.5	8.5	2.3	2.3	--
STMK1228	STMK124	STGM2106	54	18'' DIA	3.7%	166.09	164.12	170.3	169.3	166.5	164.9	166.5	164.9	20.7	3.7	3.8	--
STMK1229	STMK1228	STGM621	210	15'' DIA	10.8%	188.72	166.09	195.1	170.3	189.1	166.5	189.1	166.5	21.9	3.7	3.8	--
STMK123	STMK122	STGM1742	248	12'' DIA	6.2%	178.61	163.17	184.0	171.4	178.8	164.0	178.8	164.0	9.5	1.1	1.1	--
STMK1230	STMK1229	STGM3819	205	12'' DIA	10.0%	209.01	188.72	216.0	195.1	209.3	189.1	209.3	189.1	11.8	2.6	2.6	--
STMK1231	STMK1230	STGM3915	124	12'' DIA	8.7%	219.71	209.01	228.0	216.0	220.0	209.3	220.0	209.3	10.8	2.6	2.6	--
STMK1232	STMK1231	STGM1946	271	12'' DIA	10.7%	248.53	219.71	252.9	228.0	248.8	220.0	248.8	220.0	12.3	2.6	2.6	--
STMK1233	STMK1229	STGM578	116	12'' DIA	0.8%	189.66	188.72	196.5	195.1	190.1	189.1	190.1	189.1	3.4	1.1	1.2	--
STMK1235	STMK1115	STGM3189	181	15'' DIA	0.5%	156.63	155.74	167.2	169.2	157.3	156.4	157.4	156.4	4.7	2.9	3.6	--
STMK124	STMK122	STGM1650	179	18'' DIA	0.5%	164.12	163.17	169.3	171.4	164.9	164.0	164.9	164.0	8.0	4.5	4.5	--
STMK125	STMK124	STGM2255	244	12'' DIA	2.2%	169.53	164.12	176.2	169.3	169.8	164.9	169.8	164.9	5.4	0.8	0.8	--
STMK126	STMJ1226	STGM3715	356	12'' DIA	4.7%	176.34	159.59	185.7	170.0	176.8	160.4	176.8	160.4	8.0	4.0	4.0	--
STMK127	STMJ1226	STGM434	168	12'' DIA	0.6%	160.59	159.59	170.3	170.0	162.4	160.4	162.8	160.4	2.9	3.4	3.5	--
STMK128	STMK127	STGM3789	202	12'' DIA	0.7%	162.01	160.59	171.6	170.3	164.7	162.4	165.1	162.8	3.1	3.4	3.5	--
STMK129	STMK128	STGM3068	184	12'' DIA	0.6%	163.14	162.01	171.9	171.6	166.1	164.7	166.8	165.1	2.9	3.4	3.5	--
STML1131	STML1132	STGM1321	245	27'' DIA	1.8%	194.81	190.42	207.4	202.9	195.8	191.4	195.8	191.4	41.6	15.8	15.8	--
STML1132	J-SBT1-09	STGM452	90	30'' DIA	1.6%	190.42	188.95	202.9	196.5	191.4	189.2	191.4	189.2	52.6	15.8	15.8	--
STML1146	STML1131	STGM3690	109	12'' DIA	2.8%	197.83	194.81	206.0	207.4	202.5	195.8	202.6	195.8	5.9	8.5	8.5	--
STML1232	STMI1233	STGM4524	417	12'' DIA	0.3%	179.20	178.00	183.3	182.9	197.3	191.7	197.2	191.7	2.0	5.1	5.1	Existing 10-yr

Appendix C: Channel Vulnerability Data

Use of contents on this sheet is subject to the limitations specified on the title page of this document.

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Chehalem Creek Tributary, Upstream of Sunnycrest Road

Stream
Chehalem Creek Newberg Tributary

Reach
Lower Reach (upstream of Sunnycrest)

General Characteristics

Gradient:	≈ 0.006 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 6 ft
Average BFD:	≈ 4 ft
Substrate:	Silt
Vegetation:	Blackberries, ferns, mixed forest.
Beaver Activity:	Upstream of Sheridan Road culvert.

Issues
Some bank erosion and slumps.

Aerial view of Chehalem Creek Tributary, Sunnycrest (W 1st St) Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Typical stream section above Highway 240

Stream
Chehalem Creek Newberg Tributary

Reach
Upper Reach (upstream of Hwy 240)

General Characteristics

Gradient:	≈ 0.016 ft/ft
Valley Width:	50 – 100 feet
Planform:	Relatively straight
Average BFW:	≈ 8 ft
Average BFD:	≈ 4 ft
Substrate:	Silt
Vegetation:	Blackberries, ferns, narrow mixed forest.
Beaver Activity:	None

Issues
Bank slumps, erosion and hillslope failures.

Aerial view of Chehalem Creek Tributary, upstream Hwy 240 reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Photo of Corrine Drive Tributary channel upstream of detention pond/lake (bottom photo).

Stream
Hess Creek

Reach
East Tributary (Corrine Drive)

General Characteristics

Gradient:	≈ 0.01 ft/ft
Valley Width:	<100 feet
Planform:	Relatively straight
Average BFW:	≈ 5 ft (City data)
Average BFD:	≈ 2.7 ft (City data)
Substrate:	Silt above detention pond, and downstream at confluence
Vegetation:	Mixed
Beaver Activity:	None

Issues
Erosion at detention pond outlet. Channel incision downstream (City data).

Aerial view of Hess Creek, Corrine Drive Tributary

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Hess Creek channel about WWTP

Stream
Hess Creek

Reach
Lower Reach (WWTP)

General Characteristics

Gradient:	≈ 0.002 ft/ft
Valley Width:	250 – 300 feet
Planform:	Meandering
Average BFW:	≈ 9 ft
Average BFD:	≈ 4 ft
Substrate:	Silt
Vegetation:	Reed canary grass, blackberries
Beaver Activity:	No recent activity observed.

Issues
Invasive vegetation. Very long piped section downstream of WWTP.

Aerial view of Hess Creek, WWTP reach.

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photos of stream reach above Crestview. Significant bank erosion in this reach.

Stream
Hess Creek

Reach
Upper Reach (Above Crestview)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 9 feet
Average BFD:	≈ 3 feet
Substrate:	Silt (loose and thick in places)
Vegetation:	Residential pasture, blackberries, reed canary grass
Beaver Activity:	Moderate

Issues
Bank erosion (exposed sewer manhole)
Culvert of unknown purpose

Aerial view of Hess Creek, Crestview Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Photo of mainstem Hess Creek at confluence with Corrine Drive Tributary

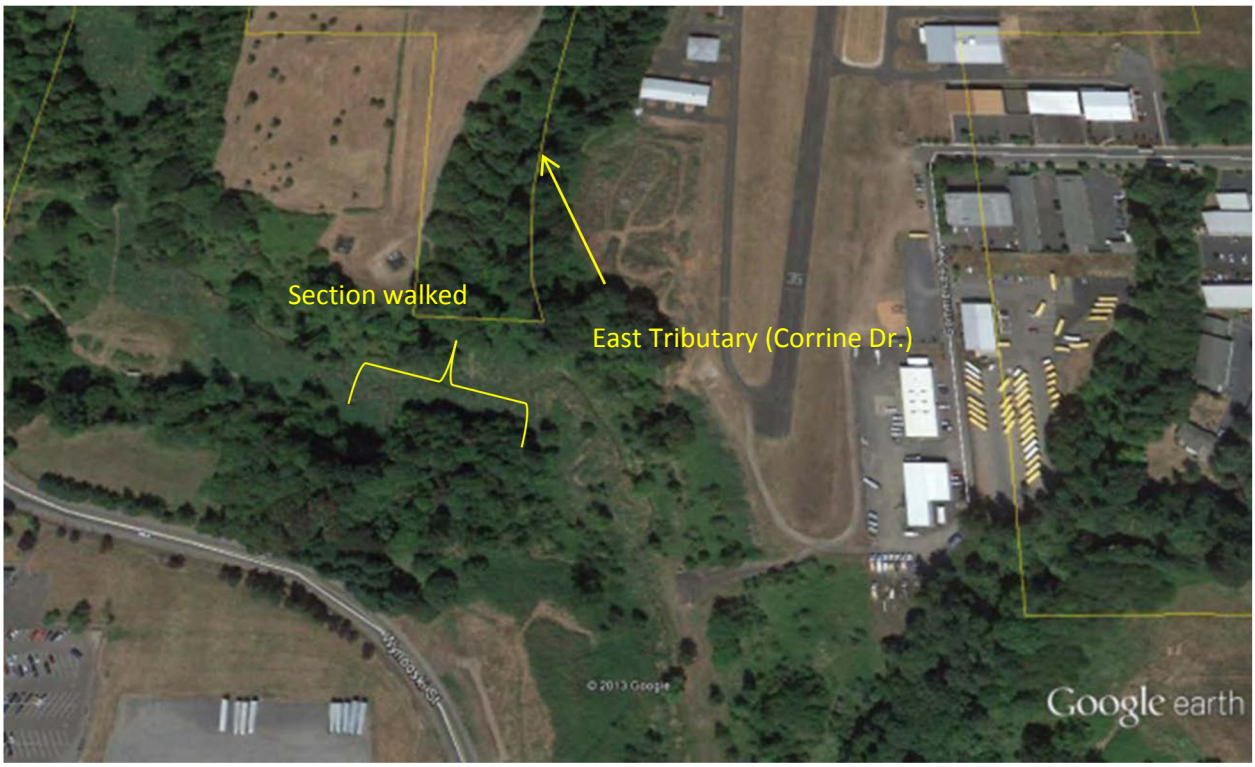
Stream
Hess Creek

Reach
Lower Reach (Near Confluence with East Trib)

General Characteristics

Gradient:	≈ 0.002 ft/ft
Valley Width:	200 – 300 feet
Planform:	Meandering
Average BFW:	≈ 11 feet
Average BFD:	≈ 2.5 feet
Substrate:	Silt
Vegetation:	Reed canary grass, blackberries, mixed vegetation along slopes at forest edge.
Beaver Activity:	None

Issues
Fair amount of bank slumping in this reach



Aerial view of Hess Creek, East Tributary Confluence Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Typical stream section upstream of NE Benjamin Road

Stream
Spring Brook Mainstem

Reach
Upper Reach (Upstream of Benjamin Road)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 8 ft
Average BFD:	≈ 3 ft
Substrate:	Silt
Vegetation:	Shrubs, lawn (residential areas)
Beaver Activity:	None

Issues
Flooding at Benjamin Road during larger events

Aerial view of Spring Brook in the vicinity of NE Benjamin Road

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photos of Hess Creek through Hoover Park (downstream of Hwy 99), and flooding during January 2011.

Stream
Hess Creek

Reach
Lower Reach (Hoover Park)

General Characteristics

Gradient:	≈ 0.006 ft/ft
Valley Width:	200 – 300 feet
Planform:	Channelized
Average BFW:	≈ 8 feet
Average BFD:	≈ 3 feet
Substrate:	Silt
Vegetation:	Lawn, blackberries and reed canary grass in undeveloped areas.
Beaver Activity:	None

Issues
Park flooding during larger storms.

Aerial view of Hess Creek, Hoover Park reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photos of stream reach below Mountainview Drive. Residential drainage pipes enter channel on west side.

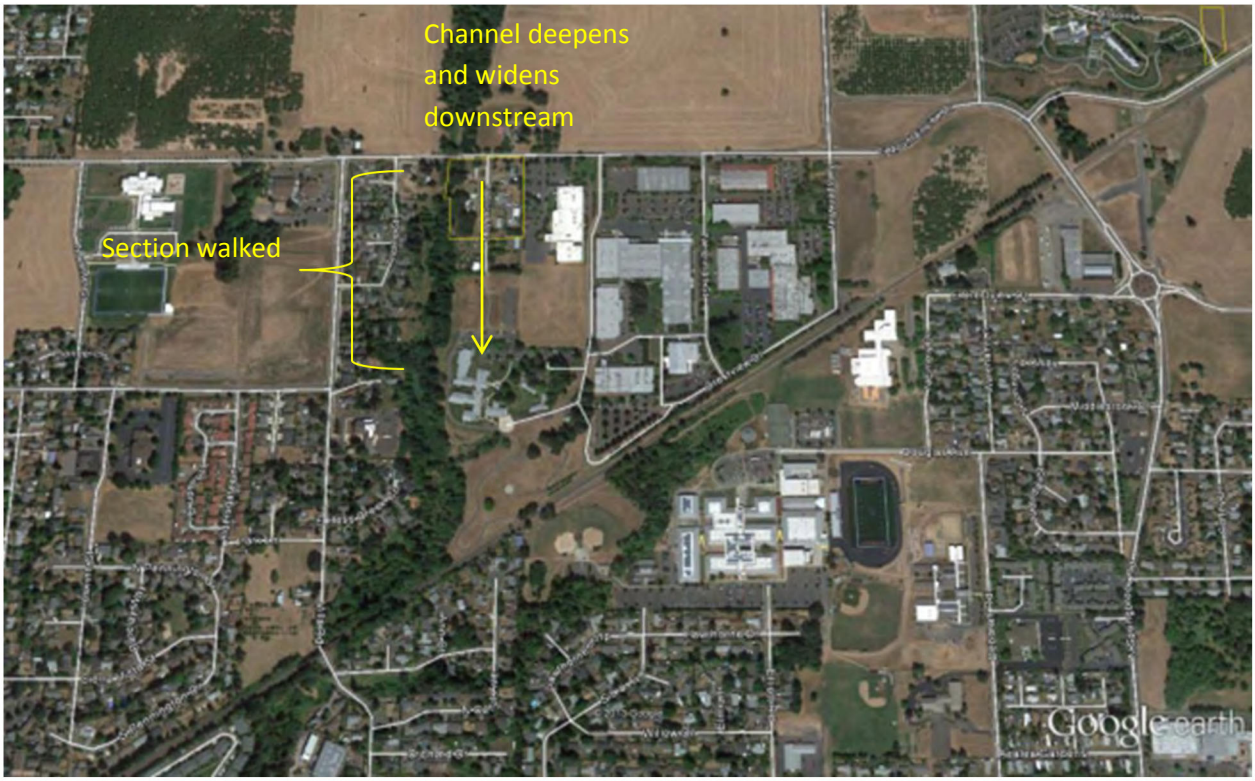
Stream
Hess Creek

Reach
Upper Reach (Below Mtn. View Dr.)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 -150 feet
Planform:	Meandering
Average BFW:	≈ 7 feet (3 – 12)
Average BFD:	≈ 3 feet (2 - 10
Substrate:	Primarily silt, some gravel
Vegetation:	Residential landscaping, lawn, trees adjacent to channel
Beaver Activity:	None

Issues
Downcutting. Some bank erosion.



Aerial view of Hess Creek, Mountainview downstream

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

One of many beaver dams in the Hess Creek reach above Mountainview Drive

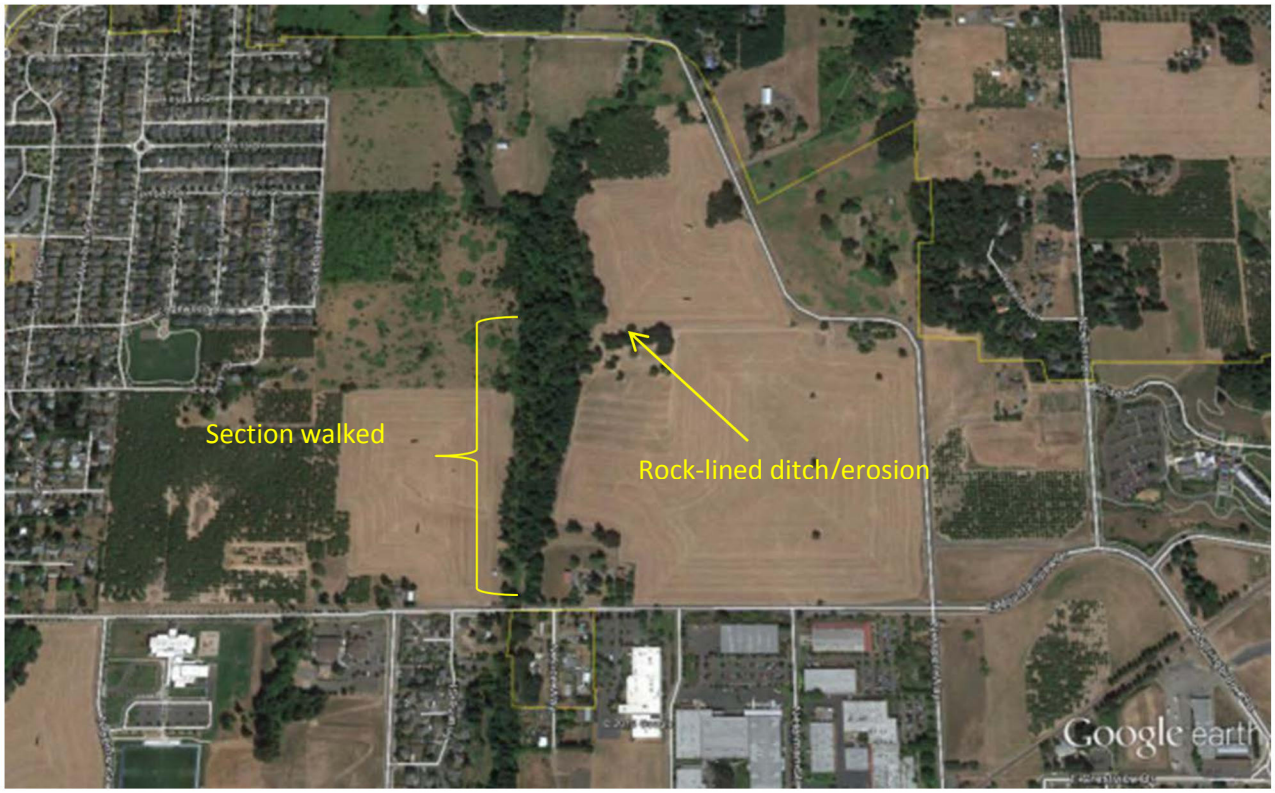
Stream
Hess Creek

Reach
Upper Reach (Above Mtn. View Dr.)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 9 feet
Average BFD:	≈ 3 feet
Substrate:	Primarily silt, some gravel, bedrock above Mountainview Dr
Vegetation:	Narrow forested riparian area, reed canary grass
Beaver Activity:	Significant

Issues
Significant erosion at ditch outfall



Aerial view of Hess Creek, Mountainview Drive Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Typical stream section between Fernwood Rd and Hayes St

Stream
Spring Brook West Tributary

Reach
Upper Reach (Upstream of Fernwood)

General Characteristics

Gradient:	≈ 0.012 ft/ft
Valley Width:	50 – 100 feet
Planform:	Relatively straight
Average BFW:	≈ 7 ft
Average BFD:	≈ 3 ft
Substrate:	Silt
Vegetation:	Mixed forest. Fairly nice riparian area.
Beaver Activity:	None

Issues
Many groundwater seeps, especially on west bank.

Aerial view of Spring Brook West Tributary in the vicinity of E Fernwood Rd

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photo of Hess Creek through GFU campus

Stream
Hess Creek

Reach
Middle Reach (George Fox University)

General Characteristics

Gradient:	≈ 0.005 ft/ft
Valley Width:	150 – 200 feet
Planform:	Meandering
Average BFW:	≈ 10 feet
Average BFD:	≈ 3 feet
Substrate:	Silt
Vegetation:	Native plants (significant restoration activity)
Beaver Activity:	None

Issues
No significant issues. GFU has and continues to restore reach.

Aerial view of Hess Creek, George Fox University Reach

Appendix D: CIP Fact Sheets and Cost Estimate

Use of contents on this sheet is subject to the limitations specified on the title page of this document.

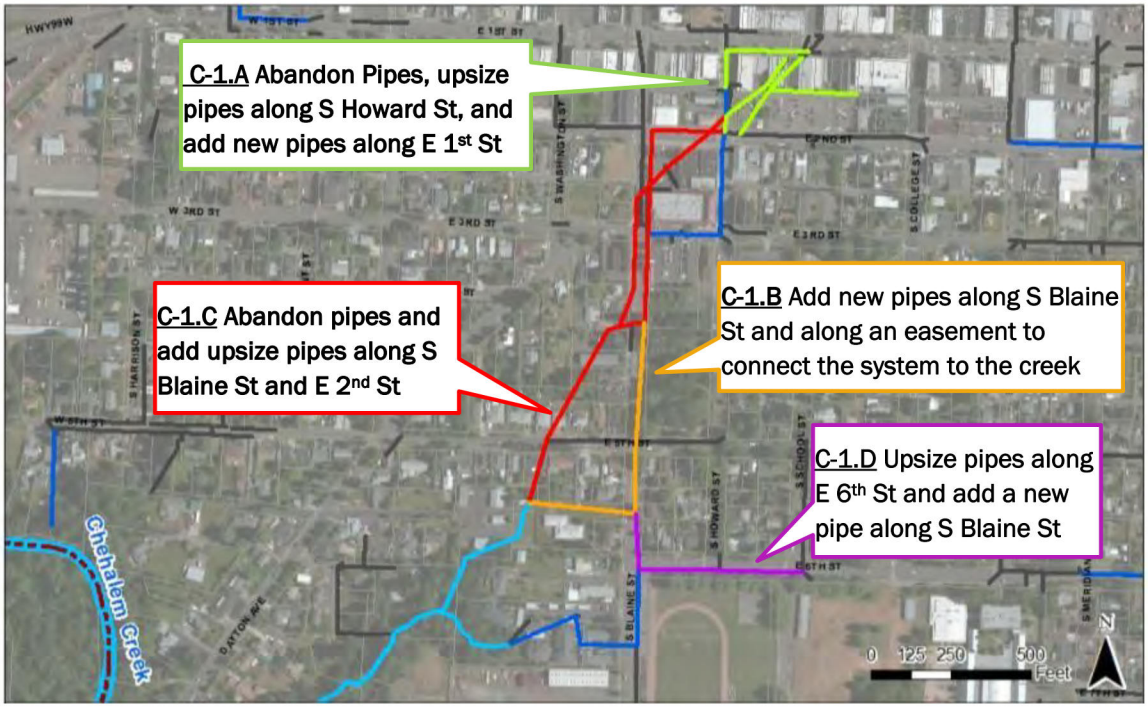
City of Newberg
Stormwater Master Plan
Prioritized Capital Improvement Projects

		Prioritization Criteria Scores							TOTAL SCORE	Implementation Timeline		
		COST	SAFETY LIABILITY	COMPLEXITY	IMPACT	ENVIRON. BENEFIT	REDUCE MAINT. COST	SUSTAIN/ LIVABILITY		Short Term (0-5 Year)	Mid Term (6-10 Year)	Long Term (>10 Year)
CIP No.	**Project Name**		***1.0***	***0.5***	***0.5***	***0.5***	***1.0***	***0.5***				
C-1	Blaine St Improvements - Design	$180,000	Design prior to all C-1 Projects						n/a	X		
C-1A	S Blaine St Improvements - 99W to 2nd St Parking Lot Decommissioning/Replacement	$131,100	3	2	2	1	3	3	10.0	X		
C-1B	S Blaine St Improvements - S Blaine St Pipe Replacement	$383,600	3	1	3	1	2	3	9.0	X		
C-1C	S Blaine St Improvements - E 2nd St to E 5th St Pipe Decommissioning/Replacement	$290,600	3	1	3	1	3	3	10.0	X		
C-1D	S Blaine St Improvements - E 6th Street Pipe Replacement	$175,800	1	2	2	1	2	2	6.5			X
C-2	S Center St Improvements - Design	$180,000	Design prior to all C-2 Projects						n/a	X		
C-2A	S Center St Improvements - E 9th St to S Center Pipe Decommissioning	$293,600	3	2	3	1	3	3	10.5	X		
C-2B	S Center St Improvements - Center, 7th and 8th Street Pipe Replacement	$930,500	1	2	3	1	2	2	7.0			X
C-3	E Columbia Dr Improvements	$79,300	1	3	2	1	3	2	8.0		X	
C-4	Oxford St Improvements	$1,092,100	1	2	2	1	3	2	7.5		X	
C-5	N College St Improvements	$259,500	1	2	2	1	2	2	6.5			X
C-6	S River St Improvements	$159,900	2	3	2	1	3	2	9.0	X		
C-7	S College St at Andrew St Improvements	$196,200	1	1	3	2	2	2	7.0			X
C-8	Dayton Avenue Green Streets	$124,900	2	3	1	2	1	3	7.5		X	
H-1	N Elliot Rd Improvements*	$239,400	1	2	1	1	1	3	5.5			X
H-2	N Edwards St Improvements	$1,217,000	1	1	3	1	1	3	6.0			X
H-3	E 3rd St Improvements - Design	$142,000	Design prior to all H-3 Projects						n/a			X
H-3A	E 3rd St Improvements - S Church and E 1st Street	$403,600	1	2	2	2	1	2	6.0			X
H-3B	E 3rd St Improvements - E 3rd Street	$341,100	1	2	2	1	1	2	5.5			X
H-4	Villa Rd Improvements*	$103,900	2	1	2	3	2	2	8.0		X	
S-1	N Springbrook Rd Improvements**	$776,600	1	2	2	1	2	2	6.5			X
S-2	Libra St Improvements	$246,500	1	2	1	1	3	2	7.0			X
A-1	Streambank Protection Projects	$190,000	2	2	1	3	2	2	8.0		X	
	Totals	$8,137,200								$ 1,618,800	$ 1,590,200	$ 4,928,200

*Project to be installed with roadway improvement project. Schedule dependent on transportation priorities.
**Project to be designed and installed with water and sewer utilities. Schedule based on joint priorities.

CIP Rating Criteria					
Criteria		Weight	Score Definition		
			3	2	1
1	SAFETY/LIABILITY	1.0	Significant Hazard; Threat to life and limb and or property	Moderate safety hazard	No safety hazard
2	COMPLEXITY	0.5	May be done by small crew in less than a month's time	Typical moderate level of difficulty project.	Requires significant design, contract SP's, complex construction, and/or permitting
3	IMPACT	0.5	Problem affects region-wide area with significant downstream and/or upstream impacts	Problem affects a small sub-basin.	Problem affects only a few individual properties
4	ENVIRONMENTAL BENEFIT	0.5	Significantly improves water quality and wildlife habitat	Moderately improves water quality and wildlife habitat	No water quality or wildlife benefit
5	LONG-TERM MAINTENANCE	1.0	Project will reduce or eliminate ongoing maintenance requirements	No change in maintenance	Project could increase City's needed maintenance activities
6	SUSTAINABILITY / LIVABILITY	0.5	Project is a long term solution that will be sustained for multiple generations. Or project adds infrastructure in deficient areas	Project is adequate to address needs in master plan timeline (10-15 years)	Short term solution that may require additional projects down the road

	Criteria Definition	
1	SAFETY/LIABILITY	What potential safety and/or liability issues are involved?
2	COMPLEXITY	How quickly can the solution be implemented and with what level of effort?
3	IMPACT	How large an area and/or how many people does the problem impact?
4	ENVIRONMENTAL BENEFIT	Are there direct environmental benefits associated with the projects?
5	LONG-TERM MAINTENANCE	Will this cause a long-term maintenance burden?
6	SUSTAINABILITY / LIVABILITY	Will the project improve the quality of life? Is this what our grandchildren would want?



Project Name	C-1: S Blaine St Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	62.0 acres
Associated Modeled Pipes/Conduits	STGM3838 and STGM685 to STMF135
Objective(s) Addressed	Pipe Replacement - Location; Structural Integrity; Flood Control

Project Description

Currently a reach of 10"-18" stormwater pipe runs through private property and under several houses. Flooding along E 6th St and S Blaine St occurs during the current and future conditions 10-year storm events.

Due to project size, this CIP has been sub-divided into several projects.

Survey and Design **$ 180,000**

C-1.A 99W to 2nd St Parking Lot Pipe Decommissioning/Replacement **$ 131,100**

A. Decommission the stormwater pipes which are in private property and add a 12" stormwater pipe along E 1st St. Upsize the stormwater pipe along S Howard St to convey existing and future flows.

C-1.B S Blaine St Pipe Replacement **$ 383,600**

B. Add new 30" stormwater pipes along S Blaine St to convey existing and future flows.

C-1.C E 2nd St to E 5th St Pipe Decommissioning/Replacement **$ 290,600**

C. Decommission the stormwater pipes which are in private property and add/upsize pipes to 18" and 24" to convey existing and future flows and connect to the new stormwater system along S Blaine St.

C-1.D E 6th St and S Blaine St Pipe Replacement **$ 175,800**

D. Upsize existing stormwater pipes to 18"to convey existing and future flows. Connect the stormwater system from E 6th St to S Blaine St to provide conveyance and storage.

See the detailed cost estimate in tables: Survey and Design Cost, C-1.A, C-1.B, C-1.C, and C-1.D.

Capital Project Implementation Cost Total	$ 1,161,100
Existing to Future % Flow Increase[1]	5%

Design Assumptions

Existing pipes on private property must be properly abandoned to maintain long term structural integrity.

Obtain an easement west of S Blaine St to connect to the existing stormwater system.

City preference is to have stormwater line run in the planter strip on the west side of S Blaine St.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

MEMORANDUM

ENGINEERING SERVICES DEPARTMENT
P.O. Box 970 • 414 E. First Street • Newberg, Oregon 97132 • Tel 503.537.1240

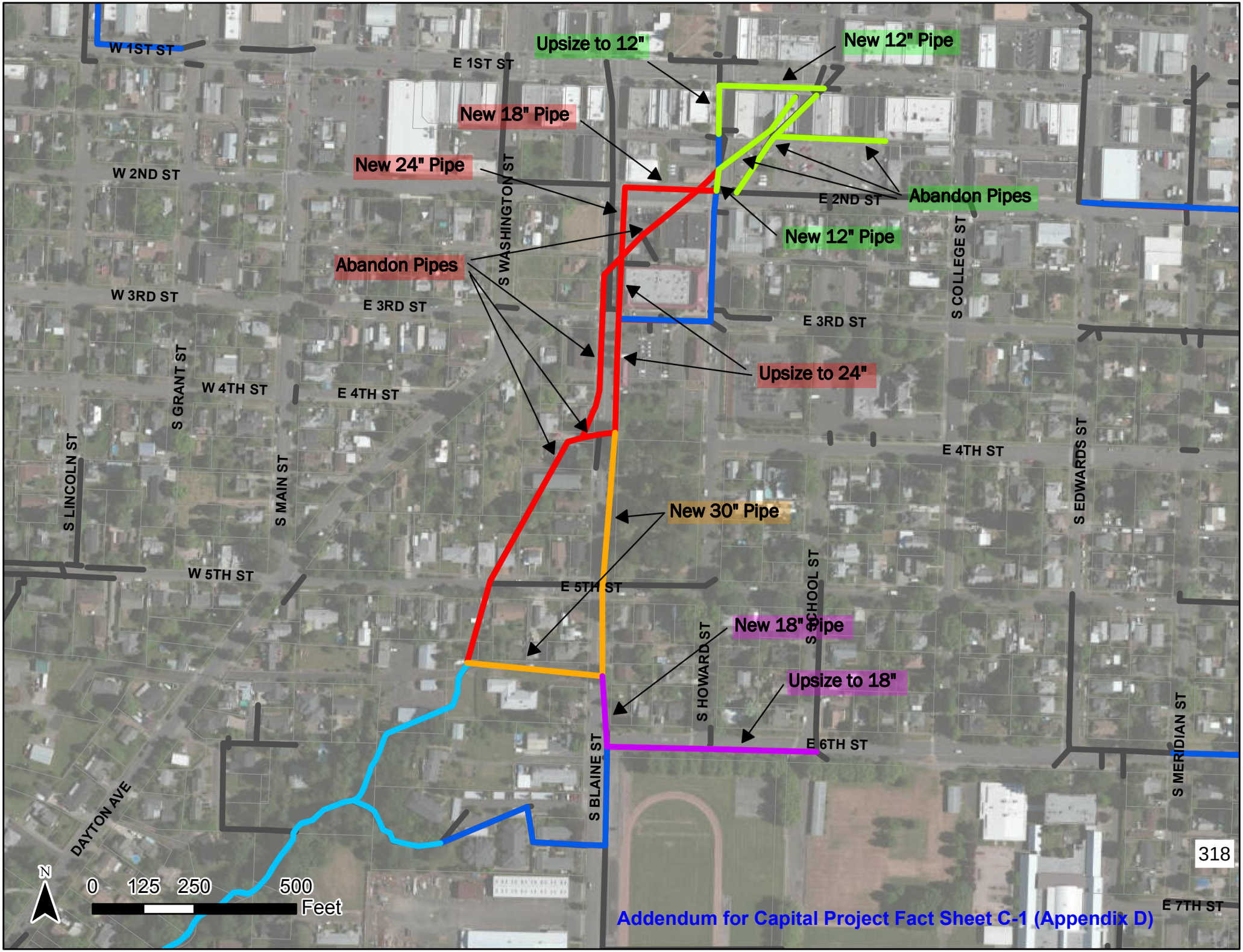
SUBJECT: **Addendum for the Stormwater Master Plan 2014**
DATE: February 2, 2015

To make the adopted Stormwater Master Plan (2014 edition) more user friendly, the following attachments are added:

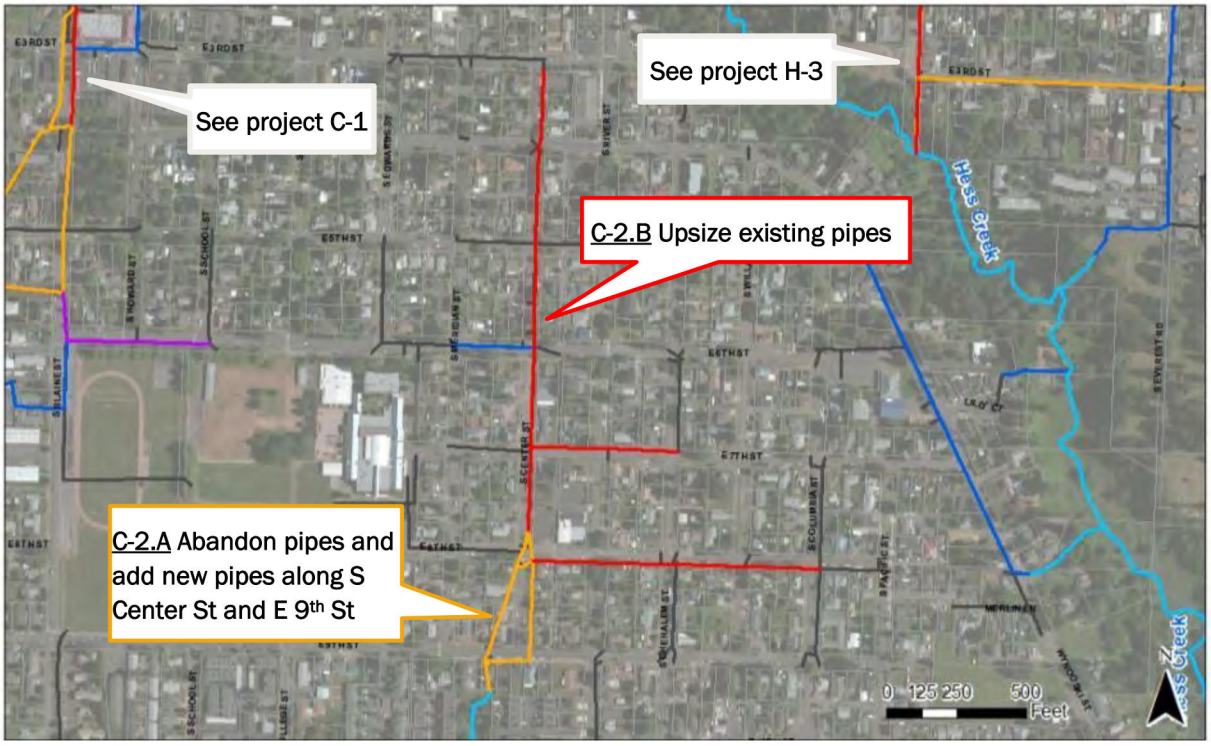
- Table B-2, sorted by the Upstream Node names. Note that the table is still arranged into 3 sections – Chehalem starting on Page 1, Hess on Page 8, and Spring Brook on Page 13. (Note: Table B-2 in the original master plan was sorted by the Conduit ID.) Please insert to Appendix B.

- Supplemental map for CIP C-1, showing the proposed pipe sizes.
  Please insert to the fact sheets in Appendix D.

Thank you.



Addendum for Capital Project Fact Sheet C-1 (Appendix D)



Project Name	C-2: S Center St Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	100.1 acres
Associated Modeled Pipes/Conduits	STGM1039, STGM1093, and STGM1333 to J4572
Objective(s) Addressed	Pipe Replacement - Location; Structural Integrity; Flood Control

Project Description

Currently a reach of 21" stormwater pipe runs through private property and under several houses. Flooding along E 8th St, E 7th St, and S Center St occurs during the current and future conditions 10-year storm events.

Decommission the stormwater pipes which are on private property and add a 30" stormwater pipe along S Center St. Upsize existing stormwater pipes to 30", 24" and 18"to convey existing and future flows.

Due to project size, this CIP has been sub-divided into several projects.

Survey and Design		**$ 180,000**
C-1.A	**E 9th St to S Center St Pipe Decommissioning**	**$ 293,600**
	E. Decommission the stormwater pipes which are on private property and add a 30" stormwater pipe along S Center St and E 9th St.	
C-1.B	**S Center St, E 8th St, and E 7th St Pipe Replacement**	**$ 930,500**
	F. Upsize existing stormwater pipes to 30", 24" and 18"to convey existing and future flows.	

See the detailed cost estimate in tables: Survey and Design Cost, C-2.A, and C-2.B.

Capital Project Implementation Cost Total	**$ 1,404,100**
Existing to Future % Flow Increase[1]	**5%**

Design Assumptions

Existing pipes on private property must be property abandon to maintain long term structural integrity.

Obtain an easement in the location of the existing pipe, which runs under a driveway on a flag lot.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	C-3: E Columbia Dr Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	56.7 acres
Associated Modeled Pipes/Conduits	STGM4199 to J4362
Objective(s) Addressed	Flood Control

Project Description

Flow is currently limited by three undersized 18" pipes which restrict flow from larger-diameter upstream pipes. This has been a maintenance concern for some time. Hydraulic modeling shows overflow from manholes during the 10-year existing/future flow event. Downstream pipe segments are 24" diameter and have capacity for current and future 10-year flow events.

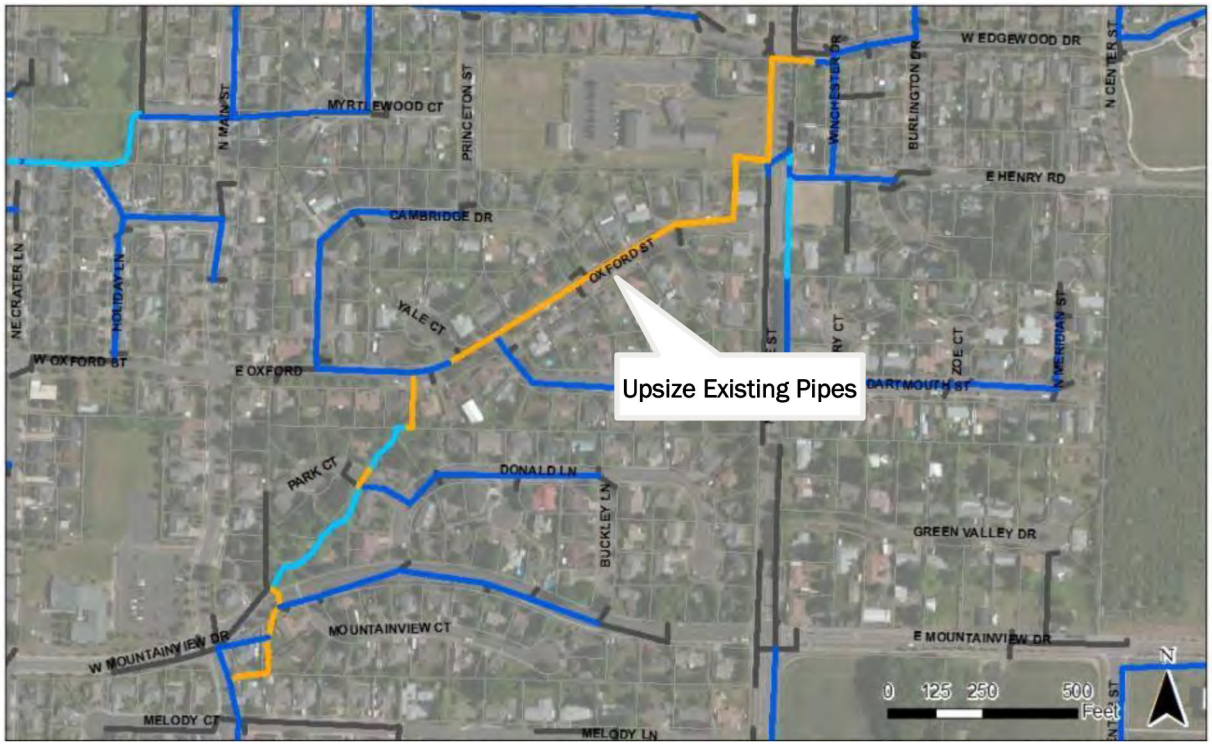
Upsize existing stormwater pipes to 24" to convey existing and future flows.

Estimated Planning Cost (2014 dollars, rounded to the thousand)

Capital Expense Sub-total (See Appendix E for details)	$ 38,600
Mobilization/Demobilization (10%)	$ 3,900
Traffic Control/Utility Relocation (5%)	$ 1,900
Erosion Control (2%)	$ 800
Construction Cost Sub-total	$ 45,200
Construction Contingency (30%)	$ 13,500
Capital Expense Total	$ 58,700
Engineering and Permitting (30%)	$ 17,600
Construction Administration (5%)	$ 2,900
Capital Project Implementation Cost Total	**$ 79,300**
Existing to Future % Flow Increase[1]	**15%**

Design Assumptions

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*



Project Name	C-4: Oxford St Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	167.4 acres
Associated Modeled Pipes/Conduits	STGM276 to J4162
Objective(s) Addressed	Flood Control

Project Description

Flow is currently restricted by fourteen undersized pipes. Flooding from manholes is shown to occur during the 10-year existing/future flow event. Pipe diameters increase and decrease in numerous places throughout this alignment. The City has installed an orifice plate which forces flows into a detention basin at Winchester and Edgewood. This project provides a wider solution to provide long term capacity.

Upsize existing stormwater pipes to 36" to provide capacity for future flows. Utilize existing structures where possible.

Estimated Planning Cost (2014 dollars, rounded to the thousand)

Capital Expense Sub-total (See Appendix E for details)	$ 574,400
Mobilization/Demobilization (10%)	$ 57,400
Traffic Control/Utility Relocation (5%)	$ 28,700
Erosion Control (2%)	$ 11,500
Construction Cost Sub-total	$ 672,100
Construction Contingency (30%)	$ 201,600
Capital Expense Total	$ 873,700
Engineering and Permitting (20%)	$ 174,700
Construction Administration (5%)	$ 43,700
Capital Project Implementation Cost Total	**$ 1,092,100**
Existing to Future % Flow Increase[1]	**5%**

Design Assumptions

The culvert at E Mountainview Drive has limited pipe cover – alternate pipe materials or roadway surfacing may need to be considered during project design.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	C-5: N College St Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	102.8 acres
Associated Modeled Pipes/Conduits	STGM4127 to STMG0727
Objective(s) Addressed	Flood Control

Project Description

Flow is currently restricted by four undersized pipes during the current and future conditions 10-year storm events.

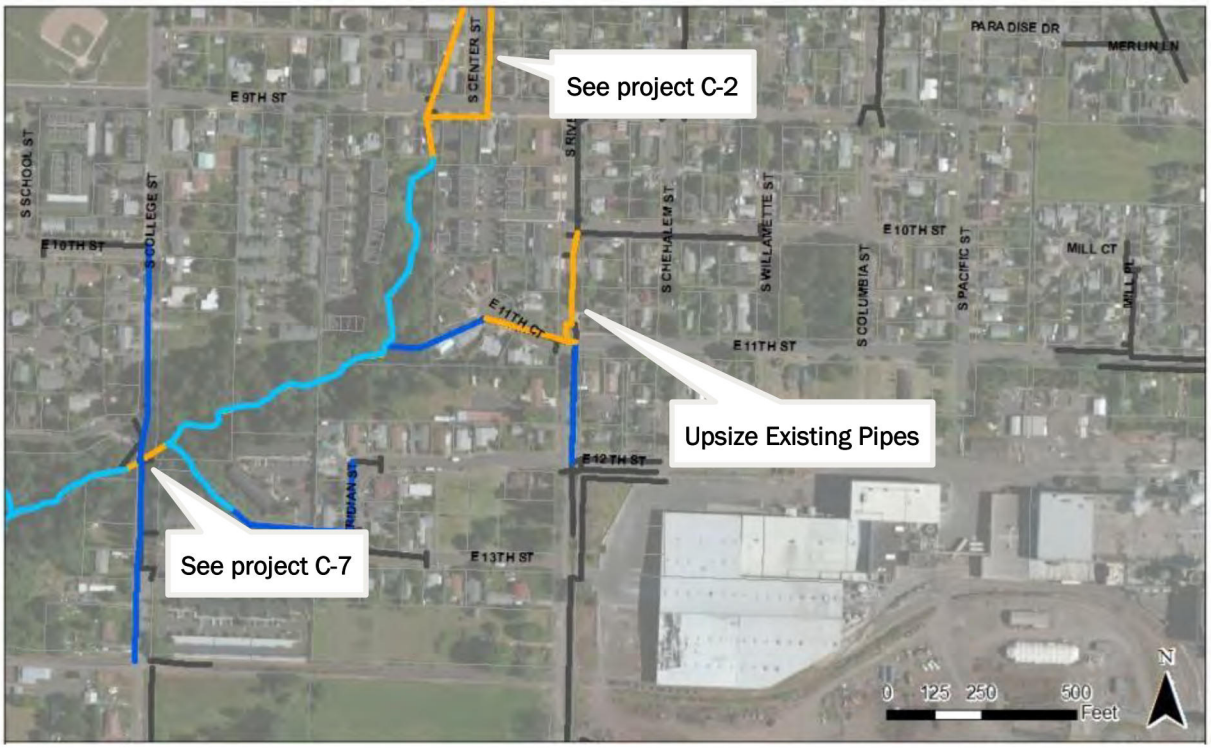
Upsize existing stormwater pipes to 24" to convey existing and future flows.

Estimated Planning Cost (2014 dollars, rounded to the thousand)	
Capital Expense Sub-total (See Appendix E for details)	$ 136,500
Mobilization/Demobilization (10%)	$ 13,700
Traffic Control/Utility Relocation (5%)	$ 6,800
Erosion Control (2%)	$ 2,700
Construction Cost Sub-total	$ 159,700
Construction Contingency (30%)	$ 47,900
Capital Expense Total	$ 207,600
Engineering and Permitting (20%)	$ 41,500
Construction Administration (5%)	$ 10,400
Capital Project Implementation Cost Total	**$ 259,500**
Existing to Future % Flow Increase[1]	**10%**

Design Assumptions

Utilize existing structures wherever possible.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*



Project Name	C-6: S River St Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	27.0 acres
Associated Modeled Pipes/Conduits	CIP_C-7_01 to STMG136
Objective(s) Addressed	Pipe Replacement - Material

Project Description

Carry-over project from the 2001 Stormwater Master Plan.

Two clay sewer tile pipe segments will be replaced with 18" pipe to convey existing and future flows.

Estimated Planning Cost (2014 dollars, rounded to the thousand)	
Capital Expense Sub-total (See Appendix E for details)	$ 77,900
Mobilization/Demobilization (10%)	$ 7,800
Traffic Control/Utility Relocation (5%)	$ 3,900
Erosion Control (2%)	$ 1,600
Construction Cost Sub-total	$ 91,100
Construction Contingency (30%)	$ 27,300
Capital Expense Total	$ 118,500
Engineering and Permitting (20%)	$ 35,500
Construction Administration (5%)	$ 5,900
Capital Project Implementation Cost Total	**$ 159,900**
Existing to Future % Flow Increase[1]	**5%**

Design Assumptions

Utilize existing structures wherever possible.

Project is adjacent to the Hwy 99 Bypass alignment. This project could be addressed during the bypass construction.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	C-7: S College St at Andrew St Improvements
Drainage	Chehalem Creek
Contributing Drainage Area	171.5 acres
Associated Modeled Pipes/Conduits	STGM2909 to J-CCT1-04
Objective(s) Addressed	Pipe Replacement - Material

Project Description

Existing pipe system under S College Street is composed of multiple pipe materials, causing maintenance problems and concerns over long term stability.

Replace two existing culverts with 130 LF of 48" culvert.

Estimated Planning Cost (2014 dollars, rounded to the thousand)

Capital Expense Sub-total (See Appendix E for details)	$ 99,000
Mobilization/Demobilization (10%)	$ 9,900
Traffic Control/Utility Relocation (10%)	$ 9,900
Erosion Control (2%)	$ 2,000
Construction Cost Sub-total	$ 120,700
Construction Contingency (30%)	$ 36,200
Capital Expense Total	$ 157,000
Engineering and Permitting (20%)	$ 31,400
Construction Administration (5%)	$ 7,800
Capital Project Implementation Cost Total	**$ 196,200**
Existing to Future % Flow Increase[1]	**5%**

Design Assumptions

Culvert replacement has the potential for significant roadway impacts during construction. A well-designed traffic control plan will be required.

Additional engineering costs have been added to allow design to consider additional alternatives (e.g. pipe busting, open bottom culvert, etc)

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	C-8: Dayton Ave Green Street Conveyance
Drainage	Chehalem Creek
Contributing Drainage Area	13.4 acres
Associated Modeled Pipes/Conduits	N/A
Objective(s) Addressed	Water Quality; Flood Control

Project Description

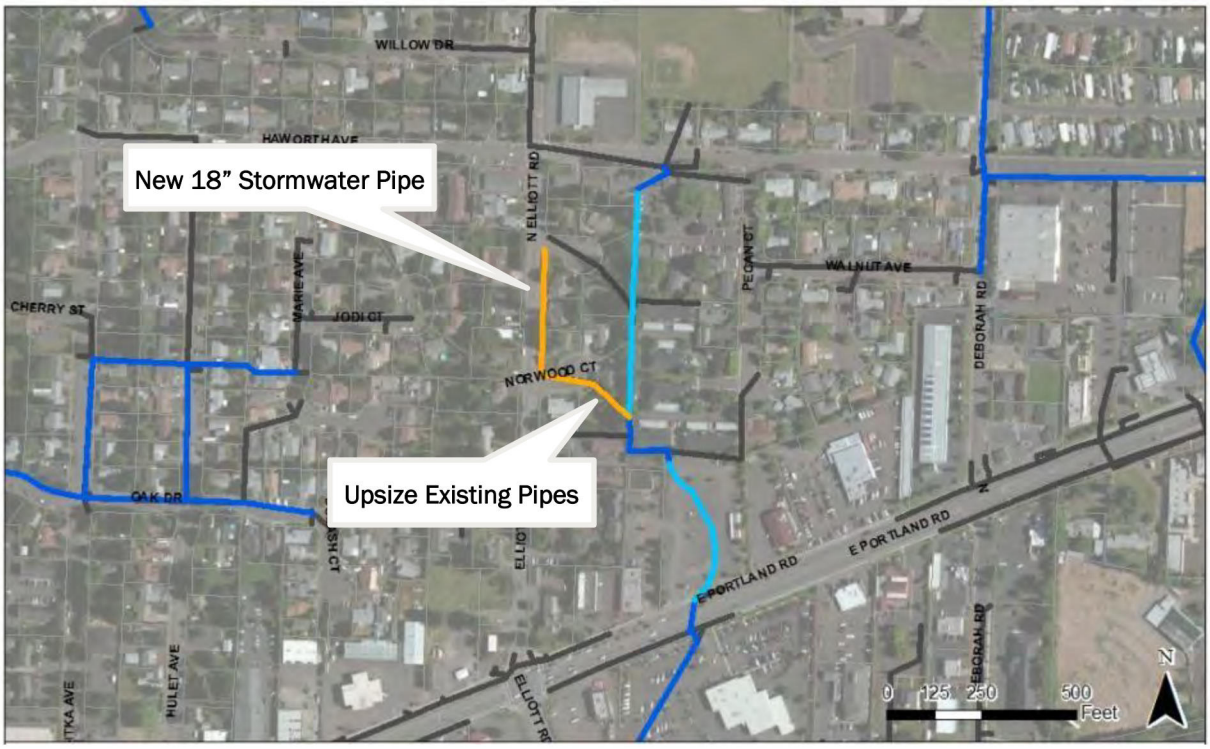
The City has reported drainage problems along Dayton Ave near W Johanna Ct. The resident at 606 NE Dayton Ave has reported frequent flooding of their driveway.

Add six stormwater planters (Low Impact Development/Green Stormwater Infrastructure Design) along Dayton Ave to provide storage capacity and water quality improvements.

Estimated Planning Cost (2014 dollars, rounded to the thousand)	
Capital Expense Sub-total (See Appendix E for details)	$ 65,700
Mobilization/Demobilization (10%)	$ 6,600
Traffic Control/Utility Relocation (10%)	$ 3,300
Erosion Control (2%)	$ 1,300
Construction Cost Sub-total	$ 76,900
Construction Contingency (30%)	$ 23,100
Capital Expense Total	$ 99,900
Engineering and Permitting (20%)	$ 20,000
Construction Administration (5%)	$ 5,000
Capital Project Implementation Cost Total	**$ 124,900**
Existing to Future % Flow Increase[1]	**0%**

Design Assumptions

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*



Project Name	H-1: N Elliot Rd Improvements
Drainage	Hess Creek
Contributing Drainage Area	17.8 acres
Associated Modeled Pipes/Conduits	Drains to STMI1140
Objective(s) Addressed	Improve Drainage Infrastructure Network

Project Description

The City has reported drainage problems along N Elliot Rd as the area does not have a public drainage system, resulting in frequent ponding during storm events.

Add a drainage system to convey flows from N Elliot Rd to the existing system to the east. The proposed pipe system is sized to convey both current and future flows.

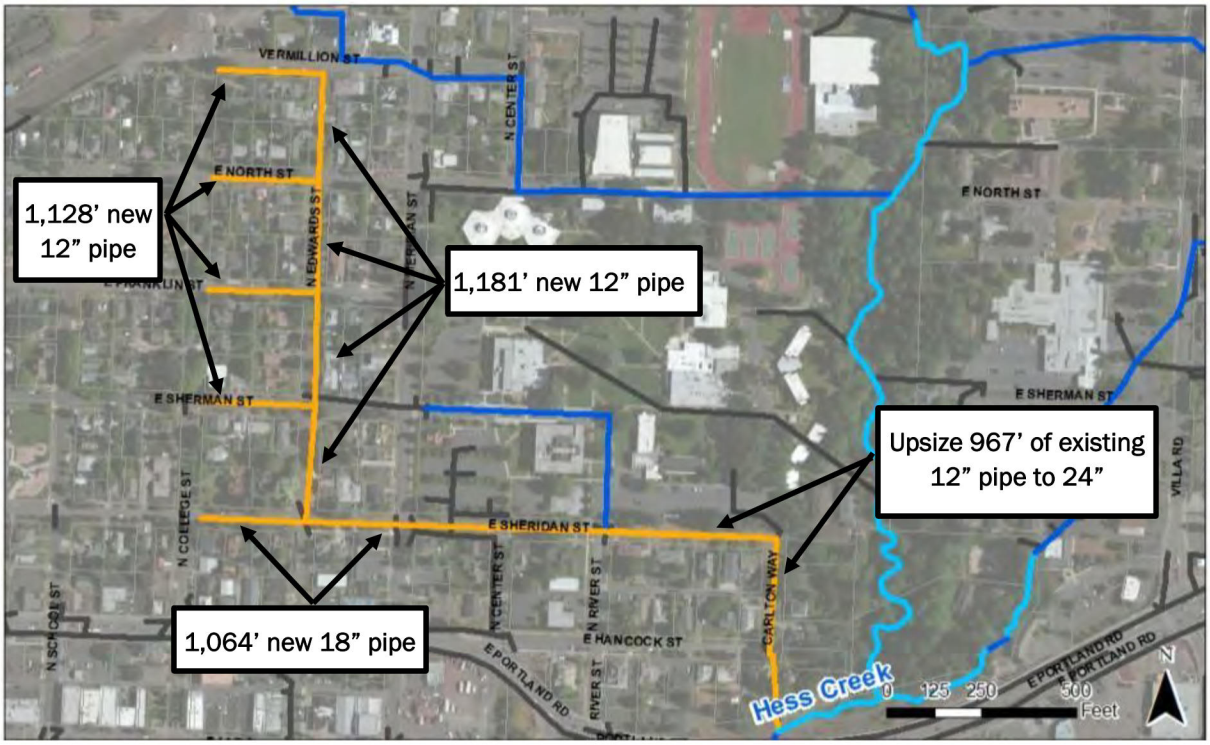
Estimated Planning Cost (2014 dollars, rounded to the hundred)

Capital Expense Sub-total (See Appendix F for details)	$ 125,900
Mobilization/Demobilization (10%)	$ 12,600
Traffic Control/Utility Relocation (5%)	$ 6,300
Erosion Control (2%)	$ 2,500
Construction Cost Sub-total	$ 147,300
Construction Contingency (30%)	$ 44,200
Capital Expense Total	$ 191,500
Engineering and Permitting (20%)	$ 38,300
Construction Administration (5%)	$ 9,600
Capital Project Implementation Cost Total	**$ 239,400**
Existing to Future % Flow Increase[1]	**5%**

Design Assumptions

Utilize the easement south of Norwood Ct to connect to the existing stormwater system.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*



Project Name	H-2: N Edwards St Improvements
Drainage	Hess Creek
Contributing Drainage Area	38.0 acres
Associated Modeled Pipes/Conduits	Drains to STMG1228
Objective(s) Addressed	Flood control; Improve Drainage Infrastructure Network

Project Description

The City has reported drainage problems along Vermillion St between N College St and the railroad. Currently a flat and undersized pipe discharges stormwater along the railroad tracks. This neighborhood has some bubblers at intersections, but does not have a defined connection to the public stormwater system.

Add a drainage system to convey flows from Vermillion St to the existing drainage system at E Sheridan St. Proposed pipes are sized to convey both current and future flows.

Estimated Planning Cost (2014 dollars, rounded to the hundred)

Capital Expense Sub-total (See Appendix F for details)	$ 640,100
Mobilization/Demobilization (10%)	$ 64,000
Traffic Control/Utility Relocation (5%)	$ 32,000
Erosion Control (2%)	$ 12,800
Construction Cost Sub-total	$ 748,900
Construction Contingency (30%)	$ 224,700
Capital Expense Total	$ 973,600
Engineering and Permitting (20%)	$ 194,700
Construction Administration (5%)	$ 48,700
Capital Project Implementation Cost Total	**$ 1,217,000**
Existing to Future % Flow Increase[1]	**0%**

Design Assumptions

The City has an additional maintenance project to address local drainage and pave gravel areas on Vermillion Street, west of College Street. Flow through planters could be added as a water quality retrofit to the area.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	H-3: E 3rd St Improvements
Drainage	Hess Creek
Contributing Drainage Area	40.7 acres
Associated Modeled Pipes/Conduits	STGM3290 and STGM3810 to Hess Creek Confluence
Objective(s) Addressed	Flood Control

Project Description

Modeling shows flooding problems along E 3rd St and S Church St during the current and future conditions 10-year storm events.

Due to project size, this CIP has been sub-divided into several projects.

Survey and Design	**$ 142,000**
H-3.A S Church St and E 1st St Improvements	**$ 403,600**

G. Upsize existing stormwater pipes to 30" and 18", as determined by modeling. Install stormwater planters (Low Impact Development/Green Stormwater Infrastructure Design) along E 1st St to provide additional storage capacity and water quality improvements.

H-3.B E 3rd St Improvements	**$ 341,100**

H. Add a 24" stormwater pipe to connect the stormwater system from E 3rd St to S Church St to provide conveyance and storage. Upsize existing stormwater pipes to 24" and 18", as determined by modeling.

See the detailed cost estimate in tables: Survey and Design Cost, H-3.A, and H-3.B.

Capital Project Implementation Cost Total	**$ 886,700**
Existing to Future % Flow Increase[1]	**5%**

Design Assumptions/Notes

E 1st St already has a sewer project that is ready for construction. The City could look at adding stormwater pipe and/or water quality swales at the same time.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	H-4: Villa Rd Improvements
Drainage	Hess Creek
Contributing Drainage Area	1,174.4 acres
Associated Modeled Pipes/Conduits	VILLA_CULVERT_1
Objective(s) Addressed	Pipe Replacement – Material; Flood Control

Project Description

The culvert on Hess Creek at Villa road is a mix of CMP and concrete box culverts. This is an area of maintenance attention during large storm events to prevent flood waters from impeding traffic on Villa Road.

The existing culvert will be upsized from a 30" to a 60" culvert to convey current and future flows.

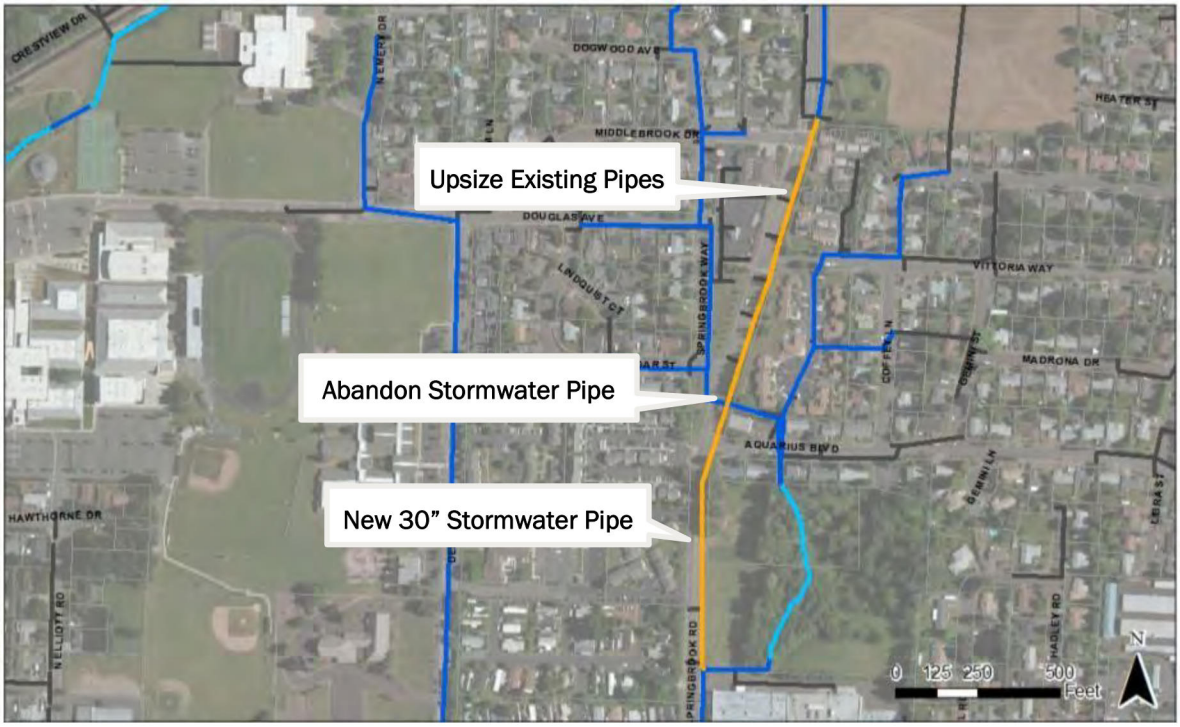
Estimated Planning Cost (2014 dollars, rounded to the thousand)

Capital Expense Sub-total (See Appendix E for details)	$ 51,300
Mobilization/Demobilization (10%)	$ 5,100
Traffic Control/Utility Relocation (5%)	$ 2,600
Erosion Control (2%)	$ 2,600
Construction Cost Sub-total	$ 61,500
Construction Contingency (30%)	$ 18,500
Capital Expense Total	$ 80,000
Engineering and Permitting (30%)	$ 20,000
Construction Administration (5%)	$ 4,000
Capital Project Implementation Cost Total	**$ 103,900**
Existing to Future % Flow Increase[1]	**25%**

Design Assumptions/Notes

This project should be constructed in conjunction with Villa Road widening and roadway improvements.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*



Project Name	S-1: N Springbrook Rd Improvements
Drainage	Spring Brook
Contributing Drainage Area	55.9 acres
Associated Modeled Pipes/Conduits	STGM72 to STMI1019
Objective(s) Addressed	Flood Control

Project Description

Modeling shows flooding problems along N Springbrook Rd during the current and future conditions 10-year storm event. The upstream stormwater system along N Springbrook Rd was upgraded during installation of traffic improvements, but flows are constricted from a 30" pipe down to an 8"-12" section of pipe near Middlebrook Dr.

Upsize the stormwater pipes along N Springbrook Rd to 30" diameter and connect the system to the existing system to the south. The proposed pipe system is sized for both current and future flows.

Estimated Planning Cost (2014 dollars, rounded to the thousand)

Capital Expense Sub-total (See Appendix E for details)	$ 408,500
Mobilization/Demobilization (10%)	$ 40,800
Traffic Control/Utility Relocation (0%)	$ 20,400
Erosion Control (10%)	$ 8,200
Construction Cost Sub-total	$ 477,900
Construction Contingency (30%)	$ 143,400
Capital Expense Total	$ 621,300
Engineering and Permitting (30%)	$ 124,300
Construction Administration (5%)	$ 31,100
Capital Project Implementation Cost Total	**$ 776,600**
Existing to Future % Flow Increase[1]	**10%**

Design Assumptions/Notes

The flow from the undeveloped area east of N Springbrook Rd (N and S of E Crestview Dr) will flow to the stormwater drainage system that runs along N Springbrook Rd. The cost of installing drainage infrastructure through future development areas is not included in this CIP, though the proposed system has been sized with capacity for flows from future development areas.

The Osten property needs to connect to the Springbrook system when it is developed.

The associated 10- and 50-yr maximum flows at STMI1019 are 47.4 and 59.1 cfs, respectively.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

Project Name	S-2: Libra St Improvements
Drainage	Spring Brook
Contributing Drainage Area	14.4 acres
Associated Modeled Pipes/Conduits	STGM876 to STMJ105
Objective(s) Addressed	Flood Control; Reduce Maintenance Frequency

Project Description

Modeling shows flooding problems along Libra St during the current and future conditions 10-year storm event. This system needs frequent maintenance to address silt accumulation.

Upsize existing stormwater pipes along Libra St to 18" to convey current and future flows.

Estimated Planning Cost (2014 dollars, rounded to the thousand)

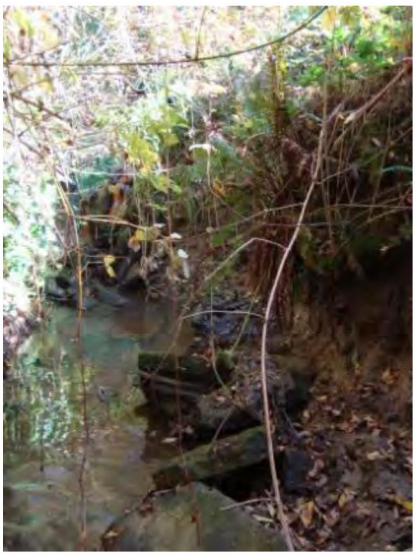
Capital Expense Sub-total (See Appendix E for details)	$ 129,700
Mobilization/Demobilization (10%)	$ 13,000
Traffic Control/Utility Relocation (5%)	$ 6,500
Erosion Control (2%)	$ 2,600
Construction Cost Sub-total	$ 151,700
Construction Contingency (30%)	$ 45,500
Capital Expense Total	$ 197,200
Engineering and Permitting (20%)	$ 39,400
Construction Administration (5%)	$ 9,900
Capital Project Implementation Cost Total	**$ 246,500**
Existing to Future % Flow Increase[1]	**20%**

Design Assumptions/Notes

The flow from the undeveloped area east of N Springbrook Rd (N and S of E Crestview Dr) should be directed to the stormwater drainage system that runs along N Springbrook Rd. The cost to install infrastructure in areas to be developed in the future is not included in this CIP, as pipes in those areas will be a developer responsibility.

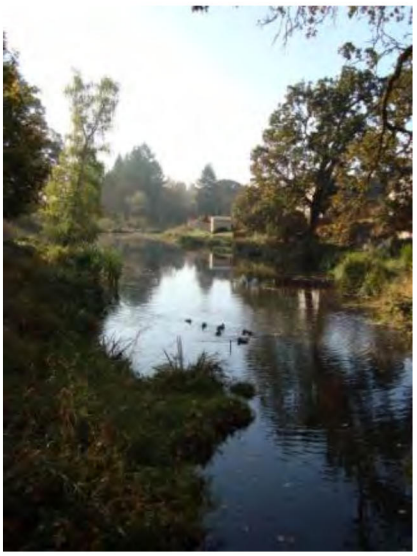
The associated 10- and 50-yr maximum flows at STMJ105 are 17.0 and 23.3 cfs, respectively.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*



West Bank Chehalem Creek
Streambank Erosion

Hess Creek (DS of Mountainview Drive)
Residential Stormwater Outfall



Corrine Tributary to Hess Creek
Detention Pond Outfall Retrofit

Project Name	A-1: Streambank Protection Improvements
Drainage	Hess Creek, Chehalem Creek, and Spring Brook
Contributing Drainage Area	N/A
Associated Modeled Pipes/Conduits	N/A
Objective(s) Addressed	Water Quality, Stream Restoration

Project Description

The stream channel assessment identified problem areas in the creek where erosion was significant.

A. West Bank Chehalem Creek (Upstream of Hwy 240)
   - This project addresses stream bank protection and riparian restoration and landscaping along the west bank of Chehalem Creek.

B. Hess Creek (Downstream of Mountainview Drive)
   - This project addresses an outfall improvement, stream bank protection, and riparian restoration and landscaping along Hess Creek.

C. Corinne Tributary to Hess Creek
   - This project addresses an outfall improvement, stream bank protection, and riparian restoration and landscaping at the detention pond outfall along Corinne Tributary.

D. Two Additional Outfall Protection and Bank Restoration Projects
   - This cost accounts for two additional outfall protection and bank restoration projects. The locations are to be determined upon City field investigation.

Estimated Planning Cost (2014 dollars, rounded to the thousand)

Capital Expense Sub-total (See Appendix E for details)	$ 100,000
Mobilization/Demobilization (10%)	$ 10,000
Traffic Control/Utility Relocation (5%)	$ 5,000
Erosion Control (2%)	$ 2,000
Construction Cost Sub-total	$ 117,000
Construction Contingency (30%)	$ 35,100
Capital Expense Total	$ 152,100
Engineering and Permitting (20%)	$ 30,400
Construction Administration (5%)	$ 7,600
Capital Project Implementation Cost Total	**$190,100**
Existing to Future % Flow Increase[1]	**N/A**

Design Assumptions/Notes: Additional project locations to be determined through stream channel observations.

[1] *Existing to future percent flow increase is based on the 25-year percent peak flow increase from the contributing drainage area between the existing and future land use scenarios for each CIP.*

CIP Cost Summary

CIP Number	CIP Name (Capital Projects)	Total Cost
C-1	Blaine St Improvements - Design	$ 180,000
C-1A	99W to 2nd St Parking Lot Pipe Decommissioning/Replacement	$ 131,000
C-1B	S Blaine St Pipe Replacement	$ 384,000
C-1C	E 2nd St to E 5th St Pipe Decommissioning/Replacement	$ 291,000
C-1D	E 6th St and S Blaine St Pipe Replacement	$ 176,000
C-2	S Center St Improvements - Design	$ 180,000
C-2A	E 9th St to S Center St Pipe Decommissioning	$ 294,000
C-2B	S Center St, E 8th St, and E 7th St Pipe Replacement	$ 930,000
C-3	E Columbia Dr Improvements	$ 79,000
C-4	Oxford St Improvements	$ 1,092,000
C-5	N College St Improvements	$ 260,000
C-6	S River St Improvements	$ 160,000
C-7	S College St at Andrew St Improvements	$ 196,000
H-1	N Elliot Rd Improvements	$ 239,000
H-2	N Edwards St Improvements	$ 1,217,000
H-3	E 3rd St Improvements - Design	$ 142,000
H-3A	S Church St and E 1st St Improvements	$ 404,000
H-3B	E 3rd St Improvements	$ 341,000
H-4	Villa Rd Improvements	$ 104,000
S-1	N Springbrook Rd Improvements	$ 777,000
S-2	Streambank Protection Projects	$ 246,000
A-1	Streambank Protection Projects	$ 190,000
TOTAL		**$ 8,013,000**

CIP Number	CIP Name (Programatic CIP)	Total Cost
P-1	Annual Pipe Replacement Program	$ 100,000
P-2	Water Quality Retrofit Program	$ 50,000
P-3	Water Quality Sensitive O&M Manual	$ 25,000
P-4	SDC Rate Study Revision	$ 15,000
P-5	Master Plan update	$ 250,000
TOTAL		**$ 440,000**

Preliminary Engineering Unit Costs

Storm Drain Pipe Installation Cost (w/ Asphalt) per Linear Foot																	
Cover Depth (feet)	Diameter (inches)																
	12	12-RCP	15	18	18-RCP	24	24-RCP	30	30-RCP	36	36-RCP	42	42-RCP	48	48-RCP	54
2-5	$ 63	$ 78	$ 77	$ 96	$ 112	$ 124	$ 152	$ 159	$ 233	$ 194	$ 294	$ 233	$ 317	$ 269	$ 371	$ 343
5-10	$ 87	$ 102	$ 106	$ 130	$ 146	$ 169	$ 197	$ 213	$ 288	$ 259	$ 359	$ 308	$ 392	$ 354	$ 456	$ 438
10-15	$ 111	$ 126	$ 135	$ 164	$ 180	$ 213	$ 241	$ 268	$ 343	$ 324	$ 424	$ 383	$ 467	$ 440	$ 541	$ 534
15-20	$ 134	$ 150	$ 164	$ 198	$ 214	$ 257	$ 285	$ 322	$ 397	$ 388	$ 488	$ 458	$ 542	$ 525	$ 627	$ 629

City of Newberg - Stormwater Master Plan
Capital Improvement Project
Preliminary Engineering Unit Costs

ITEM	UNIT	UNIT COST
Water Quality Facility Installation		
Stormwater Planter	SF	$37
Structure Installation		
Precast Concrete Manhole (48", 0-8' deep)	EA	$3,000
Precast Concrete Manhole (48", 9-12' deep)	EA	$4,400
Precast Concrete Manhole (60", 0-8' deep)	EA	$4,300
Precast Concrete Manhole (60", 9-12' deep)	EA	$7,700
Precast Concrete Manhole (72", 0-8' deep)	EA	$6,000
Precast Concrete Manhole (72", 9-12' deep)	EA	$11,100
Curb Inlet	EA	$1,700
Catch Basin	EA	$2,000
Connection to Existing Structure	EA	$900
Abandon Existing Structure	EA	$400
Abandon Existing Pipe, no excavation (12")	FT	$8.00
Abandon Existing Pipe, no excavation (15-18")	FT	$18.00
Abandon Existing Pipe, no excavation (21"-24")	FT	$23.00
Abandon Existing Pipe, no excavation (27"-36")	FT	$30.00
Outfall Improvements	EA	$5,000
Pipe Unit Cost		
HDPE Inlet Lead (12", 2-5' Deep)	FT	$63
HDPE Pipeline (12", 5-10' Deep)	FT	$87
HDPE Pipeline (12", 10-15' Deep)	FT	$111
HDPE Pipeline (15", 5-10' Deep)	FT	$106
HDPE Pipeline (15", 10-15' Deep)	FT	$135
HDPE Pipeline (18", 5-10' Deep)	FT	$130
HDPE Pipeline (18", 10-15' Deep)	FT	$164
HDPE Pipeline (24", 5-10' Deep)	FT	$169
HDPE Pipeline (24", 10-15' Deep)	FT	$213
HDPE Pipeline (30", 5-10' Deep)	FT	$213
HDPE Pipeline (30", 10-15' Deep)	FT	$268
HDPE Pipeline (36", 5-10' Deep)	FT	$259
HDPE Pipeline (36", 10-15' Deep)	FT	$324
HDPE Pipeline (48", 5-10' Deep)	FT	$354
HDPE Pipeline (60", 5-10' Deep)	FT	$509
RCP Pipeline (84", 5-10' Deep)	FT	$937
RCP Pipeline (96", 5-10' Deep)	FT	$1,115
Project Totals		
Project Sub-Total		
Mobilization/Demobilization (%)	LS	10%
Traffic Control/Utility Relocation (%)	LS	Varies by project (5-10%)
Erosion Control (%)	LS	2%
Construction Contingency (%)	LS	30%
Construction Cost Estimate		
Engineering and Permitting (%) *	LS	Varies by project (20-40%)
Construction Administration (%)	LS	5%
Total Project Engineering and Construction Cost		

* Engineering and permitting costs will be documented in each project's write-up.

Survey and Design Costs				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Projects				
C-1: Blaine St Improvements	1	EA	$ 180,000	$ 180,000
C-2: S Center St Improvements	1	EA	$ 180,000	$ 180,000
H-3: E 3rd St Improvements	1	EA	$ 142,000	$ 142,000
Major Survey and Design Cost				**$ 502,000**

CIP C-1.A: 99W to 2nd St Parking Lot Pipe Decommissioning/Replacement				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (12", 5-10' Deep)	443	FT	$ 87	$ 38,437
Abandon Existing Pipe, no excavation (12")	866	FT	$ 8	$ 6,928
Precast Concrete Manhole (48", 9-12' deep)	3	EA	$ 4,400	$ 13,200
HDPE Inlet Lead (12", 2-5' Deep)	120	FT	$ 63	$ 7,548
Catch Basin	8	EA	$ 2,000	$ 16,000
Capital Expense Sub-Total				$ 82,113
Mobilization/Demobilization	10%	LS		$ 8,211
Traffic Control/Utility Relocation	5%	LS		$ 4,106
Erosion Control	2%	LS		$ 1,642
Construction Cost Sub-Total				$ 96,072
Construction Contingency	30%	LS		$ 28,822
Capital Expense Total				$ 124,894
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 6,245
Administrative Expense Total				$ 6,245
Capital Implementation Cost Total				**$ 131,138**

CIP C-1.B: S Blaine St Pipe Replacement				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (30", 5-10' Deep)	931	FT	$ 213	$ 198,438
Precast Concrete Manhole (48", 9-12' deep)	3	EA	$ 4,400	$ 13,200
HDPE Inlet Lead (12", 2-5' Deep)	120	FT	$ 63	$ 7,548
Catch Basin	8	EA	$ 2,000	$ 16,000
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 240,187
Mobilization/Demobilization	10%	LS		$ 24,019
Traffic Control/Utility Relocation	5%	LS		$ 12,009
Erosion Control	2%	LS		$ 4,804
Construction Cost Sub-Total				$ 281,018
Construction Contingency	30%	LS		$ 84,305
Capital Expense Total				$ 365,324
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 18,266
Administrative Expense Total				$ 18,266
Capital Implementation Cost Total				**$ 383,590**

CIP C-1.C: E 2nd St to E 5th St Pipe Decommissioning/Replacement				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 10-15' Deep)	224	FT	$ 164	$ 36,745
HDPE Pipeline (24", 5-10' Deep)	602	FT	$ 169	$ 101,499
Abandon Existing Pipe, no excavation (12")	792	FT	$ 8	$ 6,336
Abandon Existing Pipe, no excavation (15-18")	717	FT	$ 18	$ 12,906
Abandon Existing Structure	2	EA	$ 400	$ 800
Precast Concrete Manhole (48", 0-8' deep)	2	EA	$ 3,000	$ 6,000
HDPE Inlet Lead (12", 2-5' Deep)	90	FT	$ 63	$ 5,661
Catch Basin	6	EA	$ 2,000	$ 12,000
Capital Expense Sub-Total				$ 181,947
Mobilization/Demobilization	10%	LS		$ 18,195
Traffic Control/Utility Relocation	5%	LS		$ 9,097
Erosion Control	2%	LS		$ 3,639
Construction Cost Sub-Total				$ 212,878
Construction Contingency	30%	LS		$ 63,863
Capital Expense Total				$ 276,741
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 13,837
Administrative Expense Total				$ 13,837
Capital Implementation Cost Total				**$ 290,578**

CIP C-1.D: E 6th St and S Blaine St Pipe Replacement				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	687	FT	$ 130	$ 89,273
Precast Concrete Manhole (48", 0-8' deep)	3	EA	$ 3,000	$ 9,000
HDPE Inlet Lead (12", 2-5' Deep)	60	FT	$ 63	$ 3,774
Catch Basin	4	EA	$ 2,000	$ 8,000
Capital Expense Sub-Total				$ 110,047
Mobilization/Demobilization	10%	LS		$ 11,005
Traffic Control/Utility Relocation	5%	LS		$ 5,502
Erosion Control	2%	LS		$ 2,201
Construction Cost Sub-Total				$ 128,755
Construction Contingency	30%	LS		$ 38,627
Capital Expense Total				$ 167,382
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 8,369
Administrative Expense Total				$ 8,369
Capital Implementation Cost Total				**$ 175,751**

CIP C-2.A: E 9th St to S Center St Pipe Decommissioning				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (30", 5-10' Deep)	516	FT	$ 213	$ 109,983
HDPE Pipeline (36", 10-15' Deep)	112	FT	$ 324	$ 36,253
Abandon Existing Pipe, no excavation (12")	143	FT	$ 8	$ 1,144
Abandon Existing Pipe, no excavation (21"-24")	360	FT	$ 23	$ 8,280
Abandon Existing Structure	2	EA	$ 400	$ 800
Precast Concrete Manhole (48", 9-12' deep)	2	EA	$ 4,400	$ 8,800
Precast Concrete Manhole (60", 9-12' deep)	1	EA	$ 7,700	$ 7,700
HDPE Inlet Lead (12", 2-5' Deep)	30	FT	$ 63	$ 1,887
Catch Basin	2	EA	$ 2,000	$ 4,000
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 183,847
Mobilization/Demobilization	10%	LS		$ 18,385
Traffic Control/Utility Relocation	5%	LS		$ 9,192
Erosion Control	2%	LS		$ 3,677
Construction Cost Sub-Total				$ 215,101
Construction Contingency	30%	LS		$ 64,530
Capital Expense Total				$ 279,632
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 13,982
Administrative Expense Total				$ 13,982
Capital Implementation Cost Total				**$ 293,613**

CIP C-2.B: S Center St, E 8th St, and E 7th St Pipe Replacement				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	803	FT	$ 130	$ 104,347
HDPE Pipeline (24", 5-10' Deep)	1,759	FT	$ 169	$ 296,571
HDPE Pipeline (30", 5-10' Deep)	670	FT	$ 213	$ 142,807
Precast Concrete Manhole (48", 0-8' deep)	11	EA	$ 3,000	$ 33,000
HDPE Inlet Lead (12", 2-5' Deep)	30	FT	$ 63	$ 1,887
Catch Basin	2	EA	$ 2,000	$ 4,000
Capital Expense Sub-Total				$ 582,612
Mobilization/Demobilization	10%	LS		$ 58,261
Traffic Control/Utility Relocation	5%	LS		$ 29,131
Erosion Control	2%	LS		$ 11,652
Construction Cost Sub-Total				$ 681,657
Construction Contingency	30%	LS		$ 204,497
Capital Expense Total				$ 886,154
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 44,308
Administrative Expense Total				$ 44,308
Capital Implementation Cost Total				**$ 930,461**

CIP C-3: E Columbia Dr Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (24", 5-10' Deep)	81	FT	$ 169	$ 13,657
HDPE Pipeline (24", 10-15' Deep)	11	FT	$ 213	$ 2,342
Precast Concrete Manhole (48", 9-12' deep)	4	EA	$ 4,400	$ 17,600
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 38,599
Mobilization/Demobilization	10%	LS		$ 3,860
Traffic Control/Utility Relocation	5%	LS		$ 1,930
Erosion Control	2%	LS		$ 772
Construction Cost Sub-Total				$ 45,161
Construction Contingency	30%	LS		$ 13,548
Capital Expense Total				$ 58,709
Administrative Expenses				
Engineering and Permitting*	30%	LS		$ 17,613
Construction & General Administration	5%	LS		$ 2,935
Administrative Expense Total				$ 20,548
Capital Implementation Cost Total				**$ 79,257**

CIP C-4: Oxford St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (36", 5-10' Deep)	1,860	FT	$ 259	$ 481,555
Precast Concrete Manhole (60", 0-8' deep)	10	EA	$ 4,300	$ 43,000
Precast Concrete Manhole (60", 9-12' deep)	3	EA	$ 7,700	$ 23,100
HDPE Inlet Lead (12", 2-5' Deep)	60	FT	$ 63	$ 3,774
Catch Basin	4	EA	$ 2,000	$ 8,000
Outfall Improvements	3	EA	$ 5,000	$ 15,000
Capital Expense Sub-Total				$ 574,429
Mobilization/Demobilization	10%	LS		$ 57,443
Traffic Control/Utility Relocation	5%	LS		$ 28,721
Erosion Control	2%	LS		$ 11,489
Construction Cost Sub-Total				$ 672,082
Construction Contingency	30%	LS		$ 201,625
Capital Expense Total				$ 873,707
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 174,741
Construction & General Administration	5%	LS		$ 43,685
Administrative Expense Total				$ 218,427
Capital Implementation Cost Total				**$ 1,092,133**

CIP C-5: N College St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (24", 5-10' Deep)	691	FT	$ 169	$ 116,504
Precast Concrete Manhole (48", 0-8' deep)	5	EA	$ 3,000	$ 15,000
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 136,504
Mobilization/Demobilization	10%	LS		$ 13,650
Traffic Control/Utility Relocation	5%	LS		$ 6,825
Erosion Control	2%	LS		$ 2,730
Construction Cost Sub-Total				$ 159,710
Construction Contingency	30%	LS		$ 47,913
Capital Expense Total				$ 207,623
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 41,525
Construction & General Administration	5%	LS		$ 10,381
Administrative Expense Total				$ 51,906
Capital Implementation Cost Total				**$ 259,528**

CIP C-6: S River St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	507	FT	$ 130	$ 65,883
Precast Concrete Manhole (48", 0-8' deep)	2	EA	$ 3,000	$ 6,000
Precast Concrete Manhole (48", 0-8' deep)	2	EA	$ 3,000	$ 6,000
Capital Expense Sub-Total				$ 77,883
Mobilization/Demobilization	10%	LS		$ 7,788
Traffic Control/Utility Relocation	5%	LS		$ 3,894
Erosion Control	2%	LS		$ 1,558
Construction Cost Sub-Total				$ 91,123
Construction Contingency	30%	LS		$ 27,337
Capital Expense Total				$ 118,460
Administrative Expenses				
Engineering and Permitting	30%	LS		$ 35,538
Construction & General Administration	5%	LS		$ 5,923
Administrative Expense Total				$ 41,461
Capital Implementation Cost Total				**$ 159,920**

CIP C-7: S College St and Andrew St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (48", 5-10' Deep)	260	FT	$ 354	$ 92,163
Connection to Existing Structure	2	EA	$ 900	$ 1,800
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 98,963
Mobilization/Demobilization	10%	LS		$ 9,896
Traffic Control/Utility Relocation	10%	LS		$ 9,896
Erosion Control	2%	LS		$ 1,979
Construction Cost Sub-Total				$ 120,735
Construction Contingency	30%	LS		$ 36,220
Capital Expense Total				$ 156,955
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 31,391
Construction & General Administration	5%	LS		$ 7,848
Administrative Expense Total				$ 39,239
Capital Implementation Cost Total				**$ 196,194**

CIP C-8: Dayton Ave Green Street Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
Stormwater Planter	1,500	SF	$ 37	$ 55,500
Curb Inlet	6	EA	$ 1,700	$ 10,200
Capital Expense Sub-Total				$ 65,700
Mobilization/Demobilization	10%	LS		$ 6,570
Traffic Control/Utility Relocation	5%	LS		$ 3,285
Erosion Control	2%	LS		$ 1,314
Construction Cost Sub-Total				$ 76,869
Construction Contingency	30%	LS		$ 23,061
Capital Expense Total				$ 99,930
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 19,986
Construction & General Administration	5%	LS		$ 4,996
Administrative Expense Total				$ 24,982
Capital Implementation Cost Total				**$ 124,912**

CIP H-1: N Elliot Rd Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	757	FT	$ 130	$ 98,369
HDPE Inlet Lead (12", 2-5' Deep)	90	FT	$ 63	$ 5,661
Catch Basin	6	EA	$ 2,000	$ 12,000
Precast Concrete Manhole (48", 0-8' deep)	3	EA	$ 3,000	$ 9,000
Connection to Existing Structure	1	EA	$ 900	$ 900
Capital Expense Sub-Total				$ 125,930
Mobilization/Demobilization	10%	LS		$ 12,593
Traffic Control/Utility Relocation	5%	LS		$ 6,297
Erosion Control	2%	LS		$ 2,519
Construction Cost Sub-Total				$ 147,339
Construction Contingency	30%	LS		$ 44,202
Capital Expense Total				$ 191,540
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 38,308
Construction & General Administration	5%	LS		$ 9,577
Administrative Expense Total				$ 47,885
Capital Implementation Cost Total				**$ 239,425**

CIP H-2: N Edwards St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (12", 5-10' Deep)	2,309	FT	$ 87	$ 200,339
HDPE Pipeline (18", 5-10' Deep)	1,064	FT	$ 130	$ 138,263
HDPE Pipeline (24", 5-10' Deep)	755	FT	$ 169	$ 127,295
HDPE Pipeline (24", 10-15' Deep)	212	FT	$ 213	$ 45,141
HDPE Inlet Lead (12", 2-5' Deep)	360	FT	$ 63	$ 22,645
Catch Basin	24	EA	$ 2,000	$ 48,000
Precast Concrete Manhole (48", 0-8' deep)	9	EA	$ 3,000	$ 27,000
Precast Concrete Manhole (48", 9-12' deep)	6	EA	$ 4,400	$ 26,400
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 640,082
Mobilization/Demobilization	10%	LS		$ 64,008
Traffic Control/Utility Relocation	5%	LS		$ 32,004
Erosion Control	2%	LS		$ 12,802
Construction Cost Sub-Total				$ 748,896
Construction Contingency	30%	LS		$ 224,669
Capital Expense Total				$ 973,565
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 194,713
Construction & General Administration	5%	LS		$ 48,678
Administrative Expense Total				$ 243,391
Capital Implementation Cost Total				**$ 1,216,956**

CIP H-3.A: S Church St and E 1st St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	1,249	FT	$ 130	$ 162,303
Stormwater Planter	1,791	SF	$ 37	$ 66,267
HDPE Inlet Lead (12", 2-5' Deep)	60	FT	$ 63	$ 3,774
Catch Basin	4	EA	$ 2,000	$ 8,000
Precast Concrete Manhole (48", 0-8' deep)	1	EA	$ 3,000	$ 3,000
Precast Concrete Manhole (48", 9-12' deep)	1	EA	$ 4,400	$ 4,400
Outfall Improvements	1	EA	$ 5,000	$ 5,000
Capital Expense Sub-Total				$ 252,744
Mobilization/Demobilization	10%	LS		$ 25,274
Traffic Control/Utility Relocation	5%	LS		$ 12,637
Erosion Control	2%	LS		$ 5,055
Construction Cost Sub-Total				$ 295,710
Construction Contingency	30%	LS		$ 88,713
Capital Expense Total				$ 384,423
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 19,221
Administrative Expense Total				$ 19,221
Capital Implementation Cost Total				**$ 403,644**

CIP H-3.B: E 3rd St Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	228	FT	$ 130	$ 29,628
HDPE Pipeline (24", 5-10' Deep)	950	FT	$ 169	$ 160,172
HDPE Inlet Lead (12", 2-5' Deep)	60	FT	$ 63	$ 3,774
Catch Basin	4	EA	$ 2,000	$ 8,000
Precast Concrete Manhole (48", 0-8' deep)	4	EA	$ 3,000	$ 12,000
Capital Expense Sub-Total				$ 213,574
Mobilization/Demobilization	10%	LS		$ 21,357
Traffic Control/Utility Relocation	5%	LS		$ 10,679
Erosion Control	2%	LS		$ 4,271
Construction Cost Sub-Total				$ 249,881
Construction Contingency	30%	LS		$ 74,964
Capital Expense Total				$ 324,846
Administrative Expenses				
Engineering and Permitting*	-	LS		-
Construction & General Administration	5%	LS		$ 16,242
Administrative Expense Total				$ 16,242
Capital Implementation Cost Total				**$ 341,088**

CIP H-4: Villa Rd Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
60" Diameter Culvert (5-10' Deep)	75	LF	$ 550	$ 41,250
Inlet and Outfall Improvements	1	LS	$ 10,000	$ 10,000
Capital Expense Sub-Total				$ 51,250
Mobilization/Demobilization	10%	LS		$ 5,125
Traffic Control/Utility Relocation	5%	LS		$ 2,563
Erosion Control	5%	LS		$ 2,563
Construction Cost Sub-Total				$ 61,500
Construction Contingency	30%	LS		$ 18,450
Capital Expense Total				$ 79,950
Administrative Expenses				
Engineering and Permitting*	25%	LS		$ 19,987.50
Construction & General Administration	5%	LS		$ 3,998
Administrative Expense Total				$ 23,985
Capital Implementation Cost Total				**$ 103,935**

CIP S-1: N Springbrook Rd Improvements				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (30", 5-10' Deep)	1,735	FT	$ 213	$ 369,807
Abandon Existing Pipe, no excavation (12")	37	FT	$ 8	$ 296
Precast Concrete Manhole (48", 0-8' deep)	3	EA	$ 3,000	$ 9,000
Precast Concrete Manhole (48", 9-12' deep)	4	EA	$ 4,400	$ 17,600
HDPE Inlet Lead (12", 2-5' Deep)	60	FT	$ 63	$ 3,774
Catch Basin	4	EA	$ 2,000	$ 8,000
Capital Expense Sub-Total				$ 408,477
Mobilization/Demobilization	10%	LS		$ 40,848
Traffic Control/Utility Relocation	5%	LS		$ 20,424
Erosion Control	2%	LS		$ 8,170
Construction Cost Sub-Total				$ 477,918
Construction Contingency	30%	LS		$ 143,376
Capital Expense Total				$ 621,294
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 124,259
Construction & General Administration	5%	LS		$ 31,065
Administrative Expense Total				$ 155,323
Capital Implementation Cost Total				**$ 776,617**

CIP S-2: Streambank Protection Projects				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
HDPE Pipeline (18", 5-10' Deep)	804	FT	$ 130	$ 104,477
Precast Concrete Manhole (48", 0-8' deep)	3	EA	$ 3,000	$ 9,000
Precast Concrete Manhole (48", 9-12' deep)	1	EA	$ 4,400	$ 4,400
HDPE Inlet Lead (12", 2-5' Deep)	60	FT	$ 63	$ 3,774
Catch Basin	4	EA	$ 2,000	$ 8,000
Capital Expense Sub-Total				$ 129,651
Mobilization/Demobilization	10%	LS		$ 12,965
Traffic Control/Utility Relocation	5%	LS		$ 6,483
Erosion Control	2%	LS		$ 2,593
Construction Cost Sub-Total				$ 151,691
Construction Contingency	30%	LS		$ 45,507
Capital Expense Total				$ 197,199
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 39,440
Construction & General Administration	5%	LS		$ 9,860
Administrative Expense Total				$ 49,300
Capital Implementation Cost Total				**$ 246,499**

CIP A-1: Streambank Protection Projects				
Description	Quantity	Unit	Unit Cost (2014)	2014 Cost
Capital Expenses				
Outfall Improvements	5	EA	$ 5,000	$ 25,000
Streambank Protection	5	LS	$ 10,000	$ 50,000
Riparian Restoration and Landscaping	5	LS	$ 5,000	$ 25,000
Capital Expense Sub-Total				$ 100,000
Mobilization/Demobilization	10%	LS		$ 10,000
Traffic Control/Utility Relocation	5%	LS		$ 5,000
Erosion Control	2%	LS		$ 2,000
Construction Cost Sub-Total				$ 117,000
Construction Contingency	30%	LS		$ 35,100
Capital Expense Total				$ 152,100
Administrative Expenses				
Engineering and Permitting	20%	LS		$ 30,420
Construction & General Administration	5%	LS		$ 7,605
Administrative Expense Total				$ 38,025
Capital Implementation Cost Total				**$ 190,125**

REQUEST FOR COUNCIL ACTION

DATE ACTION REQUESTED: April 16, 2018				
Order No. ___	**Ordinance No.** ___	**Resolution No. 2018-3460** XX	**Motion** ___	**Information** ___
SUBJECT: A Resolution Approving the Annual Evaluation of the Municipal Judge Completed in March, 2018 and Amending the February 2012 Agreement for Judicial Services for the City of Newberg (Resolution No. 2012-2989) to Provide Increased Compensation			**Contact Person (Preparer) for this Motion: Council President Denise Bacon** **Dept.: Administration** **Staff Assistance: Truman Stone, City Attorney** **File No.:**	

RECOMMENDATION:

Adopt **Resolution No. 2018-3460** approving the annual evaluation of the municipal judge.

EXECUTIVE SUMMARY:

The city council performed an annual evaluation of the municipal judge. That evaluation was held during executive session on March 19, 2018 in which no decisions were made. This resolution is to solidify that evaluation and to provide a formal guidance of his performance.

FISCAL IMPACT:

The municipal judge is currently compensated at a rate of $2,808 per month. By approval of this evaluation and resolution, the compensation will be raised four percent (4%) effective July 1, 2018 and will be $2,920 per month.

STRATEGIC ASSESSMENT:

The evaluation of the municipal judge is necessary in order to increase communication between the city council and the municipal judge concerning the performance of the municipal judge in accomplishing his assigned duties and responsibilities.

RESOLUTION NO. 2018-3460

A RESOLUTION APPROVING THE ANNUAL EVALUATION OF THE MUNICIPAL JUDGE COMPLETED IN MARCH, 2018 AND AMENDING THE FEBRUARY 2012 AGREEMENT FOR JUDICIAL SERVICES FOR THE CITY OF NEWBERG (RESOLUTION NO. 2012-2989) TO PROVIDE INCREASED COMPENSATION

RECITALS:

1. In accordance with the Newberg City Charter, a municipal judge is appointed by the city council, reports directly to the mayor and city council, and is supervised by the governing body. The city council appointed Larry Blake, Jr. as the municipal judge for the city in February, 2010.

2. The city has a contract with the municipal judge as approved by Resolution No. 2012-2989. Pursuant to that contract, the city council will evaluate the municipal judge in executive session.

3. The Open Meetings Law of the state of Oregon allows the evaluation of the job performance of the municipal judge to be conducted in executive session by the city council. Pursuant to the Standards, Criteria, and Policy Directives adopted by Resolution No. 2010-2923 on December 6, 2010, the municipal judge is evaluated annually.

4. The mayor, city councilors, and the municipal judge met in executive session on March 19, 2018, to discuss the municipal judge's annual evaluation.

5. The mayor has submitted the written evaluation which will be placed in the municipal judge's personnel file after being adopted by the city council.

6. The municipal judge is currently compensated at a rate of $2,808.00 per month. By approval of this evaluation and resolution, the compensation will be raised four percent (4%) effective July 1, 2018.

THE CITY OF NEWBERG RESOLVES AS FOLLOWS:

1. The written evaluation of the municipal judge, attached as Exhibit A and by this reference incorporated, is hereby adopted.

2. The municipal judge shall be given a copy of the evaluation to sign and may make any written comments after which the written evaluation shall be placed in the municipal judge's personnel file.

3. The Agreement for Judicial Services for the City of Newberg (Resolution No. 2012-2989) is hereby amended as shown in the attached Exhibit B, which is by this reference incorporated.

4. Except as amended herein, the remainder of the Agreement for Judicial Services for the City of Newberg (Resolution No. 2012-2989) is remains in effect.

- **EFFECTIVE DATE** of this resolution is the day after the adoption date, which is: _____, 2018.

ADOPTED by the city council of the city of Newberg, Oregon, this ____ day of _____, 2018.

_____
Sue Ryan, City Recorder

ATTEST by the mayor this _____ day of _____, 2018.

_____
Bob Andrews, Mayor

EXHIBIT A

Municipal Judge (Larry Blake, Jr.)
Annual Written Evaluation – 2018
By Newberg City Council

The city council has received a written report from the municipal judge concerning his performance during his evaluation period. The respective mayor and councilors have met with the municipal judge in executive session on March 19, 2018, to discuss their evaluation of his performance from 2017 to 2018.

The city council has evaluated the performance of Larry Blake, Jr. as the municipal judge of the city of Newberg. As part of the evaluation, council reviewed the report given to them by the municipal judge indicating his self-evaluation during the evaluation period. The city council assessed the municipal judge's performance in four major categories:

1. Case Management, Impartiality and Judicial Conduct
2. Knowledge of Law, Legal Practices and Court Management
3. Inter-departmental Relations
4. Fiscal Planning & Goals

Overall the city council found the municipal judge's performance fell between satisfactory and excellent. The city council felt the working relationship with the municipal judge was excellent and improving as time went on. The council expressed satisfaction with the initial goal setting and looks forward to further long-range strategic planning in partnership with the municipal judge.

DATED this ____ day of _____, 2018.

_____
Mayor Bob Andrews

_____
Council President Denise Bacon

_____
Councilor Mike Corey

_____
Councilor Scott Essin

_____
Councilor Stephen McKinney

_____
Councilor Patrick Johnson

_____
Councilor Matthew Murray

Comments by Larry Blake, Jr.:

_____

Acknowledged this ____ day of _____, 2018.

_____
Larry Blake, Jr., municipal judge

Exhibit "B"
to Resolution No. 2018-3460
(total of 2 pages)

AMENDMENT TO AGREEMENT FOR JUDICIAL SERVICES FOR THE CITY OF NEWBERG

The original agreement (herein Agreement) pursuant to Resolution No. 2012-2989 was effective February 1, 2012, by and between the following parties:

City of Newberg
(herein after known as **Newberg***)*
an Oregon Municipal Corporation
PO Box 970
Newberg, Oregon 97132
mailto:nlegal@newbergoregon.gov

Larry J. Blake, Jr., Attorney at Law
(herein after known as **Judge Blake***)*

3718 SW Condor, Suite 110
Portland, Oregon 97239
mailto:law@larryjblakejr.com

The parties agree to amend this Agreement as follows, effective July 1, 2018.

II) Compensation: Compensation will be paid as follows:

A) Monthly Amount – **Newberg** will pay **Judge Blake** the amount of Two Thousand Nine Hundred Twenty Dollars ($2,920) per month. It is recognized that in some months, more judicial services may be required than other months. It is also recognized that during some months, court session will not be held weekly due to legal holidays, **Judge Blake's** schedule, staff requirements, or judicial meetings. However, the compensation will remain at said amount of Two Thousand Nine Hundred Twenty Dollars ($2,920) per month.

Except as provided herein, all other provisions of the Agreement remain unaffected by this amendment.

IN WITNESS WHEREOF the parties have affixed their signatures as below indicated:

CITY OF NEWBERG

_____
Bob Andrews Date
Mayor
By authority of Resolution
No. 2018-3460

JUDGE BLAKE

_____
Larry J. Blake, Jr. Date
Attorney at Law
OSB No. 871728

APPROVED AS TO FORM & CONTENT:

Truman A. Stone, City Attorney Date

NEWBERG CITY COUNCIL MEETING INFORMATION

Meeting Date: April 16, 2018 **Prepared by: Sue Ryan**

Councilors	**Roll Call**	**Elise Yarnell appointment to Budget Committee for April 2018 to Dec. 2019**	**Consent 3/19 Minutes** **Res 3461 Yamhill County IGA re dog control licensing revenue**	**Res 3459 Del Boca Vista Hardship Water connection request – denial** **Not voted on – see motion to table to right**	**Motion to table** **Res 3459 to June 18, 2018 Council Meeting**	**Res 3457 Affordable Housing Trust Fund policies amendment**	**Res 3460 Municipal Judge Evaluation**	**Motion:** **Direct staff to continue negotiations on sale of Animal Shelter**
ANDREWS, Bob, Mayor	X	Yes	Yes		Yes	Yes	Yes	Yes
BACON, Denise	X	Yes	Yes		Yes	Yes	Yes	Yes
COREY, Mike	X	Yes	Yes		No	Yes	Yes	Yes
ESSIN, Scott	X	Yes	Yes		Yes	Yes	Yes	Yes
JOHNSON, Patrick	X	Yes	Yes		No	Yes	Yes	Yes
McKINNEY, Stephen	X	Yes	Yes		Yes	Yes	Yes	Yes
MURRAY, Matt	X	Yes	Yes		Yes	Yes	Yes	Yes
ROLL CALL VOTES		**YES: 7** **NO: 0**	**YES: 7** **NO: 0**	**NO VOTE**	**YES: 5** **NO: 2**	**YES: 7** **NO: 0**	**YES: 7** **NO: 0**	**YES: 7** **NO: 0**
MOTION (1st/2nd):		Andrews/ Corey	Bacon/ Johnson	Corey/ Johnson	Bacon/Murray	Bacon/Johnson	Andrews/Murray	Bacon/Essin
Follow Up/Dept. contact		DawnKaren ACM	Sue/CR– Mins Matt/Finance – Res 3461 IGA		Kaaren/ ENG	Doug/CDD	Sue/CR	Joe/CM
Public Comments- Requests or Complaints	4/16- None							

Meeting adjourned at 10:13 p.m.

Executive Session OR 192.660 (2) e Real Property

Start: 6:05 p.m.

End: 6:57 p.m.

Staff present: City Manager Joe Hannan,
City Attorney Truman Stone,
Community Development Director Doug Rux,
Finance Director Matt Zook

Topic of Discussion: Animal Shelter Appraisal

Executive Session OR 192.660 (2) h Legal Counsel

Start: 9:01 p.m.

End: 10:13 p.m.

Staff present: City Manager Joe Hannan
CIS Attorney Andrew Campbell

Topic of Discussion: CIS Investigation