APPENDIX M

Drainage Study

CITY OF DIXON, CALIFORNIA

THE CAMPUS

M&P Project No. 20-0024-00 (v.5)

DRAINAGE STUDY

February 13, 2024

PREPARED BY:

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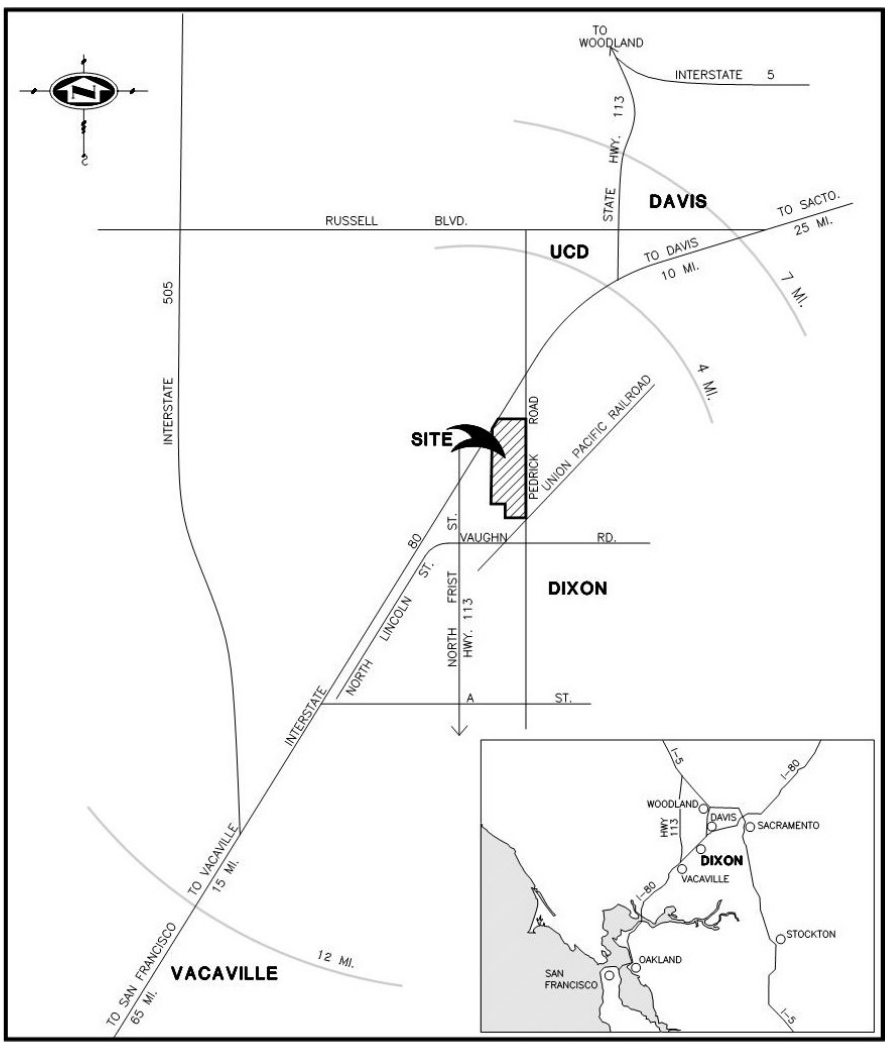
DRAINAGE STUDY

PROJECT: THE CAMPUS
LOCATION: CITY OF DIXON, CA
DATE: FEBURARY 2024

1. BACKGROUND

This drainage study provides infrastructure master plans and design standards for storm drain facilities within the proposed The Campus project. The project is located on approximately 259.7-acres within a portion of the City of Dixon in Solano County California (APNs 0111-040-010, -020, -030, -040, and 0111-080-050). The project is located within the City of Dixon's Northeast Quadrant Specific Plan (NQSP). NQSP is located south of I-80, north of Vaughn Road, east of N. First Street, and west of Pedrick Road. See **Figure 1** for Vicinity Map.

Figure 1 – Vicinity Map



The project is located within FEMA FIRM Panel 06095C0200F (revised date August 2, 2012). The project is located within Zone X, which is an area determined to be outside the 0.2% (500-year) annual chance floodplain.

2. PURPOSE

The main objective of this study is to provide the required drainage improvements necessary to serve the The Campus project without increase in flows or water surface elevations both upstream and downstream of the NQSP consistent with the City's drainage design requirements.

Per the City's Storm Drain Design Standards, storm drains shall be designed to convey the 10-year storm, roadways will be designed to convey the 100-year storm, and detention ponds will be designed to store the 100-year, 4-day storm assuming 25% of the pond is utilized prior to the storm event, and open channels should be sized for the 100-year storm with 1 foot of freeboard.

3. SITE HYDROLOGY

3.1. PRE-DEVELOPMENT CONDITIONS

The pre-development drainage scenario has been discussed in detail in the Dixon Storm Drain Report (DSDR). DSDR estimates 2700± acres of agriculture land drains across I-80 into NEQ through twin 29"x18" CMP Culverts and twin 36" culverts transition to 8'x4' culvert, then to 4'x3' box culvert and lastly to twin 24" RCP culverts. The existing culverts under Interstate 80 restrict the flow rates with associated localized flooding on the north side of I-80. The flow is conveyed across the NQSP lands via irrigations ditches and sheet flow. The flow continues easterly to the UPRR where existing culverts restrict the flow with additional localized flooding.

The pre-development and post-development drainage condition hydrologic HEC-HMS model maps and model output are included in Appendices A, B, and C. The major assumptions are listed below:

i. The offsite drainage area north of I-80 is 2700± acres with an average basin slope of 0.001.
ii. The roadside ditches/ pipes are too small to handle the design storm events and most of the flow is over-banks / fields for the conveyance routing.
iii. The stage area relationship for the storage routing north of I-80 is based on the available (1-foot contours) topographic data up to 65 feet elevation. For elevations above 65-feet the interpolation of 5-feet contours from the USGS quad maps was used. As summarized in the referenced drainage reports, there have been widespread grading activities in the past in the individual fields, but no major hauling of dirt to and from distant locations may have taken place. Therefore, the interpolation from USGS quad maps still represents reasonable data used in storage routing.
iv. The stage discharge data for twin 29"x18" CMP culverts is based on the topographic data and both the outfalls are assumed hydraulically connected. The last leg of 2-24"

RCP culverts have been modeled as a pressure pipe that will be the controlling structure for flows passing through the linear combination twin 36" pipes, 8'x4' CRBC, 4'x3' RCBC and twin 24" RCP.

v. The conveyance and storage routing through NEQ is based on topographic data.

vi. The storage routing at the UPRR is based on contours from the USGS quad maps and previously obtained topographic mapping of the area.

The area drains predominantly in the east-southeast direction, away from Interstate 80. The majority of the property is used for irrigated row crops. Runoff is collected in roadside ditches adjacent to Pedrick Road on the east and Vaughn Road on the south and conveyed via ditches to a depressed area adjacent to the UPRR tracks. In the past, the lands within the NQSP were omitted from the Dixon Resource Conservation District (DRCD) service area, and therefore no capacity was constructed in the Tremont 3 channel for this area. By inspection of the geographical information available, it appears that flows are stored within the depressed area adjacent to the UPRR and ultimately released into the downstream Tremont 3 system.

Flow from the northwest side of Interstate 80 contributes to the NQSP area. Field inspection of the existing drainage patterns within this area indicates that approximately 2,700± acres are tributary to the pipes and the existing culverts crossing of Interstate 80. The flows are then conveyed eastward by channel and overlay flow to Pedrick Road. There is an existing 24"x36" Arch CMP culvert crossing Pedrick Road at the south boundary of the existing Campbell Soup facility. The existing conditions are such that water backs up on the project site due to the culvert restriction until such time as the water surface overtops Pedrick Road. The approximate storage on the project site is about 30 acre-feet during the 100-year, 4-day storm event. A channel conveys the flows from the depressed area to Pedrick Road and culvert crossing to the UPRR where an existing culvert conveys the flows to the Tremont 3 drainage system.

3.2. POST-DEVELOPMENT CONDITIONS

The project will consist of approximately 260-acres of existing farmland that will be developed and Campus Mixed Use (CMU). This mixed-use project will include a mix of tech park, commercial, multi-family residential, medium density residential, single family residential, parks, and a 25-acre retention basin.

Proposed Retention Basin

Onsite flows will be collected and conveyed through a storm drain system to the retention basin. The proposed retention basin has a volume of up to 360 acre-feet and is located near the south end of The Campus project site. Thus, the proposed 360 ac-ft retention basin has more than enough capacity for the Campus, plus a small amount of flow (about 14 ac-ft in the 100-year, 4-day design storm) from off-site needed to eliminate downstream drainage impacts. Based on a preliminary long term infiltration rate of 4 inches per day, the required retention basin storage is approximately 233 acre-feet. The final design of the retention basin will require additional geotechnical investigations to determine the long-term infiltration rate. The retention basin will hold the runoff without discharge to the DRCD facilities.

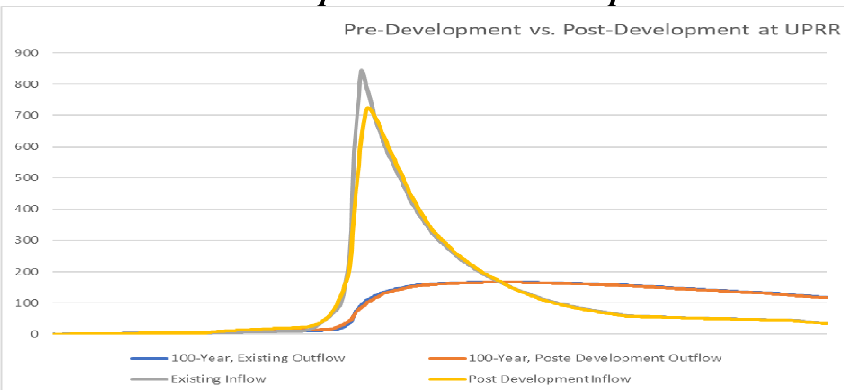
Offsite flows that historically drained to an existing drainage ditch through the project site will be collected at the west end to the project site and conveyed around the project site in a pipe / landscape swale system to the existing drainage conveyance at Pedrick Road. The final configuration will be determined with the final design; however, the preliminary analysis assumed the following schematic design. The pipe will be 60-inches in diameter and the swale has various sizes as summarized below. The Campus Drainage System was modeled with the regional drainage model, and off-site flow storm drain, and swale system and model results are summarized below:

- Along the west boundary (Along Professional Drive) of The Campus, for a length of about 2,000 feet, the swale will have bottom widths of 8 feet to 20 feet and side slopes of 3 to 4H:1V (horizontal to vertical). Along this boundary, the swale will convey the 10-year (up to 57 cfs) and 100-year (up to 193 cfs) off-site flows, and the 60-inch storm drain is not needed.
- Along the south boundary of The Campus (along Commercial Drive), for a length of about 2,800 feet the swale will have a bottom width of 8 feet and side slopes of 3 to 4H:1V. Along this boundary, the swale and the 60-inch storm drain will convey the off-site flows. For the 100-year storm, the storm drain conveys up to 98 cfs, and the swale conveys up to 95 cfs. For the 10-year storm, the storm drain conveys up to 57 cfs, and the swale conveys up to 7 cfs.
- Along the east boundary of The Campus (along Pedrick Road), for a length of about 690 feet the swale will have a bottom width of 8 feet and side slopes of 3 to 4H:1V. Along this boundary, the swale and a 24-inch storm drain will convey the off-site flows and discharge the flows to the ditch south of the Campbell's Soup parcel. For the 100-year storm, the storm drain conveys up to 5 cfs, and the swale conveys up to 175 cfs. For the 10-year storm, the storm drain conveys up to 4 cfs, and the swale conveys up to 50 cfs. Also, the runoff from the enlarged/reconstructed Pedrick Road segments will be drained to the retention basin.
- Midway along the southern boundary, there is an 18-inch storm drain set just above the 10-year water level and just below the 100-year water level. This drain conveys up to 12 cfs into the proposed retention basin (total volume of 14 ac-ft) in the 100-year storm and no flow in the 10-year storm.
- The 100-year, 4-day and 10-year, 4-day regional drainage model results are summarized in Appendix F. As shown for the 100-year storm, there are no increases in the peak water levels. As shown for the 10-year storm and as discussed below, there are five locations where the water level increases slightly:
    - Upstream end of the I-80 culverts from the Milk Farm site. This is a slight increase (0.03 feet) of existing flooding on Milk Farm Road. It causes no property damage. Thus, this is not a significant impact.
    - Upstream and downstream ends of the Milk Farm livestock I-80 crossing culvert. The water level at both ends increases but stays below the ground level. Thus, this is not a significant impact.
    - Located north of Vaughn Road along a private ditch near the Tremont 3 Drain. This small increase is below the evaluation level of accuracy of the model. This

increase is considered to be a modeling anomaly because the downstream nodes have no change in the water level or decrease in the water level. Thus, this is not a significant impact.

- Located in the I-80 Currey Road Ramp Area. The 10-year water level increase of 0.03 feet stays below channel banks. Thus, this is not a significant impact.

FIGURE 2: Pre-Development vs. Post-Development Flow Rates at UPRR



Regional Drainage System and Regional Detention Basin as a Potential Alternative to the Proposed Retention Basin

Currently the city and regional agencies are working on a regional master drainage plan for the area. If the regional plan is approved, the proposed retention basin will be converted to a detention basin, and the detention basin will be constructed with a pump outfall.. The detention basin and pump station would allow the remaining undeveloped areas of the NEQSP west of Pedrick Road to drain to the detention basin. This discharge rate is established by the rate used in the Dixon Regional Watershed Joint Powers Agreement. The pump station will be designed with a firm capacity of 5.4 cfs (using one primary pump) and a total capacity of 10.8 cfs (using the primary and the back-up pumps). The pump station will always be able to pump at least 5.4 cfs, and the total capacity of the pump station will be used to empty the basin when there is adequate capacity in the downstream channels. Use of the back-up pump will be controlled by a stage monitor system at a location in the Tremont 3 drain to be identified by City.

The regional drainage system planning is on-going, and this section of this report will be updated as phases of that regional drainage planning are completed.

4. HYDROLOGIC ANALYSIS

4.1 DESIGN RUNOFF FOR WATERSHED AREAS FROM 0 TO 100-ACRES

The City of Dixon Drainage Design Standards identifies the use of runoff charts for areas up to 100-acres. These charts, Figures 4-3 through 4-6, are provided in Appendix C**.**

Impervious Percentages for various land uses are shown in Table A-2, see Appendix C.

4.2 DESIGN RUNOFF FOR WATERSHED AREAS GREATER THAN 100-ACRES OR AREAS INCLUDING DETENTION

The methodology used for the hydrologic design shall be based on the criteria established in the City of Dixon Engineering Design Standards (latest edition) and the Solano County Water Agency (SCWA) Hydrology Manual (latest edition) except as modified by the City of Dixon Storm Drain Design Standards.

The hydrologic analysis is based on the US Army Corps of Engineers computer program HEC-HMS flood hydrograph package. Snyder unit synthetic hydrograph method has been used for modeling the design storm events of 100-year and 10-year probability of occurrence. The Snyder's peaking Coefficient Cp and Standard Lag are based on Solano County Water Agency hydrology manual (June 1999). The design storm was based on a 100-year 4-day storm to provide the detention storage requirement. See Appendix E for HEC-HMS model. The regional XPSWMM model has also used for this evaluation.

Rainfall distribution is determined from the City of Dixon Engineering Design Standards. Figure 4-1 Design Storm Rainfall Data identifies the 10- and 100-year design storm depths for precipitation in the city. The following table identifies the precipitation distribution for two design storm events.

Table 1 - Precipitation Depth (inches) Summary
(Figure 4-1 City of Dixon Engineering Design Standard, Design Storm Rainfall Data)

Design Storm	5 Min	15 Min	1 Hour	2 Hour	3 Hour	6 Hour	12 Hour	1 Day	2 Day	4 Day
10-Year	0.34	0.55	1.00	1.36	1.60	2.16	2.90	3.92	5.25	6.38
100-Year	0.48	0.79	1.42	1.91	2.27	3.06	4.12	5.55	7.72	9.39

Per the USDA Natural Resources Conservation Service's Web Soil Survey for Solano County, the site's soil is predominately located within Hydrologic Soil Groups (HSG) B and C. Group B soils have moderate infiltration rates with a moderate runoff potential when thoroughly wet. Group C soils have slow infiltration rates with a high runoff potential when thoroughly wet.

See Appendix C for calculations and Appendix E for backup data used in hydrologic calculations. See Appendix F for the regional model results.

5. HYDROLOGIC MODELING RESULTS

The following summarizes the design elements used to size the on-site retention basin:

- The Retention basin is designed using the 100-year monthly design rainfall totals

- Assumes the retention basin is empty on October 1 and shall be at least 2 feet above historic groundwater levels

- The water balance was prepared throughout the year, ending with September

- The retention basin was sized to have a minimum allowed freeboard of one foot

- The retention basin is approximately 20 feet deep, exceeding the City's preferred maximum depth of 10 feet. The additional depth is required to avoid conflicts with underground utilities due to the large pipe sizes required to collect the entire undeveloped NQSP areas west of Pedrick Road in the future.

- The pond will drain by both evaporation loss and percolation loss. The assumed percolation at is 4 inches per day. Site specific geotechnical report documenting the long-term percolation rate shall be performed prior to final basin design approval.

The following summarizes the design elements should the drainage basin be converted to a regional retention facility in the future

- Detention storage shall mitigate the increase of the post-development 100-year, 4-Day peak runoff from the project to a discharge rate of 0.011 cfs/tributary acre.

- The detention basin side slopes shall be no steeper than 4:1 in areas subject to inundation

- The detention basin is approximately 20 feet deep, exceeding the City's preferred maximum depth of 10 feet. Additional depth is required to avoid conflicts with underground utilities and due to the large pipe sizes required to collect the entire undeveloped NQSP areas west of Pedrick Road.

Table 2- Retention Basin Elevation & Storage Volume

Contour Elevation (FT)	Pond Depth (FT)	Area (SF)	Incremental Volume Avg. End (Ac-ft)	Cumulative Volume Avg. End (Ac-ft)
39	0	45,511	0.00	0.00
40	1	143,045	0.33	2.28
42	3	414,408	0.95	15.39
44	5	693,025	1.59	41.13
46	7	743,487	1.71	74.16
48	9	773,517	1.78	109.02
50	11	803,317	1.84	145.26
52	13	833,541	1.91	182.87
54	15	864,200	1.98	221.88
56	17	895,306	2.06	262.31
58	19	927,458	2.13	304.19
60	21	959,744	2.20	347.55
61	22	980,170	2.25	369.84

Table 3- Summary of 100-Year Peak Water Surface Elevations in the Retention Basin

100-Year Peak Water Surface Elevation, feet	Infiltration Rate (in/day)
54.6	4

6. HYDRAULIC ANALYSIS

Per the City of Dixon Engineering Design Standards, the storm drain system shall be designed to accommodate the 10-year storm event with the hydrologic grade line (HGL) at least 1.0-feet below the gutter flow line elevations. The preliminary 10-year hydraulic grade line (HGL) for each pipe segment was computed and shown in Appendix D.

Using the following criteria set forth in the City of Dixon Engineering Design Standards, in final design the peak runoff will be computed and the on-site storm drain system will be designed based on the following assumptions:

- Pipe Material RCP
- Manning's "n" for RCP pipe is 0.013
- Minimum storm drain main pipe size is 18 inches, the minimum diameter of a lateral from a street drainage inlet to a manhole is 12 inches
- Minimum flow velocity of at least 2.0 feet/sec flow full

7. SUMMARY OF RESULTS

A new retention pond will retain the project flows on-site without an off-site discharge including 14 ac-ft of off-site flows. The existing flows will be routed around the project site. The loss of existing flood storage on-site will not result in any significant increase of off-site flows or increase in downstream water surface elevations. This is mainly a result of removing 260 acres for the existing drainage shed area.

If the basin is converted to a future detention basin, it will be constructed to achieve the post-development 100-year 4-day flow rate of 0.011 cfs/acre. Due to topographical restraints, the detention basin will have a new storm drain pump station to fully drain the basin and to regulate the discharge.
There will not be an increase in peak flow and water surface elevations upstream (Interstate 80) or downstream (Union Pacific Railroad) of the project site.

A Storm Water Pollution Prevention Plan (SWPPP) will be prepared in conformance with the State Water Resources Control Board's latest General Construction Permit Guidelines. The SWPPP will be implemented during the construction phases of the project.

8. REFERENCES

1. City of Dixon Engineering Design Standards, 2014

2. "Solano County Hydrology Manual", Solano County Water Agency, June 1999

3. "Drainage Alternatives for the Northeast Quadrant of the City of Dixon", West Yost & Associates, June 2020

4. West Yost Technical Memorandums and XP-SWMM Model……

<u>APPENDIX A</u>:

Pre-Development Drainage Watershed Map

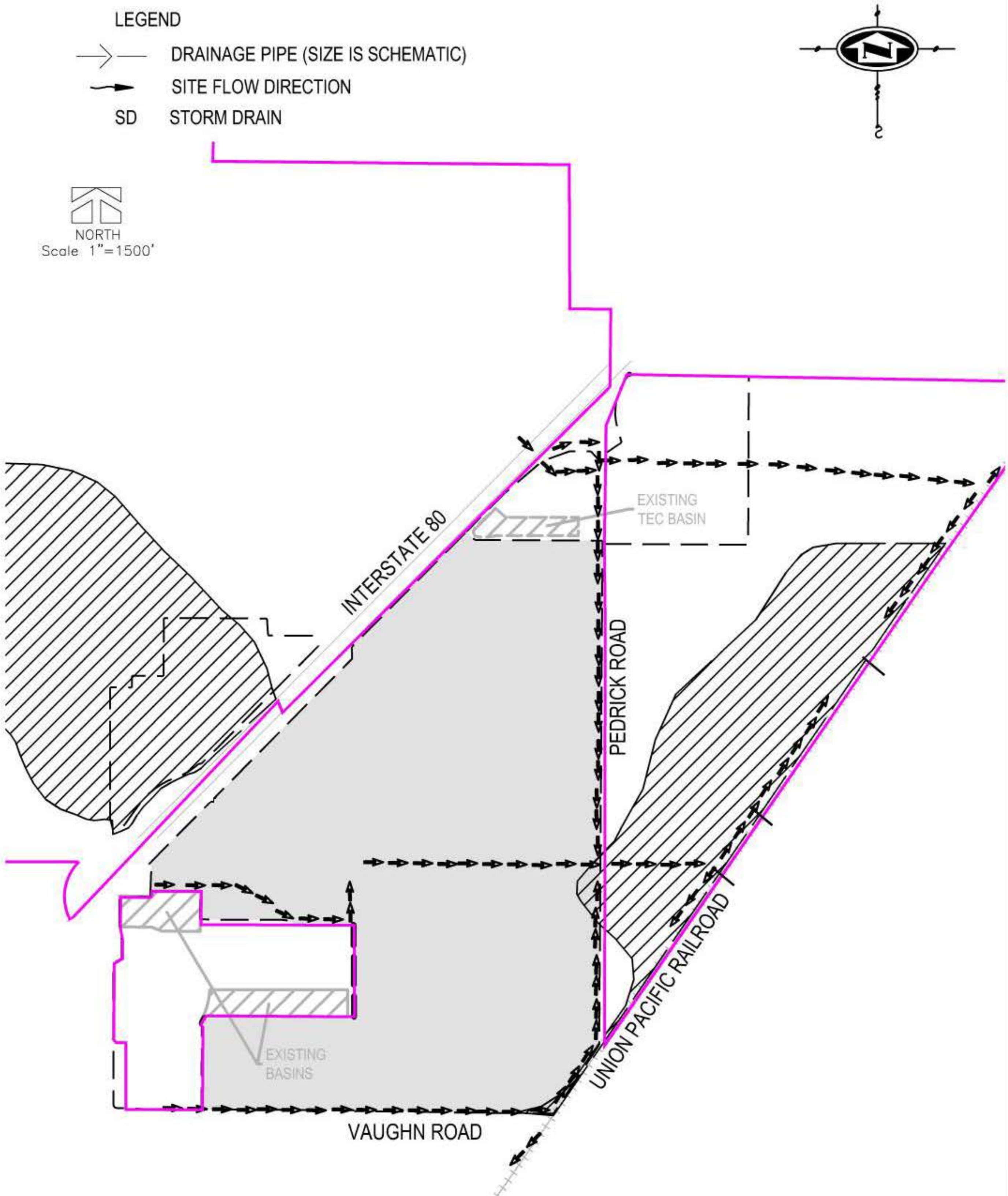


FIGURE 6-5
EXISTING DRAINAGE

APPENDIX B:

Post-Development Drainage Watershed Map

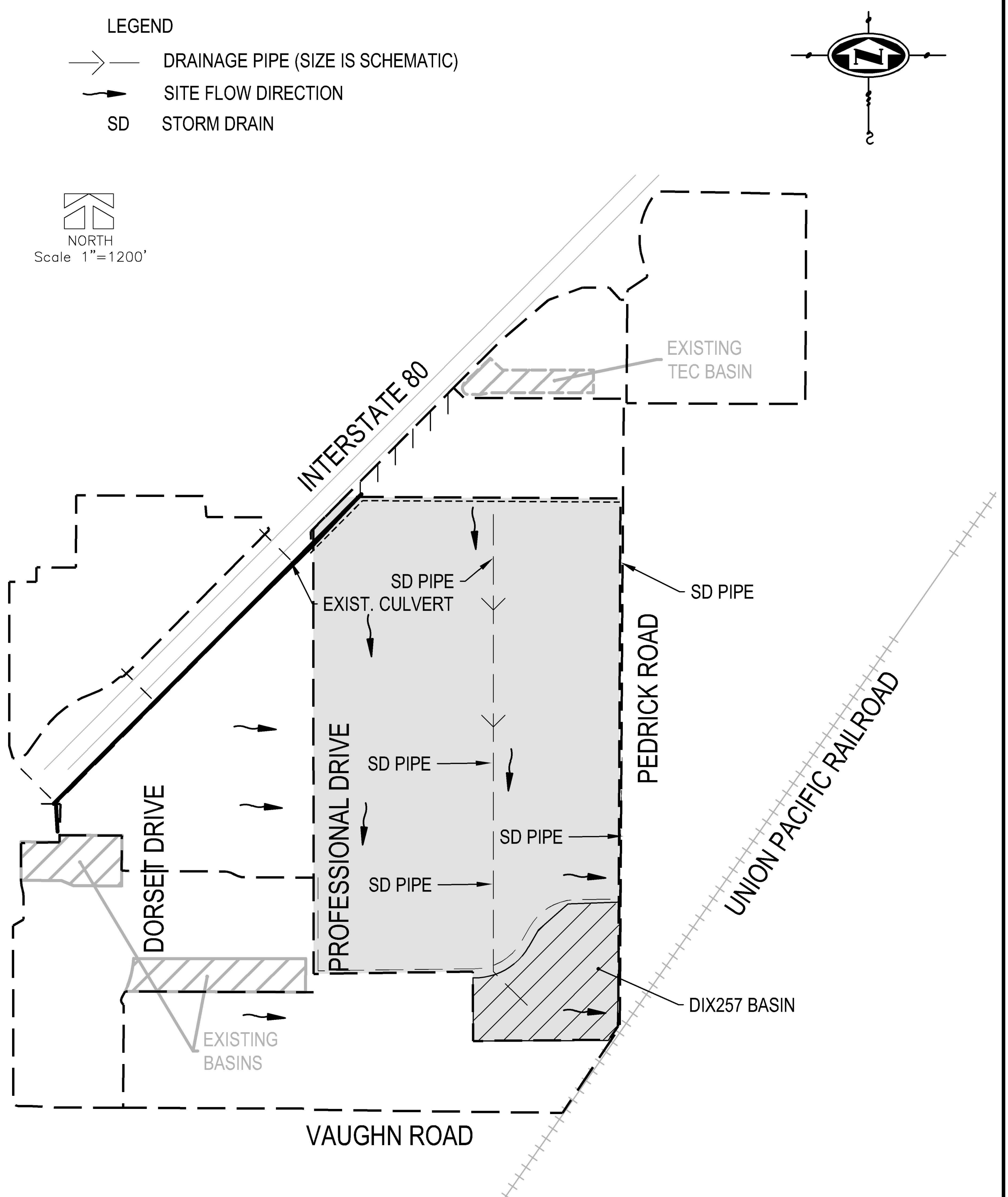
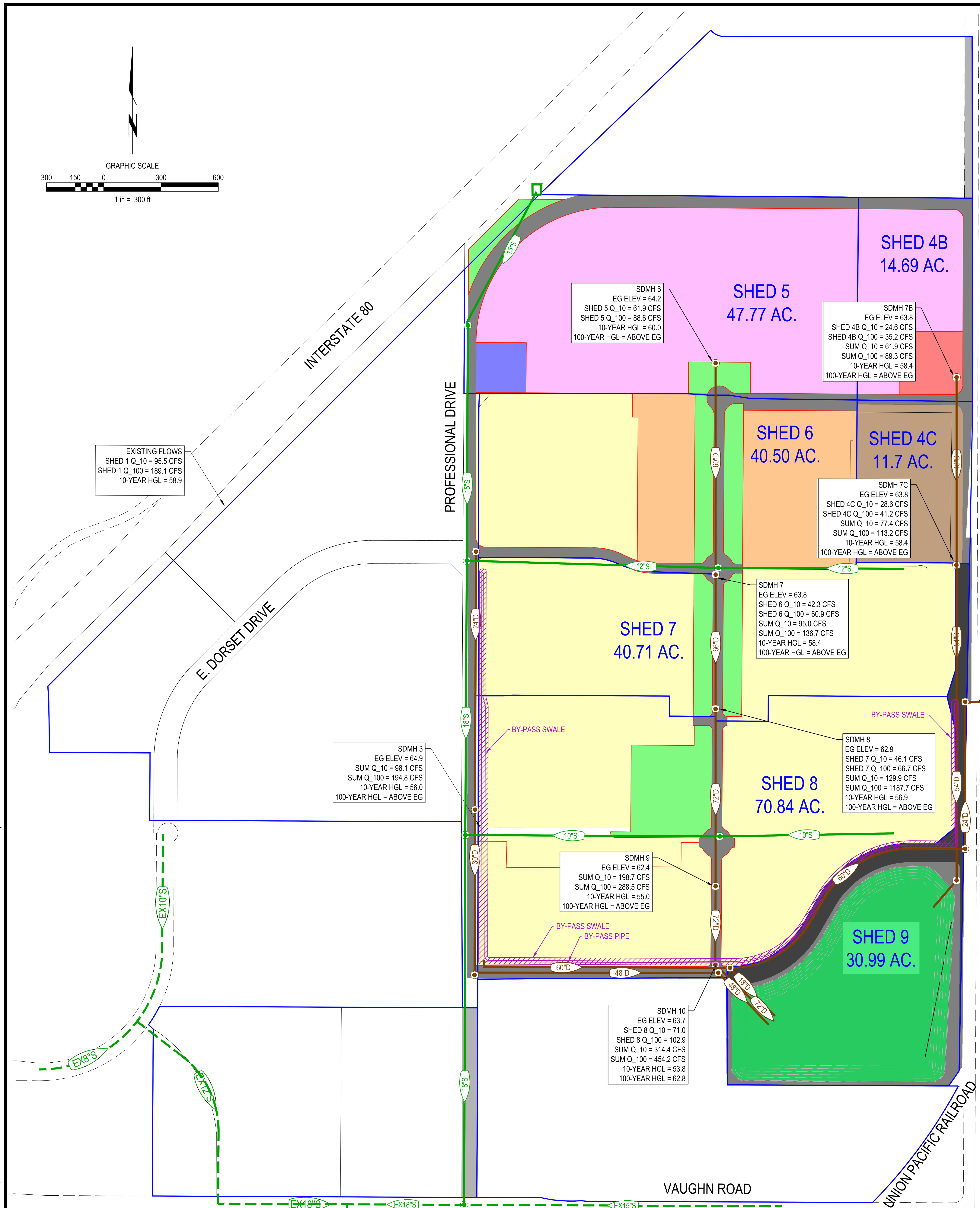


FIGURE 6-4
CONCEPTUAL DRAINAGE PLAN SCHEMATIC

<u>APPENDIX C</u>:

Hydrologic Calculations, City Design Charts & HEC Analysis



LEGEND

- ROADWAY LAND USE (95% IMPERV.)
- COMMERCIAL LAND USE (90% IMPERV.)
- INDUSTRIAL LAND USE (85% IMPERV.)
- WELL SITE INDUSTRIAL LAND USE (85% IMPERV.)
- MULTI-FAMILY RESIDENTIAL LAND USE (70% IMPERV.)
- SINGLE-FAMILY LAND USE 6-8 DU / ACRE LAND USE (50% IMPERV.)
- MEDIUM DENSITY RESIDENTIAL (70% IMPERV.)
- OPEN SPACE LAND USE (2% IMPERV.)
- LAND USE BOUNDARY
- SHED BOUNDARY
- 72"D SEWER PIPE SIZE & DIRECTION OF FLOW
- STORM DRAIN MANHOLE
- STORM DRAIN LINE
- 15"S SEWER PIPE SIZE & DIRECTION OF FLOW
- EX18"S EXISTING SEWER PIPE SIZE & DIRECTION OF FLOW
- SEWER MANHOLE
- SEWER LINE
- EXISTING SEWER LINE

NOTE:
1. PROPOSED SEWER INFORMATION COMES FROM THE DIXON 257 SEWER STUDY (JULY 2023)

HEC-HMS RESULT TABLE

10-Year Existing Conditions

Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	487.6	05Jun2003, 04:00	1.52		
I-80 North	4.043	95.5	05Jun2003, 13:30	1.52		
I80	4.043	95.5	05Jun2003, 13:30	1.52		
Dix257	0.4063	198.3	05Jun2003, 01:45	1.61		
NEQSP	0.3398	171.6	05Jun2003, 01:30	1.61		
Pedrick-Crossing	4.7891	296.1	05Jun2003, 02:00	1.53	20.1	61.3
Pedrick	4.7891	296.1	05Jun2003, 02:00	1.53		
Com3	4.7891	296.1	05Jun2003, 02:00	1.53		
D10	3.055	360.9	05Jun2003, 04:00	1.61		
R-UPRR	7.8441	124.4	05Jun2003, 18:30	1.49		
UPRR	7.8441	124.4	05Jun2003, 18:30	1.49		

100-Year Existing Conditions

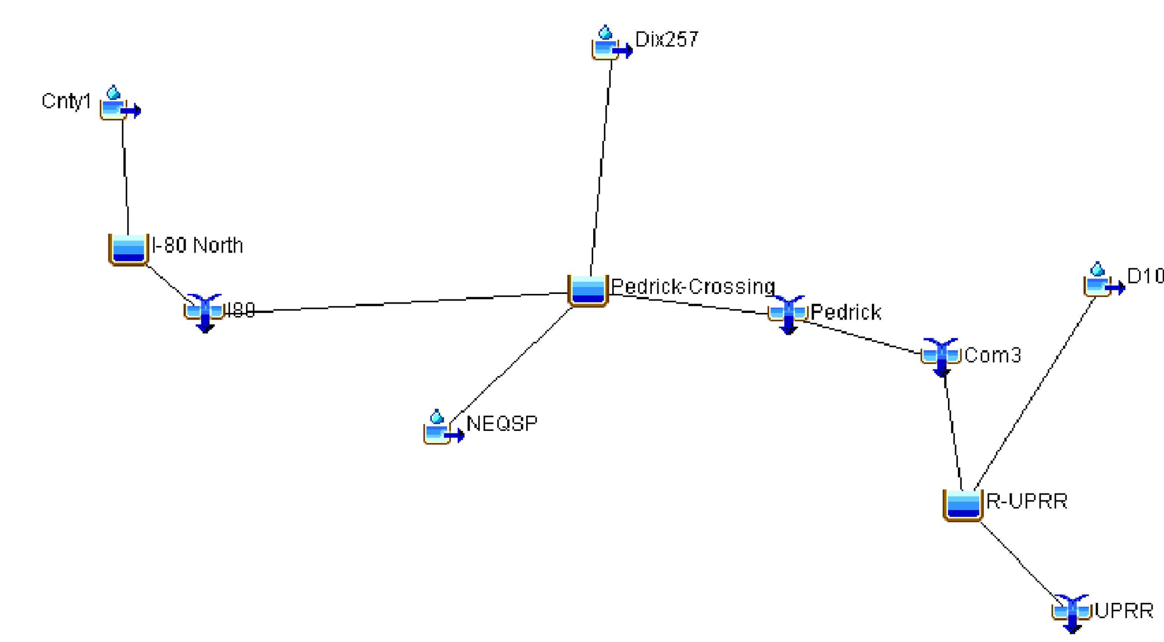
Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	791.5	05Jun2003, 04:15	2.8		
I-80 North	4.043	189.1	05Jun2003, 13:30	2.71		
I80	4.043	189.1	05Jun2003, 13:30	2.71		
Dix257	0.4063	293.6	05Jun2003, 01:45	2.94		
NEQSP	0.3398	254	05Jun2003, 01:30	2.94		
Pedrick-Cros	4.7891	412.8	05Jun2003, 02:00	2.72	29.8	61.6
Pedrick	4.7891	412.8	05Jun2003, 02:00	2.72		
Com3	4.7891	412.8	05Jun2003, 02:00	2.72		
D10	3.055	584.3	05Jun2003, 04:00	2.94		
R-UPRR	7.8441	166.9	06Jun2003, 01:00	2.29		
UPRR	7.8441	166.9	06Jun2003, 01:00	2.29		

10-Year Proposed

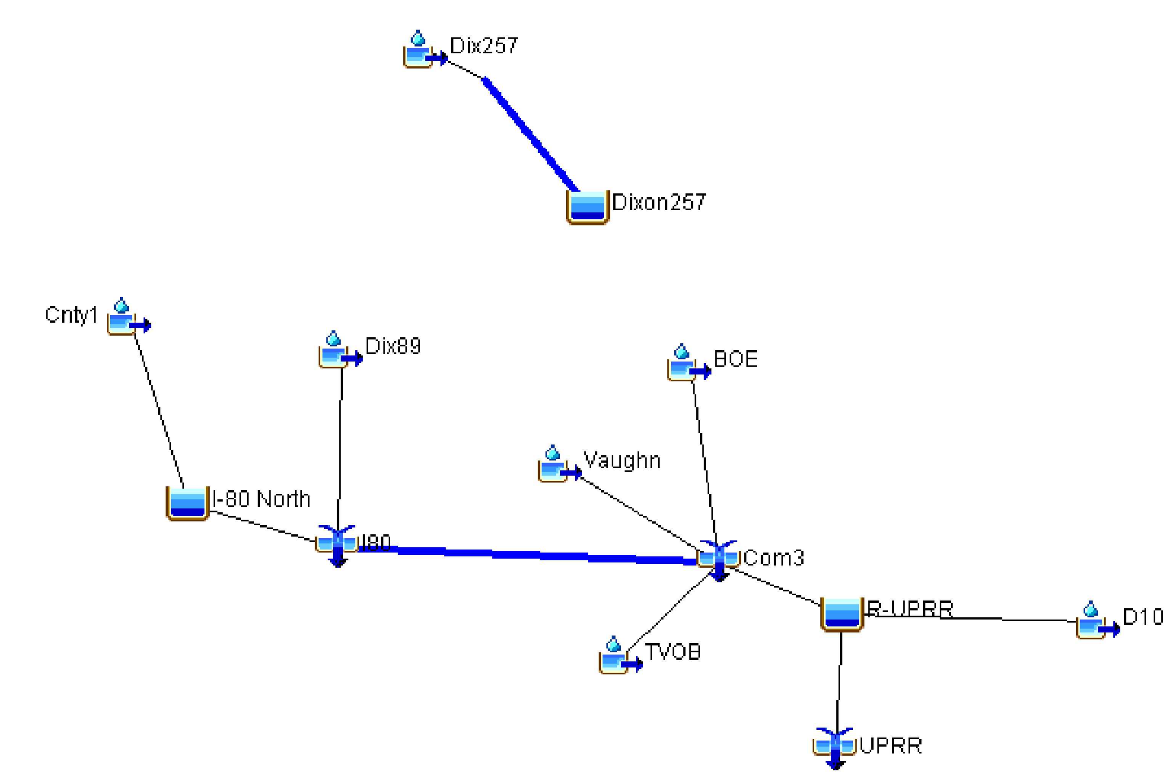
Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	487.6	05Jun2003, 04:00	1.52		
I-80 North	4.043	95.5	05Jun2003, 13:30	1.52		
Dix89	0.1391	47.3	05Jun2003, 01:45	2.94		
I80	4.1821	98.1	05Jun2003, 13:00	1.56		
Bypass	4.1821	98.1	05Jun2003, 13:15	1.56		
TVOB	0.103	33.2	05Jun2003, 01:45	2.94		
BOE	0.0563	18.1	05Jun2003, 01:45	2.88		
Vaughn	0.0414	11.7	05Jun2003, 01:45	3		
Com3	4.3828	135.9	05Jun2003, 02:00	1.63		
D10	3.055	360.9	05Jun2003, 04:00	1.61		
R-UPRR	7.4378	124	05Jun2003, 18:30	1.55		
UPRR	7.4378	124	05Jun2003, 18:30	1.55		
Dix257	0.4063	223.5	05Jun2003, 01:45	4.57		
Reach-2	0.4063	219.9	05Jun2003, 01:45	4.57		
Dixon257	0.4063	2.6	06Jun2003, 02:30	1.09	163.74	18.9

Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	791.5	05Jun2003, 04:15	2.8		
I-80 North	4.043	189.1	05Jun2003, 13:30	2.71		
Dix89	0.1391	68.7	05Jun2003, 01:45	5.43		
I80	4.1821	194.8	05Jun2003, 12:15	2.8		
Bypass	4.1821	194.8	05Jun2003, 12:30	2.8		
TVOB	0.103	48.3	05Jun2003, 01:45	5.43		
BOE	0.0563	26.4	05Jun2003, 01:45	5.35		
Vaughn	0.0414	17.1	05Jun2003, 01:45	5.51		
Com3	4.3828	204.3	05Jun2003, 11:45	2.92		
D10	3.055	584.3	05Jun2003, 04:00	2.94		
R-UPRR	7.4378	166	06Jun2003, 01:30	2.41		
UPRR	7.4378	166	06Jun2003, 01:30	2.41		
Dix257	0.4063	318.8	05Jun2003, 01:45	7.75		
Reach-2	0.4063	312.2	05Jun2003, 01:45	7.74		
Dixon257	0.4063	2.8	07Jun2003, 01:45	1.19	229	52.3

HEC-HMS SCHEMATIC 100-YEAR EVENT-PRE-DEVELOPMENT



HEC-HMS SCHEMATIC 100-YEAR EVENT-POST DEVELOPMENT



NOT FOR CONSTRUCTION

REVISIONS NO.	DESCRIPTION	APPD. ENGR.	DATE	APPD. E.U.	DATE

SCALE:
HORIZ. 1" = 300'
VERT. 1" = N/A

BENCH MARK

COMPUTED	DF
DESIGNED	DF
DRAWN	DF
PROJ. ENGR.	GB

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IMPROVEMENT PLANS FOR
DIXON 257
TRUNK DRAINAGE EXHIBIT
DIXON, CALIFORNIA

DATE JAN 2024
SHEET 1 OF 1
JOB NO. 20-0024-00

10-Year Existing Conditions

Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	487.6	05Jun2003, 04:00	1.52		
I-80 North	4.043	95.5	05Jun2003, 13:30	1.52		
I80	4.043	95.5	05Jun2003, 13:30	1.52		
Dix257	0.4063	198.3	05Jun2003, 01:45	1.61		
NEQSP	0.3398	171.6	05Jun2003, 01:30	1.61		
Pedrick-Crossing	4.7891	296.1	05Jun2003, 02:00	1.53	20.1	61.3
Pedrick	4.7891	296.1	05Jun2003, 02:00	1.53		
Com3	4.7891	296.1	05Jun2003, 02:00	1.53		
D10	3.055	360.9	05Jun2003, 04:00	1.61		
R-UPRR	7.8441	124.4	05Jun2003, 18:30	1.49		
UPRR	7.8441	124.4	05Jun2003, 18:30	1.49		

100-Year Existing Conditions

Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	791.5	05Jun2003, 04:15	2.8		
I-80 North	4.043	189.1	05Jun2003, 13:30	2.71		
I80	4.043	189.1	05Jun2003, 13:30	2.71		
Dix257	0.4063	293.6	05Jun2003, 01:45	2.94		
NEQSP	0.3398	254	05Jun2003, 01:30	2.94		
Pedrick-Cros	4.7891	412.8	05Jun2003, 02:00	2.72	29.8	61.6
Pedrick	4.7891	412.8	05Jun2003, 02:00	2.72		
Com3	4.7891	412.8	05Jun2003, 02:00	2.72		
D10	3.055	584.3	05Jun2003, 04:00	2.94		
R-UPRR	7.8441	166.9	06Jun2003, 01:00	2.29		
UPRR	7.8441	166.9	06Jun2003, 01:00	2.29		

10-Year Proposed

Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	487.6	05Jun2003, 04:00	1.52		
I-80 North	4.043	95.5	05Jun2003, 13:30	1.52		
Dix89	0.1391	47.3	05Jun2003, 01:45	2.94		
I80	4.1821	98.1	05Jun2003, 13:00	1.56		
Bypass	4.1821	98.1	05Jun2003, 13:15	1.56		
TVOB	0.103	33.2	05Jun2003, 01:45	2.94		
BOE	0.0563	18.1	05Jun2003, 01:45	2.88		
Vaughn	0.0414	11.7	05Jun2003, 01:45	3		
Com3	4.3828	135.9	05Jun2003, 02:00	1.63		
D10	3.055	360.9	05Jun2003, 04:00	1.61		
R-UPRR	7.4378	124	05Jun2003, 18:30	1.55		
UPRR	7.4378	124	05Jun2003, 18:30	1.55		
Dix257	0.4063	223.5	05Jun2003, 01:45	4.57		
Reach-2	0.4063	219.9	05Jun2003, 01:45	4.57		
Dixon257	0.4063	2.6	06Jun2003, 02:30	1.09	163.74	18.9

Element	Draiange Area (Mi^2)	Peak Discharage (cfs)	Time of Peak	Volume (in)	Storage (Ac-ft)	Elevation (ft)
Cnty1	4.043	791.5	05Jun2003, 04:15	2.8		
I-80 North	4.043	189.1	05Jun2003, 13:30	2.71		
Dix89	0.1391	68.7	05Jun2003, 01:45	5.43		
I80	4.1821	194.8	05Jun2003, 12:15	2.8		
Bypass	4.1821	194.8	05Jun2003, 12:30	2.8		
TVOB	0.103	48.3	05Jun2003, 01:45	5.43		
BOE	0.0563	26.4	05Jun2003, 01:45	5.35		
Vaughn	0.0414	17.1	05Jun2003, 01:45	5.51		
Com3	4.3828	204.3	05Jun2003, 11:45	2.92		
D10	3.055	584.3	05Jun2003, 04:00	2.94		
R-UPRR	7.4378	166	06Jun2003, 01:30	2.41		
UPRR	7.4378	166	06Jun2003, 01:30	2.41		
Dix257	0.4063	318.8	05Jun2003, 01:45	7.75		
Reach-2	0.4063	312.2	05Jun2003, 01:45	7.74		
Dixon257	0.4063	2.8	07Jun2003, 01:45	1.19	229	52.3

CITY OF DIXON
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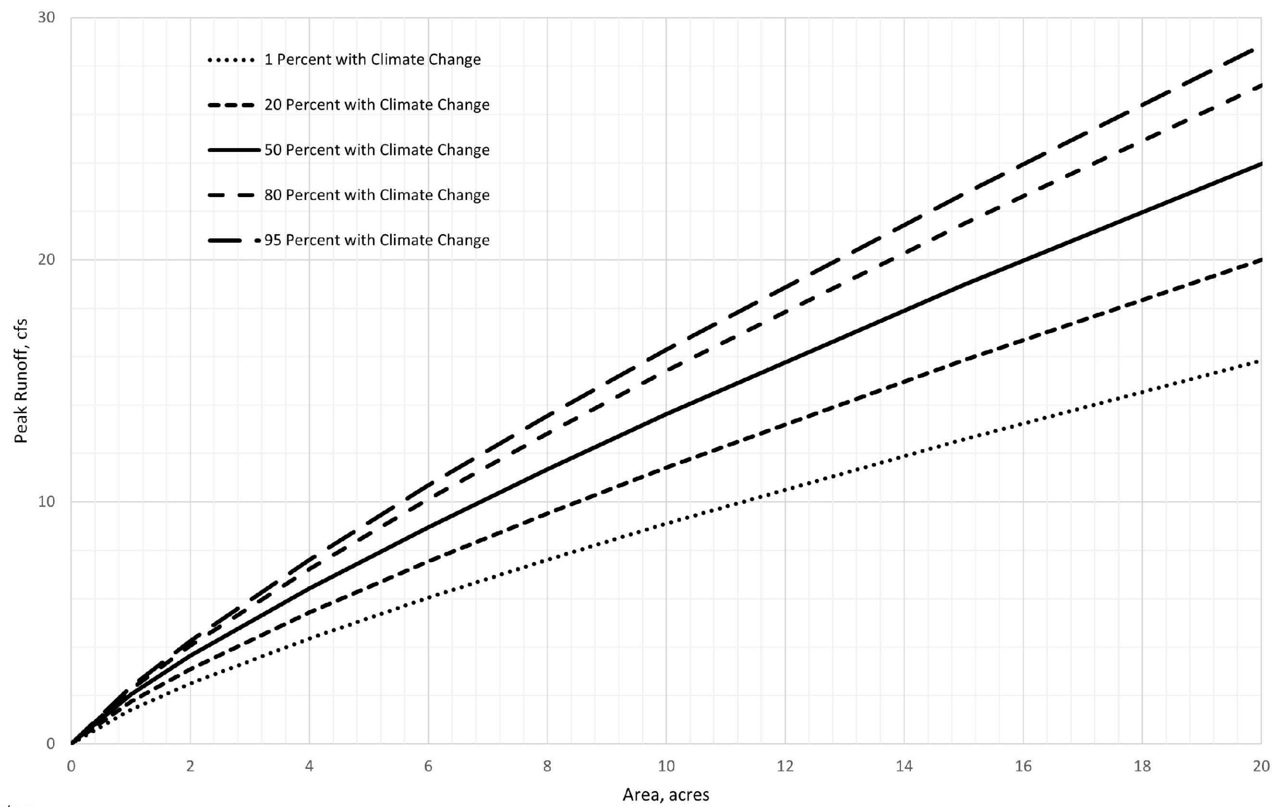
10-YEAR PEAK FLOW 0 – 80 ACRES

FIG. 4-3



Notes:
These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:
- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.

20-0024-00 Dixon 257 Drainage

Post-Development Conditions

Land Use Information and Basin "n" calculation

Basic Parameters			**Land Uses (Ac.)**							
Shed	Total Area (Ac.)	Total Area (Sq Mi.)	Roadway 95% Imp. Basin "n" = 0.03	Commercial 90% Imp. Basin "n" = 0.031	Industrial 85% Imp. Basin "n" = 0.032	Medium Density Residential 70% Imp. Basin "n" = 0.035	Single Family Res. (6-8 DU/AC.) 50% Imp. Basin "n" = 0.04	Open Space 2% Imp. Basin "n" = 0.07	**Weighted Shed Impervious %**	**Weighted Basin "n"**
Shed 4B	14.69	0.02295	0.69	2.00	12.00				**86%**	**0.032**
Shed 4C	11.70	0.01828	2.43			9.27			**75%**	**0.034**
Shed 5	47.77	0.07464	4.63		42.00			1.14	**84%**	**0.033**
Shed 6	40.50	0.06328	3.76			17.50	15.43	3.81	**58%**	**0.040**
Shed 7	40.71	0.06361	1.11				36.24	3.36	**47%**	**0.042**
Shed 8	70.84	0.11069	3.90				61.98	4.96	**49%**	**0.042**
Shed 9	30.99	0.04842	9.13					21.86	**29%**	**0.058**
Total	**257.20**	**0.40188**	25.65	2.00	54.00	26.77	113.65	35.13	**58%**	**0.041**

Snyder Method

Shed	Area		Length(1)			Centroid Length(1)	Basin Slope(2)	Snyder	Percent	Basin	Snyder Lag		Peak Flows, cfs (3)		Peak Flows, cfs (4)	
	ac	sm	L, ft	L, mi	90%L, mi	Lc, ft	S, ft/mi	Peaking	Impervious	"n"	min	hr	**10-Year**	**100-Year**	**10-Year**	**100-Year**
Shed 4B	14.69	0.02295	2000	0.379	0.341	1000	5.28	0.69	86%	0.032	15.2	0.25	**24.6**	**35.2**	***22***	***31***
Shed 4C	11.70	0.01828	1785	0.338	0.304	892	5.28	0.69	75%	0.034	15.1	0.25	**28.6**	**41.2**	***20***	***28***
Shed 5	47.77	0.07464	3606	0.683	0.615	1803	5.28	0.69	84%	0.033	23.2	0.39	**61.9**	**88.6**	***60***	***78***
Shed 6	40.50	0.06328	3321	0.629	0.566	1660	5.28	0.69	58%	0.040	26.6	0.44	**42.3**	**60.9**	***46***	***60***
Shed 7	40.71	0.06361	3329	0.631	0.567	1665	5.28	0.69	47%	0.042	28.4	0.47	**46.1**	**66.7**	***43***	***60***
Shed 8	70.84	0.11069	4392	0.832	0.749	2196	5.28	0.69	49%	0.042	33.5	0.56	**71.0**	**102.9**	***66***	***94***
Shed 9	30.99	0.04842	2905	0.550	0.495	1452	5.28	0.69	29%	0.058	35.7	0.60	**43.9**	**62.7**	***48***	***58***

(1) Length is based on 2.5 times the square root of the area, Centroid Length is 1/2 the Length

(2) Basin Slope = 0.001 ft/ft Per City of Doxon Peak Flow Figures

(3) Results from HEC-HMS Snyder Method Model

(4) Flow from City of Dixon runoff curves.

From City of Dixon Peak Flow Figures

Notes:

These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:

- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.

From Sacramento County Drainage Manual - Chapter 7

Table 7-1. Basin "n" for Unit Hydrograph Lag Equation

Basin Land Use	Percent Impervious	Channelization Description: Developed Pipe/Channel	Channelization Description: Undeveloped Natural
Highways, Parking	95	0.030	0.067
Commercial, Offices	90	0.031	0.070
Intensive Industrial	85	0.032	0.071
Apartments, High Density Res.	80	0.033	0.072
Mobil Home Park	75	0.034	0.073
Condominiums, Med. Density Res.	70	0.035	0.074
Residential 8-10 du/acre (20-25 du/ha), Ext Industrial	60	0.037	0.076
Residential 6-8 du/acre (15-20 du/ha), Low Density Res., School	50	0.040	0.080
Residential 4-6 du/acre (10-15 du/ha)	40	0.042	0.084
Residential 3-4 du/acre (7.5-10 du/ha)	30	0.046	0.088
Residential 2-3 du/acre (5-7.5 du/ha)	25	0.050	0.090
Residential 1-2 du/acre (2.5-5 du/ha)	20	0.053	0.093
Residential .5-1 du/acre (1-2.5 du/ha)	15	0.056	0.096
Residential .2-.5 du/acre (0.5-1 du/ha), Ag Res.	10	0.060	0.100
Residential <.2 du/acre (0.5 du/ha), Recreation	5	0.065	0.110
Open Space, Grassland, Ag	2	0.070	0.115
Open Space, Woodland, Natural	1	0.075	0.120
Dense Oak, Shrubs, Vines	1	0.080	0.150
Shaded values are normally not used.			

CITY OF DIXON
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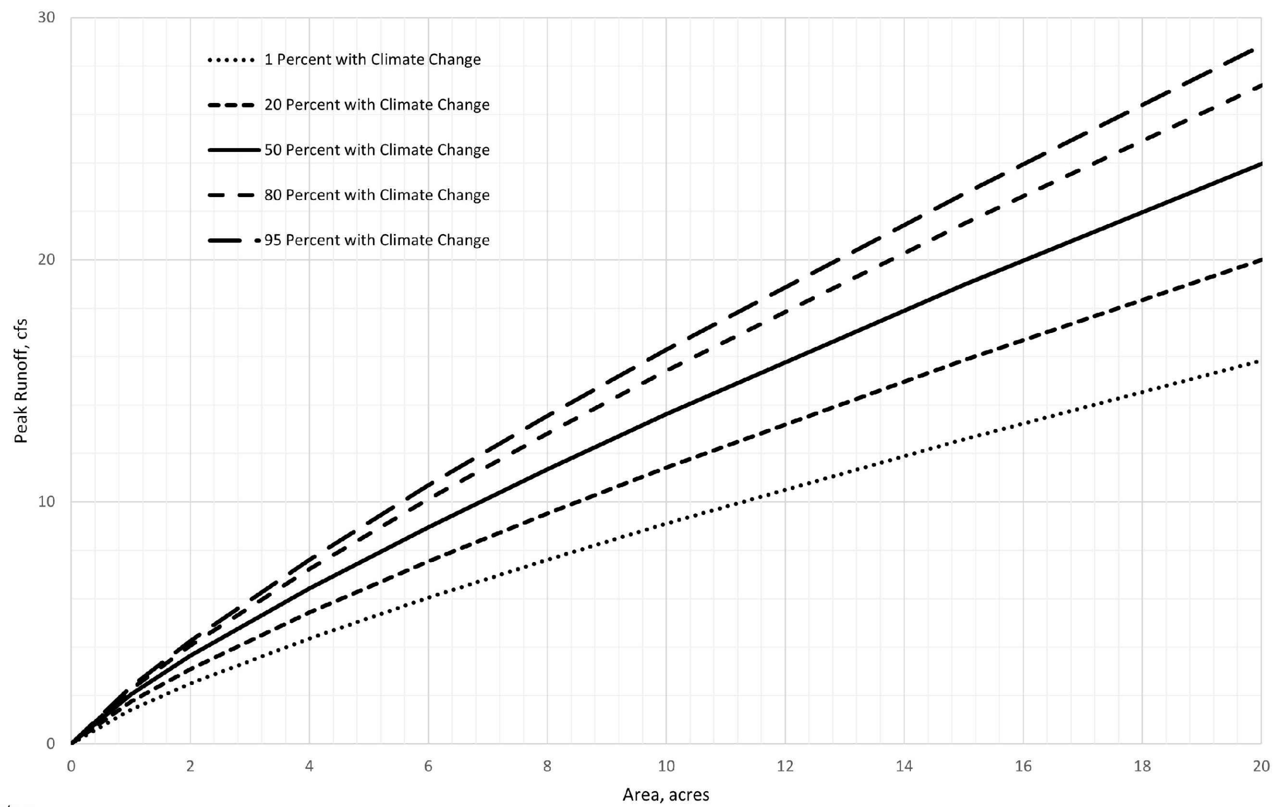
10–YEAR PEAK FLOW 0 – 80 ACRES

FIG. 4–3



Notes:

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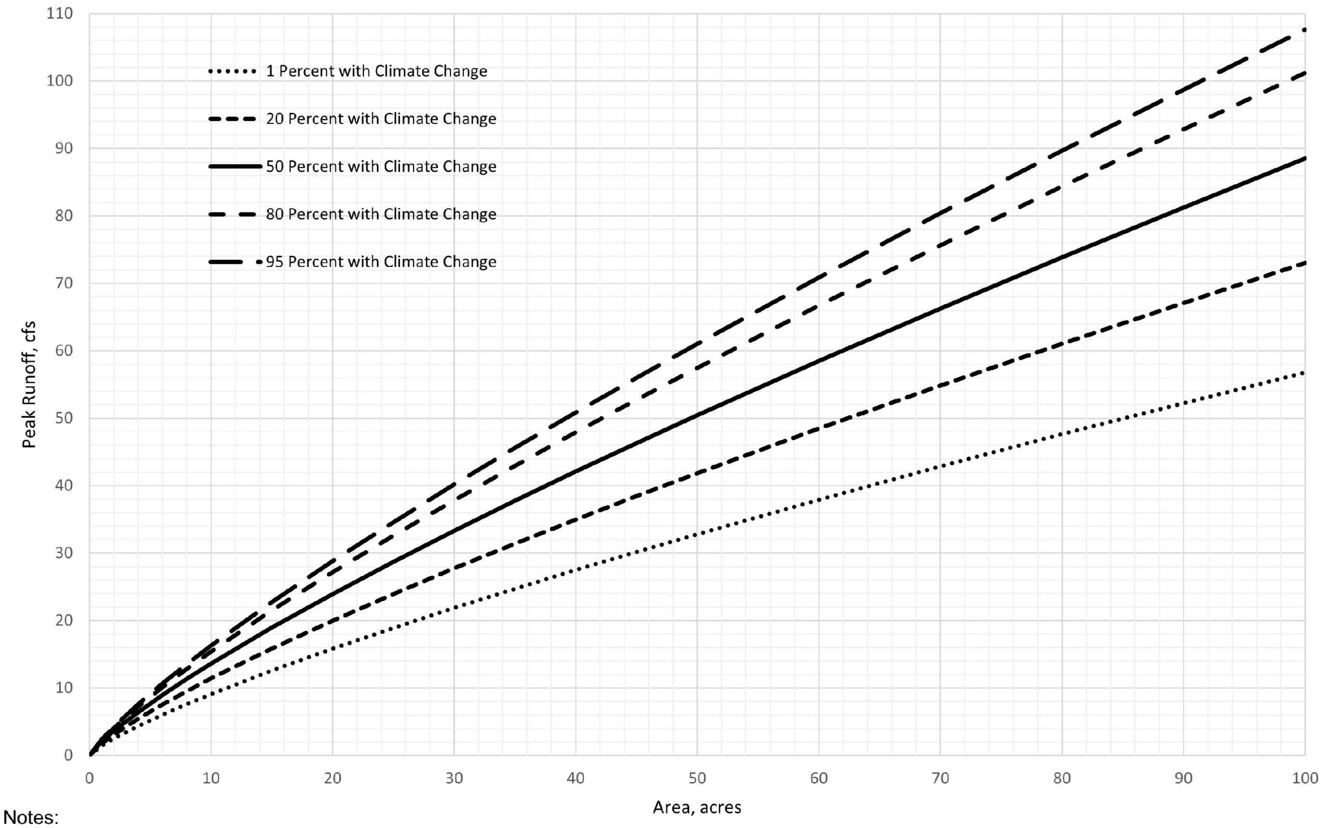
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.



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These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:
- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.

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10–YEAR PEAK FLOW
80 – 640 ACRES

FIG.
4–4

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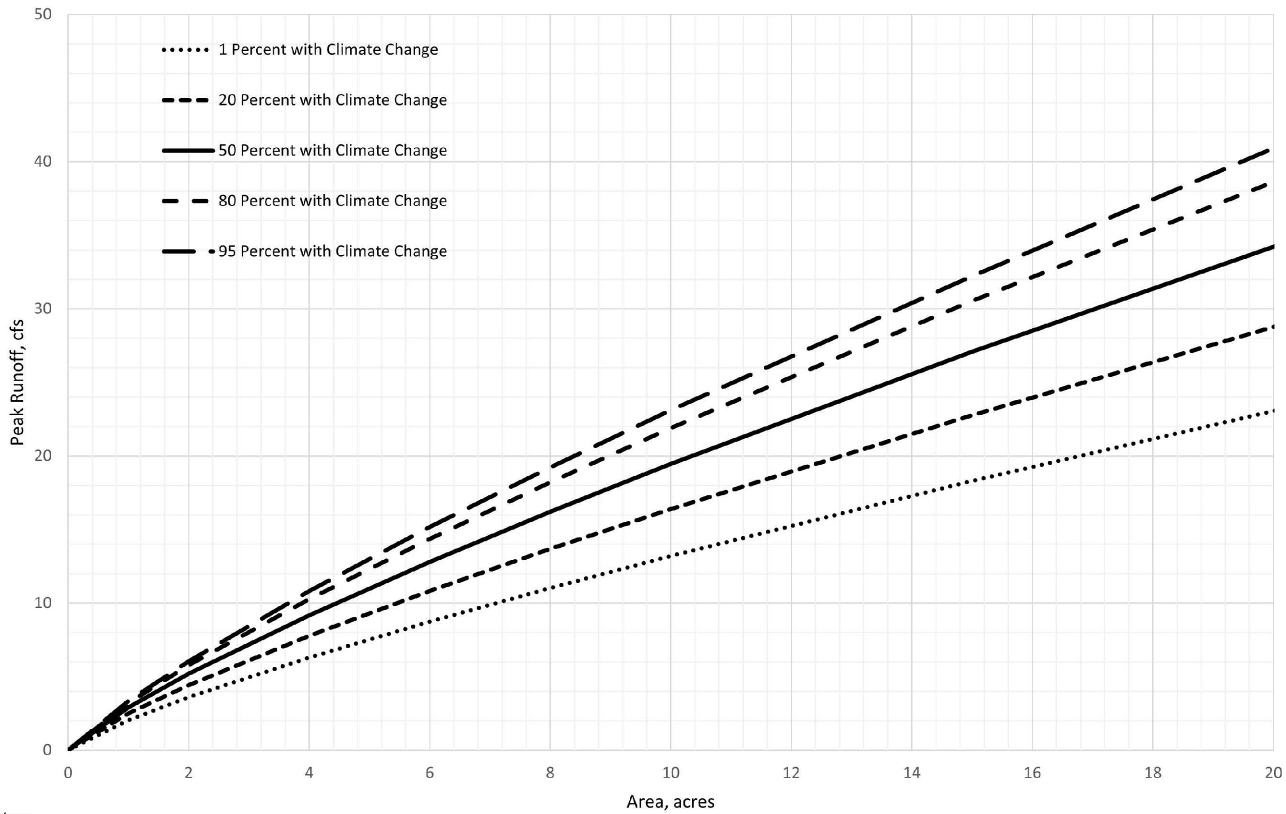
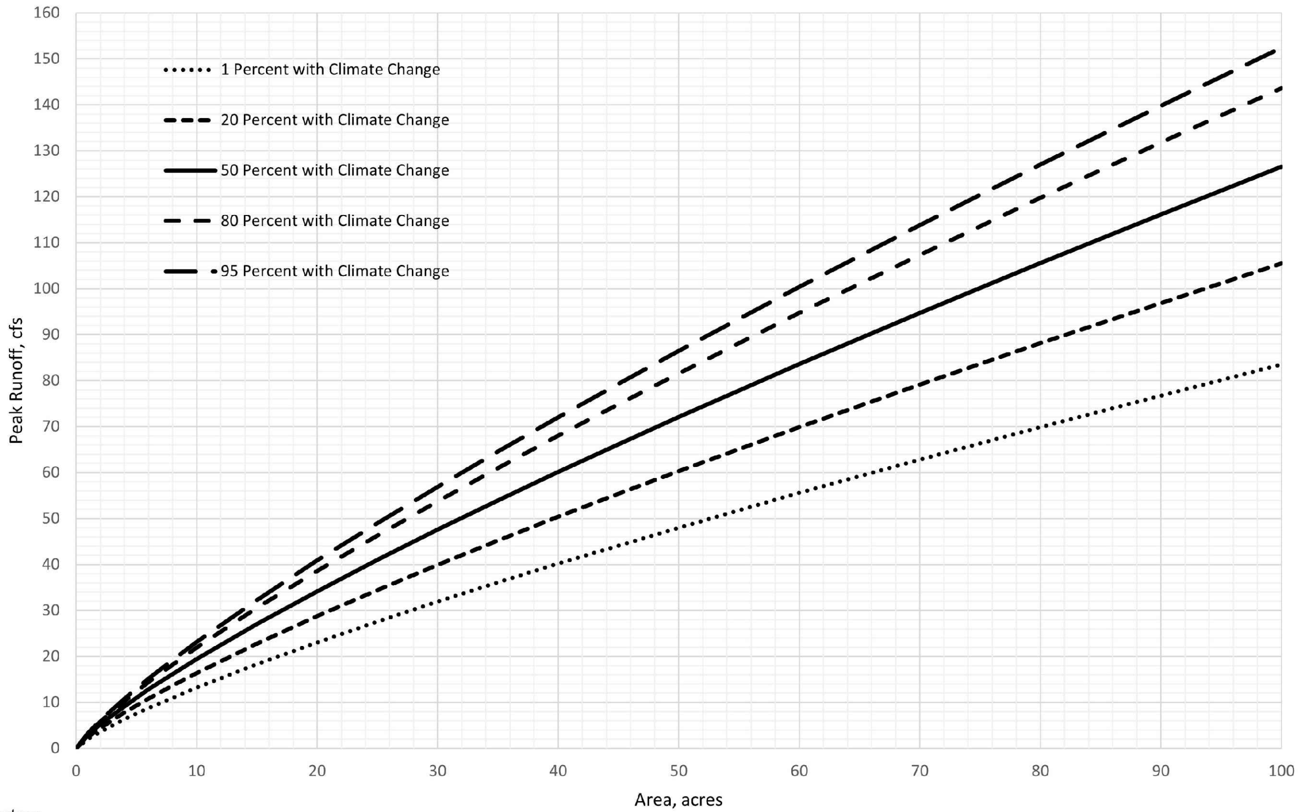
100-YEAR PEAK FLOW
0 - 80 ACRES

4-5



Notes:
These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:
- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.



Notes:
These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:
- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.

CITY OF DIXON
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Approved: March 2022

100-YEAR PEAK FLOW
80 – 640 ACRES

FIG.
4–6

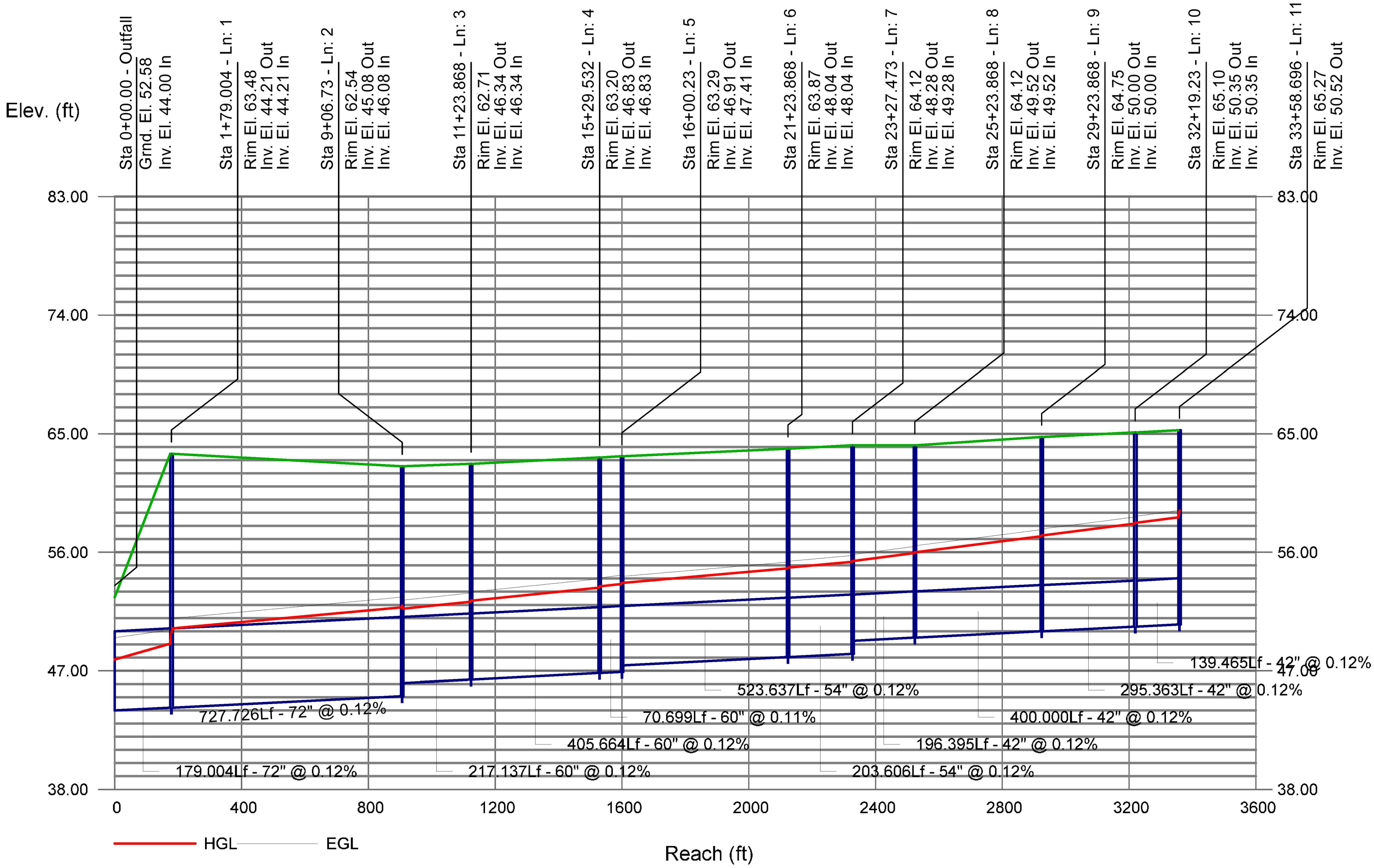
Land Use	Percent Impervious
Highways, Parking Lots	95
Commercial, Office	90
Industrial	85
Apartments, High Desnsity Residential	80
Mobile Home Park	75
Condominiums, Medium Density Residential	70
Residential (8-10 du/acre)	60-70
Residential (6-8 du/acre), Low Density Residential, Schools	50-60
Residential (4-6 du/acre)	40-50
Residential (3-4 du/acre)	30-40
Residential (2-3 du/acre)	25-30
Residential (1-2 du/acre)	20-25
Residential (0.5-1 du/acre)	15-20
Residential (0.2-0.5 du/acre)	10-15
Residential (<0.2 du/acre)	5-10
Open Space, Agricultural	2 - 5

APPENDIX D:

Hydraulic Calculations (Profiles)

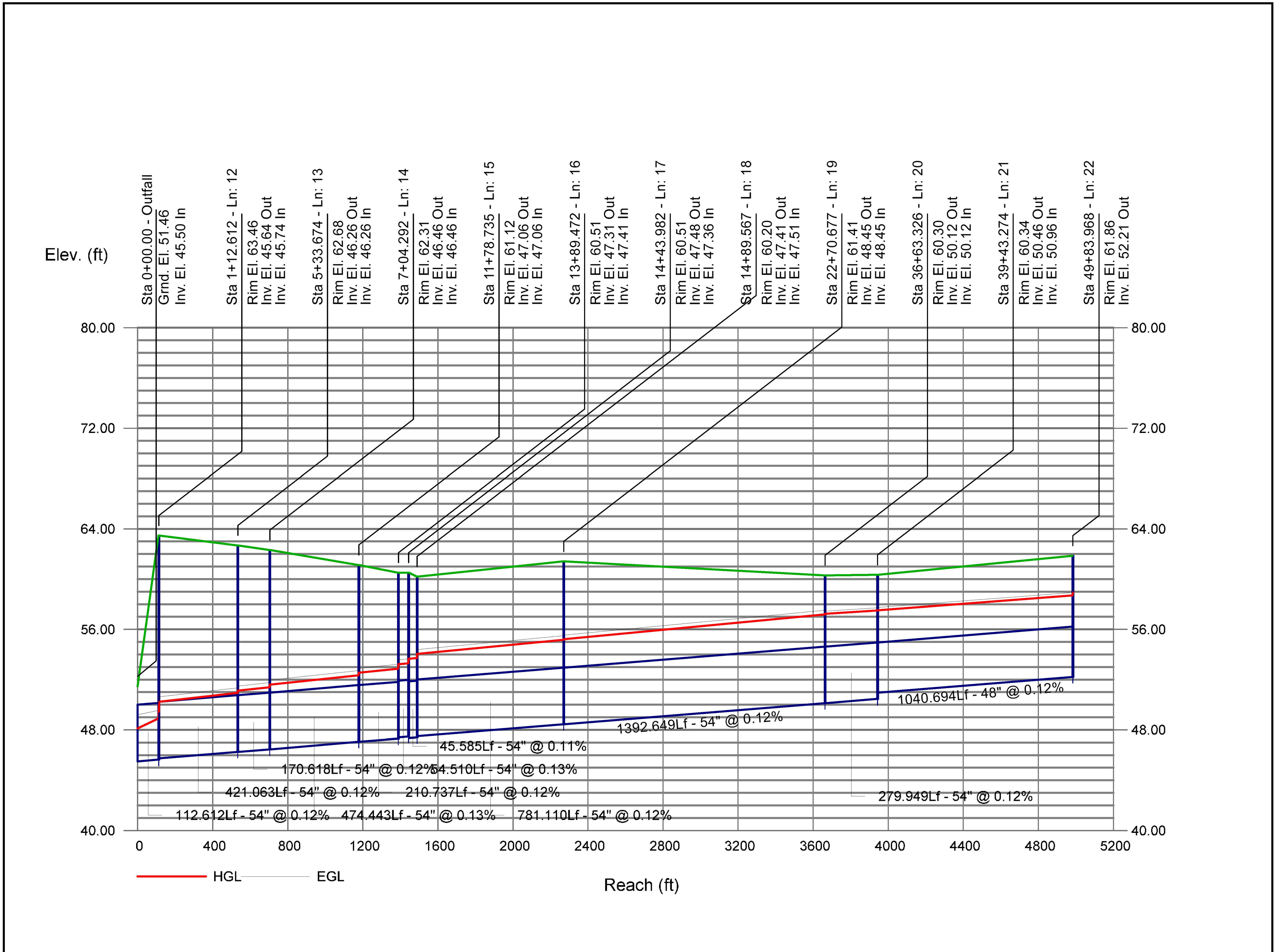
Storm Sewer Profile

Proj. file: Dixon-257-20230710.stm



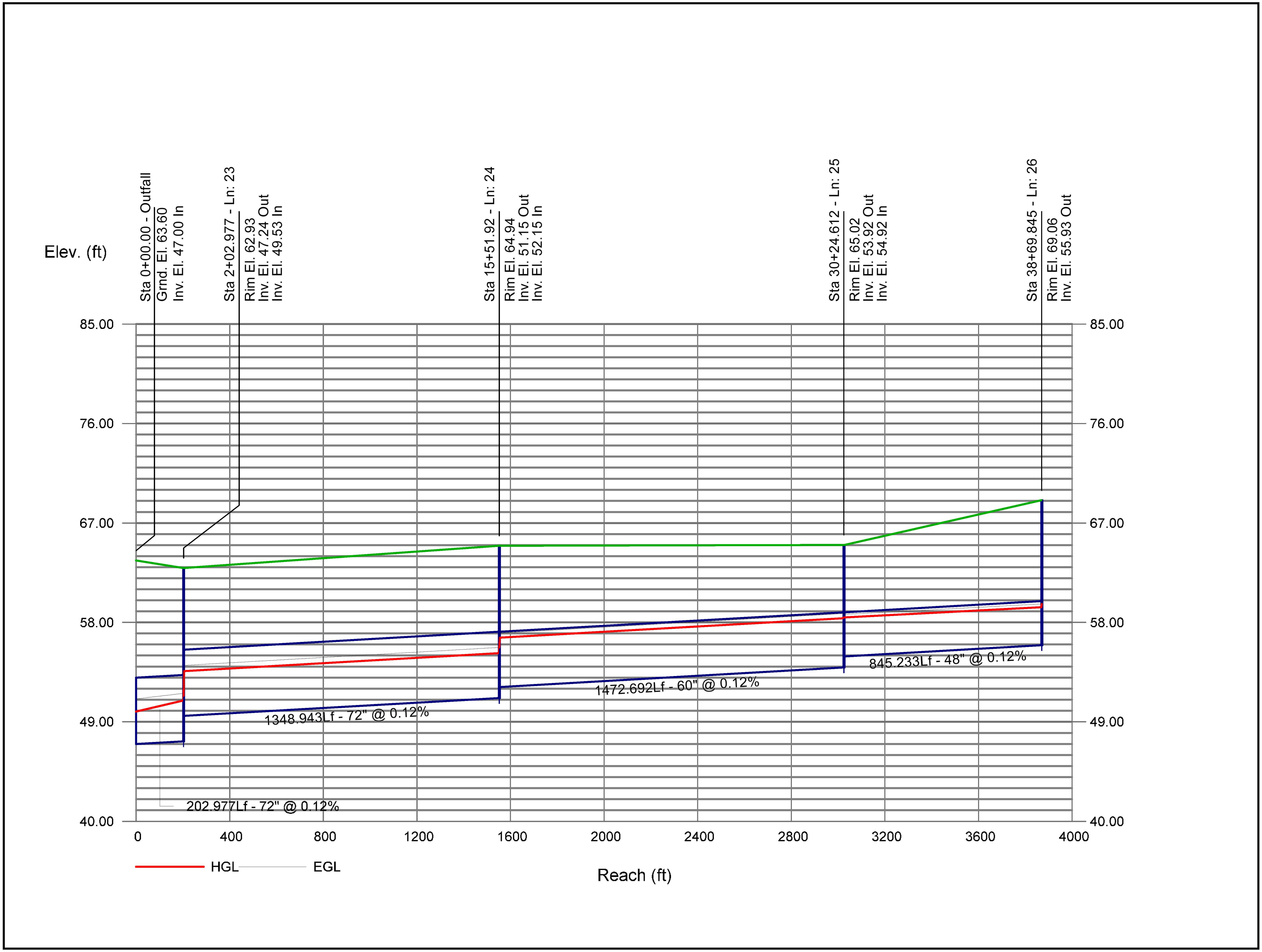
Storm Sewer Profile

Proj. file: Dixon-257-20230710.stm



Storm Sewer Profile

Proj. file: Dixon-257-20230710.stm



APPENDIX E:

Backup Data

HEC-HMS download available at:
https://www.dropbox.com/scl/fi/3tpds16ucnaa1d9fda8iz/Campus_20240119.zip?rlkey=8ebqczcexui7gf6viqw6rn8em&dl=0

Rainfall-Runoff Analysis

Impervious Acreage:	170.3	65.0%
Pervious Acreage:	91.7	35.0%
	262	65%

Date	Design Rainfall	Impervious Area Runoff	Effective Rainfall	Pervious Runoff	Total Runoff
	in	ac-ft	in	ac-in	ac-ft
October	0.33	4.68	0.00	0.00	4.68
November	4.21	59.75	1.83	13.98	73.73
December	2.86	40.59	0.90	6.88	47.47
January	12.86	182.50	6.62	50.59	233.09
February	8.61	122.19	7.79	59.53	181.72
March	9.62	136.52	5.58	42.64	179.16
April	1.43	20.29	0.07	0.53	20.83
May	0.67	9.51	0.00	0.00	9.51
June	0.71	10.08	0.00	0.00	10.08
July	0.35	4.97	0.00	0.00	4.97
August	0.00	0.00	0.00	0.00	0.00
September	0.00	0.00	0.00	0.00	0.00
Total	**41.65**	**591.08**	**22.79**	**174.15**	**765.24**
Maximum	**12.86**	**182.50**	**7.79**	**59.53**	**233.09**

Retention Basin Water Balance Analysis

Retention Pond Area (acres):	21.2	25% of Maximum Volume (ac-ft):	58.3
Retention Pond Depth (ft)	15.0		
Retention Pond Side Slope (_H:1V)	4		

Date	Start-of-Month Volume of Stored Water	Water Surface Area	Water Depth	Potential Unit Evaporation Rate	Potential Evaporation Loss	Potential Unit Percolation Loss [(a)]	Potential Percolation Loss	Total Loss	End-of-Month Volume of Stored Water
	ac-ft	ac	ft	in	ac-ft	in	ac-ft	ac-ft	ac-ft
October	0.00	0.0	0.0	4.03	0.00	124.00	0.00	0.00	4.68
November	4.68	4.8	1.5	2.10	0.85	120.00	48.41	4.68	73.73
December	73.73	17.0	6.9	1.55	2.20	124.00	175.77	73.73	47.47
January	47.47	16.1	5.3	1.55	2.08	124.00	166.20	47.47	233.09
February	233.09	20.0	15.5	2.24	3.74	112.00	186.83	190.57	224.24
March	224.24	19.9	15.1	3.72	6.16	124.00	205.38	211.54	191.87
April	191.87	19.3	13.4	5.10	8.19	120.00	192.76	191.87	20.83
May	20.83	11.1	3.5	6.82	6.32	124.00	114.83	20.83	9.51
June	9.51	7.3	2.3	7.80	4.77	120.00	73.33	9.51	10.08
July	10.08	7.3	2.3	8.68	5.30	124.00	75.78	10.08	4.97
August	4.97	5.2	1.6	7.75	3.33	120.00	51.53	4.97	0.00
September	0.00	0.0	0.0	5.70	0.00	124.00	0.00	0.00	0.00
Total				**57.04**	**42.93**	**1460.00**	**1290.81**	**765.24**	
Maximum	**233.1**	**20.0**	**15.5**	**8.68**	**8.19**	**124.00**	**205.38**	**211.54**	**233.1**

(a) These percolation rates are from the planning of the Dixon wastewater treatment plant percolation/evaporation basins. Different percolation rates may be apporpriate for other sites.

TABLE A-1
PRECIPITATION DATA
Based on City of Dixon Standards, Fig. 4-1
Mean Annual Precipitation = 19.0 inches

DURATION	10 YEAR STORM		100 YEAR STORM		25 YEAR STORM	
	Depth (inches)	Intensity (in/hr)	Depth (inches)	Intensity (in/hr)	Depth (inches)	Intensity (in/hr)
5 min	0.34	4.08	0.48	5.76	0.33	3.96
15 min	0.55	2.20	0.79	3.16	0.53	2.12
30 min	0.74	1.48	1.05	2.10	0.97	1.94
60 min	1.00	1.00	1.42	1.42	0.97	0.97
2 hr	1.36	0.68	1.91	0.96	1.30	0.65
3 hr	1.60	0.53	2.27	0.76	1.55	0.52
6 hr	2.16	0.36	3.06	0.51	2.09	0.35
12 hr	2.90	0.24	4.12	0.34	2.81	0.23
24 hr	3.92	0.16	5.55	0.23	3.79	0.16
2 day	5.25	0.11	7.72	0.16	5.17	
4 day	6.38	0.07	9.39	0.10	6.30	
10 day						
30 day						
60 day						
365 day						

Figure A-1
Estimated Lag Time

LAG = (0.728-.00546p)(A/(Si)^.5)^.2 (hr)
p = Percent Urbanization
A = Area (acres)
Si = Slope Index, (ft/mile)

Cp = KA^.15

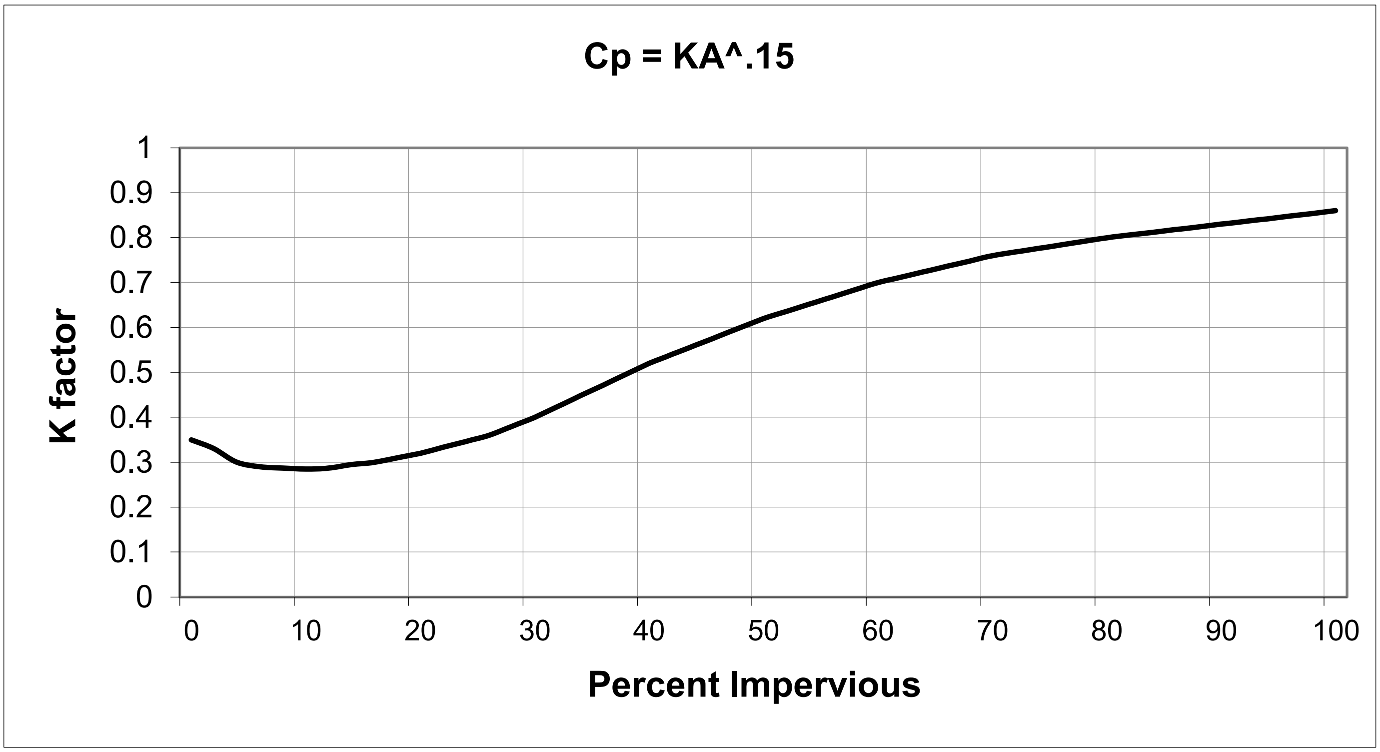


Table A-2
General Plan Land Use
Percent Impervious and Percent Urbanization

Land Use		Effective Percent Impervious	Percent Urbanization
Residential			
VLD	Very Low Density	20	40
LD	Low Density	35	70
MDL	Medium Density - Low	45	90
MDH	Medium Density - High	60	95
HD	High Density	70	95
FR	Future Residential	50	95
Industrial			
PI	Planned Business / Industrial	85	95
FI	General Industrial	85	95
E	Employment Center	Varies (60-90)	95
Commerical			
D	Downtown	85	95
NC	Neighborhood	85	95
CC	Community	85	95
HC	Highway	90	95
SC	Services	90	95
O	Prof. / Admin. Office	85	95
MU	Core Area Mixed	85	95
Other			
G	Governmental / Institutional	Varies	Varies
P	Parks	10	20
S	Schools	50	75
F	Functional (Buffers)	Varies (10)	20
A	Agricultural	3	0

Table A-3 Initial Loss and Infiltration Rate	
Initial Loss	
10 Year Design	0.2 inches
100 Year Design	0.1 inches
Uniform Infiltration (Commercial Development)	
SCS Hydrologic Soil Group B	0.16 in/hr
SCS Hydrologic Soil Group C	0.08 in/hr
SCS Hydrologic Soil Group D	0.05 in/hr

Per Sacramento County Hydrologu Standards Vol. 2

20-0024-00 Dixon 257 Drainage
Post-Development Conditions

Land Use Information and Basin "n" calculation

Basic Parameters			**Land Uses (Ac.)**							
Shed	Total Area (Ac.)	Total Area (Sq Mi.)	Roadway 95% Imp. Basin "n" = 0.03	Commercial 90% Imp. Basin "n" = 0.031	Industrial 85% Imp. Basin "n" = 0.032	Medium Density Residential 70% Imp. Basin "n" = 0.035	Single Family Res. (6-8 DU/AC.) 50% Imp. Basin "n" = 0.04	Open Space 2% Imp. Basin "n" = 0.07	**Weighted Shed Impervious %**	**Weighted Basin "n"**
Shed 1	97.79	0.15280	13.05	14.01	70.73				**87%**	**0.032**
Shed 2	38.77	0.06058	1.84	5.36	31.57				**86%**	**0.032**
Shed 3	23.95	0.03741	1.83		22.12				**86%**	**0.032**
Shed 4	38.45	0.06007	0.76	37.69					**90%**	**0.031**
Shed 5	60.46	0.09447	7.52	2.00	47.00			3.94	**81%**	**0.033**
Shed 6	56.00	0.08750	10.12			9.71	30.86	5.31	**57%**	**0.038**
Shed 7	46.21	0.07220	4.82				37.68	3.72	**51%**	**0.040**
Shed 8	75.43	0.11786	10.47				59.49	5.48	**53%**	**0.039**
Shed 9	47.49	0.07420	6.20		22.79			18.51	**54%**	**0.039**
Total	**484.54**	**0.75710**								

20-0024-00 Dixon 257 Drainage
Post-Development Conditions

<u>Trunk Drain Information</u>

Reach Name	Length (ft)	Invert Up	Invert Down	Slope (ft/ft)	Diameter (in)	Manning's n
Pipe 1	2220	45.0	42.1	0.0013	60	0.013
Pipe 2	1000	42.3	41.0	0.0013	48	0.013
Pipe 3	1325	39.4	37.65	0.0013	66	0.013
Pipe 4	370	37.55	36.8	0.0020	66	0.013
Pipe 5	870	50.9	49.8	0.0013	48	0.013
Pipe 6	1110	48.8	47.4	0.0013	60	0.013
Pipe 7	705	46.9	46.0	0.0013	66	0.013
Pipe 8	930	45.5	44.3	0.0013	72	0.013
Pipe 9	450	44.3	43.7	0.0013	72	0.013
Pipe 10	335	43.7	43.0	0.0021	72	0.013

Snyder Method

Shed	Area		Length(1)	Centroid Length(1)	Basin Slope(2)	Snyder	Percent	Basin	Snyder Lag		**Peak Flows, cfs (3)**	
	ac	sm	L, ft	Lc, ft	S, ft/mi	Peaking	Impervious	"n"	min	hr	**10-Year**	**100-Year**
Shed 1	97.79	0.15280	7297	3648	5.28	0.69	87%	0.032	35.6	0.59	**102.7**	**146.3**
Shed 2	38.77	0.06058	4594	2297	5.28	0.69	86%	0.032	26.4	0.44	**48.1**	**68.6**
Shed 3	23.95	0.03741	3611	1805	5.28	0.69	86%	0.032	22.6	0.38	**32.1**	**45.8**
Shed 4	38.45	0.06007	4575	2288	5.28	0.69	90%	0.031	25.7	0.43	**48.2**	**68.8**
Shed 5	60.46	0.09447	5738	2869	5.28	0.69	81%	0.033	31.8	0.53	**67.2**	**95.8**
Shed 6	56.00	0.08750	5522	2761	5.28	0.69	57%	0.038	35.7	0.59	**58.0**	**82.9**
Shed 7	46.21	0.07220	5016	2508	5.28	0.69	51%	0.040	35.2	0.59	**47.7**	**68.3**
Shed 8	75.43	0.11786	6409	3204	5.28	0.69	53%	0.039	40.4	0.67	**72.2**	**103.3**
Shed 9	47.49	0.07420	5085	2543	5.28	0.69	54%	0.039	34.7	0.58	**49.5**	**70.8**

(1) Length and Centroid Length Per City of Dixon Peak Flow Figures
(2) Basin Slope = 0.001 ft/ft Per City of Doxon Peak Flow Figures
(3) Results from HEC-HMS Snyder Method Model

From City of Dixon Peak Flow Figures

Notes:
These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:
- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.

From Sacramento County Drainage Manual - Chapter 7

Table 7-1. Basin "n" for Unit Hydrograph Lag Equation

Basin Land Use	Percent Impervious	Channelization Description: Developed Pipe/Channel	Channelization Description: Undeveloped Natural
Highways, Parking	95	0.030	0.067
Commercial, Offices	90	0.031	0.070
Intensive Industrial	85	0.032	0.071
Apartments, High Density Res.	80	0.033	0.072
Mobil Home Park	75	0.034	0.073
Condominiums, Med. Density Res.	70	0.035	0.074
Residential 8-10 du/acre (20-25 du/ha), Ext Industrial	60	0.037	0.076
Residential 6-8 du/acre (15-20 du/ha), Low Density Res., School	50	0.040	0.080
Residential 4-6 du/acre (10-15 du/ha)	40	0.042	0.084
Residential 3-4 du/acre (7.5-10 du/ha)	30	0.046	0.088
Residential 2-3 du/acre (5-7.5 du/ha)	25	0.050	0.090
Residential 1-2 du/acre (2.5-5 du/ha)	20	0.053	0.093
Residential .5-1 du/acre (1-2.5 du/ha)	15	0.056	0.096
Residential .2-.5 du/acre (0.5-1 du/ha), Ag Res.	10	0.060	0.100
Residential <.2 du/acre (0.5 du/ha), Recreation	5	0.065	0.110
Open Space, Grassland, Ag	2	0.070	0.115
Open Space, Woodland, Natural	1	0.075	0.120
Dense Oak, Shrubs, Vines	1	0.080	0.150

Shaded values are normally not used.

APPENDIX F:

100-Year and 10-Year Regional Model Results

Appendix F. Regional Model Water Surface Elevation Results

Node Name	100-Year Model Results: Existing Conditions WSE	100-Year Model Results: Propsosed Conditions with Retention Basin WSE	100-Year Model Results: Change in WSE from Existing Conditions	10-Year Model Results: Existing Conditions WSE	10-Year Model Results: Propsosed Conditions with Retention Basin WSE	10-Year Model Results: Change in WSE from Existing Conditions	10-Year Model Result Comments
f-Ica	50.93	50.92	0.00	50.44	50.44	0.00	
F-Ice	52.75	52.75	0.00	52.35	52.35	0.00	
F-Icf	52.79	52.79	0.00	52.66	52.66	0.00	
fne9	39.07	39.06	-0.02	38.32	38.32	0.00	
I-80G	63.95	63.95	0.00	63.81	63.81	0.00	
I80-N010	63.74	63.74	0.00	63.62	63.62	0.00	
I80-N020	63.98	63.98	0.00	63.66	63.66	0.00	
I5b	42.37	42.36	0.00	42.00	42.00	0.00	
Ica	51.28	51.27	-0.01	50.71	50.71	0.00	
Icb	51.69	51.69	0.00	51.37	51.37	0.00	
Icc	51.69	51.69	0.00	51.37	51.37	0.00	
Icd	52.46	52.46	0.00	52.07	52.07	0.00	
Ice	52.84	52.84	0.00	52.43	52.43	0.00	
Icf	52.86	52.86	0.00	52.71	52.71	0.00	
Icg	54.82	54.82	0.00	54.32	54.32	0.00	
Ich	55.94	55.94	0.00	55.58	55.58	0.00	
MilkFarm+	68.89	68.88	0.00	66.82	66.84	0.03	Upstream end of the I-80 culverts from the Milk Farm site. This is slight increase of existing flooding on Milk Farm Road. This flooding causes no property damage.
N106	60.09	60.09	0.00	60.03	60.03	0.00	
N106.1	59.01	58.93	-0.08	58.12	58.12	0.00	
N107	60.31	60.31	0.00	60.21	60.21	0.00	
nnx41	54.48	54.46	-0.03	53.93	53.88	-0.05	
Node241	68.88	68.87	0.00	60.90	61.10	0.20	Upstream end of the Milk Farm livestock crossing culvert. The WSE stays below the ground level.
Node242	68.08	68.08	0.00	60.90	61.10	0.20	Downstream end of the Milk Farm livestock crossing culvert. The WSE stays below the ground level.
Node244	67.00	66.81	-0.18	65.40	64.73	-0.67	
Node72	61.40	61.40	0.00	61.40	61.40	0.00	
Node82	63.59	63.59	0.00	63.59	63.59	0.00	
Node82.1	63.53	63.53	0.00	63.53	63.53	0.00	
Pdrk-N006	61.19	61.17	-0.02	60.67	60.67	0.00	
Pdrk-N008	61.40	61.34	-0.06	60.57	60.22	-0.35	
Pdrk-N010	61.40	61.33	-0.06	60.58	60.22	-0.36	
Pdrk-N020	60.97	60.56	-0.41	60.84	60.33	-0.51	
Pdrk-N030	62.87	62.87	0.00	62.82	62.82	0.00	
Pdrk-N040.1	63.45	63.45	0.00	63.38	63.38	0.00	
Pdrk-N040.1.1	63.81	63.81	0.00	63.81	63.81	0.00	
Pdrk-N040.1.1.1	63.77	63.77	0.00	63.77	63.77	0.00	
Pdrk-NPnd	56.70	56.70	0.00	56.70	56.70	0.00	
RBN0010	54.28	54.27	-0.01	54.08	54.06	-0.01	
RBN0010f	55.17	55.16	0.00	54.82	54.82	0.00	
RBN0020	54.57	54.56	-0.02	54.36	54.34	-0.02	
RBN0030	54.61	54.59	-0.02	54.40	54.38	-0.02	
RBN0040	54.61	54.59	-0.02	54.40	54.38	-0.02	
RBN0050	54.61	54.60	-0.02	54.40	54.38	-0.02	
RBN0060	55.46	55.44	-0.02	55.08	55.04	-0.04	
RBN0062	55.49	55.47	-0.02	55.13	55.09	-0.03	
RBN0064	55.46	55.44	-0.02	55.08	55.04	-0.04	
T3-0010	21.62	21.62	0.00	21.62	21.62	0.00	
T3-0020	31.69	31.67	-0.02	30.82	30.82	0.00	
T3-0030	32.47	32.45	-0.02	31.66	31.66	0.00	
T3-0040	33.08	33.06	-0.02	31.96	31.96	0.00	
T3-0042	35.42	35.42	0.00	34.75	34.75	0.00	
T3-0050	34.48	34.46	-0.02	32.88	32.88	0.00	
T3-0052	31.91	31.91	0.00	31.71	31.71	0.00	
T3-0054	31.89	31.89	0.00	31.70	31.70	0.00	
T3-0056	26.29	26.29	0.00	26.22	26.22	0.00	
T3-0070	36.16	36.14	-0.02	34.61	34.61	0.00	
T3-0072	36.41	36.41	0.00	36.07	36.07	0.00	
T3-0080	39.60	39.58	-0.02	38.08	38.07	0.00	
T3-0090	40.27	40.27	-0.01	39.51	39.51	0.00	
T3-0100	40.71	40.70	-0.01	39.74	39.74	0.00	
T3-0110	41.73	41.73	0.00	40.79	40.79	0.00	
T3-0120	41.94	41.94	0.00	40.90	40.90	0.00	
T3-0130	42.10	42.10	0.00	41.36	41.36	0.00	
T3-0140	42.15	42.14	0.00	41.38	41.38	0.00	
T3-0142	42.15	42.14	0.00	41.38	41.38	0.00	
T3-0150	42.37	42.36	0.00	41.74	41.73	0.00	
T3-0160	43.15	43.15	0.00	42.31	42.31	0.00	
T3-0170	43.13	43.13	0.00	42.34	42.34	0.00	
T3-0172	43.19	43.19	0.00	42.35	42.35	0.00	
T3-0174	42.98	42.98	0.00	42.28	42.28	0.00	
T3-0176	43.03	43.02	0.00	42.41	42.41	0.00	
T3-0180	43.05	43.04	0.00	42.36	42.36	0.00	
T3-0190	43.04	43.04	0.00	42.41	42.41	0.00	
T3-0200	43.04	43.03	0.00	42.43	42.42	0.00	
T3-0202	43.04	43.03	0.00	42.42	42.42	0.00	
T3-0204	43.04	43.03	0.00	42.43	42.43	0.00	

Appendix F. Regional Model Water Surface Elevation Results

Node Name	100-Year Model Results			10-Year Model Results			
	Existing Conditions WSE	Propsosed Conditions with Retention Basin WSE	Change in WSE from Existing Conditions	Existing Conditions WSE	Propsosed Conditions with Retention Basin WSE	Change in WSE from Existing Conditions	10-Year Model Result Comments
T3-0220	43.16	43.16	0.00	42.70	42.70	0.00	
T3-0230	44.58	44.58	0.00	44.01	44.01	0.00	
T3-0232	44.58	44.58	0.00	44.02	44.02	0.00	
T3-0234	45.06	45.06	0.00	44.70	44.70	0.00	
T3-0240	44.78	44.78	0.00	44.23	44.23	0.00	
T3-0250	44.83	44.83	0.00	44.40	44.40	0.00	
T3-0260	45.42	45.42	0.00	44.99	44.99	0.00	
T3-0262	45.56	45.56	0.00	45.16	45.16	0.00	
T3-0264	45.96	45.96	0.00	45.90	45.90	0.00	
T3-0270	45.70	45.70	0.00	45.55	45.55	0.00	
T3-0280	47.20	47.20	0.00	46.56	46.56	0.00	
T3-0290	47.84	47.84	0.00	47.27	47.27	0.00	
T3-0292	47.21	47.21	0.00	46.98	46.98	0.00	
T3-0310	50.21	50.20	0.00	49.84	49.84	0.00	
T3-0312	50.21	50.20	0.00	49.84	49.84	0.00	
T3-0330	51.37	51.31	-0.07	50.58	50.57	0.00	
T3-0332	51.37	51.31	-0.07	50.69	50.69	0.00	
T3-0342	53.06	53.04	-0.03	52.15	52.10	-0.05	
T3-0344	52.56	52.53	-0.03	51.79	51.77	-0.02	
T3-0346	52.55	52.53	-0.03	51.79	51.77	-0.02	
T3-0348	52.31	52.29	-0.02	51.57	51.58	0.01	Located north of Vaughn Road along a private ditch near the Tremont 3 Drain. This small increase is below the evaluation level of accuracy.
T3-0349	53.06	53.04	-0.03	52.15	52.10	-0.06	
T3-0360	53.34	53.31	-0.03	52.51	52.48	-0.03	
T3-0362	53.34	53.31	-0.03	52.51	52.48	-0.03	
T3-0370	53.51	53.47	-0.04	52.59	52.56	-0.03	
T3-0380	53.66	53.63	-0.03	53.16	53.15	0.00	
T3-0382	53.66	53.63	-0.03	53.16	53.15	0.00	
T3-0384	53.66	53.63	-0.03	53.17	53.17	-0.01	
T3-0390	53.75	53.72	-0.03	53.18	53.18	-0.01	
T3-0392	53.77	53.77	0.00	53.35	53.35	0.00	
T3-0400	53.95	53.91	-0.04	53.25	53.25	-0.01	
T3-0410	54.30	54.28	-0.02	53.79	53.76	-0.03	
T3-0414	54.30	54.28	-0.02	54.01	54.01	0.00	
T3-0440	57.53	57.45	-0.08	55.71	55.62	-0.09	
T3-0442	57.53	57.45	-0.08	56.03	56.03	0.00	
T3-0450	57.61	57.54	-0.07	56.73	56.66	-0.07	
T3-0452	60.95	60.93	-0.01	58.12	58.11	-0.01	
T3-0454	57.61	57.54	-0.07	56.86	56.86	0.00	
T3-0460	57.70	57.69	-0.01	57.54	57.53	-0.01	
T3-0462	57.89	57.88	0.00	57.60	57.60	0.00	
T3-0464	57.70	57.69	-0.01	57.54	57.53	-0.01	
T3-0470	60.20	60.05	-0.15	58.47	58.43	-0.05	
T30300	49.51	49.51	0.00	48.51	48.51	0.00	
T30320	51.20	51.19	-0.01	50.36	50.36	0.00	
T30340	53.06	53.04	-0.03	52.15	52.10	-0.06	
T30350	53.29	53.26	-0.03	52.26	52.21	-0.06	
T30430	56.33	56.25	-0.07	54.81	54.74	-0.07	
T3AS-0010	60.20	60.05	-0.15	59.19	59.18	0.00	
T3AS-0020	60.91	60.84	-0.07	59.72	59.72	0.00	
T3AS-0030	60.91	60.84	-0.07	59.72	59.72	0.00	
T3AS-0040	61.19	61.19	0.00	60.54	60.54	0.00	
T3AS-0050	61.20	61.19	0.00	60.55	60.55	0.00	
T3AS-0060	61.14	61.14	0.00	60.94	60.94	0.00	
T3AS-0070	62.39	62.39	0.00	62.11	62.11	0.00	
T3AS-0080	60.53	60.44	-0.09	59.25	59.00	-0.25	
T3AS-0090	60.55	60.45	-0.09	59.25	59.01	-0.25	
T3AS-0100	60.57	60.47	-0.09	59.26	59.01	-0.25	
T3AS-0106	61.19	61.17	-0.02	60.14	60.12	-0.02	
T3AS-0108	60.61	60.60	-0.02	60.11	60.09	-0.02	
T3AS-0110	60.58	60.57	-0.01	60.11	60.09	-0.02	
T3AS-0120	61.19	61.17	-0.02	60.67	60.67	0.00	
T3AS008	61.32	61.29	-0.03	60.20	60.18	-0.02	
T3NEQ-0010	65.16	65.16	0.00	64.30	61.90	-2.40	
T3NEQ-0020	65.30	65.19	-0.11	64.50	63.25	-1.25	
T3NEQ-0040	67.00	66.81	-0.18	65.40	64.73	-0.67	
T3NEQ-0050	67.86	67.78	-0.08	66.09	66.01	-0.08	
T3NEQ-0100	66.04	66.04	0.00	65.39	65.39	0.00	
T3RR-0010	59.86	59.85	-0.01	59.54	59.53	-0.01	
T3RR-0020	59.85	59.84	-0.01	59.53	59.53	-0.01	
T3RR-0040	55.55	55.53	-0.02	55.18	55.15	-0.04	
T3RR-0050	56.33	56.32	-0.01	56.15	56.14	-0.02	
T3T-0096	65.75	65.75	0.00	65.50	65.50	0.00	
T3UN-0010	64.11	64.11	0.00	63.40	63.40	0.00	
T3UN-0020	69.95	69.96	0.00	69.30	69.30	0.00	
T3UN-0030	69.96	69.96	0.00	69.30	69.30	0.00	
T3UN-0040	71.10	71.10	0.00	70.96	70.96	0.00	

Appendix F. Regional Model Water Surface Elevation Results

Node Name	100-Year Model Results: Existing Conditions WSE	100-Year Model Results: Propsosed Conditions with Retention Basin WSE	100-Year Model Results: Change in WSE from Existing Conditions	10-Year Model Results: Existing Conditions WSE	10-Year Model Results: Propsosed Conditions with Retention Basin WSE	10-Year Model Results: Change in WSE from Existing Conditions	10-Year Model Result Comments
T3UN-0110	65.63	65.63	0.00	65.28	65.28	0.00	
T3UN-0120	65.63	65.63	0.00	65.28	65.28	0.00	
T3UN-0130	65.63	65.63	0.00	65.29	65.29	0.00	
T3UN-0140	65.65	65.65	0.00	65.32	65.32	0.00	
T3UN-0150	65.66	65.66	0.00	65.38	65.38	0.00	
T3UN-0160	65.68	65.68	0.00	65.42	65.42	0.00	
T3UN-0170	65.98	65.98	0.00	65.72	65.72	0.00	
T3UN-0180	66.59	66.59	0.00	66.37	66.37	0.00	
T3UN0100	64.37	64.37	0.00	63.53	63.53	0.00	
T3US-0010	67.87	67.78	-0.08	66.08	66.00	-0.08	
T3US-0020	67.99	67.90	-0.09	66.29	66.24	-0.06	
T3US-0022	67.99	67.90	-0.10	66.72	66.69	-0.03	
T3US-0030	68.89	68.89	0.00	66.82	66.84	0.03	Located in the I-80 Currey Road Ramp Area. The 10-year WSE stays below channel banks.
T3US-0040	69.00	69.00	0.00	68.01	68.01	0.00	
T3US-0050	69.00	69.00	0.00	68.01	68.01	0.00	
T3US-0052	69.73	69.73	0.00	69.68	69.68	0.00	
T3US-0055	69.00	69.00	0.00	68.01	68.01	0.00	
T3US-0060	69.05	69.05	0.00	68.04	68.04	0.00	
T3US-0070	72.01	72.01	0.00	71.59	71.59	0.00	
T3US-0072	71.24	71.24	0.00	70.73	70.73	0.00	
T3US-0080	69.78	69.78	0.00	69.70	69.70	0.00	
T3US-0090	74.13	74.13	0.00	73.36	73.36	0.00	
T3US-0100	74.13	74.13	0.00	73.36	73.36	0.00	
T3US-0120	71.84	71.84	0.00	71.77	71.77	0.00	
T3US-0200	72.18	72.18	0.00	71.80	71.80	0.00	
T3US-0202	75.47	75.47	0.00	74.75	74.75	0.00	
T3US-0210	71.82	71.82	0.00	71.65	71.65	0.00	
T3US-0220	72.84	72.84	0.00	72.18	72.18	0.00	
T3US-0222	72.81	72.81	0.00	71.90	71.90	0.00	
T3US-0230	72.82	72.82	0.00	72.23	72.23	0.00	
T3US-0240	73.57	73.57	0.00	73.21	73.21	0.00	
T3US-0242	73.58	73.58	0.00	73.35	73.35	0.00	
T3US-0250	74.26	74.26	0.00	73.85	73.85	0.00	
T3US-0252	75.85	75.85	0.00	75.56	75.56	0.00	
T3US-0260	74.30	74.30	0.00	73.88	73.88	0.00	
T3US-0262	77.79	77.79	0.00	77.63	77.63	0.00	
T3US-0270	74.32	74.32	0.00	73.89	73.89	0.00	
T3US-0280	84.07	84.07	0.00	83.79	83.79	0.00	
T3US-0400	75.47	75.47	0.00	74.75	74.75	0.00	
T3US-0410	77.29	77.29	0.00	76.49	76.49	0.00	
T4-0412	54.30	54.28	-0.02	53.79	53.76	-0.03	
TEC-010	58.94	58.94	0.00	58.94	58.94	0.00	
TEC-020	61.72	61.72	0.00	61.72	61.72	0.00	
TEC-030	62.13	62.13	0.00	62.13	62.13	0.00	
TEC-040	62.76	62.76	0.00	62.76	62.76	0.00	
TEC-100	61.50	61.50	0.00	61.50	61.50	0.00	
TEC-110	62.07	62.07	0.00	62.07	62.07	0.00	
TEC-120	63.11	63.11	0.00	63.11	63.11	0.00	
TEC-200	58.94	58.94	0.00	58.94	58.94	0.00	
TEC-RB	58.94	58.94	0.00	58.94	58.94	0.00	
TSUS-0500	66.12	66.12	0.00	65.45	65.45	0.00	
Upper North	0.00	0.00	0.00	0.00	0.00	0.00	
Upper South	0.00	0.00	0.00	0.00	0.00	0.00	
Vaughn10	56.69	56.69	0.00	56.43	56.43	0.00	
Vaughn11	56.75	56.75	0.00	56.50	56.50	0.00	
Vaughn12	60.32	60.32	0.00	59.05	59.05	0.00	
Vaughn5	54.15	54.14	-0.01	53.92	53.91	-0.01	
Vaughn5f	55.22	55.21	0.00	54.82	54.82	0.00	
Vaugn2	53.07	53.05	-0.02	52.63	52.62	-0.01	
Walmrt	62.80	62.80	0.00	62.80	62.80	0.00	
WalmrtBsn	49.15	49.15	0.00	49.15	49.15	0.00	