Preliminary Drainage Study

1st Avenue South Drainage Basin Study

City of Mill City, OR

February 2015

ASHLEY ENGINEERING DESIGN

1ST Avenue South
Drainage Basin Study
City of Mill City, OR

Date
February 2015

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Draft Version

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Introduction

Background

The City of Mill City (City) is located within Marion and Linn County, approximately 30 miles southeast of Salem. The North Santiam River, which forms the boundary between Marion and Linn County, is the most dominate receiving waterway found within the City, as illustrated in Appendix A, Figure 1 – Vicinity Map. The North Santiam River flows east to west through the City forming several separate and independent drainage areas to the north and south of the river.

The City 's master plan (*City of Mill City Storm Drainage System Master Plan, Westech Engineering, Inc., 2007)* divided the City into thirteen major drainage basins, but only two of the thirteen existing drainage basins were evaluated. The other remaining basins were to be evaluated on a case-by-case basis, as prioritized by the City. The purpose of this 1st Avenue South Drainage Basin Study (Study) is to analyze the City's existing storm drainage system found within the 1st Avenue South Drainage Basin based on the general storm drainage system information provided in the City's master plan.

This Study presents the results of the evaluation of the 1st Avenue South Drainage Basin and provides recommendations for improvements and additions to the stormwater drainage system so that it will adequately serve the City over a 20-year planning period. The recommended improvements include the upgrade of existing storm drainage facilities plus proposed extensions of the conveyance system in order to meet current and future development needs.

The objectives of this 1st Avenue South Drainage Basin Study were to:

- *Summarize the Planning and Study Area Characteristics* – Review the City's master plan and summarize the basin's planning and study area characteristics.
- *Summarize the Existing Storm Drainage System* – Develop a current inventory of the existing storm drainage system based on available utility mapping and provide a map of the major storm drainage systems and other pertinent information. Identify problem areas that may present issues or constraints.
- *Conduct Storm Drainage System Analysis* – Review the hydrologic/hydraulic analysis requirements in the City's master plan and perform a hydrologic/hydraulic analysis on the basin's storm drainage system.
- *Provide Recommendations and a Capital Improvement Plan* – Provide recommendations for the basin's proposed improvements and additions to the stormwater drainage system so that it will adequately serve the City over a minimum 20-year planning period. Develop a Capital Improvement Plan (CIP) and project implementation schedule to allow the City to plan for the recommended improvements.

This Study is a conceptual planning level document that provides general storm drainage system information and guidance and does not include any engineering designs, surveying, wetland inventory or delineations, environmental, water quality, or geotechnical investigations. As such, it is recommended that this Study be viewed and implemented under the following general guidelines:

- This Study should be reviewed annually for the purpose of project prioritizing and budgeting. In addition, as the City updates its storm drainage planning efforts, the estimations and assumptions presented in this Study should be reviewed and updated as necessary. A full comprehensive update should be completed no more than every 10 years to ensure that it accurately reflects current zoning and development, anticipated growth, and system infrastructure needs. The storm drainage system mapping and other figures presented in this Study should be updated annually or as necessary to reflect current development and any storm drainage system capital plan improvements.
- Proposed recommendations and their corresponding estimated project costs presented in this Study should be considered conceptual only. Potential alternatives, additional details, and updated cost estimates should be evaluated and performed in the preliminary and final engineering stages of any recommended improvement project. The estimated project costs shown are rough order-of-magnitude estimates and have been prepared for general guidance in project evaluation and implementation from available planning level information at the time of this Study and should be updated and refined with preliminary and final engineering designs. The final costs of projects will depend on actual design and construction, including but not limited to, actual labor and material costs, site conditions, competitive market conditions, regulatory factors, final project scope, implementation schedule, and other variable factors. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions.

Planning and Study Area Characteristics

Planning and Study Area

The City's master plan divided the City into thirteen major drainage basins, designated as Santiam Highway West (SH), 1st Avenue North (1N), Elizabeth Creek (EC), Cedar Creek (CC), West Alder (WA), Alder River (AR), Spring Street (SS), Downtown (DT), 1st Avenue South (1S), Kimmel Park (KP), Cow Creek (CwC), Western Industrial (WI), and Snake Creek (SC). For this Study, the planning and study boundary includes the area that lies within the 1st Avenue South Drainage Basin (1S), as illustrated in Appendix A, Figure 4 – Existing Drainage Basin Map. The 1st Avenue South Drainage Basin is comprised of approximately 92 acres of residential, commercial, industrial, and public land within the City limits and UGB.

Planning Period

This Study is based on a 20-year planning period, starting in 2014-2015 and ending in year 2035.

Land Use and Zoning

The City currently has a Comprehensive Land Use Plan that presents the goals and policies of the City regarding natural resources, community resources, community development, citizen involvement, urban growth boundaries, and other topics requiring ongoing attention by the City. Appendix A, Figure 2 – Zoning Map shows the current land use and zoning designations for the City. As can be seen, the majority of the 1st Avenue South Drainage Basin is zoned Residential, with a small section zoned Public, and a small section zoned Commercial adjacent S. 1st Avenue. Overall, the current zoning within the study area was assumed to stay relatively the same throughout the planning period. The land use and zoning summary for the planning and study area is summarized in Table 1.

Table 1
Land Use and Zoning Summary for Study Area

Zone	Zone Description	Approximate Area within Planning and Study Area (gross acres)
CC	Central Commercial	10.4
I	Industrial	0.3
P	Public	6.4
R1	Residential Single	9.4
R2	Residential Multiple	65.9
	Approximate Total	**92.4**

Soils and Topography

A review of the Linn County Soil Survey information provided in the City's master plan was performed for the 1st Avenue South Drainage Basin. The soils primarily consist of Newberg, Sifton Variant, and Malabon Variant. Copies of the relevant soil survey information are included in Appendix C.

Topography within the 1st Avenue South Drainage Basin primarily consists of a two relatively level plateaus ranging from approximately 0-2 percent in slope from east to west. Between the two plateaus, the topography increase relatively quickly with typical slopes in excess of 10 percent. Appendix A, Figure 4 – Existing Drainage Basin Map shows the general topography and drainage patterns for the study area.

Climate and Rainfall

Precipitation values used for the hydrologic/hydraulic analysis in this Study are based on the corresponding 24-hour rainfall depths presented in *Table 2-1, Storm Event, 24 Hour Rainfall Intensities* of the City's master plan. These are summarized in Table 2 below. The rainfall intensity-duration-recurrence interval (I-D-R) curves for Zone 5, as shown in the ODOT Hydraulics Manual and as indicated in the City's master plan and Public Works Design Standards, were also used.

Table 2 24-Hour Rainfall Depths for the City of Mill City	
Storm Event, (years)	**24-Hour Precipitation, (inches)**
2-year, 24-hour	3.5
5-year, 24-hour	4.2
10-year, 24-hour	4.5
25-year, 24-hour	5.4
50-year, 24-hour	6.0
100-year, 24-hour	6.5

Source: Table 2-1, City of Mill City Storm Drainage System Master Plan.

Existing Storm Drainage System

Stormwater runoff developed within the City is generally collected and conveyed through a combination of curb and gutters, roadside ditches, storm drainage pipes, and open channels. The City's existing storm drainage systems have been developed in pieces over the years, each with variable capacities and are not necessarily consistent with upstream and downstream components.

Several jurisdictions have responsibility for the design and maintenance of storm drainage systems within the City. While the City owns and operates most of the storm drainage systems found within the City limits, ODOT, Marion County, and Linn County have jurisdiction over facilities found within their right-of-ways.

1st Avenue South Drainage Basin (1S)

As previously mentioned, the 1st Avenue South Drainage Basin is comprised of approximately 92 acres. The overall boundary of the 1st Avenue South Drainage Basin was approximated based on a review of the City's master plan's proposed boundaries, available City aerial and utility mapping, layout of the existing storm drainage systems, and existing drainage patterns. Various sub-basin boundaries were then identified by areas that could be characterized as draining to one discharge point and that were relatively uniform as to slope and land use. In general, the proposed sub-basin boundaries were identified by an east and west configuration with smaller boundaries in densely developed or unique areas, and larger boundaries in predominantly undeveloped areas. See Appendix A, Figure 4 – Existing Drainage Basin Map.

There may be cases in which a land development grading or drainage plan may alter the approximate sub-basin boundaries. As such, both the drainage basin and sub-basin boundaries should be considered approximate and may be subject to change. A review of existing drainage patterns and an update of the various boundaries will need to be performed to reflect the most current conditions during the preliminary and final engineering stages of any recommended improvement project.

Sub-Basin Existing Descriptions

Sub-basin W1 is approximately 3.7 acres. This sub-basin is the westerly portion of the basin along S. 1st Avenue and along Broadway Street and is considered to be fully developed. This sub-basin is relatively flat with ground slopes ranging between 0 - 2 percent and consists mostly of impervious surfaces. This sub-basin drains north along street curbs and gutters where it is collected within catch basins along S. 1st Avenue and Broadway Street. Stormwater is then conveyed through the existing storm drainage system where it outfalls through an existing 18-inch CMP pipe.

Sub-basin W2 is approximately 7.1 acres. This sub-basin is the westerly portion of the basin along S. 1st Avenue and along SE Fairview Street and is considered to nearly be fully developed. This sub-basin is relatively flat with ground slopes ranging between 0 - 2 percent and consists mostly of impervious surfaces. This sub-basin drains south along street curbs and gutters where it is collected within catch basins along S. 1st Avenue and the northerly part of Fairview Street. Stormwater is then conveyed through the existing storm drainage system where it outfalls through the existing 24-inch CMP pipe.

Sub-basin W3 is approximately 13.4 acres. This sub-basin is the westerly portion of the basin along S. 1st Avenue from SE Kingwood Avenue to SE Fairview Street and is considered to nearly be fully developed. This sub-basin is located just upstream of Sub-basin W2 and is relatively flat with ground slopes ranging between 0 - 2 percent, except between SE Hazel Street and SE Ivy Street where slopes exceed 10 percent. This sub-basin drains north along street curbs and gutters where it is collected within catch basins along S. 1st Avenue. Stormwater is then conveyed towards SE Fairview Street.

Sub-basin W4 is approximately 10.9 acres. This sub-basin is the westerly portion of the basin along S. 1st Avenue from SE Myrtle Street to SE Kingwood Avenue and is considered to nearly be fully developed. This sub-basin is located just upstream of Sub-basin W3 and is relatively flat with ground slopes ranging between 0 - 2 percent. This sub-basin drains north along street curbs and gutters where it is collected within catch basins along SW 1st Avenue. Stormwater is then conveyed towards S. 1st Avenue and then down to SE Fairview Street.

Sub-basin E1 is approximately 26.4 acres. This sub-basin is the north mid-easterly portion of the basin along SE 3rd Avenue from SE Kingwood Avenue to SE Fairview Street. The area is considered to be partially developed with some areas of undeveloped land and turnpike style streets. This sub-basin is located upstream of Sub-basin W2 and is relatively flat with ground slopes ranging between 0 - 2 percent, except between SE Hazel Street and SE Ivy Street where slopes exceed 10 percent. This sub-basin drains towards SE 3rd Avenue where it is collected within catch basins. Stormwater is then conveyed towards SE Fairview Street.

Sub-basin E2 is approximately 13 acres. This sub-basin is the most easterly portion of the basin north of SE Kingwood Avenue. The area is considered to be only partially developed with a large portion of the basin being farm land. This sub-basin is located upstream of Sub-basin E1 and is

relatively flat with ground slopes ranging between 0 - 2 percent, except near SE Kingwood Avenue where slopes exceed 10 percent. This sub-basin drains west towards SE 4th Avenue and then west along roadside ditches towards SE 3rd Avenue, and then north towards SE Fairview Street.

Sub-basin E3 is approximately 6.2 acres. This sub-basin is the south mid-easterly portion of the basin near SE Kingwood Avenue. The area is considered to be only partially developed. This sub-basin is located upstream of Sub-basin E1 and is relatively flat with ground slopes ranging between 0 - 2 percent, except near SE Kingwood Avenue where slopes exceed 10 percent. This sub-basin drains west towards SE Kingwood Avenue and then north along SE 3rd Avenue.

Sub-basin E4 is approximately 11.7 acres. This sub-basin is the most easterly portion of the basin south of SE Kingwood Avenue. The area is considered to be only partially developed with a large portion of the basin being farm/pasture land. This sub-basin is located upstream of Sub-basin E2 and is relatively flat with ground slopes ranging between 0 - 2 percent. This sub-basin drains west towards SE Kingwood Avenue and then north along SE 4th Avenue.

Existing Storm Drainage System Piping

There are three major existing storm drainage system pipe networks found within the 1st Avenue South Drainage Basin. These systems are located along S. 1st Avenue near the intersection of Broadway Street, along S. 1st Avenue from Myrtle Street to SE Fairview Street, and along 3rd Avenue from S. Kingwood Avenue to SE Fairview Street, as illustrated in Appendix A, Figure 3 – Existing Storm Drainage System Map.

Existing Problems Summary

The existing storm drainage system problem areas that have been identified are summarized in Table 3. The recommended approaches for correcting the existing problems are further discussed in the Recommendations and Capital Improvement Plan section of this Study.

Table 3
Existing Known Storm Drainage Problem Areas

Sub-Basin(s)	Location	System Component	Type of Problem
All	Existing 24" CMP Outfall	Piped	Inadequate Capacity
W1-W4	S 1st Avenue	Piped	Inadequate Capacity and Lack of Maintenance
E1, E3	SE 3rd Avenue	Piped	Inadequate Capacity and Lack of Maintenance
E2, E4	SE 4th Avenue	Piped	Facility Does Not Exist

Hydrologic/Hydraulic Analysis

General Approach

A hydrologic/hydraulic analysis was performed to evaluate the adequacy of the drainage basin's existing storm drainage system. See Appendix C for Sub-Basin Summaries and Calculations. The storm drainage system was first evaluated under existing conditions to identify problem areas related to excessive pipeline surcharging and general pipe capacities, and then it was evaluated under anticipated future developed conditions to identify long term drainage system improvement needs.

Hydrologic calculations were performed to determine the stormwater peak flows for each individual sub-basin using HydroCAD software. The stormwater peak flows were estimated using the 25-year storm event for both existing and future development based on *Table 4-2, Design Storm Frequency* of the City's master plan. The typical runoff coefficients (C-values and Curve Numbers) used in the hydrologic analysis of the sub-basins was based on values presented in *Table 4-4, Typical Sub-basin 'C' and 'CN' Parameters* of the City's master plan. Where the current land use did not match the zoning designation, such as land still being farmed, the runoff coefficient for the actual land use was used in the existing conditions analysis. For the future developed conditions, the appropriate runoff coefficient was used for the analysis. Areas that surround the northerly edge of the basin adjacent to the North Santiam River were assumed to drain directly to the river and were not further investigated for impacts to the existing storm drainage system.

Hydraulic calculations were then performed to compare the estimated existing storm drainage system pipe capacities to the estimated stormwater peak flows. A Manning's "n" value of 0.024 was used for the corrugated metal pipe outfall analysis and 0.013 was used for the rest of the pipe capacity analysis. The approach was to then identify the evaluated pipes that may have hydraulic capacity problems, classify them by severity, and review other potential factors to determine if a Capital Improvement Plan (CIP) project is warranted. If a project was warranted, a priority ranking for each recommended improvement was then proposed.

Analysis Methodology

Rational Method

The Rational Method, as outlined in the City's master plan, and further outlined in the ODOT Hydraulics Manual, was utilized to estimate the stormwater peak flows. Time of concentration from the furthest point of the sub-basin was calculated by using the kinematic wave equation for overland, shallow concentrated, channel, and pipe flow. Rainfall data used was based on the rainfall intensity-duration-recurrence interval (I-D-R) curves for Zone 5, as shown in the ODOT Hydraulics Manual and in the City's Public Works Design Standards.

Hydrograph Method

The Santa Barbara Urban Hydrograph (SBUH) method, as outlined in the City's master plan, and the Soil Conservation Service (SCS) method were utilized for the hydrologic calculations in addition to the Rational Method. The hydrograph methods predict a peak runoff rate and rainfall-runoff distribution based on the rainfall distribution, the total 24-hour rainfall, and the catchment characteristics including catchment area, curve number of the ground surface, and time of concentration. The NRCS Type 1A, 24-hour storm distribution with a fixed 10-minute interval was used in the hydrograph method analysis based on the 24-hour rainfall depths shown in the City's master plan.

Analysis Summary

The basin analysis involved identification of the various problems, a review of the layout of existing infrastructure and topography, and selection of the appropriate system improvements. Where existing storm drainage infrastructure was lacking, the ultimate routing of flow was assumed with flows developing at the various locations indicated in Appendix A, Figure 5 – Estimated Runoff and Capacities. The estimated stormwater peak runoff flows by drainage sub-basin for the existing conditions for both the Rational and SBUH methods is shown in Table 4.

Table 4
Estimated Peak Flows for Existing Conditions

Sub-Basin Estimates			SBUH Method		Rational Method	
No.	Approx Size (ac)	ToC (min)	Weighted 'CN'	Q (cfs)	Weighted 'C'	Q (cfs)
1S-W1	3.7	10	94	4	0.82	7
1S-W2	7.1	10	89	7	0.74	12
1S-W3	13.4	22	88	13	0.74	16
1S-W4	10.9	17	83	9	0.63	13
1S-E1	26.4	35	83	19	0.64	20
1S-E2	13.0	44	73	6	0.37	5
1S-E3	6.2	28	79	4	0.52	4
1S-E4	11.7	45	77	6	0.50	6

The estimated stormwater peak runoff flows for the future developed conditions for both the Rational and SBUH methods are shown in Table 5. It should be noted that the estimated stormwater runoff peak flows for the future developed conditions do not account for detention, low-impact development techniques, or other alternative improvement methods that may reduce the estimated flows. As such, the estimated flows are anticipated to be on the high end of values and actual stormwater peak runoff flows may likely fall somewhere between the existing and future developed condition estimates.

Table 5 Estimated Peak Flows for Future Developed Conditions						
Sub-Basin Estimates			SBUH Method		Rational Method	
No.	Approx Size (ac)	ToC (min)	Weighted 'CN'	Q (cfs)	Weighted 'C'	Q (cfs)
1S-W1	3.7	10	94	4	0.82	7
1S-W2	7.1	10	89	7	0.74	12
1S-W3	13.4	22	89	13	0.74	16
1S-W4	10.9	17	83	9	0.63	13
1S-E1	26.4	21	86	23	0.69	30
1S-E2	13.0	21	83	11	0.59	13
1S-E3	6.2	17	85	6	0.68	8
1S-E4	11.7	21	84	10	0.66	13

Recommendations and Capital Improvement Plan

Recommended Improvements

The recommended storm drainage system improvements are shown in Appendix A, Figure 6 – Recommended Improvements. Where appropriate, recommended pipe sizes were provided for either doing a full replacement of the existing storm drainage system or for installing a parallel storm drainage system alongside the existing system. Since much of the area is relatively flat, larger pipe networks are required in order to convey the estimated stormwater peak flows during the larger storm events.

For the basin's primary outfall at SE Fairview Street, a 42-inch diameter pipe is recommended. For the westerly side of the basin, a 30-inch diameter pipe is recommended along SE Fairview Street to serve S. 1st Avenue. For the easterly side of the basin, a 42-inch diameter pipe is recommended along SE Fairview Street to SE 3rd Avenue to SE Hazel Street, with a 30-inch diameter pipe recommended to serve SE 4th Avenue and the more undeveloped areas of the basin.

It should be noted that the recommended improvements should be considered as conceptual only, as each of the recommendations will need to be thoroughly evaluated and reviewed during the preliminary and final engineering efforts of each project noted. It will be necessary to confirm actual design flows; pipe sizes, locations and elevations; actual number and placement of required manholes, catch basins, and other structures; and specific routing schemes based upon actual field surveying information, the most current land use plan, proposed development, soil surveys, soil investigations, physical constraints and other relevant field conditions during preliminary and final engineering design.

Increasing pipe capacity is the traditional approach to increasing overall stormwater system conveyance and was the approach used for the recommended improvements. However, as previously mentioned above, the future developed flow estimates do not account for detention,

low-impact development techniques, or other alternative improvement methods that help reduce stormwater peak runoff flows and the corresponding storm drainage system sizes. Some of the more commonly used stormwater management methods include:

- *Detention Facilities* – Detention facilities temporarily store stormwater runoff from a developed area and then discharge the stormwater to the receiving system at a lower controlled rate. Storing the stormwater in an open basin may also reduce the overall volume of runoff by promoting infiltration. The City's current detention standard, as outlined in the Public Works Design Standards, require development to control runoff to that generated by a 5-year storm under pre-developed conditions. The detention facility must then be sized to contain the difference between a 25-year storm post-development and the 5-year storm under pre-development conditions.

- *Low-Impact Development (LID) techniques* – LID techniques are stormwater management methods that are intended to reduce peak runoff rates from impervious surfaces such as building roofs or pavement, through infiltration, which reduces the overall volume of runoff. Examples of LID techniques include vegetated infiltration swales, pervious pavements, "green streets", filter strips, etc.

With the 1st Avenue Drainage Basin's close proximity to the North Santiam River, it is recommended that stormwater quality components be incorporated into the storm drainage systems, wherever such components can be reasonably accommodated. For the easterly portion of the basin where the most developable land is located, the use of roadside bio-swales, as further described and detailed in the City's master plan, will provide detention, infiltration, and water quality treatment for these areas. For other areas in the more developed portions of the basin, catch basins and/or water quality manholes should be provided with sediment and grease traps, where appropriate.

Capital Improvement Plan

General

Capital improvements are needed to address system inadequacies, in addition to allowing for future growth. Because it is not possible to address all of the City's capital needs in one budget year, it is necessary to create a 20-year Capital Improvement Plan (CIP) based on project priority and the anticipated funding needed each year to implement the project. In general, the CIP calls attention to the deficiencies of the basin's storm drainage system and provides a systematic approach to dealing with the short-term, mid-term, and long-term infrastructure needs.

The recommended improvements were categorized into three priority levels and each was assigned an anticipated year of construction; however, some of the listed improvements will be necessary only as development occurs. Short range projects are those anticipated within the next 5 years, mid-range projects are those anticipated for a period from 5 to 10 years, and long range projects are those anticipated from 10 years to fully developed conditions. Given the fact that growth may

be faster or slower than what is anticipated in this Study, the project improvement schedule is subject to change. Some projects may be implemented prior to their anticipated date, while others may be constructed after the date established in this plan. The 20-year Capital Improvement Plan for the 1st Avenue South Drainage Basin is shown in Appendix B.

Cost Estimating Data

Project cost estimates are based on cost information from construction of similar work. Cost estimates were not based on detailed engineering designs; therefore, the project costs should be considered rough order-of-magnitude estimates. Rough order-of-magnitude cost estimates are typically associated with an accuracy of +50 percent to –30 percent to reflect the variability of costs.

The project cost estimates shown have been prepared for guidance in project evaluation and are for budgetary purposes only within the context of this Study. The final costs of the project will depend on actual design and construction, including but not limited to, actual labor and material costs, site conditions, competitive market conditions, regulatory factors, final project scope, implementation schedule, and other variable factors. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions.

For the new storm drainage system construction costs, a typical unit cost of $4 per diameter-inch per foot of pipe length was estimated. This results in a direct unit cost of $40 per foot for a 10-inch pipe, $48 per foot for a 12-inch pipe, and so on. These estimated direct unit costs assume no easements or land acquisition, common earth and typical trench excavation, HDPE pipe material, no specialty construction work, and other basic assumptions, as indicated in the cost estimate summary in Appendix B.

In addition to the estimated construction costs, a total markup allowance of 40 percent was included to account for contingencies, engineering and surveying, legal and administrative, and other project related costs. This allowance was applied to all projects equally, and therefore does not take into account design or permitting complexities or other factors that might result in higher project related costs.

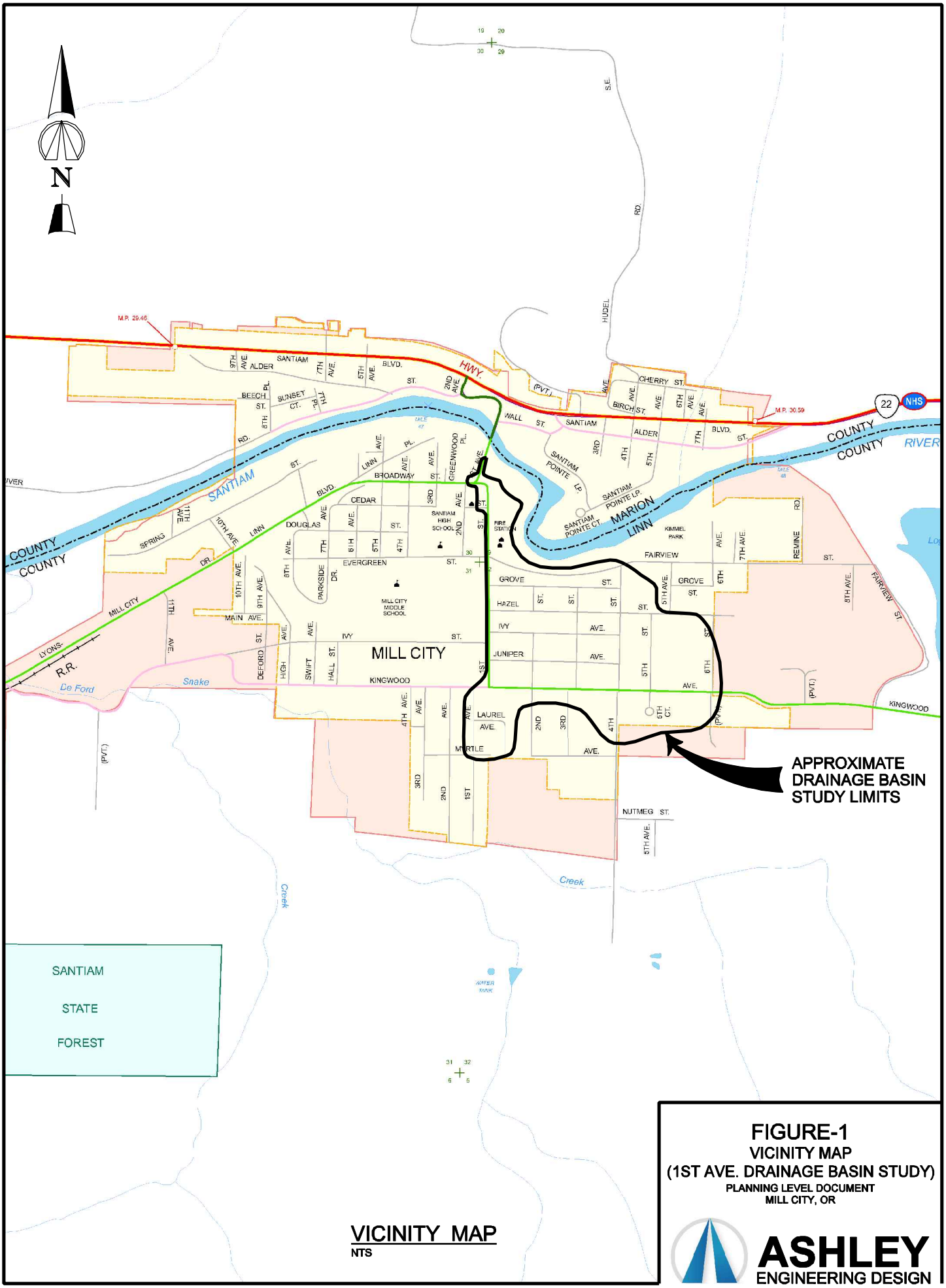
These costs presented in the Capital Improvement Plan include a 3 percent inflation factor from 2014 to the anticipated year of construction or project implementation. Before finalizing the funding for a specific project, it will be necessary to update the proposed cost estimate to current costs and further define the project as necessary.

Appendices

- Appendix A Figures/Maps
- Appendix B 20-Year Capital Improvement Plan and Cost Estimate Summary
- Appendix C Linn County Soil Survey Information
- Appendix D Sub-Basin Summaries and Calculations

Appendix A – Figures/Maps

- Figure 1 – Vicinity Map
- Figure 2 – Zoning Map
- Figure 3 – Existing Storm Drainage Map
- Figure 4 – Existing Drainage Basin Map
- Figure 5 – Estimated Runoff and Capacities
- Figure 6 – Recommended Improvements



VICINITY MAP
NTS

FIGURE-1
VICINITY MAP
(1ST AVE. DRAINAGE BASIN STUDY)

PLANNING LEVEL DOCUMENT
MILL CITY, OR

ASHLEY
ENGINEERING DESIGN

INFORMATION SHOWN ON THIS FIGURE IS BASED ON TAX ASSESSOR MAPS, GIS MAPPING, PHOTOS AND OTHER GRAPHICAL DATA AND IS SCHEMATIC. THIS FIGURE IS CONSIDERED TO BE CONCEPTUAL AND IS TO BE USED FOR PLANNING PURPOSES ONLY. ALL STORM DRAINAGE IMPROVEMENTS OR ANY OTHER IMPROVEMENT SHALL BE BASED ON ACTUAL FIELD SURVEYING AND ENGINEERING DESIGNS AS APPROVED BY THE CITY, COUNTY, AND OTHER APPROPRIATE JURISDICTIONS.

N

0 400 800 1200

Scale In Feet

LEGEND

- TAX LOTS
- CITY LIMITS
- URBAN GROWTH BOUNDARY
- CC - CENTRAL COMMERCIAL
- CH - HIGHWAY COMMERCIAL
- I - INDUSTRIAL
- P - PUBLIC
- R1 - RESIDENTIAL
- R2 - RESIDENTIAL
- SPD - SPECIAL PLANNED DISTRICT

SANTIAM HWY (HWY 22)

URBAN GROWTH BOUNDARY

SANTIAM HWY (HWY 22)

NORTH SANTIAM RIVER

RIVER RD SE

NORTH SANTIAM RIVER

SW LINN BLVD

N 1ST AVE

S 1ST AVENUE

CITY LIMITS

URBAN GROWTH BOUNDARY

CITY LIMITS

LYONS-MILL CITY DR

SW KINGWOOD AVE

SE KINGWOOD AVE

SE KINGWOOD AVE (CR 813)

URBAN GROWTH BOUNDARY

CITY LIMITS

URBAN GROWTH BOUNDARY

ZONING MAP

1"=400'

PRELIMINARY

PRELIMINARY

FIGURE-2

ZONING MAP (FEB 2015)

(1ST AVE. DRAINAGE BASIN STUDY)

PLANNING LEVEL DOCUMENT

MILL CITY, OR

ASHLEY ENGINEERING DESIGN

FILENAME: Figure2-ZoningMap.dgn PLOT DATE: 2/24/2015

Draft Version

N

0 150 300 450
Scale In Feet

LEGEND

- EXISTING OUTFALL
- EXISTING STORM DRAIN PIPE
- 12" C (PIPE DIAMETER AND MATERIAL)
- APPROX. MANHOLE LOCATION
- APPROX. CATCH BASIN LOCATION

PIPE MATERIAL

C	CONCRETE
CMP	CORRUGATED METAL PIPE
HDPE	HIGH DENSITY POLYETHELYNE
PVC	POLYVINYL CHLORIDE

NOTE:
INFORMATION SHOWN ON THIS FIGURE IS BASED ON TAX ASSESSOR MAPS, GIS MAPPING, PHOTOS AND OTHER GRAPHICAL DATA AND IS SCHEMATIC. THIS FIGURE IS CONSIDERED TO BE CONCEPTUAL AND IS TO BE USED FOR PLANNING PURPOSES ONLY. ALL STORM DRAINAGE IMPROVEMENTS OR ANY OTHER IMPROVEMENT SHALL BE BASED ON ACTUAL FIELD SURVEYING AND ENGINEERING DESIGNS AS APPROVED BY THE CITY, COUNTY, AND OTHER APPROPRIATE JURISDICTIONS.

SANTIAM POINTE LP NE
NE 5TH AVE
NORTH SANTIAM RIVER
SW BROADWAY ST
SW 3RD AVE
SW CEDAR ST
SW DOUGLAS ST
SW 4TH AVE
SW 2ND AVE
S 1ST AVE
SW EVERGREEN ST
SE FAIRVIEW ST
SE GROVE ST
SE HAZEL ST
SE IVY ST
SE JUNIPER ST
SE KINGWOOD AVE (CR 813)
SE LAUREL ST
SE MYRTLE ST
SW IVY ST
SW HALL ST
SW TUERS LN
SW KINGWOOD AVE (CR 813)
SW MYRTLE ST
SE 2ND AVE
SE 3RD AVE
SE 4TH AVE
SE 5TH AVE
SE 6TH AVE
SW 1ST AVE
SE LAUREL AVE
CITY LIMITS, TYP

8" PVC
OUTFALL
18" CMP
12" C
8" PVC (PVT)
24" C
12" HDPE
24" CMP
21" C
18" C
15" C
10" C
6" HDPE
10" HDPE
18" HDPE
SDMH OUTLET CONTROL STRUCTURE
8" STUBOUTS
12" PVC
10" PVC
30" HDPE

PRELIMINARY

FIGURE-3
EXISTING STORM DRAINAGE MAP (1ST AVE. DRAINAGE BASIN STUDY)
PLANNING LEVEL DOCUMENT
MILL CITY, OR

ASHLEY ENGINEERING DESIGN

PRELIMINARY

FILENAME: Figure3-ExstStormDrainage.dgn PLOT DATE: 2/24/2015

Draft Version

N

0 150 300 450
Scale In Feet

LEGEND

- ESTIMATED 1ST AVE DRAINAGE BASIN
- APPROX. SUB-BASIN BOUNDARY
- APPROX. CONTOUR LINE
- APPROX. RUNOFF FLOW DIRECTION
- TAX LOTS
- CITY LIMITS
- CC - CENTRAL COMMERCIAL ZONING
- I - INDUSTRIAL ZONING
- P - PUBLIC ZONING
- R1 - RESIDENTIAL ZONING
- R2 - RESIDENTIAL ZONING

NOTE:
INFORMATION SHOWN ON THIS FIGURE IS BASED ON TAX ASSESSOR MAPS, GIS MAPPING, PHOTOS AND OTHER GRAPHICAL DATA AND IS SCHEMATIC. THIS FIGURE IS CONSIDERED TO BE CONCEPTUAL AND IS TO BE USED FOR PLANNING PURPOSES ONLY. ALL STORM DRAINAGE IMPROVEMENTS OR ANY OTHER IMPROVEMENT SHALL BE BASED ON ACTUAL FIELD SURVEYING AND ENGINEERING DESIGNS AS APPROVED BY THE CITY, COUNTY, AND OTHER APPROPRIATE JURISDICTIONS.

SW 3RD AVE
SW BROADWAY ST
SW CEDAR ST
SW 4TH AVE
SW 2ND AVE
S 1ST AVE
SANTIAM POINTE LP NE
NE 6TH AVE
NORTH SANTIAM RIVER
S1-W1 (~3.7 ac)
S1-W2 (~7.1 ac)
1ST AVE SOUTH DRAINAGE BASIN APPROX. BOUNDARY
SE FAIRVIEW ST
SE GROVE ST
SE 2ND AVE
SE 3RD AVE
SE 4TH AVE
SE 5TH AVE
SE 6TH AVE
CITY LIMITS, TYP
SE HAZEL ST
S1-W3 (~13.4 ac)
S1-E1 (~26.4 ac)
SE IVY ST
APPROX. SUB-BASIN BOUNDARY, TYP
SE JUNIPER ST
S1-E2 (~13 ac)
SW KINGWOOD AVE (CR 813)
SE KINGWOOD AVE (CR 813)
SW TUERS LN
S1-W4 (~10.9 ac)
S1-E3 (~6.2 ac)
S1-E4 (~11.7 ac)
SE LAUREL ST
SE LAUREL AVE
SW 1ST AVE
SW MYRTLE ST
SE MYRTLE ST

PRELIMINARY

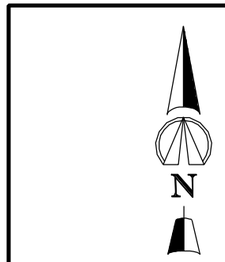
FIGURE-4
EXISTING DRAINAGE BASIN MAP (1ST AVE. DRAINAGE BASIN STUDY)
PLANNING LEVEL DOCUMENT
MILL CITY, OR

ASHLEY ENGINEERING DESIGN

PRELIMINARY

FILENAME: Figure4-DrainageBasin.dgn PLOT DATE: 2/24/2015

Draft Version



LEGEND

- EST. DRAINAGE BASIN BOUNDARY
- APPROX. SUB-BASIN BOUNDARY
- EXISTING STORM OUTFALL LOCATION
- EXISTING STORM DRAIN PIPE
- 12" C (PIPE DIAMETER & MATERIAL)
- APPROX. RUNOFF FLOW DIRECTION
- APPROX. MANHOLE LOCATION
- APPROX. CATCH BASIN LOCATION
- PIPE HAS ADEQUATE CAPACITY
- PIPE HAS MARGINAL CAPACITY
- PIPE HAS INSUFFICIENT CAPACITY (or does not currently exist)
- LOCATION WHERE RUNOFF HAS BEEN CALCULATED. ESTIMATED FLOWS ARE AS INDICATED BELOW

ESTIMATED SUB-BASIN CHARACTERISTICS

DEVELOPED CONDITIONS ESTIMATED DESIGN POINT FLOWS

DESIGN POINT	SBUH, 25-YR RUNOFF RATE	RATIONAL, 25-YR RUNOFF RATE
1	4 CFS	7 CFS
2	22 CFS	27 CFS
3	79 CFS	96 CFS
4	50 CFS	61 CFS
5	9 CFS	13 CFS
6	6 CFS	8 CFS
7	21 CFS	26 CFS
8	10 CFS	13 CFS

NOTE:

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PRELIMINARY

FILENAME: Figure5-EstimatedRunoff.dgn PLOT DATE: 2/24/2015

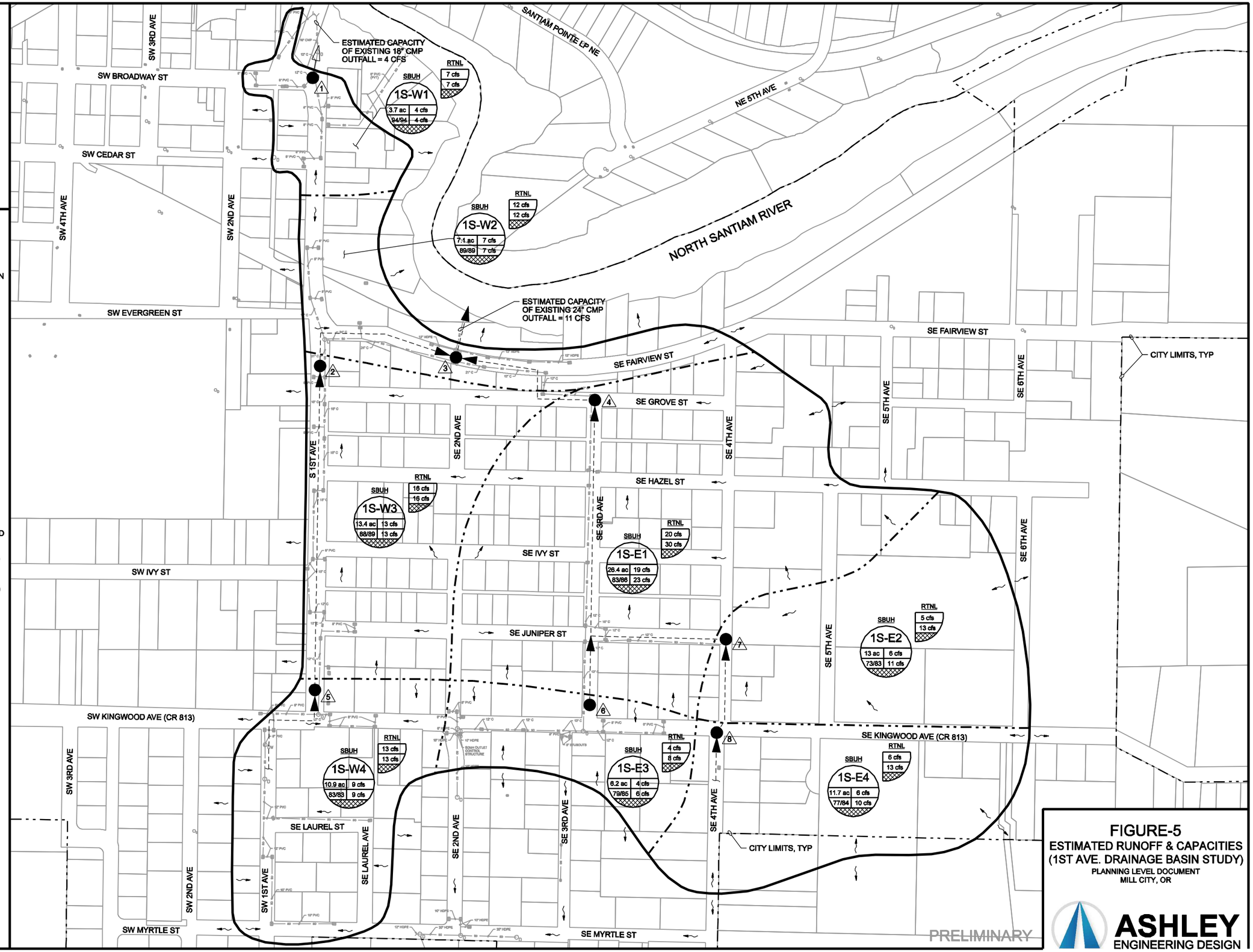


FIGURE-5
ESTIMATED RUNOFF & CAPACITIES (1ST AVE. DRAINAGE BASIN STUDY)

PLANNING LEVEL DOCUMENT
MILL CITY, OR

ASHLEY ENGINEERING DESIGN

Draft Version

N

0 150 300 450

Scale In Feet

LEGEND

- EST. DRAINAGE BASIN BOUNDARY
- APPROX. SUB-BASIN BOUNDARY
- EXISTING STORM OUTFALL LOCATION
- EXISTING STORM DRAIN PIPE
- APPROX. MANHOLE LOCATION
- APPROX. CATCH BASIN LOCATION
- 18" [3] // 12" — (RECOMMENDED REPLACEMENT PIPE SIZE AND CIP PRIORITY) RECOMMENDED IMPROVEMENTS (RECOMMENDED PIPE SIZE USING A PARALLEL SYSTEM)
- RECOMMENDED MANHOLE

NOTE:

INFORMATION SHOWN ON THIS FIGURE IS BASED ON TAX ASSESSOR MAPS, GIS MAPPING, PHOTOS AND OTHER GRAPHICAL DATA AND IS SCHEMATIC. THIS FIGURE IS CONSIDERED TO BE CONCEPTUAL AND IS TO BE USED FOR PLANNING PURPOSES ONLY. ALL STORM DRAINAGE IMPROVEMENTS OR ANY OTHER IMPROVEMENT SHALL BE BASED ON ACTUAL FIELD SURVEYING AND ENGINEERING DESIGNS AS APPROVED BY THE CITY, COUNTY, AND OTHER APPROPRIATE JURISDICTIONS.

SW BROADWAY ST
SW 3RD AVE
SW CEDAR ST
SW 4TH AVE
SW 2ND AVE
SW EVERGREEN ST
SANTIAM POINTE LP NE
NE 5TH AVE
NORTH SANTIAM RIVER
NORTH SANTIAM RIVER OUTFALL
SE FAIRVIEW ST
SE GROVE ST
SE HAZEL ST
SE IVY ST
SE JUNIPER ST
SE KINGWOOD AVE (CR 813)
SE LAUREL ST
SE MYRTLE ST
SW IVY ST
SW KINGWOOD AVE (CR 813)
SW TUERS LN
SW MYRTLE ST
S 1ST AVE
SW 1ST AVE
SE 2ND AVE
SE 3RD AVE
SE 4TH AVE
SE 5TH AVE
SE 6TH AVE
SE LAUREL AVE
CITY LIMITS, TYP
ROADSIDE BIOSWALES, WHERE THEY CAN BE REASONABLY ACCOMMODATED AS PART OF DEVELOPMENT
30" [1] // 24"
42" [1]
42" [2]
30" [3] // 24"
24" [3] // 18"
30" [2]
24" [2]
18" [3]
18" [3] // 12"
18" [3] // 15"
10" HDPE
BOSH OUTLET CONTROL STRUCTURE
8" SYBJOUTS

PRELIMINARY

FIGURE-6
RECOMMENDED IMPROVEMENTS (1ST AVE. DRAINAGE BASIN STUDY)

PLANNING LEVEL DOCUMENT
MILL CITY, OR

ASHLEY ENGINEERING DESIGN

PRELIMINARY

FILENAME: Figure6-Recommendations.dgn PLOT DATE: 2/24/2015

Draft Version

Appendix B – 20-Year Capital Improvement Plan and Cost Estimate Summary

1st Avenue Drainage Basin Study Capital Improvement Plan[1]

Project Category	Project Description	Estimated Project Priority and Schedule[2] (Cost in 2014 dollars and escalated at an average inflation rate of 3 percent per year.)				Total Estimated Project Cost[2]	Comments
		2015 - 2020	2020 - 2025	2025 - 2030	2030 - 2035		
	Budget Fiscal Year.....	0 - 5 years	5 - 10 years	10 - 15 years	15 - 20 years		
PRIORITY 1 PROJECTS	42-inch Outfall to North Santiam River	$ 51,000	$ -	$ -	$ -	$ 51,000	Approximately 130' of pipe
	30-inch along Fairview Street from S. 1st Avenue to Manhole at Outfall	$ 110,000	$ -	$ -	$ -	$ 110,000	Approximately 460' of pipe
	42-inch along 3rd Avenue from Grove to Fairview Street to Manhole at Outfall	$ 204,000	$ -	$ -	$ -	$ 204,000	Approximately 550' of pipe
	PRIORITY 1 PROJECTS SUB-TOTAL	**$ 365,000**	**$ -**	**$ -**	**$ -**	**$ 365,000**	Total Priority 1 project costs (including inflation)
PRIORITY 2 PROJECTS	24-inch along 4th Avenue from Kingwood Avenue to Juniper Street	$ -	$ 61,000	$ -	$ -	$ 61,000	Approximately 270' of pipe
	30-inch along Juniper Street from 4th Avenue to 3rd Avenue	$ -	$ 105,000	$ -	$ -	$ 105,000	Approximately 445' of pipe
	30-inch along 3rd Avenue from Juniper Street to Hazel Street	$ -	$ 147,000	$ -	$ -	$ 147,000	Approximately 515' of pipe
	42-inch along 3rd Avenue from Hazel Street to Grove Street	$ -	$ 107,000	$ -	$ -	$ 107,000	Approximately 260' of pipe
	PRIORITY 2 PROJECTS SUB-TOTAL	**$ -**	**$ 420,000**	**$ -**	**$ -**	**$ 420,000**	Total Priority 2 project costs (including inflation)
PRIORITY 3 PROJECTS	18-inch along SW 1st Avenue from Laurel Street to Kingwood Avenue	$ -	$ -	$ 68,000	$ -	$ 68,000	Approximately 350' of pipe
	18-inch along Kingwood Avenue from SW 1st Avenue to S 1st Avenue	$ -	$ -	$ 34,000	$ -	$ 34,000	Approximately 150' of pipe
	24-inch along S 1st Avenue from Kingwood Avenue to Hazel Street	$ -	$ -	$ 200,000	$ -	$ 200,000	Approximately 810' of pipe
	30-inch along S 1st Avenue from Hazel Street to Fairview Street	$ -	$ -	$ 133,000	$ -	$ 133,000	Approximately 460' of pipe
	18-inch along 4th Avenue from Myrtle Street to Kingwood Avenue	$ -	$ -	$ -	$ 90,000	$ 90,000	Approximately 375' of pipe
	18-inch along 3rd Avenue from Kingwood Avenue to Juniper Street	$ -	$ -	$ -	$ 68,000	$ 68,000	Approximately 315' of pipe
	18-inch along Hazel Street from 5th Avenue to 4th Avenue	$ -	$ -	$ -	$ 80,000	$ 80,000	Approximately 330' of pipe
	24-inch along Hazel Street from 4th Avenue to 3rd Avenue	$ -	$ -	$ -	$ 124,000	$ 124,000	Approximately 450' of pipe
	PRIORITY 3 PROJECTS SUB-TOTAL	**$ -**	**$ -**	**$ 435,000**	**$ 362,000**	**$ 797,000**	Total Priority 3 project costs (including inflation)
	CAPITAL IMPROVEMENT PROJECTS TOTAL	**$ 365,000**	**$ 420,000**	**$ 435,000**	**$ 362,000**	**$ 1,582,000**	Total cost of improvements (including inflation)
	5-YEAR ANNUAL AVERAGE	**$ 73,000**	**$ 84,000**	**$ 87,000**	**$ 72,400**		Average annual cost over each 5-year period.
	TOTAL 20-YEAR PLANNING PERIOD ANNUAL AVERAGE					**$ 79,100**	Average annual cost over the planning period.

Notes:

(1) The cost estimates shown are planning level estimates and are not based on actual designs. As such, they have been prepared for general guidance and planning and should be considered as preliminary. The final costs of an anticipated project will depend on the actual design and construction, including but not limited to, actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

(2) Project priority and schedules are proposed. Exact timing of improvements is uncertain and will depend on growth and available funding.

(3) Costs include estimated construction costs in 2014 dollars plus 40 percent allowance for contingencies, engineering, surveying, legal, administration, and other project related costs, plus 3 percent inflation to anticipated year of project. Costs do not include costs for bonds, financing, right-of-way, easement, land acquisition, or special construction.

ASHLEY ENGINEERING DESIGN

1st Avenue Drainage Basin Study Cost Estimate Summary [1]

(Estimated Costs in 2014 Dollars)

Priority No.	Location	Est. Pipe Size (in)	Est. Pipe Length (ft)	Est. No. MHs	Est. No. CBs	Subtotal	Markups (40%)	Estimated Project Cost
1	42" Outfall to North Santiam River	42	130	1	2	$ 33,800	$ 13,500	$ 47,000
1	Fairview - S 1st to MH before Outfall	30	460	2	4	$ 70,200	$ 28,100	$ 98,000
1	3rd Avenue - Grove to MH before Outfa	42	550	3	4	$125,400	$ 50,200	$ 176,000
2	4th Avenue - Kingwood to Juniper	24	270	1	4	$ 36,400	$ 14,600	$ 51,000
2	Juniper - 4th Avenue to 3rd Avenue	30	445	1	2	$ 60,900	$ 24,400	$ 85,000
2	3rd Avenue - Juniper to Hazel	30	515	2	8	$ 82,800	$ 33,100	$ 116,000
2	3rd Avenue - Hazel to Grove	42	260	1	4	$ 58,700	$ 23,500	$ 82,000
3	SW 1st Avenue - Laurel to Kingwood	18	350	2	2	$ 35,200	$ 14,100	$ 49,000
3	Kingwood Avenue - SW 1st to S 1st Ave	18	150	1	2	$ 17,300	$ 6,900	$ 24,000
3	S 1st Ave - Kingwood to Hazel Street	24	810	3	4	$ 97,300	$ 38,900	$ 136,000
3	S 1st Ave - Hazel to Fairview	30	460	1	2	$ 62,700	$ 25,100	$ 88,000
3	4th Avenue - Myrtle to Kingwood	18	375	2	4	$ 40,000	$ 16,000	$ 56,000
3	3rd Avenue - Kingwood to Juniper	18	315	1	2	$ 29,200	$ 11,700	$ 41,000
3	Hazel - 5th to 4th Avenue	18	330	1	4	$ 33,300	$ 13,300	$ 47,000
3	Hazel - 4th to 3rd Avenue	24	450	1	2	$ 50,700	$ 20,300	$ 71,000
		Total	**5,870**	**23**	**50**	**$833,900**	**$333,700**	**$ 1,167,000**

Pipe Unit Costs:

Dia. (in)	Estimated Cost per ft.
10	$40
12	$48
15	$60
18	$72
21	$84
24	$96
30	$120
36	$144
42	$168
48	$192

MH Unit Costs:

Dia. (ft)	Cost Each
4'	$3,500
5'	$4,500
6'	$6,000
8'	$9,000

CB Unit Costs:

Cost Each
$1,500

Markups Summary:

20%	Const.Contingency
15%	Engineering/Surv
5%	Legal and Admin
40%	Total

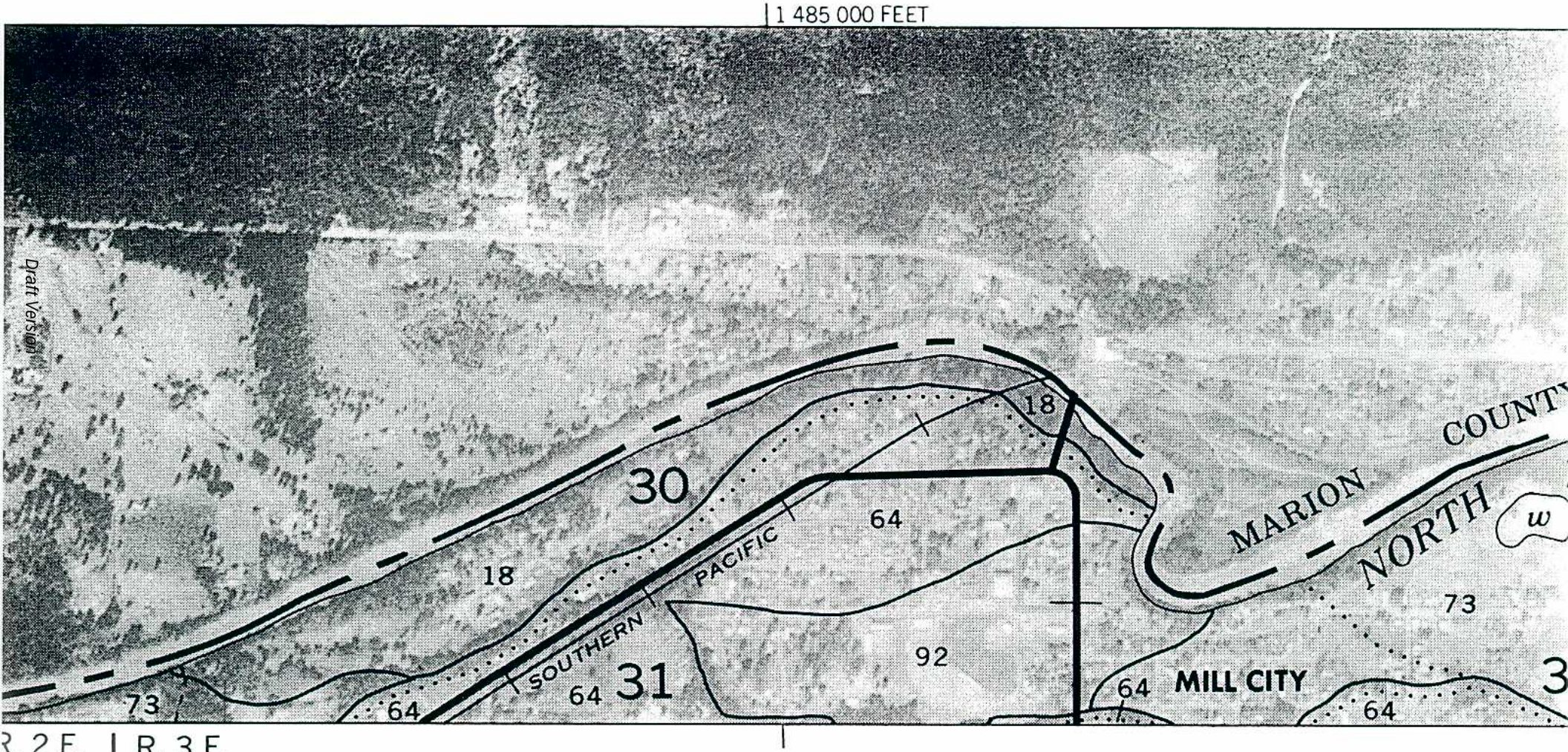
Basic Cost Estimate Assumptions:

- Common earth excavation 5'-7' max deep.
- ADS-N12 HDPE Pipe
- No rock excavation.
- No easements or property acquisitions.
- No trench dewatering.
- No specialty construction.
- Construction by private contractors.
- Markup to include contingency, engineering and surveying, legal and administrative

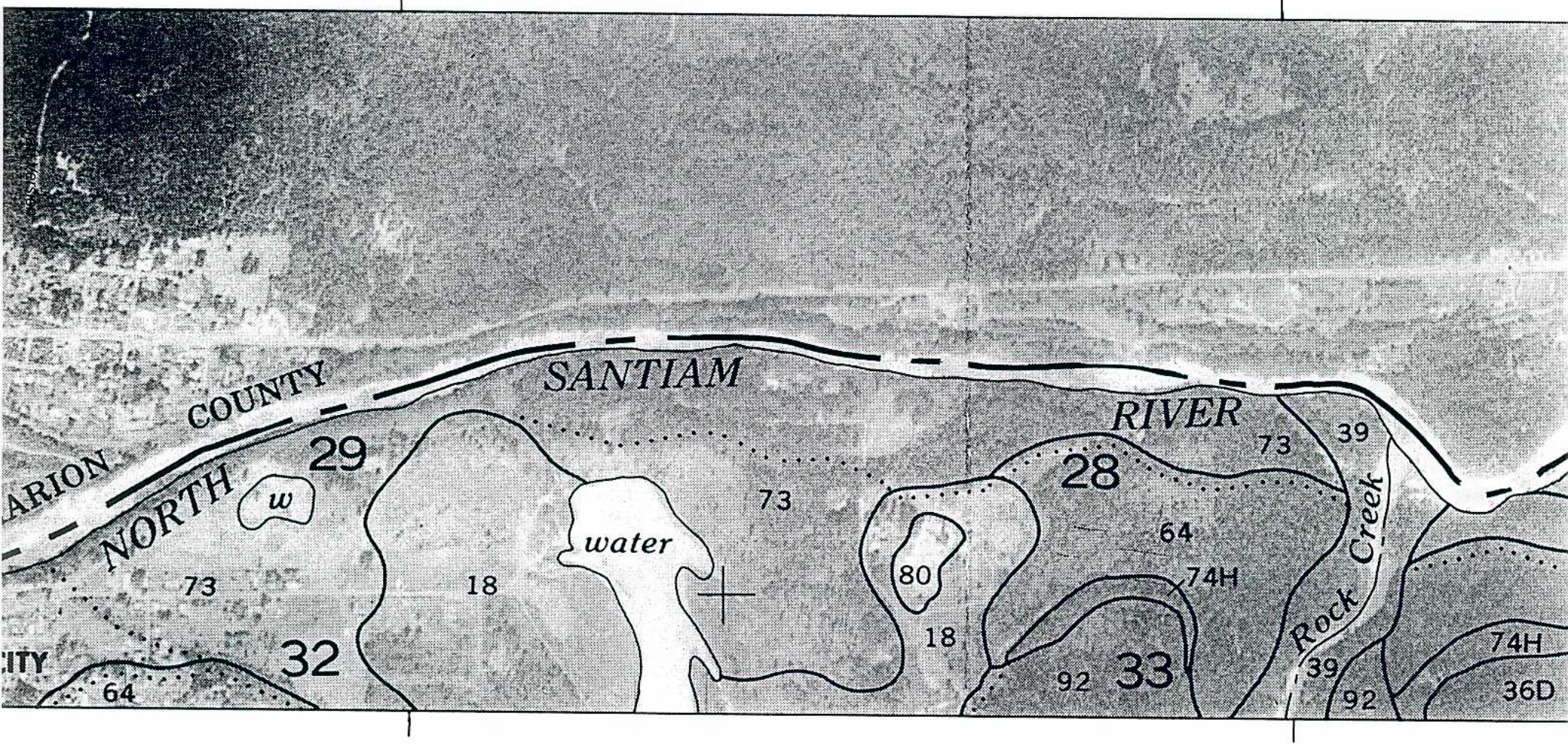
[1] Note:

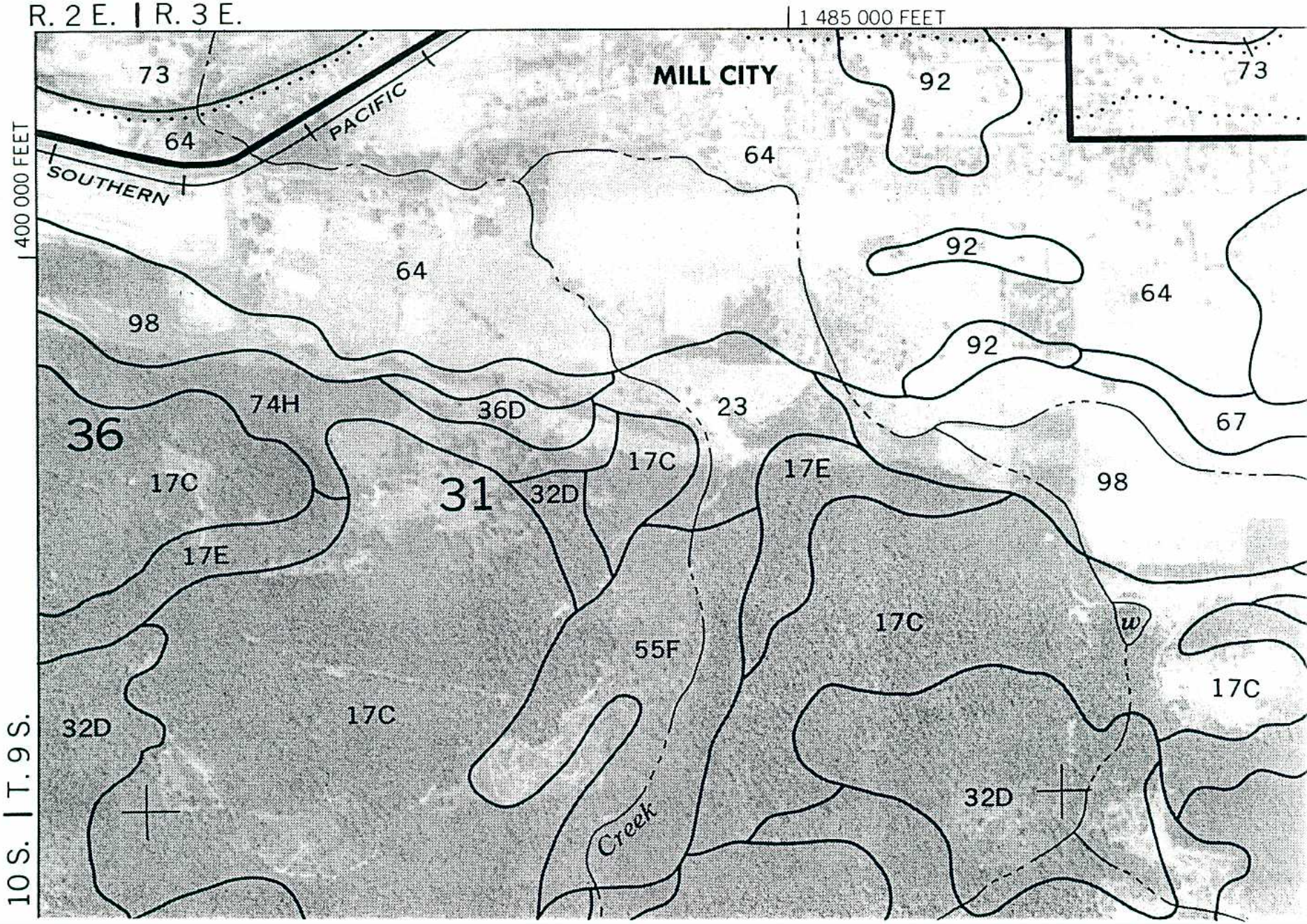
The cost estimates shown are planning level estimates and are not based on actual designs. As such, they have been prepared for general guidance and planning from the information available at the time of the estimate and should be considered as preliminary. The final costs of any anticipated project will depend on the actual design and construction, including but not limited to, actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions

Appendix C – Linn County Soil Survey Information


1 485 000 FEET
Draft Version
30
18
64
PACIFIC
SOUTHERN
64
31
73
64
92
18
MARION
NORTH
COUNTY
w
73
MILL CITY
64
64
3
R. 2 E.
R. 3 E.

INSET


SANTIAM
RIVER
COUNTY
NORTH
ARION
29
28
32
33
w
water
73
18
80
64
74H
39
92
36D
Rock Creek


R. 2 E.
R. 3 E.
1 485 000 FEET
400 000 FEET
10 S.
T. 9 S.
MILL CITY
PACIFIC
SOUTHERN
Creek
73
64
92
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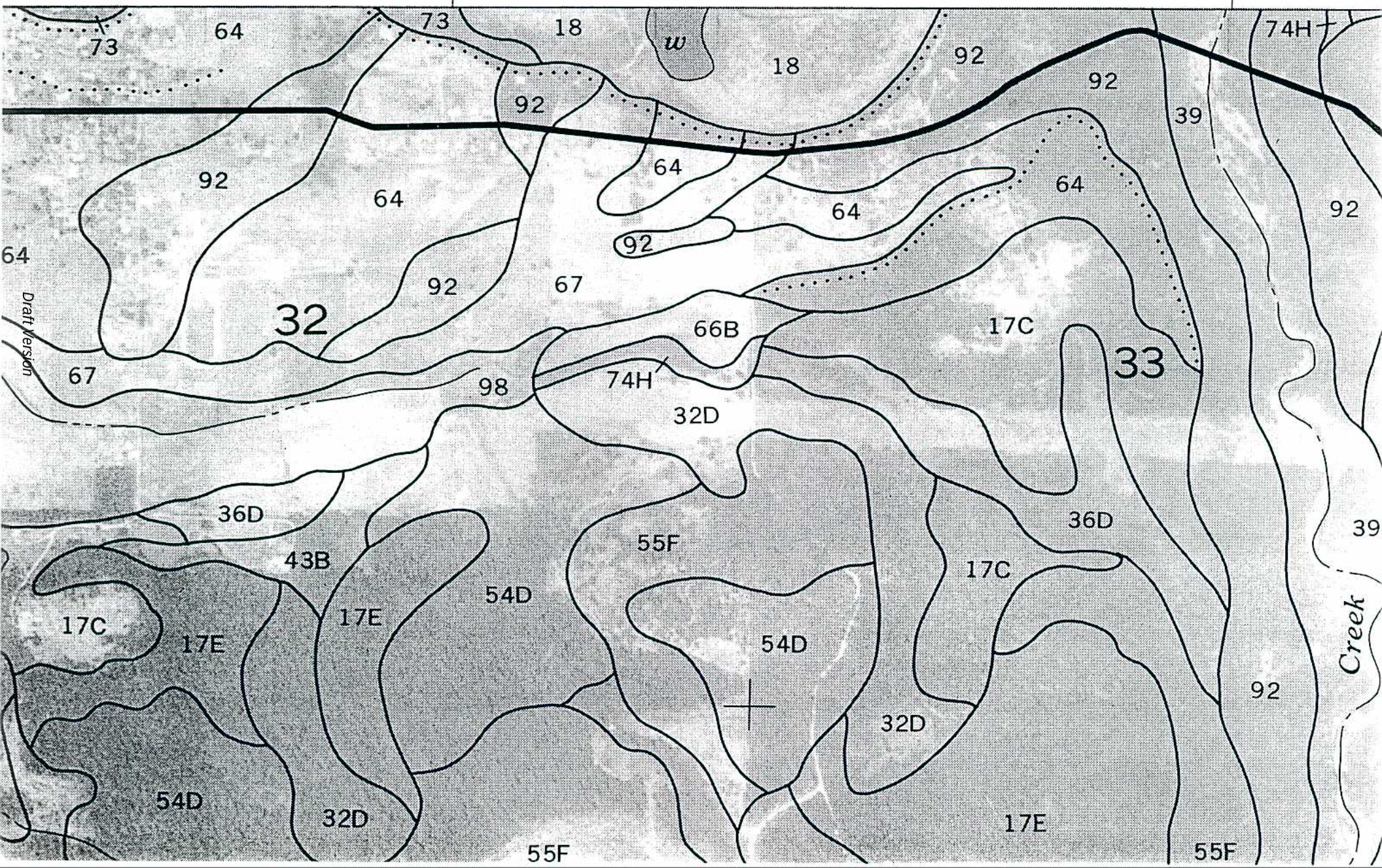
74H
36
17C
31
32D
36D
23
17E
67
55F
w


64
73
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w
18
92
92
74H
92
39
92
64
64
64
64
92
92
92
64
92
67
32
66B
17C
33
67
98
74H
32D
36D
36D
39
55F
43B
17C
54D
17E
17C
17E
54D
54D
32D
92
Creek
32D
17E
54D
55F
55F
Draft Version

TABLE 14.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1A, 1B---------- Abiqua	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
2D---------- Acanod	C	None--------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	---	High-----	High.
3---------- Amity	D	None--------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
4D, 5F, 6F-------- Apt	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
7---------- Awbrig	D	Rare--------	---	---	+.5-1.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
8---------- Bashaw	D	Frequent----	Long------	Dec-Apr	+1-0.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
9C, 9D, 9E, 9F---- Bellpine	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	High-----	High.
10E---------- Bensley	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
11F*, 11G*: Bensley----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
Valsetz----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	High.
12E, 13F, 13G, 14F, 14G--------- Blachly	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
15D---------- Bohannon	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	High-----	High.
16B---------- Briedwell	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
17C, 17E---------- Bull Run	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
18---------- Camas	A	Occasional	Brief-----	Nov-May	>6.0	---	---	>60	---	---	Moderate	Moderate.
19---------- Chapman	B	Rare---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
20C---------- Chehalem	C	None---------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	---	Moderate	Moderate.
21---------- Chehalis	B	Occasional	Brief-----	Nov-Mar	>6.0	---	---	>60	---	---	Moderate	Moderate.
22C, 22E---------- Chehulpum	C	None---------	---	---	>6.0	---	---	10-20	Soft	---	Moderate	Moderate.
23---------- Clackamas	D	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
24---------- Clackamas Variant	C	None---------	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
25---------- Cloquato	B	Occasional	Brief-----	Nov-Mar	>6.0	---	---	>60	---	---	Moderate	Moderate.
26---------- Coburg	C	None---------	---	---	1.5-2.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
27---------- Concord	D	None---------	---	---	+.5-0.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
28---------- Conser	D	Rare---------	---	---	+.5-1.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
29---------- Courtney	D	Rare---------	---	---	+.5-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
30D, 30F, 30G----- Crabtree	C	None---------	---	---	2.0-3.0	Perched	Nov-Jun	>60	---	High-----	Moderate	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
31D, 31F, 31G----- Cruiser	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High-----	High.
32D---------- Cumley	C	None--------	---	---	2.0-3.0	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
33---------- Dayton	D	None--------	---	---	+.5-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
34C, 34E, 34F----- Dixonville	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
35C*, 35E*:												
Dixonville-------	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
Philomath--------	D	None--------	---	---	>6.0	---	---	12-20	Soft	---	Moderate	Moderate.
Hazelair---------	D	None--------	---	---	1.0-2.0	Perched	Dec-Apr	20-40	Soft	---	Moderate	Moderate.
36D---------- Dupee	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	---	High-----	High.
37D, 37F, 37G----- Flane	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
38F*, 38G*:												
Flane----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
Moe----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High-----	High.
39*:												
Fluvents.												
Fluvaquents.												
40G*, 41G*:												
Harrington-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
Klickitat--------	B	None--------	---	---	>6.0	---	---	40-60	Hard	---	High-----	High.
42H*:												
Harrington-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
Rock outcrop.												

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
43B, 43D---------- Hazelair	D	None---------	---	---	1.0-2.0	Perched	Dec-Apr	20-40	Soft	---	Moderate	Moderate.
44E, 44F, 44G----- Henline	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
45F*, 45H*: Henline----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Yellowstone------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	High.
Rock outcrop.												
46---------- Holcomb	D	None---------	---	---	1.0-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
47C, 47D, 48F, 49F---------- Honeygrove	B	None---------	---	---	>6.0	---	---	>60	---	---	High-----	High.
50D, 50F, 50G----- Hummington	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
51C, 51D, 51E, 51F---------- Jory	B	None---------	---	---	>6.0	---	---	>60	---	---	High-----	High.
52D, 52F, 52G----- Keel	C	None---------	---	---	>6.0	---	---	20-40	Soft	High-----	High-----	High.
53G*, 53H*: Kilchis----------	D	None---------	---	---	>6.0	---	---	12-20	Hard	---	High-----	High.
Harrington-------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
54D, 55F, 55G, 56F, 56G, 57E---- Kinney	B	None---------	---	---	>6.0	---	---	40-60	Soft	---	High-----	High.
58F*, 58G*, 59F*, 59G*: Kinney----------	B	None---------	---	---	>6.0	---	---	40-60	Soft	---	High-----	High.
Klickitat-------	B	None---------	---	---	>6.0	---	---	40-60	Hard	---	High-----	High.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
60E*, 61F*, 62F*: Klickitat	B	None	---	---	>6.0	---	---	40-60	Hard	---	High	High.
Harrington	C	None	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
63--- Malabon	C	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
64--- Malabon Variant	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
65B--- Marcola	C	None	---	---	3.5-4.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
66B--- McAlpin	C	None	---	---	2.0-3.0	Apparent	Nov-Mar	>60	---	---	Moderate	Moderate.
67--- McBee	C	Occasional	Brief	Nov-May	2.0-3.0	Apparent	Nov-Apr	>60	---	---	Moderate	Moderate.
68F, 68G--- McDuff	C	None	---	---	>6.0	---	---	20-40	Soft	---	High	High.
69B--- Minniece	D	None	---	---	0-2.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
70D, 70F--- Moe	B	None	---	---	>6.0	---	---	>60	---	High	High	High.
71F--- Mulkey	C	None	---	---	>6.0	---	---	20-40	Hard	High	High	High.
72C, 72D, 72E, 72F--- Nekia	C	None	---	---	>6.0	---	---	20-40	Hard	---	High	High.
73--- Newberg	B	Occasional	Brief	Dec-Mar	>6.0	---	---	>60	---	---	Moderate	Moderate.
74H*. Ochrepts												

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
75C---------- Panther	D	None--------	---	---	0-1.0	Perched	Dec-Apr	40-60	Soft	---	High-----	High.
76E, 76G---------- Peavine	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	High-----	High.
77A---------- Pengra	C	None--------	---	---	1.5-2.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
78C, 79C, 79F----- Philomath	D	None--------	---	---	>6.0	---	---	12-20	Soft	---	Moderate	Moderate.
80*. Pits												
81D, 82F, 82G, 83F---------- Quartzville	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
84E, 84G---------- Ritner	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
85*. Riverwash												
86G*: Rock outcrop.												
Orthents.												
87---------- Salem	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
88B, 88C---------- Salkum	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
89B---------- Santiam	C	None--------	---	---	2.0-3.0	Perched	Dec-Mar	>60	---	---	Moderate	Moderate.
90B---------- Saturn	B	Rare--------	---	---	3.5-5.0	Apparent	Dec-Mar	>60	---	---	High-----	High.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
91--Saturn Variant	C	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
92--Sifton Variant	A	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
93C--Silverton	C	None	---	---	2.5-5.0	Apparent	Nov-May	20-40	Hard	---	Moderate	Moderate.
94B--Stayton	D	None	---	---	>6.0	---	---	12-20	Hard	---	Moderate	Moderate.
95C, 95D, 95F--Steiwer	C	None	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Moderate.
96E--Valsetz	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	High.
97E*, 97H*:												
Valsetz	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	High.
Yellowstone	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	High.
98--Waldo	D	Occasional	Brief	Jan-Apr	0-0.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
99--Wapato	D	Frequent	Brief	Dec-Apr	+1-1.0	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
100--Whiteson	D	Frequent	Brief to long.	Dec-Apr	0-1.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
101C, 101D, 101E, 101F--Willakenzie	C	None	---	---	>6.0	---	---	20-40	Soft	---	High	High.
102--Willamette	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
103C--Witham	D	None	---	---	1.5-2.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
104E, 104G-------- Witzel	D	None---------	---	---	>6.0	---	---	12-20	Hard	---	Moderate	Moderate.
105C-------------- Witzel Variant	D	None---------	---	---	>6.0	---	---	12-20	Hard	---	Moderate	Moderate.
106A, 106C-------- Woodburn	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	---	Moderate	Moderate.
107E, 107H-------- Yellowstone	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	High.
108H*:												
Zango------------	D	None---------	---	---	>6.0	---	---	10-20	Hard	---	Moderate	Moderate.
Dobbins----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	High-----	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

** A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Appendix D – Sub-Basin Summaries and Calculations

ASHLEY ENGINEERING DESIGN

SBUH - Existing Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **SBUH** - *Based on the procedures outlined in the City of Portland Stormwater Management Manual (SWMM), with NRCS Type IA using CN and Rainfall Depths from City's SD Master Plan.*

Precipitation: **3.5** ***inches, 2-Year, 24-Hr Depth***
5.4 ***inches, 25-Year, 24-Hr Depth***

Subbasin	Area (ac)	CN	Description
1st W1	2.00	92	CC
	0.26	88	I
	1.39	98	ROW (curbed)
	3.65	94	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0.0	0.0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0.0

10	Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st W2	1.42	92	CC
	1.43	80	P (buildings)
	1.89	80	R2
	2.39	98	ROW (curbed)
	7.13	89	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

10	Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st W3	2.56	92	CC
	6.26	80	R2
	1.49	93	ROW (turnpike)
	3.12	98	ROW (curbed)
	13.43	88	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
3	Channel/Pipe Flow	650	4

22	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

SBUH - Existing Conditions

Project Name: **City of Mill City - 1st Avenue Drainage Basin Study**
Subject: **Estimated Sub-basin Characteristics Summary Table**

Criteria: **SBUH** - *Based on the procedures outlined in the City of Portland Stormwater Management Manual (SWMM), with NRCS Type IA using CN and Rainfall Depths from City's SD Master Plan.*

Precipitation: **3.5** ***inches, 2-Year, 24-Hr Depth***
5.4 ***inches, 25-Year, 24-Hr Depth***

Subbasin	Area (ac)	CN	Description
1st W4	0.65	92	CC
	6.71	75	R1
	0.71	80	R2
	2.86	98	ROW (curbed)
	10.93	83	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

17 Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st E1	3.41	73	R2 (undeveloped)
	16.29	80	R2
	6.7	93	ROW (turnpike)
	26.40	83	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
30	Overland Sheet Flow	0.15	300	0.01

T_{scf} (min)		Length	Slope	Velocity
6	Shallow Concentrated	475	0.005	1.44

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

35 Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st E2	2.85	69	P (parks)
	9.79	73	R2 (undeveloped)
	0.33	93	ROW (turnpike)
	12.97	73	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
34	Overland Sheet Flow	0.15	300	0.007

T_{scf} (min)		Length	Slope	Velocity
10	Shallow Concentrated	650	0.005	1.14

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

44 Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

SBUH - Existing Conditions

Project Name: **City of Mill City - 1st Avenue Drainage Basin Study**
Subject: **Estimated Sub-basin Characteristics Summary Table**

Criteria: **SBUH** - *Based on the procedures outlined in the City of Portland Stormwater Management Manual (SWMM), with NRCS Type IA using CN and Rainfall Depths from City's SD Master Plan.*

Precipitation: **3.5** ***inches, 2-Year, 24-Hr Depth***
5.4 ***inches, 25-Year, 24-Hr Depth***

Subbasin	Area (ac)	CN	Description
1st E3	0.09	75	R1
	4.61	73	R2 (undeveloped)
	1.46	98	ROW (curbed)
	6.16	79	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
28	Overland Sheet Flow	0.15	200	0.005

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

28	Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st E4	2.58	75	R1
	7.27	73	R2 (undeveloped)
	1.85	93	ROW (turnpike)
	11.70	77	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
39	Overland Sheet Flow	0.15	300	0.005

T_{scf} (min)		Length	Slope	Velocity
6	Shallow Concentrated	650	0.008	1.82

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

45	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

SBUH - Developed Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **SBUH** - *Based on the procedures outlined in the City of Portland Stormwater Management Manual (SWMM), with NRCS Type IA using CN and Rainfall Depths from City's SD Master Plan.*

Precipitation: **3.5** ***inches, 2-Year, 24-Hr Depth***
5.4 ***inches, 25-Year, 24-Hr Depth***

Subbasin	Area (ac)	CN	Description
1st W1	2.00	92	CC
	0.26	88	I
	1.39	98	ROW (curbed)
	3.65	94	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0.0	0.0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0.0
10	Estimated ToC (min)		

Subbasin	Area (ac)	CN	Description
1st W2	1.42	92	CC
	1.43	80	P (buildings)
	1.89	80	R2
	2.39	98	ROW (curbed)
	7.13	89	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0
10	Estimated ToC (min)		

Subbasin	Area (ac)	CN	Description
1st W3	2.56	92	CC
	6.26	80	R2
	4.61	98	ROW (curbed)
	13.43	89	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
3	Channel/Pipe Flow	650	4
22	Estimated ToC (min)		

ASHLEY ENGINEERING DESIGN

SBUH - Developed Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **SBUH** - *Based on the procedures outlined in the City of Portland Stormwater Management Manual (SWMM), with NRCS Type IA using CN and Rainfall Depths from City's SD Master Plan.*

Precipitation: **3.5** ***inches, 2-Year, 24-Hr Depth***
5.4 ***inches, 25-Year, 24-Hr Depth***

Subbasin	Area (ac)	CN	Description
1st W4	0.65	92	CC
	6.71	75	R1
	0.71	80	R2
	2.86	98	ROW (curbed)
	10.93	83	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

17	Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st E1	18.90	80	R2
	7.5	98	ROW (curbed)
	26.40	86	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
2	Channel/Pipe Flow	375	4

21	Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st E2	2.85	69	P (parks)
	6.54	80	R2
	3.58	98	ROW (curbed)
	12.97	83	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
2	Channel/Pipe Flow	550	4

21	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

SBUH - Developed Conditions

Project Name: **City of Mill City - 1st Avenue Drainage Basin Study**
Subject: **Estimated Sub-basin Characteristics Summary Table**

Criteria: **SBUH** - *Based on the procedures outlined in the City of Portland Stormwater Management Manual (SWMM), with NRCS Type IA using CN and Rainfall Depths from City's SD Master Plan.*

Precipitation: **3.5** ***inches, 2-Year, 24-Hr Depth***
5.4 ***inches, 25-Year, 24-Hr Depth***

Subbasin	Area (ac)	CN	Description
1st E3	0.09	75	R1
	4.49	80	R2
	1.58	98	ROW (curbed)
	6.16	85	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

17	Estimated ToC (min)

Subbasin	Area (ac)	CN	Description
1st E4	2.58	75	R1
	5.9	80	R2
	3.21	98	ROW (curbed)
	11.69	84	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.010	2.03

T_{cpf} (min)		Length	Velocity
2	Channel/Pipe Flow	550	4

21	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

RATIONAL - Existing Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **RATIONAL** - *Based on the procedures outlined in the ODOT Hydraulics Manual, 2005 ed. using IDF Zone 5 with C-values from City's SD Master Plan.*

Precipitation: **25-yr Storm Event**

Subbasin	Area (ac)	C	Description
1st W1	2.00	0.8	CC
	0.26	0.55	I
Q25 (cfs)	1.39	0.9	ROW (curbed)
7			
	3.65	0.82	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0.0	0.0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0.0

10	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st W2	1.42	0.8	CC
	1.43	0.6	P
Q25 (cfs)	1.89	0.6	R2
12	2.39	0.9	ROW (curbed)
	7.13	0.74	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

10	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st W3	2.56	0.8	CC
	6.26	0.6	R2
Q25 (cfs)	1.49	0.85	ROW (turnpike)
16	3.12	0.9	ROW (curbed)
	13.43	0.74	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
3	Channel/Pipe Flow	650	4

22	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

RATIONAL - Existing Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table
Criteria: **RATIONAL** - *Based on the procedures outlined in the ODOT Hydraulics Manual, 2005 ed. using IDF Zone 5 with C-values from City's SD Master Plan.*
Precipitation: **25-yr Storm Event**

Subbasin	Area (ac)	C	Description
1st W4	0.65	0.8	CC
	6.71	0.5	R1
Q25 (cfs)	0.71	0.6	R2
13	2.86	0.9	ROW (curbed)
	10.93	0.63	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

17 Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st E1	3.41	0.4	R2 (undeveloped)
	16.29	0.6	R2
Q25 (cfs)	6.7	0.85	ROW (turnpike)
20			
	26.40	0.64	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
30	Overland Sheet Flow	0.15	300	0.01

T_{scf} (min)		Length	Slope	Velocity
6	Shallow Concentrated	475	0.005	1.44

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

35 Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st E2	2.85	0.2	P (parks)
	9.79	0.4	R2 (undeveloped)
Q25 (cfs)	0.33	0.85	ROW (turnpike)
5			
	12.97	0.37	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
34	Overland Sheet Flow	0.15	300	0.007

T_{scf} (min)		Length	Slope	Velocity
10	Shallow Concentrated	650	0.005	1.14

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

44 Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

RATIONAL - Existing Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **RATIONAL** - *Based on the procedures outlined in the ODOT Hydraulics Manual, 2005 ed. using IDF Zone 5 with C-values from City's SD Master Plan.*

Precipitation: **25-yr Storm Event**

Subbasin	Area (ac)	C	Description
1st E3	0.09	0.5	R1
	4.61	0.4	R2 (undeveloped)
Q25 (cfs)	1.46	0.9	ROW (curbed)
4			
	6.16	0.52	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
28	Overland Sheet Flow	0.15	200	0.005

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

28	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st E4	2.58	0.5	R1
	7.27	0.4	R2 (undeveloped)
Q25 (cfs)	1.85	0.9	ROW (curbed)
6			
	11.70	0.50	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
39	Overland Sheet Flow	0.15	300	0.005

T_{scf} (min)		Length	Slope	Velocity
6	Shallow Concentrated	650	0.008	1.82

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

45	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

RATIONAL - Developed Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **RATIONAL** - *Based on the procedures outlined in the ODOT Hydraulics Manual, 2005 ed. using IDF Zone 5 with C-values from City's SD Master Plan.*

Precipitation: **25-yr Storm Event**

Subbasin	Area (ac)	C	Description
1st W1	2.00	0.8	CC
	0.26	0.55	I
Q25 (cfs)	1.39	0.9	ROW (curbed)
7			
	3.65	0.82	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0.0	0.0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0.0

10	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st W2	1.42	0.8	CC
	1.43	0.6	P
Q25 (cfs)	1.89	0.6	R2
12	2.39	0.9	ROW (curbed)
	7.13	0.74	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
10	Overland Sheet Flow	0.014	0	0

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

10	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st W3	2.56	0.8	CC
	6.26	0.6	R2
Q25 (cfs)	4.61	0.9	ROW (curbed)
16			
	13.43	0.74	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
3	Channel/Pipe Flow	650	4

22	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

RATIONAL - Developed Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **RATIONAL** - *Based on the procedures outlined in the ODOT Hydraulics Manual, 2005 ed. using IDF Zone 5 with C-values from City's SD Master Plan.*

Precipitation: **25-yr Storm Event**

Subbasin	Area (ac)	C	Description
1st W4	0.65	0.8	CC
	6.71	0.5	R1
Q25 (cfs)	0.71	0.6	R2
13	2.86	0.9	ROW (curbed)
	10.93	0.63	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

17	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st E1	18.90	0.6	R2
	7.5	0.9	ROW (curbed)
Q25 (cfs)			
30			
	26.40	0.69	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
2	Channel/Pipe Flow	375	4

21	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st E2	2.85	0.2	P (parks)
	6.54	0.6	R2
Q25 (cfs)	3.58	0.9	ROW (curbed)
13			
	12.97	0.59	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.01	2.03

T_{cpf} (min)		Length	Velocity
2	Channel/Pipe Flow	550	4

21	Estimated ToC (min)

ASHLEY ENGINEERING DESIGN

RATIONAL - Developed Conditions

Project Name: City of Mill City - 1st Avenue Drainage Basin Study
Subject: Estimated Sub-basin Characteristics Summary Table

Criteria: **RATIONAL** - *Based on the procedures outlined in the ODOT Hydraulics Manual, 2005 ed. using IDF Zone 5 with C-values from City's SD Master Plan.*

Precipitation: **25-yr Storm Event**

Subbasin	Area (ac)	C	Description
1st E3	0.09	0.5	R1
	4.49	0.6	R2
Q25 (cfs)	1.58	0.9	ROW (curbed)
8			
	6.16	0.68	Subbasin Total

Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
0	Shallow Concentrated	0	0	0

T_{cpf} (min)		Length	Velocity
0	Channel/Pipe Flow	0	0

17	Estimated ToC (min)

Subbasin	Area (ac)	C	Description
1st E4	2.58	0.5	R1
	5.9	0.6	R2
Q25 (cfs)	3.21	0.9	ROW (curbed)
13			
	11.69	0.66	Subbasin Total

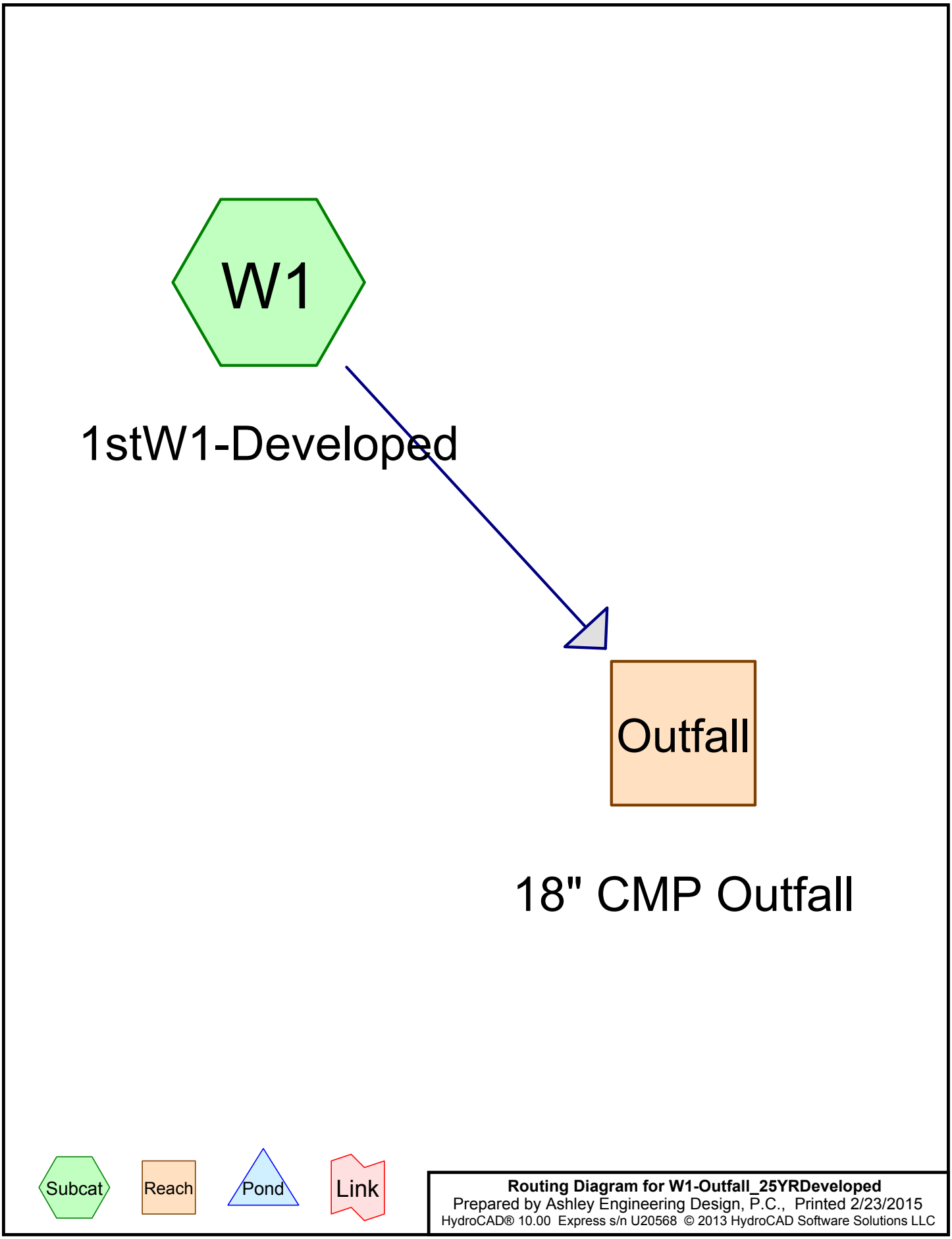
Estimated Time of Concentration (ToC)

T_{osf} (min)		'n'	Length	Slope
17	Overland Sheet Flow	0.15	150	0.01

T_{scf} (min)		Length	Slope	Velocity
2	Shallow Concentrated	250	0.010	2.03

T_{cpf} (min)		Length	Velocity
2	Channel/Pipe Flow	550	4

21	Estimated ToC (min)



Routing Diagram for W1-Outfall_25YRDeveloped
Prepared by Ashley Engineering Design, P.C., Printed 2/23/2015

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.000	92	CC (W1)
0.260	88	I (W1)
1.390	98	ROW (W1)
3.650	**94**	**TOTAL AREA**

Summary for Subcatchment W1: 1stW1-Developed

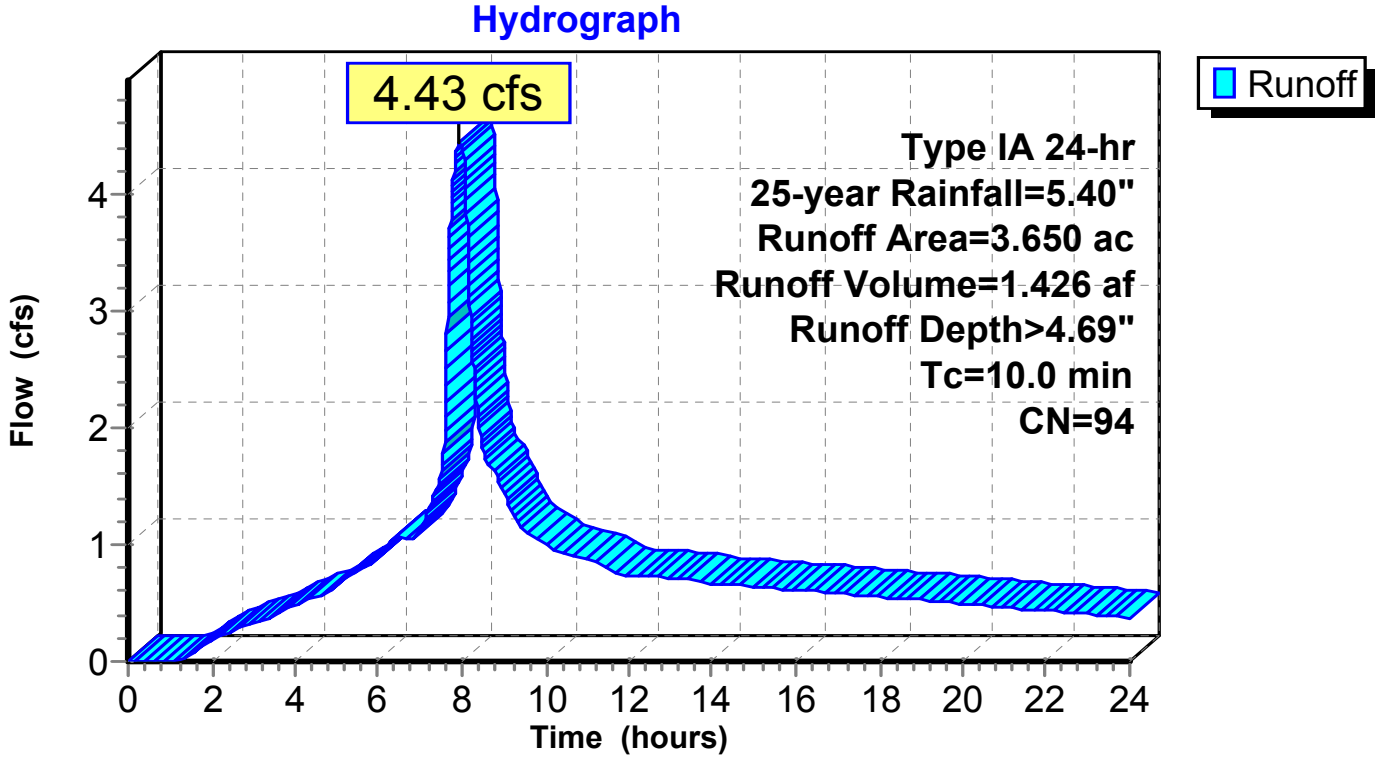
Runoff = 4.43 cfs @ 7.95 hrs, Volume= 1.426 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=5.40"

	Area (ac)	CN	Description
*	2.000	92	CC
*	0.260	88	I
*	1.390	98	ROW
	3.650	94	Weighted Average
	2.260	92	61.92% Pervious Area
	1.390	98	38.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment W1: 1stW1-Developed



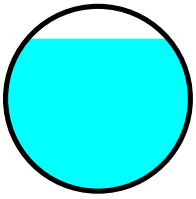
Summary for Reach Outfall: 18" CMP Outfall

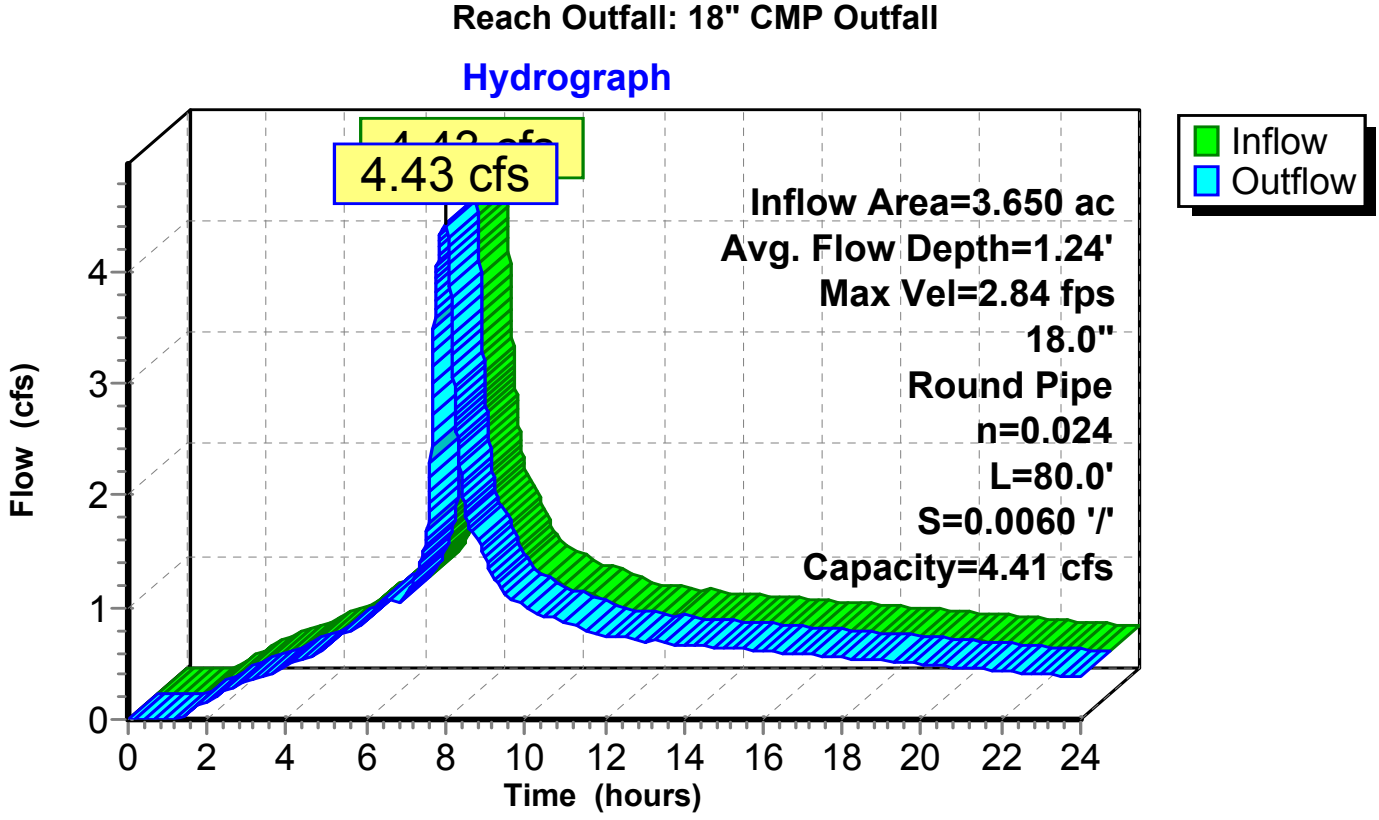
Inflow Area = 3.650 ac, 38.08% Impervious, Inflow Depth > 4.69" for 25-year event
Inflow = 4.43 cfs @ 7.95 hrs, Volume= 1.426 af
Outflow = 4.43 cfs @ 7.96 hrs, Volume= 1.425 af, Atten= 0%, Lag= 1.1 min

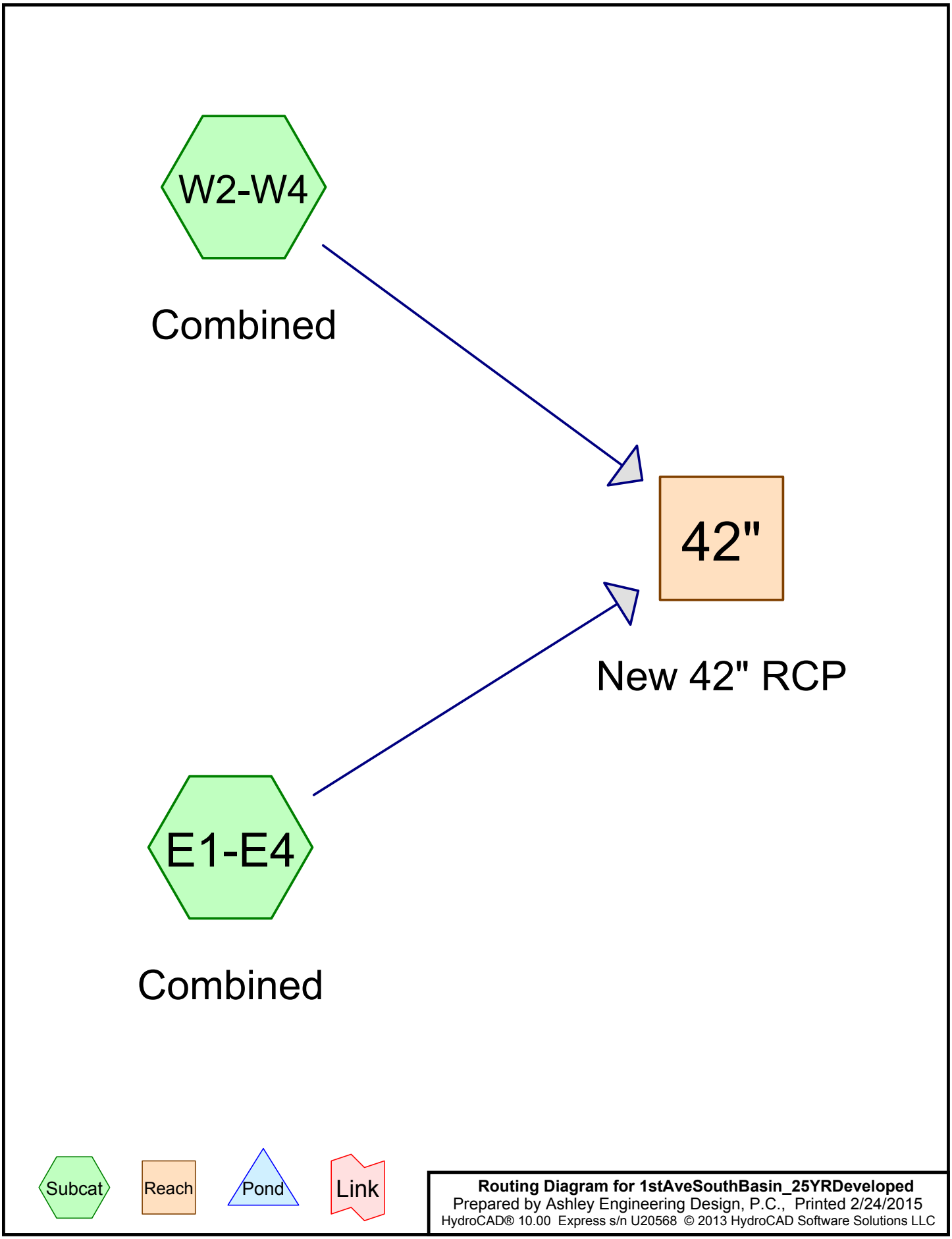
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.84 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.77 fps, Avg. Travel Time= 0.8 min

Peak Storage= 125 cf @ 7.96 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 4.41 cfs

18.0" Round Pipe
n= 0.024
Length= 80.0' Slope= 0.0060 '/'
Inlet Invert= 808.80', Outlet Invert= 808.32'







Routing Diagram for 1stAveSouthBasin_25YRDeveloped
Prepared by Ashley Engineering Design, P.C., Printed 2/24/2015

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.630	92	CC (W2-W4)
2.850	69	P (E1-E4)
1.430	80	P (W2-W4)
9.380	75	R1 (E1-E4, W2-W4)
44.690	80	R2 (E1-E4, W2-W4)
25.730	98	ROW (E1-E4, W2-W4)
88.710	**85**	**TOTAL AREA**

Summary for Subcatchment E1-E4: Combined

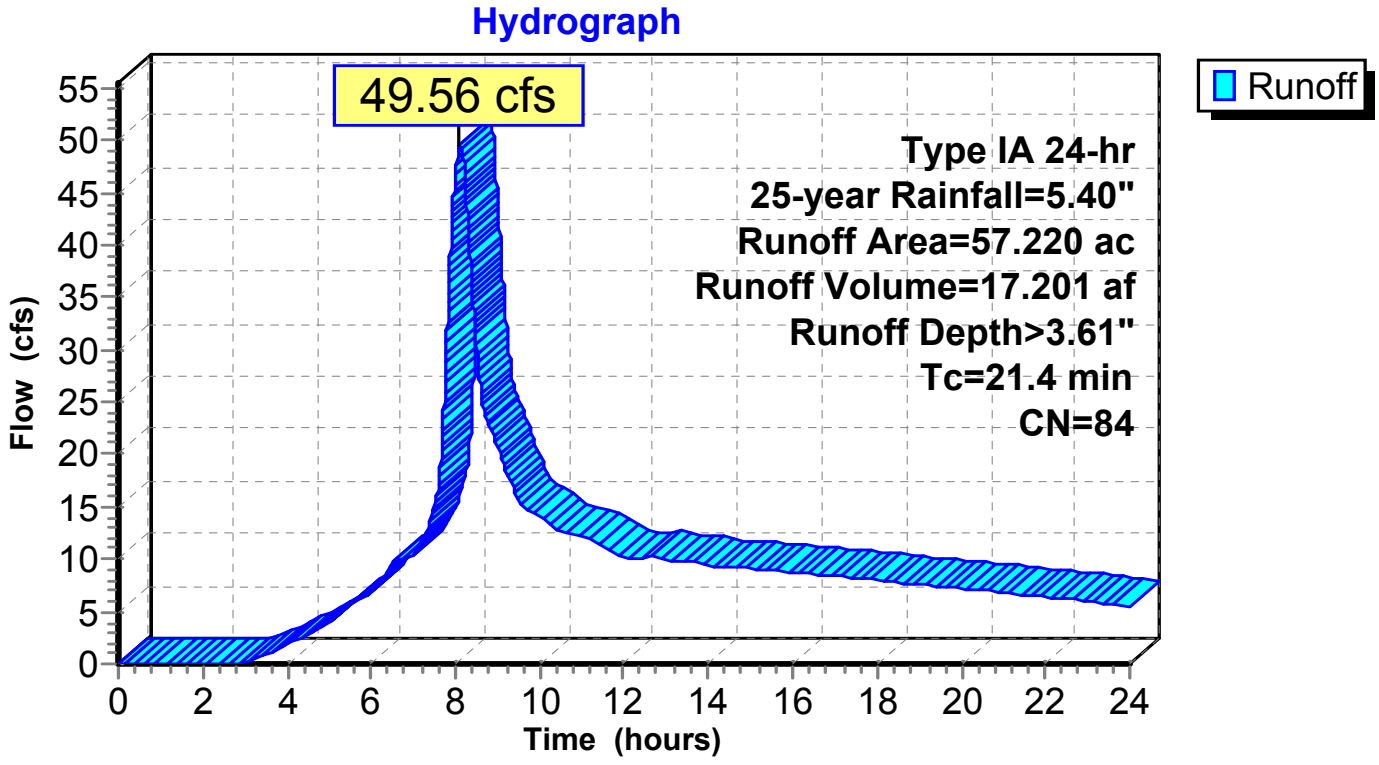
Runoff = 49.56 cfs @ 8.11 hrs, Volume= 17.201 af, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=5.40"

	Area (ac)	CN	Description
*	18.900	80	R2
*	7.500	98	ROW
*	2.850	69	P
*	6.540	80	R2
*	3.580	98	ROW
*	0.090	75	R1
*	4.490	80	R2
*	1.580	98	ROW
*	2.580	75	R1
*	5.900	80	R2
*	3.210	98	ROW
	57.220	84	Weighted Average
	41.350	79	72.26% Pervious Area
	15.870	98	27.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.4					**Direct Entry,**

Subcatchment E1-E4: Combined



Summary for Subcatchment W2-W4: Combined

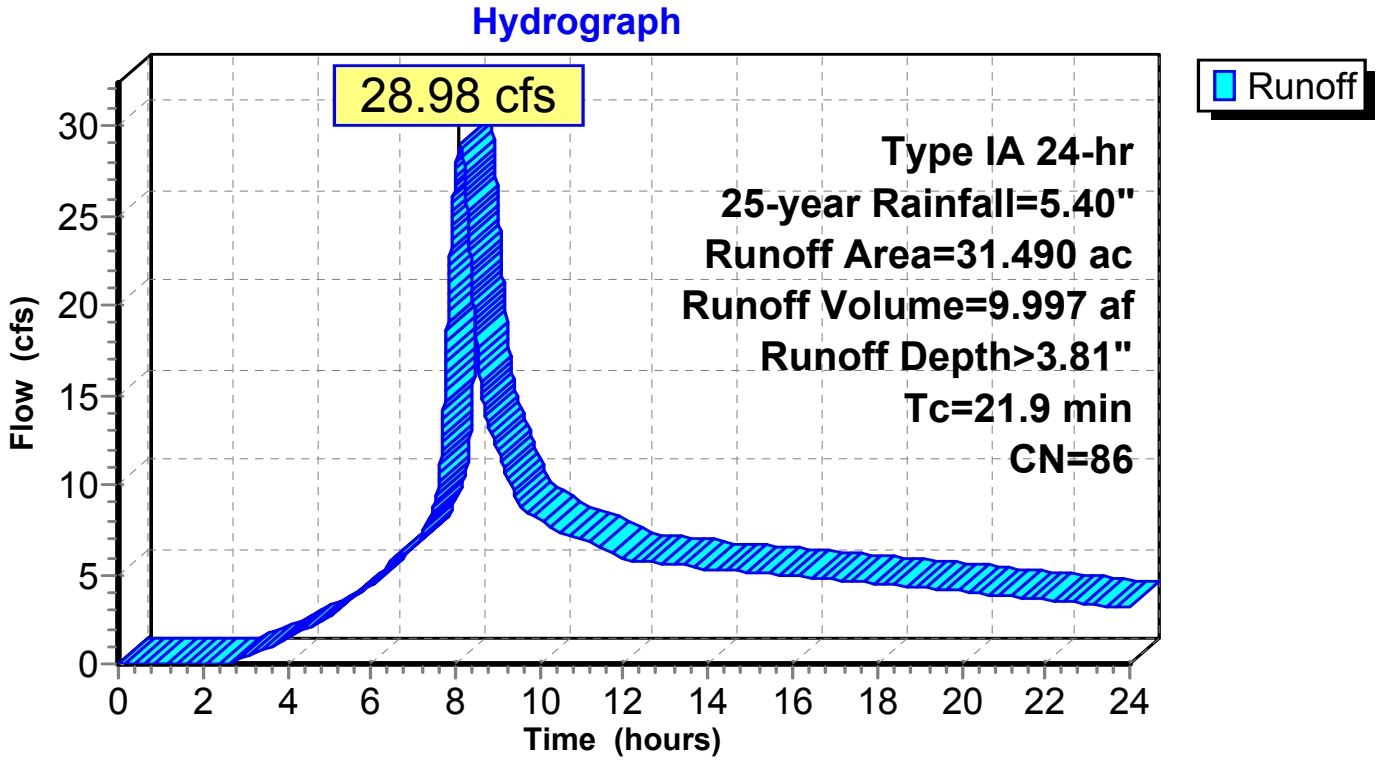
Runoff = 28.98 cfs @ 8.11 hrs, Volume= 9.997 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=5.40"

	Area (ac)	CN	Description
*	1.420	92	CC
*	1.430	80	P
*	1.890	80	R2
*	2.390	98	ROW
*	2.560	92	CC
*	6.260	80	R2
*	4.610	98	ROW
*	0.650	92	CC
*	6.710	75	R1
*	0.710	80	R2
*	2.860	98	ROW
	31.490	86	Weighted Average
	21.630	81	68.69% Pervious Area
	9.860	98	31.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.9					**Direct Entry,**

Subcatchment W2-W4: Combined



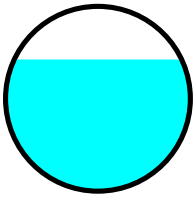
Summary for Reach 42": New 42" RCP

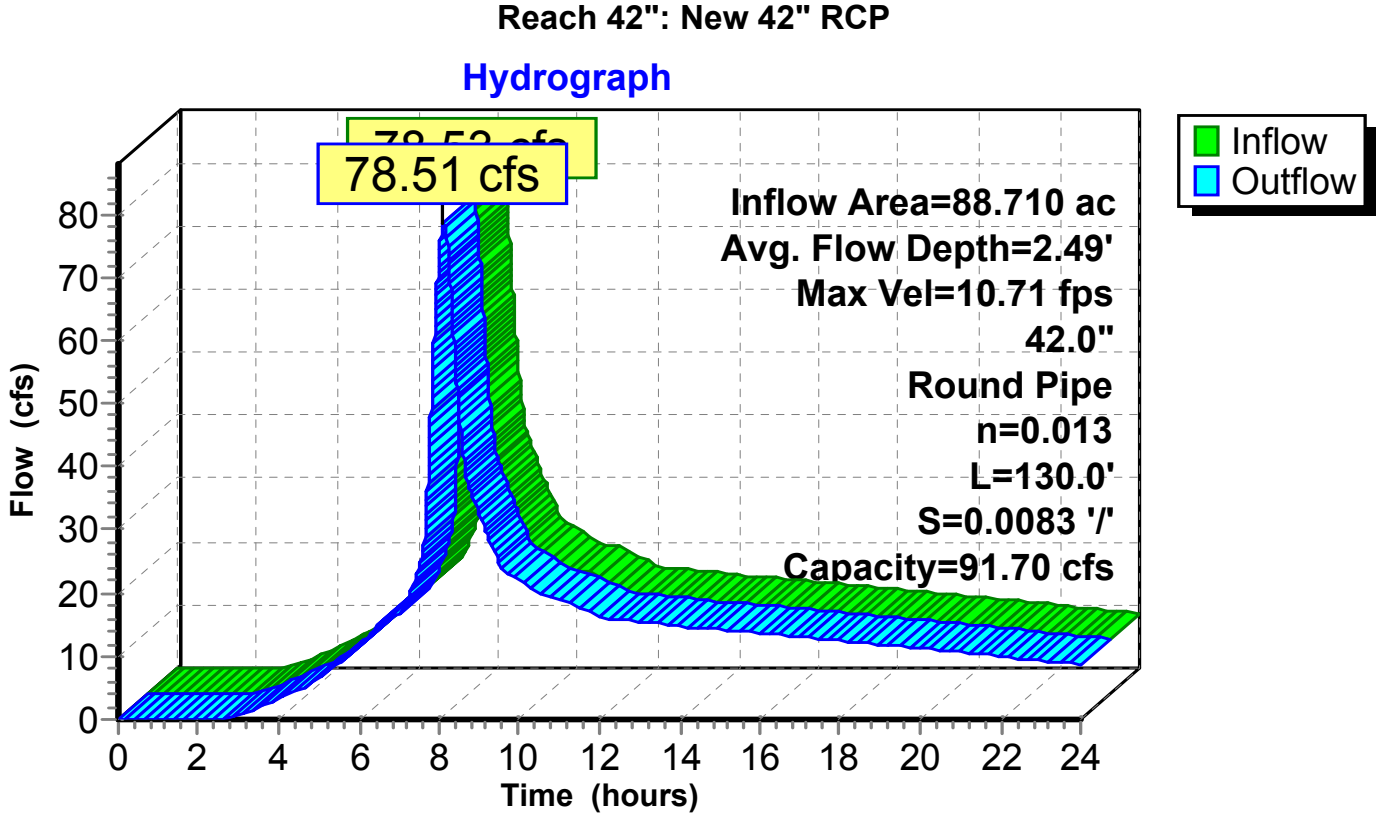
Inflow Area = 88.710 ac, 29.00% Impervious, Inflow Depth > 3.68" for 25-year event
Inflow = 78.53 cfs @ 8.11 hrs, Volume= 27.197 af
Outflow = 78.51 cfs @ 8.12 hrs, Volume= 27.191 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.71 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 6.66 fps, Avg. Travel Time= 0.3 min

Peak Storage= 953 cf @ 8.12 hrs
Average Depth at Peak Storage= 2.49'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 91.70 cfs

42.0" Round Pipe
n= 0.013
Length= 130.0' Slope= 0.0083 '/'
Inlet Invert= 825.72', Outlet Invert= 824.64'





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