URS

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Client: **City of Arlington** Project: **Stormwater Comprehensive Plan**

Location: **Arlington, WA** Subject: **XP-SWMM Hydraulic Model - Talcott**

Project No: **33757537** Calculation No: **HM-2** Revision No. **0** Sheet **1** of 24

TALCOTT BASIN ANALYSIS

(Title of Calculations/Document)

STEP 1

	Signature	Date
Methodology & Assumptions Developed		4/14/08
Methodology & Assumptions Approved	Carla Jalich	6/2/08

STEP 2

Calculations Completed		6/4/08
Calculations Checked	Carla Jalich	6/10/08

STEP 3

Task Manager Approved	n/a	
Project Manager Approved		

COMMENTS

Purpose: Evaluate the existing stormwater conveyance system that routes flows from within the Talcott 5th tier basin to the South Fork Stillaguamish River under the Lincoln Bridge on SR 530.

Background: Initial modeling was conducted using elevation data obtained via GPS surveying provided by the City of Arlington (City). The rim elevations of the manholes were measured via GPS and invert elevations were determined by measuring from the rim elevation to the pipe invert. To improve the accuracy of the model, rim elevations from the City's as-built drawing records were used. The as-built drawings generated new rim elevations and new invert elevations were created based on subtracting the original measure down distances from the new as-built data.

The focus of this evaluation was to locate potential problems within the existing Talcott Basin stormwater system. Stormwater flow routing was completed using XP-SWMM to identify necessary improvements to the stormwater drainage system.

Stormwater conveyance problems have not been reported in this basin. In the Talcott Basin, only fish habitat and fish passage concerns have been previously identified in the 1995, 1999, and 2003 assessment memos.

Approach: Because of the size of the watershed, the Talcott Basin was evaluated to determine the capacity of the existing storm drainage network under fully developed conditions. The storm drainage network includes a network of pipes with diameters ranging from 8- to 10-inches.

The location of the Talcott Basin within the City is shown in Figure 1. The model area schematic is shown in Figure 2, and Natural Resources Conservation Service (NRCS) hydrologic soil group information is included in Attachment 1.

The hydrology was developed based on the 24-hour frequency design storm (See Attachment 2). This evaluation used the rainfall data from the 2-year, 10-year, 25-year, and 100-year 24-hour storms and identified areas where flooding would be expected during similar conditions. Areas with flooding and capacity issues are identified for future stormwater drainage system monitoring. A summary of the rainfall data is presented in Table 1.

The existing storm drainage network was modeled in XP-SWMM using 24-hour frequency design storm hydrology and fully developed conditions. Hydraulics were routed for each event using XP-SWMM. Input to the model network for the Talcott Basin is included in Attachment 2. This information includes drainage areas and invert elevations of storage nodes and links. The percent impervious area was assumed to be 38 percent throughout the Talcott Basin based on the recommended value by NRCS for residential districts with ¼ acre lot sizes (see Attachment 1). The majority of soils within the Talcott Basin are classified as hydrologic soil group A by NRCS, which indicates that the soils have a high infiltration rate.

Areas of flooding observed by model results under these design conditions were identified. Several nodes throughout the drainage network were surcharged during the peak flood conditions.

Results: Attachment 3 presents selected XP-SWMM model results. Based on the assumptions made for pipe geometry and precipitation, described previously, the existing network was modeled under fully developed conditions.

The model results identified flooding in the following locations:

- The storm drain along N. Alcazar Avenue, between E. Gilman Street and Park Hill Drive (locations T-06 & T-07);

- The storm drain along N. Alcazar Avenue, near E. 5th Street (location T-09); and
- The storm drain along E. 4th Street, near N. Clara Street (location T-12).

See Table 2 for a summary of flooding conditions within the Talcott Basin.
The model indicated flooding issues at T-06, T-07, T-09, and T-12 during the 2-year storm event. Downstream of the T-06 and T-07 manholes, the slopes become flatter while the diameter remains the same. The flatter downstream slope reduces the stormwater conveyance performance potential and triggered the model to detect flooding during the 2-year storm. Downstream of T-09, starting at T-07, the slopes become significantly less steep which triggered the model to detect flooding at T-09. The flooding duration estimated during the 100-year storm at T-06, T-07, and T-09 is small compared to the magnitude of the storm event. The flooding detected by the model at T-12 was triggered by the uphill section downstream of that inlet.

The soil surrounding all of these manholes is highly permeable, therefore it is believed that the inlets in the Talcott stormwater system are not receiving as much as water as the model expects. Within the last 20 years, the City has no reports of flooding within this area, with the exception of debris clogging T-07, therefore it can be concluded that the majority of the water contributing to these inlets is infiltrating the ground prior to entering the manholes.

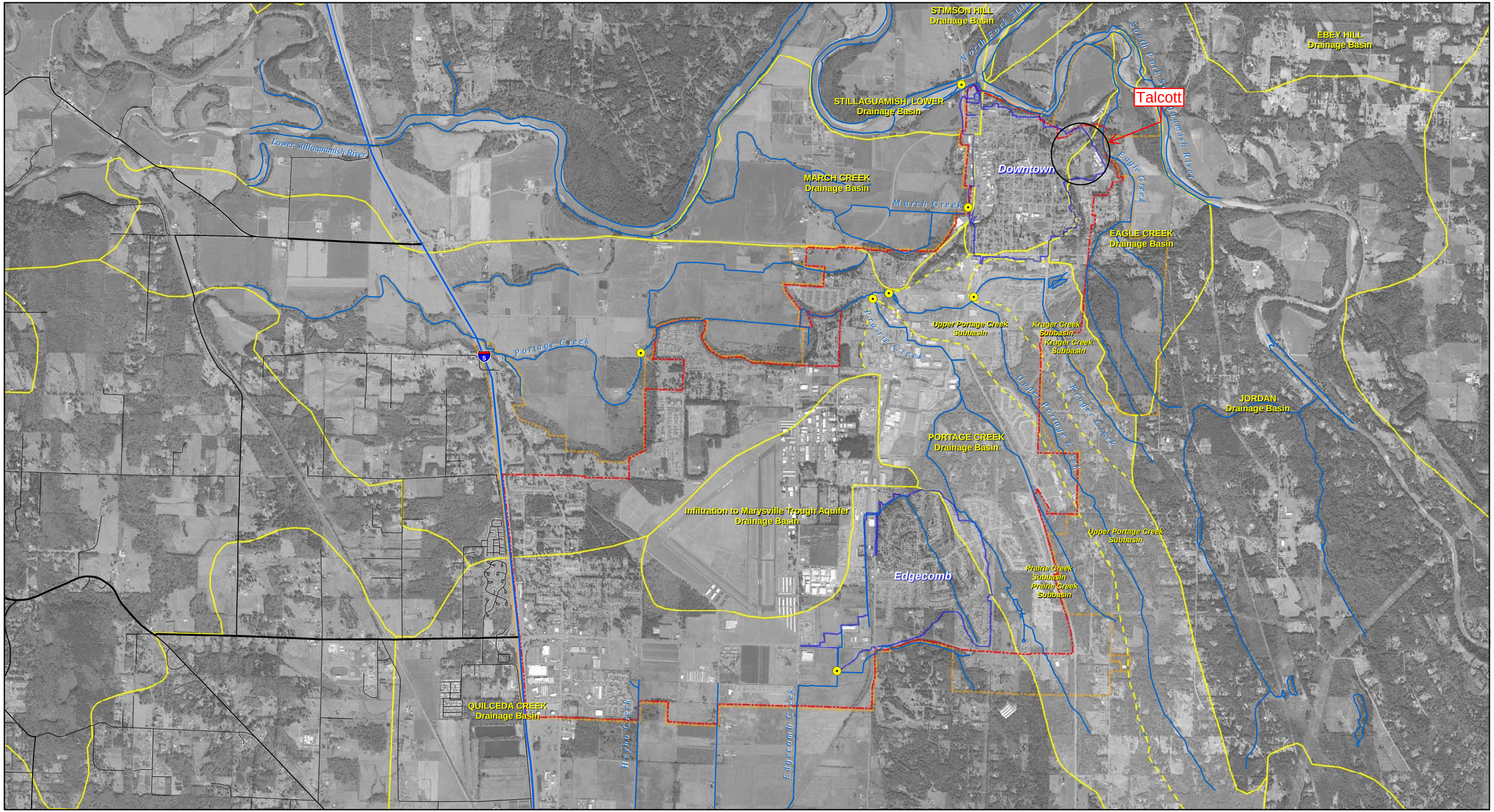
It is recommended that the City monitor and record observations in these areas during and following storm events to determine if additional modeling, and potentially upgrading the stormwater system, at these locations is necessary.

Table 1 – 24-Hour Design Rainfall

Return Period (years)	Rainfall Depth (inches)	Return Period (years)	Rainfall Depth (inches)
2-year	1.80	25-year	3.20
10-year	2.75	100-year	3.75

Table 2 - Hydraulic Model Results – Flooding Summary

	2-year Storm			10-year Storm			25-year Storm			100-year Storm		
	Flooded	Flood Volume		Flooded	Flood Volume		Flooded	Flood Volume		Flooded	Flood Volume	
Node	Time (min)	(cf)	(ac-ft)	Time (min)	(cf)	(ac-ft)	Time (min)	(cf)	(ac-ft)	Time (min)	(cf)	(ac-ft)
T-06	88	5,846	0.13	244	14,885	0.34	349	21207	0.49	437	30,365	0.70
T-07	40	1,709	0.04	76	2,743	0.06	104	3,692	0.08	137	5,088	0.12
T-09	19	357	0.01	36	3,594	0.08	42	5,510	0.13	50	8,105	0.19
T-12	687	27,441	0.63	1,274	69,076	1.59	1,370	91,484	2.10	1,378	119,364	2.74



Legend

- Drainage Basin Outfalls
- State Highway
- Arterial
- Street
- Arlington City Limits
- UGA Zones
- Drainage Basins
- Subbasins

N

1 0.5 0 1

Miles

\\Seaprojects\project\Arlington\GIS\maps\Figure 1 - Arlington Drainage Basins and Subbasins.mxd

Figure 1
Arlington Drainage Basins and Subbasins

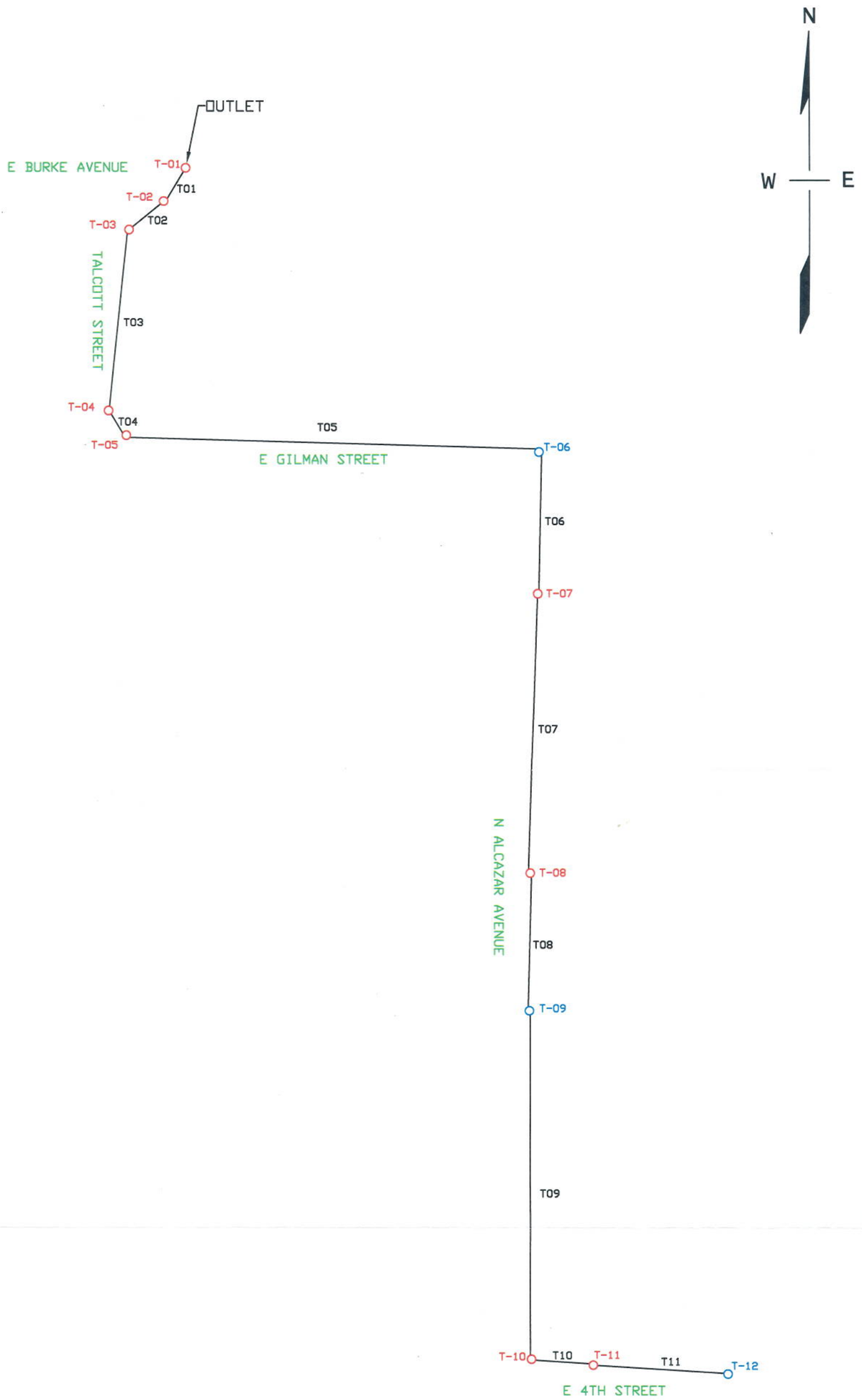


FIGURE 2
TALCOTT BASIN STORMWATER SYSTEM SCHEMATIC

LEGEND:

○ X-#	CONVEYANCE STRUCTURE WITHOUT INLET
○ X-#	CONVEYANCE STRUCTURE WITH INLET
—X#	PIPELINE

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Q:\7 – Hydraulic Model\Talcott\Calculation Package\Figures\Figure 2 Talcott – Schematic.dwg Apr 18, 2008 – 8:19pm

ATTACHMENT 1
NRCS Hydrologic Soil Group Information

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Table 2-2a Runoff curve numbers for urban areas 1/

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area 2/	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) 3/:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) 4/		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) 5/		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

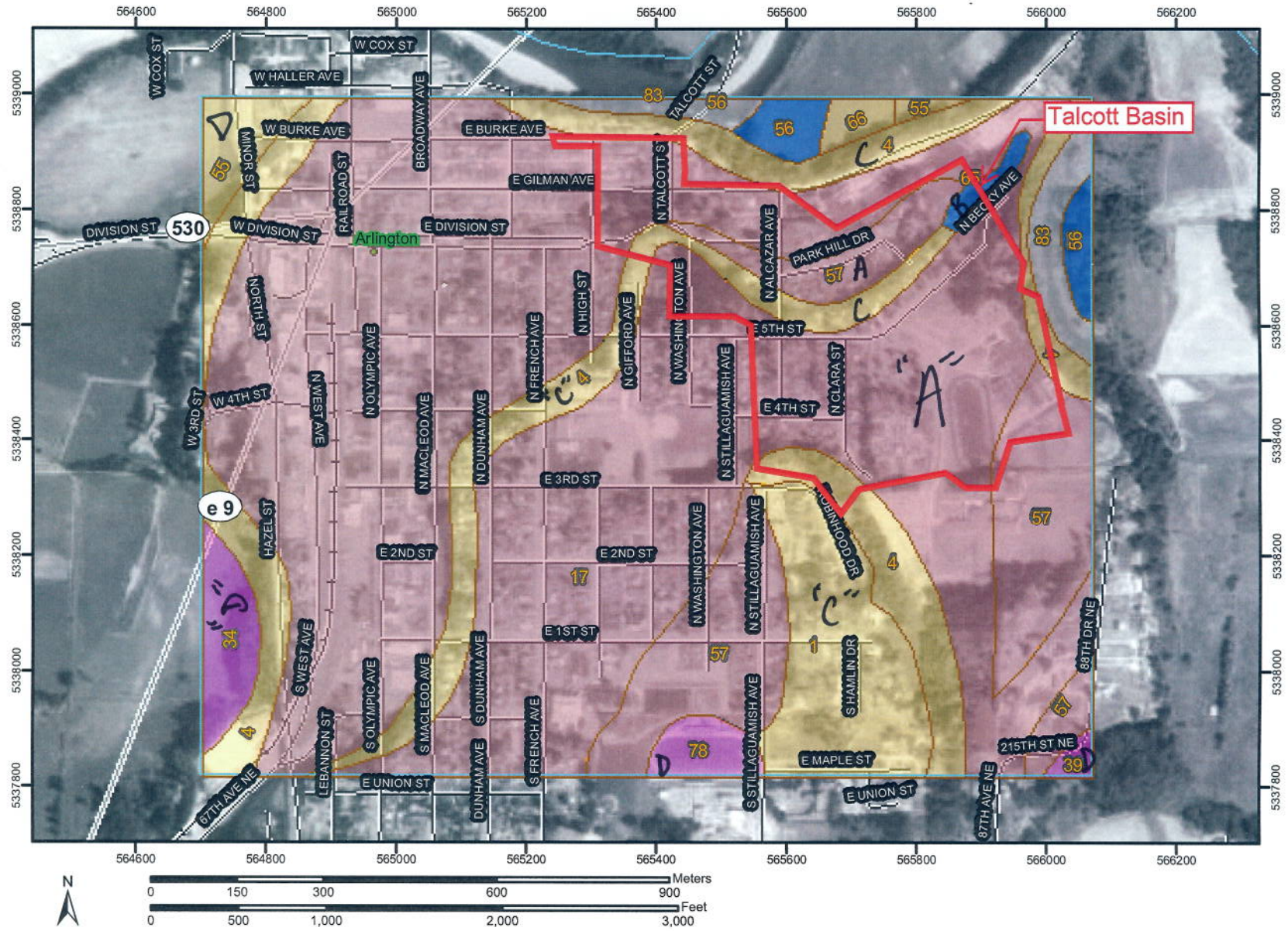
2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Hydrologic Soil Group–Snohomish County Area, Washington
(Talcott)



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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 4, Dec 12, 2006

Date(s) aerial images were photographed: 7/10/1990; 7/18/1990; 8/4/1990

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Snohomish County Area, Washington				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alderwood gravelly sandy loam, 2 to 8 percent slopes	C	24.9	5.5%
4	Alderwood-Everett gravelly sandy loams, 25 to 70 percent slopes	C	62.2	13.8%
17	Everett gravelly sandy loam, 0 to 8 percent slopes	A	275.2	61.2%
34	Mukilteo muck	D	7.1	1.6%
39	Norma loam	D	1.1	0.3%
55	Puget silty clay loam	C	6.4	1.4%
56	Puyallup fine sandy loam	B	5.9	1.3%
57	Ragnar fine sandy loam, 0 to 8 percent slopes	A	49.4	11.0%
65	Sulsavar gravelly loam, 0 to 8 percent slopes	B	2.0	0.4%
66	Sultan silt loam	C	2.2	0.5%
78	Urban land	D	4.3	0.9%
83	Water		8.8	2.0%
Totals for Area of Interest (AOI)			449.3	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

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ATTACHMENT 2
Isopluvials of 24-Hour Precipitation

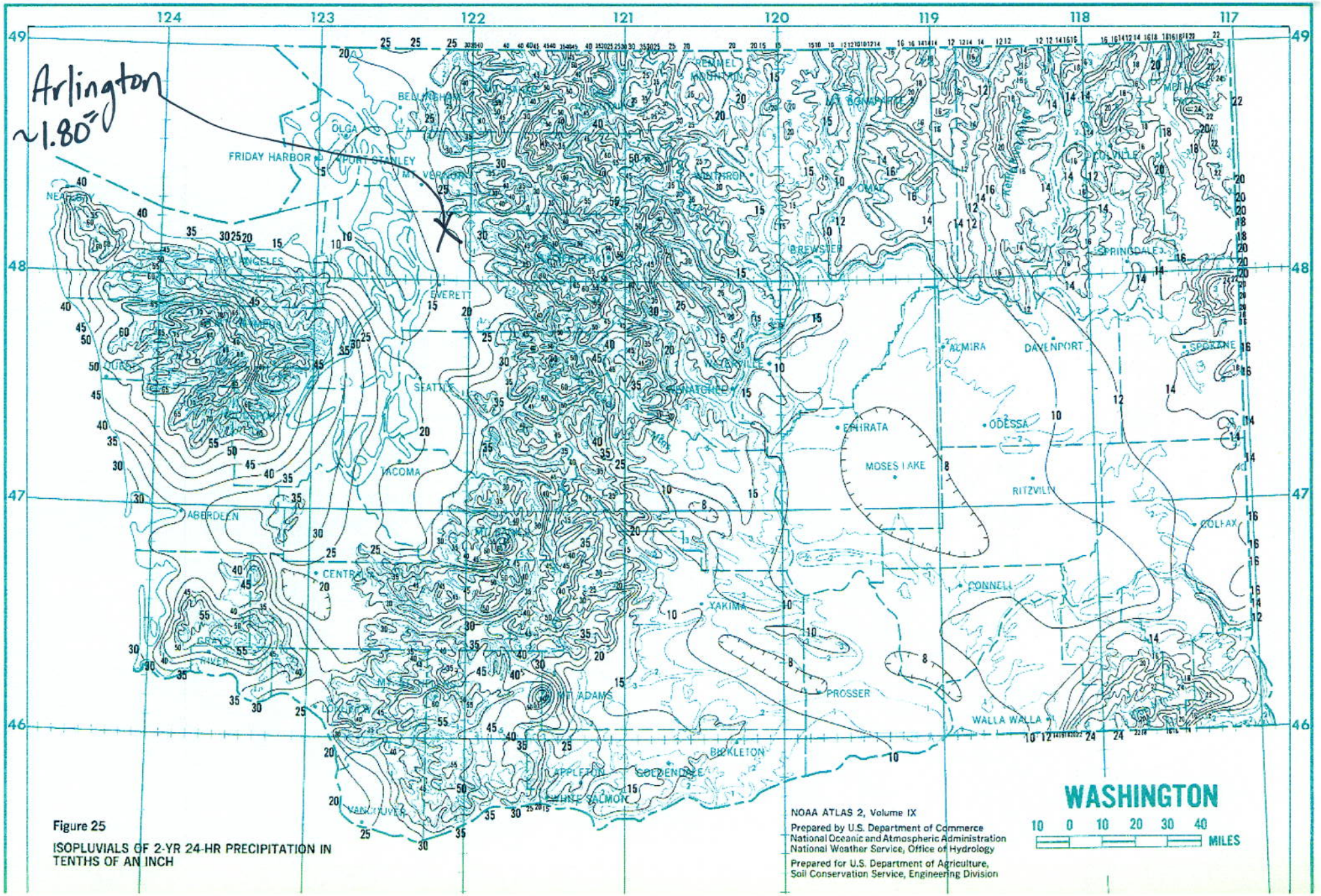

Figure 25

ISOPLUVIALS OF 2-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume IX

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

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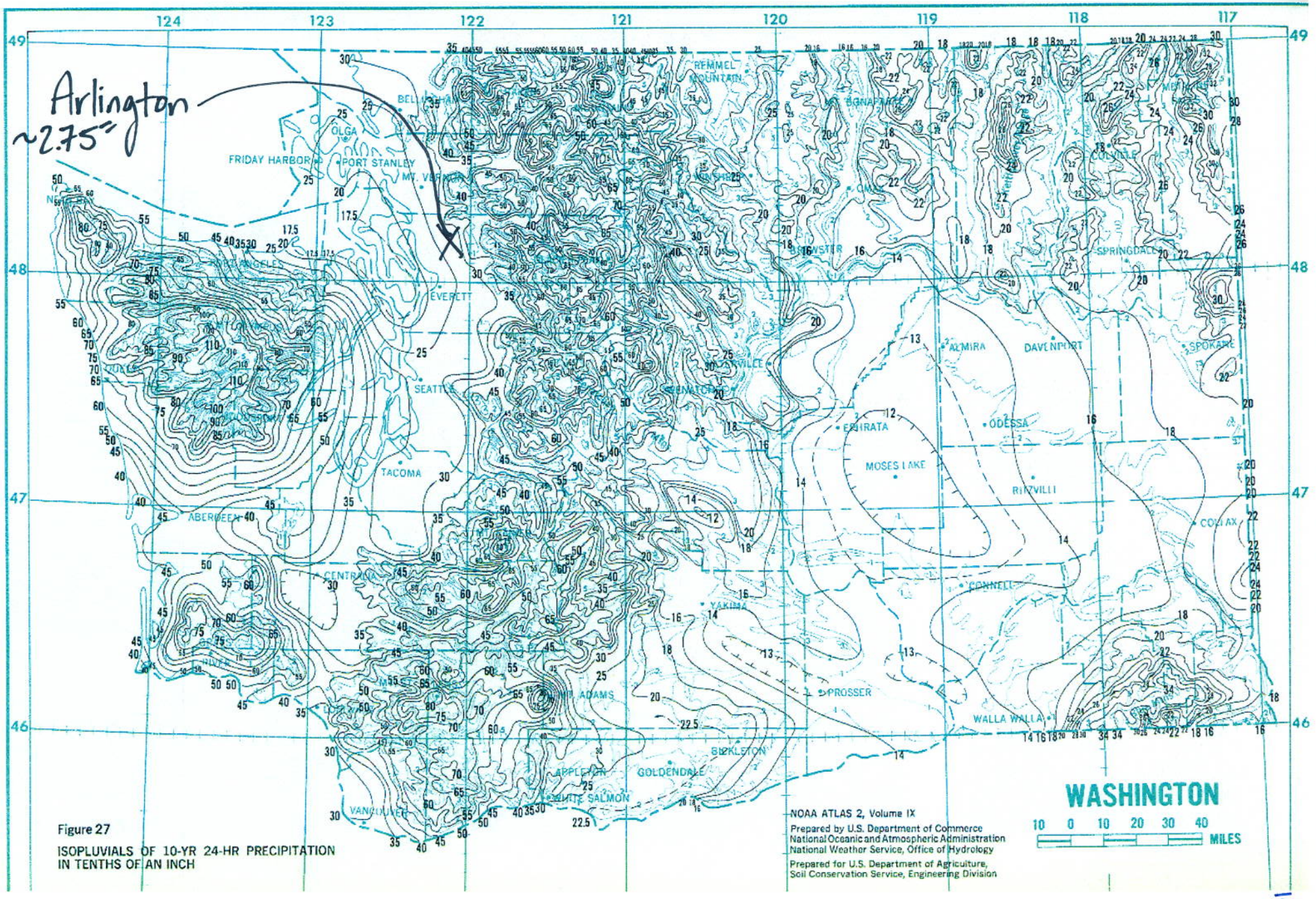

Figure 27

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume IX

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

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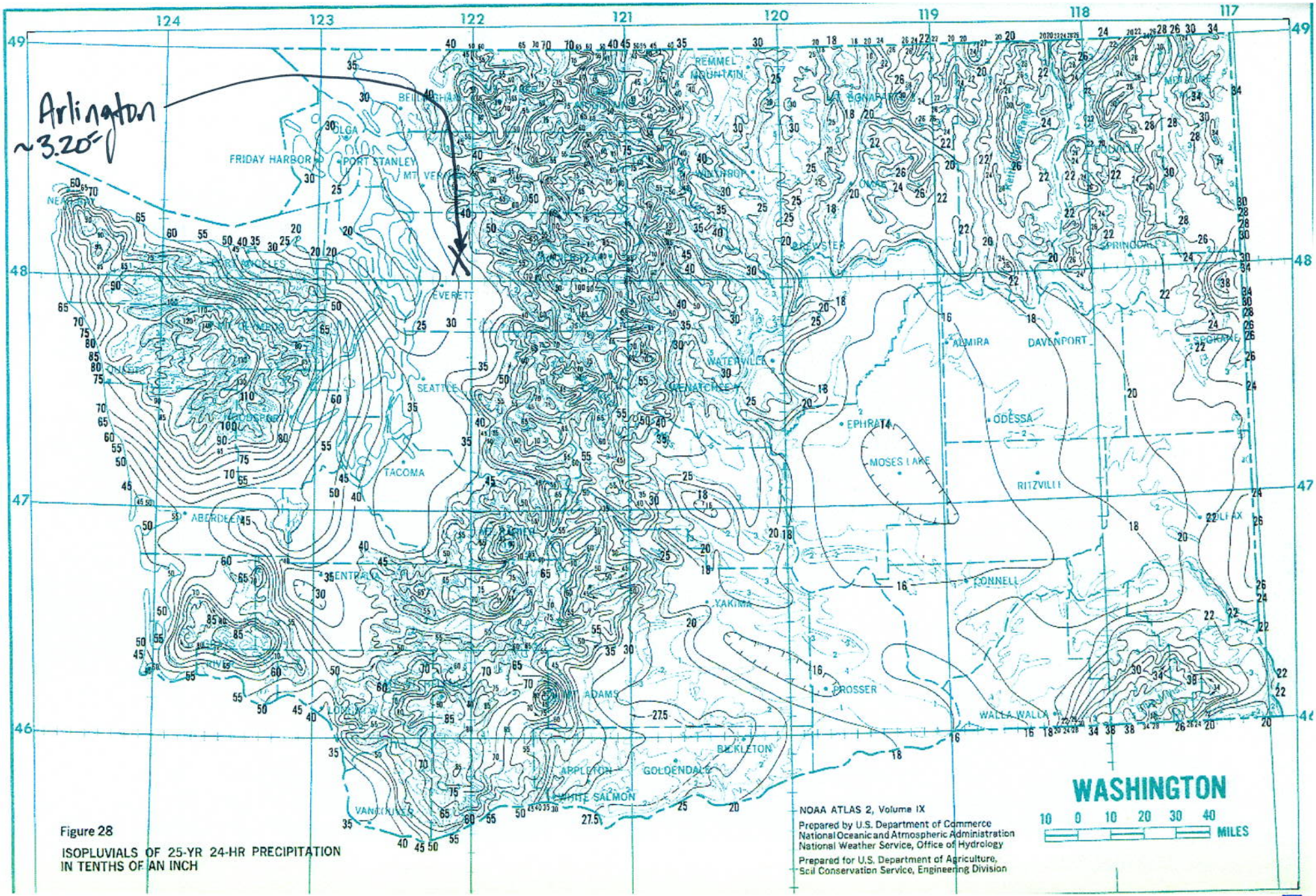

Figure 28

ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION
IN TENTHS OF AN INCH

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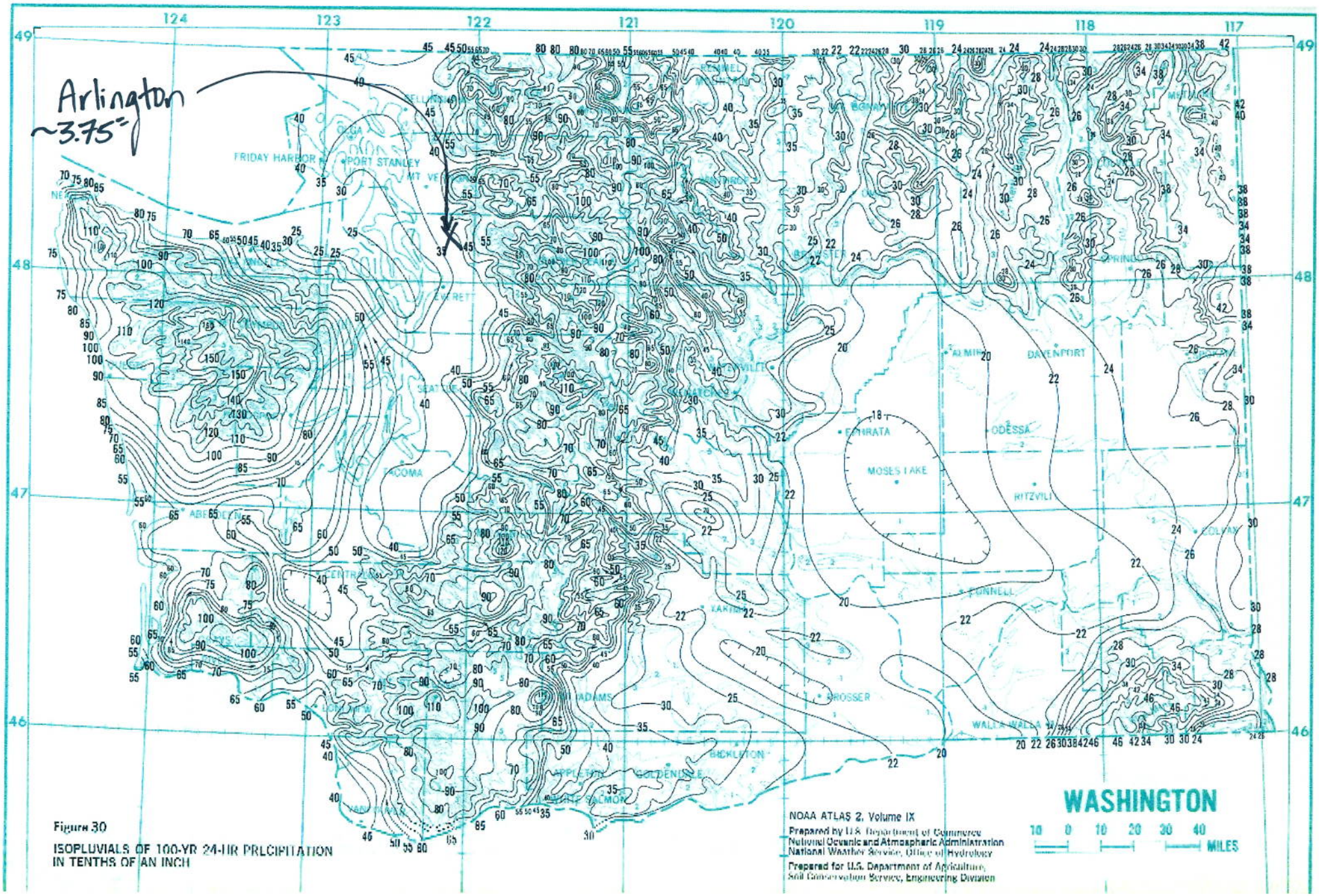
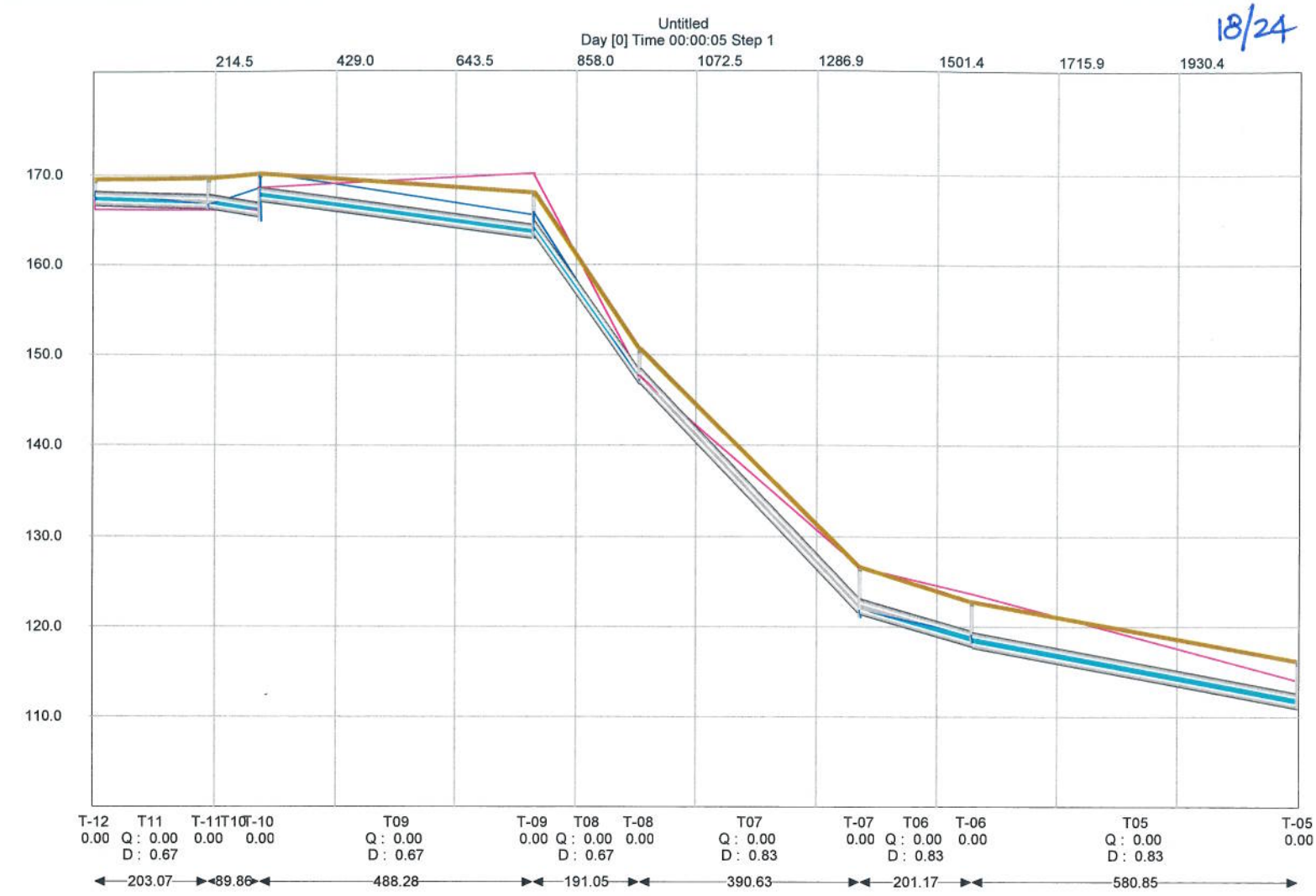


Figure 30

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

ATTACHMENT 3
Summary of XP-SWMM Input & Output


Untitled
Day [0] Time 00:00:05 Step 1
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429.0
643.5
858.0
1072.5
1286.9
1501.4
1715.9
1930.4
170.0
160.0
150.0
140.0
130.0
120.0
110.0
T-12 0.00
T11 Q : 0.00 D : 0.67
T-11 0.00
T10
T-10 0.00
T09 Q : 0.00 D : 0.67
T-09 0.00
T08 Q : 0.00 D : 0.67
T-08 0.00
T07 Q : 0.00 D : 0.83
T-07 0.00
T06 Q : 0.00 D : 0.83
T-06 0.00
T05 Q : 0.00 D : 0.83
T-05 0.00
203.07
89.86
488.28
191.05
390.63
201.17
580.85

```
##################################################
#  Table R1.  S U B C A T C H M E N T  D A T A   #
#              Physical Hydrology Data           #
##################################################
```

Subcatchment Number	Name	Channel or inlet	Width (ft)	Area (ac)	Per-cent Imperv	Slope ft/ft	"n" Imprv	"n" Perv	Deprs -sion Storge Imprv	Deprs -sion Strge Perv	Prcnt Zero Deten -tion
1	T-12#1	T-12	1370.0	37.080	38.00	0.011	0.012	0.450	0.029	0.100	0.00
2	T-09#1	T-09	1300.0	22.350	38.00	0.053	0.012	0.450	0.013	0.100	0.00
3	T-06#1	T-06	1280.0	13.500	38.00	0.063	0.012	0.450	0.012	0.100	0.00
4	Broadway#1	Broadway	960.00	8.8300	38.00	0.011	0.012	0.450	0.029	0.100	0.00

```
*================================================*
|          Table E1 - Conduit Data               |
*================================================*
```

Inp Num	Conduit Name	Length (ft)	Conduit Class	Area (ft^2)	Manning Coef.	Max Width (ft)	Depth (ft)	Trapezoid Side Slopes
1	T11	203.0700	Circular	0.3526	0.0140	0.6700	0.6700	
2	T10	89.8600	Circular	0.3526	0.0140	0.6700	0.6700	
3	T09	488.2800	Circular	0.3526	0.0140	0.6700	0.6700	
4	T08	191.0500	Circular	0.3526	0.0140	0.6700	0.6700	
5	T07	390.6300	Circular	0.5411	0.0140	0.8300	0.8300	
6	T06	201.1700	Circular	0.5411	0.0140	0.8300	0.8300	
7	T05	580.8500	Circular	0.5411	0.0140	0.8300	0.8300	
8	T04	47.8800	Circular	0.5411	0.0140	0.8300	0.8300	
9	T03	260.6600	Circular	0.5411	0.0140	0.8300	0.8300	
10	T02	57.0700	Circular	1.7671	0.0140	1.5000	1.5000	
11	T01	67.6400	Circular	1.7671	0.0140	1.5000	1.5000	

Total length of all conduits .... 2578.1600 feet

```
*================================================*
|          Table E3a - Junction Data             |
*================================================*
```

Inp Num	Junction Name	Ground Elevation	Crown Elevation	Invert Elevation	Qinst cfs	Initial Depth-ft	Interface Flow (%)
1	T-01	106.9320	95.2100	93.7100	0.0000	0.0000	100.0000
2	T-02	104.9600	100.3300	93.1200	0.0000	0.0000	100.0000
3	T-03	108.9400	103.0900	97.1200	0.0000	0.0000	100.0000
4	T-04	115.2600	111.1700	110.0000	0.0000	0.0000	100.0000
5	T-05	116.1200	112.1400	111.0000	0.0000	0.0000	100.0000
6	T-06	122.7000	119.1000	118.0000	0.0000	0.0000	100.0000
7	T-07	126.6150	122.6400	121.0000	0.0000	0.0000	100.0000
8	T-08	150.7480	148.0800	147.2500	0.0000	0.0000	100.0000
9	T-09	168.0400	164.3500	163.0000	0.0000	0.0000	100.0000
10	T-10	170.2100	168.2600	165.0000	0.0000	0.0000	100.0000
11	T-11	169.7600	167.4000	166.1600	0.0000	0.0000	100.0000
12	T-12	169.6000	167.7700	167.0000	0.0000	0.0000	100.0000

```
*================================================*
|          Table E4 - Conduit Connectivity       |
*================================================*
```

Input Number	Conduit Name	Upstream Node	Downstream Node	Upstream Elevation	Downstream Elevation	
1	T11	T-12	T-11	167.1000	166.7300	No Design
2	T10	T-11	T-10	166.7300	165.8700	No Design
3	T09	T-10	T-09	167.5900	163.4200	No Design
4	T08	T-09	T-08	163.6800	147.2900	No Design
5	T07	T-08	T-07	147.2500	121.8100	No Design
6	T06	T-07	T-06	121.7300	118.2700	No Design
7	T05	T-06	T-05	118.0500	111.3100	No Design
8	T04	T-05	T-04	111.1200	110.3400	No Design
9	T03	T-04	T-03	110.3300	102.2600	No Design
10	T02	T-03	T-02	100.8300	98.8300	No Design
11	T01	T-02	T-01	96.8300	93.7100	No Design

Selected XP-SWMM Inputs and Results


```
##########################################################
# Table E16. New Conduit Information Section             #
#            Conduit Invert (IE) Elevation and Conduit   #
#            Maximum Water Surface (WS) Elevations       #
##########################################################
```

Conduit Name	Upstream Node	Downstream Node	IE Up	IE Dn	WS Up	WS Dn	Conduit Type
T11	T-12	T-11	167.1000	166.7300	169.6000	169.1983	Circular
T10	T-11	T-10	166.7300	165.8700	169.1983	169.0207	Circular
T09	T-10	T-09	167.5900	163.4200	169.0207	168.0400	Circular
T08	T-09	T-08	163.6800	147.2900	168.0400	147.9600	Circular
T07	T-08	T-07	147.2500	121.8100	147.8002	126.6150	Circular
T06	T-07	T-06	121.7300	118.2700	126.6150	122.7000	Circular
T05	T-06	T-05	118.0500	111.3100	122.7000	112.0445	Circular
T04	T-05	T-04	111.1200	110.3400	111.8913	111.0745	Circular
T03	T-04	T-03	110.3300	102.2600	110.8894	102.8193	Circular
T02	T-03	T-02	100.8300	98.8300	101.2285	99.2274	Circular
T01	T-02	T-01	96.8300	93.7100	97.2018	94.0810	Circular

```
*==================================*
|   Conduit Convergence Criteria   |
*==================================*
```

Conduit Name	Full Flow	Conduit Slope
T11	0.4854	0.0018
T10	1.1124	0.0096
T09	1.0508	0.0085
T08	3.3306	0.0858
T07	5.1368	0.0651
T06	2.6398	0.0172
T05	2.1683	0.0116
T04	2.5691	0.0163
T03	3.5417	0.0310
T02	18.2598	0.0350
T01	20.9488	0.0461

2-Year Storm – Selected XP-SWMM Result

Table E15 - SPREADSHEET INFO LIST
Conduit Flow and Junction Depth Information for use in spreadsheets. The maximum values in this table are the true maximum values because they sample every time step. The values in the review results may only be the maximum of a subset of all the time steps in the run. Note: These flows are only the flows in a single barrel.

Conduit Name	Maximum Flow (cfs)	Total Flow (ft^3)	Maximum Velocity (ft/s)	Maximum Volume (ft^3)	##	Junction Name	Invert Elevation (ft)	Maximum Elevation (ft)
T11	0.8410	61917.4755	2.3461	73.4668	##	T-01	93.7100	94.0810
T10	0.8411	61849.3414	2.7085	32.4283	##	T-02	93.1200	97.2017
T09	0.9139	61402.4388	3.2369	178.4738	##	T-03	97.1200	101.2285
T08	3.7769	115768.9915	10.7855	2.8016	##	T-04	110.0000	110.8894
T07	3.7769	115717.0098	9.4831	39.9735	##	T-05	111.0000	111.8913
T06	2.8916	113965.0381	5.1856	111.8507	##	T-06	118.0000	122.7000
T05	2.8176	141132.1596	5.1058	33.6384	##	T-07	121.0000	126.6150
T04	2.8177	141115.5717	5.4144	23.2224	##	T-08	147.2500	147.8002
T03	2.8176	141063.5189	7.2656	7.0052	##	T-09	163.0000	168.0400
T02	2.8177	140999.5618	7.4816	4.2646	##	T-10	165.0000	169.0207
T01	2.8179	140940.3725	8.2545	2.7424	##	T-11	166.1600	169.1983
FREE # 1	2.8191	140940.3743	0.0000	0.0000	##	T-12	167.0000	169.6000

Table E15a - SPREADSHEET REACH LIST
Peak flow and Total Flow listed by Reach or those conduits or diversions having the same upstream and downstream nodes.

Upstream Node	Downstream Node	Maximum Flow (cfs)	Total Flow (ft^3)
T-12	T-11	0.8410	61917.4755
T-11	T-10	0.8411	61849.3414
T-10	T-09	0.9139	61402.4388
T-09	T-08	3.7769	115768.991
T-08	T-07	3.7769	115717.010
T-07	T-06	2.8916	113965.038
T-06	T-05	2.8176	141132.160
T-05	T-04	2.8177	141115.572
T-04	T-03	2.8176	141063.519
T-03	T-02	2.8177	140999.562
T-02	T-01	2.8179	140940.373

Table E20 - Junction Flooding and Volume Listing.
The maximum volume is the total volume in the node including the volume in the flooded storage area. This is the max volume at any time. The volume in the flooded storage area is the total volume above the ground elevation, where the flooded pond storage area starts.
The fourth column is instantaneous, the fifth is the sum of the flooded volume over the entire simulation
Units are either ft^3 or m^3 depending on the units.

Junction Name	Surcharged Time (min)	Flooded Time(min)	Out of 1D-System (Flooded Volume)	Maximum Volume	Passed to 2D cell OR Volume Stored in allowed Flood Pond of 1D-System
T-01	0.0000	0.0000	0.0000	4.6626	0.0000
T-02	0.0000	0.0000	0.0000	51.2913	0.0000
T-03	0.0000	0.0000	0.0000	51.6280	0.0000
T-04	0.0000	0.0000	0.0000	11.1757	0.0000
T-05	0.0000	0.0000	0.0000	11.2000	0.0000
T-06	198.2500	88.2778	5845.9371	59.0602	0.0000
T-07	121.4167	39.7898	1708.8520	70.5581	0.0000
T-08	0.0000	0.0000	0.0000	6.9139	0.0000
T-09	32.0500	19.0250	356.9857	63.3326	0.0000
T-10	26.0167	0.0000	0.0000	50.5241	0.0000
T-11	1352.0833	0.0000	0.0000	38.1791	0.0000
T-12	1351.1667	686.7500	27441.3927	32.6716	0.0000

10-Year Storm – Selected XP-SWMM Results

Table E15 - SPREADSHEET INFO LIST
Conduit Flow and Junction Depth Information for use in spreadsheets. The maximum values in this table are the true maximum values because they sample every time step. The values in the review results may only be the maximum of a subset of all the time steps in the run.
Note: These flows are only the flows in a single barrel.

Conduit Name	Maximum Flow (cfs)	Total Flow (ft^3)	Maximum Velocity (ft/s)	Maximum Volume (ft^3)	##	Junction Name	Invert Elevation (ft)	Maximum Elevation (ft)
T11	0.8432	68534.6730	2.3524	74.8575	##	T-01	93.7100	94.0811
T10	0.8414	68463.8006	2.7437	32.4295	##	T-02	93.1200	97.2018
T09	0.8840	68007.5534	3.2369	178.6499	##	T-03	97.1200	101.2286
T08	3.7769	148323.7597	10.7784	2.8016	##	T-04	110.0000	110.8894
T07	3.7769	148259.4651	9.4827	39.9735	##	T-05	111.0000	111.8913
T06	2.8916	145441.3874	5.1902	111.8507	##	T-06	118.0000	122.7000
T05	2.8176	181168.2263	5.1058	33.6384	##	T-07	121.0000	126.6150
T04	2.8177	181146.3614	5.4134	23.2226	##	T-08	147.2500	147.8002
T03	2.8177	181077.2750	7.2656	7.0053	##	T-09	163.0000	168.0400
T02	2.8178	181007.7417	7.4815	4.2648	##	T-10	165.0000	169.0248
T01	2.8180	180946.0545	8.2542	2.7425	##	T-11	166.1600	169.2020
FREE # 1	2.8192	180945.7146	0.0000	0.0000	##	T-12	167.0000	169.6000

Table E15a - SPREADSHEET REACH LIST
Peak flow and Total Flow listed by Reach or those conduits or diversions having the same upstream and downstream nodes.

Upstream Node	Downstream Node	Maximum Flow (cfs)	Total Flow (ft^3)
T-12	T-11	0.8432	68534.6730
T-11	T-10	0.8414	68463.8006
T-10	T-09	0.8840	68007.5534
T-09	T-08	3.7769	148323.760
T-08	T-07	3.7769	148259.465
T-07	T-06	2.8916	145441.387
T-06	T-05	2.8176	181168.226
T-05	T-04	2.8177	181146.361
T-04	T-03	2.8177	181077.275
T-03	T-02	2.8178	181007.742
T-02	T-01	2.8180	180946.055

Table E20 - Junction Flooding and Volume Listing.
The maximum volume is the total volume in the node including the volume in the flooded storage area. This is the max volume at any time. The volume in the flooded storage area is the total volume above the ground elevation, where the flooded pond storage area starts.
The fourth column is instantaneous, the fifth is the sum of the flooded volume over the entire simulation
Units are either ft^3 or m^3 depending on the units.

Junction Name	Surcharged Time (min)	Flooded Time (min)	Out of 1D-System (Flooded Volume)	Maximum Volume	Passed to 2D cell OR Volume Stored in allowed Flood Pond of 1D-System
T-01	0.0000	0.0000	0.0000	4.6627	0.0000
T-02	0.0000	0.0000	0.0000	51.2914	0.0000
T-03	0.0000	0.0000	0.0000	51.6281	0.0000
T-04	0.0000	0.0000	0.0000	11.1758	0.0000
T-05	0.0000	0.0000	0.0000	11.2001	0.0000
T-06	483.3056	243.5833	14885.0569	59.0602	0.0000
T-07	352.1250	75.5250	2743.0189	70.5581	0.0000
T-08	0.0000	0.0000	0.0000	6.9139	0.0000
T-09	51.7000	36.0917	3594.2406	63.3326	0.0000
T-10	44.6583	0.0000	0.0000	50.5751	0.0000
T-11	1373.7500	0.0000	0.0000	38.2260	0.0000
T-12	1373.5000	1273.5833	69075.8511	32.6716	0.0000

25-Year Storm – Selected XP-SWMM Results

Table E15 - SPREADSHEET INFO LIST
Conduit Flow and Junction Depth Information for use in spreadsheets. The maximum values in this table are the true maximum values because they sample every time step. The values in the review results may only be the maximum of a subset of all the time steps in the run. Note: These flows are only the flows in a single barrel.

Conduit Name	Maximum Flow (cfs)	Total Flow (ft^3)	Maximum Velocity (ft/s)	Maximum Volume (ft^3)	##	Junction Name	Invert Elevation (ft)	Maximum Elevation (ft)
T11	0.8445	68998.4775	2.3559	74.8387	##	T-01	93.7100	94.0811
T10	0.8418	68926.1055	2.7939	32.4296	##	T-02	93.1200	97.2018
T09	0.8761	68465.8860	3.2352	178.6597	##	T-03	97.1200	101.2286
T08	3.7769	160694.8604	10.7703	2.8016	##	T-04	110.0000	110.8894
T07	3.7769	160626.4293	9.4827	39.9735	##	T-05	111.0000	111.8913
T06	2.8916	156851.4701	5.1875	111.8507	##	T-06	118.0000	122.7000
T05	2.8176	194598.1460	5.1058	33.6384	##	T-07	121.0000	126.6150
T04	2.8177	194574.1367	5.4130	23.2226	##	T-08	147.2500	147.8002
T03	2.8177	194498.5434	7.2656	7.0053	##	T-09	163.0000	168.0400
T02	2.8178	194427.7067	7.4815	4.2648	##	T-10	165.0000	169.0250
T01	2.8180	194365.0351	8.2542	2.7425	##	T-11	166.1600	169.2024
FREE # 1	2.8192	194364.3897	0.0000	0.0000	##	T-12	167.0000	169.6000

Table E15a - SPREADSHEET REACH LIST
Peak flow and Total Flow listed by Reach or those conduits or diversions having the same upstream and downstream nodes.

Upstream Node	Downstream Node	Maximum Flow (cfs)	Total Flow (ft^3)
T-12	T-11	0.8445	68998.4775
T-11	T-10	0.8418	68926.1055
T-10	T-09	0.8761	68465.8860
T-09	T-08	3.7769	160694.860
T-08	T-07	3.7769	160626.429
T-07	T-06	2.8916	156851.470
T-06	T-05	2.8176	194598.146
T-05	T-04	2.8177	194574.137
T-04	T-03	2.8177	194498.543
T-03	T-02	2.8178	194427.707
T-02	T-01	2.8180	194365.035

Table E20 - Junction Flooding and Volume Listing. The maximum volume is the total volume in the node including the volume in the flooded storage area. This is the max volume at any time. The volume in the flooded storage area is the total volume above the ground elevation, where the flooded pond storage area starts. The fourth column is instantaneous, the fifth is the sum of the flooded volume over the entire simulation Units are either ft^3 or m^3 depending on the units.

Junction Name	Surcharged Time (min)	Flooded Time(min)	Out of 1D-System (Flooded Volume)	Maximum Volume	Passed to 2D cell OR Volume Stored in allowed Flood Pond of 1D-System
T-01	0.0000	0.0000	0.0000	4.6627	0.0000
T-02	0.0000	0.0000	0.0000	51.2914	0.0000
T-03	0.0000	0.0000	0.0000	51.6281	0.0000
T-04	0.0000	0.0000	0.0000	11.1758	0.0000
T-05	0.0000	0.0000	0.0000	11.2001	0.0000
T-06	720.0278	349.3833	21207.0971	59.0602	0.0000
T-07	436.6667	103.6167	3692.4317	70.5581	0.0000
T-08	0.0000	0.0000	0.0000	6.9139	0.0000
T-09	60.3333	42.3333	5509.7822	63.3326	0.0000
T-10	52.0833	0.0000	0.0000	50.5779	0.0000
T-11	1380.9167	0.0000	0.0000	38.2306	0.0000
T-12	1380.6667	1370.4167	91483.9831	32.6716	0.0000

100-Year Storm – Selected XP-SWMM Results

Table E15 - SPREADSHEET INFO LIST
Conduit Flow and Junction Depth Information for use in spreadsheets. The maximum values in this table are the true maximum values because they sample every time step. The values in the review results may only be the maximum of a subset of all the time steps in the run. Note: These flows are only the flows in a single barrel.

Conduit Name	Maximum Flow (cfs)	Total Flow (ft^3)	Maximum Velocity (ft/s)	Maximum Volume (ft^3)	##	Junction Name	Invert Elevation (ft)	Maximum Elevation (ft)
T11	0.8450	69090.5520	2.3575	74.8884	##	T-01	93.7100	94.0811
T10	0.8420	69019.8924	2.8548	32.4286	##	T-02	93.1200	97.2018
T09	0.8541	68560.5317	3.2286	178.4738	##	T-03	97.1200	101.2286
T08	3.7769	175101.6339	10.7682	2.8016	##	T-04	110.0000	110.8894
T07	3.7769	175030.7977	9.4826	39.9735	##	T-05	111.0000	111.8913
T06	2.8916	169852.6058	5.1880	111.8507	##	T-06	118.0000	122.7000
T05	2.8176	208651.5307	5.1058	33.6384	##	T-07	121.0000	126.6150
T04	2.8177	208626.0625	5.4128	23.2226	##	T-08	147.2500	147.8002
T03	2.8177	208544.4504	7.2656	7.0053	##	T-09	163.0000	168.0400
T02	2.8178	208472.6490	7.4815	4.2648	##	T-10	165.0000	169.0217
T01	2.8180	208409.7898	8.2542	2.7425	##	T-11	166.1600	169.1990
FREE # 1	2.8192	208408.8405	0.0000	0.0000	##	T-12	167.0000	169.6000

Table E15a - SPREADSHEET REACH LIST
Peak flow and Total Flow listed by Reach or those conduits or diversions having the same upstream and downstream nodes.

Upstream Node	Downstream Node	Maximum Flow (cfs)	Total Flow (ft^3)
T-12	T-11	0.8450	69090.5520
T-11	T-10	0.8420	69019.8924
T-10	T-09	0.8541	68560.5317
T-09	T-08	3.7769	175101.634
T-08	T-07	3.7769	175030.798
T-07	T-06	2.8916	169852.606
T-06	T-05	2.8176	208651.531
T-05	T-04	2.8177	208626.062
T-04	T-03	2.8177	208544.450
T-03	T-02	2.8178	208472.649
T-02	T-01	2.8180	208409.790

Table E20 - Junction Flooding and Volume Listing. The maximum volume is the total volume in the node including the volume in the flooded storage area. This is the max volume at any time. The volume in the flooded storage area is the total volume above the ground elevation, where the flooded pond storage area starts.
The fourth column is instantaneous, the fifth is the sum of the flooded volume over the entire simulation
Units are either ft^3 or m^3 depending on the units.

Junction Name	Surcharged Time (min)	Flooded Time(min)	Out of 1D-System (Flooded Volume)	Maximum Volume	Passed to 2D cell OR Volume Stored in allowed Flood Pond of 1D-System
T-01	0.0000	0.0000	0.0000	4.6627	0.0000
T-02	0.0000	0.0000	0.0000	51.2914	0.0000
T-03	0.0000	0.0000	0.0000	51.6281	0.0000
T-04	0.0000	0.0000	0.0000	11.1758	0.0000
T-05	0.0000	0.0000	0.0000	11.2001	0.0000
T-06	1048.4167	437.3667	30364.5023	59.0602	0.0000
T-07	684.5417	136.7000	5087.8588	70.5581	0.0000
T-08	0.0000	0.0000	0.0000	6.9139	0.0000
T-09	92.1583	50.3583	8104.9953	63.3326	0.0000
T-10	75.4167	0.0000	0.0000	50.5365	0.0000
T-11	1387.9167	0.0000	0.0000	38.1882	0.0000
T-12	1388.2500	1378.0833	119363.6934	32.6716	0.0000