Western R & D, Ltd.

Final Drainage Report

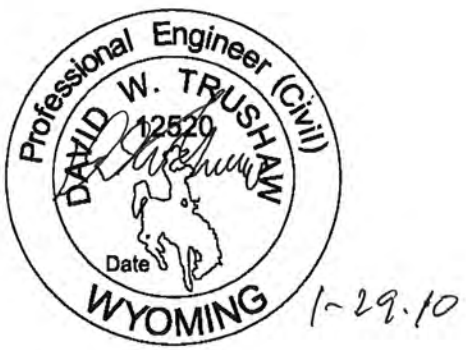
ALLISON CORRIDOR

Walterscheid Boulevard to South Greeley Highway

City of Cheyenne, Laramie County, Wyoming

January 29, 2010

By



DAVID W. TRUSHAW, PE

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January 29, 2010

Ms. Nancy A. Olson
Cheyenne MPO, Transportation Planner II
2101 O'Neil Avenue
Cheyenne, Wyoming 82001

Re: Drainage Report for Allison Corridor

Ms. Olson,

We are pleased to submit this Drainage Report for Allison Corridor.

Western R&D, Ltd. founded in 1983, is dedicated to providing its clients with quality service through technical excellence. Western provides civil engineering and surveying services in Wyoming and Colorado. Western R & D, Ltd. is committed to efficiency and quality of services while reducing costs to our clients.

"The preparation of this report has been financed in part through grant[s] from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation."

The purpose and need drives the development of the range of alternatives. Some of the common needs include transportation demand, safety, legislative direction, urban transportation plan consistency, modal interrelationships, system linkage, and the condition of an existing facility.

Thank you for your time and effort in allowing us to present our Drainage Report.

Sincerely,

David W. Trushaw, P.E.
Project Manager

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Cheyenne, WY 82009
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I. DRAINAGE PLANNING

A. Location

The portion of the Allison Road Corridor that this study covers is from South Greeley Highway to the east and Walterscheid Boulevard to the west. See Figure 1, Vicinity Map and Figure 2, Site Description Map.

Drainage sub-basin AWS is south of Allison Road and west of Walterscheid Boulevard. Drainage sub-basin ASN2 is north of Allison Road and west of Walterscheid Boulevard. These two basins combine at the intersection of Allison Road and Walterscheid Boulevard. Flow from these two basins drains southward on the west side of Walterscheid Boulevard. There is an existing 24-inch RCP that drains the flow on the south side of Allison Road around a power pole to Walterscheid Boulevard. Flow on the north side of Allison Road drains through an existing 24-inch by 38-inch elliptical RCP and combines with the flow on the south side of Allison Road.

Sub-basin AWN1 drains under Walterscheid Boulevard approximately 800 feet north of Allison Road through an existing RCP. This flow combines with flow from sub-basin AE2. The combined flow from these two basins drains eastward in Allison Road. It crosses Allison Road near Station 450+00 at a flat spot in the roadway.

Sub-basin AE1 drains to Allison Road at the street low point near Station 457+00. This flow south and west to the Allison Draw through an existing channel constructed with the Gateway South project.

Sub-basin AE3 drains eastward in Allison Road to the intersection with South Greeley Highway. For roadway and basin locations and flows, see Figure 7, Existing Sub-Basin Map (attached large format sheet).

B. Natural Watercourses

The low point in Allison Road, described above, drains a subarea of the Allison Creek. The Drainage Master Plan for Allison Creek was prepared by CH2MHill dated November 1988. This Master Plan was reviewed as reference for this subject study (Reference #1).

C. Calculations

The existing condition peak flows from the sub-basins described above are shown in Table 1. EPA SWMM Version 5.0 was used to determine the peak flow rates for the sub-basins.

Table 1
Existing Condition Peak Flow Rates

Sub-basin/Node	2 Hour Storm (cfs)		
	5 Year	50 Year	100 Year
AWS	1	9	15
AWN2	12	31	44
J3	12	38	58
AWN1	16	36	47
AE2	12	26	33
J6	26	57	69
AE1	17	36	48
AE3	1	13	15

D. Compliance Review

The site and area sub-basins lie within Sub-basin 30 from Reference #1. See Referenced Figure 1-1, *Sub-basin Map*, Page 1-13, included in Appendix 1. The Cheyenne Master Plan Organizations's Future Land Use Plan was reviewed. The two types of zoning adjacent to Allison Road are Urban Residential and Mixed Use Commercial Emphasis.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community-Panel Number 56021C 1356F, effective January 17, 2007 the site is located within a Zone 'X'. A Zone 'X' is described by FEMA as areas outside of the 0.2% annual chance floodplain. See Figure 3, *Flood Insurance Rate Map*.

The United States Department of Agriculture Natural Resources Conservation Service has provided a Web Soil Survey. The existing and developed sub-basins have been shown on the Soils Map. A Soils Report is included in Appendix B. This Report describes the soils in the site area. The soils types have been used to determine the SCS Curve Numbers for each sub-basin.

E. Groundwater Table

The State Engineer's Office has a list of wells in this area. A list of the pertinent wells and their information is included in Appendix G. The list shows that a majority of the wells in this area have a static depth of over 200-feet. A 48-inch RCP has been recently constructed under Allison Road approximately 1400-feet east of Walterscheid Boulevard. The invert of this culvert is approximately 10-feet deep and does not have seepage from the ground. Therefore, we know that the groundwater depth is greater than 10-feet deep. The groundwater table should have no affect on roadway construction for Allison Road.

F. Special Conditions

In speaking with residents, it has come to our attention that there are known flooding problems south of Allison Road, east of Waltersheid Boulevard, north of West Prosser Road, and west of South Greeley Highway. This is caused by uncontrolled drainage and little or no flood control facilities within this area. Special care must be taken to ensure that this problem is not increased.

II. PRELIMINARY DRAINAGE PLAN

A. Property Description

The Allison Corridor includes the street right-of-way of Allison Road Between South Greeley Highway and Walterscheid Boulevard. It will include roadway improvements. This portion of Allison Road is located within Section 8, Township 13 North, Ranch 66 West, 6th Principal Meridain, Cheyenne, Laramie County, Wyoming.

B. Street Identification

The portion of the west Allison Road corridor, analyzed in this study, is located between South Greeley Highway and Walterscheid Boulevard. The roadway will run in an east/west direction. The street slope will vary between 0.5% and 5%.

C. Flow Paths

There is an existing low point in Allison Road near Station 357+50 and a high point near Station 461+50.

D. Historic Flow Rates

The entire drainage basin reaches the Allison Draw upstream of the crossing at South Greeley Highway. With the construction of the approved Gateway South project north of Allison Road, a large portion of sub-basin AE1 will be directed to a proposed crossing in Allison Street near Station 453+00 where it will combine with flow from sub-basins AWN1 and AE2. This combined flow will be directed into an existing channel that runs to the Allison Draw to the southeast. Having these flow directed into a flood control facility will reduce the flooding potential in the general area.

With construction of the Allison Road improvements the proposed drainage pattern will remain consistent with the existing condition. See Figure 8, Developed Sub-Basin Map (attached large format sheet). There are two options being considered for proposed storm drain facilities in Allison Road.

Option 1 will consist of roadway improvements with curb openings to allow flow to enter and exit the road in a manner consistent with the existing condition. This option does not improve the drainage problems in this area and is considered the last option. See Figure 4.

Option 2 will consist of roadway improvements with drop inlets at the two low points in Allison Road. The flow picked up by the west drop inlets will be directed into a storm drain system that connects to the drainage facility currently under construction with the Gateway South project. This Gateway South facility was sized to accommodate the flows that would be picked up in the Allison Road drainage facilities designed with this option. The flow in the pipe will be increase by only 3 cfs during the 100-year storm event by tying into the existing storm drain system. The flow picked up by the east drop inlets will need to be directed southward in an existing utility easement. Please note that this existing utility easement is owned by the South Cheyenne Water and Sewer District. Permission to construct this facility within their easement is required. Concerns regarding utility maintenance and infiltration into the sewer will need to be addressed for the District prior to their acceptance. See Figure 5.

It should be noted that grading is currently being done on sub-basin AWN1. No drainage report is available for review for this grading. It appears that this area is being developed as a power substation. In the two options, mentioned above, sub-basin AWN1 was assumed to be gravel covered with no detention. It was also assumed that a portion of this flow will now be diverted south in Walterscheid Boulevard to the intersection with Allison Road. This will put an added burden to this intersection. The elliptical RCP that was constructed with the South High improvements to carry flow from north at this intersection was not sized to carry this additional flow.

It should also be noted that the outflow from the Gateway South Detention Pond was included in Options 2 as an inflow into the storm drain system. No outflow table was available for the detention pond.

Detention ponds should be required with future development at the areas west of Harmony Meadows and northwest of the intersection of Allison Road and Walterscheid. Also, the WAPA power sub-station should be required to retain flows in the pre-developed 5-year condition. These proposed detention areas are shown on Figure 6, *Recommended Detention Areas*.

E. Design Storm Identification

The 2-hour, 5-, 50-, and 100-year storm events were analyzed for this project. The time to the peak is approximately 45 minutes and the 2 hour storm is appropriate.

F. Peak Flow Rates

The peak flow rates for the three storm events analyzed in this study are shown below.

Table 2
Option 1 Peak Flow Rates

Sub-basin/Node	2 Hour Storm (cfs)		
	5 Year	50 Year	100 Year
AWS	1	9	15
AWN2	34	64	78
AWN1	26	108	147
J3*	44	51	57
AE2	12	26	33
AE1	19	37	46
AE3	7	13	15

* Flow not contained in storm drain

Table 3
Option 2 Peak Flow Rates

Sub-basin/Node	2 Hour Storm (cfs)		
	5 Year	50 Year	100 Year
AWS	1	9	15
AWN2	34	64	78
AWN1	26	108	147
J3*	44	51	57
AE2	12	26	33
OUT8	38	86	107
AE1	19	37	46
AE3	7	13	15

* Flow not contained in storm drain

III. CONCLUSIONS

The following recommendations are provided to facilitate safety, both public and private, for the proposed onsite improvements.

1. Option 2 is recommended as the best opportunity to control the drainage in this area in a regional manner. The facility being constructed under Allison Road is sized to carry the entire flow. The drop inlet locations and facility outlets are located to keep the drainage pattern consistent with the existing condition and reduce the drainage impact to the surrounding property owners.

2. Curb and gutter should be constructed with the roadway improvements to direct the flow to the drop inlet locations.

3. Drop inlet structures should be constructed at the two low points with storm drain connecting the west facilities to the Gateway South drainage facility under Allison Road and the west facilities to the Allison Draw to the south within an existing utility and drainage easements.

4. With future development, the area west of Harmony Meadows and northwest of the intersection of Allison Road and Walterscheid should be constructed with detention facilities. Also, the WAPA power sub-station should be required to retain flows in the pre-developed 5-year condition.

IV. REFERENCES

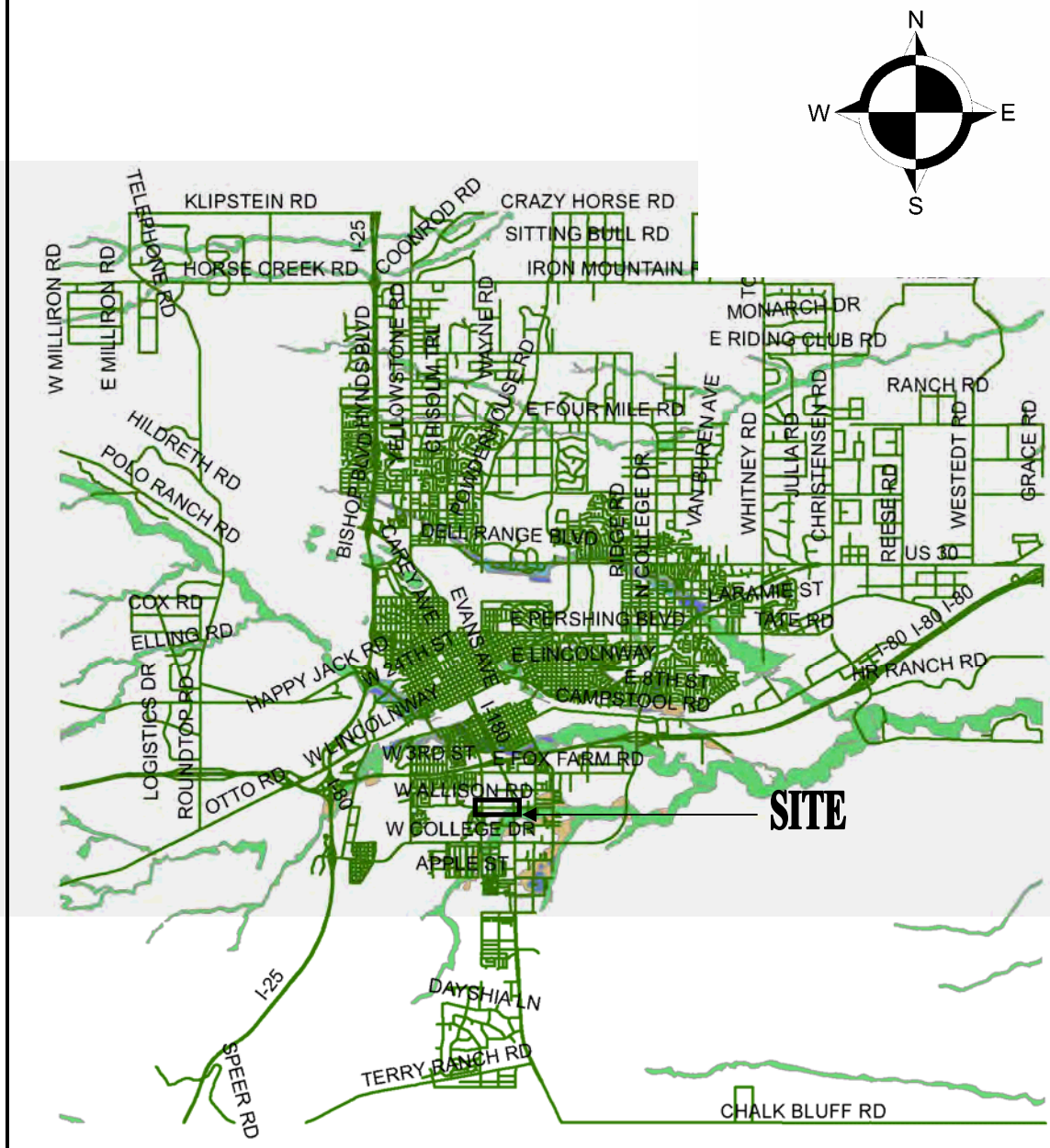
1. *Drainage Mater Plan for Allison Creek*, CH2MHill, November 1988.

2. *Final Drainage Design Gateway South*, Ayres Associates, February 2009.

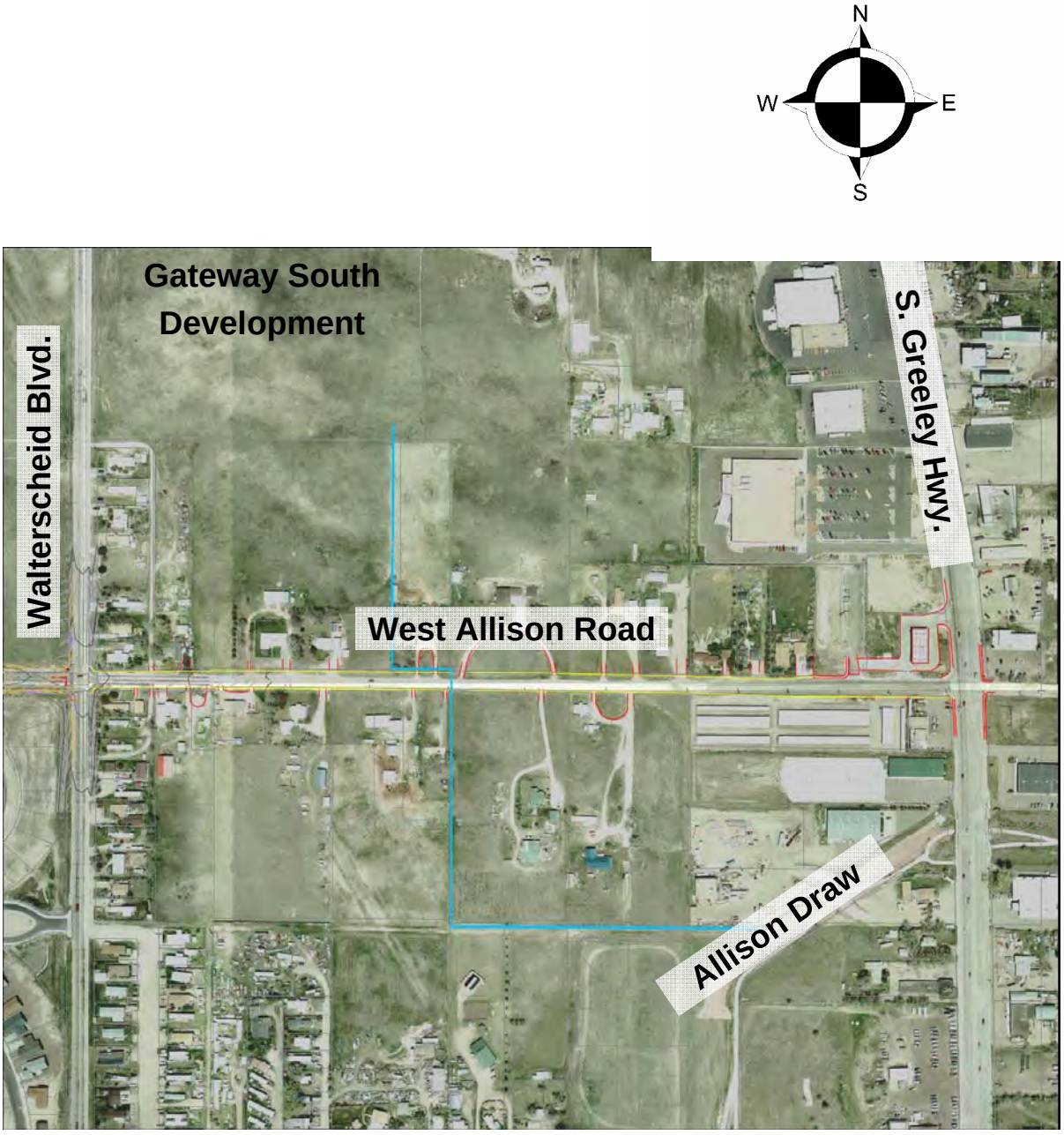
3. *Flood Insurance Rate Map, Community Panel Number* 56021C 1356F, Laramie County, Wyoming, Federal Emergency Management Agency, effective January 17, 2007.

4. *Stormwater Management Manual*, City of Cheyenne, April 1985.

Appendix A



Western Research & Development, Ltd. Civil Engineers Land Surveyors	ALLISON CORRIDOR	Vicinty Map Figure 1

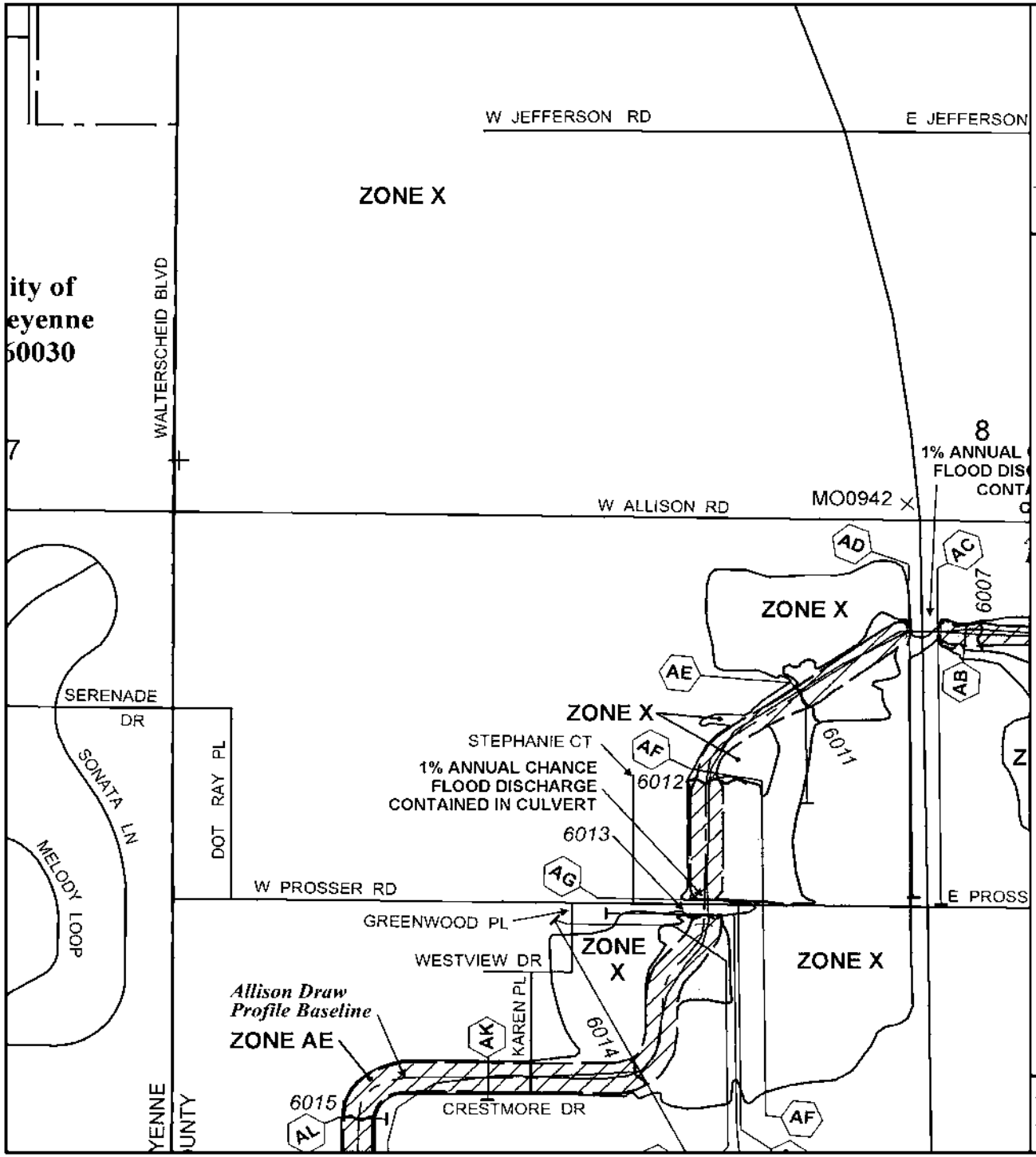


Western Research & Development, Ltd.
Civil Engineers Land Surveyors

ALLISON CORRIDOR

Site Description Map

Figure 2



MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1356F

FIRM

FLOOD INSURANCE RATE MAP

LARAMIE COUNTY, WYOMING AND INCORPORATED AREAS

PANEL 1356 OF 1650

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
CHEYENNE, CITY OF	560030	1356	F
LARAMIE COUNTY	560029	1356	F

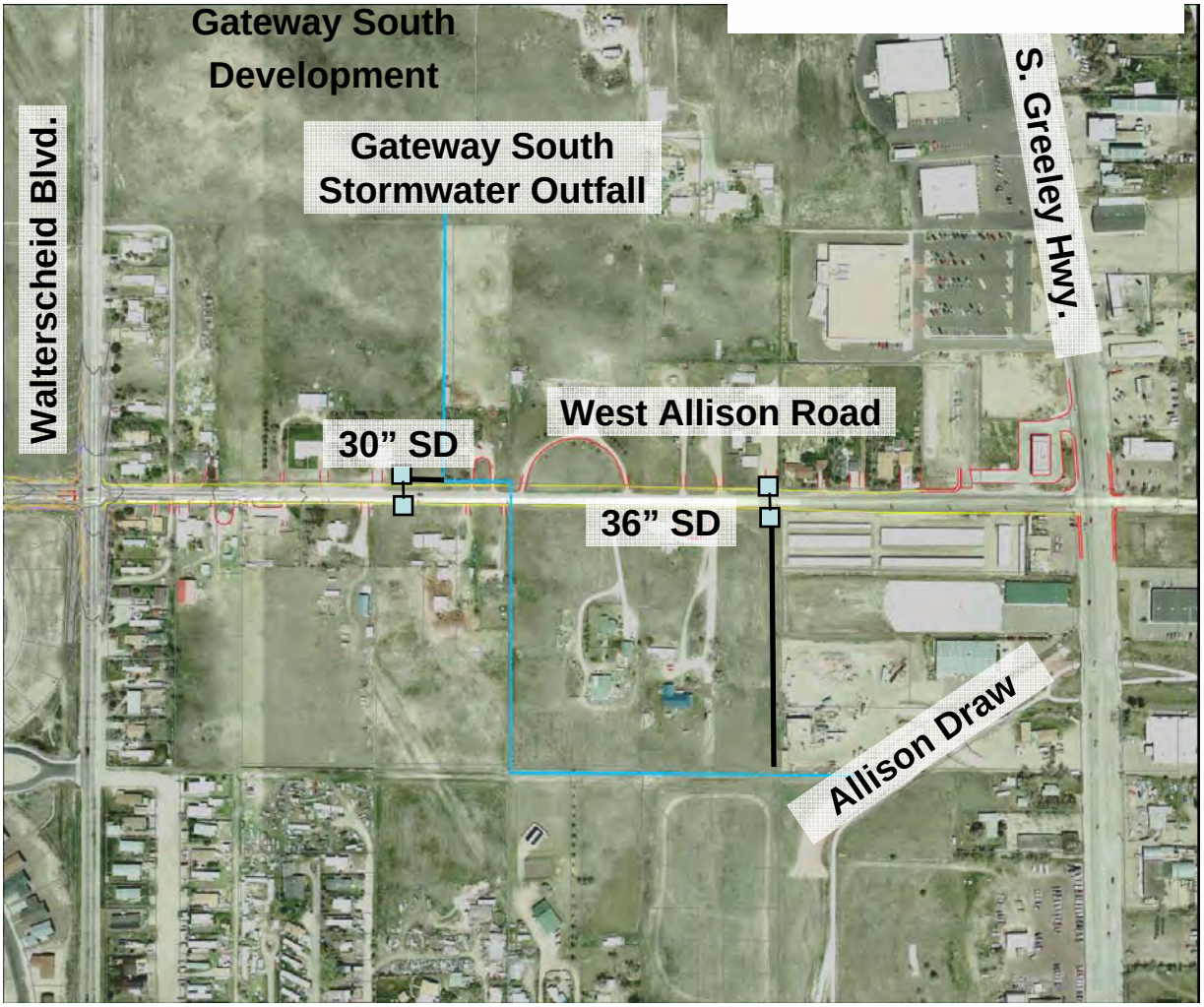
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
56021C1356F

EFFECTIVE DATE
JANUARY 17, 2007

Federal Emergency Management Agency

Western Research & Development, Ltd. Civil Engineers Land Surveyors	ALLISON CORRIDOR	Option 1 Figure 4

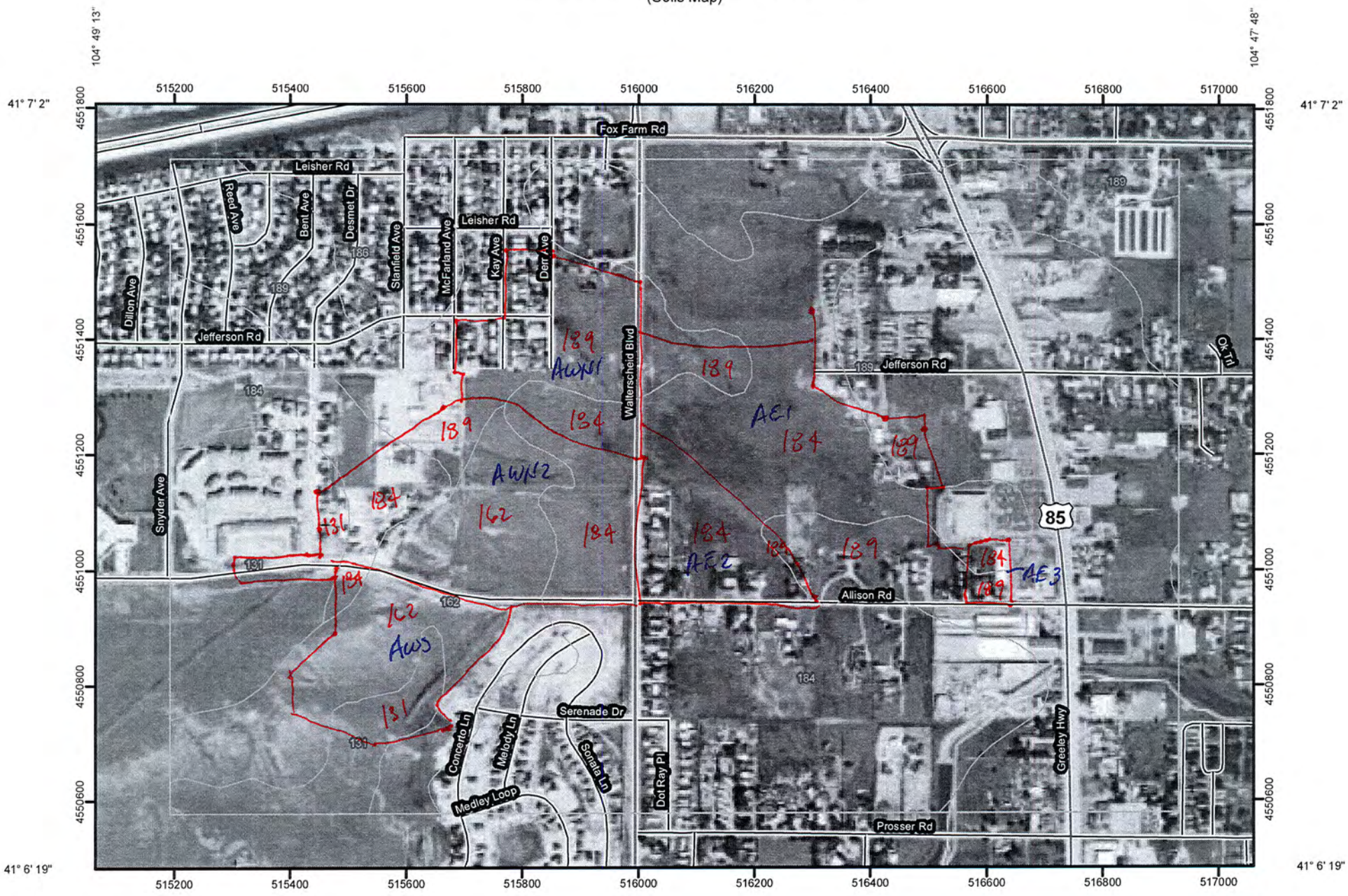


Western Research & Development, Ltd. Civil Engineers Land Surveyors	ALLISON CORRIDOR	Option 2 Figure 5

Western Research & Development, Ltd. Civil Engineers Land Surveyors	ALLISON CORRIDOR	Recommended Detention Areas Figure 6

Appendix B

Soil Map—Laramie County, Wyoming, Western Part
(Soils Map)



Map Scale: 1:9,470 if printed on A size (8.5" x 11") sheet.

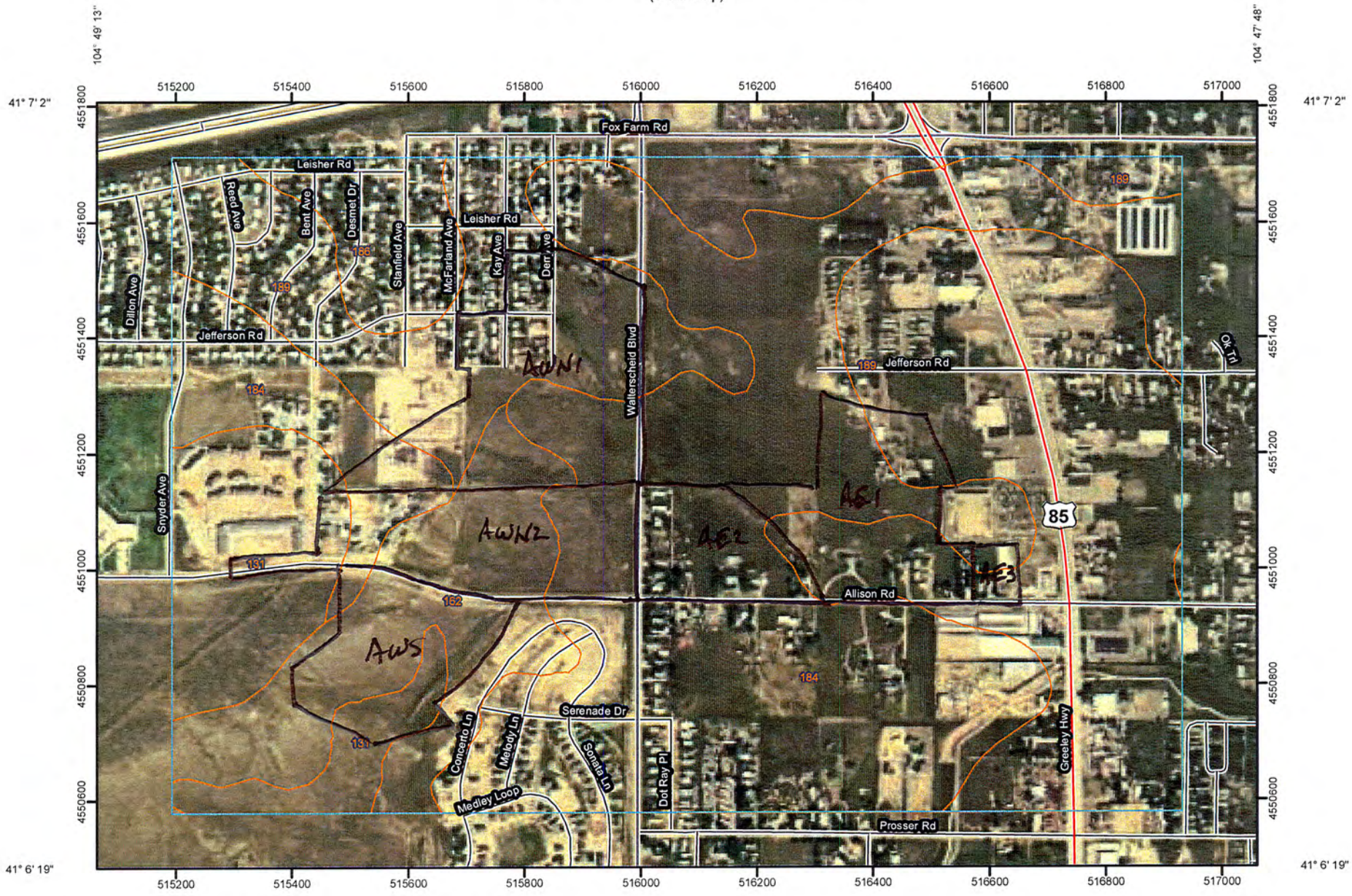
N

Meters: 0 100 200 400 600

Feet: 0 500 1,000 2,000 3,000

EXISTING BASINS SOILS MAP

Soil Map—Laramie County, Wyoming, Western Part
(Soils Map)



DEVELOPED BASINS
SOILS MAP

MAP LEGEND

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

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:9,470 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

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

Soil Survey Area: Laramie County, Wyoming, Western Part
Survey Area Data: Version 5, Feb 22, 2007

Date(s) aerial images were photographed: 9/12/2006

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.

Map Unit Description (Brief, Generated)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

Laramie County, Wyoming, Western Part

Map Unit: 131—Evanston loam, 0 to 6 percent slopes

Component: Evanston (90%)

The Evanston component makes up 90 percent of the map unit. Slopes are 0 to 6 percent. The parent material consists of alluvium derived from igneous, metamorphic and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the R067XY222WY Loamy (15-17sp) ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 9 percent.

Component: Ipson (10%)

Generated brief soil descriptions are created for major components. The Ipson soil is a minor component.

Map Unit: 162—Poposhia-Trimad complex, 3 to 15 percent slopes

Component: Poposhia (50%)

The Poposhia component makes up 50 percent of the map unit. Slopes are 3 to 6 percent. The parent material consists of alluvium derived from sandstone, siltstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R067XY222WY Loamy (15-17sp) ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 6 percent.

Component: Trimad (40%)

The Trimad component makes up 40 percent of the map unit. Slopes are 6 to 15 percent. The parent material consists of gravelly alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R067XY222WY Loamy (15-17sp) ecological site. Nonirrigated land capability classification is 6s. Irrigated land capability classification is 6s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 30 percent.

Component: Piezon (5%)

Generated brief soil descriptions are created for major components. The Piezon soil is a minor component.

Component: Rock outcrop (5%)

Generated brief soil descriptions are created for major components. The Rock outcrop soil is a minor component.

Map Unit: 184—Urban land-Ascalon complex, 0 to 6 percent slopes

Component: Urban land (65%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Component: Ascalon (25%)

The Ascalon component makes up 25 percent of the map unit. Slopes are 0 to 6 percent. The parent material consists of alluvium derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 8 percent.

Component: Altvan (5%)

Generated brief soil descriptions are created for major components. The Altvan soil is a minor component.

Component: Wages (5%)

Generated brief soil descriptions are created for major components. The Wages soil is a minor component.

Map Unit: 186—Urban land-Evanston complex, 0 to 6 percent slopes

Component: Urban land (65%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Component: Evanston (30%)

The Evanston component makes up 30 percent of the map unit. Slopes are 0 to 6 percent. The parent material consists of alluvium derived from igneous, metamorphic and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 9 percent.

Component: Ipson (5%)

Generated brief soil descriptions are created for major components. The Ipson soil is a minor component.

Map Unit: 189—Urban land-Poposhia-Trimad complex, 3 to 15 percent slopes

Component: Urban land (60%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Component: Poposhia (15%)

The Poposhia component makes up 15 percent of the map unit. Slopes are 3 to 10 percent. The parent material consists of alluvium derived from sandstone, siltstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 6 percent.

Component: Trimad (15%)

The Trimad component makes up 15 percent of the map unit. Slopes are 6 to 15 percent. The parent material consists of gravelly alluvium derived from igneous and sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. Irrigated land capability classification is 6s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 30 percent.

Component: Piezon (5%)

Generated brief soil descriptions are created for major components. The Piezon soil is a minor component.

Component: Rock outcrop (5%)

Generated brief soil descriptions are created for major components. The Rock outcrop soil is a minor component.

Data Source Information

Soil Survey Area: Laramie County, Wyoming, Western Part
Survey Area Data: Version 5, Feb 22, 2007

Western Research & Development, Ltd.
Civil Engineers Land Surveyors

Drainage Study Calculations
Project: Allison Corridor
Project #: 130-1388-00
Location: Cheyenne, Wyoming
Calculated By: DT
Date: 8/20/2009

SOIL TYPE

Soil Type #131 – Evanston loam

Soil	Percent (%)	Soil Type	Undev. CN	Dev. CN 1/8 Ac. Or less	Dev CN 1/4 Ac.	Dev CN 1 Ac.	Dev. CN Commercial	Dev. CN Gravel
Evanston	90	B	61	85	75	68	92	85
Ipson	10	B	61	85	75	68	92	85
Total	100		61	85	75	68	92	85

Soil Type #162 –Poposhia-Trimad complex

Soil	Percent (%)	Soil Type	Undev. CN	Dev. CN 1/8 Ac. Or less	Dev CN 1/4 Ac.	Dev CN 1 Ac.	Dev. CN Commercial	Dev. CN Gravel
Poposhia	50	B	61	85	75	68	92	85
Trimad	40	B	61	85	75	68	92	85
Piezon	5	B	61	85	75	68	92	85
Rock Outcrop	5	D	80	92	87	84	95	91
Total	100		62	85.4 Use 85	75.6 Use 76	68.8 Use 69	92.2 Use 92	85.3 Use 85

Soil Type #184 – Urban Land-Ascalon complex

Soil	Percent (%)	Soil Type	Undev. CN	Dev. CN 1/8 Ac. Or less	Dev CN 1/4 Ac.	Dev CN 1 Ac.	Dev. CN Commercial	Dev. CN Gravel
Urban Land	65	B	61	85	75	68	92	85
Ascalon	25	B	61	85	75	68	92	85
Altvan	5	B	61	85	75	68	92	85
Wages	5	B	61	85	75	68	92	85
Total	100		61	85	75	68	92	85

Soil Type #186 – Urban Land-Evanston complex

Soil	Percent (%)	Soil Type	Undev. CN	Dev. CN 1/8 Ac. Or less	Dev CN 1/4 Ac.	Dev CN 1 Ac.	Dev. CN Commercial	Dev. CN Gravel
Urban Land	65	B	61	85	75	68	92	85
Evanston	30	B	61	85	75	68	92	85
Ipson	5	B	61	85	75	68	92	85
Total	100		61	85	75	68	92	85

Soil Type #189 – Urban Land-Poposhia-Trimad complex

Soil	Percent (%)	Soil Type	Undev. CN	Dev. CN 1/8 Ac. Or less	Dev CN 1/4 Ac.	Dev CN 1 Ac.	Dev. CN Commercial	Dev. CN Gravel
Urban Land	60	B	61	85	75	68	92	85
Poposhia	15	B	61	85	75	68	92	85
Trimad	15	B	61	85	75	68	92	85
Piezon	5	B	61	85	75	68	92	85
Rock Outcrop	5	D	80	92	87	84	95	91
Total	100		62	85.4 Use 85	75.6 Use 76	68.8 Use 69	92.2 Use 92	85.3 Use 85

Western Research & Development, Ltd.
Civil Engineers Land Surveyors

Drainage Study Calculations

Project: Allison Corridor
Project #: 130-1388-00
Location: Cheyenne, Wyoming
Calculated By: DT
Date: 8/20/2009

CALCULATED CURVE NUMBER

AWS – Undeveloped
25% #131 + 70% #162 + 5% #184
Undeveloped CN = 0.25 * 61 + 0.25 *61 = 61

AWN1 – 75% Undeveloped + 25% Single Family (1/8 Ac. or less)
25% #184 + 75% #189
Existing CN = 0.75(0.25*61 + 0.75*62) + 0.25(0.25*85 + 0.75*85) = 67.8 Use 68
Developed 10% #162 + 30% #184 + 60% #189 and 75% Gravel + 75% Single Family
Developed CN = 0.75(0.1*85+0.3*85+0.6*85)+0.25(0.1*85+0.3*85+0.6*85)=85

Existing AWN2 – 70% Undeveloped + 15% Single Family (1/4 Ac) + 15% Commercial
10% #131 + 50% #162 + 25% #184 + 15% #189
Existing CN = 0.7(0.1*61 + 0.5*62 + 0.25*61 + 0.15*62) + 0.15(0.1*75 + 0.5*76 + 0.25*75 + 0.15*76)
+ 0.15(0.1*92 + 0.5*92 + 0.25*92 + 0.15*92) = 43.2 + 11.3 + 13.8 = 68.3 Use 68
Developed AWN2 70% Undeveloped + 30% Single Family (1/4 Ac)
10% #131 + 60% #162 + 30% #184
Developed CN = 0.7(0.1*61 + 0.6*62 + 0.3*61) + 0.3(0.1*75 + 0.6*76 + 0.3*75) =43.1+22.7=65.8 Use 66

Existing AE1 – 75% Undeveloped + 25% Single Family (1 Ac)
50% #184 + 50% 189
Existing CN = 0.75(0.5*61 + 0.5*62) + 0.25(0.5*68 + 0.5*69) = 46.1 + 17.1 = 63.2 Use 63
Developed AE1 - 50% Undeveloped + 50% Single Family (1 Ac)
60% #189 + 40% #184
Developed CN = 0.5(0.6*62+0.4*61) + 0.5(0.6*69+0.4*68) = 30.8+34.3=65.1 Use 65

AE2 – 30% Undeveloped + 70% Single Family (1/4 Ac)
95% #184 + 5% #189
Existing CN = 0.3(0.95*61 + 0.05*62) + 0.7(0.95*75 + 0.05*76) = 18.3 + 52.5 = 70.8 Use 71

AE3 – 100% Single Family (1 Ac)
50% #184 + 50% 189
Existing CN = 0.5*68 + 0.5*69 = 68.5 Use 69

Western Research & Development, Ltd.
Civil Engineers Land Surveyors

Drainage Study Calculations

Project: Allison Corridor
Project #: 130-1388-00
Location: Cheyenne, Wyoming
Calculated By: DT
Date: 8/20/2009

Existing SCS Curve Number Calculations

Subcatchment AWS

Total Area= 15.3 Width = 1430 ft.
Slope = 3.5 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Range	0.13	15.3	100%	0.13
			C_{avg} =	0.13

Subcatchment AWN2

Total Area= 34.8 Width = 1800 ft.
Slope = 4.9 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	3.4	10%	0.02
Range	0.13	24.4	70%	0.09
Streets, Asphaltic	0.01	5	14%	0.00
Roofs	0.01	2	6%	0.00
			C_{avg} =	0.12

Subcatchment AWN1

Total Area= 23.1 Width = 1840 ft.
Slope = 3.6 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	2.5	11%	0.03
Range	0.13	17.3	75%	0.10
Streets, Asphaltic	0.01	2.3	10%	0.00
Roofs	0.01	1.0	4%	0.00
			C_{avg} =	0.12

Subcatchment AE1

Total Area= 43.8 Width = 2560 ft.
Slope = 3.0 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	7.1	16%	0.04
Roofs	0.01	2.3	5%	0.00
Streets, Asphaltic	0.01	1.5	3%	0.00
Range	0.13	32.9	75%	0.10
			C_{avg} =	0.14

Subcatchment AE2

Total Area= 12.6 Width = 1500 ft.

Slope = 2.7 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	6.3	50%	0.12
Roofs	0.01	2.0	16%	0.00
Streets, Asphaltic	0.01	0.5	4%	0.00
Range	0.13	3.8	30%	0.04
			C_{avg} =	0.16

Subcatchment AE3

Total Area= 2.6 Width = 640 ft.

Slope = 2.0 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	1.2	46%	0.11
Streets, Asphaltic	0.01	0.6	23%	0.00
Roofs	0.01	0.8	31%	0.00
			C_{avg} =	0.12

1-(Pg 143 Stormwater Management Model Users Manual Version 5.0)

Western Research & Development, Ltd.
Civil Engineers Land Surveyors

Drainage Study Calculations

Project: Allison Corridor
Project #: 130-1388-00
Location: Cheyenne, Wyoming
Calculated By: DT
Date: 8/20/2009

Developed SCS Curve Number Calculations

Subcatchment AWN2

Total Area= 24.2 Width = 1442 ft.
Slope = 6.0 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	3.4	14%	0.03
Range	0.13	13.8	57%	0.07
Streets, Asphaltic	0.01	5	21%	0.00
Roofs	0.01	2	8%	0.00
			C_{avg} =	0.11

Subcatchment AWN1

Total Area= 33.8 Width = 2430 ft.
Slope = 2.9 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	2.5	7%	0.02
Gravel	0.04	28	83%	0.03
Streets, Asphaltic	0.01	2.3	7%	0.00
Roofs	0.01	1.0	3%	0.00
			C_{avg} =	0.05

Subcatchment AE1

Total Area= 22.8 Width = 1334 ft.
Slope = 3.7 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	7.1	31%	0.07
Roofs	0.01	2.3	10%	0.00
Streets, Asphaltic	0.01	1.5	7%	0.00
Range	0.13	11.9	52%	0.07
			C_{avg} =	0.14

Subcatchment AE2

Total Area= 12.6 Width = 1674 ft.

Slope = 2.0 %

Lawn	C[1]	Coverage Area	% Coverage	Weighted C
Lawns, 1to 3%	0.24	6.3	50%	0.12
Roofs	0.01	2.0	16%	0.00
Streets, Asphaltic	0.01	0.5	4%	0.00
Range	0.13	3.8	30%	0.04
			C_{avg} =	0.16

1-(Pg 143 Stormwater Management Model Users Manual Version 5.0)

EPASWMM Time Series Data
Rainfall Data from City of Cheyenne Drainage Master Plan

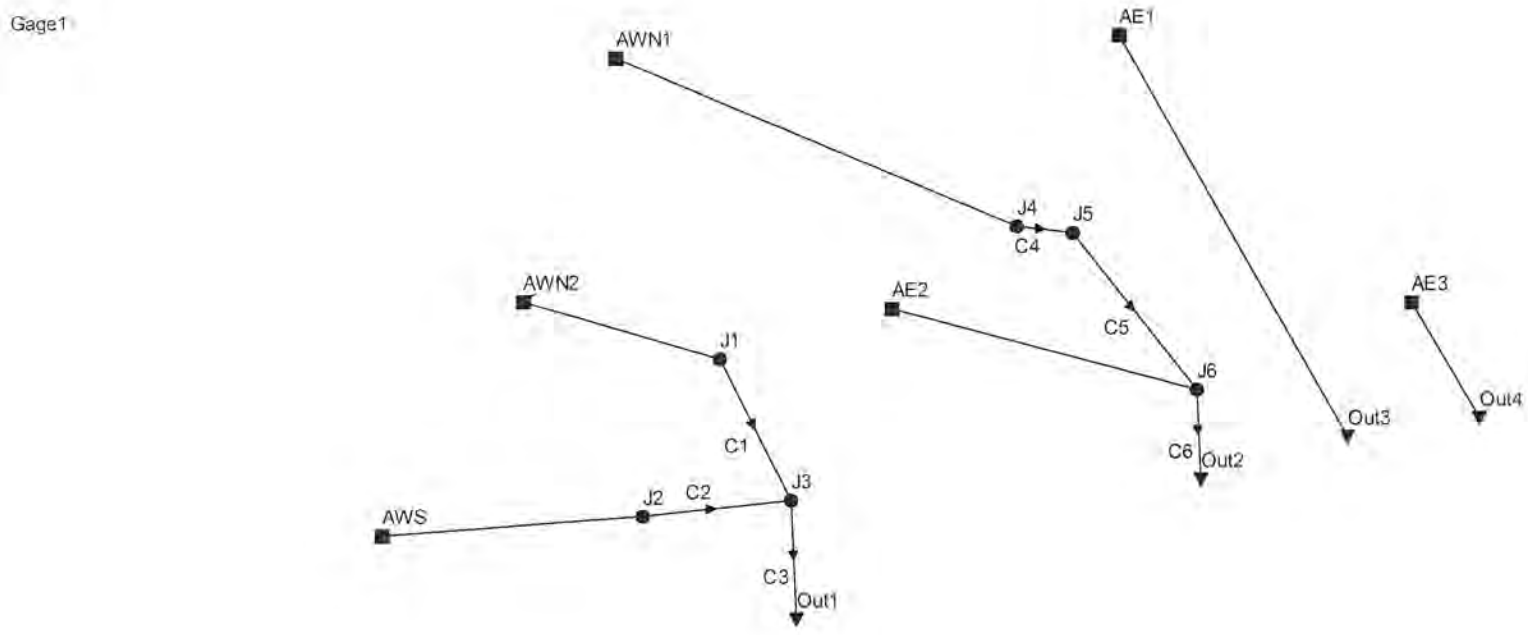
5-Year Event	
Time	In
0:00	0
0:05	0.01
0:10	0.01
0:15	0.01
0:20	0.01
0:25	0.02
0:30	0.07
0:35	0.08
0:40	0.4
0:45	0.21
0:50	0.15
0:55	0.07
1:00	0.02
1:05	0.03
1:10	0.02
1:15	0.03
1:20	0.02
1:25	0.01
1:30	0.02
1:35	0.01
1:40	0.02
1:45	0.01
1:50	0.01
1:55	0.01
2:00	0.01

50-Year Event	
Time	In
0:00	0
0:05	0.04
0:10	0.06
0:15	0.08
0:20	0.14
0:25	0.18
0:30	0.18
0:35	0.22
0:40	0.67
0:45	0.35
0:50	0.18
0:55	0.1
1:00	0.06
1:05	0.05
1:10	0.06
1:15	0.05
1:20	0.06
1:25	0.05
1:30	0.06
1:35	0.05
1:40	0.06
1:45	0.06
1:50	0.05
1:55	0.06
2:00	0.05

100-Year Event	
Time	In
0:00	0
0:05	0.09
0:10	0.1
0:15	0.12
0:20	0.18
0:25	0.22
0:30	0.23
0:35	0.24
0:40	0.76
0:45	0.39
0:50	0.22
0:55	0.12
1:00	0.08
1:05	0.09
1:10	0.08
1:15	0.09
1:20	0.07
1:25	0.08
1:30	0.09
1:35	0.08
1:40	0.09
1:45	0.07
1:50	0.07
1:55	0.06
2:00	0.06

Appendix C
Existing Storm Results

Allison East Corridor Study



2-Hour 5-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	13.881	1.260
Evaporation Loss	0.000	0.000
Infiltration Loss	10.965	0.995
Surface Runoff	2.400	0.218
Final Surface Storage	0.518	0.047
Continuity Error (%)	-0.014	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	2.400	0.782
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	2.306	0.752
Surface Flooding	0.093	0.030
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.013	

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	1.260	0.000	0.000	1.125	0.086	0.986	0.068
AWN2	1.260	0.000	0.000	1.019	0.197	11.896	0.157
AWN1	1.260	0.000	0.000	0.923	0.289	15.731	0.229
AE2	1.260	0.000	0.000	0.840	0.373	12.260	0.296
AE1	1.260	0.000	0.000	1.044	0.167	16.971	0.133
AE3	1.260	0.000	0.000	0.475	0.743	6.767	0.589
System	1.260	0.000	0.000	0.995	0.218	63.628	0.173

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.03	0.17	46.37	0 00:45	0	0
J2	JUNCTION	0.11	0.27	43.01	0 01:25	0	0
J3	JUNCTION	0.26	0.68	43.13	0 00:45	0	0
J4	JUNCTION	0.22	0.94	60.99	0 00:45	0	0
J5	JUNCTION	0.26	0.94	59.09	0 00:45	0	0
J6	JUNCTION	0.34	2.00	29.75	0 00:41	0	12
Out2	OUTFALL	0.25	0.94	0.94	0 00:55	0	0
Out1	OUTFALL	0.26	0.68	41.68	0 00:45	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out3	OUTFALL	0.00	0.00	0.00	0 00:00	0	0

Node Flow Summary

	Maximum Lateral Inflow	Maximum Total Inflow	Time of Max Occurrence	Maximum Flooding Overflow	Time of Max Occurrence

Node	Type	CFS	CFS	days	hr:min	CFS	days	hr:min
J1	JUNCTION	11.90	11.90	0	00:45	0.00		
J2	JUNCTION	0.99	0.99	0	01:25	0.00		
J3	JUNCTION	0.00	11.97	0	00:45	0.00		
J4	JUNCTION	15.73	15.73	0	00:45	0.00		
J5	JUNCTION	0.00	15.77	0	00:45	0.00		
J6	JUNCTION	12.26	26.18	0	00:45	13.00	0	00:45
Out2	OUTFALL	0.00	13.19	0	00:55	0.00		
Out1	OUTFALL	0.00	11.96	0	00:45	0.00		
Out4	OUTFALL	6.77	6.77	0	00:45	0.00		
Out3	OUTFALL	16.97	16.97	0	00:45	0.00		

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out2	92.33	2.80	13.19
Out1	76.26	2.71	11.96
Out4	67.52	0.72	6.77
Out3	79.40	2.32	16.97
System	78.88	8.55	48.77

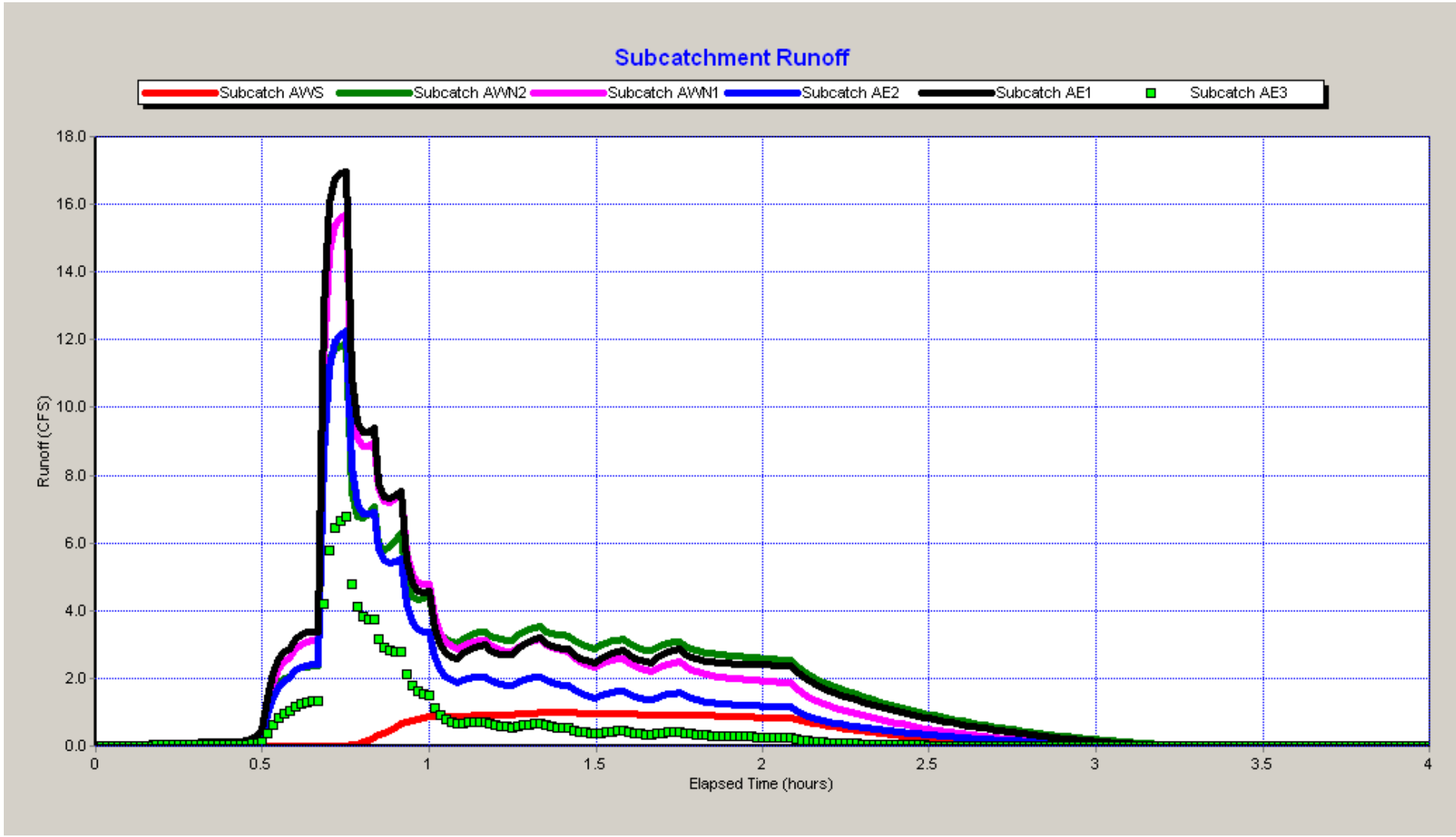
****
Link Flow Summary
****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days	hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	11.97	0	00:45	8.52	0.00	0.01	0
C2	CONDUIT	0.99	0	01:25	3.87	0.04	0.14	0
C3	CONDUIT	11.96	0	00:45	8.38	0.06	0.34	0
C4	CONDUIT	15.77	0	00:45	10.90	0.45	0.47	0
C5	CONDUIT	15.98	0	00:46	10.17	0.10	0.42	0
C6	CONDUIT	13.19	0	00:55	18.31	1.08	0.95	15

```
*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     0.50 sec
Maximum Time Step           :     0.50 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.01


Analysis begun on:  Mon Oct 19 09:56:50 2009
Analysis ended on:  Mon Oct 19 09:56:50 2009
Total elapsed time: < 1 sec
```


Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
Elapsed Time (hours)

2-Hour 50-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	32.169	2.920
Evaporation Loss	0.000	0.000
Infiltration Loss	20.925	1.899
Surface Runoff	10.731	0.974
Final Surface Storage	0.517	0.047
Continuity Error (%)	-0.012	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	10.732	3.497
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	9.296	3.029
Surface Flooding	1.436	0.468
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000

Final Stored Volume 0.000 0.000
Continuity Error (%) ..... -0.003

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	2.920	0.000	0.000	2.203	0.671	9.443	0.230
AWN2	2.920	0.000	0.000	1.903	0.970	30.999	0.332
AWN1	2.920	0.000	0.000	1.720	1.155	35.755	0.395
AE2	2.920	0.000	0.000	1.528	1.347	25.748	0.461
AE1	2.920	0.000	0.000	2.053	0.819	36.434	0.281
AE3	2.920	0.000	0.000	0.868	2.011	12.603	0.689
System	2.920	0.000	0.000	1.899	0.974	146.265	0.334

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.11	0.34	46.54	0 00:45	0	0
J2	JUNCTION	0.30	0.85	43.59	0 00:55	0	0
J3	JUNCTION	0.48	1.04	43.49	0 00:50	0	0
J4	JUNCTION	0.46	2.00	62.05	0 00:44	0	0
J5	JUNCTION	0.48	1.84	59.99	0 00:45	0	0
J6	JUNCTION	0.93	2.00	29.75	0 00:35	0	93
Out2	OUTFALL	0.49	0.94	0.94	0 02:09	0	0
Out1	OUTFALL	0.48	1.04	42.04	0 00:50	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out3	OUTFALL	0.00	0.00	0.00	0 00:00	0	0

Node Flow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min
J1	JUNCTION	31.00	31.00	0 00:45	0.00	
J2	JUNCTION	9.44	9.44	0 00:55	0.00	
J3	JUNCTION	0.00	37.84	0 00:50	0.00	
J4	JUNCTION	35.75	35.75	0 00:45	0.00	
J5	JUNCTION	0.00	37.69	0 00:45	0.00	
J6	JUNCTION	25.75	56.78	0 00:44	43.45	0 00:44
Out2	OUTFALL	0.00	13.20	0 00:35	0.00	
Out1	OUTFALL	0.00	37.77	0 00:50	0.00	
Out4	OUTFALL	12.60	12.60	0 00:45	0.00	
Out3	OUTFALL	36.43	36.43	0 00:45	0.00	

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out2	90.08	7.39	13.20
Out1	75.97	14.61	37.77
Out4	69.83	1.89	12.60
Out3	76.16	11.88	36.43
System	78.01	35.76	96.83

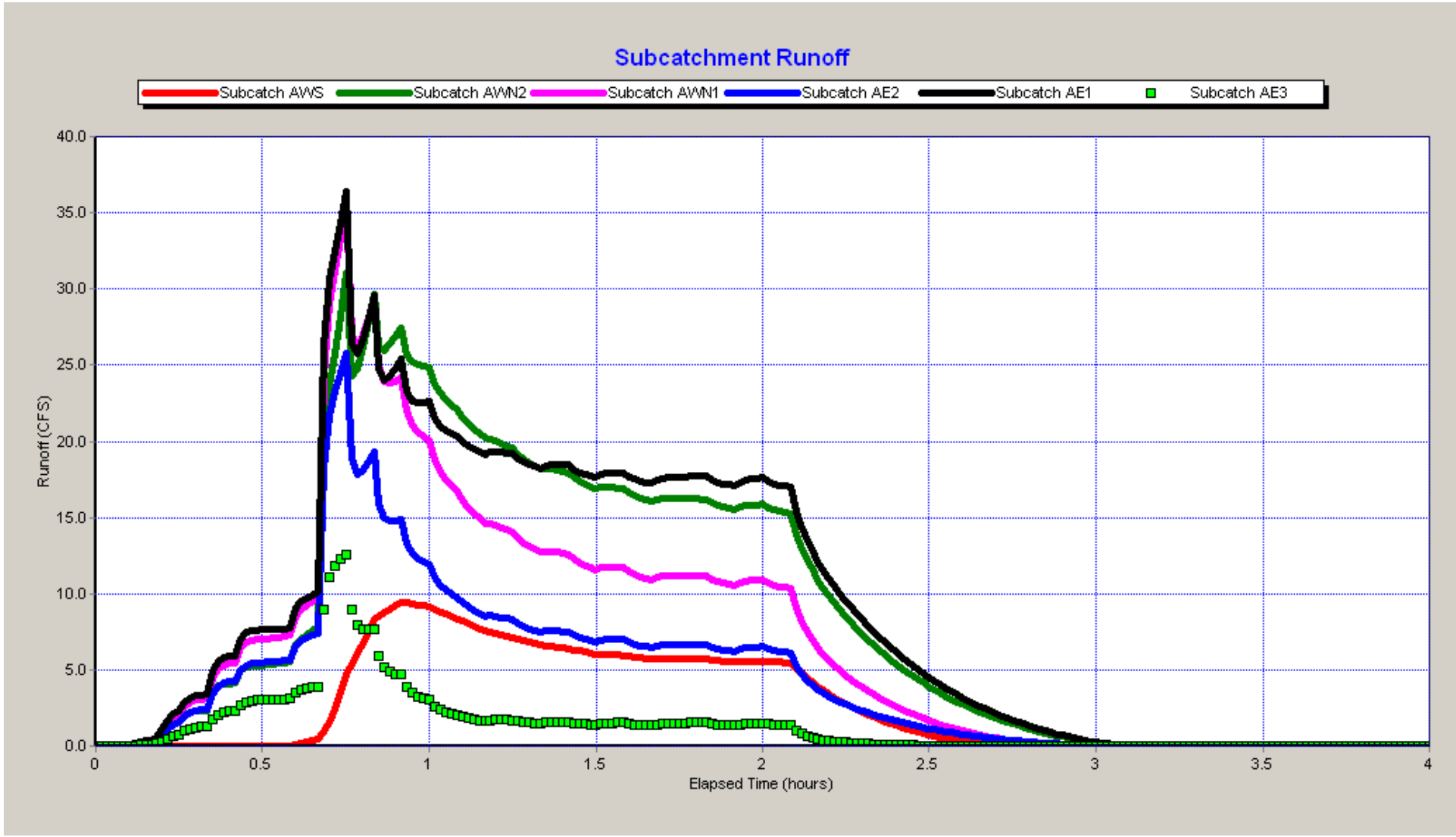
Link Flow Summary

Link	Type	Maximum Flow CFS	Time of Max Occurrence days	hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	30.88	0	00:45	10.28	0.00	0.01	0
C2	CONDUIT	9.44	0	00:55	7.41	0.38	0.43	0
C3	CONDUIT	37.77	0	00:50	8.75	0.18	0.52	0
C4	CONDUIT	37.69	0	00:45	13.04	1.08	0.92	0
C5	CONDUIT	34.77	0	00:46	11.65	0.22	0.56	0
C6	CONDUIT	13.20	0	00:35	18.28	1.08	0.95	99

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 0.50 sec
Maximum Time Step : 0.50 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01

Analysis begun on: Mon Oct 19 10:04:28 2009
Analysis ended on: Mon Oct 19 10:04:28 2009
Total elapsed time: < 1 sec


Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
Elapsed Time (hours)

2-Hour 100-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	40.541	3.680
Evaporation Loss	0.000	0.000
Infiltration Loss	24.106	2.188
Surface Runoff	15.967	1.449
Final Surface Storage	0.474	0.043
Continuity Error (%)	-0.013	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	15.967	5.203
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	13.143	4.283
Surface Flooding	2.824	0.920
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	3.680	0.000	0.000	2.563	1.071	15.408	0.291
AWN2	3.680	0.000	0.000	2.188	1.460	43.757	0.397
AWN1	3.680	0.000	0.000	1.965	1.671	47.345	0.454
AE2	3.680	0.000	0.000	1.730	1.906	32.821	0.518
AE1	3.680	0.000	0.000	2.378	1.254	48.059	0.341
AE3	3.680	0.000	0.000	0.989	2.650	15.008	0.720
System	3.680	0.000	0.000	2.188	1.449	196.027	0.394

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.15	0.43	46.63	0 00:50	0	0
J2	JUNCTION	0.39	1.13	43.87	0 00:55	0	0
J3	JUNCTION	0.58	1.22	43.67	0 00:50	0	0
J4	JUNCTION	2.42	69.50	129.55	0 00:42	0	6
J5	JUNCTION	0.60	1.98	60.13	0 00:48	0	0
J6	JUNCTION	1.03	2.00	29.75	0 00:26	0	106
Out2	OUTFALL	0.53	0.93	0.93	0 02:14	0	0
Out1	OUTFALL	0.58	1.22	42.22	0 00:50	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out3	OUTFALL	0.00	0.00	0.00	0 00:00	0	0

Node Flow Summary

	Maximum Lateral Inflow	Maximum Total Inflow	Time of Max Occurrence	Maximum Flooding Overflow	Time of Max Occurrence

Node	Type	CFS	CFS	days	hr:min	CFS	days	hr:min
J1	JUNCTION	43.76	43.76	0	00:50	0.00		
J2	JUNCTION	15.41	15.41	0	00:55	0.00		
J3	JUNCTION	0.00	57.82	0	00:50	0.00		
J4	JUNCTION	47.35	47.35	0	00:45	9.68	0	00:45
J5	JUNCTION	0.00	37.72	0	00:42	0.00		
J6	JUNCTION	32.82	69.26	0	00:45	56.07	0	00:45
Out2	OUTFALL	0.00	13.19	0	02:14	0.00		
Out1	OUTFALL	0.00	57.74	0	00:50	0.00		
Out4	OUTFALL	15.01	15.01	0	00:45	0.00		
Out3	OUTFALL	48.06	48.06	0	00:45	0.00		

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out2	92.66	7.81	13.19
Out1	79.40	21.34	57.74
Out4	69.85	2.49	15.01
Out3	79.53	17.40	48.06
System	80.36	49.04	127.45

****
Link Flow Summary
****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days	hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	43.66	0	00:50	11.08	0.00	0.02	0
C2	CONDUIT	15.40	0	00:55	8.38	0.62	0.57	0
C3	CONDUIT	57.74	0	00:50	9.72	0.27	0.61	0
C4	CONDUIT	37.72	0	00:42	13.04	1.08	0.97	13
C5	CONDUIT	38.62	0	00:50	11.32	0.25	0.59	0
C6	CONDUIT	13.19	0	02:14	18.27	1.08	0.95	109

```
*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     0.50 sec
Maximum Time Step           :     0.50 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.01


Analysis begun on:  Mon Oct 19 10:07:15 2009
Analysis ended on:  Mon Oct 19 10:07:15 2009
Total elapsed time: < 1 sec
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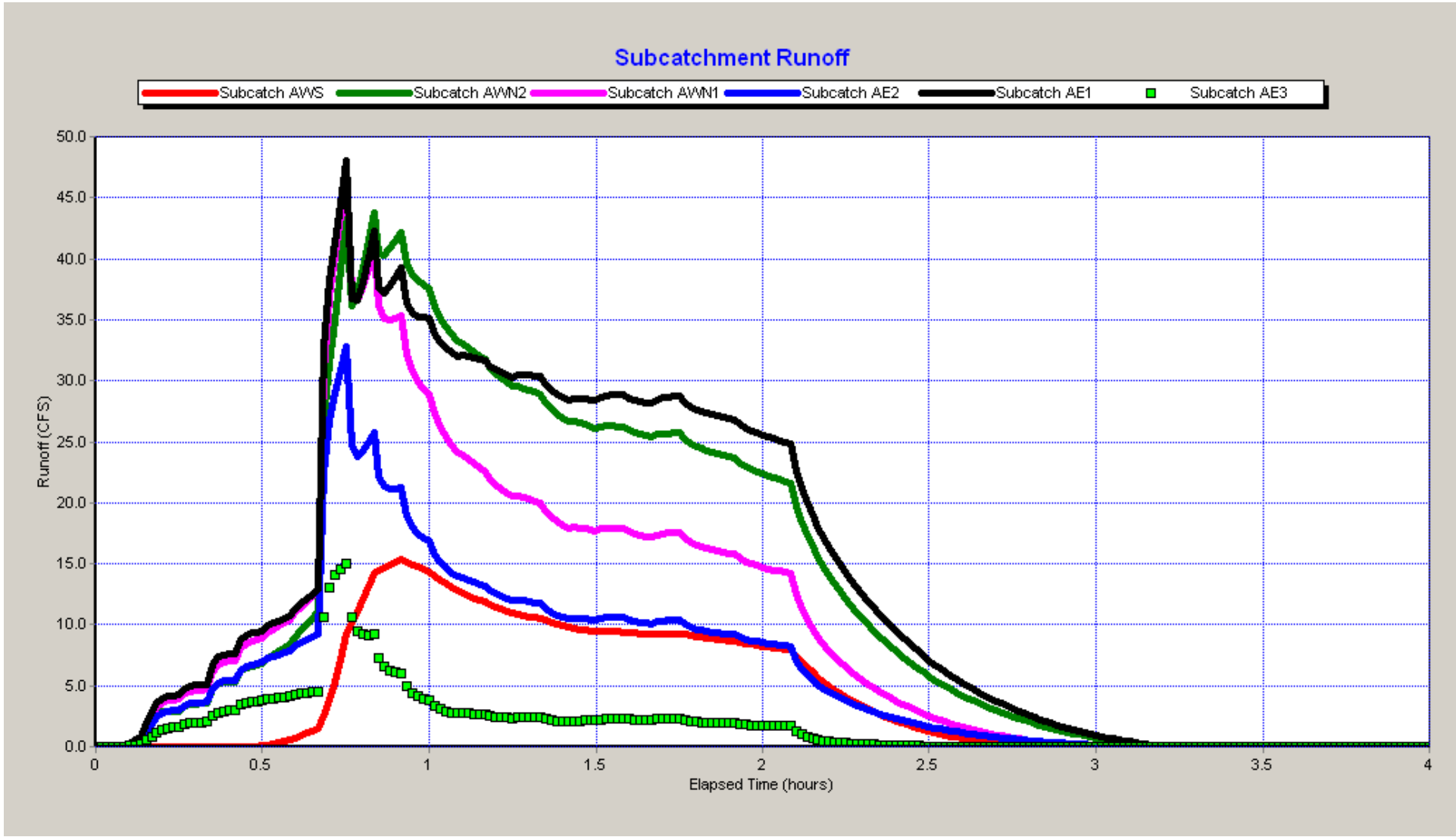
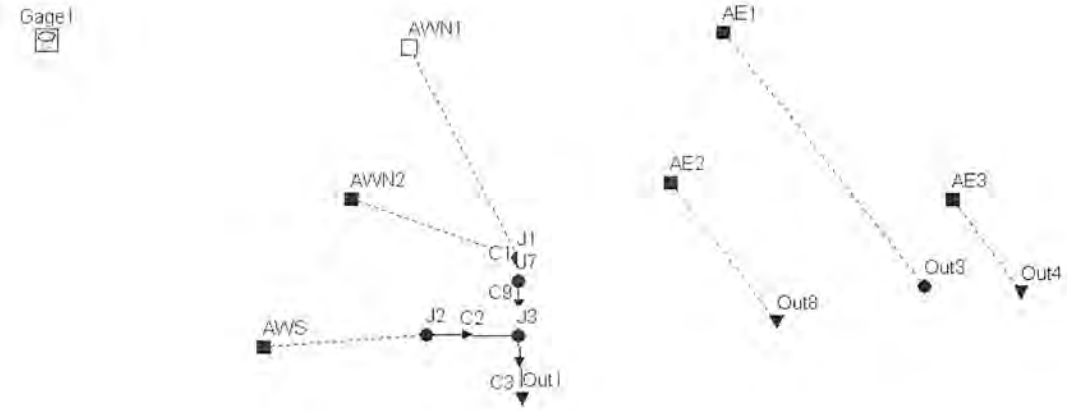

Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
Elapsed Time (hours)

Appendix D
Option 1 Storm Results

08/20/2009 00:05:00



2-Hour 5-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	11.687	1.260
Evaporation Loss	0.000	0.000
Infiltration Loss	7.723	0.833
Surface Runoff	3.529	0.380
Final Surface Storage	0.437	0.047
Continuity Error (%)	-0.022	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	3.529	1.150
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	3.483	1.135
Surface Flooding	0.045	0.015
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000

Final Stored Volume 0.000 0.000
Continuity Error (%) 0.000

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	1.260	0.000	0.000	1.125	0.086	0.986	0.068
AWN2	1.260	0.000	0.000	0.774	0.440	33.545	0.350
AWN1	1.260	0.000	0.000	0.703	0.509	25.579	0.404
AE2	1.260	0.000	0.000	0.846	0.371	12.253	0.294
AE1	1.260	0.000	0.000	0.925	0.288	18.671	0.228
AE3	1.260	0.000	0.000	0.475	0.743	6.767	0.589
System	1.260	0.000	0.000	0.833	0.380	93.129	0.302

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.45	3.30	48.40	0 00:41	0	4
J2	JUNCTION	0.11	0.27	43.01	0 01:25	0	0
J3	JUNCTION	0.38	1.10	43.55	0 00:46	0	0
Out3	JUNCTION	0.00	0.00	26.29	0 00:00	0	0
J7	JUNCTION	0.42	1.71	45.81	0 00:46	0	0
Out1	OUTFALL	0.38	1.09	42.09	0 00:46	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out8	OUTFALL	0.00	0.00	22.47	0 00:00	0	0

****
Node Flow Summary

****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min
J1	JUNCTION	55.43	55.43	0 00:45	13.99	0 00:45
J2	JUNCTION	0.99	0.99	0 01:25	0.00	
J3	JUNCTION	0.00	43.91	0 00:46	0.00	
Out3	JUNCTION	18.67	18.67	0 00:45	0.00	
J7	JUNCTION	0.00	44.88	0 00:46	0.00	
Out1	OUTFALL	0.00	43.14	0 00:46	0.00	
Out4	OUTFALL	6.77	6.77	0 00:45	0.00	
Out8	OUTFALL	12.25	12.25	0 00:45	0.00	

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out1	79.03	9.13	43.14
Out4	67.52	0.72	6.77
Out8	80.90	1.46	12.25
System	75.81	11.31	60.45

****
Link Flow Summary
****

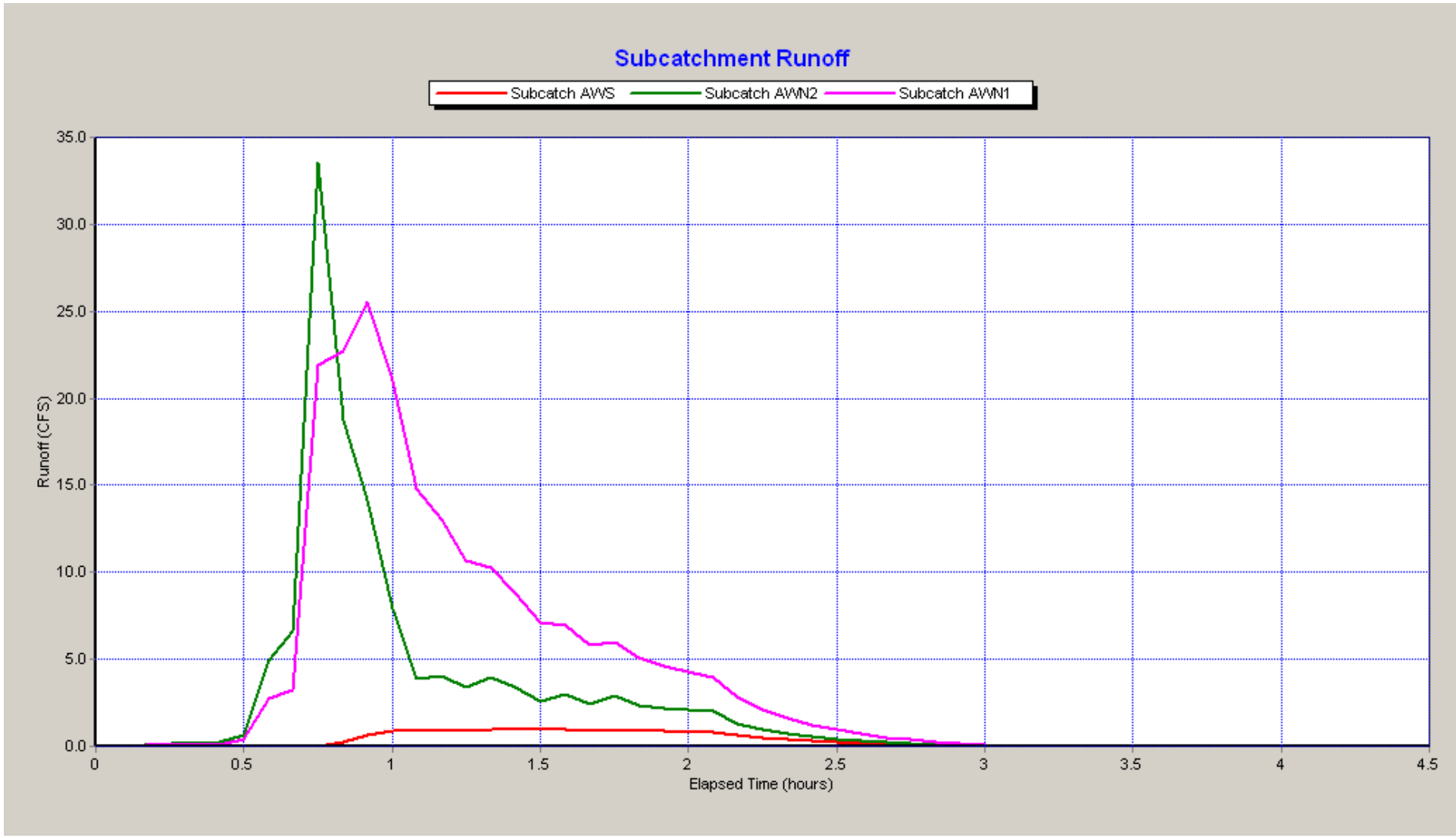
Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	44.88	0 00:46	10.00	1.08	0.85	0

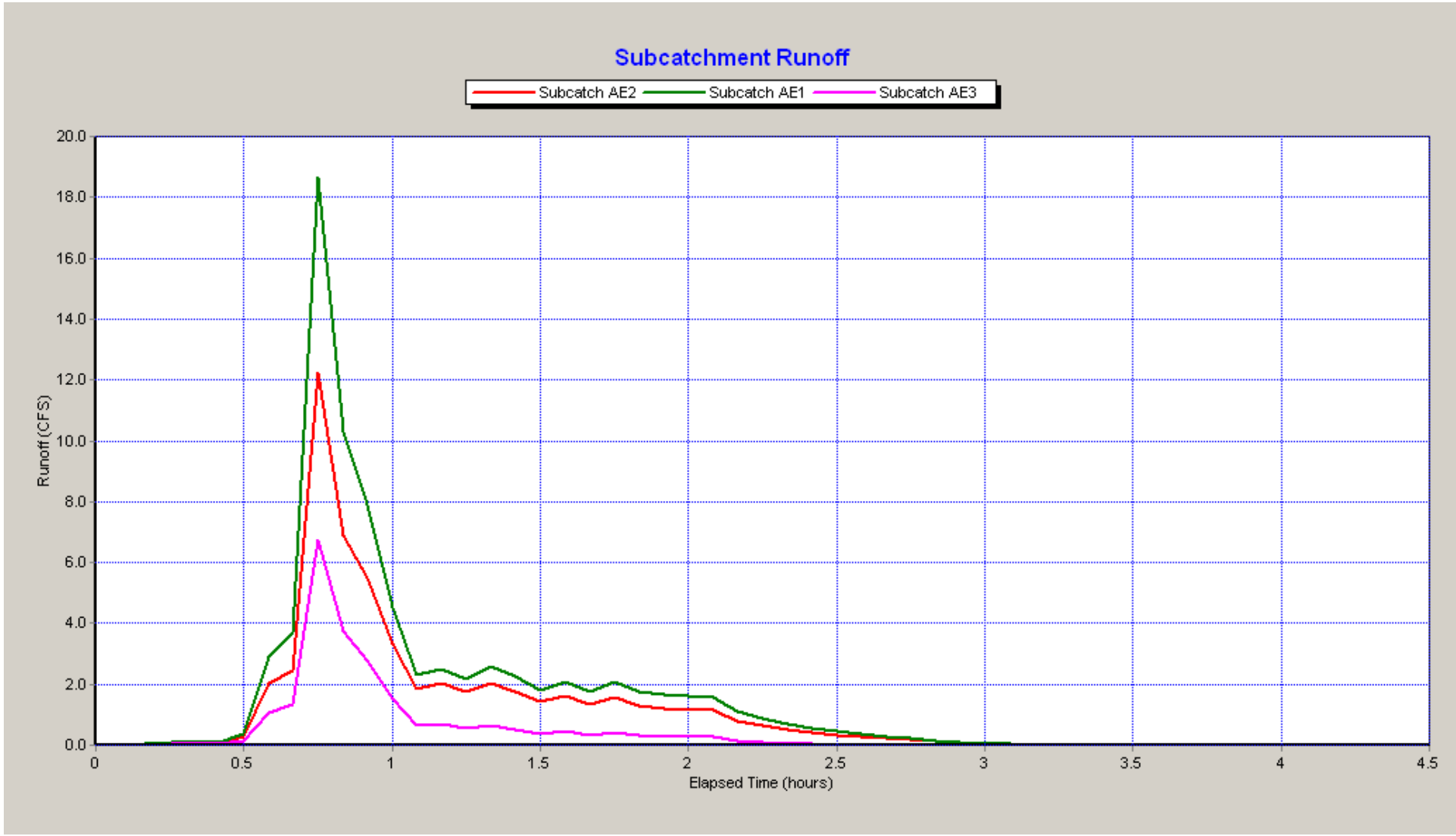
C2	CONDUIT	0.99	0	01:25	3.87	0.04	0.14	0
C3	CONDUIT	43.14	0	00:46	9.13	0.20	0.55	0
C9	CONDUIT	43.89	0	00:46	18.78	0.47	0.48	0

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 0.50 sec
Maximum Time Step : 0.50 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01

Analysis begun on: Mon Oct 19 16:08:59 2009
Analysis ended on: Mon Oct 19 16:08:59 2009
Total elapsed time: < 1 sec


Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Runoff (CFS)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)


Subcatchment Runoff
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)

2-Hour 50-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	27.083	2.920
Evaporation Loss	0.000	0.000
Infiltration Loss	13.945	1.504
Surface Runoff	12.714	1.371
Final Surface Storage	0.429	0.046
Continuity Error (%)	-0.020	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	12.714	4.143
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	10.330	3.366
Surface Flooding	2.384	0.777
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	2.920	0.000	0.000	2.203	0.671	9.443	0.230
AWN2	2.920	0.000	0.000	1.462	1.413	64.075	0.484
AWN1	2.920	0.000	0.000	1.068	1.805	107.828	0.618
AE2	2.920	0.000	0.000	1.531	1.343	25.559	0.460
AE1	2.920	0.000	0.000	1.781	1.094	36.597	0.375
AE3	2.920	0.000	0.000	0.868	2.011	12.603	0.689
System	2.920	0.000	0.000	1.504	1.371	251.389	0.469

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.99	3.30	48.40	0 00:38	0	37
J2	JUNCTION	0.30	0.85	43.59	0 00:55	0	0
J3	JUNCTION	0.60	1.16	43.61	0 01:15	0	0
Out3	JUNCTION	0.00	0.00	26.29	0 00:00	0	0
J7	JUNCTION	0.72	1.71	45.81	0 01:15	0	0
Out1	OUTFALL	0.60	1.16	42.16	0 00:55	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out8	OUTFALL	0.00	0.00	22.47	0 00:00	0	0

Node Flow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min

J1	JUNCTION	171.90	171.90	0	00:45	130.41	0	00:45	
J2	JUNCTION	9.44	9.44	0	00:55	0.00			
J3	JUNCTION	0.00	50.98	0	01:15	0.00			
Out3	JUNCTION	36.60	36.60	0	00:45	0.00			
J7	JUNCTION	0.00	44.88	0	01:15	0.00			
Out1	OUTFALL	0.00	50.86	0	00:55	0.00			
Out4	OUTFALL	12.60	12.60	0	00:45	0.00			
Out8	OUTFALL	25.56	25.56	0	00:45	0.00			

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out1	78.24	24.76	50.86
Out4	69.83	1.89	12.60
Out8	75.51	5.65	25.56
System	74.53	32.30	84.05

****
Link Flow Summary
****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	44.88	0 01:15	10.00	1.08	0.85	0
C2	CONDUIT	9.44	0 00:55	7.41	0.38	0.43	0
C3	CONDUIT	50.86	0 00:55	9.47	0.24	0.58	0
C9	CONDUIT	43.87	0 01:15	19.03	0.47	0.48	0

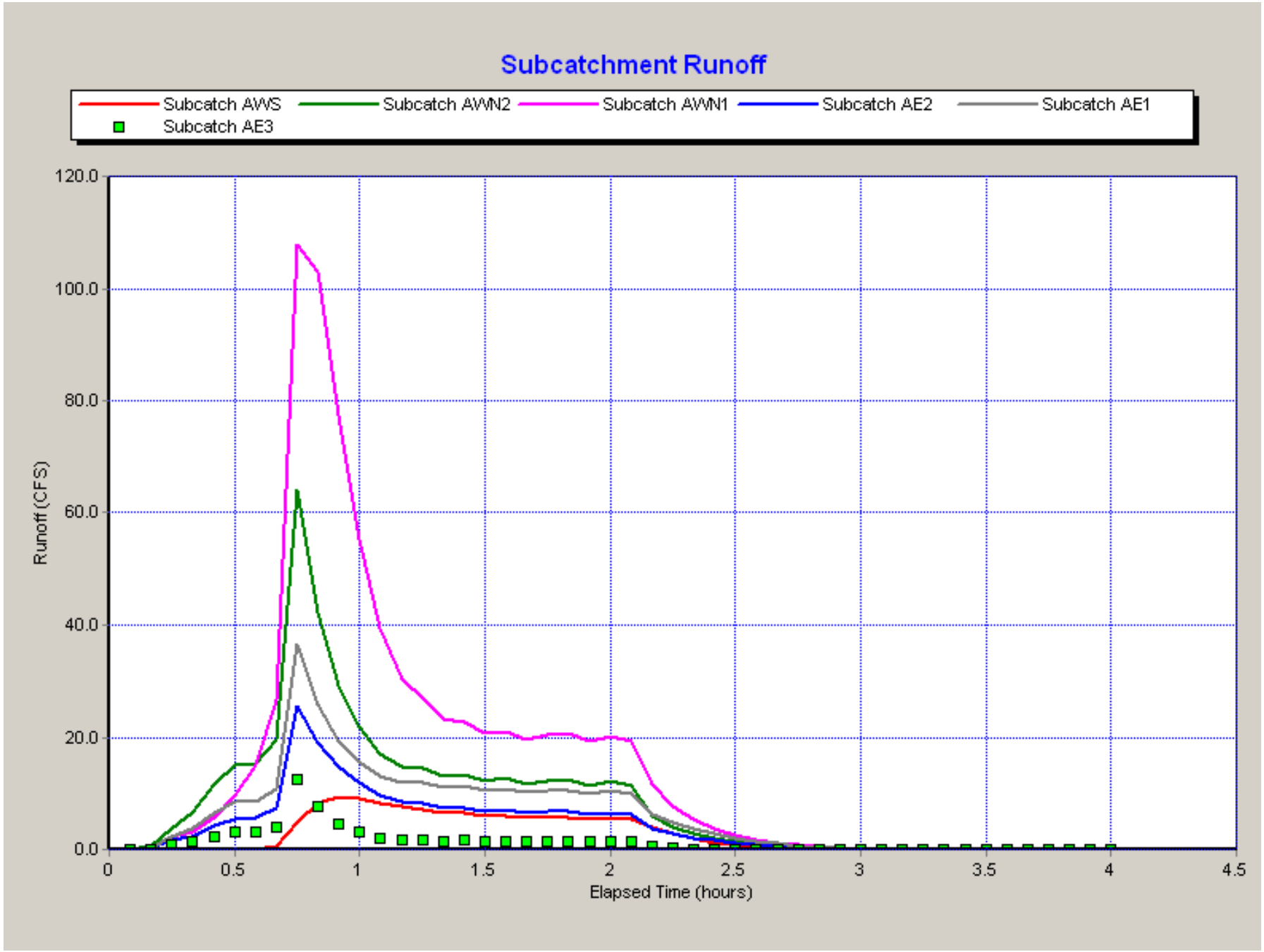
****
Highest Flow Instability Indexes
****
All links are stable.

****

Routing Time Step Summary
****

Minimum Time Step	:	0.50 sec
Average Time Step	:	0.50 sec
Maximum Time Step	:	0.50 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00

Analysis begun on: Mon Oct 19 16:31:05 2009
Analysis ended on: Mon Oct 19 16:31:05 2009
Total elapsed time: < 1 sec


Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Subcatch AE2
Subcatch AE1
Subcatch AE3
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Runoff (CFS)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)

2-Hour 100-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	34.132	3.680
Evaporation Loss	0.000	0.000
Infiltration Loss	15.828	1.706
Surface Runoff	17.883	1.928
Final Surface Storage	0.428	0.046
Continuity Error (%)	-0.021	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	17.883	5.828
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	13.507	4.402
Surface Flooding	4.376	1.426
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000

Final Stored Volume 0.000 0.000
Continuity Error (%) ..... -0.001

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	3.680	0.000	0.000	2.563	1.071	15.408	0.291
AWN2	3.680	0.000	0.000	1.681	1.956	78.197	0.532
AWN1	3.680	0.000	0.000	1.151	2.482	147.453	0.675
AE2	3.680	0.000	0.000	1.732	1.901	32.502	0.517
AE1	3.680	0.000	0.000	2.050	1.584	45.667	0.430
AE3	3.680	0.000	0.000	0.989	2.650	15.008	0.720
System	3.680	0.000	0.000	1.706	1.928	328.054	0.524

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	1.46	3.30	48.40	0 00:31	0	87
J2	JUNCTION	0.39	1.13	43.87	0 00:55	0	0
J3	JUNCTION	0.66	1.21	43.66	0 00:55	0	0
Out3	JUNCTION	0.00	0.00	26.29	0 00:00	0	0
J7	JUNCTION	0.83	1.71	45.81	0 01:59	0	0
Out1	OUTFALL	0.66	1.21	42.21	0 00:55	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out8	OUTFALL	0.00	0.00	22.47	0 00:00	0	0

****
Node Flow Summary

****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min
J1	JUNCTION	225.65	225.65	0 00:45	184.14	0 00:45
J2	JUNCTION	15.41	15.41	0 00:55	0.00	
J3	JUNCTION	0.00	56.83	0 00:55	0.00	
Out3	JUNCTION	45.67	45.67	0 00:45	0.00	
J7	JUNCTION	0.00	44.88	0 01:59	0.00	
Out1	OUTFALL	0.00	56.82	0 00:55	0.00	
Out4	OUTFALL	15.01	15.01	0 00:45	0.00	
Out8	OUTFALL	32.50	32.50	0 00:45	0.00	

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out1	80.44	29.81	56.82
Out4	69.85	2.49	15.01
Out8	78.54	7.69	32.50
System	76.28	39.99	97.75

****
Link Flow Summary
****

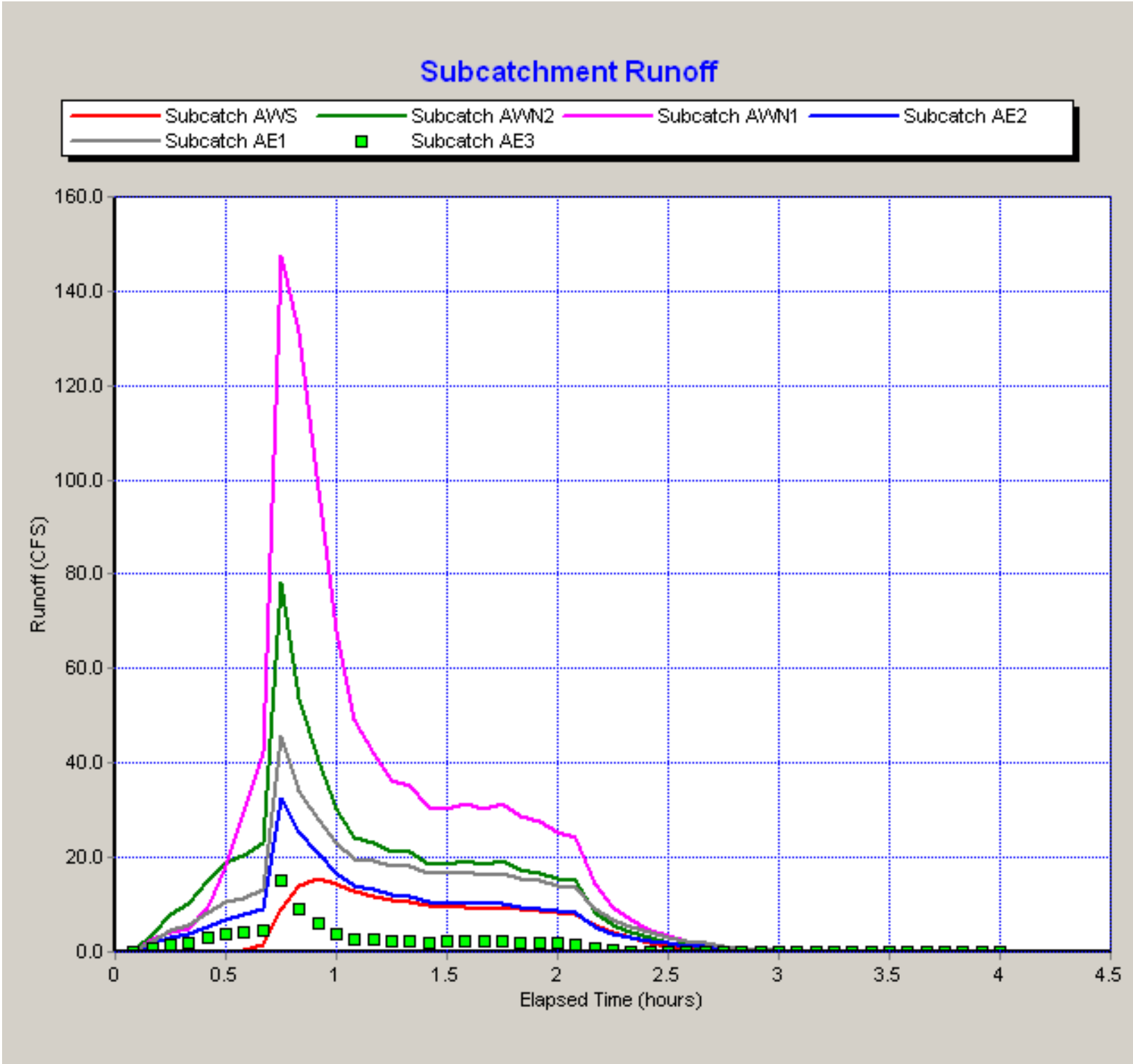
Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	44.88	0 01:59	10.00	1.08	0.85	0

C2	CONDUIT	15.40	0	00:55	8.38	0.62	0.57	0
C3	CONDUIT	56.82	0	00:55	9.66	0.26	0.61	0
C9	CONDUIT	43.87	0	01:59	19.02	0.47	0.48	0

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 0.50 sec
Maximum Time Step : 0.50 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00

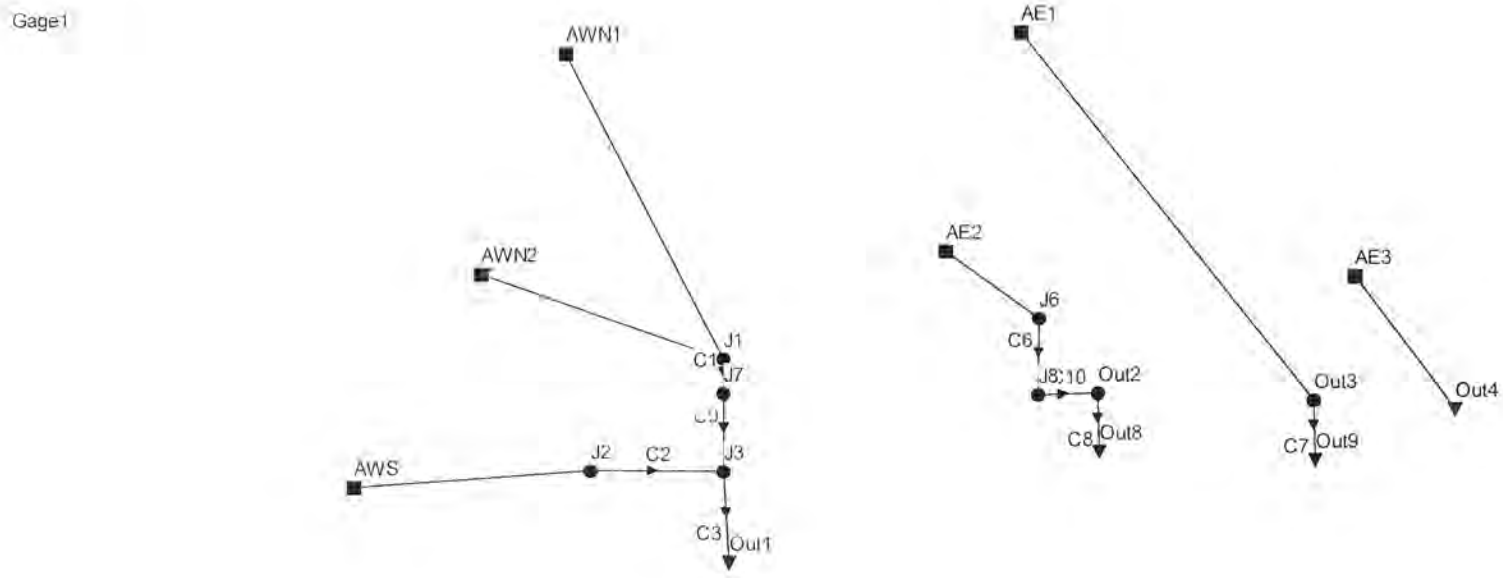
Analysis begun on: Mon Oct 19 16:39:18 2009
Analysis ended on: Mon Oct 19 16:39:18 2009
Total elapsed time: < 1 sec


Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Subcatch AE2
Subcatch AE1
Subcatch AE3
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Runoff (CFS)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)

Appendix E
Option 2 Storm Results

Allison East Corridor Study

08/20/2009 00:05:00



2-Hour 5-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	11.687	1.260
Evaporation Loss	0.000	0.000
Infiltration Loss	7.723	0.833
Surface Runoff	3.529	0.380
Final Surface Storage	0.437	0.047
Continuity Error (%)	-0.022	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	3.529	1.150
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	8.595	2.801
External Outflow	12.046	3.925
Surface Flooding	0.045	0.015
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.041	0.013
Continuity Error (%)	-0.070	

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	1.260	0.000	0.000	1.125	0.086	0.986	0.068
AWN2	1.260	0.000	0.000	0.774	0.440	33.545	0.350
AWN1	1.260	0.000	0.000	0.703	0.509	25.579	0.404
AE2	1.260	0.000	0.000	0.846	0.371	12.253	0.294
AE1	1.260	0.000	0.000	0.925	0.288	18.671	0.228
AE3	1.260	0.000	0.000	0.475	0.743	6.767	0.589
System	1.260	0.000	0.000	0.833	0.380	93.129	0.302

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.45	3.30	48.40	0 00:41	0	4
J2	JUNCTION	0.11	0.27	43.01	0 01:25	0	0
J3	JUNCTION	0.38	1.10	43.55	0 00:46	0	0
J6	JUNCTION	1.13	1.36	29.11	0 00:45	0	0
Out3	JUNCTION	0.21	1.02	15.02	0 00:45	0	0
Out2	JUNCTION	1.12	1.35	24.39	0 00:45	0	0
J7	JUNCTION	0.42	1.71	45.81	0 00:46	0	0
J8	JUNCTION	1.13	1.36	25.77	0 00:45	0	0
Out1	OUTFALL	0.38	1.09	42.09	0 00:46	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out8	OUTFALL	1.12	1.34	23.81	0 00:45	0	0
Out9	OUTFALL	0.21	1.02	12.02	0 00:45	0	0

Node Flow Summary

	Maximum	Maximum		Maximum

Node	Type	Lateral Inflow CFS	Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Flooding Overflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min
J1	JUNCTION	55.43	55.43	0	00:45	13.99	0	00:45
J2	JUNCTION	0.99	0.99	0	01:25	0.00		
J3	JUNCTION	0.00	43.91	0	00:46	0.00		
J6	JUNCTION	38.25	38.25	0	00:45	0.00		
Out3	JUNCTION	18.67	18.67	0	00:45	0.00		
Out2	JUNCTION	0.00	38.37	0	00:45	0.00		
J7	JUNCTION	0.00	44.88	0	00:46	0.00		
J8	JUNCTION	0.00	38.39	0	00:45	0.00		
Out1	OUTFALL	0.00	43.14	0	00:46	0.00		
Out4	OUTFALL	6.77	6.77	0	00:45	0.00		
Out8	OUTFALL	0.00	38.36	0	00:45	0.00		
Out9	OUTFALL	0.00	18.75	0	00:45	0.00		

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out1	79.03	9.13	43.14
Out4	67.52	0.72	6.77
Out8	99.86	27.12	38.36
Out9	79.53	2.08	18.75
System	81.48	39.05	105.01

****
Link Flow Summary
****

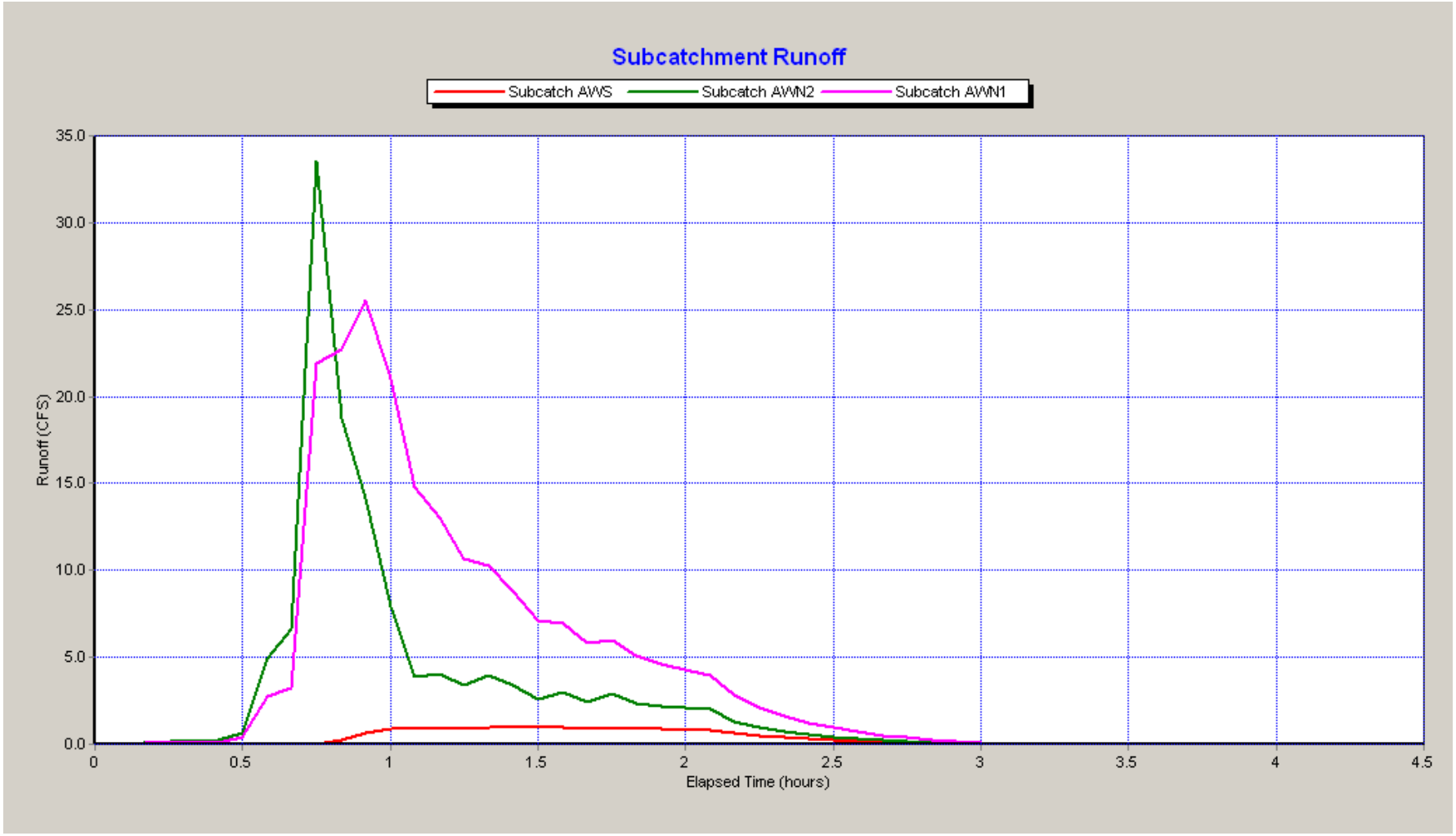
Link	Type	Maximum Flow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	44.88	0	00:46	10.00	1.08	0.85	0
C2	CONDUIT	0.99	0	01:25	3.87	0.04	0.14	0
C3	CONDUIT	43.14	0	00:46	9.13	0.20	0.55	0
C6	CONDUIT	38.39	0	00:45	11.18	0.32	0.39	0

C7	CONDUIT	18.75	0	00:45	11.76	0.52	0.51	0
C8	CONDUIT	38.36	0	00:45	10.35	0.24	0.34	0
C9	CONDUIT	43.89	0	00:46	18.78	0.47	0.48	0
C10	CONDUIT	38.37	0	00:45	10.54	0.24	0.33	0

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 0.50 sec
Maximum Time Step : 0.50 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01

Analysis begun on: Mon Dec 07 09:46:28 2009
Analysis ended on: Mon Dec 07 09:46:28 2009
Total elapsed time: < 1 sec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Subcatch AWS
Subcatch AWN2
Subcatch AWN1
Runoff (CFS)
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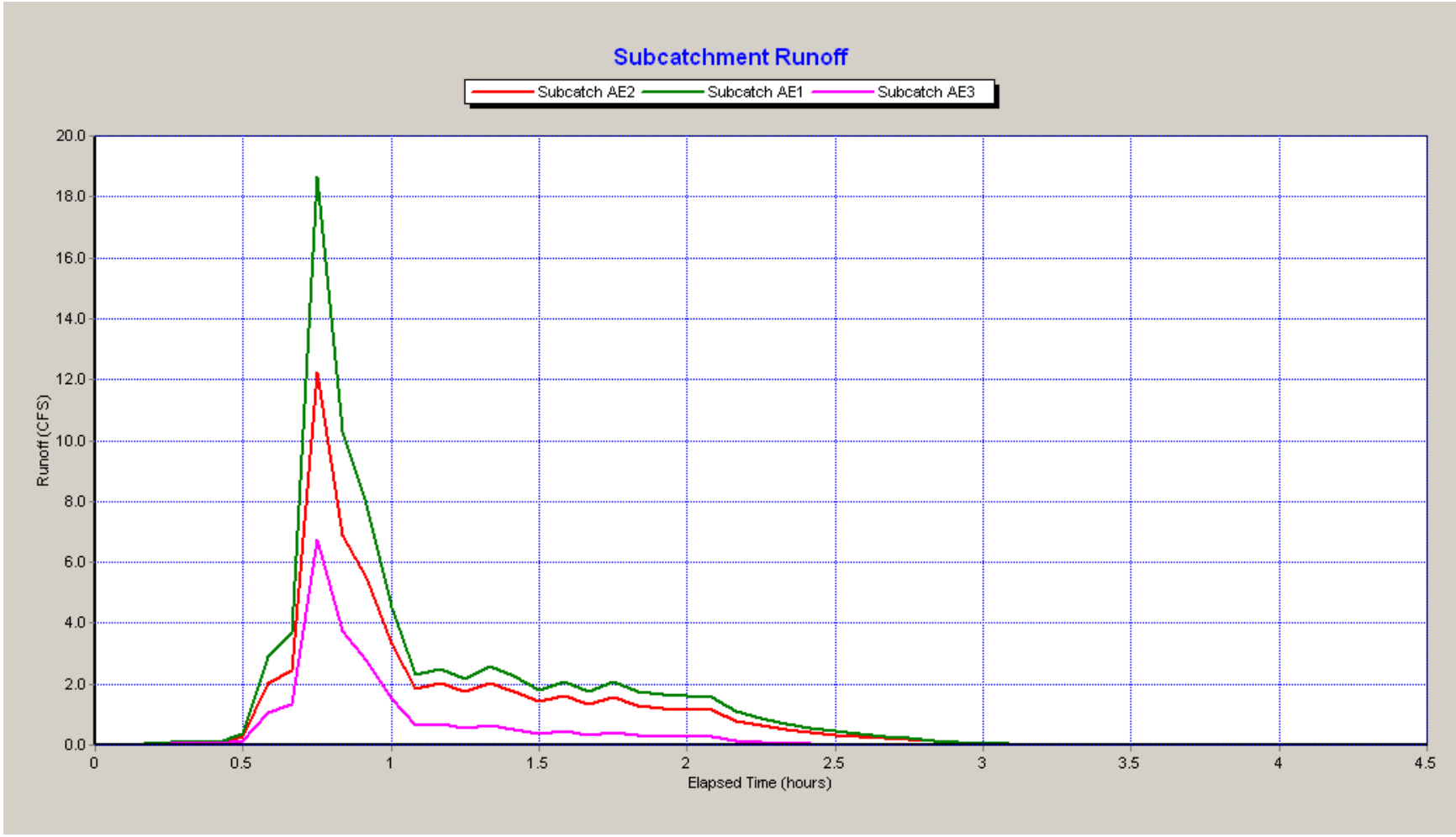
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)


Subcatchment Runoff
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
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18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)

2-Hour 50-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	27.083	2.920
Evaporation Loss	0.000	0.000
Infiltration Loss	13.945	1.504
Surface Runoff	12.714	1.371
Final Surface Storage	0.429	0.046
Continuity Error (%)	-0.020	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	12.714	4.143
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	20.165	6.571
External Outflow	30.436	9.918
Surface Flooding	2.384	0.777
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000

Final Stored Volume 0.076 0.025
Continuity Error (%) ..... -0.053

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	2.920	0.000	0.000	2.203	0.671	9.443	0.230
AWN2	2.920	0.000	0.000	1.462	1.413	64.075	0.484
AWN1	2.920	0.000	0.000	1.068	1.805	107.828	0.618
AE2	2.920	0.000	0.000	1.531	1.343	25.559	0.460
AE1	2.920	0.000	0.000	1.781	1.094	36.597	0.375
AE3	2.920	0.000	0.000	0.868	2.011	12.603	0.689
System	2.920	0.000	0.000	1.504	1.371	251.389	0.469

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	0.99	3.30	48.40	0 00:38	0	37
J2	JUNCTION	0.30	0.85	43.59	0 00:55	0	0
J3	JUNCTION	0.60	1.16	43.61	0 01:15	0	0
J6	JUNCTION	1.84	2.21	29.96	0 00:45	0	0
Out3	JUNCTION	0.45	2.00	16.00	0 00:44	0	0
Out2	JUNCTION	1.79	2.11	25.15	0 00:45	0	0
J7	JUNCTION	0.72	1.71	45.81	0 01:15	0	0
J8	JUNCTION	1.84	2.21	26.62	0 00:45	0	0
Out1	OUTFALL	0.60	1.16	42.16	0 00:55	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out8	OUTFALL	1.79	2.11	24.58	0 00:45	0	0
Out9	OUTFALL	0.45	1.84	12.84	0 00:45	0	0

****
Node Flow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min
J1	JUNCTION	171.90	171.90	0	00:45	130.41	0	00:45
J2	JUNCTION	9.44	9.44	0	00:55	0.00		
J3	JUNCTION	0.00	50.98	0	01:15	0.00		
J6	JUNCTION	86.56	86.56	0	00:45	0.00		
Out3	JUNCTION	36.60	36.60	0	00:45	0.00		
Out2	JUNCTION	0.00	86.47	0	00:45	0.00		
J7	JUNCTION	0.00	44.88	0	01:15	0.00		
J8	JUNCTION	0.00	86.54	0	00:45	0.00		
Out1	OUTFALL	0.00	50.86	0	00:55	0.00		
Out4	OUTFALL	12.60	12.60	0	00:45	0.00		
Out8	OUTFALL	0.00	86.45	0	00:45	0.00		
Out9	OUTFALL	0.00	38.96	0	00:45	0.00		

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out1	78.24	24.76	50.86
Out4	69.83	1.89	12.60
Out8	99.89	65.16	86.45
Out9	75.97	8.28	38.96
System	80.98	100.09	183.09

****

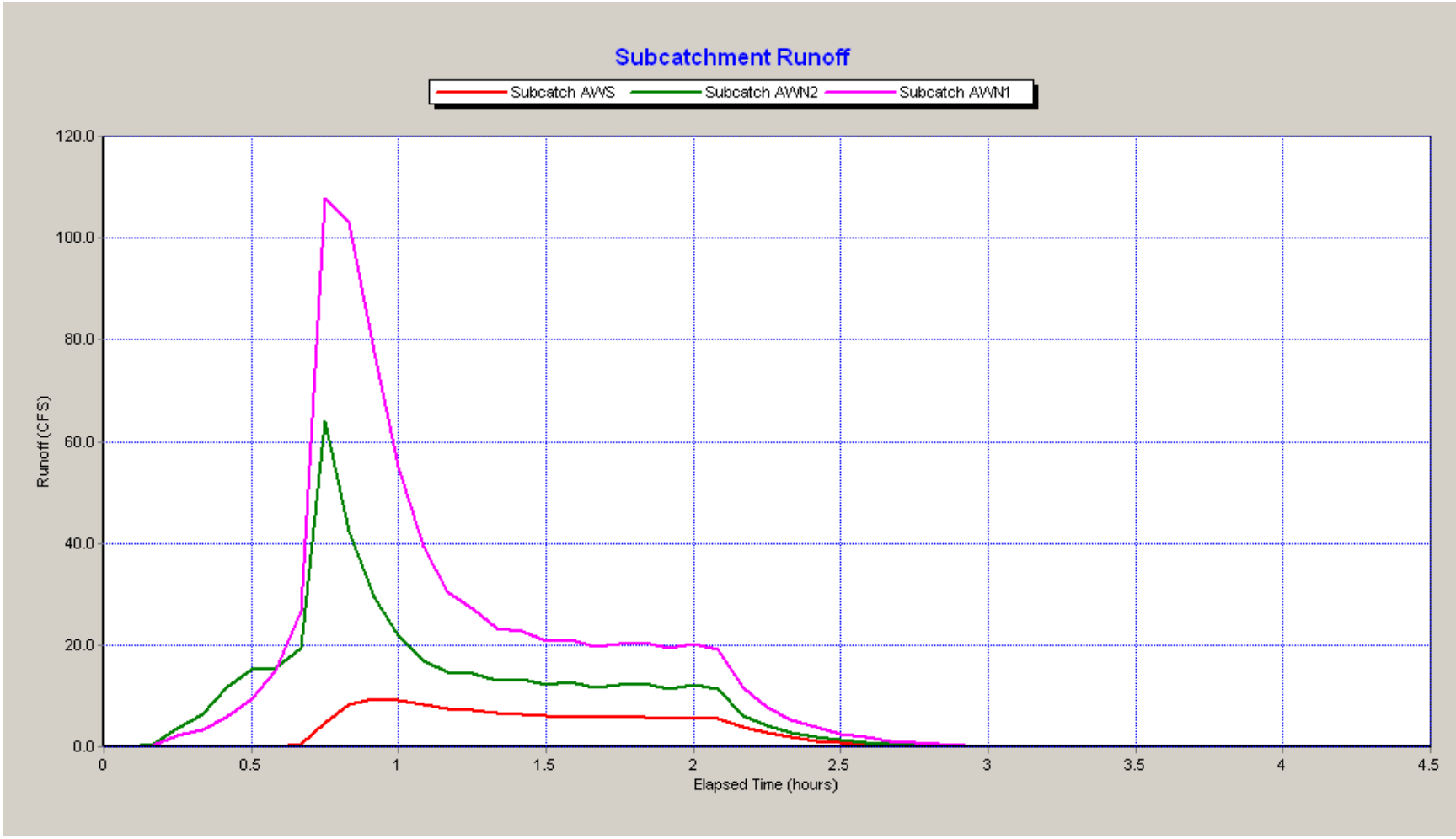
Link Flow Summary
****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	44.88	0 01:15	10.00	1.08	0.85	0
C2	CONDUIT	9.44	0 00:55	7.41	0.38	0.43	0
C3	CONDUIT	50.86	0 00:55	9.47	0.24	0.58	0
C6	CONDUIT	86.54	0 00:45	13.64	0.72	0.63	0
C7	CONDUIT	38.96	0 00:45	13.54	1.08	0.91	0
C8	CONDUIT	86.45	0 00:45	12.84	0.55	0.53	0
C9	CONDUIT	43.87	0 01:15	19.03	0.47	0.48	0
C10	CONDUIT	86.47	0 00:45	13.07	0.54	0.52	0

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 0.50 sec
Maximum Time Step : 0.50 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01

Analysis begun on: Fri Dec 04 17:04:30 2009
Analysis ended on: Fri Dec 04 17:04:31 2009
Total elapsed time: 00:00:01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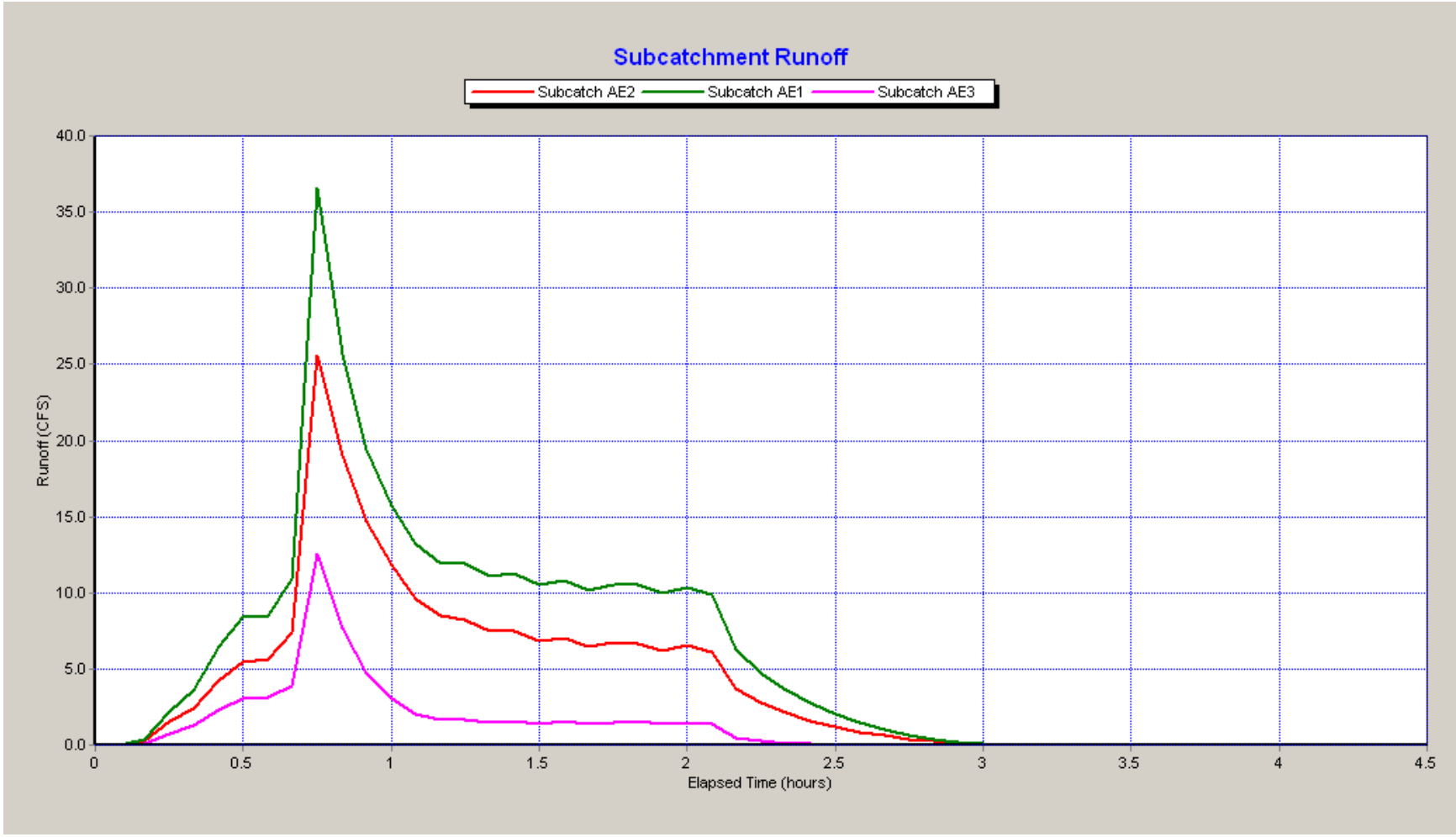
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Runoff (CFS)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)


Subcatchment Runoff
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)

2-Hour 100-Year Storm Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)

Allison East Corridor Study

****
Analysis Options
****
Flow Units ..... CFS
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... KINWAVE
Starting Date AUG-20-2009 00:00:00
Ending Date AUG-20-2009 04:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	34.132	3.680
Evaporation Loss	0.000	0.000
Infiltration Loss	15.828	1.706
Surface Runoff	17.883	1.928
Final Surface Storage	0.428	0.046
Continuity Error (%)	-0.021	

Flow Routing Continuity	Volume acre-feet	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	17.883	5.828
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	24.793	8.079
External Outflow	38.217	12.453
Surface Flooding	4.392	1.431
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.089	0.029
Continuity Error (%)	-0.049	

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Peak Runoff CFS	Runoff Coeff
AWS	3.680	0.000	0.000	2.563	1.071	15.408	0.291
AWN2	3.680	0.000	0.000	1.681	1.956	78.197	0.532
AWN1	3.680	0.000	0.000	1.151	2.482	147.453	0.675
AE2	3.680	0.000	0.000	1.732	1.901	32.502	0.517
AE1	3.680	0.000	0.000	2.050	1.584	45.667	0.430
AE3	3.680	0.000	0.000	0.989	2.650	15.008	0.720
System	3.680	0.000	0.000	1.706	1.928	328.054	0.524

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
J1	JUNCTION	1.46	3.30	48.40	0 00:31	0	87
J2	JUNCTION	0.39	1.13	43.87	0 00:55	0	0
J3	JUNCTION	0.66	1.21	43.66	0 00:55	0	0
J6	JUNCTION	2.11	2.60	30.35	0 00:45	0	0
Out3	JUNCTION	0.59	4.00	18.00	0 00:42	0	3
Out2	JUNCTION	2.03	2.42	25.46	0 00:45	0	0
J7	JUNCTION	0.83	1.71	45.81	0 01:59	0	0
J8	JUNCTION	2.11	2.59	27.00	0 00:45	0	0
Out1	OUTFALL	0.66	1.21	42.21	0 00:55	0	0
Out4	OUTFALL	0.00	0.00	0.00	0 00:00	0	0
Out8	OUTFALL	2.03	2.42	24.89	0 00:45	0	0
Out9	OUTFALL	0.56	1.98	12.98	0 00:45	0	0

Node Flow Summary

	Maximum	Maximum		Maximum

Node	Type	Lateral Inflow CFS	Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Flooding Overflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min
J1	JUNCTION	225.65	225.65	0	00:45	184.14	0	00:45
J2	JUNCTION	15.41	15.41	0	00:55	0.00		
J3	JUNCTION	0.00	56.83	0	00:55	0.00		
J6	JUNCTION	107.50	107.50	0	00:45	0.00		
Out3	JUNCTION	45.67	45.67	0	00:45	6.76	0	00:45
Out2	JUNCTION	0.00	107.29	0	00:45	0.00		
J7	JUNCTION	0.00	44.88	0	01:59	0.00		
J8	JUNCTION	0.00	107.38	0	00:45	0.00		
Out1	OUTFALL	0.00	56.82	0	00:55	0.00		
Out4	OUTFALL	15.01	15.01	0	00:45	0.00		
Out8	OUTFALL	0.00	107.28	0	00:45	0.00		
Out9	OUTFALL	0.00	38.94	0	00:46	0.00		

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
Out1	80.44	29.81	56.82
Out4	69.85	2.49	15.01
Out8	99.89	80.92	107.28
Out9	79.20	11.43	38.94
System	82.35	124.65	210.43

****
Link Flow Summary
****

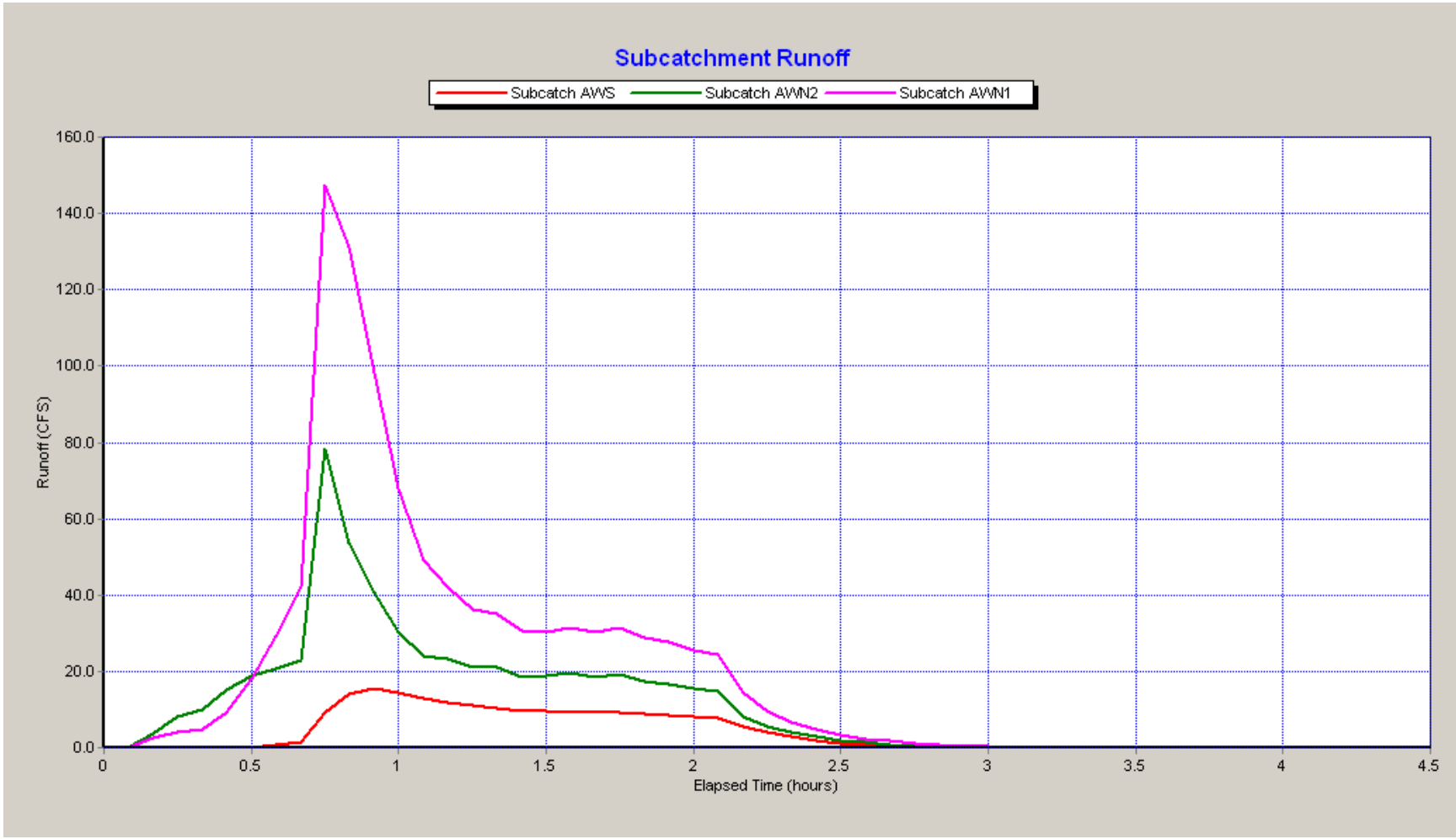
Link	Type	Maximum Flow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
C1	CONDUIT	44.88	0	01:59	10.00	1.08	0.85	0
C2	CONDUIT	15.40	0	00:55	8.38	0.62	0.57	0
C3	CONDUIT	56.82	0	00:55	9.66	0.26	0.61	0
C6	CONDUIT	107.38	0	00:45	14.18	0.90	0.74	0

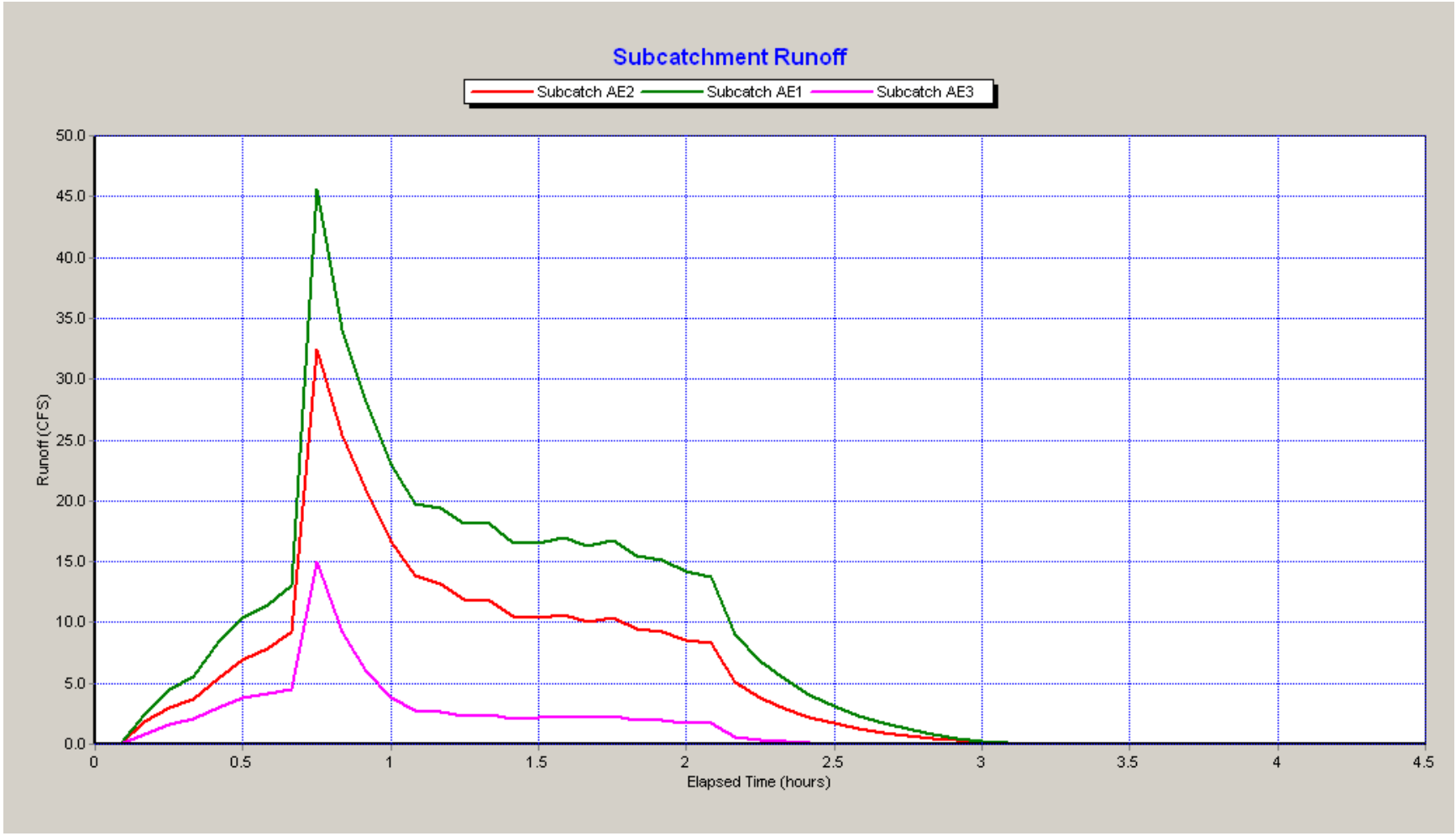
C7	CONDUIT	38.94	0	00:46	13.73	1.08	0.95	4
C8	CONDUIT	107.28	0	00:45	13.49	0.68	0.61	0
C9	CONDUIT	43.87	0	01:59	19.02	0.47	0.48	0
C10	CONDUIT	107.29	0	00:45	13.74	0.67	0.60	0

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 0.50 sec
Maximum Time Step : 0.50 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01

Analysis begun on: Fri Dec 04 15:52:48 2009
Analysis ended on: Fri Dec 04 15:52:48 2009
Total elapsed time: < 1 sec


Subcatchment Runoff
Subcatch AWS
Subcatch AWN2
Subcatch AWN1
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Runoff (CFS)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)


Subcatchment Runoff
Subcatch AE2
Subcatch AE1
Subcatch AE3
Runoff (CFS)
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45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Elapsed Time (hours)

Appendix F

Final Drainage Design

Gateway South

A proposed development of a Portion of the NW ¼, Section 8,
T. 13 N., R. 66 W., Laramie County, Wyoming.

Prepared for Gateway South, LLC

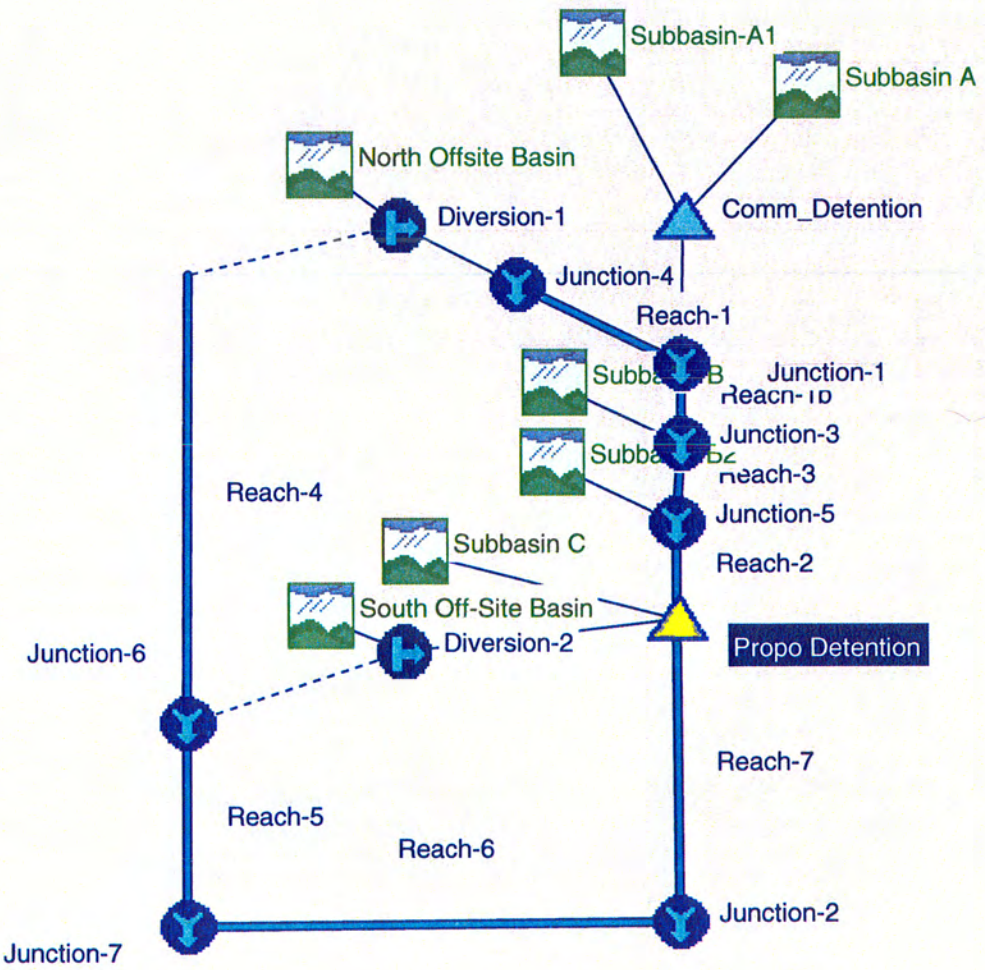
P.O. Box 1007, Cheyenne, Wyoming 82003

Prepared by Ayres Associates

214 W. Lincolway, Suite 22
Cheyenne, Wyoming 82001
307.634.9888
Fax 307.634.2353

February 17, 2009

AYRES ASSOCIATES


Subbasin-A1
Subbasin A
North Offsite Basin
Diversion-1
Comm_Detention
Junction-4
Reach-1
Junction-1
Junction-3
Reach-3
Junction-5
Reach-4
Subbasin C
Reach-2
South Off-Site Basin
Diversion-2
Propo Detention
Junction-6
Reach-7
Reach-5
Reach-6
Junction-2
Junction-7

HMS * Summary of Results for Subbasin A

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 46.846 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0144
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 1.950 (ac-ft)
Total Loss	: 0.87 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 2.81 (ac-ft)	Total Discharge	: 1.9504 (ac-ft)

HMS * Summary of Results for Subbasin-A1

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 46.846 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0144
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 1.950 (ac-ft)
Total Loss	: 0.87 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 2.81 (ac-ft)	Total Discharge	: 1.9504 (ac-ft)

HMS * Summary of Results for Comm_Detention

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Inflow	: 93.693 (cfs)	Date/Time of Peak Inflow	: 01 Jan 01 0144
Peak Outflow	: 18.925 (cfs)	Date/Time of Peak Outflow	: 01 Jan 01 0204
Total Inflow	: 3.9008 (ac-ft)	Peak Storage	: 1.7852(ac-ft)
Total Outflow	: 3.9011 (ac-ft)	Peak Elevation	: 6076.3(ft)

HMS * Summary of Results for North Offsite Basin

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 26.720 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0158
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 1.969 (ac-ft)
Total Loss	: 2.31 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 1.37 (ac-ft)	Total Discharge	: 1.9693 (ac-ft)

HMS * Summary of Results for Diversion-1

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Inflow	: 26.720 (cfs)	Date/Time of Peak Inflow	: 01 Jan 01 0158
Peak Outflow	: 19.292 (cfs)	Date/Time of Peak Outflow	: 01 Jan 01 0158
Peak Diversion	: 7.4275 (cfs)	Date/Time of Peak Diversion	: 01 Jan 01 0158
Total Inflow	: 1.9693 (ac-ft)		
Total Outflow	: 1.4219 (ac-ft)	Total Diversion	: 0.54743 (ac-ft)

HMS * Summary of Results for Subbasin B

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 21.532 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0144
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 0.9287 (ac-ft)
Total Loss	: 1.50 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 2.18 (ac-ft)	Total Discharge	: 0.92866 (ac-ft)

HMS * Summary of Results for Subbasin-B2

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 33.607 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0144
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 1.429 (ac-ft)
Total Loss	: 1.24 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 2.44 (ac-ft)	Total Discharge	: 1.4291 (ac-ft)

HMS * Summary of Results for Subbasin C

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 55.684 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0144
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 2.499 (ac-ft)
Total Loss	: 1.94 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 1.74 (ac-ft)	Total Discharge	: 2.4988 (ac-ft)

HMS * Summary of Results for South Off-Site Basin

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Discharge	: 61.842 (cfs)	Date/Time of Peak Discharge	: 01 Jan 01 0154
Total Precipitation	: 3.68 (ac-ft)	Total Direct Runoff	: 3.873 (ac-ft)
Total Loss	: 1.75 (ac-ft)	Total Baseflow	: 0.0 (ac-ft)
Total Excess	: 1.93 (ac-ft)	Total Discharge	: 3.8732 (ac-ft)

HMS * Summary of Results for Diversion-2

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Inflow	: 61.842 (cfs)	Date/Time of Peak Inflow	: 01 Jan 01 0154
Peak Outflow	: 37.405 (cfs)	Date/Time of Peak Outflow	: 01 Jan 01 0154
Peak Diversion	: 24.438 (cfs)	Date/Time of Peak Diversion	: 01 Jan 01 0154
Total Inflow	: 3.8732 (ac-ft)		
Total Outflow	: 2.3426 (ac-ft)	Total Diversion	: 1.5305 (ac-ft)

HMS * Summary of Results for Propo Detention

Project : County Run Name : Run 11

Start of Run	: 01Jan01 0100	Basin Model	: Gateway South
End of Run	: 02Jan01 0300	Met. Model	: Met 1
Execution Time	: 18Feb09 0844	Control Specs	: Control 1

Computed Results

Peak Inflow	: 152.39 (cfs)	Date/Time of Peak Inflow	: 01 Jan 01 0148
Peak Outflow	: 74.748 (cfs)	Date/Time of Peak Outflow	: 01 Jan 01 0214
Total Inflow	: 12.525 (ac-ft)	Peak Storage	: 3.0222(ac-ft)
Total Outflow	: 12.525 (ac-ft)	Peak Elevation	: 6040.0(ft)

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
POND-10	2.312	16	13.961	98	0 00:53	22.36
RD-70	2.568	9	21.933	76	0 00:53	101.42
South_Pond	72.443	37	180.237	91	0 01:40	74.65
North_Detention_Pond	26.930	30	80.376	90	0 01:05	29.04

100 YEAR

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume Mgal
OUTFALL	93.77	78.69	243.34	9.935
OUT-15	96.50	5.34	61.28	0.694
System	95.13	84.03	253.12	10.629

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
POND-10	1.218	9	10.785	75	0 00:57	13.33
RD-70	1.331	5	17.584	61	0 00:58	51.94
South_Pond	46.480	24	127.066	64	0 01:24	60.75
North_Detention_Pond	26.097	29	70.095	79	0 01:09	18.78

50 YEAR

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume Mgal
OUTFALL	92.05	53.22	165.64	6.597
OUT-15	95.00	3.86	47.48	0.493
System	93.53	57.08	174.15	7.090

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
POND-10	0.190	1	3.034	21	0 00:57	10.42
RD-70	0.020	0	0.385	1	0 00:56	9.57
South_Pond	25.146	13	78.427	40	0 01:27	35.28
North_Detention_Pond	13.220	15	39.460	44	0 01:19	10.31

10-YEAR

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume Mgal
OUTFALL	87.57	22.56	67.37	2.661
OUT-15	90.83	1.83	26.97	0.224
System	89.20	24.39	72.43	2.884

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
POND-10	0.038	0	0.570	4	0 00:51	6.70
RD-70	0.004	0	0.083	0	0 00:50	2.17
South_Pond	7.973	4	27.708	14	0 01:27	15.67
North_Detention_Pond	7.720	9	18.977	21	0 01:32	3.55

2 YEAR

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume Mgal
OUTFALL	84.18	9.95	22.15	1.128
OUT-15	86.67	0.81	13.94	0.095
System	85.43	10.76	24.75	1.223

Western
Civil Engineers Research & Development, Ltd. Land Surveyors

Subject: _____

Sheet No.:		
Project Title:		
Project No.:		
Calc. By:	Date:	Rev.:
Checked By:	Date:	

GATEWAY SOUTH STUDY
DEVELOPED CONDITION
OUTFLOW OF SOUTH POND
Q100 = 75 CFS
Q50 = 61 CFS
Q5 = ASSUME 26 CFS Q10 = 35 Q2 = 16