GODDARD SCHOOL 2ND ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS

October 6, 2009

UPDATED DRAINAGE PLAN

Prepared by Professional Engineering Consultants, P.A.

Professional **E**ngineering **C**onsultants, P.A.

October 6, 2009

City of Wichita
455 N. Main
Wichita, KS 67202

Attention: Scott Lindebak

Reference: Goddard Schools
PEC Project No. 35-07748-006-0259

Dear Mr. Lindebak:

Per your request, an updated drainage plan has been prepared for the Goddard School 2nd Addition property. This update incorporates all available as-built information for portions of the project that have been constructed, changes made to the plans through the course of the design, and changes made to the drainage plan to address flooding concerns on adjacent properties.

Major changes to the drainage model include the following:

- Addition of approximately 35 acres of drainage area to the west of 167th Street to both the existing and proposed models.
- Re-distribution of drainage areas to reflect the final site design.
- Incorporation of the private pond located north of the site into the HEC-HMS model.
- Curve number (CN) of 100 used for all pond areas.

Flooding concerns were identified at two locations adjacent to the site. These concerns included flooding around a private pond to the north of the site and flooding on properties in the Reese Farms subdivision near the outfall for Ponds 11A and 12A. The updated model was used to determine effective solutions to alleviate these concerns without causing flooding on the Goddard School property.

The private pond to the north of the site previously impounded water across the property line and backed water on to the Goddard School site. The revised drainage plan and site grading allow for the pond to back water on to an unused portion of the school's property in a more controlled manner. Previously planned discharge from the school site has been reduced by blocking one 48" culvert pipe that previously discharged runoff into this private pond. Drainage sub-basin boundaries have been relocated internally within the school site to cause more runoff attenuation within the system of detention ponds prior to discharge into the private pond. Consequently, the peak discharge from the site into the private pond has been reduced from pre-development conditions, and the peak water surface elevation of the pond is less than or equal to per-development levels for the 100-year design storm.

To address flooding concerns on the Reese Farms properties, the berms of the detention ponds at the eastern limit of the overall school property (Ponds 11A and 12A) were raised in elevation to provide additional storage for the 100-year design storm. The peak discharge from these ponds was modified to match the capacity of a downstream 30" culvert in the local subdivision.

The documentation to support the updated drainage plan is attached to this letter. Please do not hesitate to contact our office if you have any questions or require additional information.

Very truly yours,

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Amanda Bahrij, E.I.
Design Engineer

AKB:ama

Encl: As noted

cc: Joe Hickel, PEC (w/encl.)
Tom Montgomery, GLA (w/encl.)

Goddard School 2nd Addition
Existing Condition Model Input

Basin name	Tc (min)	Lag time (min)	Area (acres)	Area (mi^2)	CN	% Impervious	IA	Outfall
A	80.6	48.3	40.11	0.0627	74	0%	0.70	South
B	68.6	41.2	14.81	0.0231	74	0%	0.70	South
C	59.2	35.5	24.94	0.0390	74	0%	0.70	East
D	63.8	38.3	30.98	0.0484	76	7%	0.63	North
E	44.2	26.5	22.44	0.0351	74	0%	0.70	North
OS1	55.8	33.5	3.33	0.0052	76	8%	0.63	North
OS2	62.1	37.3	35.80	0.0559	75	5%	0.66	North
OS3	22.8	13.7	1.13	0.0018	74	0%	0.70	North
OS4	53.9	32.3	2.40	0.0038	74	0%	0.70	South
OS5	57.9	34.7	29.96	0.0468	74	0%	0.70	Reach E
OS6	32.6	19.6	6.55	0.0102	93	68%	0.14	North
			212.46					

Reach Name	Length (ft)	Slope	Manning's n	Shape	Side Slope	Outfall
Reach E	822	0.0097	0.033	Triangle	40	Reach OS2
Reach OS2	909	0.0055	0.033	Triangle	30	North

North Pond Stage/Storage	
Elevation (ft)	Acres
1419.15	3.79
1419.9	3.79
1419	3.79
1420	6.71
1421	10.10

North Pond Outfall Dimensions		
Outlet	Elevation (ft)	Length (ft)
North	1419.19	12
East	1420.30	230

Goddard School 2nd Addition
Proposed Condition Model Input

Basin name	Tc (min)	Lag time (min)	Area (acres)	Area (mi^2)	CN	% Impervious	IA	Outfall
1	15.0	9.0	5.77	0.0090	95	89%	0.10	Pond 11A
2	15.0	9.0	4.34	0.0068	95	86%	0.11	North
3	15.0	9.0	3.29	0.0051	87	56%	0.29	Pond 12A
4	45.1	27.1	11.52	0.0180	79	21%	0.52	South
5	15.0	9.0	2.09	0.0033	77	11%	0.61	South
6	62.8	37.7	5.10	0.0080	82	32%	0.44	Pond 6A
7	51.1	30.7	13.37	0.0209	85	45%	0.35	Pond 7B
8A	38.2	22.9	24.78	0.0387	85	47%	0.34	Pond 8A
8B	44.97	26.98	31.31	0.0489	87	53%	0.30	Pond 8B
9	41.36	24.82	1.67	0.0026	74	0%	0.70	South
10A	73.96	44.37	28.39	0.0444	74	0%	0.70	South
10B	72.02	43.21	12.45	0.0195	74	0%	0.70	South
11	50.99	30.60	2.66	0.0042	74	0%	0.70	East
11A	15.00	9.00	2.59	0.0040	86	57%	0.32	Pond 11A
12	25.03	15.02	2.25	0.0035	74	0%	0.70	East
12A	15.00	9.00	2.60	0.0041	87	62%	0.30	Pond 12A
13	15.00	9.00	0.69	0.0011	74	0%	0.70	North
14	30.04	18.02	1.13	0.0018	74	0%	0.70	Pond 8A
15	59.47	35.68	14.50	0.0227	90	66%	0.22	North
16	53.90	32.34	1.18	0.0018	74	0%	0.70	South
17	57.91	34.74	32.03	0.0500	74	0%	0.70	Pond 8A
18	52.63	31.58	2.28	0.0036	74	0%	0.70	Pond 8B
19	32.60	19.56	6.55	0.0102	93	68%	0.14	North
			212.53					

Goddard School 2nd Addition
Pond Outfall Dimensions

Pond	Pipe Diam. (in)	FL up	FL down	Length (ft)
4A	24	1423.26	1422.98	93
6A	15	1422.13	1421.84	109
7A	18	1421.08	1420.24	216
7B	24	1423.69	1423.52	117
8A	48 (x2)	1423.76	1423.05	88
	24	1423.05	1422.96	84
8B	48	1420.61	1420.23	93
	48	1421.10	1420.22	93
	24	1420.23	1419.93	88
11A	12	1420.86	1420.33	63
	15	1424.25	1420.33	48
12A	12	1419.42	1419.14	57

Goddard School 2nd Addition
Pond Stage-Storage Curves

Pond 4A

Elevation (ft)	Acres
1422.95	0
1423.26	0
1424	0.158
1425	0.94
1426	2.50
1427	4.63

Pond 6A

Elevation (ft)	Acres
1421.8	0
1422.13	0
1423	0.09
1424	0.43
1425	1.03
1426	1.45

Pond 7A

Elevation (ft)	Acres
1420.20	0
1421.08	0
1422	0.06
1423	0.32
1424	0.73
1425	1.00

Pond 7B

Elevation (ft)	Acres
1423.50	0
1423.69	0
1424	0.02
1425	0.25
1426	0.54
1427	0.76
1428	1.04

Pond 8A

Elevation (ft)	Acres
1422.90	0
1423.05	0
1424	0.09
1425	0.41
1426	1.00
1427	1.33
1427.5	1.47

Pond 8B

Elevation (ft)	Acres
1419.90	0
1420.23	0
1421	0.52
1422	1.91
1423	2.67
1424	3.11
1424.5	3.29

Pond 11A

Elevation (ft)	Acres
1420.33	0
1420.86	0
1421	0.0054
1422	0.384
1423	0.86
1424	1.15
1425	1.28
1426	1.37
1427	1.49

Pond 12A

Elevation (ft)	Acres
1419.14	0
1419.42	0
1420	0.076
1421	0.49
1422	0.85
1423	1.26
1424	1.52
1425	1.81
1426	2.44

North Pond

Elevation (ft)	Acres
1419.15	3.56
1419.19	3.56
1419	3.56
1420	5.74
1421	6.83

Goddard School 2nd Addition
Existing Conditions Drainage Summary

Basin	2 year Q (cfs)	5 year Q (cfs)	10 year Q (cfs)	25 year Q (cfs)	100 year Q (cfs)
A	19	32	43	54	80
B	8	13	17	22	32
C	15	24	33	41	60
D	21	33	43	54	77
E	15	26	34	44	64
OS1	3	4	5	6	9
OS2	24	38	50	63	90
OS3	1	2	2	3	4
OS4	2	3	3	4	6
OS5	18	30	40	50	73
OS6	13	17	20	24	30
East	15	24	33	41	60
North	85	135	177	222	319
North Pond	35	83	133	189	290
South	28	47	62	79	115

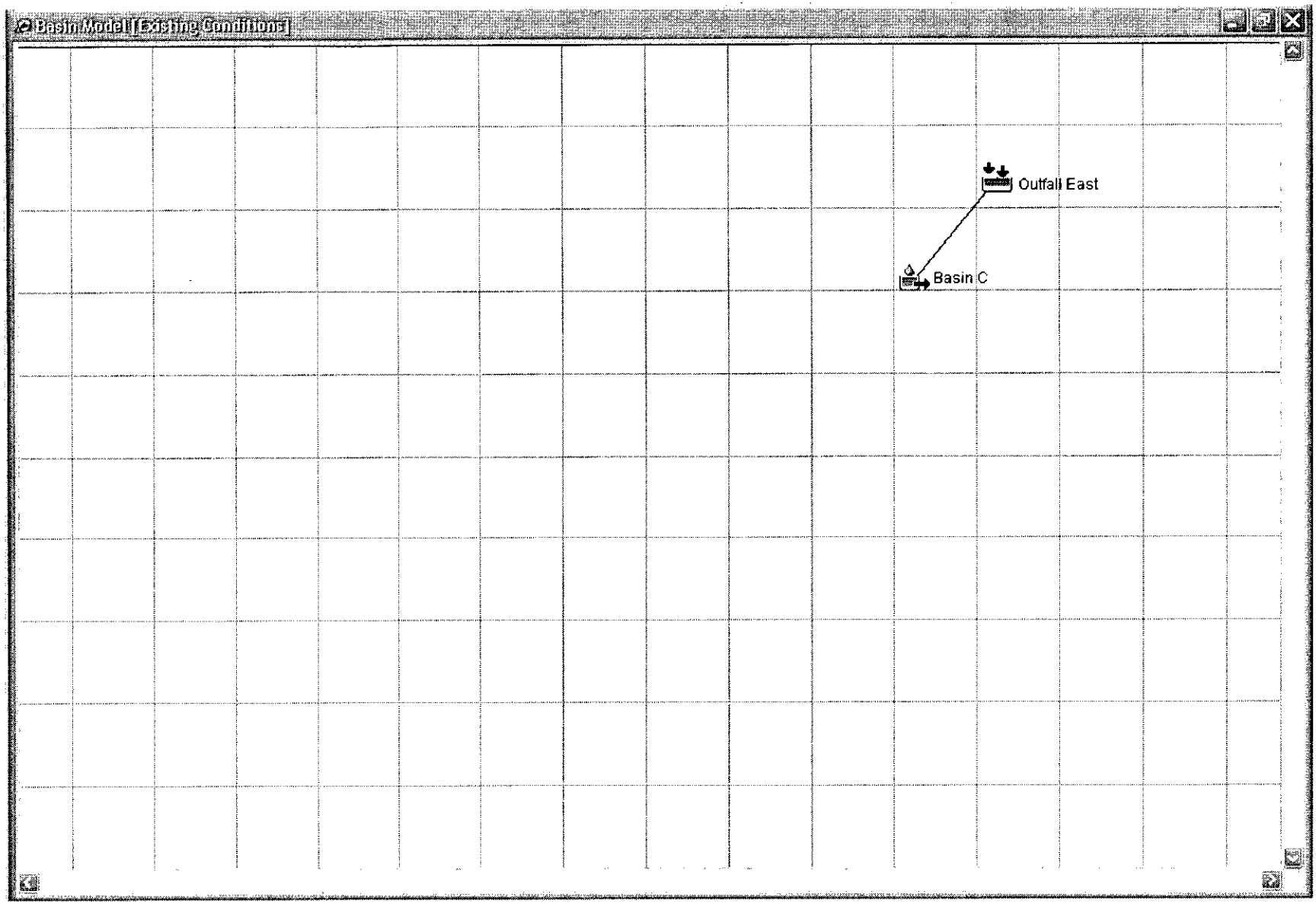
Goddard School 2nd Addition
Proposed Conditions Drainage Summary

Basin	2 year Q (cfs)	5 year Q (cfs)	10 year Q (cfs)	25 year Q (cfs)	100 year Q (cfs)
1	17	22	26	30	39
2	13	17	20	23	29
3	9	12	14	16	21
4	9	15	19	24	34
5	3	5	7	8	11
6	6	8	10	11	15
7	18	24	29	34	45
8A	41	55	67	78	103
8B	49	66	79	92	121
9	1	2	3	3	5
10A	6	11	14	18	58
10B	14	24	32	40	26
11A	7	9	11	13	16
11	2	3	4	5	7
12A	7	9	11	13	17
12	2	3	4	5	8
13	1	1	2	2.3	3
14	1	2	2	3	4
15	21	27	33	38	49
16	1	1	2	2	3
17	19	32	42	53	78
18	1	2	3	4	6
19	13	17	20	24	30
East	13	16	18	21	26
North	90	122	148	174	227
North Pond	72	113	141	168	220
South	30	48	61	76	108

Goddard School 2nd Addition
Pond Water Surface Elevation Summary

Existing	2 year WSE (ft)	5 year WSE (ft)	10 year WSE (ft)	25 year WSE (ft)	100 year WSE (ft)
North Pond	1420.2	1420.4	1420.5	1420.6	1420.8

Proposed	2 year WSE (ft)	5 year WSE (ft)	10 year WSE (ft)	25 year WSE (ft)	100 year WSE (ft)
Pond 4A	1424.7	1425.0	1425.2	1425.3	1425.6
Pond 6A	1423.4	1423.8	1424.1	1424.2	1424.6
Pond 7A	1423.5	1424.0	1424.4	1424.7	1425.4
Pond 7B	1425.9	1426.3	1426.6	1427	1427.6
Pond 8A	1425.5	1426.0	1426.3	1426.6	1427.3
Pond 8B	1422.9	1423.4	1423.7	1424.1	1424.9
Pond 11A	1423.3	1423.8	1424.1	1424.5	1425.0
Pond 12A	1422.5	1423.1	1423.5	1423.9	1424.7
North Pond	1420.4	1420.5	1420.5	1420.6	1420.7


Basin Model [Existing Conditions]
Outfall East
Basin C

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin C

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID	AB			
1. Surface description (Table 3-1)			Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)			0.17			
3. Flow length, L (total L < 300 ft.)	ft		300			
4. Two-yr 24-hr rainfall, P2	in		3.50			
5. Calculated Land slope, s	ft/ft		0.005			
5a. Land Elevation For Upper End Of Flow Path			1431.0			
5b. Land Elevation For Lower End Of Flow Path			1429.5			
6. Compute Tt	hr		0.72		=	0.72

Shallow concentrated flow

		Segment ID	BC			
7. Surface description (Paved or Unpaved)			unpaved			
8. Flow length, L	ft		1076.07			
9. Calculated Watercourse slope, s	ft/ft		0.010			
9a. Land Elevation For Upper End Of Flow Path			1429.5			
9b. Land Elevation For Lower End Of Flow Path			1418.5			
10. Average velocity, V (Figure 3-1)	ft/s		1.63			
11. Tt = L/3600V Compute Tt	hr		0.18		=	0.18

Channel Flow

		Segment ID	CD			
12. Cross sectional flow area, a	sf		4.00			
13. Wetted perimeter, Pw	ft		4			
14. Hydraulic radius, r = a/Pw Compute r	ft		1.000			
15. Channel slope, s	ft/ft		0.005			
16. Manning's roughness coeff., n			0.030			
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s		3.5			
18. Flow length, L	ft		1000			
19. Tt = L/3600V Compute Tt	hr		0.079		=	0.08
20. *Watershed or* subarea Tc or Tt (add Tt in steps 6,11, and 19)					**hr**	0.99

Use Time Of Concentration = **59 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin C
By	:	AKB
Date	:	09/30/09

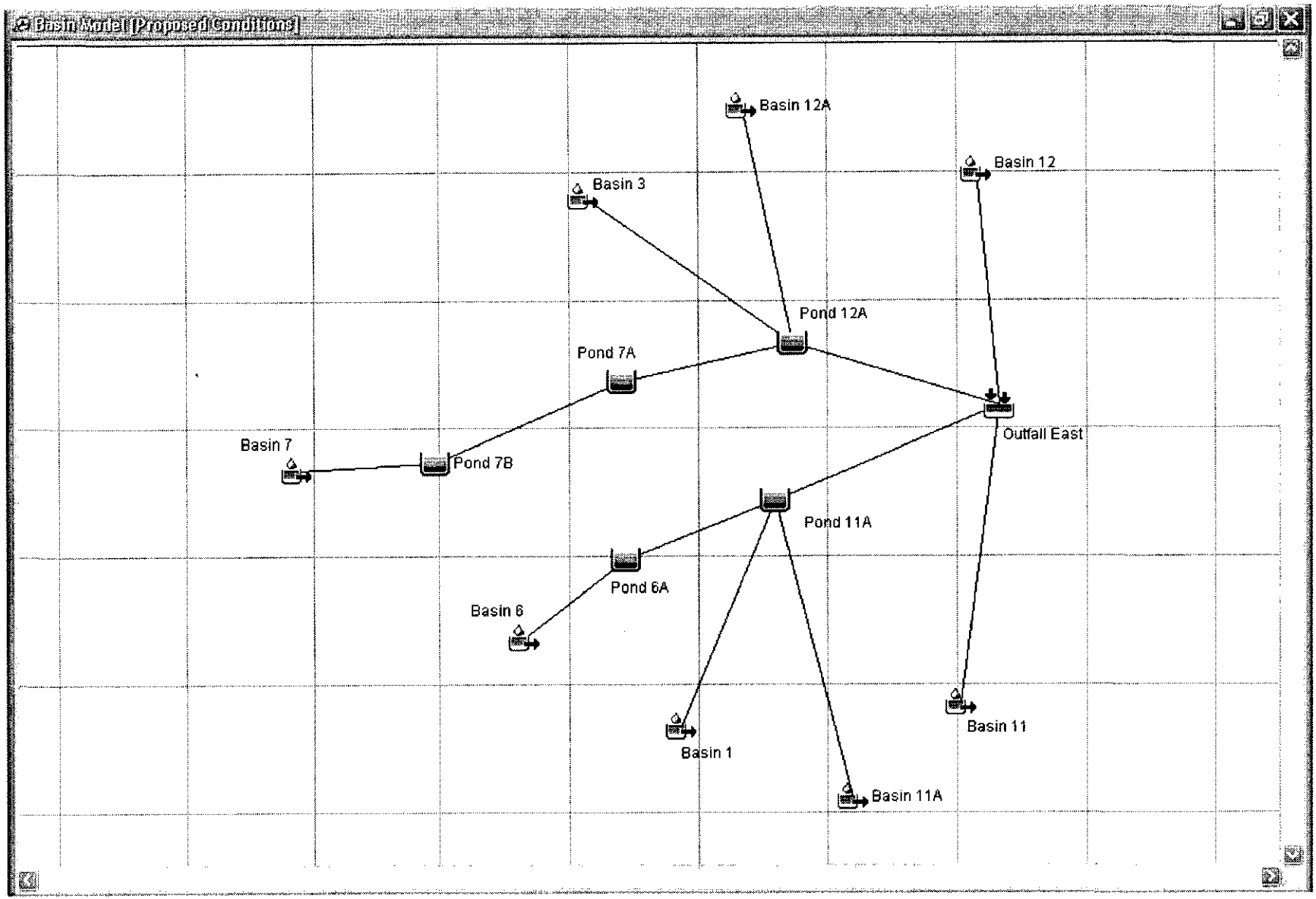
Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	24.94	1845.76
			24.94	1845.8

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986


Basin Model [Proposed Conditions]
Basin 12A
Basin 12
Basin 3
Pond 12A
Pond 7A
Outfall East
Basin 7
Pond 7B
Pond 11A
Pond 6A
Basin 6
Basin 11
Basin 1
Basin 11A

Time of Concentration (Tc) Worksheet

Project : *Goddard School 2nd Addition* **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 6

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
			AB		
1. Surface description (Table 3-1)			Dense grasses		
2. Mannings roughness coeff., n (Table 3-1)			0.24		
3. Flow length, L (total L < 300 ft.)	ft		300		
4. Two-yr 24-hr rainfall, P2	in		3.50		
5. Calculated Land slope, s	ft/ft		0.007		
5a. Land Elevation For Upper End Of Flow Path			1434.5		
5b. Land Elevation For Lower End Of Flow Path			1432.5		
6. Compute Tt	hr		0.85	=	0.85

Shallow concentrated flow

		Segment ID			
			BC		
7. Surface description (Paved or Unpaved)			paved		
8. Flow length, L	ft		1300		
9. Calculated Watercourse slope, s	ft/ft		0.008		
9a. Land Elevation For Upper End Of Flow Path			1432.5		
9b. Land Elevation For Lower End Of Flow Path			1422.2		
10. Average velocity, V (Figure 3-1)	ft/s		1.81		
11. Tt = L/3600V Compute Tt	hr		0.20	=	0.20

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	1.05

Use Time Of Concentration = **63 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 7

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
			AB		
1. Surface description (Table 3-1)			Dense grasses		
2. Mannings roughness coeff., n (Table 3-1)			0.24		
3. Flow length, L (total L < 300 ft.)	ft		300		
4. Two-yr 24-hr rainfall, P2	in		3.50		
5. Calculated Land slope, s	ft/ft		0.015		
5a. Land Elevation For Upper End Of Flow Path			1434.5		
5b. Land Elevation For Lower End Of Flow Path			1430.0		
6. Compute Tt	hr		0.61		= 0.61

Shallow concentrated flow

		Segment ID			
			BC		
7. Surface description (Paved or Unpaved)			unpaved		
8. Flow length, L	ft		1200		
9. Calculated Watercourse slope, s	ft/ft		0.008		
9a. Land Elevation For Upper End Of Flow Path			1430.0		
9b. Land Elevation For Lower End Of Flow Path			1420.9		
10. Average velocity, V (Figure 3-1)	ft/s		1.41		
11. Tt = L/3600V Compute Tt	hr		0.24		= 0.24

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr				= 0.00
20. Watershed or *subarea* Tc or Tt (add Tt in steps 6,11, and 19)					**hr** 0.85

Use Time Of Concentration = 51 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 11

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.007			
5a. Land Elevation For Upper End Of Flow Path		1430.0			
5b. Land Elevation For Lower End Of Flow Path		1428.0			
6. Compute Tt	hr	0.85		=	0.85

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.85

Use Time Of Concentration = **51 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 12

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	225			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.022			
5a. Land Elevation For Upper End Of Flow Path		1426.0			
5b. Land Elevation For Lower End Of Flow Path		1421.0			
6. Compute Tt	hr	0.42		=	0.42

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.42

Use Time Of Concentration = **25 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 1
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	0.61	45.14
C	Roads, pavement, roofs	98	5.16	505.68
			5.77	550.8

CN (weighted) = total product/total area	Use CN =	95

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 3
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	1.46	108.04
C	Roads, pavement, roofs	98	1.83	179.34
			3.29	287.4

CN (weighted) = total product/total *area*	Use CN =	87

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 6
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	3.45	255.40
C	Roads, pavement, roofs	98	0.87	85.09
C	Pond	100	0.78	77.62
			5.10	418.1

CN (weighted) = total product/total area	Use CN =	82

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 7
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	7.33	542.36
C	Roads, pavement, roofs	98	4.13	404.45
C	Pond	100	1.91	191.28
			13.37	1138.1

CN (weighted) = total product/total area	Use CN =	85

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 11A
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	1.11	81.81
C	Pond	95	1.49	141.16
			2.59	223.0

CN (weighted) = total product/total area **Use CN =** **86**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 11
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	2.66	197.00
			2.66	197.0

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for *Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 12A
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	0.97	72.01
C	Pond	95	1.63	154.91
			2.60	226.9

CN (weighted) = total product/total area	Use CN =	87

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 12
By	:	AKB
Date	:	10/05/09

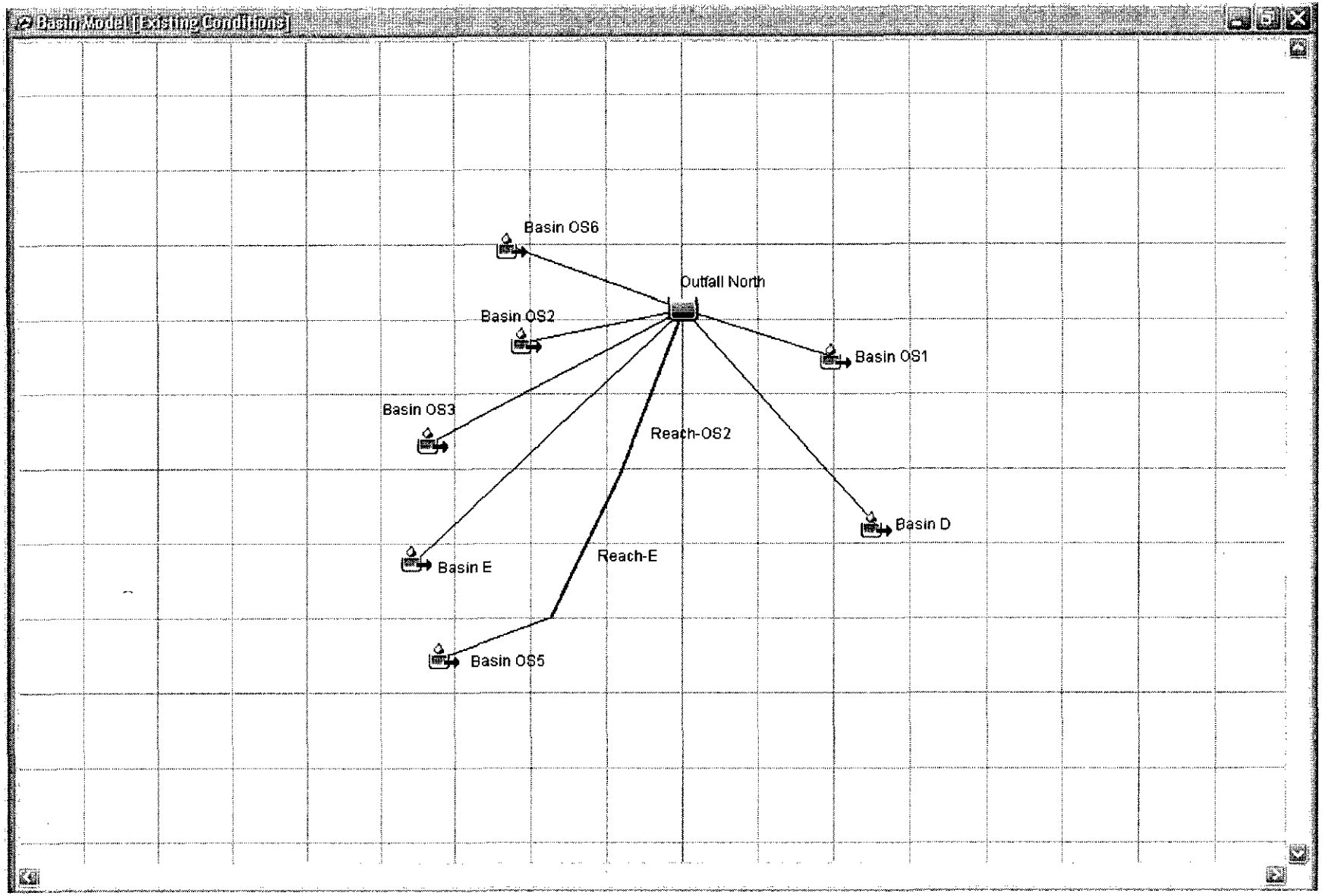
Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	2.25	166.46
			2.25	166.5

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986


Basin Model [Existing Conditions]
Basin OS6
Outfall North
Basin OS2
Basin OS1
Basin OS3
Reach-OS2
Basin D
Reach-E
Basin E
Basin OS5

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin D

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. *Flow length, L (total L < 300 ft.)*	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.003			
5a. Land Elevation For Upper End Of Flow Path		1433.0			
5b. Land Elevation For Lower End Of Flow Path		1432.0			
6. Compute Tt	hr	0.85		=	0.85

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	721.41			
9. Calculated Watercourse slope, s	ft/ft	0.007			
9a. Land Elevation For Upper End Of Flow Path		1432.0			
9b. Land Elevation For Lower End Of Flow Path		1427.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.34			
11. Tt = L/3600V Compute Tt	hr	0.15		=	0.15

Channel Flow

		Segment ID			
		CD			
12. Cross sectional flow area, a	sf	185.00			
13. *Wetted perimeter, Pw*	ft	148.02			
14. Hydraulic radius, r = a/Pw Compute r	ft	1.250			
15. Channel slope, s	ft/ft	0.008			
16. Manning's roughness coeff., n		0.030			
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s	5.2			
18. Flow length, L	ft	1170			
19. Tt = L/3600V Compute Tt	hr	0.063		=	0.06
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	1.06

Use Time Of Concentration = **64 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, *Soil Conservation Service*
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin E

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.008			
5a. Land Elevation For Upper End Of Flow Path		1436.0			
5b. Land Elevation For Lower End Of Flow Path		1433.8			
6. Compute Tt	hr	0.62		=	0.62

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	508.8			
9. Calculated Watercourse slope, s	ft/ft	0.008			
9a. Land Elevation For Upper End Of Flow Path		1433.8			
9b. Land Elevation For Lower End Of Flow Path		1429.5			
10. Average velocity, V (Figure 3-1)	ft/s	1.47			
11. Tt = L/3600V Compute Tt	hr	0.10		=	0.10

Channel Flow

		Segment ID			
		CD			
12. Cross sectional flow area, a	sf	436.50			
13. Wetted perimeter, Pw	ft	194.05			
14. Hydraulic radius, r = a/Pw Compute r	ft	2.249			
15. Channel slope, s	ft/ft	0.007			
16. Manning's roughness coeff., n		0.030			
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s	7.1			
18. Flow length, L	ft	667			
19. Tt = L/3600V Compute Tt	hr	0.026		=	0.03
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.74

Use Time Of Concentration = **44 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin OS1

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
1. Surface description (Table 3-1)		AB			
		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.007			
5a. Land Elevation For Upper End Of Flow Path		1435.0			
5b. Land Elevation For Lower End Of Flow Path		1433.0			
6. Compute Tt	hr	0.64		=	0.64

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)		BC			
		unpaved			
8. Flow length, L	ft	1373.85			
9. Calculated Watercourse slope, s	ft/ft	0.007			
9a. Land Elevation For Upper End Of Flow Path		1433.0			
9b. Land Elevation For Lower End Of Flow Path		1423.5			
10. Average velocity, V (Figure 3-1)	ft/s	1.34			
11. Tt = L/3600V Compute Tt	hr	0.28		=	0.28

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.93

Use Time Of Concentration = **56 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin OS2

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.004			
5a. Land Elevation For Upper End Of Flow Path		1437.3			
5b. Land Elevation For Lower End Of Flow Path		1436.1			
6. Compute Tt	hr	0.80		=	0.80

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	1109			
9. Calculated Watercourse slope, s	ft/ft	0.011			
9a. Land Elevation For Upper End Of Flow Path		1436.1			
9b. Land Elevation For Lower End Of Flow Path		1424.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.69			
11. Tt = L/3600V Compute Tt	hr	0.18		=	0.18

Channel Flow

		Segment ID			
		CD			
12. Cross sectional flow area, a	sf	185.00			
13. Wetted perimeter, Pw	ft	148.02			
14. Hydraulic radius, r = a/Pw Compute r	ft	1.250			
15. Channel slope, s	ft/ft	0.006			
16. Manning's roughness coeff., n		0.030			
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s	4.6			
18. Flow length, L	ft	792			
19. Tt = L/3600V Compute Tt	hr	0.048		=	0.05
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				hr	1.04

Use Time Of Concentration = **62 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin OS3

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	193			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.010			
5a. Land Elevation For Upper End Of Flow Path		1434.0			
5b. Land Elevation For Lower End Of Flow Path		1432.0			
6. Compute Tt	hr	0.38		=	0.38

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.38

Use Time Of Concentration = **23 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin OS5

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.007			
5a. Land Elevation For Upper End Of Flow Path		1447.0			
5b. Land Elevation For Lower End Of Flow Path		1445.0			
6. Compute Tt	hr	0.64		=	0.64

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	1512			
9. Calculated Watercourse slope, s	ft/ft	0.007			
9a. Land Elevation For Upper End Of Flow Path		1445.0			
9b. Land Elevation For Lower End Of Flow Path		1435.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.31			
11. Tt = L/3600V Compute Tt	hr	0.32		=	0.32

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				hr	0.97

Use Time Of Concentration = 58 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin OS6

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense Grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	298			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.020			
5a. Land Elevation For Upper End Of Flow Path		1425.0			
5b. Land Elevation For Lower End Of Flow Path		1419.0			
6. Compute Tt	hr	0.54		=	0.54

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.54

Use Time Of Concentration = **33 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin D
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	28.67	2121.61
C	Pond	100	2.31	231.40
			30.98	2353.0

CN (weighted) = total product/total area	Use CN =	76

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin E
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	22.44	1660.21
			22.44	1660.2

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project : Goddard School 2nd Addition
Project No. :
Location : Basin OS1
By : AKB
Date : 10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	3.06	226.21
C	Pond	100	0.28	27.76
			3.33	254.0

CN (weighted) = total product/total area **Use CN =** **76**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin OS2
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	34.15	2526.94
C	Pond	100	1.65	164.79
			35.80	2691.7

CN (weighted) = total product/total area	Use CN =	75

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project : Goddard School 2nd Addition
Project No. :
Location : Basin OS3
By : AKB
Date : 09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	1.13	83.48
			1.13	83.5

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin OS5
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	29.96	2217.28
			29.96	2217.3

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin OS6
By	:	AKB
Date	:	10/05/09

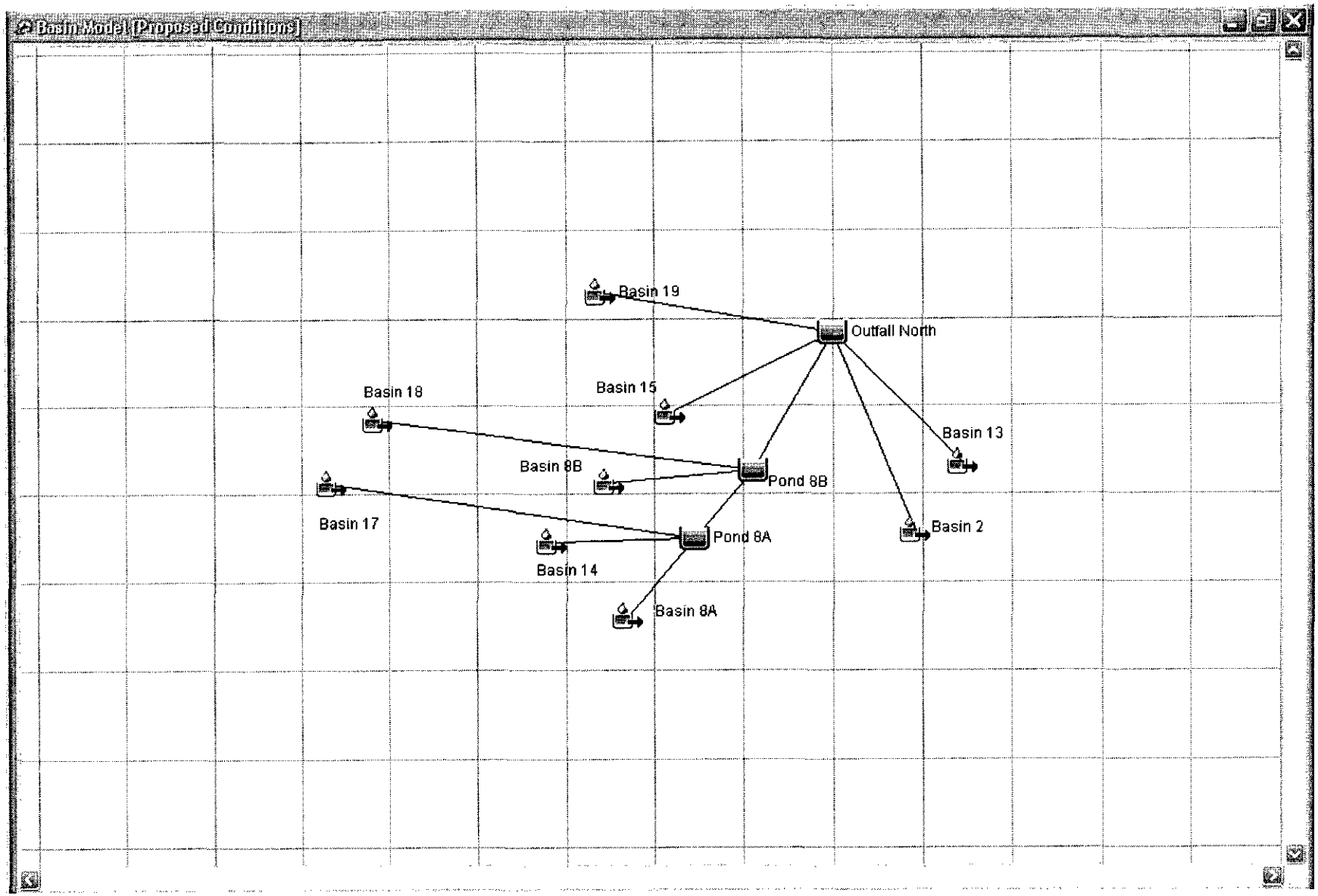
Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open Space Fair Condition	79	2.10	166.07
C	Pond	100	4.44	444.48
			6.55	610.5

CN (weighted) = total product/total area	Use CN =	93

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986


Basin Model [Proposed Conditions]
Basin 19
Outfall North
Basin 18
Basin 15
Basin 13
Basin 8B
Pond 8B
Basin 17
Pond 8A
Basin 2
Basin 14
Basin 8A

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 8A

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
			AB		
1. Surface description (Table 3-1)			Dense grasses		
2. Mannings roughness coeff., n (Table 3-1)			0.24		
3. Flow length, L (total L < 300 ft.)	ft		235		
4. Two-yr 24-hr rainfall, P2	in		3.50		
5. Calculated Land slope, s	ft/ft		0.017		
5a. Land Elevation For Upper End Of Flow Path			1436.5		
5b. Land Elevation For Lower End Of Flow Path			1432.5		
6. Compute Tt	hr		0.48	=	0.48

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s		2.0		
18. Flow length, L	ft		1122		
19. Tt = L/3600V Compute Tt	hr		0.156	=	0.16
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				hr	0.64

Use Time Of Concentration = 38 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 8B

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.013			
5a. Land Elevation For Upper End Of Flow Path		1433.5			
5b. Land Elevation For Lower End Of Flow Path		1429.5			
6. Compute Tt	hr	0.64		=	0.64

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	160			
9. Calculated Watercourse slope, s	ft/ft	0.009			
9a. Land Elevation For Upper End Of Flow Path		1429.5			
9b. Land Elevation For Lower End Of Flow Path		1428.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.56			
11. Tt = L/3600V Compute Tt	hr	0.03		=	0.03

Channel Flow

		Segment ID			
		CD			
12. Cross sectional flow area, a	sf	60.00			
13. Wetted perimeter, Pw	ft	60.13			
14. Hydraulic radius, r = a/Pw Compute r	ft	0.998			
15. Channel slope, s	ft/ft	0.006			
16. Manning's roughness coeff., n		0.030			
17 V = 1.49(r^0.667)(s^0.50)/n *Compute V*	ft/s	3.9			
18. Flow length, L	ft	1091			
19. Tt = L/3600V Compute Tt	hr	0.077		=	0.08
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				hr	0.75

Use Time Of Concentration = 45 Minutes

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 14

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		*Dense Grasses*			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	193			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.010			
5a. Land Elevation For Upper End Of Flow Path		1434.0			
5b. Land Elevation For Lower End Of Flow Path		1432.0			
6. Compute Tt	hr	0.50		=	0.50

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. *Tt = L/3600V* Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 *V = 1.49(r^0.667)(s^0.50)/n Compute V*	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add **Tt** in steps 6,11, and 19)				**hr**	0.50

Use Time Of Concentration = 30 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 15

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense Grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.007			
5a. Land Elevation For Upper End Of Flow Path		1434.0			
5b. Land Elevation For Lower End Of Flow Path		1432.0			
6. Compute Tt	hr	0.85		=	0.85

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	762			
9. Calculated Watercourse slope, s	ft/ft	0.014			
9a. Land Elevation For Upper End Of Flow Path		1432.0			
9b. Land Elevation For Lower End Of Flow Path		1421.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.94			
11. Tt = L/3600V Compute Tt	hr	0.11		=	0.11

Channel Flow

		Segment ID			
		CD			
12. Cross sectional flow area, a	sf	185.00			
13. Wetted perimeter, Pw	ft	148.02			
14. Hydraulic radius, r = a/Pw Compute r	ft	1.250			
15. Channel slope, s	ft/ft	0.008			
16. Manning's roughness coeff., n		0.030			
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s	5.2			
18. Flow length, L	ft	595			
19. Tt = L/3600V Compute Tt	hr	0.032		=	0.03
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				hr	0.99

Use Time Of Concentration = 59 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 10/5/2009
Project No: **Checked:** **Date:**
Location : Basin 17

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.007			
5a. Land Elevation For Upper End Of Flow Path		1447.0			
5b. Land Elevation For Lower End Of Flow Path		1445.0			
6. Compute Tt	hr	0.64		=	0.64

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	1512			
9. Calculated Watercourse slope, s	ft/ft	0.007			
9a. Land Elevation For Upper End Of Flow Path		1445.0			
9b. Land Elevation For Lower End Of Flow Path		1435.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.31			
11. Tt = L/3600V Compute Tt	hr	0.32		=	0.32

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.97

Use Time Of Concentration = 58 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 10/5/2009
Project No: **Checked:** **Date:**
Location : Basin18

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.004			
5a. Land Elevation For Upper End Of Flow Path		1438.0			
5b. Land Elevation For Lower End Of Flow Path		1436.8			
6. Compute Tt	hr	0.78		=	0.78

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	449			
9. Calculated Watercourse slope, s	ft/ft	0.006			
9a. Land Elevation For Upper End Of Flow Path		1436.8			
9b. Land Elevation For Lower End Of Flow Path		1434.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.26			
11. Tt = L/3600V Compute Tt	hr	0.10		=	0.10

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.88

Use Time Of Concentration = 53 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 10/5/2009
Project No: **Checked:** **Date:**
Location : Basin 19

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
1. Surface description (Table 3-1)		Dense Grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	298			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.020			
5a. Land Elevation For Upper End Of Flow Path		1425.0			
5b. Land Elevation For Lower End Of Flow Path		1419.0			
6. Compute Tt	hr	0.54		=	0.54

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.54

Use Time Of Concentration = 33 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 2
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	0.59	43.66
C	Roads, pavement, roofs	98	3.75	367.50
			4.34	411.2

CN (weighted) = total product/total area	Use CN =	95

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 8A
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	13.22	978.27
C	Roads, pavement, roofs	98	10.14	993.60
C	Pond	100	1.42	142.33
			24.78	2114.2

CN (weighted) = total product/total area	Use CN =	85

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 8B
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	14.72	1089.28
C	Roads, pavement, roofs	98	12.53	1227.94
C	Pond	100	4.06	406.00
			31.31	2723.2

CN (weighted) = total product/total area	Use CN =	87

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 13
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	0.69	51.06
			0.69	51.1

CN (weighted) = total product/total area	Use CN =	74

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 14
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	1.13	83.48
			1.13	83.5

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 15
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	4.98	368.71
C	Roads, pavement, roofs	98	7.77	761.39
C	Pond	100	1.75	174.79
			14.50	1304.9

CN (weighted) = total product/total area	Use CN =	90

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 17
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	32.03	2369.89
			32.03	2369.9

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 18
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	2.28	168.58
			2.28	168.6

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 19
By	:	AKB
Date	:	10/05/09

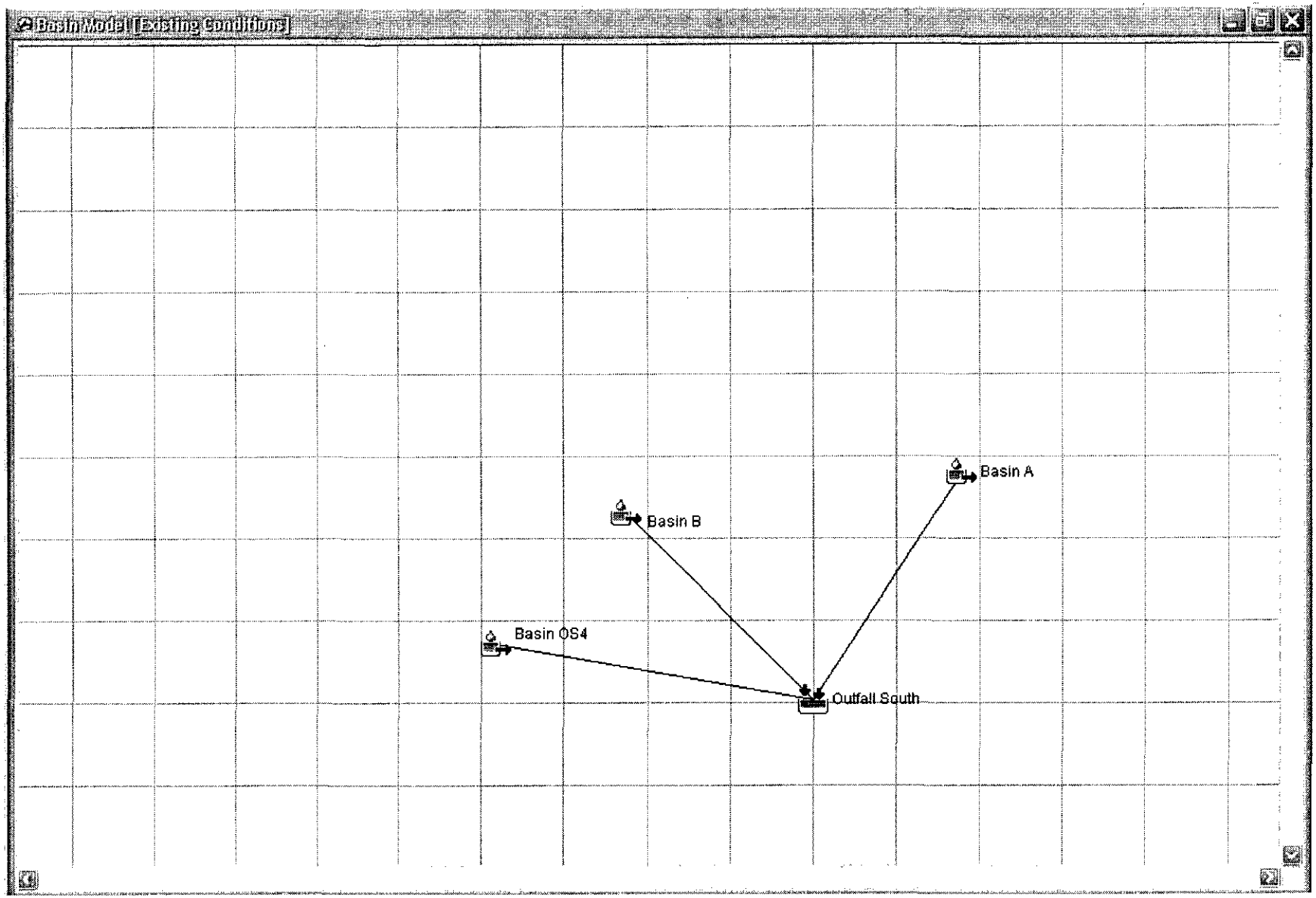
Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open Space Fair Condition	79	2.08	164.48
C	Pond	100	4.46	446.49
			6.55	611.0

CN (weighted) = total product/total area **Use CN =** **93**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986


Basin Model [Existing Conditions]
Basin A
Basin B
Basin OS4
Outfall South

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin A

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.002			
5a. Land Elevation For Upper End Of Flow Path		1431.2			
5b. Land Elevation For Lower End Of Flow Path		1430.7			
6. Compute Tt	hr	1.12		=	1.12

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	940.06			
9. Calculated Watercourse slope, s	ft/ft	0.009			
9a. Land Elevation For Upper End Of Flow Path		1430.7			
9b. Land Elevation For Lower End Of Flow Path		1422.5			
10. Average velocity, V (Figure 3-1)	ft/s	1.51			
11. Tt = L/3600V Compute Tt	hr	0.17		=	0.17

Channel Flow

		Segment ID			
		CD			
12. Cross sectional flow area, a	sf	346.50			
13. Wetted perimeter, Pw	ft	264.2			
14. Hydraulic radius, r = a/Pw Compute r	ft	1.312			
15. Channel slope, s	ft/ft	0.009			
16. Manning's roughness coeff., n		0.030			
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s	5.6			
18. Flow length, L	ft	939.52			
19. Tt = L/3600V Compute Tt	hr	0.046		=	0.05
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				hr	1.34

Use Time Of Concentration = **81 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin B

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
1. Surface description (Table 3-1)		AB			
		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.007			
5a. Land Elevation For Upper End Of Flow Path		1436.0			
5b. Land Elevation For Lower End Of Flow Path		1433.9			
6. Compute Tt	hr	0.63		=	0.63

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)		BC			
		unpaved			
8. Flow length, L	ft	1481.52			
9. Calculated Watercourse slope, s	ft/ft	0.002			
9a. Land Elevation For Upper End Of Flow Path		1433.9			
9b. Land Elevation For Lower End Of Flow Path		1430.3			
10. Average velocity, V (Figure 3-1)	ft/s	0.80			
11. Tt = L/3600V Compute Tt	hr	0.52		=	0.52

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	1.14

Use Time Of Concentration = **69 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin OS4

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
1. Surface description (Table 3-1)		AB			
		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.004			
5a. Land Elevation For Upper End Of Flow Path		1444.0			
5b. Land Elevation For Lower End Of Flow Path		1442.8			
6. Compute Tt	hr	0.79		=	0.79

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)		BC			
		unpaved			
8. Flow length, L	ft	608			
9. Calculated Watercourse slope, s	ft/ft	0.010			
9a. Land Elevation For Upper End Of Flow Path		1442.8			
9b. Land Elevation For Lower End Of Flow Path		1437.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.58			
11. Tt = L/3600V Compute Tt	hr	0.11		=	0.11

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.90

Use Time Of Concentration = **54 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin A
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	40.11	2968.34
			40.11	2968.3

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin B
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	14.81	1096.02
			14.81	1096.0

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project : Goddard School 2nd Addition
Project No. :
Location : Basin OS4
By : AKB
Date : 09/30/09

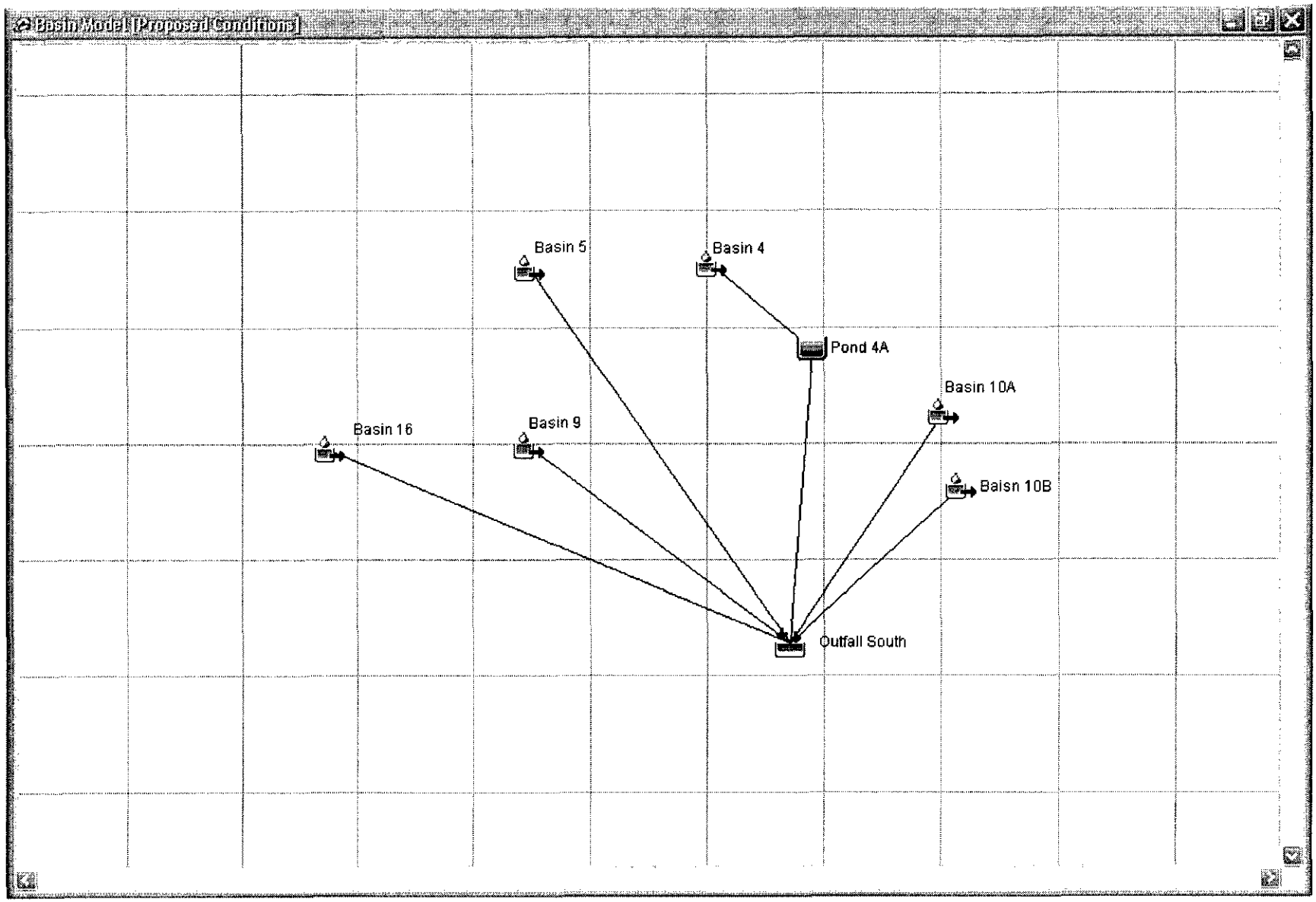
Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	2.40	177.85
			2.40	177.8

CN (weighted) = total product/total area	Use CN =	74

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986


Basin Model [Proposed Conditions]
Basin 5
Basin 4
Pond 4A
Basin 10A
Basin 16
Basin 9
Baisn 10B
Outfall South

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 4

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.010			
5a. Land Elevation For Upper End Of Flow Path		1429.0			
5b. Land Elevation For Lower End Of Flow Path		1426.0			
6. Compute Tt	hr	0.72		=	0.72

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	200			
9. Calculated Watercourse slope, s	ft/ft	0.014			
9a. Land Elevation For Upper End Of Flow Path		1426.0			
9b. Land Elevation For Lower End Of Flow Path		1423.3			
10. Average velocity, V (Figure 3-1)	ft/s	1.87			
11. Tt = L/3600V Compute Tt	hr	0.03		=	0.03

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.75

Use Time Of Concentration = 45 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 9

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Dense grasses			
2. Mannings roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L < 300 ft.)	ft	200			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.005			
5a. Land Elevation For Upper End Of Flow Path		1434.0			
5b. Land Elevation For Lower End Of Flow Path		1433.0			
6. Compute Tt	hr	0.69		=	0.69

Shallow concentrated flow

		Segment ID			
7. Surface description (Paved or Unpaved)					
8. Flow length, L	ft				
9. Calculated Watercourse slope, s	ft/ft				
9a. Land Elevation For Upper End Of Flow Path					
9b. Land Elevation For Lower End Of Flow Path					
10. Average velocity, V (Figure 3-1)	ft/s				
11. Tt = L/3600V Compute Tt	hr			=	0.00

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.69

Use Time Of Concentration = **41 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 10A

Circle One: Present | Developed

Circle One: Tc | Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
			AB		
1. Surface description (Table 3-1)			Dense grasses		
2. Mannings roughness coeff., n (Table 3-1)			0.24		
3. Flow length, L (total L < 300 ft.)	ft		300		
4. Two-yr 24-hr rainfall, P2	in		3.50		
5. Calculated Land slope, s	ft/ft		0.005		
5a. Land Elevation For Upper End Of Flow Path			1430.5		
5b. Land Elevation For Lower End Of Flow Path			1429.0		
6. Compute Tt	hr		0.95	=	0.95

Shallow concentrated flow

		Segment ID			
			BC		
7. Surface description (Paved or Unpaved)			unpaved		
8. Flow length, L	ft		1000		
9. Calculated Watercourse slope, s	ft/ft		0.005		
9a. Land Elevation For Upper End Of Flow Path			1429.0		
9b. Land Elevation For Lower End Of Flow Path			1424.0		
10. Average velocity, V (Figure 3-1)	ft/s		1.14		
11. Tt = L/3600V Compute Tt	hr		0.24	=	0.24

Channel Flow

		Segment ID			
			CD		
12. Cross sectional flow area, a	sf		346.50		
13. Wetted perimeter, Pw	ft		264.2		
14. Hydraulic radius, r = a/Pw Compute r	ft		1.312		
15. Channel slope, s	ft/ft		0.011		
16. Manning's roughness coeff., n			0.030		
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s		6.2		
18. Flow length, L	ft		800		
19. Tt = L/3600V Compute Tt	hr		0.036	=	0.04
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	1.23

Use Time Of Concentration = **74 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 9/30/2009
Project No: **Checked:** **Date:**
Location : Basin 10B

Circle One: Present [Developed]

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
			AB		
1. Surface description (Table 3-1)			Dense grasses		
2. Mannings roughness coeff., n (Table 3-1)			0.24		
3. Flow length, L (total L < 300 ft.)	ft		300		
4. Two-yr 24-hr rainfall, P2	in		3.50		
5. Calculated Land slope, s	ft/ft		0.004		
5a. Land Elevation For Upper End Of Flow Path			1429.0		
5b. Land Elevation For Lower End Of Flow Path			1427.9		
6. Compute Tt	hr		1.08	=	1.08

Shallow concentrated flow

		Segment ID			
			BC		
7. Surface description (Paved or Unpaved)			unpaved		
8. Flow length, L	ft		600		
9. Calculated Watercourse slope, s	ft/ft		0.012		
9a. Land Elevation For Upper End Of Flow Path			1427.9		
9b. Land Elevation For Lower End Of Flow Path			1421.0		
10. Average velocity, V (Figure 3-1)	ft/s		1.73		
11. Tt = L/3600V Compute Tt	hr		0.10	=	0.10

Channel Flow

		Segment ID			
			CD		
12. Cross sectional flow area, a	sf		346.50		
13. Wetted perimeter, Pw	ft		264.2		
14. Hydraulic radius, r = a/Pw Compute r	ft		1.312		
15. Channel slope, s	ft/ft		0.011		
16. Manning's roughness coeff., n			0.030		
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s		6.2		
18. Flow length, L	ft		550		
19. Tt = L/3600V Compute Tt	hr		0.024	=	0.02
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	1.20

Use Time Of Concentration = **72 Minutes**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Time of Concentration (Tc) Worksheet

Project : Goddard School 2nd Addition **By:** AKB **Date:** 10/5/2009
Project No: **Checked:** **Date:**
Location : Basin 16

Circle One: [Present] Developed

Circle One: [Tc] Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

		Segment ID			
		AB			
1. Surface description (Table 3-1)		Cultivated, >20% cover			
2. Mannings roughness coeff., n (Table 3-1)		0.17			
3. Flow length, L (total L < 300 ft.)	ft	300			
4. Two-yr 24-hr rainfall, P2	in	3.50			
5. Calculated Land slope, s	ft/ft	0.004			
5a. Land Elevation For Upper End Of Flow Path		1444.0			
5b. Land Elevation For Lower End Of Flow Path		1442.8			
6. Compute Tt	hr	0.79		=	0.79

Shallow concentrated flow

		Segment ID			
		BC			
7. Surface description (Paved or Unpaved)		unpaved			
8. Flow length, L	ft	608			
9. Calculated Watercourse slope, s	ft/ft	0.010			
9a. Land Elevation For Upper End Of Flow Path		1442.8			
9b. Land Elevation For Lower End Of Flow Path		1437.0			
10. Average velocity, V (Figure 3-1)	ft/s	1.58			
11. Tt = L/3600V Compute Tt	hr	0.11		=	0.11

Channel Flow

		Segment ID			
12. Cross sectional flow area, a	sf				
13. Wetted perimeter, Pw	ft				
14. Hydraulic radius, r = a/Pw Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17 V = 1.49(r^0.667)(s^0.50)/n Compute V	ft/s				
18. Flow length, L	ft				
19. Tt = L/3600V Compute Tt	hr			=	0.00
20. Watershed or subarea Tc or Tt (add Tt in steps 6,11, and 19)				**hr**	0.90

Use Time Of Concentration = 54 Minutes

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 4
By	:	AKB
Date	:	10/05/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	9.13	675.51
C	Roads, pavement, roofs	98	0.74	72.31
C	Pond	100	1.66	165.84
			11.52	913.7

CN (weighted) = total product/total area	Use CN =	79

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 5
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	1.86	137.82
C	Roads, pavement, roofs	98	0.23	22.22
			2.09	160.0

CN (weighted) = total product/total area	Use CN =	77

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 9
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	1.67	123.58
			1.67	123.6

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 10A
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	28.39	2100.86
C				
			28.39	2100.9

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 10B
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Open space, good condition	74	12.45	921.30
C				
			12.45	921.3

CN (weighted) = total product/total area **Use CN =** **74**

Reference: Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Numbers and Runoff Worksheet

Project	:	Goddard School 2nd Addition
Project No.	:	
Location	:	Basin 16
By	:	AKB
Date	:	09/30/09

Select one: Present Developed

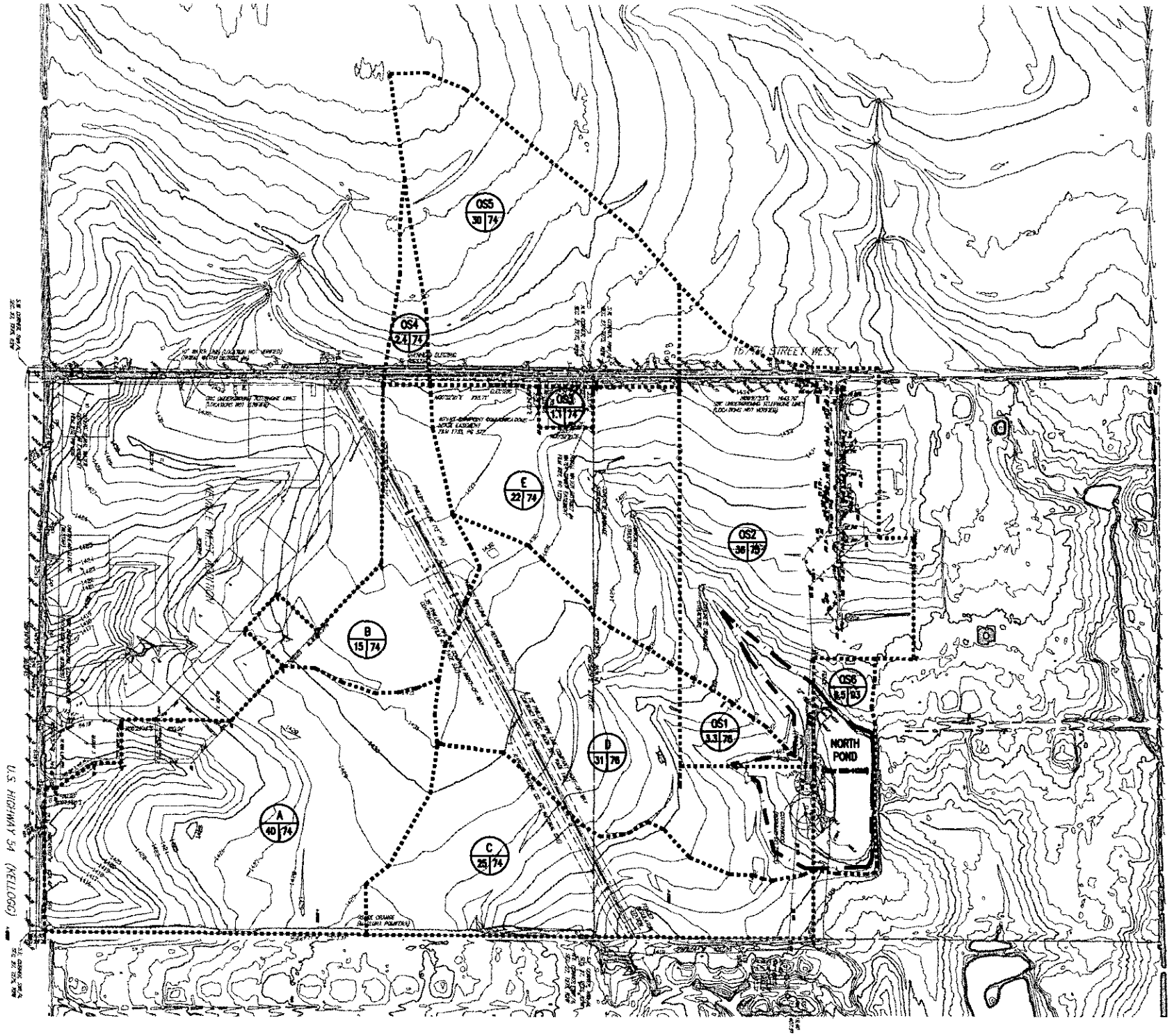
Runoff Curve Number

Hyd. Soil Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN TBL 2.2	Area acres	Product of C x area
C	Pasture, grassland, range Good condition	74	1.18	87.25
			1.18	87.2

CN (weighted) = total product/total area **Use CN =** **74**

Reference:

Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986



SCALE:

0 300 600

LEGEND

DRAINAGE BASIN BOUNDARY

100-YR WATER SURFACE ELEVATION (WSE)

BASIN NAME

A

5.2 | 85

BASIN AREA (ACRES) RUNOFF COEFFECIENT (CN)

BENCHMARKS

BENCH MARK: CHISELED " o " ON WEST END OF WATER TOWER BASE, 100' S. AND 130' E. OF THE WEST QUARTER CORNER, SEC. 27, T27S, R2W. ELEV. = 1433.38 (M.S.L.)

BENCH MARK: RAB BRASS DISK SET IN CONCRETE, 10' W. AND 1008' N. OF THE N.E. CORNER, SW1/4, SEC. 27, T27S, R2W. ELEV. = 1418.67 (M.S.L.)

BENCH MARK: RAB BRASS DISK SET IN CONCRETE, 658' W. AND 83' N. OF THE S.E. CORNER, SW1/4, SEC. 27, T27S, R2W. ELEV. = 1418.58 (M.S.L.)

DATE OF TOPOGRAPHIC SURVEY: 10-15-04
RUGGLES & BOHM P.A.

BOUNDARY INFORMATION BY: SAVOY COMPANY

No.	Revision	By	Date

GODDARD SCHOOL 2ND ADDITION

EXISTING SITE CONDITIONS

WICHITA, SEDGWICK COUNTY, KANSAS

Professional Engineering Consultants, P.A.
303 S. TOPEKA • WICHITA, KANSAS 67202
316-262-2691 • FAX 316-262-8003

Designed by	AKB	Job No.	35-07748-0259
Drawn by	AKB	Date	10/06/2009

Sheet

of

Saved 10-06-2009 11:22:20 AM by AKB
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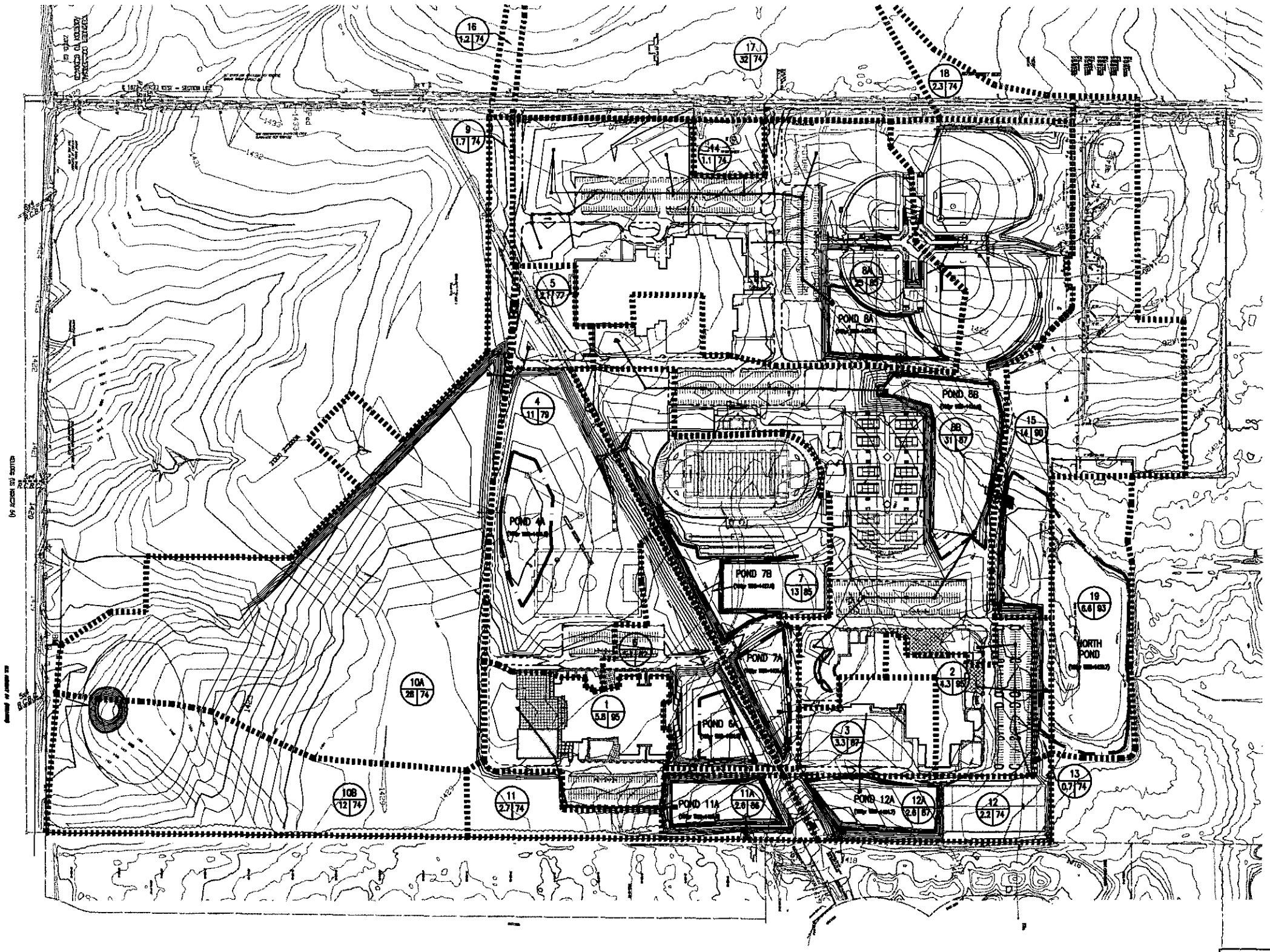
G:\2007\07748\Drainage\Existing Conditions_Final



SCALE:
0 200 400

LEGEND

DRAINAGE BASIN BOUNDARY

100-YR WATER SURFACE ELEVATION (WSE)

BASIN NAME

A
5.2 95

BASIN AREA (ACRES)

RUNOFF COEFFECIENT (CN)

No.	Revision	By	Date

GODDARD SCHOOL 2ND ADDITION

PROPOSED SITE CONDITIONS

WICHITA, SEDGWICK COUNTY, KANSAS

Professional Engineering Consultants, P.A.
303 S. TOPEKA • WICHITA, KANSAS 67202
316-262-2691 • FAX 316-262-3003

Designed by	AKB	Job No.	35-07748-0259	Sht.	of
Drawn by	AKB	Date	10/06/2009		

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Plot Scale 1:414.4102 10-06-2009 10:01:56 AM by AKB
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