PART III

SAMPLE PLAN DEVELOPMENT

In this section, all of the previous information is put into use to develop an erosion and sediment control plan for a hypothetical housing project* located in the Williamsburg area. The erosion and sediment control plan for this project was developed according to the step-by-step procedure outlined in Part II. It has been updated to meet the current requirements and minimum standards.

For educational purposes, each step is discussed separately with corresponding maps to illustrate what was done. The actual plan consists of only the four maps, the detail drawings, and the narrative. Actually, maps 1-3 could have been consolidated into one map incorporating existing site conditions, analysis, and the site plan. The site planner should choose the best method of presenting the information. However, local plan approving authorities may require additional drawings or information concerning projects in their jurisdiction.

* Note: The sample plan contained in this section is for educational purposes only. Accordingly, only a sample of the necessary information is included here. If this were an actual plan, additional information would be required.

STEP 1 - DATA COLLECTION

(See Map #1, Plate 6-1.)

Topographic Information

Topographic information was obtained by an aerial survey and is shown on the map at a scale of 1":40' with 5-foot contours.

Drainage Patterns

From on-site inspections and by studying the topographic map, the site was divided into three watersheds, each drained by a distinct swale as shown on map #2.

Soils

Soils information was obtained from the Soil Survey of James City County and the City of Williamsburg. Soil boundaries are shown on the map and each soil type is identified by a symbol.

Ground Cover

An on-site inspection was made to determine the existing vegetation. The site is located in an urban developed area and is heavily wooded. There are areas of hardwood tree growth on the north, east, and west sides of the site. Tree lines are shown on the topo map along with the type of cover on the rest of the site.

Adjacent Property
Center Street borders the property on the west. On the north, there is a two story commercial building with parking space. On the south, there is a storage building with parking space. To the east, the site borders on an unnamed intermittent stream that runs to Harper's Creek. The developer owns the property on both sides of the stream.

STEP 2 - DATA ANALYSIS

(See Map #2, Plate 6-2.)

Topography
The site has a relatively flat topography on the western side with gently sloping natural drainage swales to the east. The area between the limits of clearing and the intermittent stream has been designated a critical area and land disturbance in this area should be avoided if possible. A buffer strip of existing vegetation should be preserved.

Drainage Patterns
The site consist of three major drainage areas identified as I, II, and III on map #2. The approximate acreage of each of these areas is also indicated on the map. Each of these areas is drained by a well defined swale. The swales run from west to east and should continue to be used for site drainage if possible. Extreme care should be exercised to control erosion which will occur from any disturbance in or around these swales. For this reason, these swales have been designated as critical areas on map #2.

Soils
(See map #1.)

The predominant soils on the site are Craven fine sandy loam, Uchee loamy sand, and Emporia loamy sand.

The Craven fine sandy loam soils are deep and moderately drained. Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam approximately 5 inches thick. The subsoil extends to a depth of 42 inches. The permeability rate of the soil is 0.12 - 0.15 inches per hour, and erodibility factor (K) is 0.32. The hydrological group is C, and the high water table is between 2 - 3 feet.

The Uchee loamy sand consists of well drained Uchee soils. This soil is found on the side slopes of the narrow ridge tops. Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam approximately 5 inches thick. The subsoil extends to a depth of 42 inches. The permeability rate for this soil is 0.10 - 0.15 inches per hour, and the erodibility factor (K) is 0.24. The hydrological group is A, and the high water table is between 3.5 - 5.0 feet.

The Emporia soil consists of areas of deep well drained soils. This soil is on side slopes along the drainage areas. Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 3 inches thick. The subsurface soil layer is pale brown loam approximately 3 inches thick, and the subsoil extends to a depth of 45 inches. The permeability rate for this soil is 2.0 -6.0 inches per hour, and the erodibility factor (K) is 0.28. The hydrological group is C, and the high water table is between 3.0 - 4.5 feet.

Ground Cover
The site is now covered by medium dense tree growth. It is particularly important that trees and undergrowth on the east side of the property be preserved as a buffer area between the site and the stream. For this reason, this area has been identified as a critical area. Land disturbance in this area must be kept to a minimum.

Adjacent Areas
The site drains to an intermittent stream, then to Harper's Creek. There is a high potential during construction for degradation of non-tidal wetlands areas in Harper's Creek from sedimentation. It is important to provide appropriate measures to limit erosion and contain sediment on site during construction. In addition, runoff calculations should be made to determine if there will be an increase in runoff amounts after development, and whether this will result in downstream erosion or flooding. (See Minimum Standard 19, VESCR, Chapters 4 and 8.)

With regard to other adjacent properties, the developer owns the property on the north and south boundaries of the site, and should suffer no ill effects due to erosion or sedimentation. A natural buffer will be preserved along the edge of the proposed site. The west boundary of the site is Center Street which will be used as access for construction equipment and should be protected from sediment and mud being tracked onto the road surface.

STEP 3 - SITE PLAN DEVELOPMENT

(See Map #3, plate 6-3.)

The maps developed for data collection (Map #1) and analysis (Map #2) were used to help determine the most suitable areas for development and the most critical areas from an erosion control standpoint. Erosion potential was one of many factors which were considered in locating the buildings and parking areas.

The final site plan shown on map #3 was developed through a balanced evaluation of such factors as convenience, drainage, maintenance, costs, aesthetics, erosion potential during construction, and stormwater runoff after construction.

The following are some considerations which played a role in site planning:

Roads
The only access will be from Center Street since there is existing development on the north and south boundaries of the site and the stream is on the east boundary of the site.

Buildings
The buildings are located on the portion of the site which will require the least amount of cut and fill, and will not encroach into the critical buffer area to the east. This location also allows the natural drainage patterns to be used after development.

Parking Areas
Parking areas were clustered to provide easy access to both the buildings and Center Street.

Drainage
The larger drainage swales on the north and south were preserved. A storm sewer system has been designed to convey the runoff from impervious surfaces.

STEP 4 - PLAN FOR EROSION AND SEDIMENT CONTROL

(See map #4. Plate 6-4.)

As a first step, the limits of grading were outlined on the site plan (Map #4) so that the areas requiring erosion and sediment control practices could be determined. Since construction will take place in three separate drainage areas, the erosion and sediment control planning was considered by drainage area as follows:

Drainage Area I
Land disturbance in this area will consist of grading for three buildings, streets, sidewalks, and lawn. The primary objective in this area is to keep sediment from being transported into the drainage swale and off-site. This will be accomplished by a combination of structural, vegetative, and management practices.

Drainage Area II
Clearing and grading in this area will be limited to disturbance for streets and parking areas. The objective here is to keep the sediment from entering the drainage swale and being transported off-site. This will also be accomplished by structural, vegetative, and management practices.

Drainage Area III
The major portion of the construction for the buildings will take place in this area. Grading will be done for several buildings, sidewalks and lawns. In addition to grading, a storm sewer system will be installed to manage the stormwater runoff after development. Erosion and sediment control techniques will consist of vegetative, structural, and management practices to minimize and trap sediment on site.

Structural Measures - Area I

1. Sediment Basin
Drainage area I is completely drained by a single swale and portions of drainage areas II, and III will be drained by a storm sewer into this swale. A sediment basin constructed across the swale below all construction will be the most effective method of removing sediment from the runoff before it leaves the site. The basin will be designed to accommodate the removal of accumulated sediment and to function as a permanent runoff control measure after the site has been stabilized.

2. Check Dam
Rock check dams built across the drainage swale up-slope from the sediment basin will greatly reduce the velocity of runoff from both the construction site and the adjacent property. This measure will reduce ditchline erosion and help increase the effectiveness by allowing more sediment to settle before the runoff reaches the basin.

3. Diversion Dike
An earthen diversion dike in conjunction with a temporary slope drain will be the most effective method of diverting runoff into the sediment basin.

4. Inlet Protection
Storm sewer inlets will need to be protected to prevent sediment-laden runoff from clogging the sewer pipe during construction. Inlet protection should be used on each inlet until upland areas are stabilized.

5. Silt Fence
Silt fence should be installed downslope of disturbed areas with minimal slopes to filter sheet flow runoff before it enters the drainage swale.

6. Pipe Outlets
Rip rap outlet protection should be placed at the discharge end of all storm sewer pipes and from the sediment basins to prevent erosion and scouring at the end of the pipes and to slow the velocity of the stormwater discharge to prevent downstream erosion.

7. Tree Protection
Tree protection fencing should be installed around all areas where existing trees and vegetation are to be preserved to prevent damage and soil compaction from construction equipment and vehicles.

8. Construction Road Stabilization
All roads should be stabilized with crushed stone or aggregate base material to prevent mud from being tracked onto Center Street.

Structural Measures - Area II

1. Sediment Basin
Drainage Area II is completely drained by a single swale. As in Drainage Area I, a sediment basin incorporating a check dam, sediment trap, and diversion dikes, will be the most effective method of removing sediment from runoff before it leaves the site. The basin will be designed to accommodate the removal of accumulated sediment and to function as a permanent runoff control measure after the site has been stabilized.

2. Construction Entrance
A construction entrance with a wash rack will be needed to clean the tires of vehicles and equipment during wet conditions. There is a high potential for tracking mud and sediment onto Center Street.

3. Construction Road Stabilization
All roads and parking areas should be stabilized with crushed stone or aggregate base material to prevent mud from being tracked onto Center Street.

4. Storm Sewer Inlets
All storm sewer inlets should be protected to prevent sediment from clogging the storm sewer system pipe.

5. Silt Fence
Silt fence should be installed downslope of disturbed areas to filter sediment-laden runoff before it enters the drainage swale.

6. Tree Protection
Tree protection should be installed around areas where trees and other existing vegetation is to be preserved to prevent damage and soil compaction from construction equipment and vehicles.

Structural Measures - Area III

1. Sediment Trap
Drainage Area III is drained by a small less defined swale than Areas I and II. This is also the smallest drainage area of the site. A sediment trap incorporating a diversion dike would be the most effective method of filtering sediment-laden runoff before it leaves the site and enters the drainage swale.

2. Storm Drain Inlets
As in Areas I and II, it is important to provide storm sewer inlet protection around each of the inlets to prevent the system from being clogged with sediment.

Vegetative Measures - Areas I, II and III

1. Topsoil Stockpiling
Topsoil should be stripped from graded areas and stockpiled for use in final grading and permanent stabilization. The stockpiles will have to be kept off-site to stay clear of all construction activity. The stockpile must be stabilized with temporary vegetation to prevent soil loss and sediment transport from the stockpile itself until needed. Prior to land-disturbing activities, the contractor shall submit a supplementary E&S plan to the owner covering the off-site stockpile area which would have to be approved by the plan approving authority.

2. Temporary Seeding
Certain areas of the site will be rough graded as a first stage of construction. Finish grading will occur near project completion. These areas shall be seeded temporarily with fast germinating temporary grasses to reduce erosion potential. Diversion dikes and the sediment basin embankment shall also receive temporary seeding.

3. Permanent Seeding
Immediately following finish grading, permanent vegetation shall be applied in accordance with an overall landscape plan for the site.

4. Stabilization of Earthen Structures
All earthen structures such as sediment basins, sediment traps, and diversion dikes should be seeded and mulched immediately after being constructed with fast germinating temporary vegetation to help prevent structural damage or failure. This will also help to ensure that the structure itself will not become part of an erosion problem.

Management Strategies - Areas I, II, and III

1. Construction traffic should be limited to access roads and areas to be graded. All traffic should be prohibited from crossing drainage swales and streams except where absolutely necessary.

2. The sediment basin, diversion dikes, and sediment traps will be installed as a first step in grading.

3. All major grading should be completed within 30 days of the beginning of the project. Temporary seeding shall be applied immediately after grading is completed on the respective areas.

4. Responsibility for plan implementation should be given to the construction superintendent, and he/she should make all construction workers aware of the provisions of the plan.

5. All erosion and sediment control measures shall be checked continuously and especially after each significant storm to locate damages and conduct maintenance operations.

6. After achieving adequate stabilization, temporary E&S controls will be removed and the sediment basins will be cleaned out and converted to permanent stormwater management basins.

STEP 5 - PREPARE THE PLAN

In steps 1-4, all of the information necessary for preparing an erosion and sediment control plan was developed. In this final step, the actual plan is to be prepared in a logical format containing all the pertinent information. The checklist at the end of Part II was used as a basis for developing the following erosion and sediment control plan.

NARRATIVE

PROJECT DESCRIPTION

The purpose of this project is the construction of a new housing complex. The site is located south of Williamsburg, Virginia, on Center Street. The site will consist of construction of eight buildings, parking areas, and lawn. A total of 9.5 acres will be disturbed during construction.

EXISTING SITE CONDITIONS

The proposed site is relatively flat and drains towards the eastern boundary. Most of the site is covered with dense tree growth. The site is divided into three distinct drainage areas as identified on map #2. Each of these areas is traversed by a distinct swale which drains to the east towards Harper's Creek. The slopes along the swales average between 7 - 10% with some small areas that are 50%.

ADJACENT PROPERTY

Center Street borders the property on the west. On the north, there is a two story commercial building with parking space. On the south, there is a storage building with parking space. To the east, the site borders on an unnamed intermittent stream that runs to Harper's Creek. The developer owns the property on both sides of the stream.

Across from Center Street, there is an existing residential neighborhood of single-family dwellings.

Off-site Areas

Topsoil must be stripped from graded areas and stockpiled for use in final grading and permanent stabilization. The stockpiles will have to be kept off site to stay clear of all construction activity. The stockpile will be stabilized with temporary vegetation to prevent soil loss and sediment transport from the stockpile itself until needed. Prior to land-disturbing activities, the contractor shall submit a supplementary E&S plan to the owner covering the off-site stockpile area which would have to be approved by the plan approving authority before any off-site activity commences.

Soils

(See map #1.)

The predominant soils on the site are Craven fine sandy loam, Uchee loamy sand, and Emporia loamy sand.

The Craven fine sandy loam soils are deep and moderately drained. Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam approximately 5 inches thick. The subsoil extends to a depth of 42 inches. The permeability rate of the soil is 0.12 - 0.15 inches per hour, and erodibility factor (K) is 0.32. The hydrological group is C, and the high water table is between 2 - 3 feet.

The Uchee loamy sand consists of well drained Uchee soils. This soil is found on the side slopes of the narrow ridge tops. Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam approximately 5 inches thick. The subsoil extends to a depth of 42 inches. The permeability rate for this soil is 0.10 - 0.15 inches per hour, and the erodibility factor (K) is 0.24. The hydrological group is A, and the high water table is between 3.5 - 5.0 feet.

The Emporia soil consists of areas of deep well drained soils. This soil is on side slopes along the drainage areas. Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 3 inches thick. The subsurface soil layer is pale brown loam approximately 3 inches thick, and the subsoil extends to a depth of 45 inches. The permeability rate for this soil is 2.0 - 6.0 inches per hour, and the erodibility factor (K) is 0.28. The hydrological group is C, and the high water table is between 3.0 - 4.5 feet.

<u>CRITICAL EROSION AREAS</u>

Critical areas have been identified on map #2. The area between the site and the stream has been designated as critical due to drainage into Harper's Creek which lies east of the site. This creek has areas of non-tidal wetland vegetation which would experience serious degradation if sediment were to leave the site. Therefore, care will be taken to minimize land disturbance in this area, and sediment must be trapped on the site.

<u>EROSION AND SEDIMENT CONTROL MEASURES</u>

Unless otherwise indicated, all vegetative and structural erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the handbook. The minimum standards of the VESCR shall be adhered to unless otherwise waived or approved by a variance.

<u>STRUCTURAL PRACTICES</u>

1. <u>Temporary Diversion Dike - 3.09 and Sediment Trap - 3.13</u>
   A system of temporary diversion dikes, to direct flow into sediment traps, will be installed below major graded areas

as indicated on map #4. Specific details of the sediment traps are shown on the detail sheet.

2. Temporary Sediment Basins - 3.14
Two permanent sediment basins are to be constructed across the swales in drainage areas I and II as indicated on map #4. Specific dimensions of the embankments and spillways are shown on the detail sheet. Calculations for sediment basins are attached.

3. Outlet Protection - 3.18
Riprap is to be placed at the outlet of all pipes as indicated on map #4 per detail sheet.

4. Silt Fence Barrier - 3.05
Silt fence sediment barriers will be installed downslope of areas with minimal grades to filter sediment-laden runoff from sheet flow as indicated on map #4.

5. Tree Protection - 3.38
A fence barrier is to be placed around the trees and vegetated areas which will not be disturbed to protect the trees and other vegetation from construction equipment and soil compaction.

6. Temporary Construction Entrance - 3.02
A temporary construction entrance with a wash rack shall be installed where the access area intersects with South Henry street. During muddy conditions, drivers of construction vehicles will be required to wash their wheels before entering the highway.

7. Storm Drain Inlet Protection - 3.07
All storm sewer inlets shall be protected during construction. Sediment-laden water shall be filtered before entering the storm sewer inlets.

8. Temporary Diversion Dikes - 3.09 and Sediment Traps - 3.13
A system of diversion dikes to direct flow into sediment traps will be installed below major graded areas as indicated on map #4. Specific details of the sediment traps are shown on the detail sheet.

9. Check Dam - 3.20
Several rock check dams will be installed upslope of the sediment basins to reduce the velocity of concentrated flows which will help to increase the effectiveness of the sediment basins.

10. Temporary Slope Drain - 3.15
Temporary slope drains will be installed to protect the fill slopes from rill and gully erosion. The locations of this practice are indicated on map #4.

VEGETATIVE PRACTICES

1. Topsoiling (Stockpile) - 3.30
Topsoil will be stripped from areas to be graded and stockpiled for later use. Stockpile locations shall be located off-site and are to be stabilized with temporary vegetation. Prior to land-disturbing activities, the contractor shall submit a supplementary E&S plan to the owner covering the off-site stockpile area which would have to be approved by the plan approving authority before any off-site activity commences.

2. Temporary Seeding - 3.31
All denuded areas which will be left dormant for extended periods of time shall be seeded with fast germinating temporary vegetation immediately following grading. Selection of the seed mixture will depend on the time of year it is applied.

3. Erosion Control Blankets - 3.36 or Mulch - 3.35
Erosion control blankets will be installed over fill slopes which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas and will be applied as a second step in the seeding operation.

MANAGEMENT STRATEGIES

1. Construction will be sequenced so that grading operations can begin and end as quickly as possible.

2. Sediment trapping measures will be installed as a first step in grading and will be seeded and mulched immediately following installation.

3. Temporary seeding or other stabilization will follow immediately after grading.

4. Areas which are not to be disturbed will be clearly marked by flags, signs, etc.

5. The job superintendent shall be responsible for the installation and maintenance of all erosion and sediment control practices.

6. After achieving adequate stabilization, the temporary E&S controls will be cleaned up and removed, and the sediment basins will be cleaned out and converted to permanent stormwater management basins.

PERMANENT STABILIZATION

All areas disturbed by construction shall be stabilized with permanent seeding immediately following finish grading. Seeding shall be done with Kentucky 31 Tall Fescue according to Std. & Spec. 3.32, PERMANENT SEEDING, of the handbook. Erosion control blankets will be installed over fill slopes which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas. In all seeding operations, seed, fertilizer and lime will be applied prior to mulching.

STORMWATER MANAGEMENT

Calculation of runoff before and after development indicates that there will be a net increase in peak runoff as a result of project development. Consequently, stormwater management basins have been designed to detain and release the runoff at the 2-year pre-developed rate. (See attached runoff calculations using TR-55.)

MAINTENANCE

In general, all erosion and sediment control measures will be checked daily and after each significant rainfall. The following items will be checked in particular:

1. The sediment basin will be cleaned out when the level of sediment buildup reaches the cleanout point indicated on the riser pipe.

2. The sediment traps will be checked regularly for sediment cleanout.

3. The gravel outlets will be checked regularly for sediment buildup which will prevent drainage. If the gravel is clogged by sediment, it shall be removed and cleaned or replaced.

4. The silt fence barrier will be checked regularly for undermining or deterioration of the fabric. Sediment shall be removed when the level of sediment deposition reaches half way to the top of the barrier.

5. The seeded areas will be checked regularly to ensure that a good stand is maintained. Areas should be fertilized and re-seeded as needed.

Worksheet 2: Runoff curve number and runoff

Project SAMPLE E&S PLAN By ____ Date ____

Location ____ Checked ____ Date ____

Circle one: (Present) Developed

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
CRAVEN EMPORIA C 85%	WOODED - GOOD	70			8.27	578.9
LKHEE A 15%	WOODED - GOOD	30			1.46	43.80
				Totals =	9.73	622.7

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{622.7}{9.73} = 63.99$; Use CN = 64

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	25	
Rainfall, P (24-hour)	in	3.36	6.5	
Runoff, Q .... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	0.65	2.62	

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project SAMPLE E&S PLAN By ____ Date ______

Location ____________ Checked ____ Date ______

Circle one: (Present) Developed

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Unit	Segment 1	Segment 2	Total
Segment ID		AB		
1. Surface description (table 3-1)		DENSE WOODS		
2. Manning's roughness coeff., n (table 3-1) ..		0.80		
3. Flow length, L (total L ≤ 300 ft)	ft	185		
4. Two-yr 24-hr rainfall, P_2	in	3.36		
5. Land slope, s	ft/ft	.16		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.43	+	= 0.43

Shallow concentrated flow	Unit	Segment 1	Segment 2	Total
Segment ID		BC		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	215		
9. Watercourse slope, s	ft/ft	.14		
10. Average velocity, V (figure 3-1)	ft/s	6.0		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.01	+	= .01

Channel flow	Unit	Segment 1	Segment 2	Total
Segment ID		CE		
12. Cross sectional flow area, a	ft^2	1.5		
13. Wetted perimeter, p_w	ft	3.6		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	0.42		
15. Channel slope, s	ft/ft	.0324		
16. Manning's roughness coeff., n		.033		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.55		
18. Flow length, L	ft	340		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.02	+	= .02

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr **0.46**

Worksheet 4: Graphical Peak Discharge method

Project SAMPLE E&S PLAN By ____ Date ____

Location ____ Checked ____ Date ____

Circle one: (Present) Developed ____

1. Data:

Drainage area .... A_m = .015 mi^2 (acres/640)

Runoff curve number .... CN = 64 (From worksheet 2)

Time of concentration .. T_c = .46 hr (From worksheet 3)

Rainfall distribution type = II (I, IA, II, III)

Pond and swamp areas spread throughout watershed ...... = — percent of A_m (____ acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2		
3. Rainfall, P (24-hour)	in	3.36		
4. Initial abstraction, I_a .... (Use CN with table 4-1.)	in	1.125		
5. Compute I_a/P		0.334		
6. Unit peak discharge, q_u .... (Use T_c and I_a/P with exhibit 4-____)	csm/in	440		
7. Runoff, Q .... (From worksheet 2).	in	0.65		
8. Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		—		
9. Peak discharge, q_p .... (Where $q_p = q_u A_m Q F_p$)	cfs	4.3		

Worksheet 2: Runoff curve number and runoff

Project SAMPLE E&S PLAN By ____ Date ________

Location ________________ Checked ____ Date ________

Circle one: Present (Developed) ________________

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
C	OPEN SPACE	74			2.83	209.42
C	WOODS	70			3.30	231.0
	IMPERVIOUS	98			4.7	460.60
					Totals = 10.83	901.02

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{901.02}{10.83} = 83.19$; Use CN = 83

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	25	100
Rainfall, P (24-hour)	in	3.36	6.5	8.2
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	1.74	4.55	6.17

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project SAMPLE E&S PLAN By ____ Date ________

Location ______________________ Checked _____ Date ________

Circle one: Present (Developed) ______________________

Circle one: (T_c) T_t through subarea ______________________

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Unit	Segment 1	Segment 2	Total
Segment ID		AB		
1. Surface description (table 3-1)		DENSE GRASSES		
2. Manning's roughness coeff., n (table 3-1) ..		0.24		
3. Flow length, L (total L $\le$ 300 ft)	ft	100		
4. Two-yr 24-hr rainfall, P_2	in	3.36		
5. Land slope, s	ft/ft	.01		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	.30	+	= .30

Shallow concentrated flow	Unit	Segment 1	Segment 2	Total
Segment ID		BC		
7. Surface description (paved or unpaved)		PAVED		
8. Flow length, L	ft	200		
9. Watercourse slope, s	ft/ft	.02		
10. Average velocity, V (figure 3-1)	ft/s	2.95		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	.02	+	= .02

Channel flow	Unit	Segment 1	Segment 2	Total
Segment ID		CD	DE	
12. Cross sectional flow area, a	ft^2		1.5	
13. Wetted perimeter, p_w	ft		3.6	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		0.42	
15. Channel slope, s	ft/ft		.0324	
16. Manning's roughness coeff., n		.013	.033	
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	AVG. 5.1	4.55	
18. Flow length, L	ft	640	200	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.03	+ 0.01	= 0.04
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.36

Worksheet 4: Graphical Peak Discharge method

'roject SAMPLE Ed'S PLAN By ____ Date ____

Location ____ Checked ____ Date ____

Circle one: Present (Developed) ____

1. Data:

Drainage area .... A_m = .0169 mi^2 (acres/640)

Runoff curve number .... CN = 83 (From worksheet 2)

Time of concentration .. T_c = .36 hr (From worksheet 3)

Rainfall distribution type = II (I, IA, II, III)

Pond and swamp areas spread throughout watershed ...... = — percent of A_m (____ acres or mi^2 covered)

			Storm #1	Storm #2	Storm #3
2.	Frequency	yr	2	25	100
3.	Rainfall, P (24-hour)	in	3.36	6.5	8.2
4.	Initial abstraction, I_a (Use CN with table 4-1.)	in	.410	.410	.410
5.	Compute I_a/P		0.122	0.063	0.05
6.	Unit peak discharge, q_u (Use T_c and I_a/P with exhibit 4-____)	csm/in	600	625	625
7.	Runoff, Q (From worksheet 2).	in	1.74	4.55	6.17
8.	Pond and swamp adjustment factor, F_p (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		—	—	—
9.	Peak discharge, q_p (Where $q_p = q_u A_m Q F_p$)	cfs	17.6	48.1	65.2

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Project SAMPLE E&S PLAN

Basin # 1 Location AREA I

Total area draining to basin: 10.83 acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 10.83 acres = 725.6 cu. yds.

2. Available basin volume = 730* cu. yds. at elevation 39.8. (From storage - elevation curve) * BELOW DEWATERING ORIFACE

3. Excavate 0 cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x 10.83 acres = 357.4 cu. yds.

5. Elevation corresponding to cleanout level = 37.9.

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = 1.9 ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 10.83 acres = 725.6 cu. yds.

8. Total available basin volume at crest of riser* = 1343 cu. yds. at elevation 42. (From Storage - Elevation Curve).

* Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = 6 in.

10. Diameter of flexible tubing = 8 in. (diameter of dewatering orifice plus 2 inches).

Preliminary Design Elevations

11. Crest of Riser = 42

Top of Dam = 45

Design High Water = 43

Upstream Toe of Dam = 34

Basin Shape

12. Length of Flow / Effective Width $\frac{L}{We}$ = $\frac{200}{70}$

If > 2, baffles are not required 2.85 > 2

If < 2, baffles are required ______

Runoff

13. Q_2 = 17.6 cfs (From Chapter 5) - TR-55

14. Q_{25} = 48.1 cfs (From Chapter 5) - TR-55

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = ______ cfs. (riser and barrel)

Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = 48.1 cfs. (riser and barrel)

16. With emergency spillway: - NOT USED

Assumed available head (h) = ________ ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = 1 ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = 60 in. Actual head (h) = 1 ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = 50 ft.

Head (H) on barrel through embankment = 9 ft.

(From Plate 3.14-7).

19. Barrel diameter = 30 in.

(From Plate 3.14-B [concrete pipe] or Plate 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = 90 inches.

Height = 29 inches.

(From Table 3.14-D).

Emergency Spillway Design - NOT USED

21. Required spillway capacity Q_e = Q_{25} - Q_p = ________ cfs.

22. Bottom width (b) = ________ ft.; the slope of the exit channel (s) = ________ ft./foot; and the minimum length of the exit channel (x) = ________ ft.
(From Table 3.14-C).

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = 8 ft.

    Slope of upstream face of embankment (Z) = 2 :1.

    Slope of principal spillway barrel (S_b) = 1 %

    Length of barrel in saturated zone (L_s) = 50 ft.

24. Number of collars required = 2 dimensions = 5

    (from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 45

    Design High Water = 43

    Emergency Spillway Crest = —

    Principal Spillway Crest = 42

    Dewatering Orifice Invert = 39.8

    Cleanout Elevation = 37.9

    Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = 34

NOTES:

1. The Basin for this example was designed as a temporary sediment basin only. Stormwater Management is required due to the increase in runoff, and the inability to modify the natural channel. This basin would therefore be designed by a Certified Professional Engineer in compliance with the state Stormwater Regulations, and would be modified to act as a temporary sediment basin.
2. The Basin in Area II is not calculated in this example.