The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 14

February 21, 2023

Compilation of Virgina DEQ Inspection Reports - Mountain Valley Pipeline
Spread G - 2021 and 2022

Assembled by Wild Virginia, February 17, 2023

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, January 5, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County** **Montgomery County**	**STA 11216+00 – 11246+69** **STA 11596+94 – 11620+00** **MVP-MN-258.03/.04/.05**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-OO6, S-RR14 and S-RR13.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, January 5, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, January 5, 2021**

Figure 1: **STA 11217+00** – Controls in place functioning properly. Area stabilized with straw. 	Figure 2: **STA 11231+00** – Controls in place functioning properly. Area stabilized with straw. 
Figure 3: **STA 11601+00** – Controls in place functioning properly. Area stabilized with straw. 	Figure 4: **STA 11615+00** – Controls in place functioning properly. Area stabilized with straw. 

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Monday, January 11, 2021	Project Contact:	Brian Clauto
Spread G: Montgomery	ST11790-11780 ST 11330 ATWS 1487, 1373, 1057, 1147 MLV 26, AR MN 258.04, AR GI 256	Weather:	Snow

<u>ACTIVE STAGE OF CONSTRUCTION:</u> (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *<u>Comments:</u>* Inspected the following resources: S-IJ52, W-IJ46, S-006, S-RR14, S-RR13S-NN11, S-NN13, S-NN12
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*<u>72-Hour Deadline</u> from Notification*)
- N/A

Ineffective Controls: (*<u>24-Hour Deadline</u> from Notification)*
- N/A

<u>Recommended Corrective Action</u>: N/A

<u>Deadline:</u> <u>N/A</u>

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, January 11, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

<u>Project Name</u>: Mountain Valley Pipeline **<u>Date</u>: Monday, January 11, 2021**

- <u>Figure 1</u>: Designated crossing S-IJ52 ECD's are in place.

- <u>Figure 2</u>: Designated crossing S-006 ECD's are in place.

- <u>Figure 3</u>: Designated crossing S-RR14 ECD's are in place.

<u>Figure 4</u>: Designated crossing S-NN12 ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Wednesday, January 20, 2021	Project Contact:	Brian Clauto
Spread G: Montgomery	ST11670-11766+76 ST 11980-11973 MLV 26	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MN21, S-MN22, S-EF65, S-EF62, S-IJ52
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- St11749+50 P1 requires sediment removal.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, January 20, 2021**

DEQ
Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

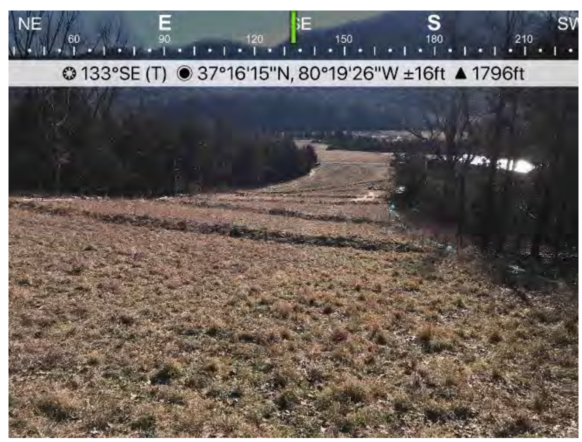
Project Name: Mountain Valley Pipeline **Date: Wednesday, January 20, 2021**

- Figure 1: Gate remains installed near St11670

- Figure 2: St11677+00 ECD's are installed and the area is temporarily stabilized.

- Figure 3: St11749+50 P1 requires sediment removal.

Figure 4: St11973+00 ECD's are in place and the area remains stabilized.



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, January 26, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Montgomery**	**ST11929+78-11980** **AR-MN266**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: N/A
- MVP inspections noted maintenance required on sumps located on MN-266
- Offsite timbering activities were evident near St11960

Routine Maintenance: (*72-Hour Deadline from Notification*)
- St11960+00 P1 fencing is torn

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, January 26, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, January 26, 2021**

- Figure 1: AR –MN266 has been stabilized with mulch.

- Figure 2: MVP inspectors have reported AR-MN266 sump maintenance.

- Figure 3: P1 is torn near St11960+00.

Figure 4: Area is stabilized near St11970+00

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, January 26, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11978+54 – 12008+53 MVP-MN-266/268/268.01**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G36 and S-NN6.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, January 26, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, January 26, 2021**

Figure 1: **Stream S-G36** – Controls in place and functioning properly around North Fork Roanoke River Crossing.

BRG: 128°SE (T) **LAT:** 37.268685 **LON:** -80.314426 ±16ft **ALT:** 1571ft

Figure 2: **STA 11978+54** – Controls in place and functioning properly.

BRG: 325°NW (T) **LAT:** 37.270603 **LON:** -80.326004 ±495ft **ALT:** 1764ft

Figure 3: **STA 11987+00** – Controls in place and functioning properly.

BRG: 298°NW (T) **LAT:** 37.268161 **LON:** -80.320438 ±16ft **ALT:** 1608ft

Figure 4: **STA 12007+00** – Controls in place and functioning properly.

BRG: 253°W (T) **LAT:** 37.268904 **LON:** -80.314689 ±16ft **ALT:** 1574ft

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Marshall Willis
Inspection Date:	Friday, February 5, 2021	Project Contact:	Brian Clauto, Cory Chalmers
Spread G: Giles County	Laydown Yard 026 Laydown Yard 028 Laydown Yard 029	Weather:	Snow

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Friday, February 5, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Friday, February 5, 2021**

Figure 1: **Laydown Yard 026** – Controls in place and functioning properly around fueling station.

BRG: 161°S (T) **LAT:** 37.318733 **LON:** -80.657545 ±16ft **ALT:** 1786ft

Figure 2: **Laydown Yard 026** – Secondary containment in place and functioning properly.

BRG: 288°W (T) **LAT:** 37.318037 **LON:** -80.656706 ±98ft **ALT:** 1769ft

Figure 3: **Laydown Yard 028** – Controls in place and functioning properly.

BRG: 200°S (T) **LAT:** 37.336107 **LON:** -80.808359 ±16ft **ALT:** 1535ft

Figure 4: **Laydown Yard 029**– Controls in place and functioning properly.

BRG: 264°W (T) **LAT:** 37.362355 **LON:** -80.677207 ±98ft **ALT:** 1710ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, February 24, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST11470-11353+94** **AR-GI 256**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-0013, S-0014, S-KL43
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St11426 sump is at clean out level and requires maintenance
- St11358 multiple CFS's require cleanout and rill repair

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, February 24, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, February 24, 2021**

- Figure 1: Near St11358 multiple CFS and rill erosion require repair.

- Figure 2: St11426 sump is at clean out level and requires maintenance.

- Figure 3: Designated stream S-KL43, ECD's are in place.

Figure 4: Designated stream S-0013, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Marshall Willis
Inspection Date:	Wednesday, February 24, 2021	Project Contact:	Brian Clauto, Cory Chalmers
Spread G: Giles County Craig County	MVP-GI-256 STA 11353+21 – 11525+00 MVP-CR-258.01/258.02	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-PP4, S-PP3, S-PP1, S-OO13, S-OO14, W-CD12 and S-KL43.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, February 24, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, February 24, 2021**

Figure 1: **STA 11456+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 11396+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11526+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 11494+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, March 2, 2021	Project Contact:	Brian Clauto
Spread G: Craig Giles	ST11620-11600 ATWS 1370, 1370A, 1057, 1373 AR- MRV25, GI 234, GI249.01, 258.01	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-Q14, S-G32, S-RR13, S-RR14, S-006
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant ____________________

Date: **Tuesday, March 2, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, March 2, 2021**

- Figure 1: ECD's remain installed on AR-GI 234

- Figure 2: Blanket matted remains installed at AR GI- 234

- Figure 3: Designated crossing S-G32, ECD's are in place and functioning.

- Figure 4: Designated crossing S-006, ECD's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, March 2, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11184+85 – 11227+59** **MVP-GI-249.02** **MVP-MLV-AR-25**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, March 2, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, March 2, 2021**

Figure 1: **STA 11228+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 11210+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11195+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 11180+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Monday, March 8, 2021	Project Contact:	Brian Clauto
Spread G: Giles	ST11290+00-11353+99 ATWS 633, 633A, 1147 AR-GI256.02	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: W-MM10, S-MM18, S-NN13, S-NN14, S-NN11
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _______________

Date: **Monday, March 8, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Monday, March 8, 2021**

- Figure 1: At MP213.8 areas have recently been re stabilized with mulch.

- Figure 2: Near St11310+00 the area has recently been re stabilized with mulch.

- Figure 3: Near St11320+00 the area has recently been re stabilized with mulch.

- Figure 4: Above designated stream crossing S-NN12, ECD's and stabilization in place.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, March 11, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11011+87 – 11065+00** **MVP-GI-243.01** **MVP-GI-245.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-RR4, S-RR5, S-IJ18 and S-IJ16-B.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- MVP-GI-243.01: CFS maintenance needed.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, March 11, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Thursday, March 11, 2021**

Figure 1: **MVP-GI-243.01** – CFS maintenance needed.

Figure 2: **STA 11013+00** – Controls in place and functioning properly.

Figure 3: **STA 11029+00** – Controls in place and functioning properly.

Figure 4: **STA 11048+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, March 18, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11596+94 – 11618+91 STA 11765+00 – 11792+18 MVP-MN-258.05/.04 MVP-MLV-AR-26**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-OO6, S-RR13, S-RR14, W-IJ46-PEM and S-IJ52.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, March 18, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, March 18, 2021**

Figure 1: **STA 11615+00** – Controls in place and functioning properly.

Figure 2: **STA 11602+00** – Controls in place and functioning properly.

Figure 3: **STA 11765+00** – Controls in place and functioning properly.

Figure 4: **STA 11792+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Monday, March 22, 2021	Project Contact:	Brian Clauto
Spread G: Giles	ST11245+43-11185+00 ATWS 1347, 1370, 1370A AR-MLV 25	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: W-RR18, S-RR2
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _____

Date: **Monday, March 22, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, March 22, 2021**

- Figure 1: St11237+00 newly installed CFS

- Figure 2: St11245+43 installation of CFS

- Figure 3: Near St11217+00 stabilization is being applied to stockpile.

- Figure 4:Near St11208 ECD's are in place and functioning.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, March 23, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Giles County	**STA 11165+00 – 11230+00**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, March 23, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, March 23, 2021**

Figure 1: **STA 11218+00** – Controls in place and functioning properly.

Figure 2: **STA 11207+00** – Controls in place and functioning properly.

Figure 3: **STA 11201+00** – Controls in place and functioning properly.

Figure 4: **STA 11190+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, March 23, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST11185-11192, ST11300-11254+66** **AR-GI 249.02, GI-253.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

- ☐ Tree Felling
- ☐ Clearing/Grubbing
- ☐ Grading
- ☐ Trenching
- ☐ Stringing/Welding
- ☐ Lowering/Backfilling
- ☐ Final Grading
- ☐ Temp. Stabilization
- ☐ Perm. Stabilization
- ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: W-MM10, S-MM17, S-MM18
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, March 23, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, March 23, 2021**

- Figure 1: Designated crossings S-MM17 and W-MM10, ECD's are in place and functioning.

- Figure 2: Designated crossing S-MM18, ECD's are in place and functioning.

- Figure 3: Near St11280 has recently been re stabilized.

- Figure 4: Near ST 11258+00 ECD's are in place at the end of the LOD.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Wednesday, March 24, 2021	Project Contact:	Brian Clauto
Spread G: Giles	ST11230-11254+66 AR-MLV25 ATWS 1347	Weather:	Wet

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☒ Clearing/Grubbing	☒ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: W-RR18, S-RR2
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, March 24, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Wednesday, March 24, 2021**

- Figure 1: Near ATWS 1347, ECD's are in place.

- Figure 2: Above St11230+00 ECD's and stockpile stabilization in place.

- Figure 3: Near St11248+00 area is planned for grubbing, ECD's are in place.

- Figure 4: Near designated crossings S-RR2 and W-RR18, no land disturbance has occurred.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, March 30, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST11150+00-11120+00** **ATWS 1367** **AR-GI 249.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: N/A

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

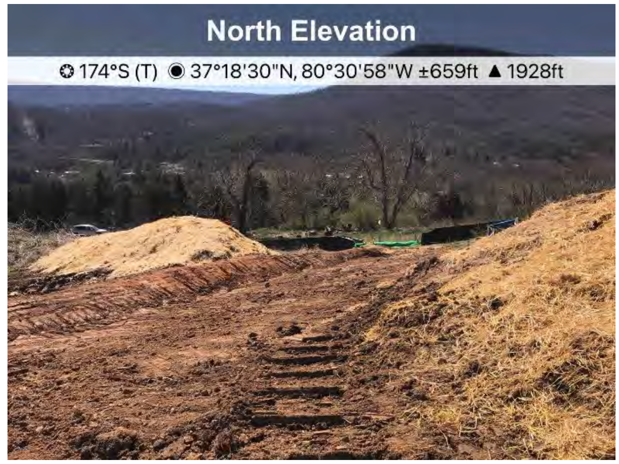
Date: **Tuesday, March 30, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, March 30, 2021**

- Figure 1: Near St 11150+00, grading activities were ongoing and ECD's were in place.

- Figure 2: Near St 1114800 stockpiles have been stabilized and ECD's have been installed.



- Figure 3: St 11133+67 karst area remains protected.

- Figure 4: Near St 11138+00, ROW travel lane maintenance was being conducted.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, March 30, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11064+28 – 11151+27** **MVP-GI-249** **MCP-GI-245.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ16a.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, March 30, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, March 30, 2021**

Figure 1: **STA 11148+00** – Controls in place and functioning properly.

Figure 2: **STA 11139+00** – Controls in place and functioning properly.

Figure 3: **STA 11100+00** – Controls in place and functioning properly.

Figure 4: **STA 11067+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Thursday, April 1, 2021	Project Contact:	Brian Clauto
Spread G: Craig	ST11600-11620 ATWS 1373, 1057 AR 258.04	Weather:	Wet

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

- ☐ Tree Felling
- ☐ Clearing/Grubbing
- ☐ Grading
- ☐ Trenching
- ☐ Stringing/Welding
- ☐ Lowering/Backfilling
- ☐ Final Grading
- ☐ Temp. Stabilization
- ☐ Perm. Stabilization
- ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-006, S-RR14, S-RR13
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Thursday, April 1, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, April 1, 2021**

- Figure 1: Designated crossing S-RR13, ECD's are in place.

- Figure 2: Designated crossing S-RR14, ECD's are in place.

- Figure 3: Designated crossing S-RR006, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, April 5, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11158+50 – 11170+00** **MVP-GI-256.02** **MVP-GI-249.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☒ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-NN13, S-NN14 and S-NN17.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, April 5, 2021**

DEQ
Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline | **Date: Monday, April 5, 2021**

Figure 1: **MVP-GI-256.02** – Controls in place and functioning properly.

BRG: 226°SW (T) **LAT:** 37.304000 **LON:** -80.471603 ±5443ft **ALT:** 2088ft

Figure 2: **STA 11167+00** – PPL actively installing CWD and level spreader outlet.

BRG: 240°SW (T) **LAT:** 37.310146 **LON:** -80.514244 ±32ft **ALT:** 1868ft

Figure 3: **STA 11167+00** – PPL actively installing CWD and level spreader outlet.

BRG: 48°NE (T) **LAT:** 37.310492 **LON:** -80.514443 ±16ft **ALT:** 1840ft

Figure 4: **STA 11161+00** – Controls in place and functioning properly.

BRG: 299°NW (T) **LAT:** 37.310801 **LON:** -80.515844 ±541ft **ALT:** 1832ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, April 12, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST11145-11064+85** **ATWS 1366, 1367** **AR GI 249, 245.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: N/A

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

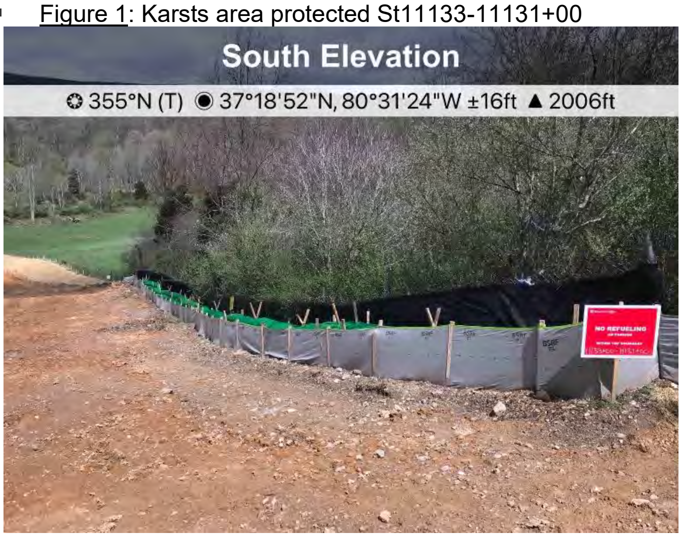
Date: **Monday, April 12, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, April 12, 2021**

- Figure 1: Karsts area protected St11133-11131+00



- Figure 2: ECD's are in place at St1126+00

- Figure 3: Grading activities near St11090+00

- Figure 4: On going slope drain install near St11140+00

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, April 13, 2021	Project Contact:	Brian Clauto
Spread G: Craig Giles	ST11524-11470 AR 258.02	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☒ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-QQ2, S-PP4, S-PP3, S-PP1
- ECD's were in place at designated crossing per active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St11488+00 waterbar is does not run the length of the ROW and does not meet the standard and spec.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: ____ Matthew Grant ____________

Date: **Tuesday, April 13, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, April 13, 2021**

<table>
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- Figure 1: Lowering activity near St11524+00.

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- Figure 2: Welding activity near St11493+00.

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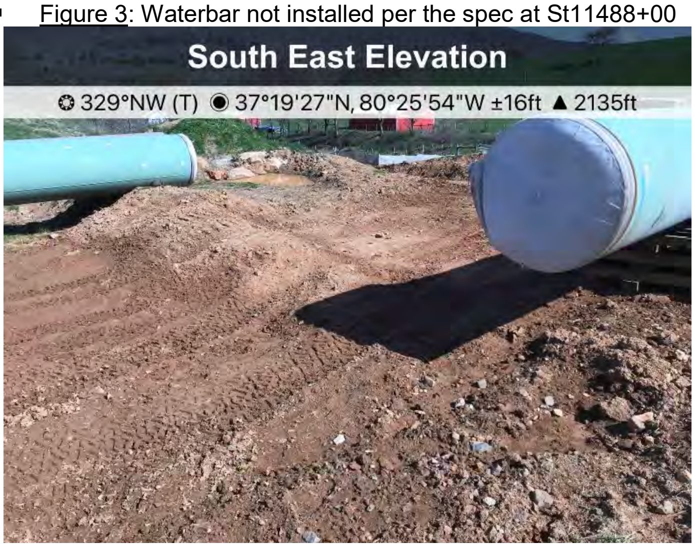
- Figure 3: Waterbar not installed per the spec at St11488+00



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- Figure 4:ECD's are in place at designated crossing S-PP1.

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FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, April 13, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Craig County** **Giles County**	**STA 11353+67 – 11524+16** **MVP-CR-258.02** **MVP-GI-256**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-PP4, S-PP3, S-PP2, S-PP1, W-CD14, S-OO13, S-OO14 and S-KL43.

Ineffective Controls: (*24-Hour Deadline from Notification)*

- STA 11467+50: Slope drain improper installation. Discharges onto fill slope.
- STA 11409+50: Waterbar end-treatment improper installation. CFS outlet higher than waterbar.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, April 13, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline**

Date: **Tuesday, April 13, 2021**

Figure 1: **STA 11467+50** – Slope drain improper installation. Discharge down fill slope.

BRG: 146°SE (T) **LAT:** 37.320873 **LON:** -80.436374 ±16ft **ALT:** 2260ft

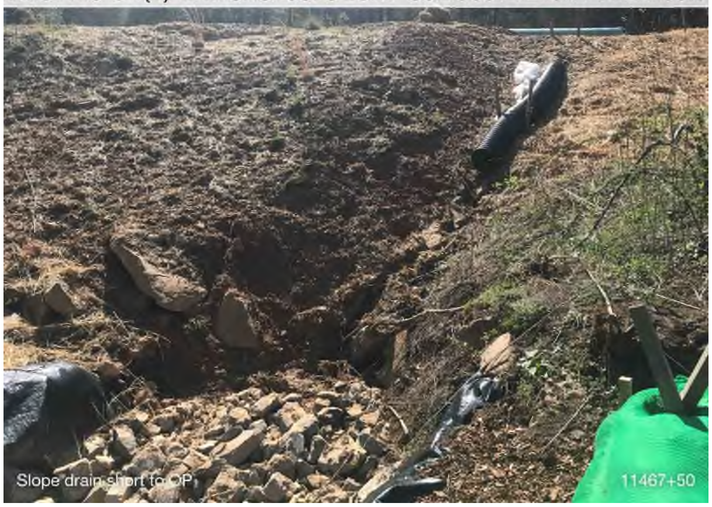


Figure 2: **STA 11409+50** – Waterbar end-treatment improper installation. CFS outlet higher than waterbar.

BRG: 169°S (T) **LAT:** 37.312151 **LON:** -80.451925 ±16ft **ALT:** 2223ft

Figure 3: **Stream S-KL43** – Controls in place and functioning properly.

BRG: 209°SW (T) **LAT:** 37.307598 **LON:** -80.466666 ±164ft **ALT:** 1949ft

Figure 4: **Stream S-OO14** – Controls in place and functioning properly.

BRG: 182°S (T) **LAT:** 37.318895 **LON:** -80.441035 ±1925ft **ALT:** 2162ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, April 22, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11150+00 – 11158+12** **STA 11298+29 – 11254+88** **MVP-GI-253.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

- ☐ Tree Felling
- ☐ Clearing/Grubbing
- ☐ Grading
- ☐ Trenching
- ☒ Stringing/Welding
- ☐ Lowering/Backfilling
- ☐ Final Restoration
- ☐ Temp. Stabilization
- ☐ Perm. Stabilization
- ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-MM18, S-MM17 and W-MM10.

Ineffective Controls: (*24-Hour Deadline from Notification)*

- STA 11294+50: Waterbar does not extend full width of ROW.
- STA 11287+30: Slope drain does not have outlet protection.
- STA 11286+00: Slope drain does not have outlet protection.
- STA 11281+75: Slope drain does not have outlet protection.
- STA 11281+25: Slope drain does not have outlet protection.
- STA 11278+50: Slope drain does not have outlet protection.
- STA 11276+00: Slope drain does not have outlet protection.
- STA 11274+00: Slope drain does not have outlet protection.
- STA 11270+00: Slope drain does not have outlet protection.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, April 22, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Thursday, April 22, 2021**

Figure 1: **STA 11294+50** – Waterbar does not extend full width of ROW.

Figure 2: **STA 11287+30** – Slope drain does not have outlet protection.

Figure 3: **STA 11286+00** – Slope drain does not have outlet protection.

Figure 4: **STA 11281+75** – Slope drain does not have outlet protection.

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Thursday, April 22, 2021**

Figure 5: **STA 11281+25** – Slope drain does not have outlet protection.

Figure 6: **STA 11278+50** – Slope drain does not have outlet protection.

Figure 7: **STA 11276+00** – Slope drain does not have outlet protection.

Figure 8: **STA 11274+00** – Slope drain does not have outlet protection.

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, April 22, 2021**

Figure 9: **STA 11270+50** – Slope drain does not have outlet protection. 	

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, April 26, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST11254+66-11168** **ATWS 1347, 1464** **AR MLV 25, GI 249.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-YZ6, W-RR1b
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _____________________

Date: **Monday, April 26, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, April 26, 2021**

- Figure 1: Near St11233, pipe has been strung and ECD's are in place.

- Figure 2: Near St11246+83, area has been stabilized and ECD's are in place.

- Figure 3: Near St11190, pipe has been strung and ECD's are in place for active construction.

- Figure 4: Designated crossing S-YZ6 &W-RR1b, fell trees remain in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, April 26, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11158+12 – 11250+00** **MVP-MLV-AR-25** **MVP-GI-249.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, April 26, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, April 26, 2021**

Figure 1: **STA 11247+00** – Controls in place and functioning properly.

BRG: 106°E (T) **LAT:** 37.302043 **LON:** -80.505112 ±12986ft **ALT:** 2229ft

Figure 2: **STA 11233+00** – Controls in place and functioning properly.

BRG: 347°N (T) **LAT:** 37.303642 **LON:** -80.505547 ±13714ft **ALT:** 2126ft

Figure 3: **STA 11198+00** – Controls in place and functioning properly.

BRG: 296°NW (T) **LAT:** 37.303724 **LON:** -80.505674 ±13714ft **ALT:** 2161ft

Figure 4: **STA 11191+00** – Controls in place and functioning properly.

BRG: 319°NW (T) **LAT:** 37.306628 **LON:** -80.509749 ±32ft **ALT:** 2023ft

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, April 27, 2021	Project Contact:	Brian Clauto
Spread G: Giles	ST11300-11353+60 10970-11062 ATWS 633A, 633 AR 253.02, 242.01	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MM17, W-MM10, S-NN12, S-NN11, S-MN11, S-E24, S-E25, S-RR5, S-PA07, S-IJ18, S-IJ65, S-IJ16B
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

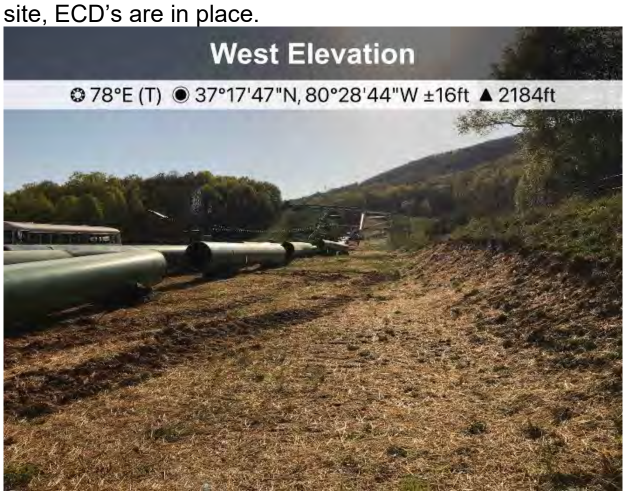
Inspector Signature: _____ Matthew Grant _____________________

Date: **Tuesday, April 27, 2021**

FIELD INSPECTION PHOTO LOG

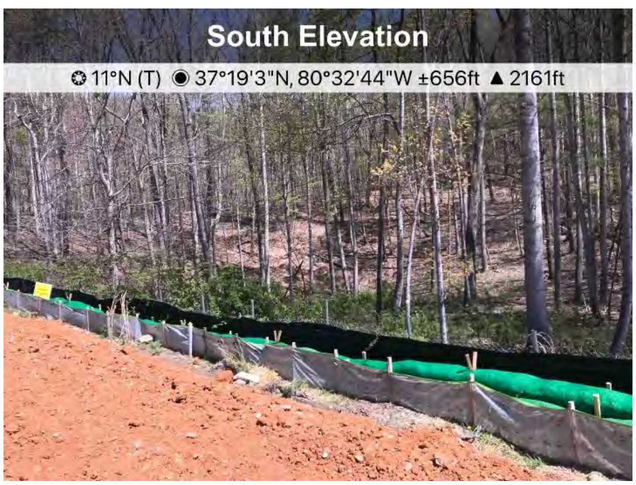
Project Name: Mountain Valley Pipeline **Date: Tuesday, April 27, 2021**

- Figure 1: Near St11301+00 pipe is strung and welding crews on site, ECD's are in place.



- Figure 2: Designated crossing S-NN11, ECD's are in place.

- Figure 3: Near St11056 the karsts area is protected by ECD's.



- Figure 4: Above designated crossing S-RR5, additional ECD crews are mobilizing.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Marshall Willis
Inspection Date:	Tuesday, April 27, 2021	Project Contact:	Brian Clauto, Cory Chalmers
Spread G: Giles County	STA 10971+74 – 11098+43 MVP-GI-242.01 MVP-GI-245.01	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-MN11, S-E24, S-E25, S-RR5, S-IJ18, S-IJ16b and S-IJ16a.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, April 27, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, April 27, 2021**

Figure 1: **STA 10992+00** – Controls in place and functioning properly.

Figure 2: **STA 11020+00** – Controls in place and functioning properly.

Figure 3: **STA 11033+00** – Controls in place and functioning properly.

Figure 4: **STA 11045+00** – Controls in place and functioning properly.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, April 28, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10819+00 – 10859+34** **MVP-GI-241.03**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☒ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-YZ1, S-A34 and S-A33.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- STA 10839+00: Temp. topsoil waterbar does not have end-treatment.
- STA 10840+70: Temp. topsoil waterbar does not have end-treatment.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, April 28, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, April 28, 2021**

Figure 1: **STA 10822+00** – Controls in place and functioning properly.

BRG: 305°NW (T) **LAT:** 37.339871 **LON:** -80.613778 ±98ft **ALT:** 2374ft

Figure 2: **STA 10839+00** – Temp. topsoil WB does not have end-treatment.

BRG: 126°SE (T) **LAT:** 37.340445 **LON:** -80.609822 ±16ft **ALT:** 2574ft

Figure 3: **STA 10840+70** – Temp. topsoil WB does not have end-treatment.

BRG: 109°E (T) **LAT:** 37.339724 **LON:** -80.609891 ±32ft **ALT:** 2414ft

Figure 4: **Streams S-A33 and S-A34**– Controls in place and functioning properly.

BRG: 308°NW (T) **LAT:** 37.337736 **LON:** -80.605453 ±98ft **ALT:** 2299ft

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, May 4, 2021	Project Contact:	Brian Clauto
Spread G: Giles	ST11025-10928 ATWS 1145, 1146 AR 244	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☒ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-IJ19, S-RR5/PA07, S-E25, S-E20, S-Y2, S-Y3
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, May 4, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, May 4, 2021**

- Figure 1: Above designated crossing S-RR5/ PA07, ECD's are in place for active construction.

- Figure 2: Active installation of CWD near St10977.

- Figure 3: Protected area neat St 10965+51

- Figure 4: Actively grading near St10955

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, May 5, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST10802+08-10820** **AR 241.02** **ATWS 464**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☒ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources:S-Z13, S-Z14, W-Z5
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St10805+09-10820 pre topsoil segregation temporary water diversions are not installed per spec MVP-ES56.2A, water bars do not extended the full length of 125 of the ROW.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, May 5, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Wednesday, May 5, 2021**

- Figure 1: St10805+09 installation of waterbars uphill do not extend the full length of the ROW.

- Figure 2: Designated crossing S-Z14, ECD's are in place.

- Figure 3: Near crossing W-Z5

- Figure 4: Neat St10817+20 WB does not extend the full length of the ROW.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Marshall Willis
Inspection Date:	Wednesday, May 5, 2021	Project Contact:	Brian Clauto, Cory Chalmers
Spread G: Craig County	STA 11524+16 – 11471+52 MVP-CR-258.02 MVP-CR-258.01	Weather:	Wet

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

- ☐ Tree Felling
- ☐ Clearing/Grubbing
- ☐ Grading
- ☒ Trenching
- ☐ Stringing/Welding
- ☒ Lowering/Backfilling
- ☐ Final Restoration
- ☐ Temp. Stabilization
- ☐ Perm. Stabilization
- ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-QQ2, S-PP4, S-PP3 and S-PP1.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, May 5, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, May 5, 2021**

Figure 1: **Stream S-QQ2**– Controls in place and functioning properly around stream crossing. (Sinking Creek)

BRG: 178°S (T) **LAT:** 37.333126 **LON:** -80.431150 ±541ft **ALT:** 2008ft

Figure 2: **STA 11521+00** – Controls in place and functioning properly.

BRG: 263°W (T) **LAT:** 37.328683 **LON:** -80.421833 ±16ft **ALT:** 2248ft

Figure 3: **STA 11495+00** – Controls in place and functioning properly.

BRG: 230°SW (T) **LAT:** 37.325289 **LON:** -80.429496 ±16ft **ALT:** 2288ft

Figure 4: **STA 11478+00** – Controls in place and functioning properly.

BRG: 65°NE (T) **LAT:** 37.280701 **LON:** -80.388092 ±6562ft **ALT:** 2148ft

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Marshall Willis
Inspection Date:	Tuesday, May 11, 2021	Project Contact:	Brian Clauto, Cory Chalmers
Spread G: Giles County	STA 10674+92 – 10707+00 MVP-GI-241/241.01/241.03/241.04	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☒ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G30 and S-G32.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- STA 10677+00: Topsoil waterbar does not have end-treatment.
- STA 10677+61: Topsoil waterbar does not have end-treatment.
- STA 10677+93: Topsoil waterbar does not have end-treatment.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, May 11, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, May 11, 2021**

Figure 1: **STA 10677+00** – Topsoil waterbar does not have end-treatment.

BRG: 147°SE (T) **LAT:** 37.350207 **LON:** -80.659164 ±32ft **ALT:** 2116ft

Figure 2: **STA 10677+61** – Topsoil waterbar does not have end-treatment.

BRG: 116°SE (T) **LAT:** 37.349931 **LON:** -80.658916 ±32ft **ALT:** 2094ft

Figure 3: **STA 10677+93** – Topsoil waterbar does not have end-treatment.

BRG: 140°SE (T) **LAT:** 37.350121 **LON:** -80.658662 ±16ft **ALT:** 2104ft

Figure 4: **Stream S-G30** – Controls in place and functioning properly.

BRG: 271°W (T) **LAT:** 37.350379 **LON:** -80.657914 ±16ft **ALT:** 2074ft

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, May 17, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10749+71 – 10789+05** **MVP-GI-241.01/241.04/241.03**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☒ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G35.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, May 17, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, May 17, 2021**

Figure 1: **STA 10748+00** – Controls in place and functioning properly.

Figure 2: **STA 10752+00** – Controls in place and functioning properly.

Figure 3: **STA 10756+00** – Controls in place and functioning properly.

Figure 4: **Stream S-G35** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, May 18, 2021	Project Contact:	Brian Clauto
Spread G: Giles	AR GI 234 ATWS 1129 Yard 28	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-Q14

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, May 18, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Tuesday, May 18, 2021**

- Figure 1: Access road GI 234 matting remains installed.

- Figure 2: Access road GI 234 matting remains installed.

- Figure 3: Designated crossing S-YZ4 along GI 234.

- Figure 4: Pollution prevention devices in place at Yard 28.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, May 18, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11596+94 – 11618+91 MVP-MN-258.05**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-OO6, S-RR13 and S-RR14.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, May 18, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, May 18, 2021**

Figure 1: **Stream S-RR13** – Controls in place and functioning properly around Craig Creek.

Figure 2: **Stream S-RR14** – Controls in place and functioning properly around S-RR14

Figure 3: **STA 11608+00** – Controls in place and functioning properly.

Figure 4: **Stream S-OO6** – Controls in place and functioning properly around Craig Creek.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Wednesday, May 26, 2021	Project Contact:	Brian Clauto
Spread G: Giles	ATWS 466, 464, 1145, 1146 St10850-10858 St10802+81-10818+31 St11010-11025 AR GI 244, 241.03, 241.02	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-E25, S-E24, S-YZ1, P-YZ1, S-Z14, S-Z13
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

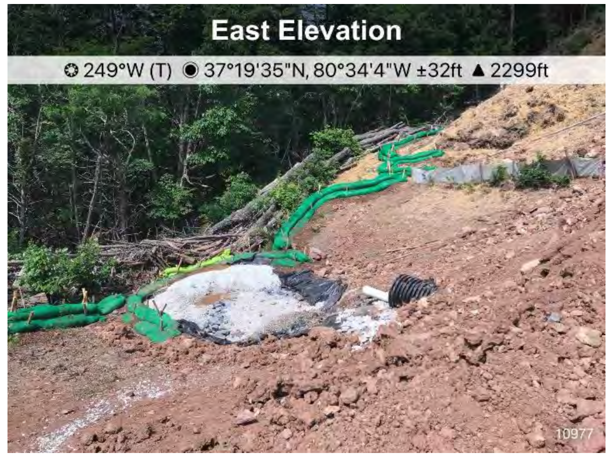
Date: **Wednesday, May 26, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Wednesday, May 26, 2021**

- Figure 1: St10977 ECD's have been installed.

- Figure 2: St10977 ECD's have been installed.



- Figure 3: St10966+50 Sensitive resource area is protected.

- Figure 4: St10858+73 grading activity.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Thursday, May 27, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR GI 240, 258.04** **ATWS 1057, 1373** **St10690-10660** **St11620-11600**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☒ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-RR13, S-RR14, S-006, S-G30.
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _____

Date: **Thursday, May 27, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, May 27, 2021**

- Figure 1: Installation of ECD at St10688+91.

- Figure 2: Installation of temporary waterbar at St10676.

- Figure 3: Designated crossing S-RR13, ECD's are in place.

- Figure 4: Designated crossing S-006, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, June 3, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10707+22 – 10749+71** **Laydown Yard 029** **MVP-GI-241.01/.04**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G33 and W-Z11.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, June 3, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, June 3, 2021**

Figure 1: **Laydown Yard 029** – Controls in place and functioning properly.

BRG: 153°SE (T) **LAT:** 37.362826 **LON:** -80.676986 ±213ft **ALT:** 1712ft

Figure 2: **STA 10723+00** – Controls in place and functioning properly.

BRG: 148°SE (T) **LAT:** 37.348082 **LON:** -80.643674 ±213ft **ALT:** 2411ft

Figure 3: **STA 10730+00** – Controls in place and functioning properly.

BRG: 139°SE (T) **LAT:** 37.346974 **LON:** -80.642498 ±32ft **ALT:** 2334ft

Figure 4: **STA 10738+00** – Controls in place and functioning properly.

BRG: 127°SE (T) **LAT:** 37.346188 **LON:** -80.639681 ±16ft **ALT:** 2354ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, June 7, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR 241.01** **ATWS 469, 1334, 1056, 464** **St10749-10802**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☒ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-G35, S-S4, S-Z9, S-Z7, S-Z13
- ECD's were in place and functioning at the designated crossings for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- Uncontained trash at St 10749+50

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, June 7, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, June 7, 2021**

- Figure 1: Designated crossing S-G35 ECD's are in place.

- Figure 2: Uncontained trash at St10749+50

- Figure 3: Designated crossing S-Z7, ECD's are in place.

- Figure 4: ECD's are in place and pipe is strung near St10789.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, June 9, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR 258.02, 258.01, GI 249.01** **ATWS 1347, 1370, 1370A, 1464** **St 11530-11472** **St 11226-11170**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☒ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-QQ2, S-PP4, S-PP3, S-PP1
- ECD's were in place and functioning at the designated crossings for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St 11515+30 sump lacks stone

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, June 9, 2021**

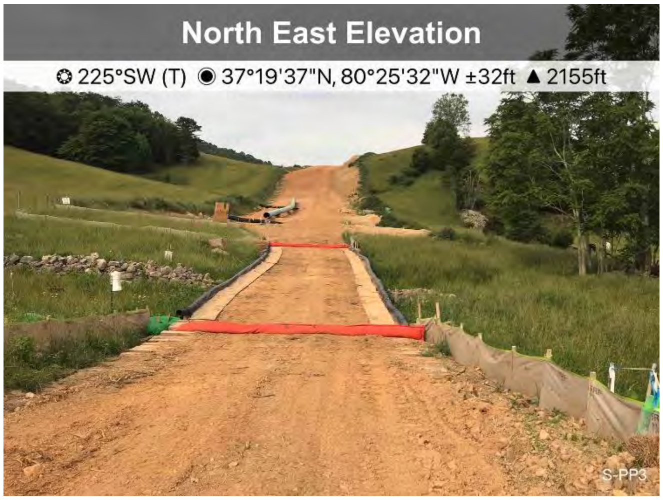
FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline**

Date: **Wednesday, June 9, 2021**

- Figure 1: St 11515+30 sump lacks stone.

- Figure 2: Designated crossing S-PP3, ECD's are in place.



- Figure 3: St11218+71 active trenching

- Figure 4: St 11200 stabilized slope

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, June 10, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10675+39 – 10667+00** **STA 11765+00 – 11788+43** **MVP-GI-240** **MVP-MLV-AR-25**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ52 and W-IJ46-PFO.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, June 10, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, June 10, 2021**

Figure 1: **STA 10675+00** – Controls in place and functioning properly.

BRG: 100°E (T) **LAT:** 37.350634 **LON:** -80.659512 ±16ft **ALT:** 2156ft

Figure 2: **STA 10669+00** – Controls in place and functioning properly.

BRG: 22°NE (T) **LAT:** 37.345776 **LON:** -80.673701 ±42813ft **ALT:** 2272ft

Figure 3: **STA 10668+00** – Controls in place and functioning properly.

BRG: 316°NW (T) **LAT:** 37.351774 **LON:** -80.660598 ±16ft **ALT:** 2224ft

Figure 4: **STA 11766+00** – Controls in place and functioning properly.

BRG: 290°W (T) **LAT:** 37.296027 **LON:** -80.368025 ±16ft **ALT:** 1949ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Friday, June 11, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10929+71 – 11023+80** **MVP-GI-244**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-E24, S-E25, S-RR5, S-IJ19 and S-IJ18.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Friday, June 11, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Friday, June 11, 2021**

Figure 1: **STA 11020+00** – Controls in place and functioning properly.

BRG: 281°W (T) **LAT:** 37.323307 **LON:** -80.554028 ±16ft **ALT:** 2458ft

Figure 2: **STA 10993+00** – Controls in place and functioning properly.

BRG: 311°NW (T) **LAT:** 37.324776 **LON:** -80.562949 ±16ft **ALT:** 2587ft

Figure 3: **STA 10970+00** – Controls in place and functioning properly.

BRG: 277°W (T) **LAT:** 37.327311 **LON:** -80.570350 ±16ft **ALT:** 2433ft

Figure 4: **STA 10937+00** – Controls in place and functioning properly.

BRG: 291°W (T) **LAT:** 37.330321 **LON:** -80.580914 ±16ft **ALT:** 2283ft

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Friday, June 25, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10656+80 – 10675+00** **STA 10749+41 – 10774+15** **MVP-GI-240**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G35, S-SS4 and S-Z9.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Friday, June 25, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Friday, June 25, 2021**

Figure 1: **STA 10670+00** – Controls in place and functioning properly.

BRG: 142°SE (T) **LAT:** 37.351245 **LON:** -80.660704 ±16ft **ALT:** 2256ft

Figure 2: **STA 10664+00** – Controls in place and functioning properly.

BRG: 307°NW (T) **LAT:** 37.352778 **LON:** -80.661354 ±16ft **ALT:** 2203ft

Figure 3: **STA 10751+77** – Controls in place and functioning properly.

BRG: 102°E (T) **LAT:** 37.344677 **LON:** -80.635558 ±98ft **ALT:** 2229ft

Figure 4: **STA 10764+00** – Controls in place and functioning properly.

BRG: 80°E (T) **LAT:** 37.343719 **LON:** -80.632378 ±1384ft **ALT:** 2078ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, June 28, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR GI 249, 245.01** **ATWS 1366, 1367** **St 11151-11040**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☒ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-IJ16-a
- ECD's were in place and functioning at the designated crossings for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, June 28, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, June 28, 2021**

- Figure 1: St11099 grading activities, ECD's are in place.

- Figure 2: St11066 pipe has been strung and ECD's are in place.

- Figure 3: Designated crossing S-IJ16-A

- Figure 4: St 11123 ditch has been dug and ECD's are in place

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, June 28, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11084+78 – 11158+12** **MVP-GI-245.01** **MVP-GI-249**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☒ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Restoration	☐ Temp. Stabilization	☐ Perm. Stabilization	☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ16-a.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, June 28, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, June 28, 2021**

Figure 1: **STA 11151+00** – Controls in place and functioning properly.

BRG: 103°E (T) **LAT:** 37.312516 **LON:** -80.518535 ±16ft **ALT:** 2029ft

Figure 2: **STA 11138+00** – Controls in place and functioning properly.

BRG: 285°W (T) **LAT:** 37.312907 **LON:** -80.518180 ±15492ft **ALT:** 2143ft

Figure 3: **STA 11124+00** – Controls in place and functioning properly.

BRG: 279°W (T) **LAT:** 37.315474 **LON:** -80.526587 ±16ft **ALT:** 1946ft

Figure 4: **STA 11087+00** – Controls in place and functioning properly.

BRG: 263°W (T) **LAT:** 37.315434 **LON:** -80.538351 ±16ft **ALT:** 2171ft

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Wednesday, June 30, 2021	Project Contact:	Brian Clauto
Spread G: Giles	AR GI 256.02 ATWS 1147 St 11328+63-11354+28	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-NN13, S-NN11
- ECD's were in place and functioning at the designated crossings for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, June 30, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, June 30, 2021**

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- Figure 1: Designated crossing S-NN11

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- Figure 2:Designated crossing S-NN11

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- Figure 3: St 11328+63 ECD's are in place.

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- Figure 4: St 11342 ECD's are in place.

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FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, June 30, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Craig County** **Giles County**	**STA 11540+00 – 11470+00** **STA 11327+85 – 11355+00** **MVP-GI-256/256.02** **MVP-CR-258.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☒ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-PP4, S-PP3, S-PP1, S-NN12 and S-NN11.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- STA 11489+00: Re-stabilization needed.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- STA 11492+50: Sump cleanout needed.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Various - See Comments

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, June 30, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, June 30, 2021**

Figure 1: **STA 11492+50** – Sump cleanout needed.

Figure 2: **STA 11489+00** – Re-stabilization needed.

Figure 3: **STA 11475+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 11515+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Friday, July 9, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11762+50 – 11770+00 STA 12001+72 – 12008+53 MVP-MN-266/266.03/268 MVP-MLV-AR-26**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ52, W-IJ46-PEM and S-G36.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- MVP-MN-266.03: Discharge bypassing P1 and causing minor erosion.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- STA 12004+00: P1 repair needed.
- MVP-MN-266.03: P1 undermined.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Various - See Comments

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Friday, July 9, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Friday, July 9, 2021**

Figure 1: **MVP-MN-266.03** – Discharge bypassing P1 causing minor erosion.

Figure 2: **MVP-MN-266.03** – P1 undermined.

Figure 3: **STA 12004+00** – P1 repair needed.

Figure 4: **STA 11976+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, July 12, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR GI 241.01** **ATWS 1390, 1391** **St 10709+88-10728+87**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

▪ *Comments:* Inspected the following resources: N/A

Routine Maintenance: (*72-Hour Deadline from Notification*)
- St10713+36 sediment in flow path
- St10723+80 rill erosion, sediment in inlet protection,& CFS outlet requires sediment removal
- St10725+42 rill erosion, sediment in inlet protection,& CFS outlet requires sediment removal
- 10728+87 end treatment not allowing water off the ROW

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, July 12, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, July 12, 2021**

- Figure 1: St10713+36 sediment in flow path

- Figure 2:St10723+80 rill erosion and sediment in inlet protection

- Figure 3: St10723+80 CFS requires sediment removal

- Figure 4: St 10725+42 rill erosion and sediment in inlet protection

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, July 12, 2021**

- Figure 5: St 10725+42 CFS requires sediment removal

- Figure 6: St 10728+87 end treatment is not allowing water off the ROW

- Figure 7: Fuel protected at ATWS 1390

- Figure 8: Stabilized area near St10709+88

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, July 12, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10708+10 – 10760+00** **MVP-GI-241.01**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G33, W-Z11 and S-G35.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- STA 10730+30: Waterbar maintenance needed. Sediment accumulation in throat.
- STA 10732+00: Inlet protection maintenance needed.
- STA 10739+50 to 10741+00: Inlet protection maintenance needed.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- STA 10731+94: CFS maintenance needed.
- STA 10755+40: Waterbar does not extend full length of ROW.
- STA 10756+00: Waterbar does not extend full length of ROW.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Various - See Comments

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, July 12, 2021**

FIELD INSPECTION PHOTO LOG

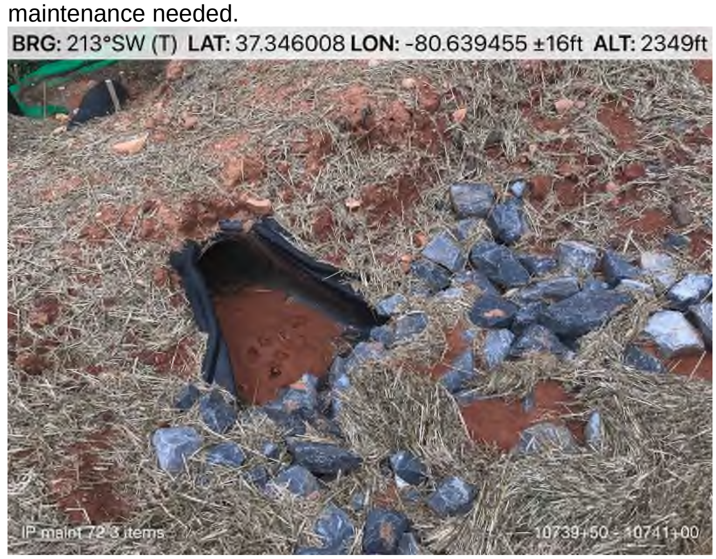
Project Name: Mountain Valley Pipeline **Date: Monday, July 12, 2021**

Figure 1: **STA 10730+30** – Waterbar maintenance needed.

Figure 2: **STA 10731+94** – CFS maintenance needed.

Figure 3: **STA 10732+00** – Inlet protection maintenance needed.

Figure 4: **STA 10739+50 to 10741+00** – Inlet protection maintenance needed.



FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, July 12, 2021**

Figure 7: **STA 10755+40** – Waterbar does not extend full length of the ROW.

Figure 6: **STA 10756+00** – Waterbar does not extend full length of the ROW.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, July 13, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**AR GI 240 & 241 ATWS 1335, 816 St 10656+57-10694+99**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-0043
- ECD's were in place and functioning above the designated crossing.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- St10713+36 sediment in flow path
- St10723+80 rill erosion, sediment in inlet protection,& CFS outlet requires sediment removal
- St10725+42 rill erosion, sediment in inlet protection,& CFS outlet requires sediment removal
- 10728+87 end treatment not allowing water off the ROW

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, July 13, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date**: **Tuesday, July 13, 2021**

- Figure 1: St10664+56 Inlet protection requires maintenance due to sediment.

- Figure 2: St10664+00 Inlet protection requires maintenance due to sediment.

- Figure 3: St10682+68 Inlet protection requires maintenance due to sediment.

- Figure 4: St10689+92 Inlet protection requires maintenance due to sediment.

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, July 13, 2021**

- Figure 5: Designated crossing S-0043, ECD's are in place.

- Figure 6 St10656+75 area is temporarily stabilized

- Figure 7: St10660+81 area is temporarily stabilized

- Figure 8: ECD has been installed at St10669

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, July 13, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Giles County	**STA 10656+00 – 10670+00 STA 10759+00 – 10798+83 MVP-GI-240**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-SS4, S-Z9, S-Z7 and S-Z7-Braid.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, July 13, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, July 13, 2021**

Figure 1: **STA 10669+00** – Controls in place and functioning properly.

Figure 2: **STA 10664+00** – Controls in place and functioning properly.

Figure 3: **STA 10774+00** – Controls in place and functioning properly.

Figure 4: **STA 10788+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Wednesday, July 14, 2021	Project Contact:	Brian Clauto
Spread G: Giles	AR GI 253.02 ATWS 633A, 633 St 11298-11353+60	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☒ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MM17, S-NN12, S-NN11
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- St11323 Inlet protection requires clean out.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, July 14, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Wednesday, July 14, 2021**

- Figure 1: St11323 inlet protection requires sediment removal

- Figure 2: Designated crossing S-NN12

- Figure 3: Designated crossing S-NN11

- Figure 4: St11305 x ray crew on site

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, July 20, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Craig	**AR GI 258.01 St 11470-11355+08**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-OO12, S-OO13, S-OO14., W-CD12, S-KL43
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, July 20, 2021**

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Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, July 20, 2021**

- Figure 1: Designated crossing S-OO12

- Figure 2: Designated crossing S-OO13

- Figure 3: Designated crossing S-OO14 & W-CD12

- Figure 4: St11422+91 actively being graded

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, July 26, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**AR GI 242.01 St 11970-10990 ATWS 467, 1331**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-E21, S-E20, S-MN11
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- ATWS 1331 fill slope requires rill repair and re stabilization

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St 10970 waterbar does not extend to the sump and will require reinstall
- St10967+19 waterbar end treatment appears not to allow water off ROW
- St 10967+75 hole in bridge mat underlayment
- St 10967+75 torn bridge wattle
- St 10967+35 CWD level spreader requires stabilization per ES 67
- St 10934+80 CWD level spreader lacks perimeter berm and stabilization

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Various - See Comments

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, July 26, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, July 26, 2021**

- Figure 1: St 10970 waterbar does not extend to the sump and will require reinstall

- Figure 2: St10967+19 waterbar end treatment appears not to allow water off ROW

- Figure 3: St 10967+75 hole in bridge mat underlayment

- Figure 4: St 10967+75 torn bridge wattle

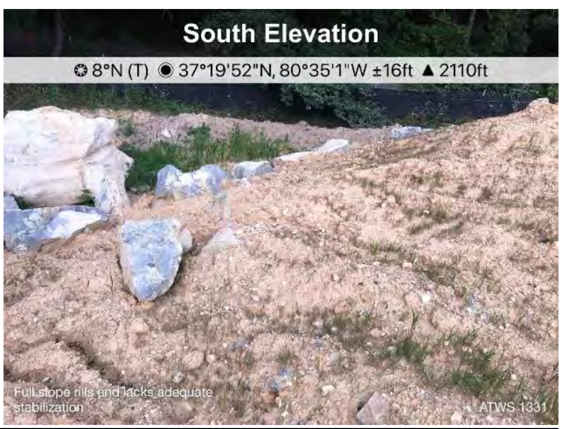
FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, July 26, 2021**

- Figure 5: St 10967+35 CWD level spreader requires stabilization per ES 67

- Figure 6: St 10934+80 CWD level spreader lacks perimeter berm and stabilization

- Figure 7: ATWS 1331 fill slope requires rill repair and re stabilization



FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Marshall Willis
Inspection Date:	Monday, July 26, 2021	Project Contact:	Brian Clauto, Cory Chalmers
Spread G: Giles County Craig County	STA 11524+16 – 11528+00 STA 10971+74 – 10929+71 MVP-CR-258.02 MVP-GI-242.01	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☒ Trenching ☐ Stringing/Welding

☒ Lowering/Backfilling ☒ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-MN11.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, July 26, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, July 26, 2021**

Figure 1: **STA 10969+00** – Controls in place and functioning properly.

BRG: 266°W (T) **LAT:** 37.327408 **LON:** -80.569155 ±164ft **ALT:** 2452ft

Figure 2: **STA 10955+00** – Controls in place and functioning properly.

BRG: 295°NW (T) **LAT:** 37.324559 **LON:** -80.588027 ±18789ft **ALT:** 2247ft

Figure 3: **Stream S-MN11** – Controls in place and functioning properly.

BRG: 337°NW (T) **LAT:** 37.333088 **LON:** -80.559416 ±5449ft **ALT:** 2992ft

Figure 4: **STA 11527+00** – Controls in place and functioning properly.

BRG: 57°NE (T) **LAT:** 37.329510 **LON:** -80.419994 ±16ft **ALT:** 2281ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, July 27, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR 241.02, 241.03** **St 10815-10802** **ATWS 464**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-Z13, S-Z14 S-YZ1, W-PYZ1
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St10815+45 lacks stabilization per ES 67
- Two tone area lacks stabilization from 10815+45-10814+26
- St10811+78 lacks stabilization per ES 67
- St10811+78 to10810 two tone area lacks stabilization
- From St10808 to 10809 two tone area lacks stabilization.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, July 27, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Tuesday, July 27, 2021**

- Figure 1: St10815+45 lacks stabilization per ES 67

- Figure 2: Two tone area lacks stabilization from 10815+45-10814+26

- Figure 3: St10811+78 lacks stabilization per ES 67

- Figure 3: St10811+78 to10810 two tone area lacks stabilization

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, July 27, 2021**

- Figure 5: From St10808 to 10809 two tone area lacks stabilization.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, July 27, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11158+12 – 11252+17** **STA 10802+00 – 10820+00** **MVP-GI-249.03** **MVP-MLV-AR-25**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☒ Trenching ☒ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Restoration ☒ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-NN17 and S-Z14.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, July 27, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, July 27, 2021**

Figure 1: **STA 11227+00** – Controls in place and functioning properly.

Figure 2: **STA 11245+00** – Controls in place and functioning properly.

Figure 3: **STA 11210+00** – Controls in place and functioning properly.

Figure 4: **STA 11163+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, August 3, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR GI 234** **St 11620-11600** **ATWS 1057, 1373**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-RR13, S-RR14, S-OO6
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

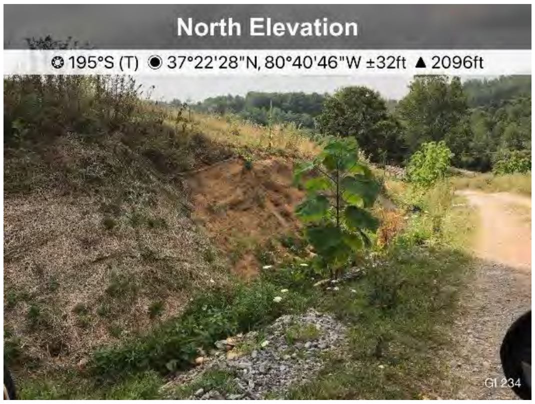
Inspector Signature: Matthew Grant

Date: **Tuesday, August 3, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, August 3, 2021**

▪ Figure 1: AR GI 234 ditch line



▪ Figure 2: Designated crossing S-RR13, ECD's are in place.

▪ Figure 3: Designated crossing S-RR14, ECD's are in place.

▪ Figure 3: Designated crossing S-OO6, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, August 3, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**MVP-Laydown Yard-026** **MVP-Laydown Yard-028** **MVP-ANC-005**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- Laydown Yard 028: Control/properly dispose of trash and debris around yard.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, August 3, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, August 3, 2021**

Figure 1: **Laydown Yard 028** – Control/properly dispose of trash and debris.

BRG: 319°NW (T) **LAT:** 37.334026 **LON:** -80.802850 ±16ft **ALT:** 1556ft

Figure 2: **MVP-ANC-005** – Controls in place and functioning properly.

BRG: 43°NE (T) **LAT:** 37.334309 **LON:** -80.802111 ±36ft **ALT:** 1568ft

Figure 3: **Laydown Yard 026** – Fueling station controls in place and functioning properly.

BRG: 276°W (T) **LAT:** 37.319223 **LON:** -80.657565 ±213ft **ALT:** 1813ft

Figure 4: **Laydown Yard 026** – Controls in place and functioning properly. Fertilizer properly stored.

BRG: 335°NW (T) **LAT:** 37.318842 **LON:** -80.658473 ±403ft **ALT:** 1805ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Friday, August 6, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11298+08 – 11356+18** **MVP-GI-253.02** **MVP-GI-256**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Restoration ☒ Temp. Stabilization ☐ Perm. Stabilization ☐ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Friday, August 6, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Friday, August 6, 2021**

Figure 1: **STA 11299+00** – Controls in place and functioning properly.

Figure 2: **STA 11317+00** – Controls in place and functioning properly.

Figure 3: **Stream S-NN12** – Controls in place and functioning properly along stream S-NN12.

Figure 4: **STA 11346+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, August 16, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11298+08 – 11356+18** **MVP-GI-253.02** **MVP-GI-256**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☒ Trenching ☒ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Ineffective Controls: (*24-Hour Deadline from Notification)*
- STA 10858+00 to 10859+00: Stabilize fill slope.
- STA 10857+00 to 10859+00: Stabilize fill slope.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, August 16, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, August 16, 2021**

<table>
<tr>
<td>Figure 1: STA 10858+00 to 10859+00 – Stabilize fill slope.
</td>
<td>Figure 2: STA 10857+00 to 10859+00 – Stabilize fill slope.
</td>
</tr>
<tr>
<td>Figure 3: STA 10795+00 – Controls in place and functioning properly.
</td>
<td>Figure 4: STA 10791+00 – Controls in place and functioning properly.
</td>
</tr>
</table>

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Monday, August 23, 2021	Project Contact:	Brian Clauto
Spread G: Giles	St 10883+60-10930 ATWS 1331, 470, 1333	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☐	☒	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☒	☐	☐

- *Comments:* Inspected the following resources: S-Y2, S-Y3
- ECD's were in place and functioning above the designated crossing for active construction.
- Sediment removal was on going at S-Y2.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St 10891+97 sump requires maintenance
- St 10890+00 sump requires maintenance
- St 10890+75 sump requires maintenance
- St 10924 temporary waterbar has no end treatment
- St 10924+56 temporary waterbar end treatment is not keyed in
- St 10925+50 temporary waterbar has no end treatment

.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _____

Date: **Monday, August 23, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, August 23, 2021**

- Figure 1: St 10891+97 sump requires maintenance

- Figure 2: St 10890 sump requires maintenance

- Figure 3: St 10890+75 sump requires maintenance

- Figure 4: St 10924 waterbar has no end treatment

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, August 23, 2021**

- Figure 5: St 10924{+56 water bar end treatment not keyed in

- Figure 6: St 10925+50 water bar has no end treatment

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, August 23, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10859+34 – 10930+00**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-Y3, Y2 and S-A32.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, August 23, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, August 23, 2021**

Figure 1: **STA 10859+34** – Controls in place and functioning properly.

Figure 2: **STA 10870+00** – Controls in place and functioning properly.

Figure 3: **STA 10872+00** – Controls in place and functioning properly.

Figure 4: **STA 10878+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, August 24, 2021	Project Contact:	Brian Clauto
Spread G: Giles	St 10819- 10804 ATWS 464 AR 241.03, 241.02	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-YZ1, P-YZ1, S-Z14
- ECD's were in place and functioning above the designated crossing for active construction.
- Ongoing installation of additional controls from St 10807+98 through 10804.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, August 24, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

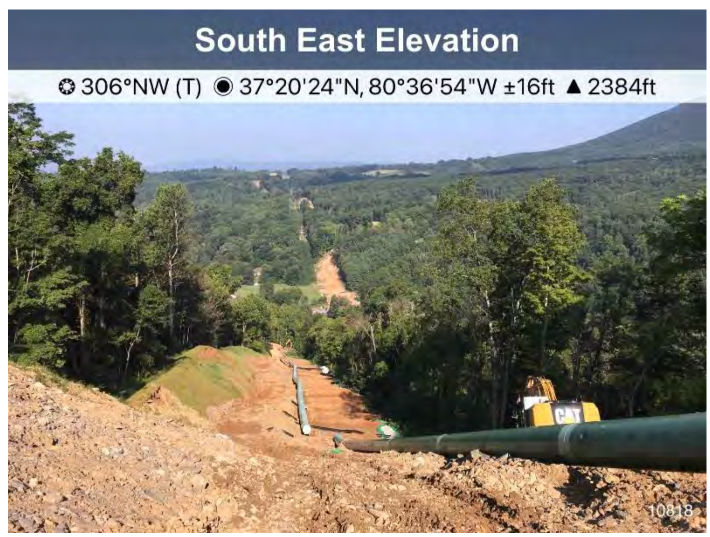
Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, August 24, 2021**

- Figure 1: Additional control installed near St 10807+98

- Figure 2: St 10803+57 ECD installed at base of trench.

- Figure 3: Designated crossing S-YZ1

- Figure 4: St 10818 ECD ongoing maintenance



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, August 24, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10695+00 – 10710+00** **STA 10820+00 – 10802+66** **MVP-GI-241.01/.02/.03**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☐ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-Z14 and S-G32.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, August 24, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, August 24, 2021**

Figure 1: **Stream S-Z14** – Controls in place and functioning properly.

Figure 2: **STA 10708+00** – Controls in place and functioning properly.

Figure 3: **STA 10705+00** – Controls in place and functioning properly.

Figure 4: **Stream S-G32** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, August 30, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**St 10807- 10803+20** **St 10883+10** **St 10926-10930** **St10759+87-10757+12** **ATWS 464, 471** **AR GI241.02**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-A32, S-G35, S-Y2, S-Y3, S-Z13
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, August 30, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, August 30, 2021**

- Figure 1: Designated crossing S-A32, ECD's are in place.

- Figure 2: St 10926+75 ECD's are in place.

- Figure 3: St 10803+20 ECD's are in place.

- Figure 4: St 10759+87 above designated stream S-G35, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, September 2, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10819+00 – 10859+24** **MVP-GI-241.03**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☒ Trenching	☐ Stringing/Welding
☒ Lowering/Backfilling	☐ Final Restoration	☐ Temp. Stabilization	☐ Perm. Stabilization	☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-A34 and S-A35.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- STA 10830+89: Slope drain inlet protection maintenance needed.
- STA 10831+29: Slope drain inlet protection maintenance needed.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 72-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, September 2, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, September 2, 2021**

Figure 1: **STA 10830+89** – Inlet protection maintenance needed.

Figure 2: **STA 10831+29** – Inlet protection maintenance needed.

Figure 3: **STA 10827+00** – Controls in place and functioning properly.

Figure 4: **STA 10838+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, September 8, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Craig	**St 11353-11471**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☒ Temp. Stabilization ☒ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-0012, S-0013, S-0014, W-CD12
- ECD's were in place and functioning above the designated crossing for active construction, except for S-0013 near St 11451

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- St 11451 P1 is down and torn
- St 11444- 11445 areas of rill erosion and lacks stabilization

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Various - See Comments

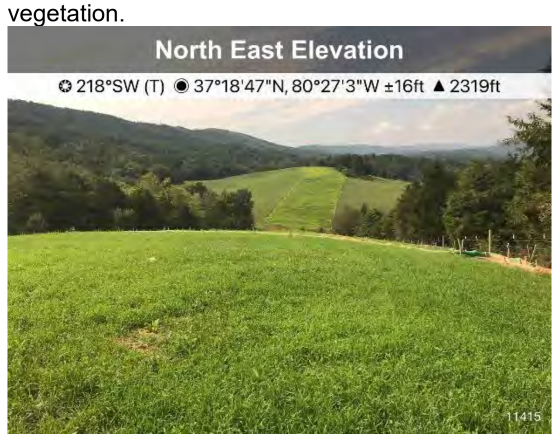
The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, September 8, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, September 8, 2021**

▪ Figure 1: P1 is down and torn at near St 11451. 	▪ Figure 2: St 11444-11445 lacks stabilization and rill erosion has occurred. 
▪ Figure 3: St 11428 on going grading activities and permanent stabilization. 	▪ Figure 4: St 11415 area has been stabilized with permanent vegetation. 

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, September 8, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County** **Craig County**	**STA 11353+21 – 11526+00** **MVP-CR-258.02** **MVP-GI-256.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☒ Final Restoration ☒ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-KL43, W-CD12, S-OO14, S-OO13, S-OO12, S-PP1, S-PP2, S-PP3 and S-PP4.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, September 8, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, September 8, 2021**

Figure 1: **STA 11526+00** – Controls in place and functioning properly.

Figure 2: **STA 11514+00** – Controls in place and functioning properly.

Figure 3: **STA 11425+00** – Controls in place and functioning properly.

Figure 4: **STA 11413+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Friday, September 10, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Craig County** **Montgomery County**	**STA 11596+00 – 11619+00** **STA 11978+54 – 11988+96** **MVP-MN-258.04** **MVP-MN-266**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-OO6, S-RR13 and S-RR14.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Friday, September 10, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Friday, September 10, 2021**

Figure 1: **STA 11598+00** – Controls in place and functioning properly.

Figure 2: **STA 11616+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **Stream S-RR13** – Controls in place and functioning properly along Craig Creek.

Figure 4: **STA 11960+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, September 14, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11158+37 – 11230+00** **MVP-MLV-AR-25** **MVP-GI-249.01/.03**	**Weather:**	**Dry**

<u>ACTIVE STAGE OF CONSTRUCTION:</u> (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☒ Final Restoration ☐ Temp. Stabilization ☒ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

<u>Comments:</u> Inspected the following resources: S-NN17.

Routine Maintenance: (*<u>72-Hour Deadline</u> from Notification*)

- STA 11165+72: Re-stabilize stockpile.

<u>Recommended Corrective Action</u>: Maintain and install all controls per the approved PSS&S.

<u>Deadline:</u> <u>Within 72-Hour of Notification</u>

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, September 14, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, September 14, 2021**

<table>
<tr>
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Figure 1: **STA 11228+00** – Controls in place and functioning properly.

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Figure 2: **STA 11208+00** – Controls in place and functioning properly.

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Figure 3: **STA 11197+00** – Controls in place and functioning properly.

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Figure 4: **STA 11165+72** – Re-stabilize stockpile.

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FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, September 16, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11254+88 – 11353+21** **MVP-GI-253.02**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☒ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-NN11, S- NN12, W-MM10, S-MM17 and S-MM18.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, September 16, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Thursday, September 16, 2021**

Figure 1: **STA 11285+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 11267+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11304+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 11313+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, September 21, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**St10883+33, 10859+78, 10759-10798** **ATWS1056, 1334, 469, 466, 1360, 1332, 1333** **AR GI 241.02**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☒ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-Y2, S-A32, S-SS4, S-Z9, S-Z7
- ECD's were in place and functioning above the designated crossing for active construction. Sediment removal has been completed on S-Y2 where access was approved.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, September 21, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, September 21, 2021**

- Figure 1: Designated crossing S-Y2, ECD's are in place and functioning for active construction.

- Figure 2: Designated crossing S-32, ECD's are in place and functioning.

- Figure 3: Designated crossing S-G35, ECD's are in place and functioning.

- Figure 4: Designated crossing S-S4, ECD's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, September 27, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**AR GI 256.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Other

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-NN14
- ECD's were in place and functioning above the designated crossing for active construction. Sediment and gravel removal has been completed on S-NN14.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, September 27, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, September 27, 2021**

▪ Figure 1: Designated crossing S-NN14 	▪ Figure 2: Escaped sediment and gravel has been removed and the area has been stabilized. 
Figure 3: Additional CFS has been installed on portions of AR 256.02. 	▪ Figure 4: Escaped sediment and gravel has been removed and the area has been stabilized. 

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, September 30, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10819+00 – 10883+56** **MVP-GI-241.03**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☒ Trenching ☒ Stringing/Welding

☒ Lowering/Backfilling ☐ Final Restoration ☒ Temp. Stabilization ☐ Perm. Stabilization ☐ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-A34, S-A33 and S-A32.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, September 30, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, September 30, 2021**

Figure 1: **STA 10830+00** – Controls in place and functioning properly.

Figure 2: **STA 10843+00** – Controls in place and functioning properly.

Figure 3: **STA 10852+00** – Controls in place and functioning properly.

Figure 4: **STA 10877+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, October 6, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11158+37 – 11230+00** **MVP-MLV-AR-25** **MVP-GI-249.01/.03**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☒ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-NN17

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, October 6, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, October 6, 2021**

Figure 1: **STA 11227+00** – Controls in place and functioning properly.

Figure 2: **STA 11219+00** – Controls in place and functioning properly.

Figure 3: **STA 11191+00** – Controls in place and functioning properly.

Figure 4: **STA 11163+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, October 13, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11669+00 – 11768+00 MVP-MLV-AR-26**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ12, W-MN7, W-KL51-PSS, S-KL55, W-KL49-PEM, W-KL50 and W-KL48-PSS-1.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, October 13, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, October 13, 2021**

Figure 1: **STA 11682+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 11709+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11720+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 11751+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, October 18, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR 251.01** **10859-10930** **11230-11255** **ATWS1360, 1332, 1347, 1331, 471**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☒ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-A32, S-Y3, S-Y2, S-RR2, W-RR1b
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

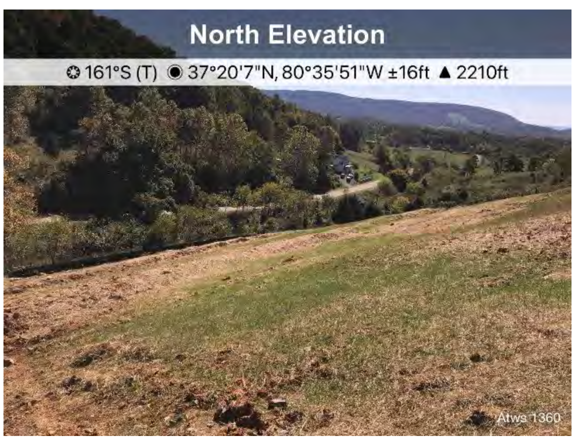
The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, October 18, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, October 18, 2021**

▪ Figure 1: St 10859 ECD's are in place and area has been stabilized. 	▪ Figure 2: Designated crossing S-A32, ECD's are in place. 
▪ Figure 3: ATWS 1360 area is stabilized 	▪ Figure 4: St 10899 area is stabilized and ECD's are in place. 

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, October 18, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10859+34 – 10929+71**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-A32, S-Y3 and S-Y2.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, October 18, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, October 18, 2021**

Figure 1: **STA 10859+00** – Controls in place and functioning properly. Area stabilized outside of active travel lane.

BRG: 291°W (T) **LAT:** 37.337672 **LON:** -80.604354 ±98ft **ALT:** 2288ft

Figure 2: **STA 10878+00** – Controls in place and functioning properly. Area stabilized outside of active travel lane.

BRG: 89°E (T) **LAT:** 37.335681 **LON:** -80.598313 ±16ft **ALT:** 2296ft

Figure 3: **STA 10899+00** – Controls in place and functioning properly. Area stabilized outside of active travel lane.

BRG: 11°N (T) **LAT:** 37.334599 **LON:** -80.592117 ±98ft **ALT:** 2540ft

Figure 4: **STA 10918+00** – Controls in place and functioning properly. Area stabilized outside of active travel lane.

BRG: 131°SE (T) **LAT:** 37.332882 **LON:** -80.584734 ±213ft **ALT:** 2233ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, October 27, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR 249.03, AR258.04** **11230-11160** **11618+60-11600** **ATWS1370A, 1370, 1347, 1464, 1369**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-NN17, S-RR13, S-RR14, S-OO6
- ECD's were in place and functioning above the designated crossing for active construction.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, October 27, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Wednesday, October 27, 2021**

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- Figure 1: Permanent stabilization and waterbars have been installed near St 11210

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- Figure 2: St 11160 Mountain Lake road crossing, ECD's are in place and slope is stabilized.

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- Figure 3: Designated crossing S-RR13, ECD's are in place.

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- Figure 4: Designated crossing S-OO6, ECD's are in place.

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FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, November 1, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10674+92 – 10759+05** **MVP-GI-241.01/.04**	**Weather:**	**Dry**

<u>**ACTIVE STAGE OF CONSTRUCTION:**</u> (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

<u>Comments:</u> Inspected the following resources: S-G30, S-G32, S-G33, W-Z11 and S-G35.

Ineffective Controls: (*<u>24-Hour Deadline</u> from Notification)*

- ATWS 1390: Stabilization needed.
- STA 10707+25: Stabilization needed.
- STA 10676+15: Stabilization needed.

<u>**Recommended Corrective Action**</u>**:** Maintain and install all controls per the approved PSS&S.

<u>**Deadline:**</u> <u>Within 24-Hour of Notification</u>

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, November 1, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, November 1, 2021**

Figure 1: **ATWS 1390** – Stabilization needed.

Figure 2: **STA 10707+25** – Stabilization needed.

Figure 3: **STA 10676+15** –Stabilization needed.

Figure 4: **STA 10728+00** – Controls in place and functioning properly. Area stabilized with straw.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, November 8, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11098+00 – 11158+12** **MVP-GI-245.02** **MVP-GI-249**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*

- STA 11146+00: Stabilization needed.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Within 24-Hour of Notification

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, November 8, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date**: **Monday, November 8, 2021**

Figure 1: **STA 11104+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 11115+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11146+15** –Stabilization needed.

Figure 4: **STA 11151+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Monday, November 8, 2021	Project Contact:	Brian Clauto
Spread G: Montgomery	ATWS 1487 MLV 26 11790-11766+32	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-IJ52, W-IJ46-PEM
- ECD's were in place and functioning above the designated crossing.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, November 8, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, November 8, 2021**

- Figure 1: St11790 area is stabilized and ECD's are in place.

- Figure 2: Designated crossing S-IJ52, ECD's are in place.

- Figure 3: St11770 ECD's are in place and area is stabilized.

- Figure 4: St11785+93 ECD's are in place and area is stabilized.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, November 10, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Montgomery	**St11024-10931 AR 244**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☒ Final Grading ☐ Temp. Stabilization ☒ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-IJ18, S-RR5, S-E24, S-PA07
- ECD's were in place and functioning above the designated crossing.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, November 10, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Wednesday, November 10, 2021**

▪ Figure 1: St11024 area is stabilized and ECD's are in place.

▪ Figure 2: Designated crossing S-E24, ECD's are in place.

▪ Figure 3: St10961+75 permanent restoration has been applied.

▪ Figure 4: St10950 active restoration grading.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, November 29, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**St11494** **St10656+76-10712+41** **St10700-10691+21** **AR GI240, 241.01, 241** **ATWS 1390, 1391, 816**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-PP1, S-G33, S-G32
- ECD's were in place and functioning above the designated crossing.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, November 29, 2021**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, November 29, 2021**

- Figure 1. Designated crossing S-PP1, ECD's are in place.

- Figure 2: Designated crossing S-G33, ECD's are in place.

- Figure 3: Designated crossing S-G32, ECD's are in place.

- Figure 4: St10691+21 ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, December 1, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**St10968-10930** **AR GI242.01** **ATWS 1331, 467**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MN11, S-E20, S-E21
- ECD's were in place and functioning above the designated crossing.
- Crews were on site preparing AR GI 242.01.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, December 1, 2021**

FIELD INSPECTION PHOTO LOG

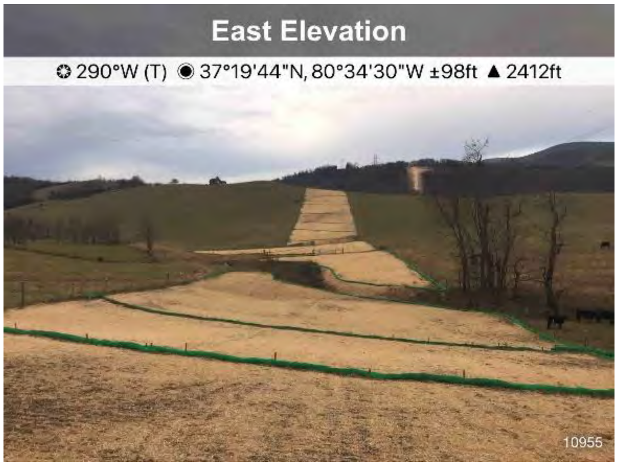
Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, December 1, 2021**

- Figure 1. Designated crossing S-MN11, ECD's are in place.

- Figure 2: Construction of AR GI 242.01, ECD's have been installed.

- Figure 3: St10968 area has been stabilized and ECD's are in place.

- Figure 4: St10955 are has been stabilized and ECD's are in place.



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, December 2, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10656+00 – 10675+13** **Laydown Yard 028/029** **MVP-GI-240** **MVP-GI-238.01**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, December 2, 2021**

DEQ
Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, December 2, 2021**

Figure 1: **Laydown Yard 029** – Controls in place and functioning properly.

BRG: 27°NE (T) **LAT:** 37.333986 **LON:** -80.803010 ±16ft **ALT:** 1564ft

Figure 2: **STA 10673+00** – Controls in place and functioning properly. Area stabilized with straw.

BRG: 87°E (T) **LAT:** 37.350623 **LON:** -80.660672 ±98ft **ALT:** 2123ft

Figure 3: **STA 10665+00** – Controls in place and functioning properly. Area stabilized with straw

BRG: 299°NW (T) **LAT:** 37.353081 **LON:** -80.661320 ±32ft **ALT:** 2255ft

Figure 4: **Laydown Yard 029** – Controls in place and functioning properly.

BRG: 193°S (T) **LAT:** 37.363271 **LON:** -80.676799 ±98ft **ALT:** 1814ft

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, December 6, 2021**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11254+88 – 11298+29** **MVP-GI-253.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-MM18, W-MM10 and S-MM17.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, December 6, 2021**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, December 6, 2021**

Figure 1: **STA 11297+00** – Controls in place and functioning properly. Area stabilized with straw

Figure 2: **STA 11284+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11273+00** – Controls in place and functioning properly. Area stabilized with straw

Figure 4: **STA 11256+00** – Controls in place and functioning properly. Area stabilized with straw

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, December 6, 2021**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**St11296-11255 AR GI253.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MM18, W-RR1b, W-MM10, P-MM2
- ECD's were in place and functioning above the designated crossing.
- Crews were on site preparing AR GI 242.01.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, December 6, 2021**

FIELD INSPECTION PHOTO LOG

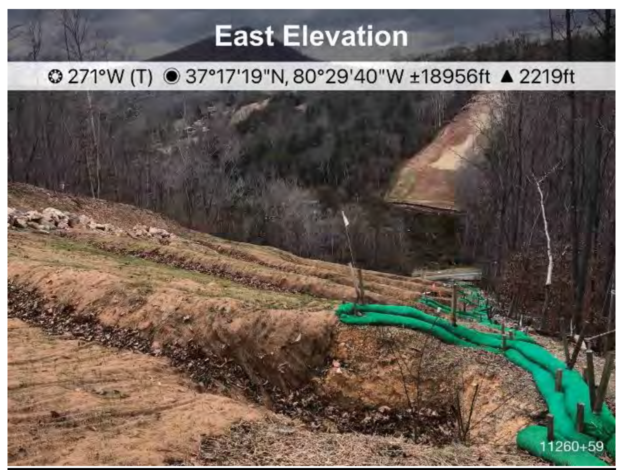
Project Name: **Mountain Valley Pipeline** **Date:** **Monday, December 6, 2021**

- Figure 1. Designated crossing S-MM18, ECD's are in place.

- Figure 2: Designated crossing W-RR1B, ECD's are in place.

- Figure 3: St11265+41 area is stabilized and ECD's are in place.

- Figure 4: St11265+41 area is stabilized and ECD's are in place



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, January 11, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10929+00 – 10972+00** **STA 11167+00 – 11227+00** **MVP-MLV-AR-25** **MVP-GI-249.01** **MVP-GI-241.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-MN11.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, January 11, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, January 11, 2022**

Figure 1: **MVP-GI-242.01** – Controls in place and functioning properly along access road.

BRG: 140°SE (T) **LAT:** 37.332773 **LON:** -80.560607 ±16ft **ALT:** 3018ft

Figure 2: **STA 10970+00** – Controls in place and functioning properly. Area stabilized with straw.

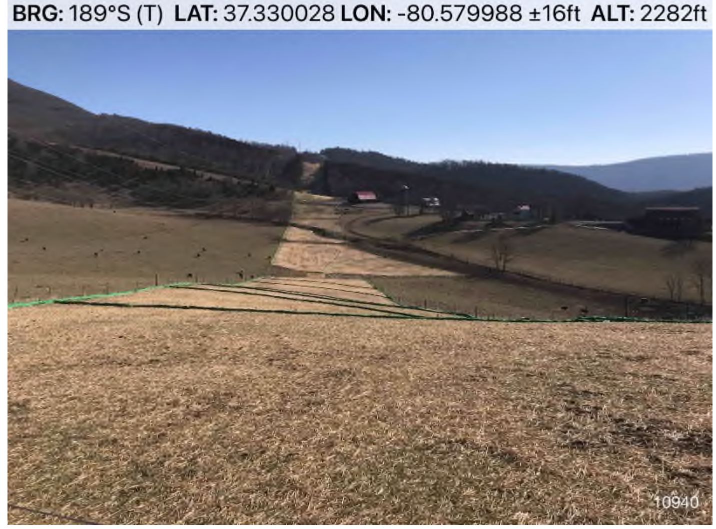
BRG: 305°NW (T) **LAT:** 37.327106 **LON:** -80.570319 ±16ft **ALT:** 2452ft

Figure 3: **STA 10961+00** – Controls in place and functioning properly.

BRG: 307°NW (T) **LAT:** 37.327940 **LON:** -80.572925 ±16ft **ALT:** 2308ft

Figure 4: **STA 10940+00** – Controls in place and functioning properly. Area stabilized with straw.

BRG: 189°S (T) **LAT:** 37.330028 **LON:** -80.579988 ±16ft **ALT:** 2282ft



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, January 11, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ST1127-11170** **ATWS 1464, 1370, 1370A, 1347** **AR GI 249.01, 025**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: N/A

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant ___________________

Date: **Tuesday, January 11, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, January 11, 2022**

- Figure 1: ATWS 1370, ESC's in place.

- Figure 2: ATWS 1464, ESC's in place.

- Figure 3: St1194+57 ESC's are in place and functioning.

Figure 4: St11215 ESC's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Monday, January 24, 2022	Project Contact:	Brian Clauto
Spread G: Giles	St10803+35-10797+16, 10883+74, 100757+79-10760 ATWS 464, 1334, 1056 AR-GI 242.01	Weather:	Snow

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-Z13, S-A32, S-G35
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, January 24, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, January 24, 2022**

- Figure 1: ESC controls were snow covered near St 10803+35

- Figure 2: Designated stream crossing S-G35, ESC controls were in place.

- Figure 3: Designated stream crossing S-A32, ESC controls were in place.

- Figure 4: Aquatic Buffer for S-Z13, ESC controls were in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, January 25, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**St11668+66-11766+03, 11614+73-11607+87** **ATWS1057**	**Weather:**	**Snow**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources:
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, January 25, 2022**

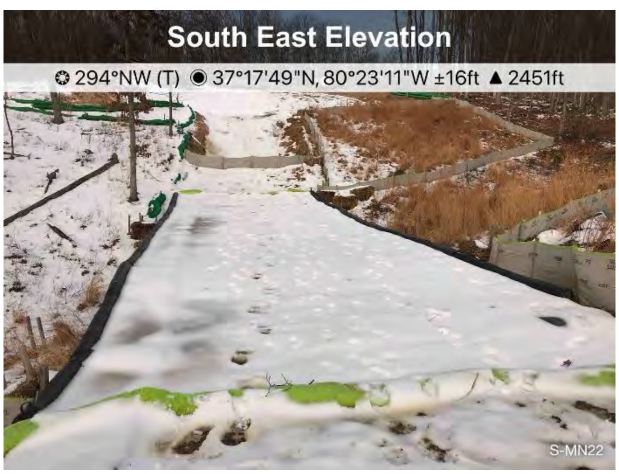
FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, January 25, 2022**

- Figure 1: ESC controls were snow covered near St 11672

- Figure 2: Designated stream crossing S-MN21, ESC controls were in place.

- Figure 3: Designated stream crossing S-MN22, ESC controls were in place.



- Figure 4: Designated stream crossing S-EF35, ESC controls were in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, January 31, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10656+00 – 10711+00** **MVP-GI-240** **MVP-GI-241.01/241.04**	**Weather:**	**Snow**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G30, S-G29 and S-G32.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, January 31, 2022**

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, January 31, 2022**

Figure 1: **STA 10656+00** – Controls in place and functioning properly.

BRG: 73°E (T) **LAT:** 37.352936 **LON:** -80.663591 ±13421ft **ALT:** 2242ft

Figure 2: **STA 10661+00** – Controls in place and functioning properly.

BRG: 126°SE (T) **LAT:** 37.353408 **LON:** -80.662035 ±10429ft **ALT:** 2186ft

Figure 3: **STA 10699+00** – Controls in place and functioning properly.

BRG: 142°SE (T) **LAT:** 37.348760 **LON:** -80.651932 ±213ft **ALT:** 2084ft

Figure 4: **STA 10693+00** – Controls in place and functioning properly.

BRG: 257°W (T) **LAT:** 37.349569 **LON:** -80.653743 ±32ft **ALT:** 1995ft

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	**Monday, January 31, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**St10710-10696+73 ATWS 1390, 1391 AR-GI 241.01**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-G33, S-AB13, S-AB14, S-G32
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant ____________________

Date: **Monday, January 31, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, January 31, 2022**

- Figure 1: ESC controls were snow covered near St 10710 above stream S-G33.

- Figure 2: St 10705+34, ESC controls were in place.

- Figure 3: Designated stream crossing S-G32, ESC controls were in place.

- Figure 4: ECD's in place at St 10696+73.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, February 9, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11023+80 – 11151+27** **MVP-GI-244** **MVP-GI-249**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Restoration	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ19, S-IJ18, S-IJ17 and S-IJ16-B.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, February 9, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, February 9, 2022**

Figure 1: **STA 11068+00** – Controls in place and functioning properly.

BRG: 307°NW (T) **LAT:** 37.267910 **LON:** -80.471223 ±16535ft **ALT:** 2192ft

Figure 2: **STA 11081+00** – Controls in place and functioning properly.

BRG: 96°E (T) **LAT:** 37.316280 **LON:** -80.543244 ±13795ft **ALT:** 2238ft

Figure 3: **STA 11096+00** – Controls in place and functioning properly.

BRG: 103°E (T) **LAT:** 37.313340 **LON:** -80.535043 ±98ft **ALT:** 1910ft

Figure 4: **STA 11131+00** – Controls in place and functioning properly.

BRG: 133°SE (T) **LAT:** 37.314253 **LON:** -80.523731 ±164ft **ALT:** 2050ft

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Wednesday, February 9, 2022	Project Contact:	Brian Clauto
Spread G: Giles	St11025-11064 ATWS 1146, 1145, 1465 AR-GI 244	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-IJ 18, S-IJ19, S-IJ16b
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, February 9, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Wednesday, February 9, 2022**

- Figure 1: Designated crossing S-IJ19, ESC's are in place and functioning.

- Figure 2: St 11044+71, ESC controls were in place.

- Figure 3: Designated crossing S-IJ16b, ESC's are in place and functioning.

- Figure 4: St 11057, ECD's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, February 22, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**St 11521-11533, 10975-10974+96** **ATWS 874A, 874** **AR-GI242.01, 243.01, 258.02**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MN11, W-HS07, S-RR2, S-QQ2
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant ____________________

Date: **Tuesday, February 22, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, February 22, 2022**

- Figure 1: Designated crossing S-RR2, ESC's are in place and functioning.

- Figure 2: ESC controls were in place on AR 243.01

- Figure 3: St10975, ECD's are in place and functioning.

- Figure 4: St11533, ECD's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, March 8, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Craig**	**St 11522-11472+43** **AR-Cr 258.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-PP4, S-PP3, S-PP1, S-QQ2
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, March 8, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, March 8, 2022**

- Figure 1: Designated crossing S-PP4, ESC's are in place and functioning.

- Figure 2: Designated crossing S-PP3, ESC's are in place and functioning.

- Figure 3: St 11492+87, ECD's are in place and functioning.

- Figure 4: St11472+73, ECD's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, March 8, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County** **Craig County**	**STA 11353+67 – 11525+00** **MVP-GI-256.02** **MVP-CR-258.02**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-KL43, S-OO12, S-OO13, S-OO14, S-PP1, S-PP3 and S-PP4.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, March 8, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, March 8, 2022**

Figure 1: **STA 11486+00** – Controls in place and functioning properly.

Figure 2: **STA 11449+00** – Controls in place and functioning properly.

Figure 3: **STA 11433+00** – Controls in place and functioning properly.

Figure 4: **STA 11412+00** – Controls in place and functioning properly.

COMPREHENSIVE PIPELINE INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis, Matt Grant**
Inspection Date:	**Monday, March 21, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**Laydown Yard 026** **Laydown Yard 029**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Laydown Yard

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

	SWPPP AMENDMENTS, MODIFICATIONS AND UPDATES	***Yes***	***No***	***N/A***	Reviewed during re-inspection? ☐Yes ☐No ***Location / Description***
1	Is the SWPPP being amended whenever there is a change in the design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants to surface waters? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 5, 6).	☒	☐	☐	
2	Has the SWPPP been amended if inspections or investigations by the operator's qualified personnel or by state or federal officials find that existing control measures are ineffective in minimizing pollutants in discharges? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 5, 6).	☒	☐	☐	
3	Have there been updates to the SWPPP when any modifications to its implementation have occurred, including a record of dates when major grading activities occur, construction activities temporarily or permanently cease on a portion of the site or stabilization measures are initiated? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 5).	☒	☐	☐	
4	Is there documentation in the SWPPP of replaced or modified controls? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 5).	☒	☐	☐	
5	Has the SWPPP been updated to indicate areas that have reached final stabilization? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 5).	☒	☐	☐	

	INSPECTIONS AND CORRECTIVE ACTIONS	*Yes*	*No*	*N/A*	Reviewed during re-inspection? ☐Yes ☐No ***Location / Description***
6	Have inspections required by the SWPPP been conducted at the required frequency, including a modified frequency for impaired water(s), approved TMDL(s), and exceptional waters when applicable? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 4, 5, 6).	☒	☐	☐	
7	Are inspection reports completed and appropriately signed? (Va. Code §62.1- 44.15:31) (MVP Standards & Specifications for VA, pp. 5, 6).	☒	☐	☐	
8	Are corrective actions taken consistent with the requirements of the approved Annual Standards and Specifications? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 3, 5).	☒	☐	☐	

	ESC AND SWM PLAN IMPLEMENTATION	*Yes*	*No*	*N/A*	Reviewed during re-inspection? ☐Yes ☐No ***Location / Description***
9	Is the specified sequencing of the project being implemented in accordance with the approved erosion and sediment control plan and stormwater management plans? (Va. Code §62. 1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.B and C).	☒	☐	☐	
10	Is topsoil segregation being carried out in accordance with the SWPPP? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 10, 11).	☒	☐	☐	
11	Have all denuded areas requiring temporary or permanent stabilization been stabilized within 7 days, and have stabilization requirements for impaired waters, approved TMDL(s), pollutants of concern and exceptional waters, when applicable, been met? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.B) (9VAC 25-840-40.1).	☒	☐	☐	
12	Are soil stockpiles adequately stabilized with seeding and/or protected with sediment trapping measures? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.2).	☒	☐	☐	
13	Has a permanent vegetative cover has been established that is uniform, mature enough to survive and will inhibit erosion? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 1, 15, 16) (9VAC 25-840-40.3).	☐	☐	☒	
14	Have sediment trapping facilities been constructed as the first step in land disturbance activities? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.4).	☒	☐	☐	
15	Have earthen structures been stabilized immediately after installation? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.5).	☒	☐	☐	
16	Are sediment traps and basins installed in accordance with MS-6 and the approved plan? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.6).	☐	☐	☒	
17	Are finished cut and fill slopes adequately stabilized to prevent or correct excessive erosion? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.7).	☒	☐	☐	
18	Is concentrated runoff flowing down cut or fill slopes contained in an adequate permanent or temporary structure? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.8).	☒	☐	☐	

19	Is adequate drainage or other protection provided for water seeps? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.9).	☒	☐	☐	
20	Do all operational storm sewer inlets have adequate inlet protection? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.10).	☒	☐	☐	
21	Are stormwater conveyance channels adequately stabilized with channel lining and/or outlet protection? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.11).	☒	☐	☐	
22	Is in-stream construction conducted using measures to minimize channel damage? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.12).	☐	☐	☒	
23	Are temporary stream crossings of non-erodible material installed where applicable? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.13).	☐	☐	☒	
24	Is necessary re-stabilization of in-stream construction complete? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.15).	☐	☐	☒	
25	Are utility trench operations conducted and stabilized in accordance with MS-16? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.16).	☐	☐	☒	
26	Are soil and mud kept off paved or public roads to minimize the transport of sediment? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.17).	☒	☐	☐	
27	Have all temporary control structures that are no longer needed been removed and disturbed soil resulting from their removal permanently stabilized? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.18).	☐	☐	☒	
28	Are properties and waterways downstream from development adequately protected from erosion, sediment and damage in accordance with the standards and criteria specified by 9VAC25-840.19(a-n)? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-40.19).	☒	☐	☐	
29	Are all E&S control measures and systems being inspected, maintained and repaired as necessary to ensure functionality? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-60.A).	☒	☐	☐	
30	Are permanent control measures included in the SWPPP in place? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC 25-840-54.C).	☒	☐	☐	

	POLLUTION PREVENTION PLAN IMPLEMENTATION	***Yes***	***No***	***N/A***	Reviewed during re-inspection? ☐Yes ☐No ***Location / Description***
31	Are chemicals, fertilizers, pesticides and other potential pollutants being properly stored (e.g., under cover or within secondary containment) and handled? (Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☒	☐	☐	
32	Are construction products, materials, and wastes being properly stored, handled, and disposed of? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☒	☐	☐	
33	Is trash and debris being controlled and properly disposed of? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☒	☐	☐	

34	Are measures in place to prevent discharge of spills or leaks from fueling, operation or storage of vehicles, motors and other mechanical equipment? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☒	☐	☐	
35	Have spills, leaks, or stains (e.g., from hydraulic hoses, vehicle/equipment maintenance and fueling operations, etc.) been cleaned up in accordance with the pollution prevention plan? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☒	☐	☐	
36	Are chemicals, soaps, solvents, and wash water from construction materials or vehicle washing (e.g., form release oils and curing compounds from hand tools) prevented from leaving the site or properly treated prior to discharge? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☒	☐	☐	
37	Is concrete wash-out water being directed into a properly installed and maintained leak-proof container or leak-proof settling basin? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, p. 1) (9VAC25-870-54.D).	☐	☐	☒	
38	Are all unauthorized non-stormwater discharges prevented from leaving the site, including untreated hydrostatic testing water? Va. Code §62.1-44.15:31) (MVP Standards & Specifications for VA, pp. 1, 13) (9VAC25-870-54.D).	☒	☐	☐	

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

PIPELINE INSPECTION REPORT

REQUEST FOR CORRECTIVE ACTION

Project Name: Mountain Valley Pipeline **Date: Monday, March 21, 2022**

Location or Checklist #	Regulatory Citation/Legal requirement[1]	Observation/Recommended Corrective Action

Comments: Inspected the following Laydown Yards: 026 and 028.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, March 21, 2022**

[1] Refers to applicable regulation found in the most recent publication of the State Water Control Law (Va. Code § 62.1-44.2 et seq.), Virginia Erosion and Sediment Control Regulations (9VAC25-840), the Virginia Stormwater Management Program (VSMP) Regulations (9VAC25-870), or the General Permit for Discharges of Stormwater from Construction Activities (9VAC25-880).

PIPELINE INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, March 21, 2022**

Figure 1: **Laydown Yard 026** – Fueling station controls in place and functioning properly.

Figure 2: **Laydown Yard 028** – Controls in place and functioning properly.

Figure 3: **Laydown Yard 026** – Controls in place and functioning properly.

Figure 4: **Laydown Yard 026** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, March 29, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11900+00 – 12007+33 MVP-MN-266/266.03/268**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: W-NN6.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, March 29, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, March 29, 2022**

Figure 1: **STA 11928+00** – Controls in place and functioning properly.

Figure 2: **STA 11947+00** – Controls in place and functioning properly.

Figure 3: **STA 11965+00** – Controls in place and functioning properly.

Figure 4: **STA 12003+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, March 29, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Montgomery	**St11900-11928 AR-266, 266.03 ATWS 1487**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: N/A

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _____

Date: **Tuesday, March 29, 2022**

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

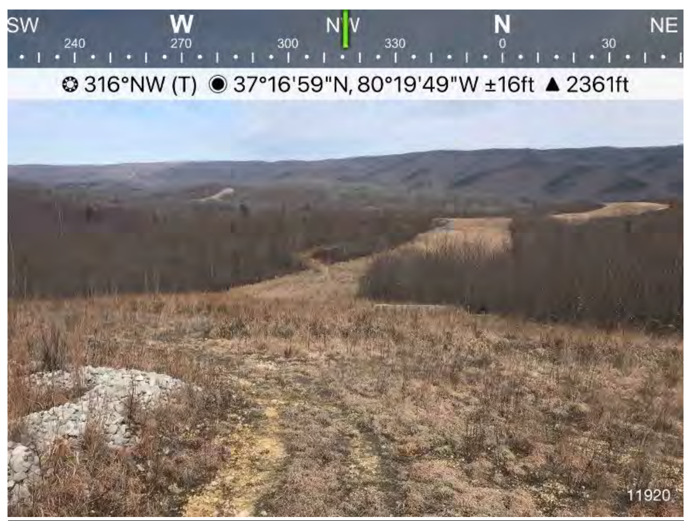
Project Name: Mountain Valley Pipeline **Date: Tuesday, March 29, 2022**

- Figure 1: ATWS 1487 remains dormant and access to ROW locked.

- Figure 2: AR 266 ESC in place and functioning

- Figure 3: St 11298, ECD's are in place and functioning.

- Figure 4: St11920, ECD's are in place and functioning.



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, April 4, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11788+23 – 11900+00 MVP-MN-266.03**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, April 4, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, April 4, 2022**

Figure 1: **STA 11800+00** – Controls in place and functioning properly.

Figure 2: **STA 11825+00** – Controls in place and functioning properly.

Figure 3: **STA 11844+00** – Controls in place and functioning properly.

Figure 4: **STA 11885+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, April 19, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11596+94 – 11620+00 MVP-MN-258.03/258.04/258.05**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-OO6, S-RR13 and S-RR14.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, April 19, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, April 19, 2022**

Figure 1: **STA 11598+00** – Controls in place and functioning properly.

Figure 2: **Stream S-OO6** – Controls in place and functioning properly along Craig Creek crossing.

Figure 3: **STA 11619+00** – Controls in place and functioning properly.

Figure 4: **Stream S-RR14** – Controls in place and functioning properly along stream crossing.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, April 25, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Craig County** **Giles County**	**STA 11353+21 – 11471+52** **MVP-CR-258.01** **MVP-GI-256**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-OO13, S-OO14 and S-KL43.

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, April 25, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, April 25, 2022**

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<tr>
<td>Figure 1: STA 11470+00 – Controls in place and functioning properly.
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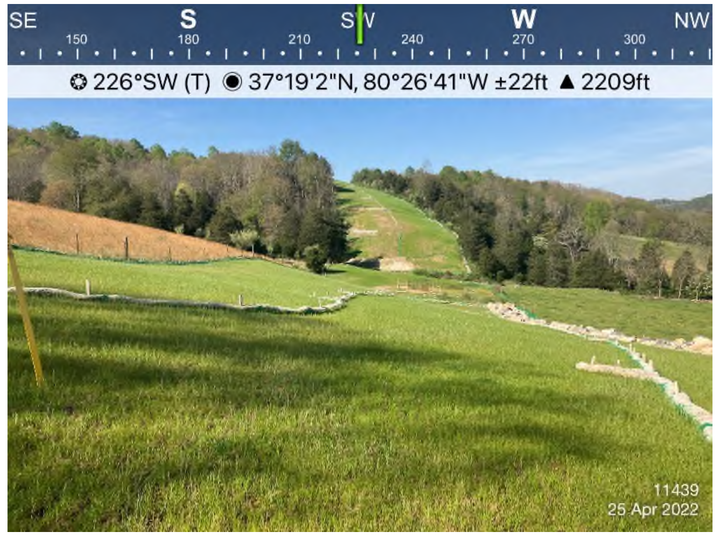
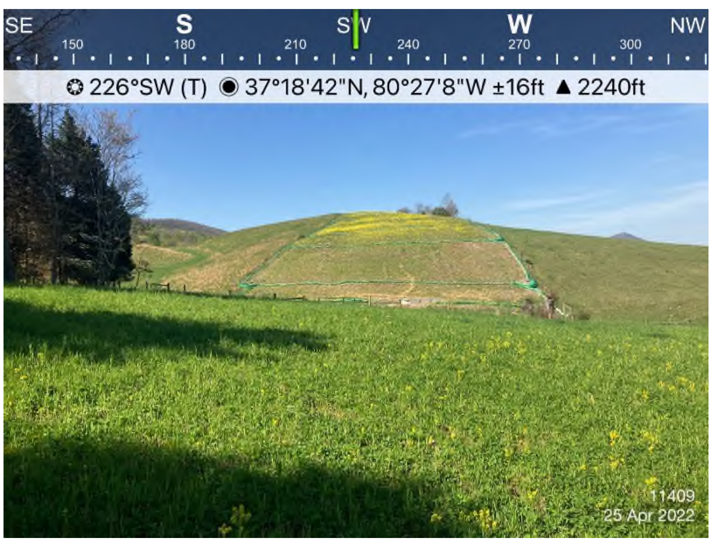
<td>Figure 2: STA 11439+00 – Controls in place and functioning properly.
</td>
</tr>
<tr>
<td>Figure 3: STA 11409+00 – Controls in place and functioning properly.
</td>
<td>Figure 4: STA 11367+00 – Controls in place and functioning properly.
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FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, May 11, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10929+71 – 11023+80** **MVP-GI-244/234**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-E24, S-E25, S-RR5, S-IJ19 and S-IJ18.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, May 11, 2022**

DEQ
Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

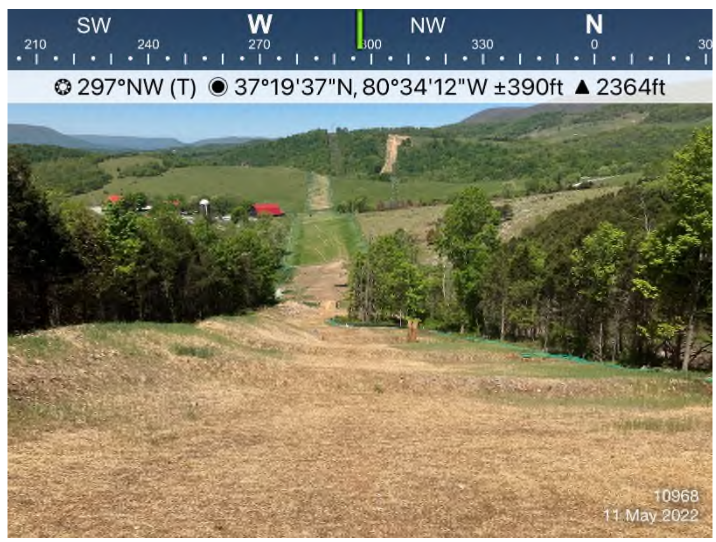
Project Name: **Mountain Valley Pipeline** **Date:** **Wednesday, May 11, 2022**

Figure 1: **STA 11020+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 10993+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 10978+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 10968+00** – Controls in place and functioning properly. Area stabilized with straw.



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, May 23, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**ATWS 1390,1391, 816** **AR-GI 240, 241, 241.04, GI-234**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

- ☐ Tree Felling
- ☐ Clearing/Grubbing
- ☐ Grading
- ☐ Trenching
- ☐ Stringing/Welding
- ☐ Lowering/Backfilling
- ☐ Final Grading
- ☐ Temp. Stabilization
- ☐ Perm. Stabilization
- ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-G32, S-Q14, S-G33
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant ___________________

Date: **Monday, May 23, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, May 23, 2022**

- Figure 1: Designated crossing S-G32, ESC's are in place and functioning.

- Figure 2: Above designated crossing S-Q14, ESC's are in place and functioning.

- Figure 3: Designated crossing S-G33, ESC's are in place and functioning.

- Figure 4: AR GI-234 ECD P1 remains in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, May 31, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Craig	**AR-CR258.01 St11467-11361**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-0012, S-0013, S-0014, S-KL43, S-NN11
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, May 31, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** | **Date:** **Tuesday, May 31, 2022**

- Figure 1: Designated crossing S-0013&S-0013, ESC's are in place and functioning.

- Figure 2: St11439 ECD's and stabilization in place.

- Figure 3: Designated crossing S-0014, ESC's are in place and functioning.

- Figure 4: St11463 ECD's and stabilization in place.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, June 6, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Giles County	**STA 10859+34 – 10929+71**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-Y3, S-Y2 and S-A32.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, June 6, 2022**

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline**   **Date:** **Monday, June 6, 2022**

Figure 1: **STA 10922+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 10901+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **Stream S-Y2** – Controls in place and functioning properly along stream crossing.

Figure 4: **STA 10877+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, June 13, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**AR-GI 245.02, 249 ATWS 1366, 1367 St11098-11155**	**Weather:**	**Dry**

<u>ACTIVE STAGE OF CONSTRUCTION:</u> (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *<u>Comments:</u>* Inspected the following resources: S-NN17
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*<u>72-Hour Deadline</u> from Notification*)
- St11145+76 denuded soil on waterbar requires additional stabilization.

Ineffective Controls: (*<u>24-Hour Deadline</u> from Notification)*
- N/A

<u>Recommended Corrective Action</u>: Maintain and install all controls per the approved PSS&S.

<u>Deadline:</u> <u>Within 72-Hour of Notification</u>

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

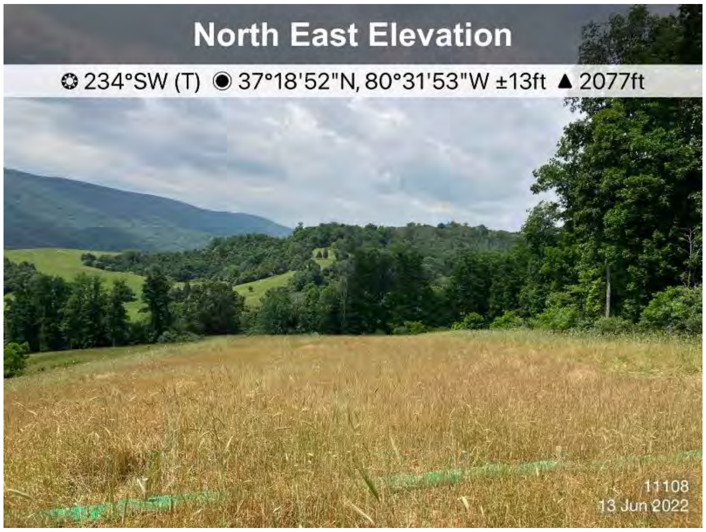
Inspector Signature: _____ Matthew Grant _____

Date: **Monday, June 13, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, June 13, 2022**

- Figure 1: St11108, ECD's and stabilization in place.



- Figure 2: St11120, ECD's and stabilization in place.

- Figure 3: Designated crossing S-NN17, ESC's are in place and functioning.

- Figure 4: St 11145+67 denuded soil on waterbar requires stabilization.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, June 14, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Montgomery County**	**STA 11670+00 – 11770+00** **MVP-MLV-AR-26**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-MN21. S-MN22, S-EF65, S-EF62, S-IJ52, W-IJ46-PEM and W-IJ46-PFO.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, June 14, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date**: **Tuesday, June 14, 2022**

Figure 1: **STA 11679+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 2: **STA 11709+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 3: **STA 11718+00** – Controls in place and functioning properly. Area stabilized with straw.

Figure 4: **STA 11751+00** – Controls in place and functioning properly. Area stabilized with straw.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, June 14, 2022	Project Contact:	Brian Clauto
Spread G: Montgomery	AR MLV-26 St11668+66-11766+03	Weather:	Dry

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-MM21, S-MM22, S-EF65, S-EF62, S-IJ52, W-IJ46
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, June 14, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, June 14, 2022**

▪ Figure 1: Designated crossing S-MM22, ESC's are in place and functioning. 	▪ Figure 2: St11766+03, ECD's and stabilization in place. 
▪ Figure 3: Designated crossing S-MM21, ESC's are in place and functioning. 	▪ Figure 4: Designated crossing S-IJ52, ESC's are in place and functioning. 

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, June 27, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Giles County	**STA 10593+00 – 10602+18** **STA 10660+00 – 10674+92** **STA 10705+00 – 10712+73** **MVP-GI-238** **MVP-LY-029** **MVP-GI-240/241.01**	**Weather:**	**Rainy**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G21 and S-G33.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, June 27, 2022**

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, June 27, 2022**

Figure 1: **STA 10594+00** – Controls in place and functioning properly.  	Figure 2: **Laydown Yard 029** – Controls in place and functioning properly. 
Figure 3: **STA 10665+00** – Controls in place and functioning properly.  	Figure 4: **STA 10710+00** – Controls in place and functioning properly. 

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, June 27, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Montgomery** **Giles**	**AR GI 241.01, 241.04** **AR MN 258.04** **ATWS 1391, 1390, 816, 1057, 1373** **St11620-11600**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-AB14, S-RR13, S-RR14, S-006
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, June 27, 2022**

DEQ
Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, June 27, 2022**

- Figure 1: Designated crossing S-RR13, ESC's are in place and functioning.

- Figure 2: St11614, ECD's and stabilization in place.

- Figure 3: Designated crossing S-RR14, ESC's are in place and functioning.

- Figure 4: Designated crossing S-006, ESC's are in place and functioning.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Thursday, July 7, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11254+88 – 11298+30** **MVP-GI-253.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: W-MM10, S-MM17 and S-MM18.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Thursday, July 7, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Thursday, July 7, 2022**

Figure 1: **STA 11298+00** – Controls in place and functioning properly.

Figure 2: **STA 11292+00** – Controls in place and functioning properly.

Figure 3: **STA 11267+00** – Controls in place and functioning properly.

Figure 4: **STA 11257+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Thursday, July 7, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR-GI 253.06** **St11298-11255+22**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: W-MM19, S-MM17, S-MM18, W-RR1B
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Thursday, July 7, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Thursday, July 7, 2022**

- Figure 1: St11280, ECD's and stabilization are in place.

- Figure 2: St11260, ECD's and stabilization are in place

- Figure 3: Designated crossing S-MM18, ECD's are in place.

- Figure 4: Designated crossing W-RR1B, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, July 11, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10819+00 – 10859+34** **MVP-GI-241.03/241.02**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-A-34, S-A33 and S-Z13.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, July 11, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, July 11, 2022**

Figure 1: **STA 10819+00** – Controls in place and functioning properly.

Figure 2: **STA 10836+00** – Controls in place and functioning properly.

Figure 3: **STA 10849+00** – Controls in place and functioning properly.

Figure 4: **STA 10858+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, July 11, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR-GI 241.03** **ATWS 465, 466** **St10819-10860**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-A33, S-A34, S-Y2
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: _____ Matthew Grant _______________

Date: **Monday, July 11, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, July 11, 2022**

- Figure 1: St10840, ECD's and stabilization are in place.

- Figure 2: St10819, ECD's and stabilization are in place

- Figure 3: Designated crossing S-A33&34, ECD's are in place.

- Figure 4: St10858, ECD's and stabilization are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, July 12, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Giles County	**STA 11023+80 – 11098+43 MVP-GI-244/245.02**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-IJ19, S-IJ18 and S-IJ16b.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, July 12, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, July 12, 2022**

Figure 1: **STA 11030+00** – Controls in place and functioning properly.

Figure 2: **STA 11045+00** – Controls in place and functioning properly.

Figure 3: **STA 11054+00** – Controls in place and functioning properly.

Figure 4: **STA 11090+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, July 12, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: **Giles**	**AR-GI 244, 245.02** **ATWS 1366** **St11024-11100**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-IJ18, S-IJ19, S-IJ16b
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

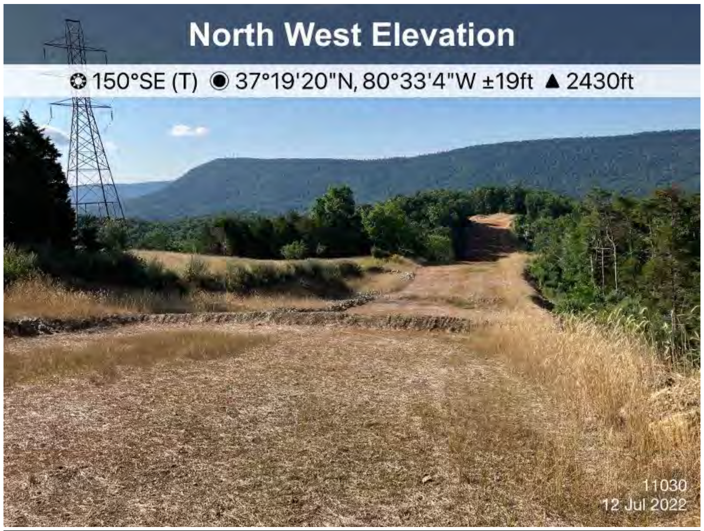
The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, July 12, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** — **Date**: **Tuesday, July 12, 2022**

▪ Figure 1: St11030, ECD's and stabilization are in place. 	▪ Figure 2: St11083, ECD's and stabilization are in place 
▪ Figure 3: Designated crossing S-IJ18, ECD's are in place. 	▪ Figure 4: Designated crossing S-IJ16B, ECD's are in place. 

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Monday, July 18, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 11158+37 – 11230+00** **MVP-GI-249.01/249.03** **MVP-MLV-AR-25**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-NN17.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Monday, July 18, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Monday, July 18, 2022**

Figure 1: **STA 11227+00** – Controls in place and functioning properly.

Figure 2: **STA 11213+00** – Controls in place and functioning properly.

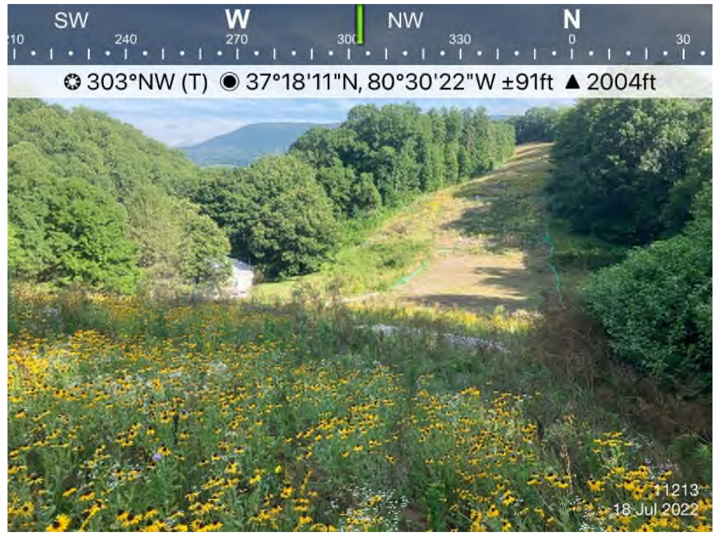


Figure 3: **STA 11200+00** – Controls in place and functioning properly.

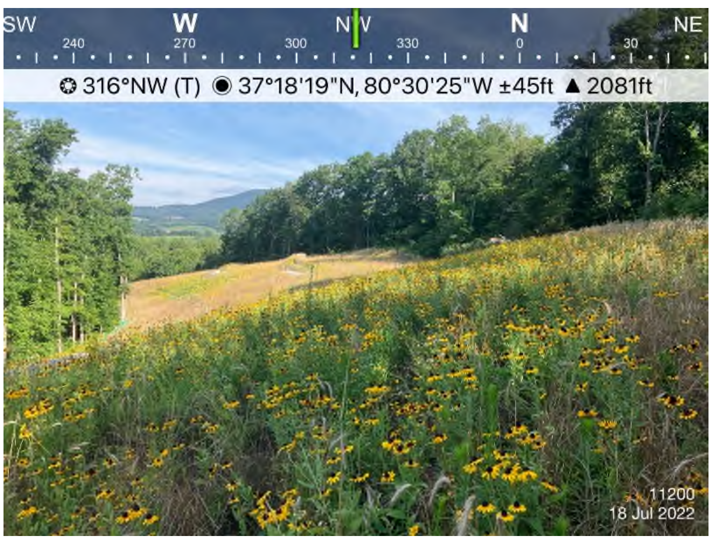


Figure 4: **STA 11178+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Tuesday, July 26, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: **Giles County**	**STA 10749+71 – 10798+83**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: S-G35, S-SS4, S-Z9 and S-Z7.

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Tuesday, July 26, 2022**

DEQ
Virginia Department of Environmental Quality

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date:** **Tuesday, July 26, 2022**

Figure 1: **Stream S-Z9** – Controls in place and functioning properly.

Figure 2: **STA 10770+00** – Controls in place and functioning properly.

Figure 3: **STA 10788+00** – Controls in place and functioning properly.

Figure 4: **STA 10751+00** – Controls in place and functioning properly.

FIELD INSPECTION REPORT

Project Name:	Mountain Valley Pipeline	Inspector:	Matthew Grant
Inspection Date:	Tuesday, July 26, 2022	Project Contact:	Brian Clauto
Spread G: Giles	ATWS 1056, 469, 1334 St10750+50-10800	Weather:	Wet

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-G35, S-SS4, S-Z9, S-Z7, S-Z10
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Tuesday, July 26, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, July 26, 2022**

- Figure 1: St10790, ECD's and stabilization are in place.

- Figure 2: Designated crossing S-Z7, ECD's are in place.

- Figure 3: Designated crossing S-Z9, ECD's are in place.

- Figure 4: Designated crossing S-G35, ECD's are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Marshall Willis**
Inspection Date:	**Wednesday, August 3, 2022**	**Project Contact:**	**Brian Clauto, Cory Chalmers**
Spread G: Montgomery County	**STA 11788+43 – 11900+00 MVP-MN-266.03**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Restoration ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

Comments: Inspected the following resources: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Marshall Willis

Date: **Wednesday, August 3, 2022**

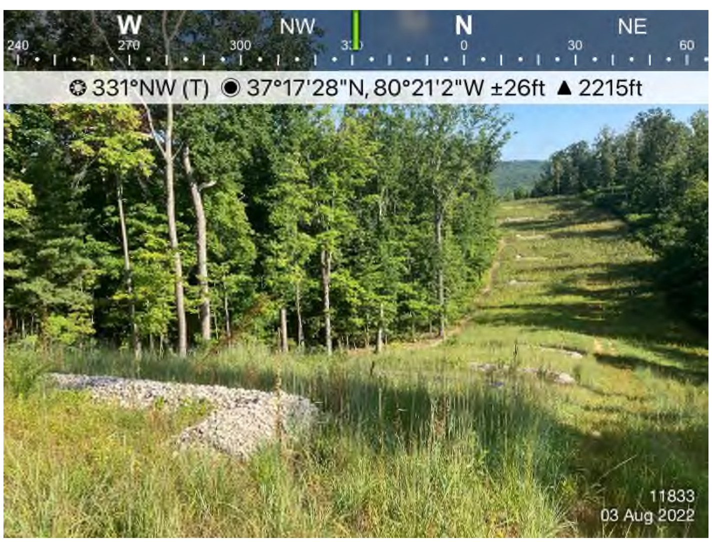
FIELD INSPECTION PHOTO LOG

<u>Project Name</u>: Mountain Valley Pipeline **<u>Date</u>: Wednesday, August 3, 2022**

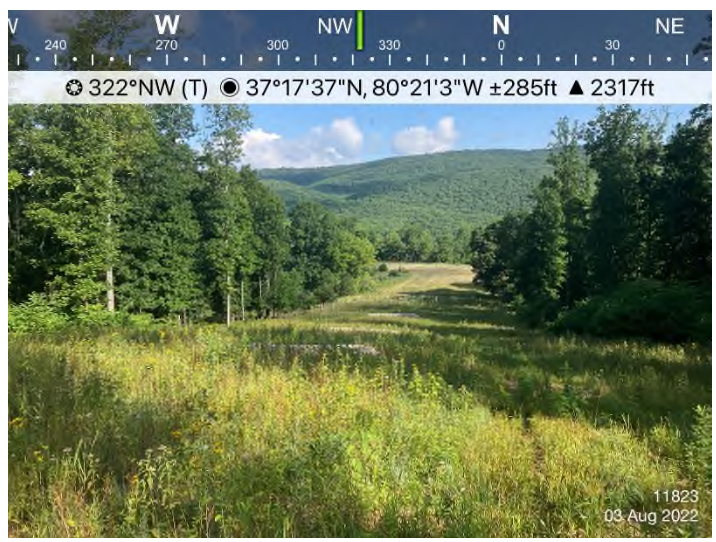
<u>Figure 1</u>: **STA 11870+00** – Controls in place and functioning properly.

<u>Figure 2:</u> **STA 11855+00** – Controls in place and functioning properly.

<u>Figure 3</u>: **STA 11833+00** – Controls in place and functioning properly.



<u>Figure 4</u>: **STA 11823+00** – Controls in place and functioning properly.



FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Wednesday, August 3, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Montgomery	**ATWS 1456, 1457 AR MN 266.03 St11900-11790**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: N/A

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Wednesday, August 3, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: **Mountain Valley Pipeline** **Date**: **Wednesday, August 3, 2022**

- Figure 1: St11900 ECD's and stabilization are in place.

- Figure 2: St11855, ECD's and stabilization are in place.

- Figure 3: St11840, ECD's and stabilization are in place.

- Figure 4: St11833, ECD's and stabilization are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, August 8, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Craig	**AR CR 258.01 St11531-114900**	**Weather:**	**Dry**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling ☐ Clearing/Grubbing ☐ Grading ☐ Trenching ☐ Stringing/Welding

☐ Lowering/Backfilling ☐ Final Grading ☐ Temp. Stabilization ☐ Perm. Stabilization ☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-QQ2, S-PP4, S-PP3, S-PP1
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, August 8, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, August 8, 2022**

- Figure 1: St11531 ECD's and stabilization are in place.

- Figure 2: St11498, ECD's and stabilization are in place.

- Figure 3: St11493, ECD's and stabilization are in place.

- Figure 4: Designated crossing S-PP1, ECD's and stabilization are in place.

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Monday, August 22, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**AR GI 241.03, 241.02 St10820-10804**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☐	☒	☐
3.	Areas of offsite sediment deposition observed?	☒	☐	☐

- *Comments:* Inspected the following resources: S-YZ1, S-Z14
- MVP crews were on site and AR GI 241.03 repairs were being conducted.

Routine Maintenance: (*72-Hour Deadline from Notification*)
Access road 241.03 has areas of erosion and will require repair.

Ineffective Controls: (*24-Hour Deadline from Notification)*
St 10807+68 Retrieve sediment that is outside the limit of disturbance approximately 15 ft. to 20 ft. and restabilize the disturbed area.

ST 10806+00, STA 10808+00, & STA10815+00 sloughing of subsoil pile, repair and restabilize subsoil pile.

Designated stream S-YZ1 has been impacted approximately 2000 ft. with access road stone. Remove sediment/stone per FERC approval and land owner approval.

Recommended Corrective Action: Maintain and install all controls per the approved PSS&S.

Deadline: Various - See Comments

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector Signature: Matthew Grant

Date: **Monday, August 22, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Monday, August 22, 2022**

- Figure 1: Designated stream S-Z1 has been impacted by access road stone.

- Figure 2: AR GI 241.03 has areas of erosion that will require repair.

- Figure 3: St10805 subsoil stockpile has slipped and will require repair.

- Figure 4: St10806 subsoil stockpile has slipped and will require repair.

FIELD INSPECTION PHOTO LOG

▪ Figure 5: St10807+68 sediment has escaped off LOD. 	

FIELD INSPECTION REPORT

Project Name:	**Mountain Valley Pipeline**	**Inspector:**	**Matthew Grant**
Inspection Date:	**Tuesday, August 23, 2022**	**Project Contact:**	**Brian Clauto**
Spread G: Giles	**ATWS 1056, 1334, 469 St10750-10800**	**Weather:**	**Wet**

ACTIVE STAGE OF CONSTRUCTION: (Check all that apply)

☐ Tree Felling	☐ Clearing/Grubbing	☐ Grading	☐ Trenching	☐ Stringing/Welding
☐ Lowering/Backfilling	☐ Final Grading	☐ Temp. Stabilization	☐ Perm. Stabilization	☒ Dormant

		Yes	No	N/A
1.	Are controls installed and implemented in accordance with the approved erosion and sediment control plan and stormwater management plans?	☒	☐	☐
2.	Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?	☒	☐	☐
3.	Areas of offsite sediment deposition observed?	☐	☒	☐

- *Comments:* Inspected the following resources: S-G35, S-S54, S-Z9, S-Z7
- ECD's were in place and functioning at the designated crossings.

Routine Maintenance: (*72-Hour Deadline from Notification*)
- N/A

Ineffective Controls: (*24-Hour Deadline from Notification)*
- N/A

Recommended Corrective Action: N/A

Deadline: N/A

The recommended corrective action deadline date applies to all conditions noted on this report unless otherwise noted. If listed condition(s) currently constitute non-compliance and/or corrective actions are not completed by the deadline, other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

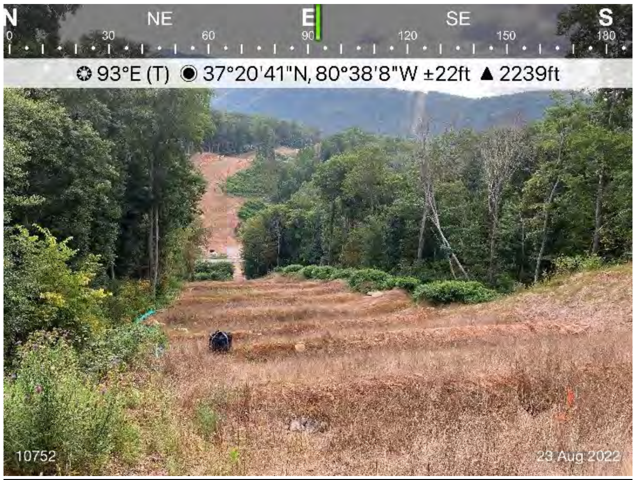
Inspector Signature: Matthew Grant

Date: **Tuesday, August 23, 2022**

FIELD INSPECTION PHOTO LOG

Project Name: Mountain Valley Pipeline **Date: Tuesday, August 23, 2022**

- Figure 1: St10752, ECD's and stabilization are in place.



- Figure 2: Designated crossing S-Z7, ECD's are in place.

- Figure 3: St10790, ECD's and stabilization are in place.

- Figure 4: Designated crossing S-G35, ECD's are in place.

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EXHIBIT 15

February 21, 2023

Numeric Turbidity Water Quality Standards: A Tool to Protect Aquatic Life

Introduction

In recent years, West Virginia and Virginia have faced a major buildout of pipeline infrastructure. These large-scale, linear pipeline construction projects require earth disturbance along hundreds of miles of rugged and often highly erodible terrain. In-stream excavation is often required to cross the hundreds of streams and rivers along the pipeline route. Excavation adjacent to, and within, streams and rivers has the potential to cause significant sediment pollution if erosion control best management practices (BMPs) are ineffective in keeping sediment from leaving the worksite and/or right of way. Increased erosion and sedimentation in streams harm aquatic life. Sediment pollution can smother spawning beds and fish eggs, reducing juvenile fish survival. Increased sedimentation also degrades habitat for benthic macroinvertebrates, aquatic insects that provide food for larger fish species, causing impacts to benthic community health and diversity, in addition to the species who feed on them.

Increased sediment loads in rivers used as sources of potable water can also impact downstream drinking water utilities. Water utilities may experience increased treatment costs by having to replace filters more often or change their treatment processes to remove the excess sediment. Excess sediment in drinking water is not only aesthetically displeasing but it interferes with the disinfection process. High organic matter content in source water can create harmful disinfection byproducts, placing a burden on water utilities and their customers.

With support from groups like Trout Unlimited (TU) and West Virginia Rivers Coalition, citizen observers have submitted hundreds of complaints to state agencies, detailing sediment pollution and failed or lacking erosion controls, resulting in numerous violations issued to pipeline companies requiring mitigation of sediment pollution impacts.

How Are Streams Protected from Turbidity Impacts?

Turbidity, often referenced in sediment-related standards, is a measurement of water clarity; suspended organic materials/sediments affect water clarity. To protect aquatic resources and potable water sources, instream water quality standards are established. Standards can be "numeric" or "narrative."

(Continued on next page.)

West Virginia has a **numeric standard** explained in Figure 1. Essentially, this standard creates a numeric limit for suspended material that can be measured instream while allowing for a healthy aquatic community (referred to as "meeting its designed or existing use"). West Virginia also has **narrative water quality standards** as seen in Figure 2. The standard states that projects cannot discharge distinctly visible solids to state waters or create sediment deposits on stream bottoms.

WV NUMERIC TURBIDITY STANDARD 8.33

No point or non-point source to West Virginia's waters shall contribute a net load of suspended matter such that the turbidity exceeds 10 NTU's over background turbidity when the background is 50 NTU or less, or have more than a 10% increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTUs. This limitation shall apply to all earth disturbance activities and shall be determined by measuring stream quality directly above and below the area where drainage from such activity enters the affected stream. Any earth disturbing activity continuously or intermittently carried on by the same or associated persons on the same stream or tributary segment shall be allowed a single net loading increase.

FIG. 1

8.33.1

This rule shall not apply to those activities at which Best Management Practices in accordance with the State's adopted 208 Water Quality Management Plan are being utilized, maintained and completed on a site-specific basis as determined by the appropriate 208 cooperative or an approved Federal or State Surface Mining Permit is in effect. This exemption shall not apply to Trout Waters.

Practices that disturb the land surface have the potential to cause increased turbidity and resultant sedimentation, therefore they are required to implement BMPs to assure sediments are not discharged to waters due to runoff/erosion. Permitted projects are allowed a one-time exceedance in water quality standards due to suspended material, but ongoing continuous or intermittent sedimentation issues are not allowed. The regulation provides an exemption to the numeric standards for projects with permitted, completed and maintained erosion BMPs, though this exemption is void in waters supporting trout populations.

WV NARRATIVE STANDARD

§47-2-3. Conditions Not Allowable In State Waters

3.2.a. Distinctly visible floating or settleable solids, suspended solids, scum, foam or oily slicks;
3.2.b. Deposits or sludge banks on the bottom;

FIG. 2

Virginia has a **narrative water quality standard**, shown in Figure 3, but no numeric water quality standard. The narrative standard states that turbidity cannot exist at concentrations that impair designated uses, such as swimming and boating or supporting trout populations. For example, turbidity cannot be of a level that would smother redds for trout reproduction. To implement this standard, the state is supposed to establish permit conditions that ensure the protection of designated uses of a given stream. These conditions typically include the use of erosion control BMPs. In Virginia, thanks to strong stakeholder action, the Virginia Water Quality Control Board has directed the Department of Environmental Quality to develop numeric turbidity standards.

VA NARRATIVE STANDARD

A. State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life. Specific substances to be controlled include, but are not limited to: floating debris, oil, scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled. Conditions within mixing zones established according to 9VAC25-260- 20 B. do not violate the provisions of this subsection.

FIG. 3

Enforcement of Turbidity Standards in WV and VA

In WV and VA, enforcement of sediment standards has focused on the permitting and inspection of erosion control BMPs and documentation of sediment entering streams causing exceedances of the WV narrative water quality criterion such as the example in Figure 4. To date, no pipeline company has been cited for exceeding numeric turbidity standards in WV. Inspectors do not take turbidity measurements in the field and instead rely on visual assessment of BMPs and documentation/evidence of sedimentation in streams.

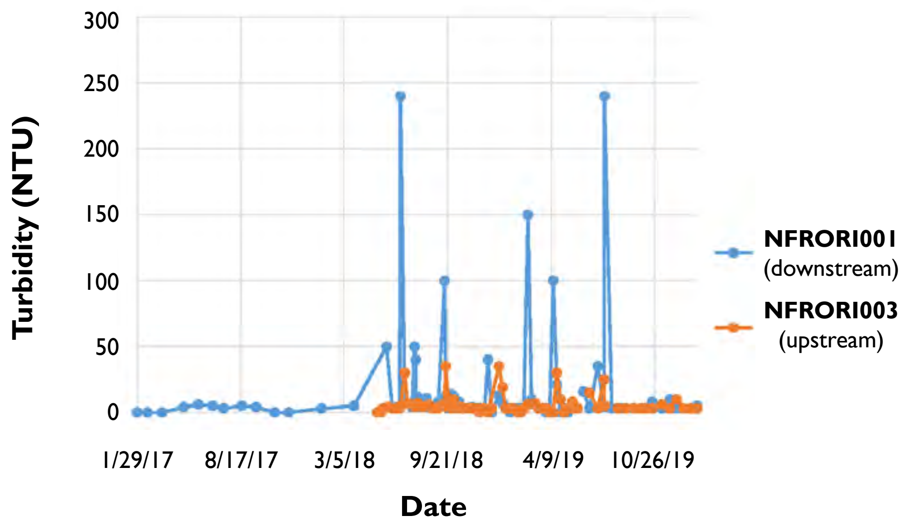
There are a variety of erosion control techniques, such as silt fence, super silt fence, compost filter socks, slope drains, and slope breakers with sumps and terminus treatments, all designed to keep sediment within the worksite and out of streams and rivers. Practices for implementation of these methods are detailed in state guidance documents such as the Virginia Erosion and Sediment Control Handbook and the West Virginia Erosion and Sediment Control Field Manual. In some cases, where steep slopes and highly erodible terrain increase erosion potential, these BMPs have been proven to be ineffective. In addition, even when proper BMPs for site conditions are used, BMPs fail due to improper installation or a lack of maintenance.

FIG. 4 In this tributary to Georgescamp Run, distinctly visible settleable solids and deposits are considered "conditions not allowable" in the WV permit for the project. WVDEP issued a violation to the Mountaineer Xpress Pipeline for this incident.

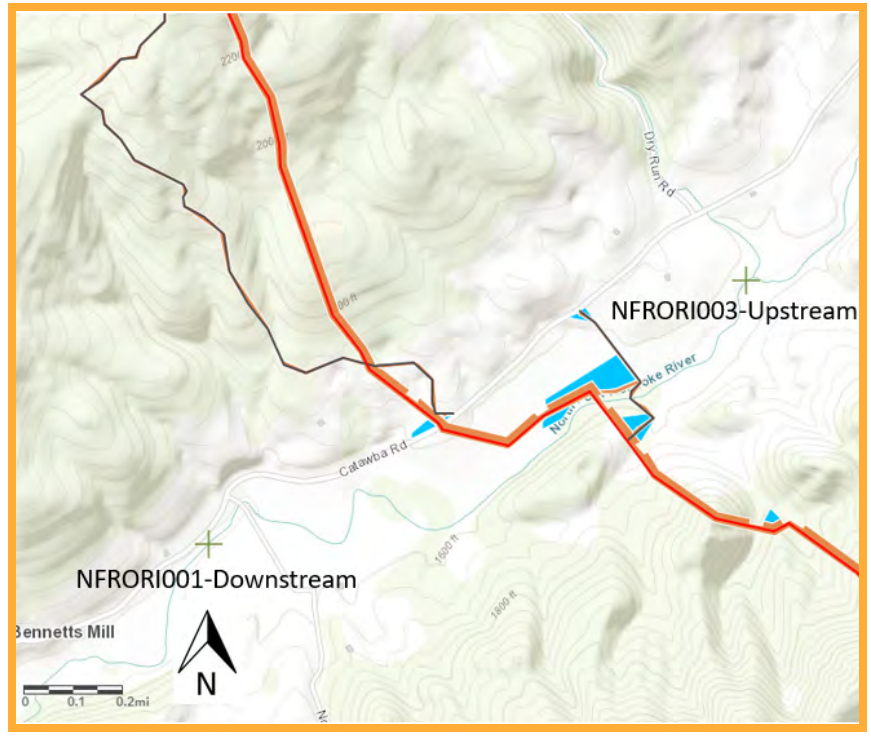
The Case for Numeric Turbidity Standards

Turbidity can lead to adverse effects on fish and invertebrates. Researchers have identified numeric turbidity thresholds where aquatic life can be affected. For example, turbidity levels as low as 4 NTU have been shown to adversely affect invertebrate densities and diversity in flowing waters (Rosetta, 2005). Research has also shown that turbidity increases can affect fish feeding strategies and inhibit growth. One study showed that turbidity levels of 40 NTU caused a 62% decrease in brook trout growth rates when compared with clear water (Sweka, J.A. and Hartman, K.J., 2001). Enforcement of narrative turbidity standards is effective in reducing turbidity impacts on aquatic life but may still allow adverse impacts to aquatic life. Figure 5 illustrates citizen science data showing turbidity increases downstream of pipeline construction at levels that could impact aquatic life in the stream. Existing research can be used to identify numeric turbidity thresholds that protect aquatic life and designated uses. Setting and enforcing science-based numeric standards would provide a more effective tool for agencies to protect aquatic life in West Virginia and Virginia's streams and rivers.

NORTH FORK ROANOKE RIVER



TURBIDITY AT MVP PIPELINE CROSSING, FIG. 5



On the North Fork Roanoke River in Montgomery County, Virginia, volunteers have been monitoring several sites near the Mountain Valley Pipeline crossing since 2017. During one notable event on June 22, 2018, a short but heavy downpour resulted in turbidity levels exceeding the maximum detection limit of the 120-centimeter secchi tube (>240 NTU). At the same time, upstream of pipeline construction turbidity levels on the North Fork Roanoke River only elevated to 30 NTU. Similar occurrences took place on September 15, 2018; February 23, 2019; April 13, 2019; and July 21, 2019. On July 19, 2018 turbidity downstream of the pipeline rose to 50 NTU, despite no rainfall in the past 48 hours and low water conditions in the stream. After this event, volunteers noted new sediment buildup on the streambed. Though Virginia has no numeric turbidity standards, these measurements far exceed numeric standards in nearby states such as West Virginia. The difference in turbidity values upstream and downstream of the pipeline crossing would suggest that the increased turbidity and resultant sedimentation instream is due to pipeline construction activities, even in absence of visual observation of construction activities.

Recommendations

Numeric turbidity standards could be an effective tool for state agencies to more effectively protect aquatic life from adverse impacts of earth disturbance activities, such as pipeline construction. The following recommendations relative to numeric water quality standards would enhance the protection of waters in WV and VA, respectively.

- **Development of numeric turbidity standards in Virginia: The VADEQ should prioritize the development of numeric turbidity criteria that protect existing and designated stream uses.** With the current real-time monitoring partnership with USGS, the VADEQ would be equipped to enforce numeric turbidity standards on a number of important streams along the MVP and ACP.

Additional recommendations continued on next page.

- **Enforcement of already established numeric turbidity standards in West Virginia** as opposed to relying on narrative water quality standards: Numeric turbidity standards would be best enforced by continuous turbidity monitoring above and below construction activities. It is impractical for continuous monitoring to occur at all stream crossings, so it is recommended that WVDEP initiate continuous monitoring on high-priority streams, such as those that support naturally reproducing trout populations. This could potentially be conducted in partnership with the U.S. Geological Services (USGS), such as real-time continuous monitoring that currently occurs along the MVP and Atlantic Coast Pipeline (ACP) in Virginia. Continuous monitoring in select streams could provide additional data to be used in compliance monitoring where routine inspections are not practical, such as remote areas that are not easily accessible. Turbidity readings could be monitored remotely. Enforcement staff would be alerted when spikes in turbidity occur and field inspections are warranted. An alternative monitoring strategy could be developed for streams where continuous turbidity monitoring is not viable, possibly including field measurements above and below pipeline construction by field inspectors or citizen scientists.

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Acknowledgements

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The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 16

February 21, 2023

A REPORT BY WILD VIRGINIA

FEBRUARY 2023

MOUNTAIN VALLEY PIPELINE POLLUTION IN VIRGINIA WATERSHEDS

PREPARED BY

DAVID SLIGH
CONSERVATION DIRECTOR, WILD VIRGINIA

Introduction

The Mountain Valley Pipeline (MVP) has caused hundreds of environmental problems and damaged dozens of streams and wetlands all along the project's path through West Virginia and Virginia. This report describes how these impacts are often concentrated within individual watersheds and streams in Virginia, providing a new perspective on the heavy toll the project has already taken on our state waters. We also address proposed and likely new impacts in these same stream systems, both separately and in combination with the past impacts.

Wild Virginia has previously reported on a huge overall number and variety of events where pipeline-related activities led to the release of sediment or other materials off of the MVP right of way (ROW) or resulted in other off-site impacts.[1] In this report we designate these events, collectively, as "pollution incidents," which have either directly damaged Virginia waterbodies or off-site properties Mountain Valley had no right to access, or have created unacceptable and imminent threats to waters, due to off-site releases of sediment.

Proposals to resume construction on the MVP would allow Mountain Valley Pipeline, LLC (Mountain Valley) to create 452 new discharges of sediment and associated pollutants throughout the same Virginia stream systems that have already been negatively affected by the project. The supposedly limited impacts each of these new, separate discharges would cause, would also be concentrated to a great degree in some small stream systems and single streams. So, even if individual new discharges would be realtively minor, the combined effects of all new discharges could be greatly multiplied on an ecological scale.

Importantly, there is no rational basis to doubt that more construction by Mountain Valley would result in just as many or more pollution problems than have already been observed. The pollution controls implemented so far have failed miserably and frequently, and so-called "enhanced" measures have not stopped the damage.

If Mountain Valley had the capacity and will to properly control pollution from its sites, these pollution incidents would not have still been occuring three years and nine months after Mountain Valley first began stripping forests and fields of vegetation and altering the landscape. And if construction had not stopped at that time, in the fall of 2021, it is almost certain that MVP pollution would have continued to plague our waters and our communities up to today.

Allowing construction to rush forward again would certainly lead to great harm. To quote the title of a previous Wild Virginia report, "MVP's Record of Pollution Incidents is Predictive of Future Water Quality Threats."

One glaring fault in all of the regulatory reviews and permitting processes that have addressed the MVP is the failure to look at combined or cumulative impacts from the project in a scientifically and logically valid way. Assessments of such combined or cumulative impacts

[1] See Wild Virginia, *Documenting the Damage: An Analysis of Virginia State Inspection Reports for MVP*, December 13, 2021 [hereinafter Wild Virginia, 2021]; Wild Virginia, *MVP's Record of Pollution Incidents is Predictive of Future Water Quality Threats*, July 28, 2022 [hereinafter Wild Virginia, 2022].

on the environment are required by multiple statutes and regulations under which the MVP has been and is now being reviewed. There are a number of different definitions of the term "cumulative impacts" and the required scope and nature of analyses that are to consider net effects of actions varies from one statute and regulatory scheme to another.[2] This report addresses these issues in two ways:

First, we describe serious flaws in the approach Mountain Valley has used to conduct a cumulative impacts analysis in materials submitted to the U.S. Army Corps of Engineers (Corps) in 2022.[3] Those analyses are apparently designed to address observations that previous cumulative impact reviews were deficient to meet Clean Water Act (CWA) requirements, as described below, but the new assessments still fall far short of the mark. The specific examples presented below, which show concentrations of proposed discharges in six individual watersheds, forcefully illustrate the flaws in all agency reviews to this date.

Second, we present the evidence of many past and ongoing water quality assaults from the MVP, alongside the details about proposed new discharges in Virginia watersheds. This wider view is pertinent to regulatory decisions before multiple agencies, including the Corps, the U.S. Fish and Wildlife Service (FWS), and the U.S. Forest Service (USFS). Again, an examination of example watersheds is useful, though it must be understood that these problems are found much more widely, in both Virginia and West Virginia.

This combined view, integrating both past and possible future pollution sources, is the only logical way to understand the MVP's likely impacts on our waters or to make sound decisions that will prevent future damages. Without question, the impacts from these proposed new discharges would add to the effects of MVP's previous failures to control sediment discharges but no party, neither MVP nor any federal or state agency, has yet confronted that reality or analyzed the likely outcomes in a scientifically meaningful way.

Mountain Valley's Cumulative Impacts Review in the CWA 404 Application

Conservation groups have called for proper cumulative impacts reviews by all responsible agencies since the intial Environmental Impact Statement (EIS) was being prepared by the Federal Energy Regulatory Commission (FERC) - to no avail. The supposed analyses of combined impacts in aquatic systems that FERC deemed acceptable in its 2017 Final EIS, and which other agencies endorsed when they adopted that EIS as cooperating agencies, was done for areas represented by 10-digit Hydrologic Unit Codes (HUC-10s).[4] As late as December, 2022 the USFS contended that HUC-10s are "still [] appropriate for the cumulative effects analysis because they are the scale at which indirect and cumulative effects are reasonably

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[2] These include requirements to assess cumulative or combined impacts under the Clean Water Act, the National Environmental Policy Act (NEPA), and other statutes and implementing regulations. A discussion of these various requirements is beyond the scope of this report.

[3] Two documents submitted to the Corps that address cumulative water impacts include: *Appendix Q, Revised Cumulative Impact Assessment Report - Hydrology, Mountain Valley Pipeline*, January 2022 (Revised May 2022) [hereinafter *Appendix Q*]; *Supplemental Cumulative Impact Assessment Report for the Clean Water Act Section 404 and Rivers and Harbors Act Section 10 Permit Applications, Mountain Valley Pipeline*, July 22, 2022 [hereinafter *Supplemental Cumulative Impacts Report*].

[4] Federal Energy Regulatory Commission, *Mountain Valley Pipeline and Equitrans Expansion Project, Final Environmental Impact Statement*, FERC/FEIS-0272F, June 2017, at 4-577 [hereinafter FERC FEIS, 2017].

expected to occur for the resources analyzed."[5] As discussed below, these aerial units are often not appropriate for assessing potential cumulative impacts, because of their size and the arbitrary nature of the areas included.

Echoing some of the concerns repeatedly raised by the public, the U.S. Environmental Protection Agency (EPA) also expressed that the cumulative impacts assessments previously conducted for the MVP were insufficient, in a letter dated May 27, 2021and submitted in response to a public notice by the Army Corps of Engineers (Corps) to address Mountain Valley's proposed discharges.[6] In that letter, EPA stated that there was a need for "a conclusive evaluation of cumulative effects at a watershed scale."[7] This criterion, of conclusive evaluation at a watershed scale, has still not been met and the Corps must not issue a permit for the MVP without it.

As discussed in Appendix Q, the Corps requested that Mountain Valley supplement its application for a CWA section 404 permit by submitting "an assessment of cumulative effects (40 CFR § 230.11(g)) to the aquatic environment associated with the completed and proposed discharge of dredged and/or fill material into WOTUS for each 12-digit Hydrological Unit Code (HUC)."[8]

The supposed cumulative impacts reviews Mountain Valley submitted are merely a rote accounting of numeric estimates of temporary and permanent pollution impacts in streams and wetlands, in units of linear feet of streams and acres of waterbody areas. The reports fail to explain or analyze a variety of factors without which a cumulative impacts review in an aquatic system is meaningless, including but not limited to: location and proximity of impacts within a stream system, size of streams affected, downstream effects, synergistic[9] as well as additive impacts, and sensitivity of native aquatic biota to the pollution threats and alteration of habitats.

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[5] U.S. Forest Service, *Mountain Valley Pipeline and Equitrans Expansion Project, Draft Supplemental Environmental Impact Statement*, R-8-MB 166, December 2022 [hereinafter DSEIS], at 83..

[6] Letter from Jeffrey D. Lapp, U.S. EPA to Michael Hatten, U.S. Army Corps of Engineers, *Re: LRH-2015-00592-GBR, LRP-2015-798, NAO-2015-0898; Mountain Valley Pipeline, LLC; Mountain Valley Pipeline, Wetzel County, West Virginia to Pittsylvania County, Virginia*, May 27, 2021 [hereinafter EPA Letter].

[7] Id. at page 8 of enclosure with EPA letter. We note that EPA mentioned the HUC-12 scale as a basis for analysis but did not address the fact that these defined areas are often not watersheds or that the HUC sizes and other characteristics are often inappropriate for this purpose and, thus, cannot provide the kind of conclusive evalution on a watershed scale EPA deemed necessary.

[8] Appendix Q at 1.

[9] Many studies of aquatic systems have found significant synergistic effects ("ecological surprises") from multiple stressors, often exceeding the magnitude of merely additive effects. See e.g. Paine, R.T., M.J. Tegner, E.A. Johnson, *Compounded perturbations yield ecological surprises*, Ecosystems, 1, 535-545, 1998; Christensen, M.R., M.D. Graham, R.D. Vinebrooke, D.L. Findlay, M.J. Paterson, M.A. Turner, *Multiple anthropogenic stressors cause ecological surprises in boreal lakes*, Global Change Biology, 12, 2316-2322, 2006; Lindenmayer, D.B., G.E. Likens, C.J. Krebs, R.J. Hobbs, *Improved probability of detection of ecological "surprises,"*, Proceedings of the National Academy of Sciences of the United States of America, 107, 21957-21962, 2010; Dehedin, A., C. Maazouzi, S. Puijalon, P. Marmonier, C. Piscart, *The combined effects of water level reduction and an increase in ammonia concenration on organic matter processing by key freshwater shredders in alluvial wetlands*, Global Change Biology, 19, 763-774, 2013.

Again, though Mountain Valley submitted the material as described by the Corps, using 12-digit Hydrologic Unit Code (HUC-12) areas for its analysis, this approach cannot meet the need for a "conclusive evaluation . . . at a watershed scale," as EPA deemed necessary.

Overall Findings on MVP Pollution Incidents

As referenced above, this report is the third in a series prepared by Wild Virginia to describe and assess water impacts documented by inspectors working for the Virginia Department of Environmental Quality (DEQ) or its contractor.[10] In this report we have extended our previous reviews, looking at a total of 980 DEQ inspection reports and 5,352 "action item" descriptions (and in many cases associated photographs and additonal documents). Some of the materials were newly acquired since *Wild Virginia, 2022* was published, having been acquired by additional records requests.

We also provide in this report evidence gathered by citizens that extend and amplify findings of the state inspectors. In some cases, these photographs and, especially, videos accesible through links included here, show the MVP pollution incidents more graphically and shockingly than do the descriptions and photos compiled by DEQ and MBP personnel.

Most of the state inspection reports cited are not included in materials submitted by Mountain Valley to the various agencies nor are they included in analyses prepared by those agencies. In particular, the Draft Supplemental EIS (DSEIS) issued by the USFS. in December, 2022 fails to discuss thousands of Virginia state inspection reports reviewed in this analysis.

Pertinent to the intent of this review, to highlight actual impacts to waterbodies or discharges off MVP work sites that pose definite threats to water quality, are the following observations from the previous reports of what are termed herein "pollution incidents."

These pollution incidents have sometimes been designated by DEQ as violations of regulatory requirements. In some other cases, DEQ has not cited specific events as violations but they clearly present impacts or threats to water quality and are, therefore, pertinent to any analysis of existing conditions in Virginia waters affected by the MVP and of any prediction of future impacts that pipeline activities would cause. Also, as explained below, each category described in this report as a pollution incident was cited as a violation by the state in its enforcement lawsuit against Mountain Valley.

Important findings from *Wild Virginia, 2022* that relate to waterbody impacts and threats include the following:[11]

- in at least 113 instances, MVP activities have caused measurable sediment deposits in streams and wetlands in Virginia;
- in at least 684 instances, MVP activities have caused measurable sediment deposits on land off the project right of way (ROW) and beyond the control of sediment treatment or reduction measures;

[10] The contractor providing these services is McDonough, Bolyard, and Peck and is referred to throughout this report as MBP.
[11] See Wild Virginia, 2022 at 1.

- the timing of MVP pollution incidents corresponds closely with the periods when active construction was occurring and those incidents have occurred throughout the period from May, 2018 through at least October, 2021, whenever clearing, trenching, and backfilling of trenches was underway;
- many pollution incidents have occurred outside periods of unusually high rainfall, refuting assertions that historically wet periods are an overriding cause of MVP's violations and pollution problems; and
- supposed "enhanced" pollution control measures promised in a consent decree with Virginia[12] have not stopped the pollution and waterbody damages.

Findings of this report, not included in the 2021 or 2022 reports, include:

→ in at least 687 instances pollution control structures have been be undermined, overtopped, overwhelmed, or otherwise bypassed by water carrying sediment off-site, resulting in discharges that are poorly treated or untreated;
→ individual watersheds, including some very small headwater drainages, have suffered numerous deposits of sediment in streams and wetlands, off-site sediment deposits on land, and discharges of poorly treated or untreated sediment-laden water;
→ at least 1,135 pollution incidents caused by MVP have impacted waterbodies in the upper Roanoke River watershed (Subbasin), the area which the MVP affects most heavily.

As mentioned above, the kinds of information presented in this and the past Wild Virginia reports is pertinent to all of the various regulatory reviews now underway. In fact, decisions based on those reviews cannot be valid without incorporating these findings and the underlying agency data that is analyzed herein. We note that much of this information was acquired by Wild Virginia through Freedom of Information Act (FOIA) requests and, to our knowledge, has not been acquired or reviewed by the reponsible agencies. Those agencies will fail in their duties if they do not obtain and review the full record before issuing final decisions.

Cumulative Water Quality Impacts Analysis

As stated above, in past cumulative impact analyses, Mountain Valley compiled figures of predicted temporary and permanent stream impacts for areas designated by 10-digit HUCs.[13] In size, the HUC-10 units along the MVP route range from the smallest at 42,604 acres (Laurel Creek, 0505000702) to the largest at 233,528 acres (Meadow River, 0505000506). In many cases, the pipeline path touches just a small section of these HUC-10 areas and, in almost all cases, any overall impacts will be highly diluted by the large size of the unit. In relation to real impacts on ecosystems, these assessments are often meaningless.

[12] The DSEIS also discusses "enhanced measures" (e.g. at page 26), in relation to modeling analyses. The USFS must review the record which shows that some of these measures have failed repeatedly in preparing its final SEIS. It is also important to recoginze that, even when such measures are added on a piecemeal basis when a particular failure happens, there is no evidence that such measures have been or are planned on a systematic basis wherever called for. For example, though compost filter socks have failed hundreds of times, especially on steeper slopes, we are unaware of any effort to replace them on a large scale - just to respond when particular locations fail.

[13] FERC FEIS, 2017 at 4-577.

In its more recent applications and reports now under review by federal agencies, Mountain Valley included information about possible project and non-project impacts in areas represented by 12-digit Hydrologic Unit Codes (HUC-12s) through which the pipeline's path passes. In some cases, these units are much more appropriate than the HUC-10 units used before and this approach is a marginal improvement on the previous analyses. By comparison, the sizes of the HUC-12 units in Virginia, range from a low of 15,320 acres (Bradshaw Creek-North Fork Roanoke River, 030101010203) to a high of 40,523 acres (Sawmill Hollow-Roanoke River, 030101010301).[14] However, in many cases these units still cannot fulfill EPA's call for "a conclusive evaluation of cumulative effects at a watershed scale."

Below, we discuss the reasons the latest cumulative impact reviews are insufficient. Then, in succeeding sections, we present information about a sampling of specific Virginia watersheds affected by the MVP, to illustrate deficiencies in the assessments of combined or cumulative impacts to stream systems and Mountain Valley's failure to accurately charaterize affected aquatic environments.

<u>Aerial Extent and Nature of Areas Addressed</u>
Ecologically-valid assessements of potential combined or cumulative effects on stream systems may and sometimes should be made at multiple drainage area scales. A sound basis for the use of only those areas designated as HUC-12s, as Mountain Valley has done in its latest attempt, has not been explained in any analysis Wild Virginia has viewed, and in many cases is completely inappropriate. Regulatory decisions made on this basis will be abitrary and capricious and not supported by rational or technically-sound bases.

An fundamental problem with the use of only HUC-12 areas to assess cumulative effects in watersheds is that in numerous cases these areas are not watersheds at all.[15] As the U.S. Geological Survey (USGS) explains, a watershed is "an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel."[16] Many of the areas represented by 12-digit HUCs do not meet this definition.

Of twenty-one HUC-12 areas in Virginia that Mountain Valley has assessed in its cumulative impacts analysis, eleven are not watersheds[17] and, therefore, cannot be the basis for the kind of evaluation that is necessary and which EPA found missing in supporting material it reviewed in 2021. For example, one of these areas is the Little Stony Creek-New River HUC-

[14] All figures as the size of HUC-12 units used herein are taken from Appendix Q.
[15] We note that throughout Appendix Q, the term "HUC-12 watershed" is used, betraying a misunderstanding of the basic technical framework for the analysis. See Omernik, James M., Glenn E. Griffith, Robert M. Hughes, James B. Glover, and Marc H. Weber, *<u>How Misapplication of the Hydrologic Unit Framework Diminishes the Meaning of Watersheds</u>*, Environ Manage. 2017 Jul;60(1):1-11.
[16] USGS web page, "<u>Watersheds and Drainage Basins</u>." [a review of the literature confirms that this definition or very similar ones are essentially universal among scientists, water managers, etc.]
[17] These inlude: Little Stony Creek-New River, Lower Sinking Creek, Wilson Creek-North Fork Ronaoke River, Bradshaw Creek, Sawmill Hollow-Roanoke River, Brake Branch-South Fork Roanoke River, Madcap Creek-Blackwater River, Standiford Creek-Smith Mountain Lake, Owens Creek-Pigg River, Tomahawk Creek-Pigg River, Shockoe Creek-Banister River.

12 which, as explained below, actually includes three separate watersheds and stream systems, each of which drains to the New River. Some other HUC units used in these analyses fail to qualify as watersheds because they receive flows from upstream HUCs, such as the Wilson Creek-North Fork Roanoke River HUC-12 and the Lower Sinking Creek HUC-12.

Even where the HUC-12 units are watersheds, they may be inappropriate for a meaningful cumulative impacts analysis. Where there is a heavy concentration of impacts in just one smaller drainage within the HUC-12 area, it is irresponsible to ignore the possible cumulative effects in that smaller watershed. The Green Creek watershed is such an example - where all forseeable impacts from the MVP for the entire South Fork Blackwater River HUC-12 will fall within a small headwater section of Green Creek, In this section Green Creek is a first order stream that drains an area that is less than one-tenth the size of the HUC unit. Mountain Valley proposes nine new stream discharges and five new wetland discharges in this small, sensitive stream system that is home to native trout. Such serious localized conditions and the threats posed by the MVP to them are hidden in the analysis using the large HUC-12 area.

As stated above, it may be useful to look at cumulative impacts on stream systems at multiple levels. It also may be appropriate to include more than one HUC-12 unit. The combination of the Lower Sinking Creek and Upper Sinking Creek areas, both of which are heavily affected by the MVP, make up a unified stream system where a combination of project and non-project activities will certainly build upon each other. An examination at this larger scale cannot negate the need to look at smaller functional watershed units but may be a useful additional analysis, especially since we know that downstream distribution of sediment, well beyond the narrowly focused reviews MVP has conducted, is a certain result of discharges from the pipeline work areas.

On an even bigger scale still, the Upper Roanoke River Subbasin, which is represented by a HUC-8 unit, designated 03010101, is very large and water quality impacts from the pipeline must be considered in the context of a multitude of activities, over a watershed with a wide diversity of land uses and other features. Still, Mountain Valley proposes 244 new discharges within this watershed. The potential impacts from these new discharges will increase the net impact to the drainage and the degree to which that combined impact is predictable should be addressed. This is particularly true when we consider that the Roanoke River is impounded by dams at three locations dowstream from many of the MVP discharges and that the reservoirs formed by those dams capture and concentrate sediment inputs from upstream. The smaller Niagara dam may be espedially vulnerable to increased sedimentation.

And, within the upper Roanoke watershed, Virginia inspectors have already documented ninety-six incidents when sediments were deposited in waterbodies, 473 incidents of sediment deposited off-site by MVP, and 566 incidences when pollution control structures or devices were undermined, overtopped, overwhelmed, or otherwise bypassed - a total of 1,135 pollution incidents. Even for such a large drainage this combination of past and proposed new impacts must be considered as a whole.

Factors Considered in Cumulative Reviews of Stream Systems

In addition to concerns about the size and nature of each area addressed in the cumulative impacts assessment, there are serious deficiencies in the methods Mountain Valley has used to estimate impacts. To understand the true nature and extent of combined or cumulative impacts in a stream system, one must do more than the kind of simplistic accounting exercise Mountain Valley has produced, where it only lists supposed linear feet of stream and acres of aquatic environments to be affected and adds the numbers together for arbitrarily-chosen areas.

Questions that should be addressed to honestly understand and avoid unacceptable combined impacts in a unified aquatic system of any size may include, but are not limited to:

- In what part of the drainage will the impacts be caused? For example, will the combined project and non-project effects be exerted primarily on 1st order streams and intermittent or ephemeral streams, on larger streams, or in both types?
- What is the nature of the individual waterbodies? For example, does it matter if the number of linear feet of stream affected includes an area with bedrock substrate, or with a gravel and cobble botttom; how does that areal impact compare to the same length of stream impacted in a flat, sandy-bottomed section? Is the stream closely connected to groundwater in karst terrain?
- Would the impacts occur in waters where native aquatic species are relatively pollution-sensitive or pollution-tolerant? Will the impacts occur in spawning areas, pool and riffle habitats, or at other especially sensitive times or locations?
- How many individual stream segments or wetland areas will be affected within close proximity to one another?
- How will a number of upstream impacts be combined in their effects on downstream environments? Will sediments or other pollutants released, even in small amounts or for short periods at individual sites, accumulate and persist to cause negative effects?
- Specifically, how have the chemical, physical, and biological characteristics of the watershed streams been affected by past pipeline impacts in ways that have changed from the true baseline conditions? Have those impacts persisted, how long might they continue to be evident, and how will new impacts interact with them?
- In addition to additive effects, what type of synergistic or antagonistic effects from multiple stressors may be predicted?

As noted above, later in this report, we present information about specific watersheds that new MVP discharges would affect and contrast those watersheds, in size and in the nature of resources and likely impacts, with the HUC-12 areas in which they lie.

The following watersheds are included in these detailed examinations:

- Kimballton Branch - within the Stony Creek HUC-12
- Doe Creek - within the Little Stony Creek-New River HUC-12
- Flatwoods Branch - within the Wilson Creek-North Fork Roanoke River HUC-12
- Green Creek - within the South Fork Blackwater River HUC-12
- Little Creek - within the Madcap Creek-Blackwater River HUC-12
- headwaters of Cherrystone Creek - within the Cherrystone Creek HUC-12

The Nature of Past MVP Water Quality Impacts

The MVP has repeatedly caused negative water quality impacts and the threat of impacts due to releases of sediment from its work areas, access roads, and other sites. These releases are, theoretically, to be limited in volume, hydraulic force, and pollutant concentrations through a combination of measures to prevent soil erosion, concentrated water flows on and off the ROW, and sediment realeases off-site. Mountain Valley contends and agencies have endorsed the idea that these controls will adequately protect water quality. These assertion have been proven untrue on a grand scale and there is no credible argument that renewed construction on the project will produce better results.

Below we describe types of problems that we term "pollution incidents" throughout this report. These events may or may not have been designated as violations of applicable permit requirements by the state, by FERC, or by any other authority but they are, nonetheless, pollution incidents, because they result in excessive amounts of sediment flowing off of MVP's ROW and affecting downslope or downstream resources.

For each of these types of pollution incidents, numerous illustrations from the MVP's path in Virginia are depicted and described. The specific information about example watersheds, in later sections, shows the degree to which impacts are concentrated in certain watersheds, and further illustrates why the arbitrary use of HUC-12 areas is insufficient to make a valid assessment of combined or cumulative effects.

<u>Measurable Sediment Deposits in Waterbodies Caused by MVP</u>

Deposits of sediment in a stream or wetland may negatively affect the aquatic system in a number of ways, both in relation to the maintenance of aquatic organisms and communities and in relation to human uses. Agencies are required to protect both types of uses under Virginia's water quality standards (WQS).[18]

State inspection reports describe at least one hundred and thirteen (113) instances when this type of impact was observed.[19] We note that descriptions in the MBP Action Item Log sometimes report that sediment was deposited off the ROW but do not explicitly state that a waterbody was impacted. In some of those cases, Wild Virginia was able to determine that deposits were indeed found in streams by examining MBP

[18] See 9 VAC 25-260-10.A, "All state waters, including wetlands, are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish;" and 9 VAC 25-260-20.A., "State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards *or interfere directly or indirectly with designated uses of such water* or which are inimical or harmful to human, animal, plant, or aquatic life." (emphasis added).

[19] See Appendix A to this report for a list of these incidents, identified by Date first noted by the inspector and either Action Item Log ID number or DEQ inspection type/Spread.

photographs and additional reports. Given the ambiguities in some reports, it is likely that the total of these pollution incidents is greater than 113.

The DEQ and MBP reports distinguish between those occurrences when sediment deposits were observed on the stream bottom or in a wetland and those where sediment-laden water is observed in a waterbody. In part, that distinction may be related to DEQ's interpretation of its regulations regarding discharges that are forbidden under its Virginia Water Protection (VWP) Permit Program.[20] Whatever the reason for the distinction, both types of pollution can and often do "interfere . . .with designated uses" of state waters and should be prevented whenever the WQS apply.

In an enforcement suit the state brought against Mountain Valley, the state alleged that Mountain Valley violated provisions of Virginia law that "prohibit the dredging, filling, or discharging of any pollutant into to, or adjacent to wetlands or other surface waters without a Virginia Water Protection permit issued by the Board."[21] The complaint described instances when the state said Mountain Valley's activities resulted in sediment deposits in waterbodies for which Mountain Valley "did not possess a permit to discharge the fill into surface waters."[22]

The discharges of fill into waterbodies cited in the enforcement complaint are described in DEQ VWP Inspection Reports, where inspectors made observations about the depth of deposits, the linear feet of streams or the area of a wetland covered in sediment, and whether the deposits would substantially disrupt aquatic organism movement.

The incidents cited in the court complaint include the nine instances shown in the table below, when measurable sediment deposits were observed in waterbodies by inspectors working on behalf of the state. Through a review of all available DEQ and MBP reports, Wild Virginia has identified a total of 113 instances,[23] including those nine covered in the lawsuit, when sediments have been deposited in measurable amounts in waterbodies. Clearly, these incidents qualify as "pollution incidents" and constitute damages to the aquatic environments affected,, as well as interferences with designated uses under the WQS.

Date	Stream Impacted	Sediment Deposition in Waterbody
May, 2018	Unnamed tributary (UT) to Blackwater River	approx. 1,100 linear ft. of deposits, depth from 1 to 11 inches
May, 2018	UT to Blackwater River	approx. 1,690 linear ft. of deposits, depth from 1 to 10 inches
June, 2018	UT to Flatwoods Branch	approx. 3,600 linear ft. of deposits, depth

[20] The program is authorized under Code of Virginia § 62.1-44.15:20. and administered through regulations at 9 VAC Chapter 210.
[21] David K. Paylor and State Water Control Board v. Mountain Valley Pipeline, LLC, Complaint in the Circuit Court of Henrico County, Case no. Case No. CL18006874-00., at 3[hereinafter Paylor v. Mountain Valley].
[22] Id. at paragraphs 44, 47, 48, 51, 52, 54, and 58.
[23] These instances are listed by date and either Action Item Log ID number or DEQ inspection type and date in Appendix A to this report.

		from 1 to 7 inches
June, 2018	Two UTs to North Fork Roanoke River	total approx. 2,200 linear ft. of deposits, depth from 1 to 5 inches
June, 2018	UT to Flatwoods Branch	approx. 209 linear ft. of deposits, depth < 0.5 to 3 inches
Aug., 2018	UT to Sinking Creek	approx. 600 linear ft. of deposits, depth from < 0.5 to 3 inches
Sept., 2018	Kimballton Branch	approx. 630 linear ft. of deposits, depth from < 0.5 to 9 inches
Sept., 2018	wetland adj. to UT Mill Creek	approx. 350 sq. ft. of deposits, depth from < 0.5 to 6 inches
Oct., 2018	UT to Blackwater River	linear ft. not known, impacts private property owner denied access, depth from < 0.5 to 2 inches where observable

As discussed above, the threshold that determines whether impacts on state waters in Virginia are damaging is whether the WQS regulations have been violated. It seems unquestionable that the conditions described violate those conditions.

The instances when these deposits were caused by Mountain Valley have ranged in time between May, 2018 and September 22, 2021.[24] Throughout that 3-year period, this type of pollution incident occurred nearly in nearly every period when Mountain Valley was clearing land, trenching, or backfilling trenches with soil.[25] Likewise, these incidents occurred in nearly every area affected by the MVP, including in eighteen of the twenty-one HUC-12 areas touched by the pipeline route.

The last significant construction activities on MVP, according to Mountain Valley's reports to FERC, as referenced in *Wild Virginia*, 2022, occurred in October, 2021 One of the most damaging pollution events happened in August of 2021 in the Doe Creek watershed, as shown below.

Below are just a couple additional examples of these impacts, presented here as representations of special circumstances that are of concern on a wider basis. Many others are described in later sections for individual watersheds.

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[24] This information is taken from: a document prepared by MBP inspectors and labeled "Action Item Log through 7-14-2022," which is accessible at [*Wild Virginia, 2022*], Appendix B, and associated computer folders, including photographs and text documents, each labeled to correspond with an ID number for each of 5,364 descriptions in a column headed "Action_Item_Issue;" a collection of inspection reports made by DEQ personnel and accessible on the DEQ's website at https://www.deq.virginia.gov/get-involved/topics-of-interest/mountain-valley-pipeline, under links at the section titled "Inspection Reports." In this report, MBP inspection reports are referenced by Action Item IDs and DEQ inspection reports are referenced by the name of the tab under which they are accessible on the website (Complaint, Spread G, Spread H, or Spread I) and the date of the report.

[25] See *Wild Virginia, 2022*, narative at pdf pages 6-7 and tables at 11-13 and 15-17 depicting times when Mountain Valley was clearing land, trenching, or backfilling trenches and corresponding periods when sediment deposition in waterbodies and off the MVP ROW were observed by state inspectors.

August 16, 2018 - Sediment deposited in unnamed tributary to Sinking Creek over a karst feature.[26] This is one of six instances, in watersheds in both New River and Roanoke River basins, where records explcitly state that sediment was deposited in a waterbody or on land in a way that could affect karst environments. These areas are especially vulnerable to the transport of pollutants through groundwater and into wells and springs, sometimes many miles away from the initial impact sites.

August 2021
Sediment deposited in unnamed tributary to Mill Creek. The deposits extended over an area of the stream approximately 175 feet in lenght. This is a coldwater stream that is habitat for sensitive native trout and orangefin madtom. The landowner whose property was affected refused access for Mountain Valley to remove the sediment. Inspectors noted that three months after the incident, the sediment was no longer visible. Presumably it had been transported downstream.[27] As discussed further below in the section related to deposits on land outside the MVP ROW, delays in removing off-site sediment have sometimes lasted many months and sometimes the pollution was never removed from waterbodies or adjacent properties.

Note that construction was almost completely halted between October, 2019 and April, 2021, and sediment deposits in waterbodies from MVP were also stopped in that period. Then, during the summer and early fall of 2021, when construction re-started for a short period, some particularly serious pollution impacts were inflicted on streams and landowners, as illustrated in the Doe Creek watershed section later in this report.

In many cases, state inspection records describe efforts to remove sediment from waterbodies after these pollution incidents occurred, sometimes terming such efforts "remediation."[28] However, no information reviewed indicates that the risks and benefits of physical removal of sediments from the affected waterbodies was assessed before it was allowed. It is certain that digging or otherwise working in sensitive waterbodies to remove sediment has disrupted habitats. In the most extreme case discovered in the records, Mountain Valley personnel were allowed to use pressure washers and vacuum devices to remove its pollution from a stream. This case is described below in the section relaed to the Doe Creek watershed.

Further, Wild Virginia has been able to find no evidence in state records that long-term or lingering biological impacts or habitat alterations due to sediment deposition in streams, or removal of those sediments, was ever assessed by DEQ or any other party. For some of the most extreme cases, those mentioned above and cited in the enforcement lawsuit, Wild Virginia asked DEQ, for such information in a Freedom of Information Act (FOIA) request. The infomation requested included, in part:

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[26] MBP Action Item Log ID 580.
[27] MBP Action Item Log ID 5035.
[28] See for example Action Item Log ID numbers 1562, 1571, 1662, 3452, 3683, etc.

> "Any chemical, physical, or biological measurements or observations at the each of the sites [where the VWP inspections were conducted] . . . Any description or discussion related to reviews of requests or plans to work in the . . . streams to remove the sediment deposits described in the reports, including possible chemical, physical, or biological impacts those activities might cause. . . . Any description or discussion of chemical, physical, or biological impacts actually caused by removal of sediments from the streams."[29]

DEQ did not provide any evidence in response to the FOIA to show that these streams, which were impacted by heavy deposits of sediment for hundreds or thousands of feet, were ever examined to assess the resulting state of those waterbodies.

Figures 1 - 9 below show a sampling of the waterbodies impacted by MVP's sediment discharges and deposit in waterbodies. Other examples are shown in watershed-specific sections later in the report.

[Note: abbreviation used in photo captions - UT means "unnamed tributary to"]

[29] Letter from David Sligh, Wild Virginia to Diana Adams, DEQ, *Re: Wild Virginia FOIA Request, Assessments at VWP Inspection Sites on MVP*, September 29, 2021.

Figure 1 - Sediment deposits in UT Blackwater River,
August 1, 2018, DEQ Inspection, Spread I, Source: DEQ [report says "sediment appears to have been removed from stream" on Aug. 15, 2018]

Figure 2 - Sediment deposited in UT Sinking Creek, August 29, 2018, DEQ VWP inspection, Source: DEQ [notes that sediment shown approx, 300 ft. downstream from ROW]

Figure 3 - Sediment deposited in wetland W-G2, adjacent to Little Cherrystone Cr., February 12, 2019, Action Log ID 1888, Source: MBP [deadline for removal of sediment extended "due to wet ROW conditions," removed after 10 days]

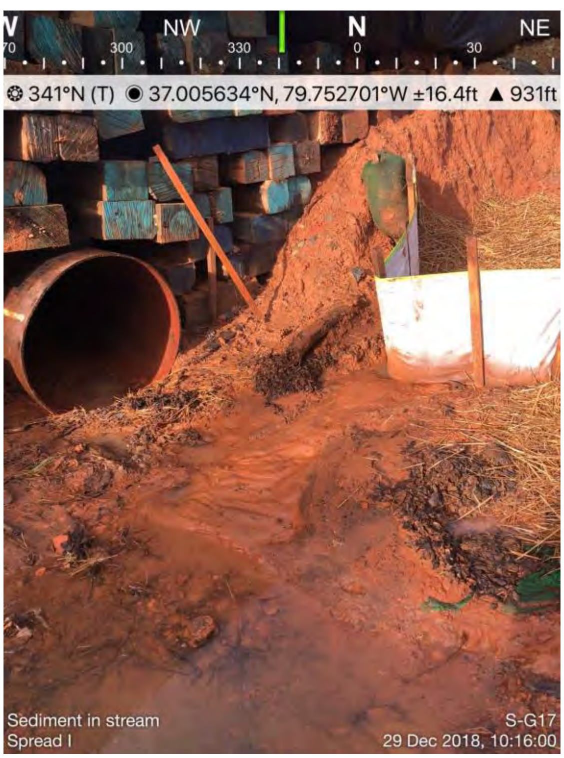

Figure 4 - Sediment deposited in UT Blackwater River, December 29, 2018, Action Log ID 1562, Source: MBP

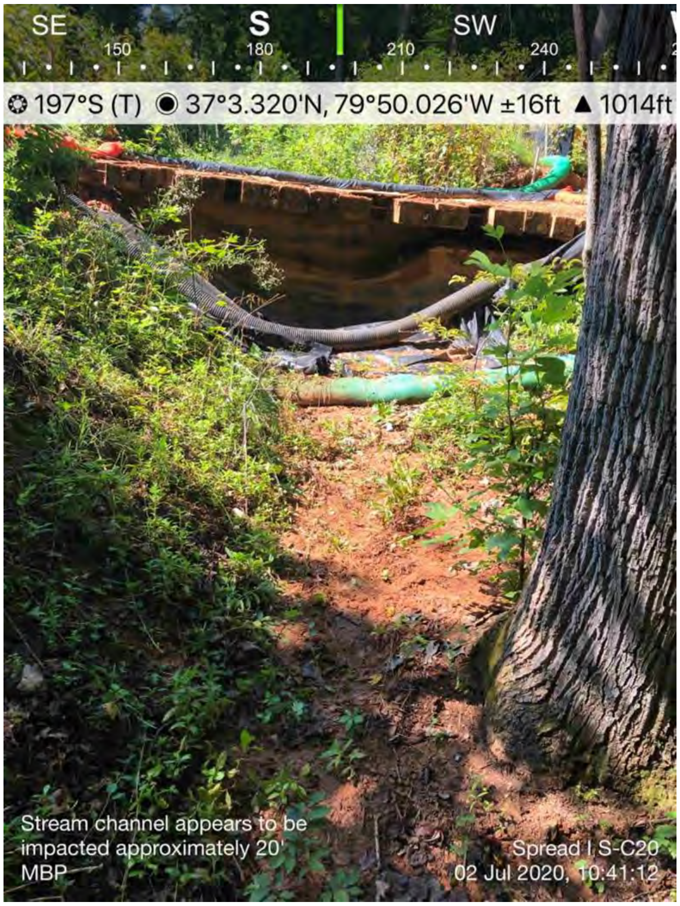

Figure 5 - Sediment deposited in UT Maggodee Creek, July 2, 2020, Action Log ID 4313, Source: MBP.
[report states deposits 2.5 inched deep, 3 ft. wide, cover approx. 20 linear feet of bed; deposits in place five days before removal.

Figure 6 - Sediment deposited in UT to Roanoke River, July 23, 2019, Action Log ID 3301, Source: MBP [failure to recover sediment without landowner agreement, after 72 days sediment had washed away]

Figure 7 - Sediment deposited in UT Mill Creek and adjacent property, August 16, 2021, Action Log ID 5035, deadline to clean up extended loa [report states impacts extend approx. 75 linear feet upstream and 100 linear feet downstream; landowner denied permission to access impacted areas; approx. 3 months later, inspector reported sediment deposits no longer visible.

Figure 8 - Sediment deposited in UT Blackwater River, May 31, 2018, DEQ VWP inspection rpt. [sediment in streambed approx. 1,690 linear feet of stream impacted with deposits up to 5 inches deep; impacted area approx. 685 feet from ROW]

Figure 9 - Sediment deposited in UT Blackwater River, May 31, 2018, DEQ VWP inspection report, Source: DEQ [sediment covered approx. 1,110 linear feet of streambed, up to 7 inches deep]

Sediment Deposited Outside MVP Pollution Controls

In at least 684 instances, MVP activities have caused measurable sediment deposits on land off the project ROW and beyond the control of sediment treatment or reduction measures.[30] DEQ or MBP inspectors may or may not have traced these off-site deposits to waterbodies, but they present a threat of sediment discharge at any time while they remain in these areas, because storm runoff can move the materials downslope and downstream.

In its lawsuit against Mountain Valley, the state cited these types of pollution incidents on numerous occasions. For example paragraphs 41, 57 allege the release of sediment off the ROW onto adjacent private property and paragraph 62 alleges forty-two such incidents.[31] Off-site releases of sediment "adjacent to wetlands or other surfaces waters" without coverage by a VWP Permit violate Va. Code § 62.1-44.15:20 and the regulations at 9 VAC 25-21-50.

Virginia law also recognizes that such situations are pollution incidents and likely sources of water pollution problems. The Code of Virginia states that if "sediment has been deposited in significant amounts in areas where those deposits are not contained by best management practices," they may pose "an imminent" threat of adverse impacts to water quality and may be the basis for a stop-work instruction. Va. Code § 62.1-44.15:37.1.A.

These deposits are a harm to landowners whose land is adjacent to the MVP ROW and whose property interests may be encroached upon by these pollution releases. These parties often face a choice whether to have farm fields or other areas further disturbed by personnel attempting to remove the sediments or by the continued presence of the pollution, sometimes indefinitely.

An important observation from the state inspection records is that in many instances the off-site sediment deposits, both on land and in waterbodies, stay in place for extended periods, sometimes until they are carried away downstream by subsequent storm runoff events. In at least 117 instances, state records indicate that the usual deadlines for correcting problems, including for retrieving off-site sediment or other materials, were waived or extended because there was a delay in getting landowner permisstion to do so. In some cases permission was never granted and inspectors noted that the sediment was no longer present - clearly, in of these cases the sediment was eventually carried away in runoff.

The following photographs show a number of these instances of off-site sediment deposits at various locations along the MVP in Virginia and, the discussions below for individual watersheds provide descriptions and photographs of more of this type of pollution incident.

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30 See Appendix A to this report for a list of these instances, identified by date of occurrence and either Action Item Log ID number or DEQ inspection type or Spread.

31 See Paylor v. Mountain Valley.

Figure 10 - Sediment deposits off ROW onto a farm field, near UT to Harpen Creek, June 28, 2019, DEQ Inspec. Rpt. Spread I, Source: DEQ

Figure 11 - Sediment deposited off ROW, June 3, 2019, Action Item ID 2844, near Dry Run, Source: MBP

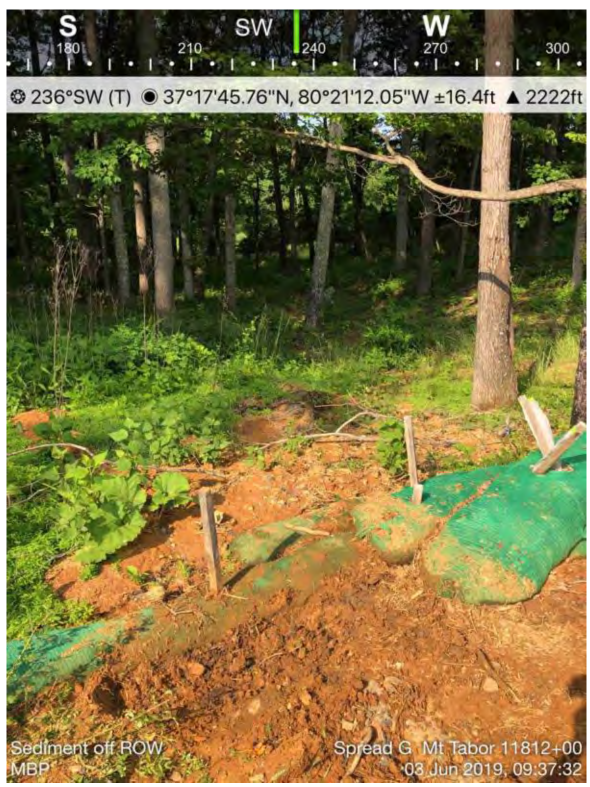

Figure 12 - Sediment off ROW near UT Little Creek, September 9, 2018, Source: citizen observer, accessible at [Virginia Pipeline Violations Facebook page]

Untreated or Poorly Treated Discharges from MVP Sites
In at least 687, instances pollution control structures at MVP sites have been undermined, overtopped, overwhelmed, or otherwise bypassed by water carrying sediment off-site, resulting in discharges that are poorly treated or untreated. These pollution incidents result in sediment-laden water flowing across land and into streams and wetlands, where it can cause a variety of harms.

In its enforcement lawsuit against Mountain Valley, the state cited instances where pollution control features were "overwhelmed" or were not adequately installed or maintained and led to "sediment-laden" water discharging from MVP sites.[32] In some cases, inspection reports indicate that sediment deposition off-site and/or in waterbodies occurred. In many other cases, measurable deposits were not mentioned but these releases off-site are definitely pollution incidents that have affected hundreds of waterbodies all through the pipeline's path across Virginia.

Descriptions of pollution incidents in DEQ and MBP inspection reports are not always consistent but some terms describing the failures or problems with pollution control measures do appear repeatedly. Word searches in the inspection records show:

408 instances when controls were "undermined"
279 instances when controls were "overtopped," "overrwhelmed," or "overrun"

The records also reveal that measures that have been designated as "enhanced" pollution controls have failed or been ineffective in many cases. So-called "super silt fence," where fabric material is physically backed by what resembles chain-link fencing, was mentioned in relation to pollution incidents in 41 instances. Triple-stack compost filter socks, were mentioned in relation to pollution incidents 34 times.

One other "enhancement" that has been cited to support claims that past MVP pollution won't be repeated if construction re-starts, is the addition of yet more inspectors and site checks. However, it is clear that the thousands of inspections by DEQ and MBP in Virginia, by the West Virginia Department of Environmental Protection (DEP), the Federal Energy Regulatory Commission (FERC), and others have not stopped the pollution. The record shows that the damages to waterbodies and property only slows or stops when Mountain Valley is forced to stop construction.

As explained above, sometimes Mountain Valley has been granted waivers or extensions of deadlines by Virginia officials, so that corrections that are supposed to happen within 24 or 72 hours take longer, sometimes much longer. In addition to delays when off-site sediment could not be removed due to a lack of landowner permission to work outside the ROW, another common cause for waivers is cited repeartedly in Virginia inspection reports. In 192 instances, inspectors listed the fact that the ROW was "wet" or "saturated" as a reason why pollution control measures need not be installed, repaired, or replaced within the usual required time. Instead of a day or three to install or repair some pollution control feature,

[32] See Paylor v. Mountain Valley

Mountain Valley would be allowed to delay for additional days and sometimes for much longer. Such delays are not without considerable risk and often obvious further harm to the environment.

Seemingly routine conditions for which DEQ and MBP inspectors note only that maintenance is required are, in many cases, the cause of off-site pollution discharges and when the maintenance is delayed, additional pollution incidents may well occur. For these delays to be allowed for a condition that can hardly be unexpected, that the ground would be wet or saturated after storms, is a major flaw in the plans and methods that are supposed to protect our waters and adjacent landowners. It is predictable that this kind of problem will continue indefinitely if MVP work continues, given that rainstorms and wet ROWs will continue.

One example of such a problem area relates to sumps. These are features found in thousands of locations along the pipeline route. They are small pits placed at the boundary of a work area to slow off-site water flows and collect settled materials before the water passes through a filtering device, such as silt fencing or compost filter socks, or a combination of the two (sometimes call end treatments). These sumps are to be cleaned of sediment deposits *before* they exceed half their volume, to maintain capacity to continue removing sediment from stormwater flows and to slow and reduce the force of the runoff flows.

But in more than one hundred instances the MBP inspectors created "action items" where they had found that sumps were full, and in many of those cases this condition had already led to pollution incidents: for example - where sumps were full and the end treatments had been "overrun" (action item 480), "overtopped" (action items 858 and 2757), "overwhelmed" (action items 904 and 1833), "undermined" (action items 1590 and 2903), or where measurable sediment deposits were found off the ROW (action items 896, 2060, 2498, and 3624).

And yet, corrections have routinely taken much longer than expected or normally required. Sometime inspectors explicitly noted that waivers of the usual deadlines were granted, sometimes it is not so stated but substantial delays occurred nonetheless. A partial list of delayed sump corrections, designated by Action Item Log ID numbers:

- 1890, sump full on 2/15/19, delay allowed for wet ROW, finally corrected 7 days later
- 1922, sump full on 2/19/19, delay allowed for wet ROW, finally corrected 34 days later
- 2044, sump full on 2/28/19, delay allowed for wet ROW, finally corrected 14 days later
- 2052, sump full on 3/1/19, delay allowed for wet ROW, finally corrected 25 days later
- 2060, sump full on 3/4/19, delay allowed for wet ROW, finally corrected 7 days later
- 2129, sump full on 3/7/19, delay allowed for wet ROW, finally corrected 7 days later
- 2548, sump full on 4/19/19, dealy allowed for wet ROW, finally corrected 7 days later
- 3624, sump full on 10/23/19, delay allowed for wet ROW, finally corrected 14 days later
- 3952, sump full on 2/12/20, delay allowed for wet ROW, finally corrected 6 days later
- 4852, sump full on 6/12/21, delay allowed for wet ROW, finally corrected 4 days later
- 5187, sump full on 9/23/21, delay allowed for wet ROW, finally corrected 10 days later

A variety of problems at a work site, including lack of adequate ground cover over bare dirt, inadequate or missing water bars or sump capacity, etc. can lead to huge amounts of muddy water leaving these sites. Wild Virginia has viewed thousands of photographs included with DEQ and MBP inspection reports but rarely seen the extreme nature of these discharges depicted. We have provided no videos by the state. Visits to these sites have revealed much more graphic views of pollution from the MVP sites than gained in looking at state records. To provide that fuller picture, we have supplement the photos from state reports with those from citizen monitors.

The images on the following pages are screenshots from three videos recorded by a local volunteer observer along a section of the MVP pipeline right of way in Franklin County, Virginia. The videos are especially vivid illustrations of the way MVP control practices and structures have failed to properly control pollution from pipeline sites in hundreds of instances.

The three sites shown in these images all lie within less than a thousand feet of each other, along a stretch of the MVP ROW in Franklin County. As shown in the annotated satellite image in Figure 22, the pipeline site and the three discharges shown lie up a relatively steep slope from the Blackwater River. Measurements show that the distance of water flow from the pipeline ROW to the stream would be between 300 and 500 feet in this area.

The timing of these three incidents refutes frequent claims by Mountain Valley and by agency officials that MVP pollution problems happened primarily during the first year of construction and were largely due to one period of especially heavy storms. These videos, dated September 27, 2018, August 22, 2019, and November 11, 2020, show that sediment-laden waters have poured off of MVP sites frequently and repeatedly and that even after three or more years, Mountain Valley has not taken measures adequate to stop these polluted discharges.

Figures 13 - 15 -

September 27, 2018

Sediment-laden water overflowing compost filter socks and leaving the MVP ROW, several hundred feet upslope of the Blackwater River.

Taken from a [video accessible at Virginia Pipeline Violations] Facebook page

Figures 16 - 18 - August 22, 2019
Sediment-laden water flowing over, around, and through super silt fence and leaving the MVP ROW, several hundred feet upslope of the Blackwater River.
Taken from a [video accessible at Virginia Pipeline Violations Facebook page]

Figures 19 - 21 - November 11, 2020, Sediment-laden water overwhelming a end treatment and leaving the MVP ROW, several hundred feet upslope of the Blackwater River.
Taken from a [video accessible at Virginia Pipeline Violations Facebook page]

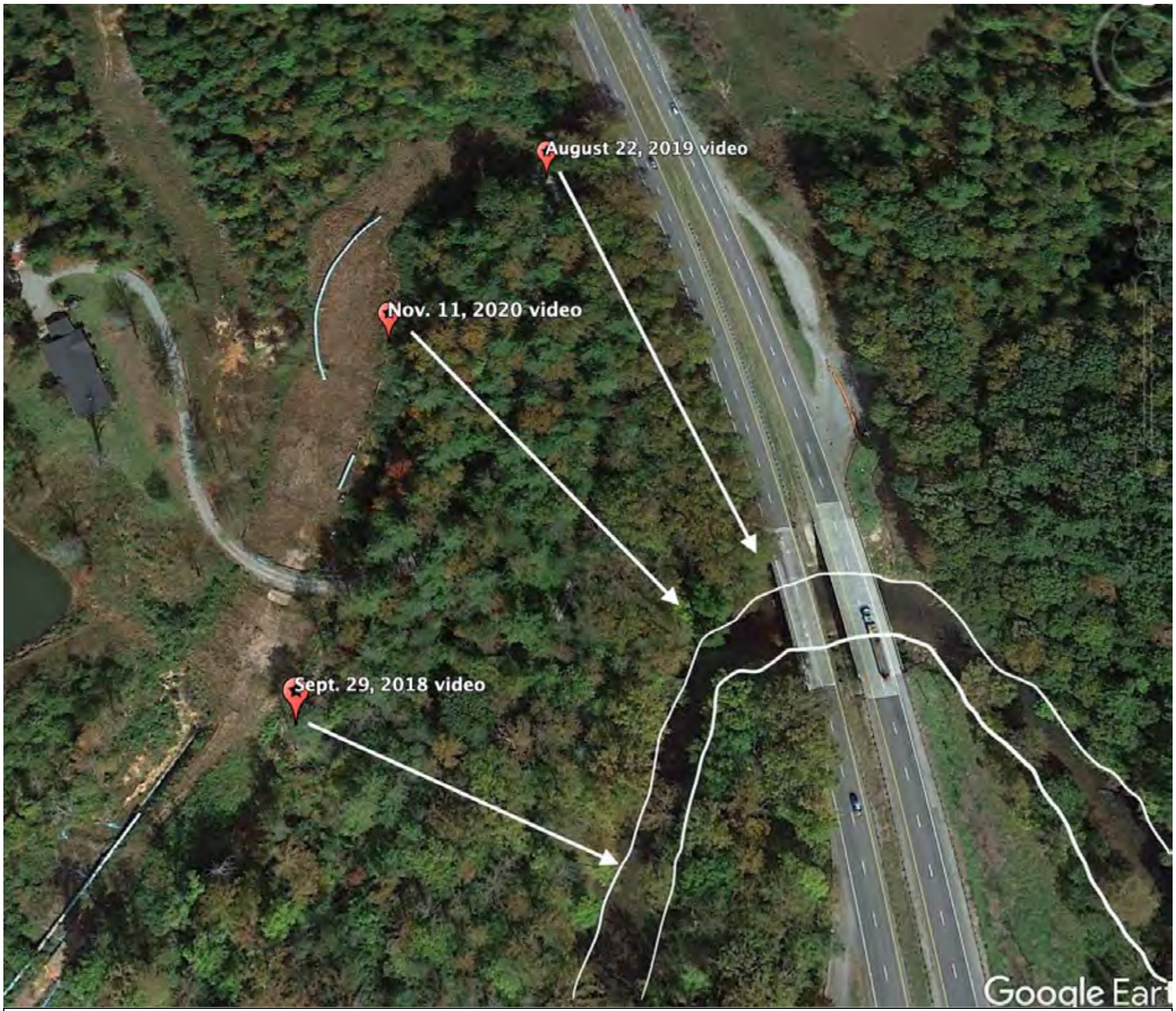

Figure 22 - Satellite image annotated to show locations at which videos depicted on previous pages were filmed and their relation to the Blackwater River. White arrows show approximate flows paths of water flowing off the MVP ROW.

A couple of additional examples of MVP pollution controls failing are shown below.

Figure 23 - Sediment-laden water undermining compost filters socks and discharging to a UT of Bradshaw Creek, July 23, 2019, DEQ Complaint inspection report, Source: DEQ

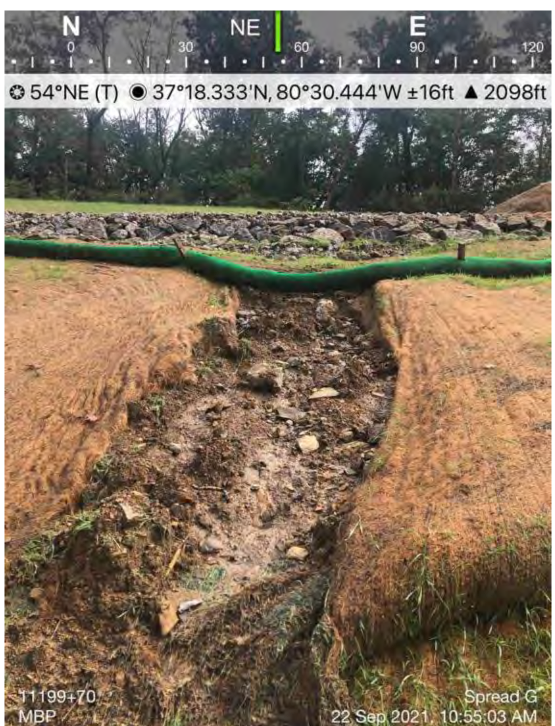

Figure 24 - Compost filter sock undermined near Sinking Creek, September 22, 2021, Action Log ID 5196, Source: MBP

Selected Virginia Watersheds
Concentrations of Proposed Discharges and Past Impacts

The following discussions describe six watersheds in Virginia, the proposed new stream and wetland discharges Mountain Valley proposes in each, and the record of pollution incidents. These examples demonstrate why HUC-12 areas are not appropriate for understanding combined or cumulative impacts in these aquatic systems.

<u>Doe Creek watershed</u>

In the supplemental materials submitted to the Corps to discuss cumulative impacts, Mountain Valley provides standard figures for project and non-project impacts within the Little Stony Creek-New River HUC 12 (050500020304),[33] an area of greater than 45 square miles (mi^2).[34] As shown in the annotated satellite image below, this HUC 12 area actually contains three watersheds draining to significant tributaries that flow southward into the New River. In addition, there is a section of the HUC 12 outside these three watersheds of approximately 10 mi^2 in size.[35]

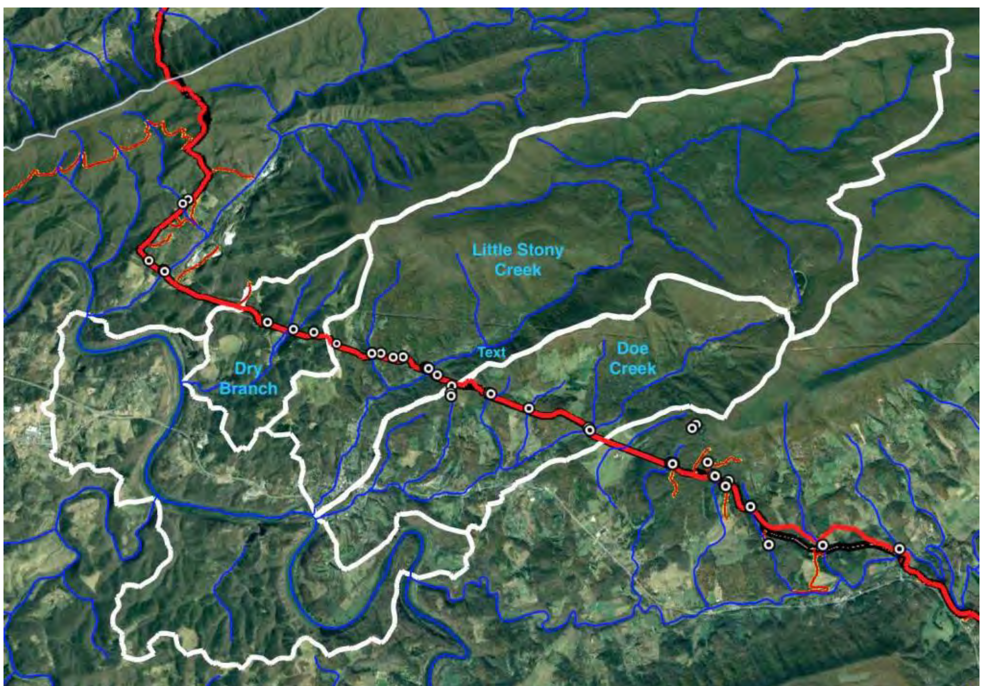

Figure 25 - Annotated satellite image showing Little Stony Creek HUC-12 area and separate watersheds within that area.

[33] *Supplemental Cumulative Impact Assessment Report for the Clean Water Act Section 404 and Rivers and Harbors Act Section 10 Permit Applications*, July 22, 2022.

[34] Drainage area statistics in this report are taken from EPA's Natural Hydrography Database Plus (NHDPlus) or from Mountain Valley's application materials, unless other sources are cited. In some cases, the figures vary slightly from one source to another.

[35] Images of watershed areas are created using aerial photography from Google Earth Plus.

The three watersheds within this HUC-12 area, include Little Stony Creek, Doe Creek, and Dry Branch. Each of these three stream systems to the north of the New River will be impacted by the MVP. Those areas outside these watersheds will not be affected by the MVP and are not directly connected to the three named streams. Thus, these areas should be excluded from the analysis.

As discussed above, a rationale that the USFS offered to justify its choice of HUC units (in its case HUC-10s) was that those areas are at "the scale at which indirect and cumulative effects are reasonably expected to occur for the resources analyzed."[36] There is no rational basis to expect that cumulative effects in one watershed within this HUC-12 area will be related to those in any of the others or to include all in one cumulative effects analysis.

Each of the three streams mentioned is important in its own right and each is an important contributor of flows and materials to the New River. The characteristics described below for Doe Creek demonstrate why it is necessary to look at combined impacts in each of these distinct stream systems and why simplistic and questionable estimates of permanent and temporary waterbody impacts across a larger HUC area are improper.

Mountain Valley proposes intensive new impacts to each of the three watersheds in the HUC-12 and waterbodies in each of these drainages have already been assaulted by discharges of pollutants from MVP-related activities. The problems with the approach to cumulative impacts assessments overall is clearly demonstrated for the Doe Creek watershed.

The Doe Creek drainage measures 8.5 mi^2, or around 19% of the Little Stony Creek HUC-12 unit. A 2.15 mile segment of the pipeline path crosses Doe Creek watershed midway between the Creek's mouth and the upper reaches of the stream to the northeast. The MVP right of way and the six new stream discharges that Mountain Valley proposes in the Doe Creek watershed affect not only the mainstem of the Creek but also impact four significant unnamed tributaries as well. Doe Creek is a first order stream upstream of the pipeline path and becomes a second order stream at that point, where one of the tributaries joins it. Of the four tributaries, two are ephemeral, one is intermittent, and one is a first order perennial stream.

Mountain Valley claims that a total of 590 linear feet of streams will be temporarily impacted by these six discharges and that no permanent impacts will occur. We have found no analysis of the potential impacts on this stream system from the collection of proposed discharges that accounts for the fact that they will affect all of these arteries feeding the downstream segments or how the combination of sediments release will affect the lower reaches of Doe Creek or the portion of the New River into which it discharges and no recognition that the segment of the New River is part of the historic range of the endangered Candy Darter. In fact, if a combined impacts review on a scale larger than the individual watersheds is to be conducted, one that looks at the combined imputs from all the tributaries to this section of the River should be considered.

Pollution discharges from MVP activities have already affected Doe Creek and its tributaries on numerous occasions and no party has described these in context of the watershed or

[36] DSEIS at 83.

explained how they affect current conditions in these streams, or how these inputs have or will contribute to combined or cumulative impacts to this stream system. State inspectors have reported four separate instances when visible and measurable sediment deposits resulting from MVP activities were observed in watershed streams.

In the worst of these cases, Doe Creek was coated with sediment for a distance of more than 3,500 linear feet.[37] According to the MBP report, this impact was first observed on August 18, 2021 and the "Item Corrected Date" was fifteen days later, on September 2, 2021. The report describes the supposed "correction" for the deposition of sediments over a stretch at least two thirds of a mile long as follows:

> Streambed was cleaned of sediment with pressure washers and vac trucks to the extent allowed by landowners, approximately 3500 LF(DB)[38]

Aside from those instances where Virginia inspectors documented sediment deposition directly in streams in this watershed, there were eleven other instances when sediment was deposited on the land outside of the pollution control structures and thus were available to be carried to the streams during subsequent storms.[39]

One landowner's home was surrounded by MVP's mud and debris, requiring a brigade of workers to remove it with shovels and buckets, as shown in Figure 28. Off-site sediment deposits was not removed until nearly nine days had passed, providing ample opportunity for those sediments to be entrained by storm runoff and carried to waterbodies.

Finally, as in many other sites along the MVP route, the erosion and sediment control measures Mountain Valley has used and intends to continue using have simply failed perform the functions promised in the plans. Virginia inspectors have documented at least eleven instances when the silt fences, compost filter socks, and other devices and structures that are supposed to prevent unacceptable waterbody impacts were "undermined," "overtopped," or "overwhelmed."[40]

Given that the majority of these failues occurred in the summer of 2021, more than three years after MVP construction began, it is clear that Mountain Valley has not solved problems that led to pollution incidents at the start of the project. In one of these instances, inspectors found a "triple stack cfs overtopped,"[41] showing that one of the so-called "enhanced" pollution control features had also been ineffective.

Photographs below show some of the great damage Mountain Valley has caused in the Doe Creek watershed, to the environment and to the people who live there.

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[37] See MBP Action Item Log, ID number 5068. Other incidents of sediment deposition in streams in this watershed are shown on the Action Item Log as ID numbers 5065 and 5123 and on a DEQ Field Inspection Report for Spread G, dated August 23, 2021.

[38] Action Item Log ID 5068.

[39] These included incidents under the following ID numbers of the Action Item Log ID numbers 532, 672, 4971, 5061, 5062, 5064, 5067, 5077, 5081, 5124, and 5125.

[40] See Action Item Log ID numbers 530, 2029, 2567, 2570, 4912, 5071, 5072, 5073, 5066, 5063, 5075.

[41] Action ID Log number 4912.

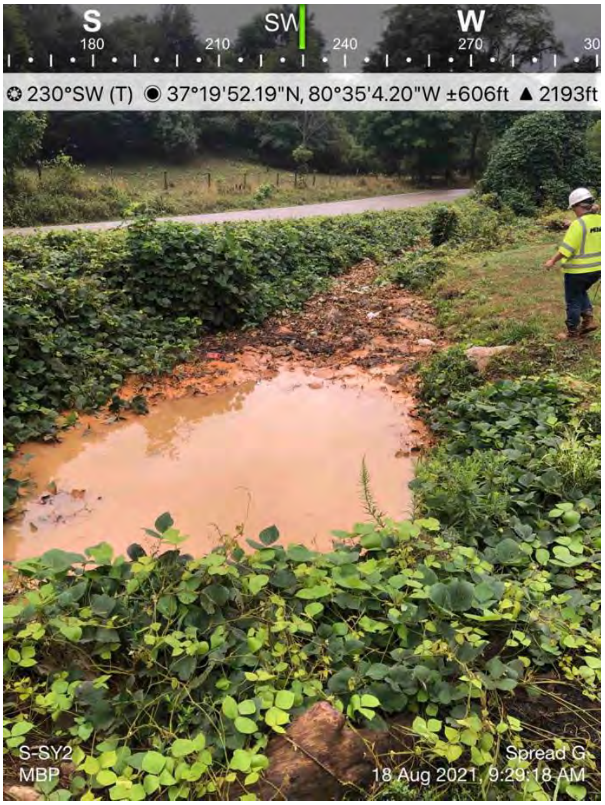

Figure 26 - Sediment deposited in Doe Creek, August 18, 2021, Action Log ID 5068, Source: MBP

Figure 27 - Sediment deposited off MVP ROW near Doe Creek, August 18, 2021, Action Log ID 5068, Source: MBP

Figure 28 - Workers using a pressure washer and pump truck in an attempt to remove sediment deposited in Doe Creek from MVP worksites. August 20, 2021. Action Log ID 5068. Source: MBP

[Inspectors first identified this pollution incident on August 18, 2021 and the MBP report lists the "item corrected date" as September 2, 2021, fifteen days after the stream impact occurred.]

Figure 29 - Workers removing sediment from a landowner's property after the pollution "overwhelmed perimeter controls" at MVP sites. Action Log ID 5067. Source: MBP

Figure 30 - Sediment overflowing compost filter socks, deposited off MVP ROW near UT Doe Creek, August 19, 2021, Action Log ID 5081, Source: MBP

Figure 31 - Sediment deposited in UT Doe Creek, August 18, 2021, Action Log ID 565, Source: MBP

Kimballton Branch watershed

This small watershed lies within the Stony Creek HUC-12 area. The entire HUC covers an area of 31,289 acres[42] but the Kimballton Branch drainage is just 1,117 acres in size,[43] approximately 3.6 percent of the area for which Mountain Valley has purportedly assessed cumulative impacts. Yet, as shown in the annotated aerial photo shown below, a large percentage of the pipeline's path through the Stony Creek watershed will disturb land and discharge to waterbodies via two proposed crossings that fall within the Kimballton Branch watershed.

Much of the land surface in both the Stony Creek HUC-12 and Kimballton Branch is within the boundaries of the Jefferson National Forest. Kimballton Branch discharges to Stony Creek in the section designated as critical habitat for the endangered Candy darter by the U.S. Fish and Wildlife Service.[44]

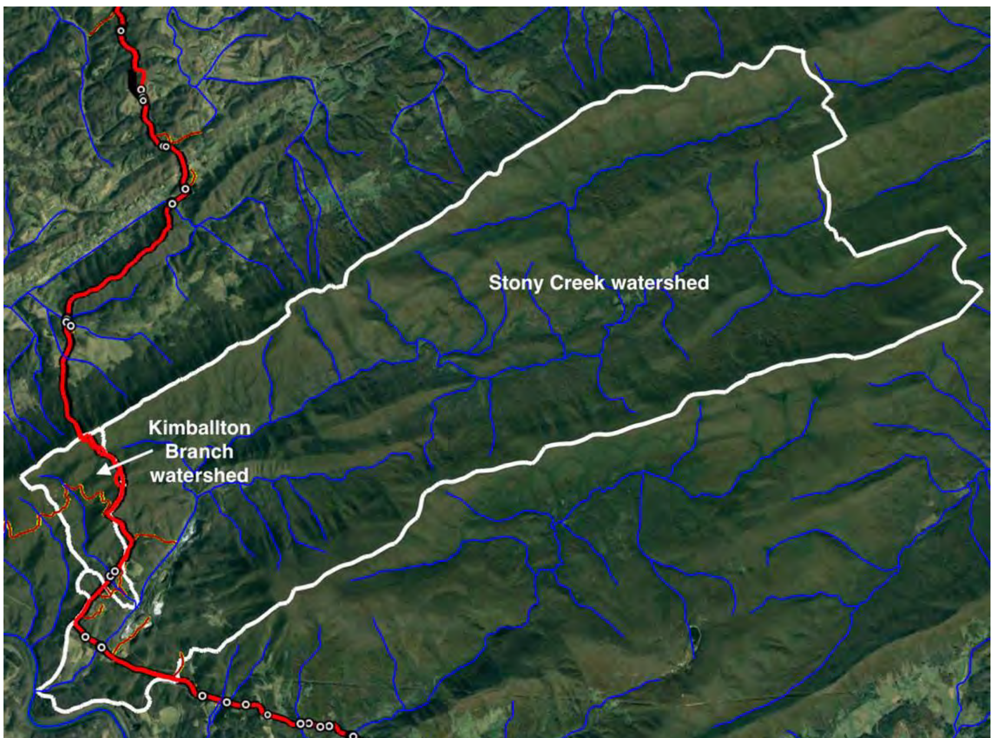

Figure 32 - Stony Creek HUC-12 (050500020305) and Kimballton Branch watershed. Created with Google Earth Plus with data from National Hydrography Dataset. Red line depicts MVP pipeline ROW; proposed new discharges shown by circles.

[42] Appendix Q, Revised Cumulative Impact Assessment Report - Hydrology, Mountain Valley Pipeline, revised May 2022 (Appendix Q), at 64.
[43] Nation Hydrography Dataset Kimballton Branch Watershed Report.
[44] Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Candy Darter, 86 FR 17956, 17964 (April 7, 2021) (codified at 50 C.F.R. § 17.95(e)) (designated segement 2b, "approximately 31.1 skm (19.3 smi) of Stony Creek from the confluence with White Rock Branch, downstream to the confluence with the New River.").

Mountain Valley proposes two new discharges within this watershed, one to Kimballton Branch, a first order stream and habitat for native trout, and one to an ephemeral unnamed tributary to Kimballton Branch.

Clearly, Mountain Valley's bare listing of supposed linear feet of impacts in the Stony Creek HUC-12 or in the Kimballton Branch watershed provides no understanding of possible true impacts on either of these streams or on the stream system as a whole. The permit application filed with the Corps of Engineers claims there will be a combined 176 linear feet of temporary impacts from the two discharges, both pipeline ROW crossings.[45] Mountain Valley claims no permanent stream impacts will be caused by the MVP.

And by placing those impacts within the context of the entire Stony Creek drainage, when they will be confined to such a small portion of the system, Mountain Valley clearly obscures the true magnitude and importance of any cumulative impacts. Though the Stony Creek HUC does in fact represent a watershed, unlike many of the HUC-12 units assessed, viewing impacts on this scale and ignoring more localized combined effects in a functional way is negligent for agencies responsible for protecting these resources.

Serious pollution events, which must be considered in any true assessment of current conditions or possible impacts, have already been caused by MVP activities in the Kimballton Branch watershed. These include the following:

Date Observed	Inspection Report	Description
August 20, 2018	MBP Action Item Log, Issue ID 604	Inspectors report "sediment off ROW" and "caused by swale runoff" at access road AR GI 234. Reported that deadline for correction was extended and on 10/3/18 that adjacent landowner refused permission to retrieve the sediment.
September 5, 2018	VWP Inspection Report	Approx. 630 linear feet of Kimballton Br. stream channel impacted by sedi-mentation. Deposits up to 9 inches depth. Aquatic life movement substantially disrupted.
November 28, 2018	Field Inspecrtion Report	Designated stream SQ14 shows signs of sediment and possibly road gravel in the stream, access road AR GI 234.
December 20, 2018	Field Inspection Report	Designated stream SQ14 shows signs sediment and possibly road gravel in the stream, access road source.

As shown by the DEQ and MBP inspections, the areas where stream bottoms were covered in sediments have already greatly exceeded the predicted impact areas that Mountain Valley

[45] Mountain Valley Pipeline Individual Permit Application Feburary, 2021, at pdf page 86 (Table 2).

included in its application to the Corps. And these impacts, from measurable sediment deposits in streams, have been supplemented by sediment-laden water discharged from MVP work areas and ROW, as demonstrated by incidents that occurred in August, 2018.

There is also no basis to assume that long-term and even permanent impacts have not already occurred in Kimballton Branch or downstream in Stony Creek. The impact on biota in these streams from repeated damages from the MVP activities, spread over a four-month period in one year (2018), must be considered first and any new impacts that would be caused by discharges now proposed must be included in any assessments.

We also refer to the questions outlined above in this report that must be considered when overall impacts to a watershed are analyzed. Kimballton Branch is a first order perennial stream in the segment where crossing S-Q13 is proposed and the discharge at crossing S-Q12 would enter an ephemeral stream. Both streams are coldwater fisheries and habitat for native trout species. It has long been documented in the scientific literature that these types of headwater streams have an outsized impact on the larger watersheds in which they lie and these values are not accounted for in analyses that seem to assume all streams are the same.

The following photographs vividly show the kinds of damage MVP has already inflicted on Kimballton Branch streams.

Figure 33 - Sediment deposited in Kimballton Branch, August 18, 2018, Action Log ID 604, Source: MBP

Figure 34 - Sediment deposited in Kimballton Branch, September 5, 2018, VWP inspection report, Spread G, Source: DEQ [Approx. 630 linear feet of Kimballton Branch stream channel impacted by sedimentation. Deposits up to 9 inches depth. Report indicates that aquatic life movement substantially disrupted.]

<u>Flatwoods Branch</u>
The watershed of Flatwoods Branch lies within the Wilson Creek-North Fork Roanoke River HUC-12 (030101010202) which is 25,895 acres in size. The Flatwoods drainage comprises just about 11% of the HUC, measureing 2,787 acres. As shown in Figure 35, all of MVP's proposed crossings and the ROW within this HUC area fall within the Flatwoods Branch watershed. Thus, the rational scale on which to base a cumulative impacts analsis is the one drainage that will be so heavily impacted.

Flatwoods Branch and one unnamed tributary are first order perennial streams in the areas where the MVP ROW impacts them and where new discharges are proposed. Numerous intermittent and ephemeral streams would be affected and in many instances already have been. In all, Mountain Valley proposes to create 10 new discharges to streams and 5 to wetlands (13 ROW crossings and 2 timber mat crossings) in this watershed.

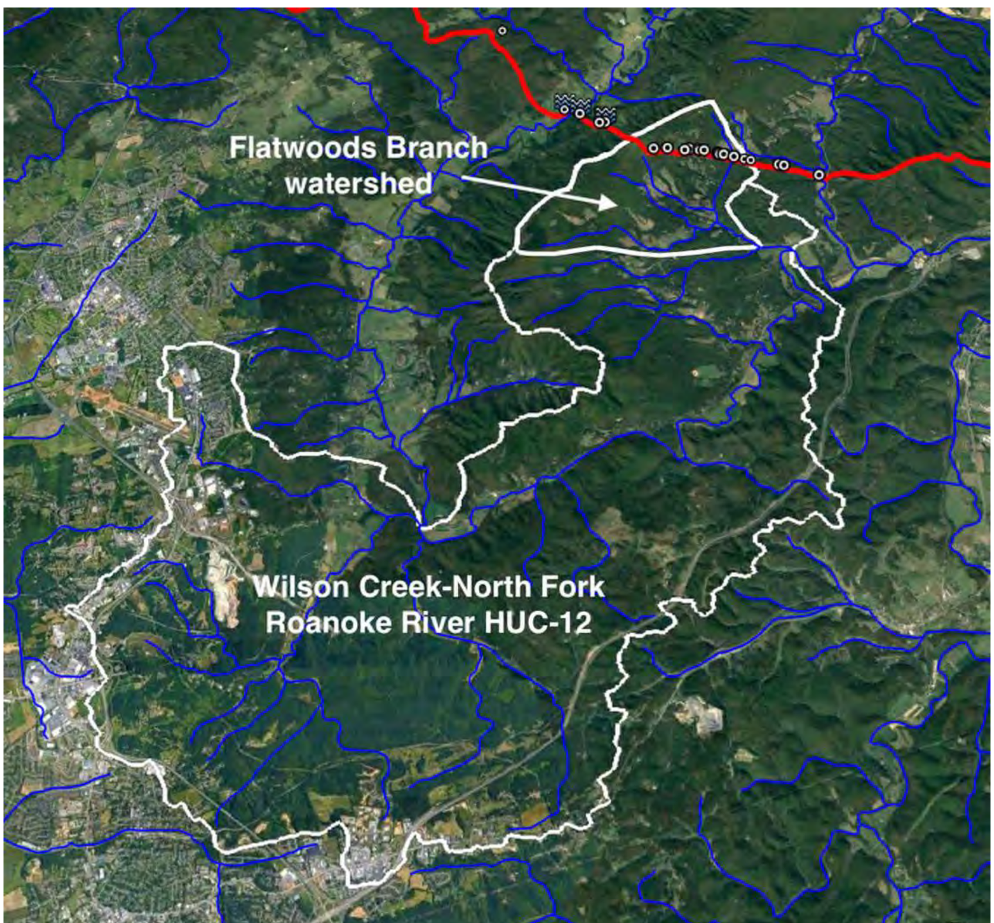

Figure 35 - Wilson Creek-North Fork Roanoke River HUC-12 and Flatwoods Branch watershed, showing all MVP impacts proposed for the smaller drainage.

More than 1.6 miles of the pipelines path runs through the Flatwoods Branch watershed, descending nearly 1,000 feet in elevation, from the ridge of Paris Mountain to the Flatwoods crossing.

The MVP has caused dozens of pollution events in this watershed, beginning in June, 2018 and continuing to at least October of 2021. Inspectors from DEQ and MBP have documented the following incidents:

- 7 times MVP caused measurable sediment deposits in waterbodies
- 17 additional times when measurable sediment deposits were found outside pollution controls
- 16 times when compost filter socks, silt fences, etc. failed to properly treat runoff

The observations of some of the sediment deposits in waterbodies include:

June 26-27, 2018
Inspectors found 3,600 linear feet of stream channel in UT Flatwoods Branch "impacted by sedimentation" to depths up to 7 inches. Notations indicate that sedimentation affected the "stream's viable habitat," and that aquatic life movement would be substantially disrupted. See Figures 36 and 37. (from VWP inspection report)

June 27, 2018
Inspectors found 209 linear feet of stream channel in UT Flatwoods Branch "impacted by sedimentation" to depths up to 3 inches. Notations indicate that sedimentation affected the "stream's viable habitat," and that aquatic life movement would be substantially disrupted. (from VWP inspection report)

August 1, 2018
Sediment in UT Flatwoods Branch. As of August 15, 2018 "sediment appears to have been removed from stream." (Action Item Log ID 491). This is the same stream impacted on June 26-27, 2018.

July 17, 2019
Sediment in UT Flatwoods Branch. Sediment "retrieved" seven days later after a delay in getting landowner agreement to access the area. (Action Item Log ID 3248). This is the same stream as was impacted in June and August of 2018. See Figure 38.

As noted above, inspectors have document pollution incidents in which measurable sediment deposits were observed off the ROW were observed off the ROW on 17 occasions. These have been identified in June, July, August, October, November, and December of 2018; January and July of 2019; and October of 2021.

Photo 1: Sedimentation within "SMM-15" ~160' downstream of LOD; Depth = 3"
Orientation: Downstream

Figure 36- Sediment deposits in UT Flatwoods Branch, June 27, 2018, VWP Inspection Report, Source: DEQ [original photo caption retained]

Photo 4: Sediment in stream ~3,485' from LOD near access road; Depth = 2"
Orientation: Downstream

Figure 37- Sediment deposits in UT Flatwoods Branch, June 27, 2018, VWP Inspection Report, Source: DEQ [original photo caption retained]

Figure 38 - Sediment deposited in UT Flatwoods Branch, July 19, 2019, Action Item Log ID 3248, Source: MBP [This is an example of what inspectors often term "remediation" through physial removal of sediments from the stream.]

Little Creek

Mountain Valley's analysis of cumulative impacts from MVP and other dredge and fill discharges addresses the Madcap Creek-Blackwater River HUC-12 (030101010503), an area of 37,059 acres. Like a number of HUC areas along the MVP route, this HUC-12 is not a watershed and is, therefore not suitable for this analysis.

As noted above in this report, useful cumulative effects assessments may be possible at multiple watershed scales, where combined impacts may reach a threshold of importance based on the nature of the impacts and the characteristics of the waterbodies to be affected.

While the Madcap Creek-Blackwater HUC is not an appropriate area for this purpose, it may be argued that a useful analysis of combined impacts can be made for the the Little Creek watershed. As shown in the image below, the concentration of pipeline features, both ROW acreage and proposed new discharges is highly concentration in this drainage. All sediment discharges from the MVP and other sources in the watershed may affect the downstream portions of Little Creek to its mouth at the Blackwater River and there are likely signficant biological linkages in this system of headwaters and larger stream segments.

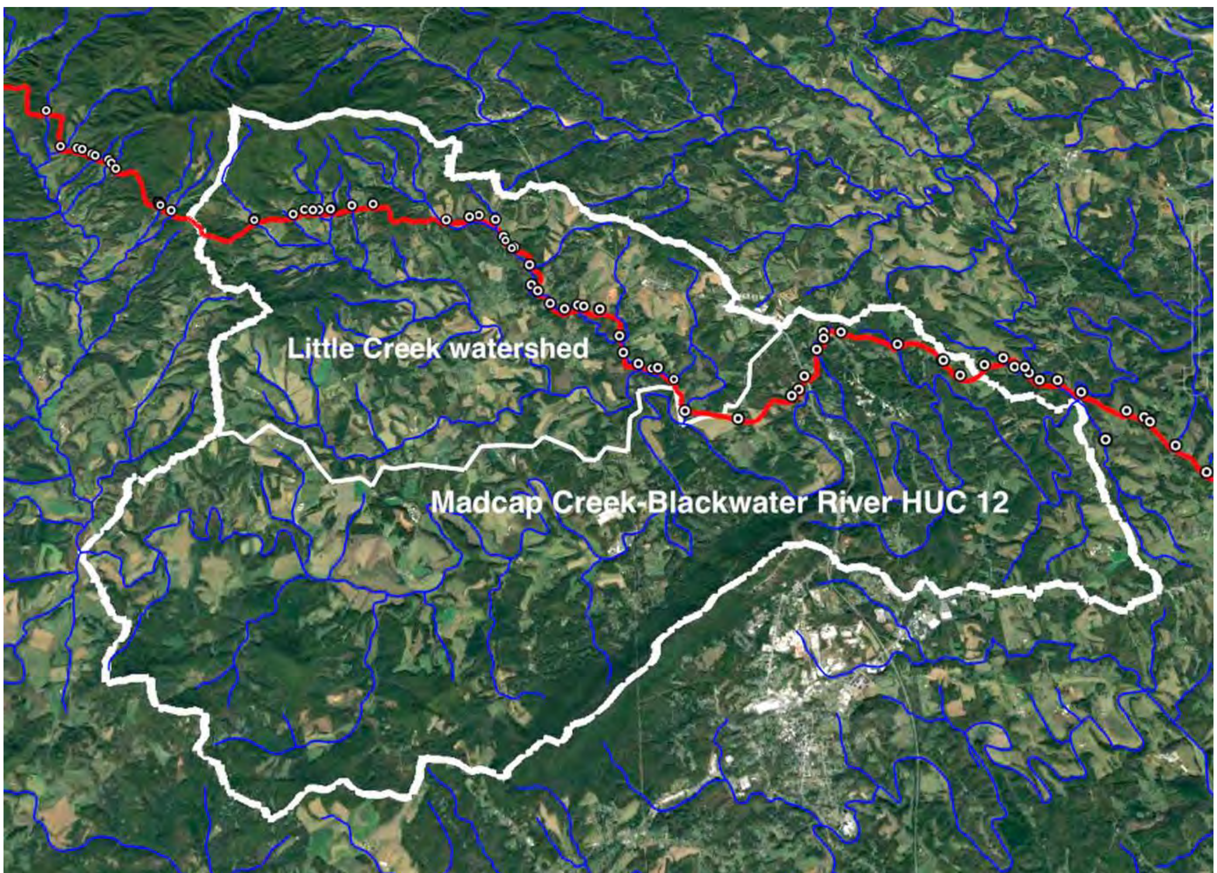

Figure 39 - Annotated satellite image showing Madcap Creek HUD-12 and the Little Creek watershed that form part of the HUD area.

Within the Little Creek watershed, Mountain Valley proposes 51 new discharges (43 to streams and 8 to wetlands). These would affect Little Creek, it's largest tributary Teels Creek, and numerous other unnamed tributaries to these two streams. This is an extraordinary number of new pollution sources concentrated in one drainage. The fact that the impacts would be imposed on

Teels Creek alone, a second order stream, would have seven new discharges along a segment nearly four stream miles long. These would be accompanied by twelve new discharges to a collection of tributaries to Teels Creek, including ephemeral streams, intermittent streams, and first order perennial streams.

An astounding number and variety of pollution incidents have already been documented in this watershed, both by state inspectors and citizen monitors. These include seven instances when measurable sediment deposits were documented by state inspectors in streams and wetlands. These occurred throughout the period from June, 2018 to August, 2019. There have also been fifty instances when sediment deposits were found on lands outside the ROW and outside the pollution control structures. For at least thirteen of these instances, cleanup or retrieval of the sediments were delayed by site condition or landowner resistence to having Mountain Valley further encroach on and disturb their properties. In some cases those deposited materials were never retrieved. Figures 40 - 42 show offsite sediment deposits from MVP.

In seventy-five instances sediment barriers on MVP sites were overtopped, undermined, or otherwise shown to be ineffective at controlling offsite pollution discharges. During the period between June of 2018 and November of 2021, these pollution incidents happened in at least 24 separate months.

One serious problem that has occurred multiple times in this watershed is damage to and serious erosion from stream banks related to MVP bridges and other activities. Figures 42 and 43 are just two examples of this pollution source. This damage to actual stream banks and channel can and surely has contributed much greater loads of sediment to affected streams that the periodic discharges from the sites, because they will slough away in every significant high flow event, as long as they are unstable. And, attempts at stalization are often unsuccessful, both in the short term and the long term.

Figure 39 - Sediment deposits off ROW, at UT to Teels Creek, September 23, 2018, Source: citizen monitor

Figure 40 - Sediment deposits off ROW, at UT to Teels Creek, September 23, 2018, Source: citizen monitor

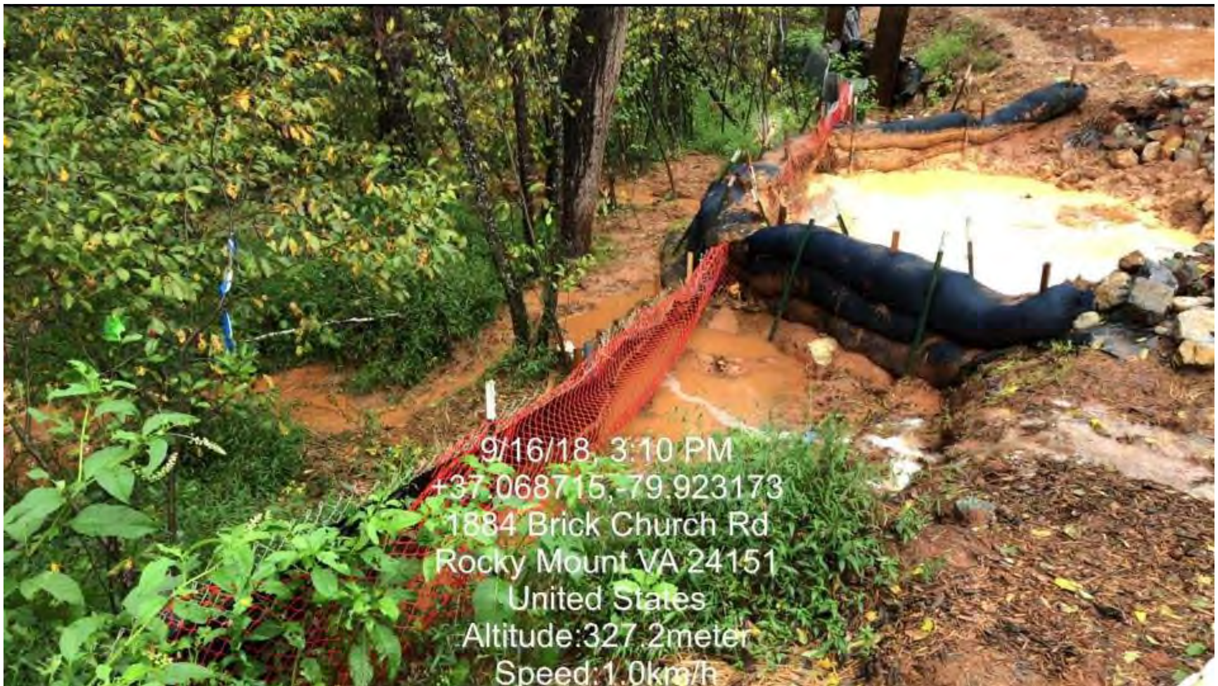

Figure 41 - Sediment deposits off ROW, at UT to Teels Creek, September 23, 2018, Source: citizen monitor.

Figure 42 - Stream bank eroded at MVP site, Teels Creek, July 10, 2019, Action Log ID 3187, Source: MBP

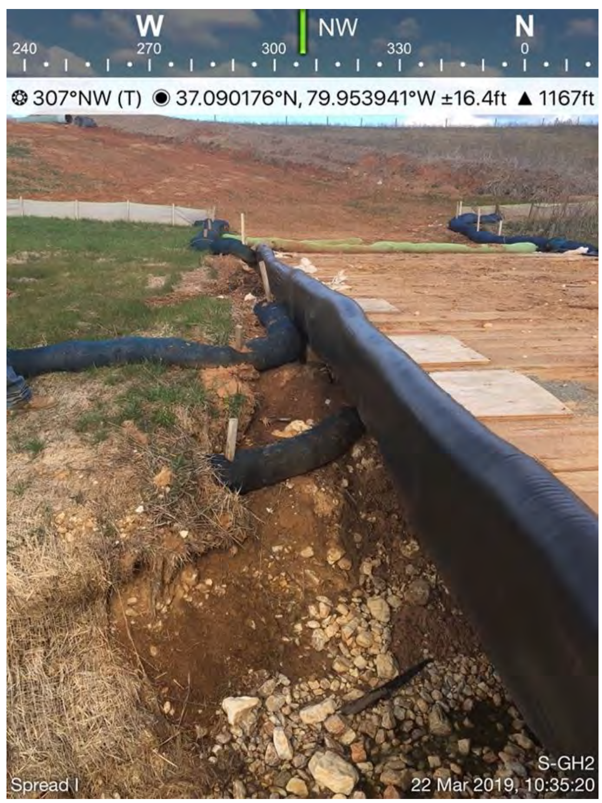

Figure 43 - Stream bank eroded at MVP site, UT Teels Creek, July 10, 2019, Action Log ID 2313, Source: MBP

Green Creek watershed

This small watershed lies within the South Fork Blackwater River HUC-12 (030101010502), which is 18,019 acres in size.[46] This headwater drainage of Green Creek covers 1,280 acres, 7% of the total HUC area.[47] In this section, Green Cr. and other tributaries are 1st order perennial or intermittent streams. By contrast, the South Fork Blackwater is a third order stream where it flows into the Blackwater River. Also, while the Green Creek watershed is estimated to be about 95% forested, the South Fork Blackwater watershed is just over 70% forested, with more than 20% in farmland.

The entirety of the pipeline ROW within the HUC-12 unit passes across this watershed for a distance of about 1.23 miles and there are fourteen new discharges proposed - 9 to streams and 5 to wetlands.[48] As shown on Figure 44, all of the pipeline's impacts would occur in just the very headwater section of the watershed. This concentration of impacts in just one small drainage makes it imperative that any cumulative impacts analysis include focus on this area.

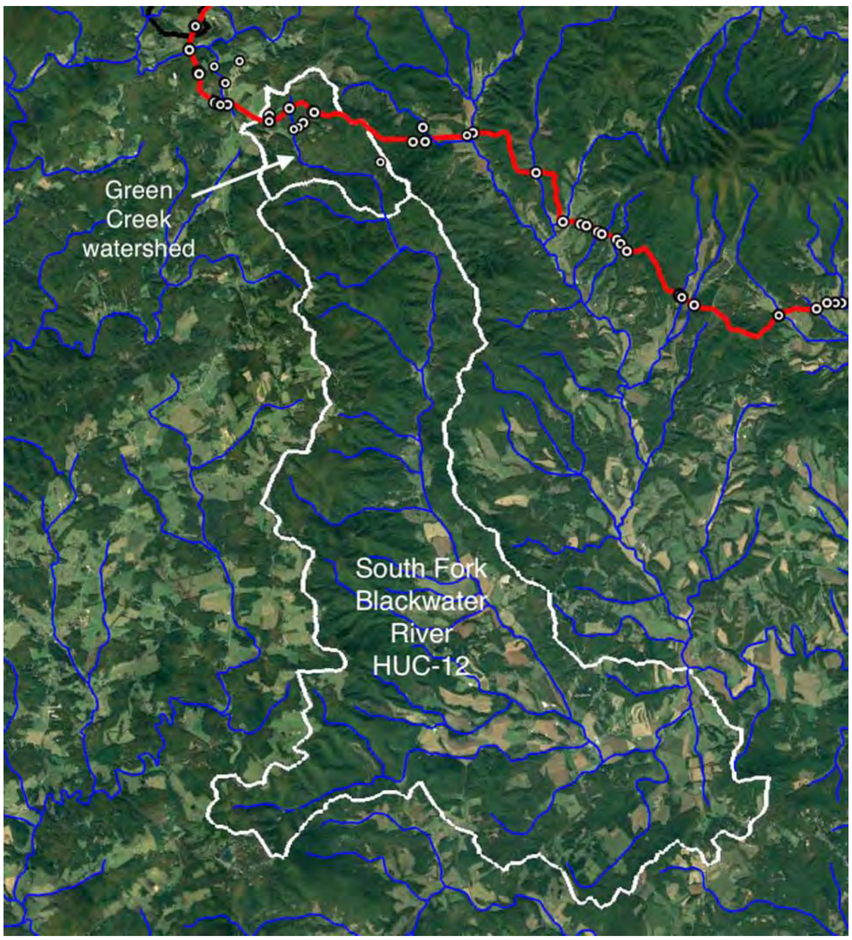

Figure 44 - Annotated satellite image of South Fork Blackwater River HUC-12 and Green Creek watershed, with MVP ROW and discharge only in the headwaters.

[46] Appendix Q, Revised Cumulative Imapact Assessment Report - Hydrology, Mountain Valley Pipeline, January 2022 (Revised May 2022), at 82.
[47] U.S. EPA, Watershed Report, Green Creek.
[48] Appendix Q at 78-79.

Pollution incidents that have been caused by MVP activities in this watershed include two incidents when sediment deposits were made in streams (Action Item Log IDs 1053 and 3306), occuring in October, 2018 and July, 2019. Additional off-site sediment deposits were documented six times, mostly concentrated in the fall of 2018 but followed by one incident in April, 2019. Finally, pollution control structures failed to properly treat discharges from the work sites in at least four instances, in July and September of 2018 and March and August of 2019. Figure 45 shows one pollution incident, when heavily sediment-laden water overtopped a compost filter sock in an area that drains to the native trout waters of Green Creek.

Figure 45 - Sediment-laden water overtopping perimeter control, July 25, 2018, Action Log ID 458, Source: MBP [an additional compost filter sock was added 10 days after this situation was observed]

Upper Cherrystone Creek watershed

The Cherrystone Creek HUC-12 unit is a watershed measuring 29,138 acres in size.[49] The upper Cherrystone watershed examined here covers an area of 8,720 acres or about 30% of the HUC-12 area. Of 48 new discharges proposed in the HUC area (34 to streams and 14 to wetlands),[50] 28 (21 stream and 7 wetland) are within this headwater drainage. An analysis of the combined new discharges in the Cherrystone HUC unit may be useful, since the mainstem Creek is affected in two sections.

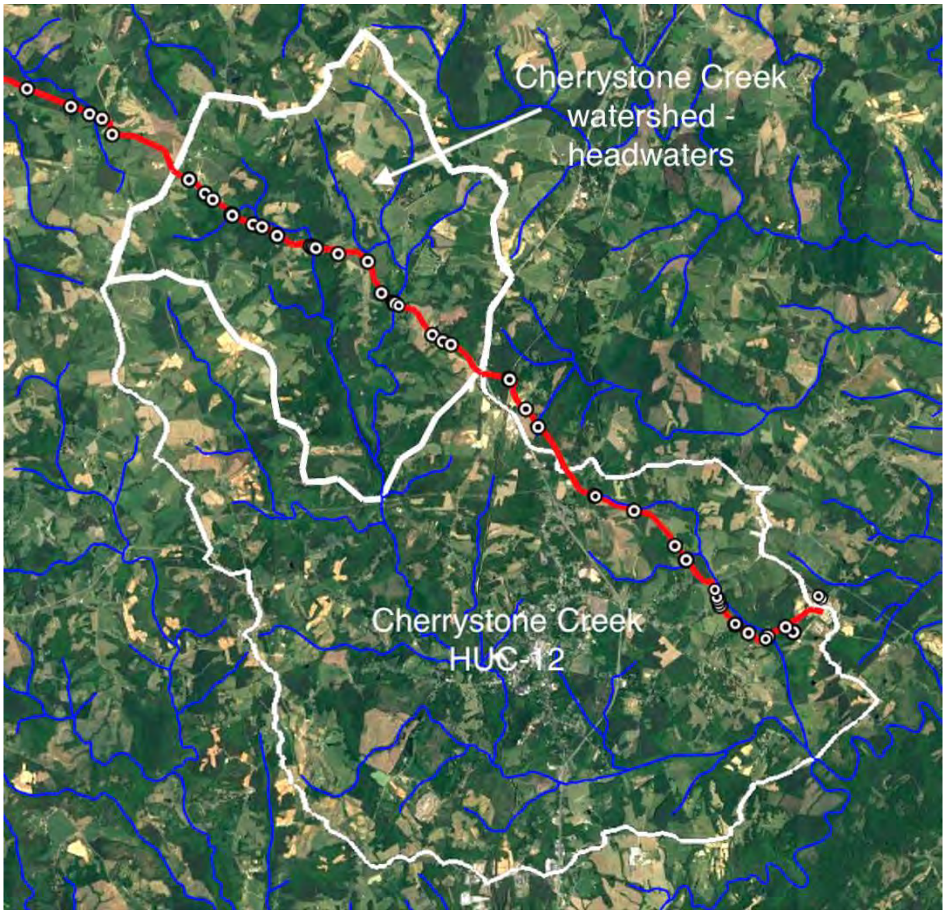

Figure 46 - Annotated satellite image of Cherrystone Creek HUC-12 and upper Cherrystone Creek watershed.

However, an analysis of combined effects in the upper watershed is vital for a number of reasons. Nearly four and a half miles of the pipeline's ROW crosses the upper watershed and both the Creek itself and nearly every other significant tributary, including the largest, Pole Bridge Branch, is crossed by the pipeline ROW.

[49] Appendix Q at 88.
[50] Id. at 86-87.

Maybe the most important feature that sets this watershed apart is that all of these proposed impacts lie just upstream of the Cherrystone Reservoir. On both Cherrystone Creek and Pole Bridge Branch, the MVP ROW is less than two stream miles upstream of the impounded portions of the streams. Thus, all of the sediment discharged from upstream activities will affect the reservoir and it is important that these combined impacts be assessed.

A number of pollution incidents have already been documented in the upper Cherrystone watershed, including those shown in Figures 46 and 47 below, from February and April of 2019. One particularly significant event is labeled Action Item Log ID 1547 and is described in the inspection reports as follows:

"Sediment off ROW and in drainage channel conveying runoff into stream" on December 28, 2018. According to the report, after a delay in acquiring landowner permission to access affected areas, "sediment was retrieved and straw placed" by February 18, 2019, 52 days after the incident was discovered. According to coordinates shown on MBP photographs, the location of the release was just about 250 feet upgradient from a UT of Pole Bridge Branch and about 1,000 feet from Pole Bridge Branch, which provides habitat for the sensitive Orangefin Madtom, a fish that is designated "under review" by the FWS for listing under the Endangered Species Act.[51]

Figure 47 - Sediment deposited in UT to Cherrystone Creek, Action Item ID 2646, Source: MBP

[51] U.S. Fish and Wildlife Service, ECOS Environmental Conservation Online System [webpage for Orangefin Madtom]().

Figure 48 - Sediment deposited off ROW onto streambank at UT to Pole Bridge Branch, February 18, 2019, Action Log ID 1901, Source: MBP [deadline to remove extended "due to wet ROW," not removed until 6 days after deposited]

Conclusion

The information about the areas in Virginia where MVP activitis, including proposed new discharges, would have the most concentrated impacts shows tht new and adequate cumulative or combined impact analyses must be conducted before any of the federal agencies now reviewing the project can make valid decisions. Any decision based on the current assessments, which are deeply flawed in their focus and simplistic in nature, would be arbitrary and capricious.

The enormous record of the MVP's impacts on the waters and land in its path through Virginia shows many hundreds of pollution incidents and it is irrational to believe continued construction would not result in similar damages. The cost of this unwise project have already been great, for our resources and our communities. We must not add to that burden with new discharges and addition destruction.

Appendix A to
MVP Pollution in Virginia Watersheds

	Depositon in waterbody	Action log ID or DEQ inspection report type	Date	Inacident Description	Spread
x		17	5/29/18	Silt fence breached by sediment that over topped fence and released outside of ROW limits.	G
	x	VWP	5/31/18	sediment deposited in stream	H
	x	VWP	5/31/18	sediment deposited in stream	H
x		34	6/5/18	24 CYs of rock were [pushed off ROW	H
x		66	6/11/18	Sediment bypassed LOD	G
x		93	6/12/18	Multiple RCE's tracking mud onto roads	H
x		105	6/14/18	Sump filled with sediment and sediment left ROW	H
x		115	6/15/18	Sediment went under SSF	H
	x	VWP	6/18/18	sediment deposited in stream	H
x		142	6/18/18	clean dirt up that exited ROW	H
x		143	6/18/18	clean dirt up that exited ROW	G
x	x	195	6/22/18	Sediment deposit off of timber matting	H
x		192	6/22/18	RCE clogged with mud. Trackout on road	H
x	x	217	6/23/18	Sediment in S-G40	H
x	x	218	6/23/18	Sediment in W-PP8. Sediment overtopped ECD	H
x		206	6/23/18	silt over flowing SS+D15	H
x		209	6/23/18	Discharge from torn filter fabric	H
x		216	6/23/18	SSF topped with sediment	H
			6/23/18	Sediment in S-G39	
x		222	6/23/18	Evidence of sediment release	H
x		237	6/25/18	Sediment outside ROW	H
x		230	6/25/18	Water bar failure resulted in sediment outside ROW	H
x		258	6/26/18	Sediment leaving the ROW	
x		260	6/26/18	Sediment leaving the ROW	I

x		261	6/26/18	Sediment Leaving the ROW	
x		262	6/26/18	Sediment leaving the ROW	
x		263	6/26/18	Sediment leaving the ROW	
x		264	6/26/18	Sediment leaving the ROW	
x		275	6/26/18	J hooks overrun with sediment	H
x	x	297	6/27/18	Stream impact at S-MM13	H
		251	6/30/18	Sediment leaving ROW Cleanup and Maintenance needed	I
x		251	6/30/18	Sediment leaving ROW Cleanup and Maintenance needed	
	x	3164	7/9/18	Timber mat bridge dislodged from stream bank	I
x	x	3172	7/9/18	Stream impact	I
x		3167	7/9/18	Sump/CFS end treatment needs maintenance	I
x		3168	7/9/18	Sediment off ROW	I
x		3170	7/9/18	Sediment off ROW	I
x		3171	7/9/18	Sediment in buffer area/stream impact	I
x		Field	7/14/18	Sed. off ROW	I
x	x	Field	7/19/18	Sed. to Tributary NF Blackwater R.	H
x		Field	7/19/18	Sed. off ROW	H
x		437	7/23/18	Sediment off ROW	H
x	x	441	7/25/18	Stream S-G40 Impacted by Sediment	H
x		445	7/25/18	Sumps filled with sediment and sediment off ROW	I
x		449	7/25/18	Sumps filled with sediment and sediment off ROW and in stream	I
x		450	7/25/18	Sump filled with sediment and sediment left ROW	I
x	x	466	7/27/18	Stream Impacted by Sediment.	G
x		467	7/27/18	Sediment Off ROW	I
x	x	491	8/1/18	Sediment in Stream	H
x	x	Field	8/1/18	Sediment in stream	I
x		489	8/1/18	Sediment off ROW	I
x		Field	8/1/18	Sediment off ROW	I
x		Field	8/1/18	Sediment off ROW	I
x		493	8/3/18	Waterbar end treatments were overtopped	I
x		494	8/3/18	Sediment left the ROW	I
x	x	501	8/4/18	SSF is at capacity, small amount of sediment in stream	H
x		496	8/4/18	sediment off ROW	G

x		499	8/4/18	SSF needs mainenance, sediment off ROW	H
x		504	8/6/18	Waterbar ET was overtopped	I
x		505	8/6/18	Silt off ROW	I
x		506	8/6/18	Multiple Waterbar End Treatments were overtopped	I
x		507	8/6/18	Sediment left the ROW	I
x		508	8/6/18	Silt off ROW	I
x		511	8/6/18	CFS blew out, sediment off ROW	H
x	x	524	8/9/18	Sediment in streambed	H
x		516	8/9/18	waddle over topped with sediment	G
x		526	8/9/18	Sediment off ROW	H
x	x	531	8/10/18	stream is being impacted from sediment runoff	G
x		532	8/10/18	Sediment runoff of ROW	G
x		536	8/10/18	Compost Filter Sock overtopped with sediment ,eroded	G
x		537	8/10/18	ET overtopped & sediment left ROW	I
x		538	8/10/18	Sediment left the row	I
x		549	8/13/18	Sediment off ROW	G
x		553	8/13/18	Waterbar end treatment was overtopped and sediment left the ROW	I
x		555	8/13/18	Sediment left the ROW	I
x		556	8/13/18	offsite sediment	G
x		559	8/14/18	SSF at 50% capacity, sediment discharged	G
x	x	575	8/15/18	sediment in stream bed	G
x		565	8/15/18	End treatment overtopped, Sediment off ROW	I
x		569	8/15/18	Sump needs maintenance. Sediment off ROW.	I
x		570	8/15/18	P1 Silt Fence needs maintenance. Sediment off ROW.	I
x		572	8/15/18	Sediment overtopping end treatment. Sump needs maintenance. Sediment off ROW.	
x		577	8/15/18	Sediment off ROW	G
x	x	580	8/16/18	sediment in stream bed above Karst feature	G
x		589	8/17/18	Sediment off ROW	G
x		596	8/17/18	Sediment off ROW	G

x	x	599	8/18/18	sediment released into stream above Karst feature	G
x		603	8/20/18	sediment off ROW	G
x		604	8/20/18	Sediment off ROW	G
x		614	8/21/18	CFS almost overtopped, Sediment Leaving ROW	H
x	x	626	8/22/18	Road falling into stream, sediment in stream	G
x		624	8/22/18	Sediment off ROW	G
x		672	8/27/18	Sediment off of ROW	G
x		689	8/28/18	sediment off ROW at stream crossing	G
x	x	Field	8/29/18	Sed. in Trib. To Sinking Cr.	G
x		691	8/29/18	End treatment overwhelmed. Sediment off RoW.	I
x		692	8/29/18	Sediment left the ROW	I
x		708	8/31/18	Sediment built up on CFS (overrun)	H
x		739	8/31/18	sediment off ROW	G
x		726	9/1/18	sediment off ROW	G
x		742	9/3/18	Sediment left the ROW	I
x		744	9/3/18	Sediment left the ROW	I
x		746	9/3/18	Sediment left the ROW	I
x		750	9/3/18	Sediment left the ROW	I
x		756	9/3/18	Sediment left the ROW	I
x		758	9/3/18	Sediment left the ROW	I
x		766	9/4/18	sediment off ROW above Karst feature	G
x		779	9/4/18	Sediment off ROW	I
x		784	9/4/18	Sediment off ROW	I
x		771	9/4/18	CFS overtopped	G
x	x	Field	9/5/18	Sed. to Trib. To Stony Cr.	G
x		775	9/5/18	CFS has been overtopped. Sediment off RoW.	I
x		776	9/5/18	Minor sediment off RoW.	I
x		786	9/5/18	RCE stone in Winding Way Drive.	G
x		798	9/5/18	Sediment has left the ROW	G
x		799	9/6/18	Sediment thrown off ROW when cleaning out CFS	G
	x	807	9/7/18	CFS saturated and keeping stream from flowing freely.	I
x		844	9/10/18	Sediment off ROW	I
x		847	9/10/18	Sediment off ROW	I

x		834	9/11/18	Sediment left the ROW	I
x		842	9/11/18	End treatment full and overran with sediment	G
x		851	9/12/18	Sediment off ROW, all ECDs require maintenance	I
x		852	9/12/18	Sediment off ROW underneath CFS	I
x		853	9/12/18	Retaining wall has failed. SSF overtopped and sediment off RoW.	I
x		854	9/12/18	854 Sediment off ROW	I
x		856	9/13/18	Sediment off ROW, end treatment overtopped	I
x		874	9/13/18	Sediment off ROW	G
x		855	9/14/18	Sump full of sediment. End treatment overtopped. Sediment off RoW.	I
x		883	9/15/18	Sediment off ROW, CFS full of sediment	I
x		876	9/17/18	Mud on private driveway	I
x		877	9/17/18	Sediment left the ROW	I
x		886	9/17/18	Sediment left the ROW	I
x		889	9/17/18	Sediment left the ROW	I
x		891	9/17/18	Sediment left the ROW	I
x	x	SWPPP	9/18/18	Sed. to Trib. To Blackwater R.	H
x		896	9/18/18	Sediment off RoW. Sump full.	I
x		901	9/18/18	Sediment off RoW	I
x		903	9/18/18	Sediment off RoW	I
x		904	9/18/18	Sump full. End treatment overwhelmed. Sediment off RoW.	I
x		915	9/18/18	Sediment left the ROW	I
x		918	9/18/18	Sediment left the ROW	I
x		920	9/18/18	Sediment left the ROW	I
x		927	9/19/18	sediment off ROW	G
x	x	VWP	9/20/18	Sed. in wetland W-IJ10	H
x		936	9/20/18	Sediment off ROW	H
x		937	9/20/18	Sediment of ROW/Perimeter Controls failed	H
x		938	9/20/18	Sediment off ROW	H
x		939	9/20/18	CFS/gravel washed outside LOD	H
x		941	9/20/18	Sediment off ROW, Sumps overtopped	I
x		946	9/20/18	Sediment left the ROW	I
x		948	9/20/18	Sediment left the ROW	I

x		1207	9/20/18	Sediment off RoW. ECDs need maintenance	I
x		858	9/24/18	Sumps full of sediment. End treatment overtopped. Sediment off RoW.	I
x		872	9/24/18	Sediment left the ROW	I
x		951	9/24/18	Sediment has discharge into Aquatic Buffer Area	I
x		960	9/25/18	Sediment left the ROW	I
x		962	9/26/18	Crossing of private road is clogged with mud and requires maintenance	H
x		Field	9/26/18	Sed. off ROW	I
x		Field	9/26/18	Sed. off ROW	I
x	x	972	9/29/18	sediment in Buffer Area and stream. mat bridge full of sediment.	I
x		984	10/3/18	Sediment off ROW	H
x		997	10/5/18	Sediment off ROW	G
x		998	10/5/18	Debris on access road	G
x	x	1012	10/6/18	Sediment deposists in streambed	G
x		1006	10/6/18	Sediment off ROW	G
x		1029	10/9/18	CFS overtopped with sediment/debris	H
x		1037	10/11/18	Sediment laden water from ROW crossing Mt Tabor Road at MLV 26. Impacting stream.	G
x	x	1041	10/12/18	Stream impacted with sediment	I
x	x	1053	10/12/18	Sediment impacted stream	H
x	x	1059	10/12/18	Stream S-KL36 impacted with sediment	I
x		1047	10/12/18	SSF overtopped/sediment overtopped CFS	H
x		1050	10/12/18	road base material washed off ROW/CFS overrun	H
x		1051	10/12/18	road base material washed off ROW/CFS overrun/impacted stream	H
x		1054	10/12/18	road base material washed from driveway onto Wades Gap Rd	H
x		1057	10/12/18	Multiple ECD failutes, sediment off ROW	I
x		1060	10/12/18	Sediment off ROW	H
x		1066	10/12/18	Sediment off ROW	H

x		1067	10/12/18	sediment traveled onto gravel road	H
x		1078	10/12/18	sediment off ROW	
x		1079	10/12/18	sediment off ROW	
x		1083	10/12/18	CFS overtopped/sediment filled	
x		1086	10/12/18	sediment off ROW	
x		1088	10/12/18	sediment off ROW	
x		1089	10/12/18	sediment off ROW	
x		1090	10/12/18	Sediment off ROW, CFS J hook full of sediment	
x		1093	10/12/18	sediment off ROW above Karst Feature	
x		1113	10/12/18	sediment off ROW	G
x		1115	10/12/18	sediment off ROW	G
x		1122	10/13/18	sediment off ROW	G
x		1123	10/13/18	Sediment off ROW	H
x		1130	10/13/18	culvert under access road discharge gravel/sediment off ROW	G
x		1139	10/13/18	Sediment off ROW	I
x	x	1157	10/15/18	Stream S-E48 impacted with sediment	I
x		1145	10/15/18	Road base material washed off ROW	H
x		1159	10/15/18	End treatment overtopped, sediment off ROW	I
x	x	VWP	10/16/18	Sed. to Trib. To Blackwater R.	I
x		1170	10/16/18	Sediment off ROW.	I
x		1172	10/16/18	Sediment off ROW.	I
x		1174	10/16/18	Silt fence overtopped, sediment off ROW.	I
x		1187	10/17/18	Sediment left the ROW	I
x		2826	10/17/18	Sediment off ROW	I
x		1196	10/18/18	Sediment desposited into stream	H
x		1197	10/18/18	Sediment overtopped CFS/Sediment off ROW	H
x		1199	10/18/18	Sediment off of ROW	H
x		1216	10/23/18	CFS is overtopped with rock and sediment	H
x		Field	10/23/18	Sed. off ROW	I
x		Field	10/23/18	Sed. off ROW	I
x		Field	10/24/18	Sed. off ROW	G
x		1253	10/27/18	Sediment off ROW, CFS full of sediment.	I

x		1254	10/27/18	CFS end treatment undermined, sediment off ROW.	I
		1255	10/27/18	CWD plunge pool full of sediment.	I
x		1256	10/27/18	Sediment off ROW, rock flume damaged from erosion, end treatment overtopped.	I
x		1257	10/27/18	Sediment off ROW, slope failure into CWD plunge pool, sediment overtopped outlet.	I
?		1258	10/27/18	Sediment off ROW, end treatment overtopped. Retrieve sediment off ROW,	I
x		1264	10/29/18	Sediment off ROW	I
x		1309	11/5/18	Sediment overtopped CFS	H
x		1320	11/5/18	end treatment was overtopped and sediment is off ROW	H
x		1330	11/7/18	Stone in RCE full of sediment, washing and tracking into roadway	I
x	x	1327	11/8/18	Sediment in Wetland. Sediment overtopping CFS	I
x		1332	11/8/18	Sediment off RoW.	I
x		1333	11/8/18	Sump and end treatment need maintenance. Sediment off ROW	I
x		1349	11/9/18	Sediment off RoW. No perimeter controls adjacent to stockpile.	I
x		1350	11/9/18	Sediment off ROW, end treatment overtopped.	I
x		1365	11/10/18	End treatment needs maintenance. Sediment off RoW.	I
x	x	1377	11/14/18	Sediment observed in CH-J.	
x		1367	11/14/18	Gap in CFS perimeter control. CFS undermined. Sediment off RoW.	I
x		1370	11/14/18	Sediment and rock being tracked into public roadway.	I
x		1381	11/16/18	Sediment leaving the ROW	I
x	x	1392	11/19/18	Sediment off ROW	
x	x	1395	11/19/18	Sediment in stream bed of S-H23	I

x		1403	11/20/18	Sediment off RoW	I
x		1419	11/24/18	Mud on the road and CIS RCE needs Maintenance	I
x		1421	11/24/18	Mud covering road and road falling into open trench	I
x		1426	11/27/18	Sediment off ROW	I
x		1427	11/27/18	Sediment overtopping CFS	I
x		1428	11/27/18	Sediment off ROW	I
x		1431	11/27/18	Sediment overtopping CFS	I
x		1432	11/27/18	Sediment overtopping CFS	I
x		1435	11/27/18	Sediment off ROW	I
x		Field	11/27/18	Sed. off ROW	G
x	x	Field	11/28/18	Sed. to Trib. Stony Cr.	G
x	x	Field	11/29/18	Sed. to wetland	I
x		1449	11/29/18	Sediment off ROW, slope eroded into CFS and overtopped.	I
x	x	1459	11/30/18	Stream has been impacted with sediment.	I
x		1465	12/4/18	Access Road MVP-PI-328 needs maintenance. Sediment tracking on road.	I
x	x	1478	12/7/18	Sediment off ROW, appears that it may have traveled to stream	I
x		1479	12/8/18	1479 tracking on roadway	G
x		1482	12/13/18	1482 RCEs clogged with mud; trackout observed	I
x		1492	12/17/18	Tracking in the access road and highway and RCE not to spec filled with sediment	I
x	x	1497	12/18/18	Stream impacted by sediment	I
x	x	1499	12/18/18	Slopes are not stabilized, stream impacted by sed.	I
x		1495	12/19/18	Sediment off ROW	I
x		1513	12/19/18	CFS is overtopped with sediment	I
x	x	Field	12/20/18	Sed. to Trib. To Stony Cr.	G
x	x	1516	12/21/18	CFS was located in the stream at S-G17	I
x		1520	12/22/18	CFS has got full of sediment and left the LOD	H
x		1533	12/27/18	Sediment off ROW	I
x		1550	12/27/18	Sediment off ROW	I

x		1556	12/27/18	Sediment off ROW	I
x		1542	12/28/18	Dirt over side of timber mat bridge over S-B9	I
x		1547	12/28/18	Sediment off ROW and in drainage channel coveying runoff into stream	I
x	x	1562	12/29/18	Stream is impacted with sediment	I
x	x	1570	12/29/18	Sediment off ROW	I
x	x	1571	12/29/18	Sediment in stream/wetland	I
x		1564	12/29/18	Sediment left the ROW	I
x		1567	12/29/18	Sediment off ROW	I
x		1568	12/29/18	Sediment off ROW	I
x	x	1577	12/30/18	Sediment off ROW in Stream	I
x		1574	12/30/18	P1 defeated, sediment off ROW, mass slope erosion	I
x		1576	12/30/18	Perimeter CFS overrun with sediment	I
x		1578	12/30/18	Sediment off ROW	I
x		1582	12/30/18	CFS end treatment undermined	I
x		1583	12/30/18	CFS end treatment overrun/undermined	I
x		1584	12/30/18	Hole in SSF and sediment off ROW	I
x		1587	1/2/19	CFS undermined and Sediment off the ROW	I
x		1588	1/2/19	Sediment over J Hook, Sediment off ROW	I
x		1589	1/2/19	Sediment over CFS, Sediment off ROW	I
x		1591	1/2/19	Sediment over CFS	I
x		1597	1/2/19	Sediment overtopped CFS/left ROW	H
x	x	1617	1/3/19	CFS overtopped with sediment	I
x		1601	1/3/19	Sediment spilling around J-hook	I
x		1603	1/3/19	Sediment left the ROW	I
x		1612	1/3/19	CFS Overrun	I
x		1614	1/3/19	Sediment off ROW (Due to overrun end treatment)	I
x		1615	1/3/19	Unfiltered water bypassing end treatment/perimeter controls	I
x		1616	1/3/19	Sediment off ROW (bypassing upslope sump/perimeter controls)	I
x		1618	1/3/19	CFS undermind at end treatment	I
x		1619	1/3/19	CFS undermined at end treatment	I
x		1620	1/3/19	ediment off ROW (from undermined sump)	I

x		1621	1/3/19	Sediment off ROW(from undermined sump)	I
x		1622	1/3/19	End treatments overwhelmed leading to sediment off ROW	I
x		1623	1/3/19	Sediment off ROW	I
x		1633	1/7/19	Sediment left the ROW	I
x	x	1662	1/9/19	Sediment observed on stream banks/bed	I
x		1644	1/9/19	Sediment off RoW. Nearly impacting S-H32	I
x		1645	1/9/19	SSF undermined. Sediment off RoW.	I
x		1646	1/9/19	Sump and end treatment are full of sediment. Sediment off RoW.	I
x		1698	1/9/19	Sediment over CFS	I
x		1714	1/23/19	Sediment leaving ROW due to Perimeter CFS full of sediment	I
x		1715	1/23/19	CFS full of sediment, sediment leaving ROW	I
x		1719	1/23/19	Sump needs to be enlarged. Sediment off RoW	I
x		1730	1/25/19	Spoil material overtopping perimeter CFS	I
x		1731	1/25/19	Sediment bypassing CFS end treatment resulting in sediment off ROW	I
x		1753	1/29/19	Sediment left the ROW	I
x		1756	1/30/19	CFS full of sediment, sediment leaving ROW	I
x		1775	2/2/19	CFS allowing sediment over it	I
x		1779	2/2/19	CFS over half the height with sediment/ sediment outside of CFS	
x		1780	2/4/19	dirt from topsoil pile outside of LOD overtopped silt fence	G
x		1797	2/4/19	Sediment left the ROW I	
x		1798	2/4/19	CFS is in stream I	
x	x	1829	2/6/19	S-D1-EPH impacted with sediment. Stream banks severely eroded. I	
x		1844	2/7/19	RCE has mud accumulation; trackout noted.	I
x		1833	2/10/19	Sump full of sediment. End treatment overwhelmed. Sediment off ROW. I	

x		1857	2/12/19	Significant sediment on access road. Sediment tracking onto adjacent roads.	I
x		1858	2/12/19	Sediment in roadside ditch from curlexed bank	I
x		1863	2/13/19	CFS allowing sediment over it	I
x	x	1888	2/14/19	Sediment deposition in wetland W-G2	I
x		1901	2/18/19	Spoil material on stream bank	I
x		1916	2/19/19	CFS is overtoppped with rock	I
x		1918	2/19/19	Sediment bypassing perimeter controls/gap in controls	I
x		1927	2/21/19	Spoil material overtopping CFS	I
x		1935	2/21/19	SSF full of sediment. Sediment off RoW.	
x	x	1963	2/25/19	Sediment in wetland W-D3	I
x		1962	2/25/19	Sediment from trench bypassing ECDs and deposited into buffer area	I
x		1968	2/26/19	Sediment off ROW	I
x		1972	2/26/19	Sediment off ROW	I
x		1973	2/26/19	Sediment overtopping CFS. Sediment off RoW.	I
x		1975	2/26/19	Sediment overtopping CFS perimeter control. Sediment off	I
x	x	Field	2/27/19	Sed. to wetland W-IJ10	H
x		2003	2/27/19	Sediment off ROW.	I
x		2005	2/27/19	Sediment off ROW	I
x		2014	2/27/19	sediment off ROW	G
x		2017	2/28/19	CFS overtopped with sediment	I
x		2055	3/4/19	Sediment left the ROW	I
x		2056	3/4/19	Sediment left the ROW	I
x		2057	3/4/19	Sediment left the ROW	I
x		2060	3/4/19	Sump full/Sediment left ROW	I
x		2063	3/4/19	CFS was undermined/Sediment left the ROW	I
x		2070	3/4/19	Sediment left the ROW	I
x		2073	3/4/19	CFS is full of sediment/sediment left the ROW	I
x		2078	3/4/19	CFS undermined, sediment off ROW	I
x	x	2093	3/5/19	Stream impacted and bank eroded GAS S-D1-EPH	I
x		2134	3/7/19	sediment off ROW	I

x		2138	3/7/19	ECDs need maint (overtopped, torn)	I
x		2190	3/12/19	CFS overtopped with spoil material	I
x		2211	3/13/19	CFS overtopped	I
x		2213	3/13/19	CFS overtopped	I
x	x	Field	3/14/19	Sed. to S-CD8	I
x		Field	3/14/19	Sed. off ROW	I
x		2224	3/15/19	SSF, CFS require maintenance, sediment off ROW	I
x		2283	3/20/19	SSF undermined/sediment off ROW	I
x		2306	3/22/19	Repair CFS, remove sediment, stabilize banks	
x	x	Field	3/27/19	Sed. to Cherrystone Cr.	I
x		2366	3/27/19	Sediment off ROW	I
x		2384	3/29/19	CFS undermined leading to SOR	I
x		2385	3/29/19	Sediment off ROW	I
x		2429	4/2/19	CFS full and sediment off ROW	I
x		2434	4/2/19	Sediment off ROW - Straw was applied but sediment was not retrieved	I
	x	2441	4/4/19	Bank eroded; stream impacted	I
	x	2452	4/8/19	Stream bank eroded	I
x	x	2461	4/9/19	Sediment impacting S-A40	I
x		2459	4/9/19	Sediment off ROW	I
	x	2470	4/10/19	Bank eroded	I
x	x	2496	4/15/19	Sediment outside LOD and in stream	I
x	x	2496	4/15/19	Sed. to weltand W-EF51	I
x		2498	4/15/19	Sediment off ROW, Sump full of sediment	
x		2499	4/15/19	Sediment off ROW	I
x		2500	4/15/19	Sediment off ROW	I
x	x	Field	4/16/19	Sed. to S-EF46	i
x		2505	4/16/19	Sediment off ROW 2505 2511	I
x		2506	4/16/19	P1 undermined and sediment off ROW	I
x		2510	4/16/19	P1 undermined and sediment off ROW	
x		2515	4/16/19	Contractor discovered the sediment off ROW	
x	x	Field	4/18/19	Sed. to W-IJ3	I
x		2550	4/19/19	Spoil material overtopping CFS	I
x		2552	4/20/19	CFS check dam overtopped with sediment	I

x		2554	4/20/19	P1 SF needs maintenance; sediment off ROW	I
x		2578	4/22/19	CFS overtopped	I
x	x	2621	4/24/19	Stream banks eroding around timber matting S-C1	I
x		2601	4/24/19	CFS undermined, over half full, sediment off ROW	I
x		2603	4/24/19	Super silt fence undermined at end treatment, sediment off ROW	I
x		2617	4/24/19	ECDs needs maintenance (CFS overtopped; P1 SF half full)	I
x		2618	4/24/19	Sediment off ROW	I
x	x	2646	4/27/19	Sediment in stream	I
x	x	2649	4/27/19	Sediment in stream	I
x		2641	4/27/19	Sediment off ROW	I
x		2642	4/27/19	CFS overtopped	I
x		2645	4/27/19	CFS overtopped/undermined	I
x		2650	4/27/19	Sediment bypassing CFS	I
x		2655	4/27/19	tracking on Riddle Road	I
x		2661	4/27/19	sediment off ROW at timber mat bridge	I
x		2662	4/27/19	sediment off ROW	I
x		2663	4/27/19	CFS overtopped, sediment off ROW	I
x		2671	4/27/19	1 CFS filled with sediment/ undermined/ sediment off ROW	I
x		2672	4/27/19	P1 full of sediment. Sediment off ROW	I
x		2690	4/30/19	CFS full/overtopped.	I
x		2692	4/30/19	Sediment off ROW	I
x		2707	4/30/19	Sediment off ROW	I
x		2725	5/2/19	Sediment off ROW	I
x		2757	5/8/19	Sump full/ CFS end treatment overtopped.	I
x		2758	5/8/19	sediment off ROW	I
x		2765	5/9/19	Sediment off ROW	I
x		2768	5/9/19	Sediment off ROW	I
x		2772	5/9/19	Sediment off ROW	I
x	x	2781	5/13/19	Sediment in S-E5 stream	I
x	x	2786	5/13/19	Stream bank sloughed off into stream channel (S-A41)	I
x		2780	5/13/19	Sediment off ROW	I
x		2805	5/17/19	Sediment off RoW	I

x		2807	5/17/19	Sediment off RoW	I
x		Field	5/17/19	Sed. off ROW	I
x		2814	5/22/19	Gravel from access road falling onto stream banks	I
x		2839	5/31/19	CFS needs Maintenance, sediment off ROW	I
x		2843	6/1/19	RCE clogged with sediment/tracking on roadway	I
x		2844	6/3/19	Sediment off ROW	G
x		2848	6/3/19	Sediment off ROW above Karst feature	G
x		2853	6/3/19	Sediment off ROW	G
x		2859	6/3/19	sediment off ROW	G
x		2862	6/3/19	CFS overtopped	G
x		2863	6/3/19	CFS overtopped	G
x		2864	6/3/19	CFS overtopped	G
x		2865	6/3/19	CFS overtopped	G
x		2867	6/3/19	P1 overtopped/knocked down	G
x		2868	6/3/19	CFS overtopped	G
x		2869	6/3/19	sediment off ROW	G
x		2872	6/3/19	CFS overtopped	G
x		2873	6/3/19	CFS overtopped	G
x		2876	6/3/19	CFS overtopped, sediment off ROW	G
x		2889	6/5/19	CFS undermined/overtopped	I
x		2890	6/5/19	Sediment off ROW	I
x		2898	6/7/19	P1 undermined, sediment off ROW	G
x	x	2906	6/10/19	Sediment/Gravel off ROW and in stream	
x		2912	6/10/19	Sediment off ROW	
x	x	Field	6/11/19	Sed to W-IJ10	H
x	x	Field	6/11/19	Sed. to W-Q10	H
x		2931	6/11/19	Sediment off ROW	
x	x	Field	6/12/19	Sed. to S-F11	i
x	x	Field	6/12/19	Sed. to wetland near Cherrystone Cr.	I
x		2953	6/12/19	Sediment bypassing end treatment. Sediment off RoW	
x		2957	6/12/19	Sediment off ROW	
x		2961	6/12/19	Sediment off ROW	I
x		2969	6/12/19	CFS overtopped	I
x		2972	6/12/19	Sediment off ROW	I
x		2975	6/12/19	Sediment from timber mat bridge displaced off RoW	I

x		2992	6/18/19	sediment off ROW	G
x		2997	6/18/19	Wattle off ROW	I
x		2998	6/18/19	CFS off ROW	I
x	x	3014	6/19/19	Sediment under bridge on streambank	I
x		3006	6/19/19	Sediment off RoW	I
x		3011	6/19/19	Sediment off RoW	I
x		3012	6/19/19	Sediment off ROW	I
x		3020	6/19/19	Tracking onto Timber Ridge road	I
x		3022	6/19/19	Sediment off ROW	I
x		3024	6/19/19	Sediment off ROW	I
x		3031	6/20/19	CFS overtopped with sediment	I
x		3032	6/20/19	sediment off RoW	I
x		3038	6/20/19	Sediment off ROW	I
x		3039	6/20/19	Sediment off ROW	I
x		3043	6/20/19	Sediment offf RoW	I
x		3050	6/20/19	Sediment off ROW	I
x		3052	6/20/19	CFS overtopped	I
x		3053	6/20/19	Sediment off ROW	I
x		3055	6/20/19	CFS overtopped/ full of sediment	I
x		3056	6/20/19	Sediment off ROW	I
x		3057	6/20/19	Sediment off ROW	I
x		3062	6/20/19	CFS overtopped	I
x		3074	6/25/19	Sediment off ROW	I
x		3076	6/25/19	Sediment off ROW	I
x		3078	6/25/19	Sediment off ROW	I
x		3083	6/26/19	CFS overtopped	I
x		3089	6/28/19	CFS overtopped	I
x		3099	6/28/19	CFS overtopped	I
x		3101	6/28/19	CFS overtopped	I
x		3102	6/28/19	Sediment off ROW	I
x		3113	7/2/19	Material pushing through gap between SSF and Timber mat bridge	H
x	x	3122	7/5/19	Sediment in stream	I
x		3121	7/5/19	Sediment off ROW	I
x		3124	7/5/19	Sediment off ROW	I
x		3143	7/8/19	Sediment off ROW	G
	x	3187	7/10/19	Stream bank sloughing off	I

x	x	Field	7/10/19	Sed. to S-YZ4	I
x		3186	7/10/19	CFS overtopped/undermined	I
x		3202	7/11/19	Sump/CFS needs maintenance (accumulated sediment over half the height and CFS bypassed)	I
x		3203	7/11/19	Sediment off ROW	I
x	x	3218	7/12/19	Sediment in S-YZ5 stream	I
x		3208	7/12/19	Sediment off ROW	I
x		3210	7/12/19	Sediment off ROW	I
x		3215	7/12/19	Sediment off ROW	I
x		3220	7/12/19	Sedimnet off ROW G retrieve sediment	
x		3237	7/16/19	Sediment off ROW	G
x	x	3248	7/17/19	Sediment off ROW	H
x	x	3249	7/17/19	Sediment overtopped SSF	H
x		3247	7/17/19	Gravel washed outside LOD from flash flood	H
x		3250	7/18/19	sediment off ROW	G
x		3251	7/18/19	Sediment off ROW	G
x		3263	7/18/19	Sediment Off ROW	I
x		3266	7/19/19	Sediment off RoW	G
x	x	3281	7/20/19	Sediment off ROW	H
x		3294	7/22/19	Sediment off ROW	
x	x	3301	7/23/19	Sediment impacted stream	
x		3298	7/23/19	sediment off ROW	
x		3302	7/23/19	CFS overtopped	
x	x	3306	7/24/19	Sediment off ROW and in stream	
x	x	Field	7/24/19	Sed. to W-EF-PHO	H
x		3311	7/24/19	ECDs need maintenance (accumulated sediment and undermined)	
x		3313	7/24/19	Sediment off ROW	
x		3330	7/25/19	sediment off ROW	
x	x	3357	7/31/19	S-EF19 impacted with sediment	H
x	x	3358	7/31/19	S-IJ50 impacted by sediment	H
x		3340	7/31/19	Sediment off ROW	
x		3372	8/7/19	Sediment off RoW	H
x		3378	8/7/19	Sumps not built to spec/sediment off ROW	H
x		3385	8/8/19	Sediment off ROW	I
x		3405	8/16/19	Sediment off ROW	I

x		3407	8/16/19	Sediment off ROW	I
x		3419	8/19/19	Sediment off ROW	I
x		3423	8/20/19	Sediment off RoW	I
x	x	3452	8/21/19	Stream impacted with sediment	I
x		3448	8/21/19	Sediment off ROW	I
x		3451	8/21/19	Sediment off ROW	I
x	x	Field	8/22/19	Sed. to S-D20	I
x		3464	8/22/19	Sediment off ROW	I
x		3484	8/27/19	Sediment off ROW	I
x		3490	8/27/19	Sediment off ROW	I
x		3518	9/6/19	Sediment in buffer zone of S-G9(GAS)	I
x		3577	9/25/19	Endtreatment over topped and sediment off RoW	H
x	x	Field	9/26/19	Sed. to S-EF19	H
x	x	Field	9/26/19	Sed to W-EF5PO	H
x		3614	10/16/19	Sediment in road crossing	I
x		3623	10/23/19	Compost Filter Sock - needs maintenance - sediment off ROW undermined and minimal sediment appeared to be off the 3623 right of way)	I
x		3640	10/25/19	3640 minimal sediment appeared to be off the right of way	I
x		3643	10/28/19	3643 minimal sediment appeared to be off the right of way	I
x		3645	10/28/19	3645 minimal sediment appeared to be off the right of way	I
x		3648	10/28/19	3648 minimal sediment appeared to be off the right of way	I
x		3659	10/28/19	3659 Sediment off ROW	I
x		3663	10/28/19	3663 Sediment off ROW	I
x	x	3683	10/29/19	3683 Sediment off ROW Impacted W-A5 (from overtopped P1)	I
x		3668	10/29/19	3668 Sediment off ROW	I
x		3669	10/29/19	3669 CFS et bypassed /undermined	I
x		Field	10/29/19	Sed. of ROW	I
x		3670	10/29/19	3670 Sediment off ROW at two locations (two sump discharges)	I
x		3674	10/29/19	3674 CFS end treatment bypassed	I

x		3675	10/29/19	3675 Sediment off ROW	I
x		3685	10/29/19	3685 Perimeter P1 SF overtopped	I
x		3690	10/30/19	3690 Sediment off ROW. Upslope waterbar failure at 14923+50.	I
x		3693	10/30/19	3693 Sediment off ROW. Controls over topped	I
x		3695	10/30/19	3695 Sediment off ROW due to undermined CFS.	I
x		3698	10/30/19	Sediment off RoW	I
x		3700	10/30/19	Sediment off ROW. Upslope control failure and incorrect installation of waterbar at 14896+00.	I
x		3803	12/16/19	sediment off right of way I	I
x		3833	12/27/19	Trackout noted	I
x		3963	2/12/20	Triple stack CFS end treatment undermined / Sediment off ROW	I
x		4050	2/28/20	Sediment off ROW (Caused by CFS being undermined)	I
x		4135	4/14/20	Sediment off ROW caused by undermined CFS end treatment	I
x		4137	4/14/20	Sediment off ROW caused by undermined CFS end treatment	I
x		4139	4/14/20	Sediment off ROW caused by overtopped CFS	I
x		4149	4/17/20	Sediment traveled outside LOD	H
x		4168	4/22/20	Sediment off ROW caused by end treatment overtopping	I
x		4182	4/27/20	Sediment off ROW caused by overtopped CFS end treatment	I
x	x	Field	5/4/20	Sed. to Foul Ground Cr.	I
x		4207	5/4/20	Sediment off ROW caused by CFS end treatment being bypassed	I
x		4254	5/26/20	Sediment off ROW	I

x	x	4313	7/2/20	Stream channel impacted from sediment that was in geotextile liner that detached from timber mat bridge	I
x		4315	7/7/20	Gravel overtopped CFS	G
x		4355	8/17/20	Sediment off ROW.	I
x	x	4458	11/12/20	Sediment entering stream from bridge	H
x	x	4462	11/12/20	Sediment entering stream S-GH11 from sump	H
x		4465	11/12/20	Sediment off ROW	H
	x	4492	11/13/20	Stream S-EF48 impacted with sediment from stormwater bypass of ECDs.	I
x	x	Field	8/23/21	Sed. to S-Y2	G

This table was originally presented as Appendix B to "Documenting the Damage." The instances listed above have been supplemented by additional records acquired from the state since that report was released.

Additional incidents of sediment deposits in waterbodies not listed above include those with the following

Action Item Log ID	Date reported
5068	8/18/21
5074	8/18/21
5065	8/18/21
5184	9/22/21
5035	8/16/21
5031	8/16/21
5093	8/20/21
5102	8/20/21
5109	8/20/21

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 17

February 21, 2023

VWP Field Inspection Reports
Prepared by Virginia DEQ
Mountain Valley Pipeline

Compiled by Wild Virginia
February 17, 2023

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread H, Franklin County	**VWP Permit #**	N/A	**Inspection Date**	5/31/2018
Inspector Name	Nathan Hughes; Jesse Roberts	**Phone # & Email Address**	(804) 698-4026; Nathan.Hughes@deq.virginia.gov (540) 562-6785; Jesse.Roberts@deq.virginia.gov		
Address or lat/long (if no permit no.)	Cahas Mountain Road; near Mile Post 255.5	**Others Present During Inspection**	N/A		
Project Phase	Land Clearing; Grading	**Reason for Inspection**	Complaint		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 2,800 linear feet (comprising 2 separate streams) have been impacted by sedimentation: ~1,110 linear feet of stream located south of project's Limits of Disturbance (LOD); ~1,690 linear feet of stream impacts located north of project's LOD
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	N/A	Impacted streams are located greater than 50 feet from project's LOD
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channels' viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures had been repaired and were functioning properly
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On May 31, 2018, DEQ staff conducted an inspection to document sedimentation within two separate stream channels located on property adjacent to the Mountain Valley Pipeline (MVP) Right-of-Way (ROW). The property is situated west of Cahas Mountain Road (Route 742) in Franklin County, Virginia. Stream 1 is located approximately 260 feet south of Mountain Valley Pipeline (MVP) "Limits of Disturbance" (LOD); Stream 2 is located approximately 420 feet north of Mountain Valley Pipeline LOD.

Construction Activities at time of Inspection:
MVP ROW clearing completed; ROW grading in progress.

Inspection Results:
On May 31, 2018, DEQ staff observed and documented sedimentation in two separate stream channels located west of Cahas Mountain Road.

Stream 1 (located approximately 260-feet south of MVP LOD);
Approximately 1,110 linear feet of stream channel contained sediment ranging from 1-inch to a maximum depth of 11-inches was observed. Sediment within the stream's thalweg was generally 1-3 inches in depth; sediment bars and pool deposition was generally 3-7 inches in depth.

Stream 2 (located approximately 420-feet north of MVP LOD);
Approximately 1,690 linear feet of stream channel contained sediment ranging from 1-inch to a maximum depth of 10-inches was observed. Sediment within the stream's thalweg was generally 1.5 to 5-inches in depth; sediment bars and pool deposition was generally 3 to 6 inches in depth.

Recommended Corrective Actions

Close-up of number on survey stake

Sediment located on north side of SF

Sediment within channel at debris dam ~420-feet from MVP LOD
Depth 3 to 8-inches (average), Maximum depth of 11-inches; Sediment deposit 12-feet wide

Site Name: Mountain Valley Pipeline_Cahas Mountain Road Date: 5/31/2018

Sediment in channel near treeline ~1,000-feet from MVP LOD
Channel 3-feet wide; Sediment depth 6.5-inches

Sediment within channel ~685-feet from MVP LOD
Channel 3 to 5-feet wide; Sediment depth 3-inches in thalweg, 3 to 6-inches on sediment bars

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread H, Montgomery County	**VWP Permit #**	N/A	**Inspection Date**	6/26/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 698-4026; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Bacchus Road; 37°15'30.5"N, 80°17'46.8"W Stream Crossing SMM-15	**Others Present During Inspection**	N/A		
Project Phase	Land Clearing; Grading	**Reason for Inspection**	Complaint		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 3,600 linear feet of stream channel have been impacted by sedimentation
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	N/A	Impacted streams are located greater than 50 feet from project's LOD
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channels' viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures had been repaired and were functioning properly
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On June 27,18, DEQ staff conducted an inspection to document sedimentation within an unnamed tributary of Flatwoods Branch located on property adjacent to the Mountain Valley Pipeline (MVP) Right-of-Way (ROW). The impacted stream channel is situated north of Bacchus Road in Montgomery County, Virginia.

Construction Activities at time of Inspection:
MVP ROW clearing completed; ROW grading in progress.

Inspection Results:
On June 27, 2018, DEQ staff observed and documented sedimentation within an unnamed tributary to Flatwoods Branch, identified as Stream Crossing SMM-15, located north of Bacchus Road.

Stream 39 and 40
Approximately 3,600 linear feet of stream channel contained sediment ranging from 1-inch to a maximum depth of 7-inches was observed. Sediment within the stream's thalweg was generally <1-3 inches in depth; sediment bars and pool deposition was generally 1.5-7 inches in depth.

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove sediment from impacted stream channels using hand removal methods (buckets and shovels) and stabilize with appropriate seed mix where applicable.

Photo 1: Sedimentation within "SMM-15" ~160' downstream of LOD; Depth = 3"
Orientation: Downstream

Photo 2: Sediment in stream ~685' from LOD; Depth = 3"
Orientation: Upstream

Photo 3: Sediment in stream at debris dam ~1,690' downstream of LOD; Depth = 2-7"
Orientation: Upstream

Photo 4: Sediment in stream ~3,485' from LOD near access road; Depth = 2"
Orientation: Downstream

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread H, Montgomery County	**VWP Permit #**	N/A	**Inspection Date**	6/26/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 698-4026; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Catawba Road; 37°15’53.6”N, 80°18’30.8”W Stream Crossing #39 and #40	**Others Present During Inspection**	N/A		
Project Phase	Land Clearing; Grading	**Reason for Inspection**	Complaint		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 2,200 linear feet (comprising 2 separate streams) have been impacted by sedimentation
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	N/A	Impacted streams are located greater than 50 feet from project’s LOD
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channels’ viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures had been repaired and were functioning properly
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On June 26,18, DEQ staff conducted an inspection to document sedimentation within two separate unnamed tributaries to North Fork Roanoke River located on property adjacent to the Mountain Valley Pipeline (MVP) Right-of-Way (ROW). The impacted stream channels are situated south of Catawba Road (Route 785) in Montgomery County, Virginia.

Construction Activities at time of Inspection:
MVP ROW clearing completed; ROW grading in progress.

Inspection Results:
On June 26, 2018, DEQ staff observed and documented sedimentation in 2 separate stream channels, identified as Stream Crossing 39 and 40, located south of Catawba Road.

Stream 39 and 40
Approximately 2,200 linear feet of stream channel contained sediment ranging from 1-inch to a maximum depth of 5-inches was observed. Sediment within the stream's thalweg was generally <1-3 inches in depth; sediment bars and pool deposition was generally 1.5-5 inches in depth.

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove sediment from impacted stream channels using hand removal methods (buckets and shovels) and stabilize with appropriate seed mix where applicable.

Photo 1: Sedimentation within "Stream 39" ~25' downstream of LOD
Orientation: Downstream

Photo 2: 4.5" of sediment at debris dam ~210' from Photo 1
Orientation: Downstream

Site Name: Mountain Valley Pipeline_Spread H south of Catawba Road Date: 6/26/2018

Photo 3: Sediment in stream at confluence with "Stream 40" ~265' downstream of Photo 1
Orientation: Downstream

Photo 4: Sediment in stream ~1,325' from Photo 1
Orientation: Upstream

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread H, Montgomery County	**VWP Permit #**	N/A	**Inspection Date**	6/27/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 698-4026; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Half Acre Rock Road; Stream Crossing MN-513	**Others Present During Inspection**	N/A		
Project Phase	Land Clearing; Grading	**Reason for Inspection**	Construction		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 209 linear feet has been impacted by sedimentation
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	N/A	Impacted stream is located greater than within and downstream of LOD
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channels' viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures had been repaired and were functioning properly
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On June 27, 2018, DEQ staff conducting field inspections documented sedimentation within an unnamed tributary to Flatwoods Branch located on property adjacent to the Mountain Valley Pipeline (MVP) Right-of-Way (ROW).

Construction Activities at time of Inspection:
MVP ROW clearing completed; ROW grading in progress.

Stream MN-513
Approximately 209 linear feet of stream channel contained sediment ranging from <0.5-inch to a maximum depth of 3-inches was observed. Sediment within the stream's thalweg was generally <1-inch in depth; sediment bars and pool deposition was generally 1-3 inches in depth.

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove sediment from impacted stream channel using hand removal methods (buckets and shovels) and stabilize with appropriate seed mix where applicable.

Photo 1: Sedimentation and woody debris within Stream MN-513 at bridge crossing
Orientation: Downstream

Photo 2: Sedimentation and woody debris downstream of bridge crossing
Orientation: Downstream

DEQ VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread G, Giles County	**VWP Permit #**	N/A	**Inspection Date**	8/29/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 698-4026; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Stream Crossing NN-12	**Others Present During Inspection**	N/A		
Project Phase	Land Clearing; Grading	**Reason for Inspection**	Construction		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 600 linear feet of stream channel has been impacted by sedimentation
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	Yes	
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channels' viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures had been repaired and were functioning properly
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On August 29, 2018, DEQ staff conducting field inspections documented sedimentation within Stream NN-12 located on property adjacent to the Mountain Valley Pipeline (MVP) Right-of-Way (ROW).

Construction Activities at time of Inspection:
MVP ROW clearing completed; ROW grading in progress.

Stream NN-12
Approximately 600 linear feet of stream channel contained sediment ranging from <0.5-inch to a maximum depth of 3-inches was observed. Sediment within the stream's thalweg was generally <1-inch in depth; sediment bars and pool deposition was generally 1-3 inches in depth. Cleanup activity ESC repair were underway at time of field inspection.

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove sediment from impacted stream channel using hand removal methods (buckets and shovels) and stabilize with appropriate seed mix where applicable.

Photo 1: Seed/straw area within forested stream buffer downslope of ESC failure
Orientation: N/A

Photo 2: Sedimentation and seed/straw in small pool downslope of ESC failure
Orientation: Downstream

Photo 3: Sediment in stream approximately 300' downstream of ROW; Depth = 1-3"
Orientation: Downstream

Photo 4: Sediment along bank of stream approximately 500' downstream of ROW; Depth = 2"
Orientation: Upstream

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread G, Giles County	**VWP Permit #**	N/A	**Inspection Date**	9/5/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 698-4026; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Stream Crossing Q-14	**Others Present During Inspection**	N/A		
Project Phase	Land Clearing; Grading	**Reason for Inspection**	Construction		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 630 linear feet of stream channel has been impacted by sedimentation
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	Yes	
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channel's viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures were being repaired
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On September 5, 2018, DEQ staff conducting field inspections documented sedimentation within Stream Q-14 located on property adjacent to the Mountain Valley Pipeline (MVP) Access Road (#G/I 234).

Construction Activities at time of Inspection:
Access Road maintenance, Stormwater measures and Erosion & Sedimentation Controls

Stream Q-14
Approximately 630 linear feet of stream channel contained sediment ranging from <0.5-inch to a maximum depth of 9-inches was observed. No flow was present in the 10-12'wide channel at time of inspection. Sediment within the stream's thalweg was generally 3-inches in depth; sediment bars and pool deposition was generally >6-inches in depth. Landowner permission was not granted for Kimballton Branch downstream of Rogers Road culverts.

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove sediment from impacted stream channel using hand removal methods (buckets and shovels) and stabilize with appropriate seed mix where applicable.

Photo 1: View from Access Road G/I 234 toward Kimballton Branch downslope of ESC failure
Orientation: N/A

Photo 2: Access Road construction/maintenance near Photo 1
Orientation: Upslope

Photo 3: Sediment in stream approximately 50’ downslope of Access Road G/I 234 Depth = 3”
Orientation: Downstream

Photo 4: Sediment at debris dam approximately 400’ downstream of Photo 1; Depth = 4”
Orientation: Downstream

Photo 5: Sedimentation in channel 100’ upstream of Rogers Road culverts; Depth = 8”
Orientation: Upstream

Photo 6: Sedimentation in channel downstream of Rogers Road culverts; no landowner permission
Orientation: Downstream

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread H, Roanoke County	**VWP Permit #**	N/A	**Inspection Date**	9/20/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 921-1970; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Wetland Crossing IJ-10 Access Road 288	**Others Present During Inspection**	N/A		
Project Phase	Access Road	**Reason for Inspection**	Construction		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Approximately 350 square feet of wetlands were impacted by gravel
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	Yes	
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	N/A	
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures had been repaired and were functioning properly
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	
Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

General Notes:
On September 20, 2018, DEQ staff conducted a field inspection for Wetland IJ-10 located on MVP Access Road 288.

Construction Activities at time of Inspection:
Access Road 288 being maintained; ESCs replaced and functioning properly

Stream NN-12
Approximately 350 square feet of wetlands contained gravel ranging from <0.5-inch to a maximum depth of 6-inches was observed.

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove gravel from impacted wetland using hand removal methods (i.e. buckets and shovels) and stabilize with appropriate seed mix where applicable.

Site Name: Mountain Valley Pipeline_Spread H; Wetland IJ-10 Date: 9/20/2018

Photo 1: Access Road 288 **Orientation:** Facing Bent Mountain Road

Photo 2: Gravel from Access Road 288 in Wetland IJ-10 due to ESC failure
Orientation: N/A

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP FIELD INSPECTION CHECKLIST

Short Form

Project Name	Mountain Valley Pipeline Spread I, Franklin County	**VWP Permit #**	N/A	**Inspection Date**	10/16/2018
Inspector Name	Nathan Hughes; Matt Grant	**Phone # & Email Address**	(804) 921-1970; Nathan.Hughes@deq.virginia.gov (804) 418-9874; Matthew.Grant@deq.virginia.gov		
Address or lat/long (if no permit no.)	Stream Crossing E-48 (BonBrook #2)	**Others Present During Inspection**	N/A		
Project Phase	Grading; Trenching	**Reason for Inspection**	Construction		

PERMIT / REGULATORY REQUIREEMNT	**Yes/ No/ NA**	**Location, Description and Other Notes**
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas **have occurred**.* *(This includes sedimentation impacts due to inadequate or failed erosion controls.)*	Yes	Linear footage of stream channel impact unknown due to lack of adjacent landowner permission.
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	Yes	
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation within 30 days of completing purposeful work in the area.	N/A	
Construction activities are **not** substantially disrupting aquatic life movement.	No	Sedimentation observed within stream channel's viable habitat
E&S controls are present, properly maintained, and functioning.	Yes	At the time of inspection, E&S measures were being repaired
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity.	N/A	
Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom.	N/A	
Time-of-year restrictions are being adhered to.	N/A	
Water quality monitoring is being conducted during permanent stream relocations.	N/A	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	Yes	

Heavy equipment is placed on mats or geotextile fabric when working in authorized temporary wetland impact areas.	N/A	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	N/A	

Inspection Summary		
Compensation Completed	Reporting	On-Site Monthly Inspections Completed
☐ Yes ☐ No ☒ N/A	Preconstruction Notice Received: ☐ Yes ☐ No ☒ N/A Construction Status Updates Received: ☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A

Notes

General Notes:
On October 16, 2018, DEQ staff conducting field inspections documented sedimentation in Stream E-48 located on property adjacent to and within the Mountain Valley Pipeline (MVP) right-of-way (RoW).

Construction Activities at time of Inspection:
Stormwater measures and Erosion & Sediment Controls

Stream E-48
Sediment ranging from <0.5-inch to a maximum depth of 2-inches was observed. Sediment was also observed within forested buffer. Flow was present in the 1-3'wide channel at time of inspection. Sediment within the stream's thalweg was generally <1-inch in depth; sediment bars and pool deposition was generally 1 to 2-inches in depth. Landowner permission was not granted for adjacent property downstream.

Clean-up activities and seed/straw present at time of inspection, however more remediation needed

Recommended Corrective Actions

1. Repair erosion and sediment controls in areas where needed;
2. Stabilize all slopes above and below perimeter controls;
3. Remove sediment from impacted stream channel using hand removal methods (buckets and shovels) and stabilize with appropriate seed mix where applicable.

Photo 1: Overview of Stream Crossing E-48 **Orientation:** ENE

Photo 2: View downstream from bridge in Photo 1 **Orientation:** Downstream

Site Name: Mountain Valley Pipeline_Spread I; Stream E-48 Date: 10/16/2018

Photo 3: Sediment in stream and on banks at edge of RoW; Depth = 0.5-2”
Orientation: Downstream

Site Name: Mountain Valley Pipeline_Spread I; Stream E-48 Date: 10/16/2018

Photo 4: Overview of stream crossing and sediment within forested buffer
Orientation: SE

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 18

February 21, 2023

Documenting the Damage

An Analysis of Virginia State Inspection Reports for MVP

Wild Virginia
December 13, 2021

Introduction

The public and the State Water Control Board (Board) have seen only a small portion of the record on Mountain Valley Pipeline's failures to comply with water quality requirements, because no comprehensive look at the huge mass of state inspection reports has been presented previously. A more complete picture, which Wild Virginia has assembled through an exhaustive review of records, demonstrates that there is no reasonable assurance that MVP is able or willing to abide by requirements imposed on it by Virginia, under the existing certification or under that which the Board is now considering.

Based on our review of the state inspection reports, we believe that:

MVP has violated rules imposed by the Board's water quality certification for upland activities at least 1,500 times.

This number eclipses the total of 396 violations the Department of Environmental Quality (DEQ) has alleged.[1]

The record shows the following:

- MVP has deposited sediment off of its construction sites at least 569 times. At least 100 of those off-site releases have deposited sediments in streams or wetlands.

- In more than 360 instances, MVP has failed to install pollution controls in accordance with state-approved plans. 37 of these occurred in spring and summer of 2021.

- In at least 553 instances, MVP failed to meet deadlines to fix deficiencies in pollution controls.

This record must compel the State Water Control Board to insist that DEQ reform the way it reports MVP violations for its upland activities and the way the Department responds to them, to ensure that this pattern does not continue.

The magnitude and scope of violations makes clear that the Board cannot assume that MVP would comply with any new requirements the Board might approve, if it issues a new water quality certification for stream and wetland crossings.

State Inspection Reports

[1] See *A pipeline runs through it: Stream crossings by the Mountain Valley Pipeline,* by Laurence Hammack, Roanoke Times, December 11, 2021.

Wild Virginia has reviewed 895 inspection reports prepared by DEQ staff.[2] These cover the period from May, 2018 to October, 2021.

On most of the documents, labeled "Field Inspection" reports, the inspectors have given "yes" or "no" answers to the following questions:

1. Are controls installed and implemented in accordance with the approved erosion and sediment (E&S) control plan and stormwater management plans?
2. Are all control measures properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications?
3. Areas of offsite sediment deposition were observed?

If the inspector answered "no" for the first question, that MVP has failed to implement the approved plans for construction and pollution controls, then MVP has violated the provisions of the State Water Control Law and regulations.

Likewise, a "yes" answer to the third question, indicating that sediment has been deposited offsite, indicates a violation of applicable legal requirements. Further, if the materials flowing offsite are deposited into a stream or wetland, the DEQ considers this an illegal discharge.

Without more information than is provided on the reports, it is not possible to determine whether a "no" answer on question 2 constitutes a violation. The company is given 24 or 72 hours to maintain or repair features and only assesses a violation if those deadlines are missed.

Similar information about conformance with plans and offsite discharges is found in a body of evidence assembled by the firm Mcdonough Bolyard Peck (MBP), which conducts inspections of MVP sites under contract with DEQ. Wild Virginia acquired thousands of records on the MBP inspections from DEQ, through a Freedom of Information Act (FOIA) request.

In regard to regular inspections, MBP has created what it terms "action items" for which MVP responses and follow-up by inspectors are needed. A summary table of all action items contains 4,687 action items (Appendix A to this report). MBP's action item log we acquired covers the period from May, 2018 to March 18, 2021.

Each item on MBP's log has an identification number, pertinent dates, and descriptive information about the issues and how they have been or are to be addressed.

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[2] These reports are accessible on the DEQ website at https://www.deq.virginia.gov/get-involved/topics-of-interest/mountain-valley-pipeline, listed under Spreads G, H, and I.

The specific problems on the Action Item Log are not as neatly categorized as those on the DEQ reports discussed above. However, many of the same types of violations are noted. In some cases, the same incident is addressed in both the DEQ reports and the MBP list but some from each source appear to be unique. We have taken pains not to "double count" alleged violations in our review.

Sediment Releases Off MVP Rights of Way

Appendix B to this report includes a list of five hundred and sixty-nine instances where MVP is alleged to have released pollutants off of its sites and those releases caused sediment deposits on the ground and/or in waterbodies. Both inspectors' descriptions and photographs which we have reviewed support these assertions. That list, which we still believe to be incomplete, was an astounding revelation, given that DEQ has cited MVP for around 50 such releases.

Figure 1 shows the geographic spread of the offsite discharges that affected streams and wetlands and a partial list of those streams includes:

- Blackwater River
- Doe Creek
- Foul Ground Creek
- Harpen Creek
- Little Creek
- Mill Creek
- Multiple tributaries to Blackwater River
- Multiple tributaries to Flatwoods Branch
- Multiple tributaries to Foul Ground Creek
- Multiple tributaries to North Fork Blackwater River
- Multiple tributaries to North Fork Roanoke River
- Multiple wetlands near Blackwater River tributaries
- Tributary to Catawba Creek
- Tributary to Cherrystone Creek
- Tributary to Indian Run
- Tributary to Jonnikin Creek
- Tributary to Little Cherrystone Creek
- Tributary to Owens Creek
- Tributary to Pole Bridge Branch
- Tributary to Poplar Camp Creek
- Tributary to Roanoke River
- Tributary to Sinking Creek
- Tributary to Teels Creek
- Tributary to Turkey Creek
- Wetland near Little Cherrystone Cr.
- Wetland near tributary To Rocky Creek

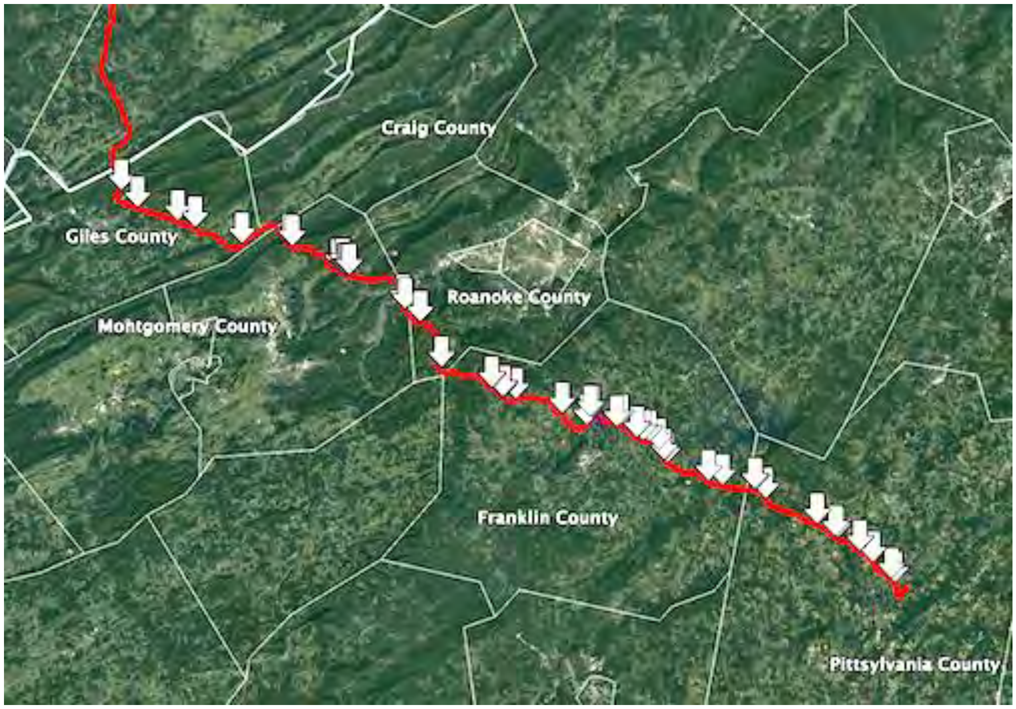

Figure 1 - sites of reported sediment deposits in streams and wetlands along MVP's path

These pollution events violate state law in at least two ways. First, as explained in Virginia's enforcement lawsuit against MVP, those that impact waterbodies are unpermitted discharges under the State Water Control Law and Virginia Water Protection Permit regulations. Second, Virginia's Erosion and Sediment Control regulations state that both "[p]roperties and waterways downstream from development sites shall be protected from sediment deposition. . . ." 9 VAC 25-840-40(19).

In addition, in many if not all cases these impacts violate Virginia's water quality standards regulation as well. These pollution events, especially in headwater systems, are of great concern and may have serious and long-lasting ecological impacts. Many of the small streams affected play extremely important roles as habitat for rare and sensitive species and as vital parts of the larger stream systems in which they lie. DEQ claims that allowing MVP to enter the streams with shovel and dig out its mud is "remediation" but provides no analysis to justify this assumption. In fact, given the sensitivity of many of these tiny streams and the native organisms, it seems possible that this intrusive operation may cause more harm than good.

<u>Serious and Repeated Offenses</u>

There are a number of individual streams and small waterdsheds where state inspectors documented dumping of sediments from MVP on multiple occasions. These specific instances are sometimes also combined with repeated deficiencies in pollution controls. These other incidents, even if they did not result in direct discharges of sediments into the waterbodies, presented threats of additional off-site sediment deposition and often of discharges of water bearing large concentrations of sediment but not filtered through the pollution control structures as required.

One stream that has been beleaguered by MVP's violations and assaults is a small unnamed tributary to the Blackwater River. This waterbody begins as an intermittent stream with associated wetlands and flows through a predominately forested watershed of about 1 square mile in area. Downstream from the sites of repeated MVP discharges of mud to the stream, the tributary is designated as habitat for the rare Orangefin Madtom, a fish listed by the State of Virginia as "threatened" and which has been proposed for a federal endangered or threatened listing.

On December 29, 2018, MBP inspectors created action items, noting problem accumulations of sediment on a bridge and in a water bar channel and deposition of sediment into both this small tributary stream and an adjacent wetland. On January 9, 2019, they again reported that the water bar channel had excess sediments and on April 19, 2019 that perimeter filter socks were full of sediment and there was a problem with filter fabric on the bridge. Then in November 2020, inspectors again found that there was erosion upslope from the stream, accumulations of dirt on the bridge, and that sediment-laden water bypassed pollution control structures and polluted the stream again.

In all, MBP personnel cited ten different times when problems were cited and actions required by MVP, stretching over a period of nearly two years. There can be no clearer example to show that MVP has failed to reform its behavior through the life of this project or that DEQ actions have been ineffective at forcing change.

In some cases, these discharges of mud have inundated large portions of streams and, according to DEQ scientists' reports resulted in serious impairments of aquatic life designated uses. This certainly violates narrative water quality criteria contained in the standards, which prohibit interference with any designated use. And aquatic life support is a designated use for all waters in the Commonwealth. Recreational designated uses, which include aesthetic enjoyment as well as activities like fishing, swimming, and boating, are also surely "interfered with" when a stream bottom is coated with a thick layer of mud.

For example, in a report labeled "VWP Field Inspection Checklist" and dated June 26, 2018, inspectors noted that "[a]pproximately 3,600 linear feet of stream channel have been impacted by sedimentation." The deposits in this tributary to Flatwoods Branch were as much as 7 inches deep. The report indicates that the sedimentation affected the "channels' viable habitat" and were "substantially disrupting aquatic life movement."[3]

These types of impacts in a stream constitute an immediate impairment in the section directly affected but impacts can and almost certainly are found farther downstream and may be long-lasting. Flatwoods Branch is one of the feeder streams to the North Fork Roanoke River, which provides habitat for the federally endangered Roanoke Logperch. And several streams in the small Flatwoods Branch watershed were negatively affected by MVP discharges and on numerous occasions MVP failed to adequately implement and/or maintain pollution controls.

Other streams with extensive impacts from illegal sediment discharges are within the Blackwater River watershed in Franklin County. Figure 2 shows one of these, which was covered in mud for a length of nearly 1,700 linear feet. The stream in Figure 3 is near the site of a crossing made by boring under the small tributary, also in the Blackwater River drainage.

In a recent document given to the Board, DEQ attempts to downplay the seriousness of the pollution incidents caused by MVP, with an emphasis on the assertion that "there has never been any reported evidence of a fish kill."[4] Surely DEQ knows and the Board must understand that this is a weak and wholly insufficient measure as to whether damage was done to these waters. Prevention of fish kills, while important, is far from the ultimate goal of the water regulations and standards. Rather, these waters are to be maintained in a state to fully support all designated uses, preserving the physical, chemical, and biological integrity of the stream systems and wetlands.

There is simply no question as to whether each of the streams into which sediments were deposited were degraded to some extent and the full weight and duration of those impacts is not known, because there is no evidence that DEQ has even attempted to assess those factors.

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[3] The wording of the report form calls for a yes or no answer to the statement "Construction activities are **not** substantially disrupting aquatic life movement." An answer of "no," as was entered on this inspection report, creates a double negative, meaning that movement of organisms is disrupted. This reading is clearly supported by the reality that the thick coating of mud would inevitably affect movement within the stream channel.

[4] Agenda document with attachments for December 14, 2021 State Water Control Board meeting, at pdf page 295.

Figure 2 - Tributary to North Fork Blackwater River, Franklin County

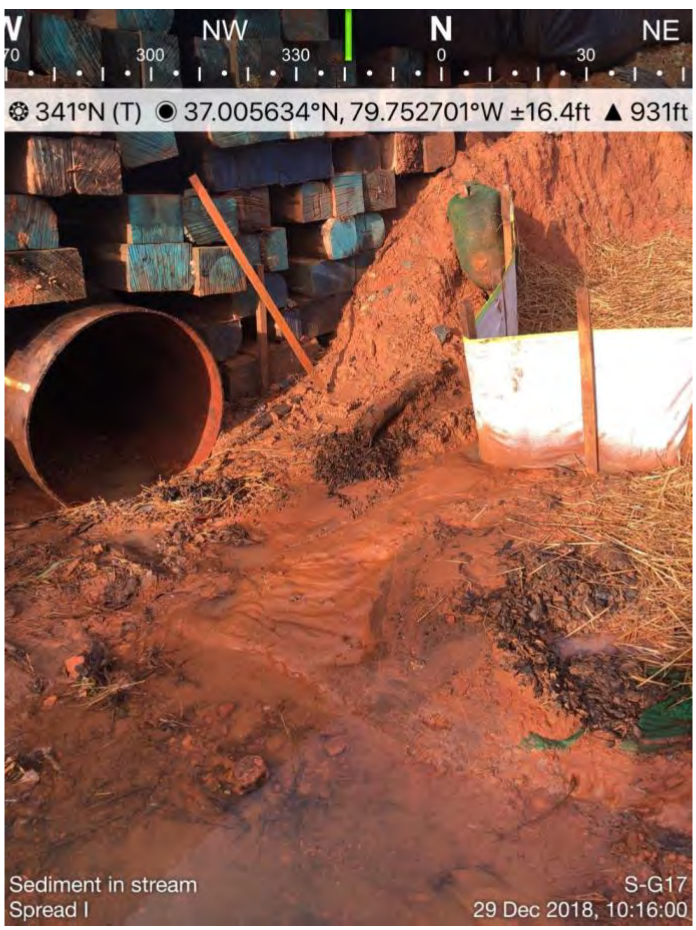

Figure 3 - Tributary to Blackwater River

In addition to the assaults that have been shown to affect waters through direct deposition, sediment-laden water certainly reaches those streams as a result of off-site sediment.

Every deposit of sediment in an area not protected by pollution-control structures is a constant threat to water quality unless and until it is removed to a controlled site. The next storm may well carry that pollution to the nearest waterbody and certainly has done so, considering the huge number of times these events have occurred. And, the delays that have often happened, due both to MVP's violation of time requirements and practical limits on their ability to retrieve the sediments, heighten those threats. This reality is reflected in Virginia law, which with deems situations where "sediment has been deposited in significant amounts in areas where those deposits are not contained by best management practices" as "likely to [cause] adverse impacts to water quality"[5] These conditions may justify a stop work order for pipeline work where they are found, based this statute.

Fig. 6: **STA 15338+00** – Sediment off ROW.

Figure 4 - Sediment dumped on a neighbor's farm filed by MVP

Plans Aren't Implemented as Required

[5] See Code of Virginia § **62.1-44.15:37.1**.A.(iii)(b).

The backbone of the regulatory scheme for the pipeline is the approved plans and specifications that DEQ has reviewed and approved. If those plans are executed as required, then proper treatment and control of pollution is supposed to result.

In at least three hundred and sixty instances, MVP has failed to install the structures or take other actions as it is obligated to do. These failures to carry out the plans sometimes lead directly to polluted discharges and impairment of waterbodies. Sometimes the failures create the risk of pollution problems that may be produced, depending on other factors.

For example, DEQ cited a case in the fourth quarter of 2019 when the Department said MVP discharged " [s]ediment off ROW caused by [an] incorrectly installed water bar."[6] As shown by the action item log, both before and since DEQ identified that violation, MVP has on many occasions failed to install water bars correctly or at all, until ordered to do so. Many of these instances were not asserted in DEQ enforcement actions and, to the best of our knowledge, have not been reported to the Board.

MVP has violated a wide range of requirements under approved plans and those violations have extended from the first months of construction through this year. The record clearly refutes the company's claim that pollution problems are traceable to record amounts of rainfall in 2018 and that those "challenge" have since been addressed with additional protections. On the contrary, problems continue to arise on a frequent basis, due at times to MVP's failure to carry out the plans it is required to implement.

During the period from April through August of 2021, state inspectors documented thirty-seven times when MVP simply failed to install required controls or installed them incorrectly. This is particularly difficult to justify, since these are measures MVP has been required to install for more than two years, so the company cannot claim either newly encountered conditions or a lack of knowledge or ability to perform these required tasks. On fifteen separate occasions MVP failed to build water bars in accordance with specifications, despite the fact that it has built thousands of these structures along the path of the pipeline.

These and other basic components of the erosion and sediment (E&S) control and stormwater management systems for the pipeline, that must be in place to prevent pollution, have too often been "missing" or "not installed," in the words of inspectors but it seems that DEQ has assessed allowed these shortcomings to continue throughout the life of the project. What assurances can the Board or the public have that MVP will do better in the future, either in further upland work or in waterbody crossings.

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[6] Letter from Tiffany R. Severs, DEQ to Todd L. Normane, Mountain Valley Pipeline, LLC, April 30, 2020, Appendix A, page 1.

Deadline Missed
As noted above, for some deficiencies identified by state inspectors MVP is allowed periods of 24 or 72 hours to make repairs or perform necessary maintenance. Missed deadlines are violations of the upland certification.

In its enforcement complaint against MVP, the state cited 180 instances where such deadlines were exceeded. During that same period leading up to the court action, DEQ reports show that MVP missed the deadlines 408 times in 2019. In just one one period, from June 11 - July 16, 2019, MVP violated this provision 120 times.[7]

Conclusion
MVP's record of violating requirements has exacted a heavy cost on our state waters and on landowners and nearby residents. We respectfully request that the State Water Control Board take the necessary action to ensure that this deplorable pattern does not continue and that new activities do not exacerbate the problems already created.

[7] DEQ Comprehensive Pipeline Inspection Report, July 18, 2019, accessible through DEQ website under Spread I, document entitled SWPPP report.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 19

February 21, 2023

Mountain Valley Pipeline
Water Quality-Related Violations and Damage to Waterbodies
Summary of Findings from West Virginia DEP Inspection Reports

The following tables describe pollution events and violations documented by inspectors for the West Virginia Department of Environmental Protection (DEP). Overwhelmingly, these findings demonstrate the failure of Mountain Valley Pipeline's erosion and sediment controls to mitigate damage to local waterbodies as a result of pipeline construction. Specifically, Mountain Valley's construction activities have violated state water quality standards as well as stormwater construction permit requirements. The data shows that such violations have occurred repeatedly over the years from 2018 to 2022, and likely continue to this day.

Table 1 (pages 2 - 3) shows water impacts that were not cited as violations of water quality standard but were similar in nature to other incidents that WVDEP categorized previously as violations of water quality standards detailed in Table 2. As such, these impacts can be categorized as de facto violations of West Virginia's water quality standards.

Table 2 (pages 4 - 6) shows impacts the DEP designated violations of water quality standards.

Table 3 (pages 7 - 21) shows incidents DEP cited as violations of stormwater construction permit requirements.

Table 1. MVP Impacts to Waters of the U.S. in 2020-2022

Date	Document Type	Impact Description
Feb 10, 2020	Emergency Response	Representative stated that significant rain event caused slope failure above wetland W-K12. At the time of inspection wetland W-K12 was being impacted with sediment laden water (SLW). The SLW was flowing through wetland W-K12 and entering stream S-K23.[1]
Feb 12, 2020	Emergency Investigation	An earthen slip occurred on ROW above an UT of Stout Run. A road slip left sediment and stone into the stream channel.[2]
Apr 30, 2020	Complaint Investigation	SLW was present downslope in Wetland W-C13 both within the MVP LOD and outside the MVP LOD. It appeared the SLW was entering Painters Run.[3]
Aug 6, 2020	Emergency Response	Sediment impacted Stream S-KP12[4]
Nov 23, 2020	Emergency Response	Approximately 1 cup of sediment bubbled up into stream during core drilling on stream bank.[5]
Mar 25, 2021	Self-Reported Incident RE#: 32-13206	A localized rain event in the project area created a significant volume of water to flow onto an access road which caused sediment to enter two small order streams.[6]

[1] 2020, February 10. West Virginia Department of Environmental Protection. Emergency Response. Spill Hotline Reference Number 13-99368 (A)

[2] 2020, February 12. West Virginia Department of Environmental Protection. Emergency Investigation.

[3] 2020, April 30. West Virginia Department of Environmental Protection. Complaint Investigation.

[4] 2020, August 6. West Virginia Department of Environmental Protection. Emergency Response. Spill Hotline Ref. No. 41-5906 (A)

[5] 2020, November 23. West Virginia Department of Environmental Protection. Emergency Response. Spill Hotline Ref. No. 45-11242 (A)

[6] 2021, March 25. Mountain Valley Pipeline. Self-Reported Incident RE#: 32-13206

Jun 13, 2021	Emergency Response	At stream crossing S-W13b flood waters scoured the bank downstream of three culverts. The scoured bank was about 2 foot high by 4 foot wide.[7]
Aug 22, 2021	Spill Report Hotline	Representative of MVP stated a significant rain event occurred over weekend while crews were working on steep slopes. Due to water bars being removed for equipment to travel downslope controls were overwhelmed with sediment and sediment laden water leading to impacts downslope in Lick Creek.[8]
April 11, 2022	Self-Reported Incident RE #: 13-25775	Due to significant rainfalls, several flash flooding events occurred in the project area. As a result, an ECD failure occurred allowing a small amount of sediment to reach a delineated wetland near Springdale.[9]
May 9, 2022	Emergency Response	Sediment slip 1.3 cubic yards.[10]
May 9, 2022	Emergency Response	Sandbags washed out from the crossing.[11]
May 11, 2022	Emergency Investigation	The company had received approximately 4.2-inches of rain fell over a 36-hour period which led to the impact in UNT of Indian Creek.[12]

[7] 2021, June 13. West Virginia Department of Environmental Protection. Emergency Response.

[8] 2021, August 22. West Virginia Department of Environmental Protection. Spill Hotline Ref. No. 45-17420 and 45-17425

[9] 2022, April 11. Mountain Valley Pipeline. Self-Reported Incident RE #: 13-25775

[10] 2022, May 9. West Virginia Department of Environmental Protection. Emergency Response. HSEM Reference: 21-26330(A)

[11] 2022, May 9. West Virginia Department of Environmental Protection. Emergency Response HSEM Reference: 21-26311 (A)

[12] 2022, May 11. West Virginia Department of Environmental Protection. Inspection of Emergency Spill Hotline HSEM Reference: 21-26364 (A)

Table 2. Violations of Water Quality Standards Cited by WVDEP Inspectors

Date	Violation Number	Violated the following WV Legislative Rules (Requirements Governing Water Quality Standards)[13, 14]:
May 9, 2018	W18-52-001-CP	Title 47, Series 2, Section 3.2.b.-Section 3.2.b. - Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of the stream.
June 6, 2018	W18-09-076-TJC	Title 47, Series 2, Section 3.2.a.- caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in UNT Meathouse Fork (39° 11.891’ X 80° 33.209’). Title 47, Series 2, Section 3.2.b.-Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of UNT Dry Fork (39° 11.384’ X 80° 33.554’)
July 17, 2018	W18-52-003-CP	Title 47, Series 2, Section 3.2.b.-Section 3.2.b. - Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of UNT of Birch River (S-F34).
July 18, 2018	W-18-52-004-CP	Title 47, Series 2, Section 3.2.b.-Section 3.2.b. - Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom and banks of UNT of Harmony Creek
July 27, 2018	W18-17-077-TJC	Title 47, Series 2, Section 3.2.b.-Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of Grass Run (S-A11a).
Aug 1, 2018	W18-17-082-TJC	Title 47, Series 2, Section 3.2.a.- caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in Right Fork of Big Elk Creek (39° 26.6589’ X 80° 28.9724’), Goose Run (39° 26.17952’ X 80° 28.5256’) and UNT Goose Run (39° 26.100’ X 80° 28.4922’). Title 47, Series 2, Section 3.2.b.-Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of in UNT Goose Run (39° 26.100’ X 80° 28.4922’), Seal

[13] 2019, April 19. West Virginia Department of Environmental Protection. Consent Order Issued Under the Water Pollution Control Act. Order Number 8951

[14] 2020, December 17. West Virginia Department of Environmental Protection. Consent Order Issued Under the Water Pollution Control Act. Order Number 9925

		Run (39° 20.4891’ X 80° 30.7324’) and Grass Run (39° 20.1127’ X 80° 31.3233’).
Aug 2, 2018	W18-52-005-CP	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in Stony Creek and Slate Run.
Aug 10, 2018	W18-09-083-TJC	Title 47, Series 2, Section 3.2.a.- caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in UNT Meathouse Fork (39° 11.891’ X 80° 33.209’). Title 47, Series 2, Section 3.2.b.-Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of UNT Meathouse Fork (39° 11.891’ X 80° 33.209’), UNT Dry Fork (39° 11.377’ X 80° 33.566’), UNT Kincheloe Creek (39° 10.006’ X 80° 34.736’), Wetland UNT Kincheloe Creek (WJ-40) (39° 10.060’ X 80° 34.626’), Wetland UNT Smoke Camp Run (W-I26) (39° 08.208’ X 80° 34.610’), Wetland UNT Left Fork of Freemans Creek (W-B47) (39° 04.744’ X 80° 34.904), UNT Laurel Run (39° 01.133’ X 80° 35.813’) and Laurel Run (39° 01.043’ X 80° 35.867’).
Aug 13, 2018	W18-10-001-JHH	Title 47, Series 2, Section 3.2.b.-Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of wetland WQR-1 and stream A-104 (both are UTs of Buffalo Creek of the Meadow River).
Sept 20, 2018	W18-52-009-CP	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in UNT of Painters Run along access road 231.01 off Painters Run Road near station 10270
Sept 25, 2018	W18-52-011-CP	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in UNT of Little Kanawha River.
Sept 25, 2018	W18-52-010-CP	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in UNT of Knawls Creek.
Sept 26, 2018	W18-32-001-JTL	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in Stream S-H58 and TTWV-S-E58 that flow into Hans Creek.
Sept 27, 2018	W18-32-002-JTL	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in Stream S-A60, Stream S-Z4, Stream S-Z5, Wetland W-22 and Indian Creek.
Oct 2, 2018	W18-32-003-JTL	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in pond (P-D1) and stream (S-D29) at station #9687.
Nov 27, 2018	W18-52-014-CP	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in Knawl’s Creek.

Feb 6, 2019	W19-32-002-JTL	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in an UNT of Brammer Branch
Apr 22, 2019	W19-45-008-JTL	Title 47, Series 2, Section 3.2.b.- Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of stream S-T35(A) a tributary of Lick Creek.
July 9, 2019	W19-45-021-JTL	Title 47, Series 2, Section 3.2.b. - Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of the stream.: Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits in Stream S-T35A an UNT of Lick Creek at station No. 8634+00 MVP ROW.
July 18, 2019	W19-51-024-JTL	Title 47, Series 2, Section 3.2.a.- Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in a conveyance/ephemeral stream that becomes Fall Run a tributary of the Holly River.
Aug 7, 2019	W19-45-026-JTL	Section 3.2.b. - Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of Stream S-K16 and UNT of Hungard Creek near station No. 8929+00.
Aug 14, 2019	W19-04-073-TJC	Title 47, Series 2, Section 3.2.b.-Caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of Keith Run (38° 47.179’ X 80° 31.816’) in two locations.
Sept 11, 2019	W19-17-030-JTL	Section 3.2.a-Responsible party has caused conditions not allowable in waters of the State by allowing distinctly visible settleable solids in Stream S-B75 (Goose Run) a tributary of Big Elk Creek.
Nov 7, 2019	W19-04-032-JTL	Section 3.2.b-Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits on the bottom of a stream: Permittee has caused conditions not allowable in waters of the State by allowing sediment deposits in Stream S-L49 (Elliott Run) a tributary of Little Kanawha River at station No. 3946+00 and by allowing erosion controls pellets in Elliott Run (Stream S-L49) and Stream S-H117.

Table 3. Violations of MVP's Stormwater Construction Permit Cited by WVDEP Inspectors

Date	Violation Number	Violated the following terms and conditions of WV/NPDES General Water Pollution Control Permit No. WV0116815, Registration No. WVR310667[1, 2]:
Apr 3, 2018	W18-52-021-RDD	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through silt sock located at the Bradshaw Compressor Station. Section G.4.e.2. - Permittee has failed to properly implement controls: lack of drop inlet protection at the Mobley Compressor Station.
May 9, 2018	W18-52-001-CP	Section G.4.e.2. - Permittee has failed to implement appropriate controls which allowed a failure of controls at station 9492+92.85 allowed sediment laden water to leave site without going through an appropriate device. Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device.
May 9, 2018	W18-52-002-CP	Section G.4.c. - Permittee has failed to modify your SWPPP when the SWPPP proves to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges- additional controls were not added to areas where installed controls failed. Section G.4.e.2. - Permittee has failed to implement controls: water bars/slope breakers were improperly installed- did not have outlets, outlet was directed down denuded slope, slope of water bar was inappropriate, and inadequate number of bars were installed. Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device from control failure at stations 6812+58 (sheet 6.38) and 6854+00 (sheet 6.39).
June 6, 2018	W18-09-076-TJC	Section G.4.e.2.- failed to properly implement controls: improperly installed water bars were noted in areas scattered throughout the inspected area. An improperly installed BMP at the terminus of a water bar located adjacent to the Dry Fork access (MVP-DO-049) caused sediment laden water to bypass the device

		Section D.1.- failed to operate and maintain all erosion control devices. An improperly operated temporary right of way diversion and outlet was noted at 1851+00. This deficiency caused sediment laden water to leave the site and CNA was noted as a result. Section G.4.e.2.A.ii.j: Failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Offsite sediment deposits and sediment laden water was noted in areas scattered throughout the inspected area.
June 6, 2018	W18-17-065-TJC	Section B- failed to comply with the General Permit and approved Storm Water Pollution Prevention Plan (SWPPP). Perimeter controls and treatment at water bar outlets are not in place as detailed by the SWPPP from 513+64 to 556+00. There are no BMPs in place to prevent sediment laden water from leaving the site in this area in violation of the issued permit.
July 17, 2018	W18-52-003-CP	Section G.4.e.2. - Permittee has failed to properly implement controls: installed controls failed allowing sediment laden water to leave site and flow into UNT of Birch River (S-F34). Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device- control failure near station 5518+00 (GPS coordinates: 38˚25.4570'N, 80˚34.2329'W deposited sediments into UNT of Birch River (S-F34).
July 18, 2018	W-18-52-004-CP	Section G.4.e.2. - Permittee has failed to implement controls appropriate for the project: inadequate controls at terminus of water bars. Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device at several locations along UNT of Harmony Creek (Photos 6-8)
July 27, 2018	W18-17-077-TJC	Section G.4.e.2.A.ii.j: Failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Offsite sediment deposits were noted in Grass Run. Section G.4.e.2.- failed to properly implement controls: improperly constructed water bars were noted throughout the inspected area.
Aug 1, 2018	W18-17-082-TJC	Section G.4.e.2.- failed to properly implement controls: improperly installed water bars were noted throughout the inspected area. Water bars did not shed stormwater off of the project area in small quantities as designed. Sheet flow BMPs (Super Silt Fence) were noted in concentrated flow areas throughout the inspected area. Section D.1.- failed to operate and maintain all erosion control devices. Improperly operated and maintained BMPs were noted in areas scattered throughout the inspected area.

		G.4.e.2.A.ii.f.-Failed to protect fill slopes. Concentrated flow was being directed over unstable fill slopes in areas scattered throughout the inspected area. Section G.4.e.2.A.ii.j: Failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Offsite sediment deposits and CNA were noted in areas scattered throughout the inspected area.
Aug 2, 2018	W18-52-005-CP	Section G.4.e.2. - Permittee has failed to properly implement controls: controls at Wayside/Talcott (station 9466+16) and Slate Run (station 9624+00) are insufficient to prevent the release of sediment laden water into adjacent streams of Stony Creek and Slate Run. Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device at Wayside/Talcott (station 9416+16) and Slate Run (station 9624+00)
Aug 10, 2018	W18-09-083-TJC	Section G.4.e.2.- Failed to properly implement controls: improperly installed water bars were noted throughout the inspected area. Water bars installed at steep angles were observed during the inspection. Water bars that discharged stormwater into unstable diversions as well as water bars that terminated prior to the edge of the LOD and did not discharge stormwater off site in small quantities as designed were observed. Section D.1.- Failed to operate and maintain all erosion control devices. BMPs that were not properly operated and maintained that caused offsite sediment deposits were noted in areas scattered throughout the inspected area. G.4.e.2.A.ii.f.-Failed to protect fill slopes. Concentrated flow that was being directed over fill slopes and/or unstable diversions that caused fill slope erosion were noted in areas scattered throughout the inspected area. Section G.4.e.2.A.ii.j: Failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Offsite sediment deposits and CNA were noted in areas scattered throughout the inspected area.
Aug 13, 2018	W18-10-001-JHH	Section G.4.e.2.- Failed to implement controls appropriate for the project: perimeter controls are being used for concentrated flow in multiple locations on the project, silt fence being installed on the southern portion of the pad area was not joined or trenched in properly. Section D.1.- Failed to operate and maintain erosion control devices: perimeter controls in multiple locations on the project have not been maintained. Section G.4.c: Failed to modify your SWPPP when it proves to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges: alterations /modifications to the SWPPP have not occurred in areas where failed controls have repeatedly led to off-site sediment loss.

		Section B- failed to comply with the General Permit and approved Storm Water Pollution Prevention Plan (SWPPP): The roadside diversion with checks and several cross drains were not in place on site as prescribed in the SWPPP. This lack of stormwater control in the lower portion of the site was causing unnecessary erosion, lack of treatment and standing water in the fuel storage area. Section G.4.e.2.A.ii.j: Failed to prevent sediment-laden water from leaving the site without going through an appropriate device: this was evident at six different locations along the project LOD perimeter.
Aug 15, 2018	W18-52-006-CP	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls- Water bar terminus needed maintenance near Bingham Road station 7450+00 (Photo 5), timber mat bridge fabric was torn station 7465+00 (Photos 9& 10), CFS needs maintenance near Bingham Road (Photo 12) and station 7232+00 (Photos 13 & 14) Section G.4.c. - Permittee has failed to modify your SWPPP when the SWPPP proves to be ineffective - water bar terminus at station 7084+00 has failed allowing release of sediment laden water to leave site; controls added to have proved inadequate to control flow. Inadequate number of water bars are installed on slope between 7084+00 to 7093+50 leading to continued failure of installed water bars. Section G.4.e.2. - Permittee has failed to properly implement controls: inadequate controls were installed near ROW entrance of Bingham Road station 7450+00 (Photo 11), water bars were improperly sloped near Bingham Road station 7450+00 (Photos 1-4), water bars lacked outlet near Bingham Road station 7450+00 (Photos 6-8), inadequate controls installed at base of fill slope at 7158+00 (Photos 17 & 18), inadequate number of water bars were installed between stations 7084+00 to 7093+50 (photos 21 & 22), inadequate controls were installed at water bar terminus at station 7084+00 (photos 23-30) and ditch checks were not installed in road side ditch below failed control at 7084+00. Section G.4.e.2.A.i.b. - Permittee has failed to provide interim stabilization on areas where construction activities have temporarily ceased for more than 21 days, specifically on waste piles near Bingham Road station 7465+37 (Photos 19 & 20), Bamboo Road station 7158+00 (Photos 15 & 16) and all other areas where applicable. Section G.4.e.2.A.ii.f. - Permittee has failed to protect fill slopes at station 7158+00 (Photos 15 & 16). Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device- sediment laden water from failed water bar

		terminus is conveyed through road side ditch into culverts to leave perimeter at GPS location 38˚5.84131'N, 80˚43.1339'W (photos 28-30).
Sept 11, 2018	W18-52-008-CP	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device at Station 900 where concentrated flow has over topped installed perimeter controls.
Sept 20, 2018	W18-52-009-CP	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls- Silt fence along access road 231.01 off Painters Run Road near station 10270 needs replaced. Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device- controls failed along access road 231.01 off Painters Run Road near station 10270.
Sept 25, 2018	W18-52-011-CP	Section G.4.e.2. - Permittee has failed to properly implement controls: inadequate perimeter controls installed at base of fill slope at station 550, which allowed sediment laden water to release into UNT of Little Kanawha River (photos 1-3). Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device into UNT of Little Kanawha River (photos 1-3).
Sept 25, 2018	W18-52-010-CP	Section G.4.e.2. - Permittee has failed to properly implement controls: inadequate controls at sumps near station 3625+00 and perimeter controls near station 3634+00 which allowed sediment laden water to leave site (photo 1-6). Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device in UNT of Knawls Creek.
Sept 26, 2018	W18-32-001-JTL	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Off-site sediment deposits in multiple locations were observed from station numbers 9915+00 through 9897+00. Section D.1-Permitte has failed to properly operate and maintain all facilities and systems: Evidence was observed that waterbar outlets where not being maintained to limit impacts off the ROW.
Sept 27, 2018	W18-32-002-JTL	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device: At station #9630+00 SLW was entering Stream S-A60. SLW was observed leaving portions of ROW and entering Indian Creek at the CR 23/9, SLW was observed leaving portions of ROW near Station numbers 9417+75, 9779+00 and 9778+00. Impacted areas include Stream SA60, Stream S-Z4, Stream S-Z5, Wetland W-22 and Indian Creek.

		Section G.4.e.2.D.i. - Permittee has failed to inspect and clean all adjacent public and private roads of debris originating from the construction site along CR 23/9 Ellison ridge road. Section D.1-Permitte has failed to properly operate and maintain all facilities and systems: Multiple waterbar outlets were being overwhelmed at the time of inspection.
Oct 2, 2018	W18-32-003-JTL	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device near station #9687. Off site sediment deposits were also observed at station numbers 9717+52 and 9724+51. Section G.4.e.2.A.ii.f. - Permittee has failed to protect fill slopes and stabilize channels at station #9687. Section D.1-Permitte has failed to properly operate and maintain all facilities and systems: Evidence was observed that BMP's were not being maintained to limit impacts off the ROW.
Oct 3, 2018	W18-52-012-CP	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls unacceptable amount of sediment was left in sumps after maintenance was performed at Painters Run Road station 10270.
Oct 10, 2018	W18-52-013-CP	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device at AR 210 and Painter's Run Road station 10270. Section G.4.e.2.D.i. - Permittee has failed to inspect and clean all adjacent public and private roads of debris originating from the construction site at AR 210 and Painter's Run Road station 10270.
Oct 25, 2018	W18-52-033-RDD	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device at Station 489 and 493. Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls stabilized diversion ditch near Mainion Run, perimeter controls near Sams run crossing, and waterbars and associated sumps near Sams Run.
Nov 27, 2018	W18-52-014-CP	Section G.4.e.2. - Permittee has failed to properly implement controls sufficient to prevent release of sediment laden water into Knawl's Creek. Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device entering Knawl's Creek.
Nov 30, 2018	W18-17-113-TJC	Section G.4.e.1.E.: Permittee has failed to provide an adequate stone access entrance/exit to reduce the tracking of sediment onto the public or private roads. Access Roads WV-HA – 31.1 off CR 50/4, WV-HA-29.04 off CR 50/5 and WV-HA-29.5 off CR 50/5 lacked a stable construction entrance and track out was noted on the adjacent public roadways as a result. Section G.4.e.2.D.i.: Permittee has failed to inspect and clean all adjacent public and private roads of debris originating from the

		construction site. The responsible party was making an attempt to clean track out debris from CR 50/5 at the time of inspection, however a film of sediment that originated from the site covered the road.
Feb 6, 2019	W19-32-002-JTL	Section G.4.e.2.A.ii.j - Permittee has failed to prevent sediment-laden water from leaving the site without going through an appropriate device at the MVP contractor yard in Beaver, WV. Sediment laden water was entering an UNT of Brammer Branch. Section D.1-Permitte has failed to properly operate and maintain all facilities and systems: Evidence was observed that BMP's were not being maintained in and along a drainage ditch that flowed through the yard and terminated upslope of the UNT of Brammer Branch causing Conditions Not Allowable. Section G.4. - Permittee has failed to comply with the General Permit and approved Storm Water Pollution Prevention Plan (SWPPP). Erosion control devices near station number 8816+00 are not in place as detailed by the SWPPP.
Feb 11, 2019	W19-34-003-JTL	Section G.4.e.2-Permittee failed to implement controls appropriate for the project. Evidence that enhanced erosion was occurring in the waterbar and slopes near station 6017+50 and at station 5960+50 erosion occurring on the slope and SLW being concentrated in wetland W-IJ-55 with the potential to migrate off site. Section D.1-Permitte has failed to properly operate and maintain all facilities and systems: Evidence was observed at station 5960+50 that BMP's were not being maintained causing Sediment Laden Water to be present in Wetland W-IJ-55. Section G.4.e.2.A.ii.e.-Permittee has failed to protect fill slopes by diverting runoff away from the slope to a stable channel. At Station 5960+50 above Wetland W-IJ-55 erosion was occurring on the slope and no diversion was in place to convey runoff to a stable channel.
Apr 22, 2019	W19-45-008-JTL	Section D.1.-Permittee failed to properly operate and maintain all systems of treatment: Controls implemented on slope above stream S-T35(A) had sediment build up in waterbars due to erosion occurring on slope. Section G.4.c-Permittee failed to modify the SWPPP by taking measures to ensure compliance with the permit: Waterbars were implemented incorrectly between stations 8438+00 through 8628+00. Section G.4.e.2.A.ii.j - Permittee failed to prevent sediment-laden water from leaving the site without going through an appropriate device at station #8633+71. Evidence of Sediment laden water and sediment deposits were observed to have impacted Stream S-T35(A) a tributary of Lick Creek. Section G.4.e.2.A.ii.f. - Permittee failed to protect fill slopes between station #8638+00 and #8628+00: Erosion on slope due to improper Waterbar implementation.

		Section G.4.e.2. - Permittee failed to properly implement controls appropriate for the project: Waterbars were installed to terminate on the ROW at station #8633+71 causing erosion to occur on the ROW and sediment to impact Stream S-T35(A).
May 13, 2019	W19-45-010-JTL	Section G.4. - Permittee has failed to comply with the General Permit and approved Storm Water Pollution Prevention Plan (SWPPP). Waterbar outlet controls near station #8399+10 were not in place at the time of installation as detailed by the SWPPP.
May 24, 2019	W19-45-015-JTL	Section G.4.c.- Permittee has failed to modify the Storm Water Pollution Prevention Plan (SWPPP): Perimeter controls were not in place at the base of a soil pile allowing sediment deposits past the LOD at station 8387+96.
May 29, 2019	W19-04-013-JTL	Section D.1-Permitte has failed to properly operate and maintain all facilities and systems: Evidence was observed at station 4031+00 and 4027+00 that controls were not being maintained causing Sediment to be transported past the LOD. Section G.4.e.2-Permittee has failed to implement controls appropriate for the project: Evidence that enhanced erosion was occurring on ROW, in Waterbars and slopes near station 4031+00 and 4027+00 was observed. Section G.4.e.2.A.ii.e.-Permittee has failed to protect fill slopes by diverting runoff away from the slope to a stable channel: At Stations 4030+00 and 4027+00 waterbars were terminating onto the fill slope causing controls to be overwhelmed along the perimeter and sediment to be transported past the LOD. Section G.4.e.2.A.ii.j.-Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: Sediment deposits from SLW leaving the site was observed at station No.'s 4030+00 and 4027+00.
May 30, 2019	W19-34-014-JTL	Section D.1-Permittee has failed to properly operate and maintain all facilities and systems: Evidence was observed at stations 6474+16, 6478+48, 6508+30, 6510+10 and 6514+60 that controls were not being maintained causing Sediment to be deposited past the LOD. Section G.4-Permittee has failed to follow approved SWPPP: At station 6945+00 ROW diversion had not been installed per SWPPP. Station No. 6497+50 Perimeter controls not installed per SWPPP. Section G.4.e.2.A.i.d. - Permittee has failed to stabilize clean water diversions prior to becoming functional: Above stream S-EE1 and at station 6485+10 clean water diversions had not been stabilized prior to becoming functional. Section G.4.e.2-Permittee failed to implement controls appropriate for the project: Controls had not been enhanced and/or implemented at stations 6508+30, 6510+40 and 6514+60 to eliminate sediment from being deposited past the LOD. Section G.4.e.2.A.ii.j-Permittee has allowed sediment laden to leave the site without going through and appropriate device: At

		station No.'s 6508+30, 6510+40 and 6514+60 evidence that SLW had left the site was observed.
June 5, 2019	W19-51-015-JTL	Section D.1-Perimittee has failed to at all times properly operate and maintain all systems of treatment and control: Construction entrance at Rt 82 crossing was not maintained to prevent sediment laden water and sediment to be deposited past the permitted LOD. Section G.4.e.2.A.ii.j_Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: At the Route 82 crossing sediment deposits and sediment laden water were observed past the LOD. Sediment deposits were observed in the roadside ditch that paralleled Route 28 as well as downslope past a culvert outlet approximately 500 feet past the LOD.
June 12, 2019	W19-32-17-JTL	Section G.4.e.2.A.ii.j-Permitee has allowed sediment laden to leave the site without going through and appropriate device: At station No. 9780+00 evidence that SLW had left the site was observed due to a significant amount of sediment deposits and scouring being present past controls and LOD. At the Dargo silt fence downslope of station No. 9780+00 sediment deposits was observed past controls and the LOD.
June 19, 2019	W19-51-018-JTL	Section G.4.e.2.A.ii.j-Permittee has allowed sediment laden to leave the site without going through and appropriate device: At station No. 6587+00 evidence was observed that sediment laden water had left the site due to sediment deposits being present past controls and the LOD above Stream S-L38.
July 9, 2019	W19-45-021-JTL	Section G.4.e.2.A.ii.j- allowed sediment laden to leave the site without going through and appropriate device: At station No. 8634+00 evidence that SLW had left the site was observed due to impacts to Stream S-T35A and impacts off site past controls and LOD.
July 18, 2019	W19-51-024-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: Along AR-MVP-WB-119 multiple controls had not been maintained allowing sediment to be deposited past the LOD. At station No. 4559+96 sediment deposits were observed in a ditch that was located along AR-WB-119. At station No.'s 4559+96 and 4539+00 controls had not been maintained leading to controls becoming overwhelmed with sediment and sediment laden water being observed past the LOD. Section G.4.e.2.A.ii.j-Permittee has allowed sediment laden to leave the site without going through and appropriate device: At station No. 4559+96 and at several locations along AR-MVP-WB-119; evidence was observed that sediment laden water had left the site due to sediment deposits being present past controls and the LOD downslope of AR-MVP-WB-119. At and near station No. 4539+00 SLW was observed leaving the ROW; flowing past

		controls and entering the roadside ditch that flows downslope towards the ROW crossing with AR-MVP-WB-119 and was conveying downslope through a culvert inlet/outlet approximately 400 feet past the LOD towards Fall Run a tributary of the Holly River.
Aug 1, 2019	W19-04-025-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: At Access Roads BR-095, BR-097 and BR-099 controls had not been maintained and at station No.'s 3831+00 through 3829+00 controls had not been implemented correctly and or were not being maintained causing erosion and sediment to be deposited past the LOD. Section G.4.e.2.A.ii.f. - Permittee has failed to protect fill slopes: At station No.'s 3831+00 through 3829+00 fill slope erosion was occurring between waterbars causing controls to be overwhelmed and sediment deposits to be present in the ditch that parallel's US 19/HWY 4 and past the LOD at station No. 3831+00. Section G.4.e.2. - Permittee has failed to implement controls appropriate for the project: At station No. 3831+00 through 3829+00 waterbars were terminating onto the ROW causing erosion to occur on the slope that led to control failures above US19/Hwy4. Section G.4.e.2.A.ii.j.-Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: Sediment deposits were observed past the LOD at station No. 3831+00 and in a roadside ditch that parallels US 19/HWY 4 at station No. 3829+00. At Access Road MVP-BR-097 sediment deposits were present past the LOD. In the Roadside ditch near station No. 3897+75 downslope of MVP-BR- 099 sediment deposits were observed above Stream S-K34/35. Sediment deposits were observed past the LOD due to a Waterbar failure South of BR-099 on MVP ROW. Sediment deposits were present past LOD at BR- 097.
Aug 7, 2019	W19-45-026-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: At Station No.'s 8951+00 through 8956+00 erosion was present in waterbars. Several Waterbar outlets had no controls present casing erosion to occur below the termini. Sumps that were present below the Waterbar termini were overwhelmed with sediment and were not functioning as designed. Erosion present on slopes near station No. 8946+00 causing controls to be overwhelmed with sediment and not functioning as designed. Section G.4.e.2.A.ii.f. - Permittee has failed to protect fill slopes: At station No.'s 8951+00 through 8956+00 waterbars were terminating onto a steep slope causing erosion and sediment deposits to overwhelm controls leading to sediment deposits to be present past the LOD. At station No. 8946+00 erosion was present in multiple locations on the fill slope overwhelming perimeter controls.

		Section G.4.e.2.A.ii.j.-Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: Sediment deposits were observed past the LOD at station No. 8956+00.
Aug 14, 2019	W19-04-073-TJC	Section D.1.- Mountain Valley Pipeline LLC. failed to operate and maintain all erosion control devices. A culvert on access road MVP-BR-092.01 was plugged and in need of maintenance. This allowed concentrated flow stormwater to flow from the top of the slope to the base of the slope which caused offsite sediment deposits. A water bar terminus BMP in inspected area 3 (adjacent to 3760+00) was inundated with sediment and in need of maintenance. Section G.4.e.2.A.ii.j.- Mountain Valley Pipeline LLC. failed to prevent sediment-laden water from leaving the site without going through an appropriate device. This deficiency was a result of poorly maintained BMPs which allowed sediment laden water to bypass treatment. Section B- Mountain Valley Pipeline LLC. failed to comply with the General Permit and approved Storm Water Pollution Prevention Plan (SWPPP). The approved SWPPP indicates the need for ditch checks in the upslope ditch of all access roads as well as rock outlet protection and a sediment control device placed at the outlets of the installed culverts. The access road lacked the proposed ditch checks, rock outlet protection and an installed sediment control device at the outlet of the installed culverts.
Aug 14, 2019	W19-21-074-TJC	Section G.4.e.2.- Mountain Valley Pipeline LLC. failed to properly implement controls. Water bars that were improperly installed were noted in areas scattered throughout the inspected area. Water bars that were installed at steep angles (> 12%) were noted. Water bars that were installed at varying angles were noted. Water bars that did not extend across the entire disturbed right of way and terminated prior to the installed perimeter silt fence were noted. Water bars that discharged stormwater over unprotected fill slopes were noted. Six improperly installed water bars on the project area adjacent to 2768+00 were discharging into a stabilized diversion. The installed diversion carried the stormwater to the base of the hill where it was being treated with two pieces of perimeter silt fence. The amount of stormwater being directed at the installed perimeter controls overwhelmed the BMPs and caused a significant amount of offsite sediment deposits adjacent to Cove Run. Improperly installed timber mat equipment bridges were noted at the Clover Run, Oil Creek and Cove Run (S-K-45) crossings. The installed perimeter controls were not properly merged with the installed timber mat equipment bridges which caused areas where sediment laden water could bypass treatment. An improperly installed straw bale dewatering structure was noted in the Cove Run watershed adjacent to

		2770+00. The dewatering structure had a layer of impermeable plastic inside of the geotextile fabric which caused the structure to not function as designed. Section D.1.- Mountain Valley Pipeline LLC. failed to operate and maintain all erosion control devices. Perimeter controls that were in need of maintenance were noted in areas scattered throughout the inspected area. This deficiency caused sediment laden water to bypass treatment and led to offsite sediment laden water adjacent to 2919+50. The offsite sediment laden water adjacent to 2919+50 occurred due to a dewatering operation at the time of inspection. Section G.4.e.2.A.ii.j. - Mountain Valley Pipeline LLC. failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Sediment laden water bypassed treatment due to improperly installed BMPs and poorly maintained BMPs.
Aug 26, 2019	W19-09-028-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: At station No.'s 1833+50 and 1730+00 controls were not being maintained leading to perimeter controls being overwhelmed with sediment causing them not to function as designed. Section G.4.e.2.A.ii.j.-Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: Evidence that Sediment Laden water left the site was observed due to sediment deposits being observed past the LOD due to control failures at Station No.'s 1833+00 and 1730+00.
Sept 9, 2019	W19-21-029-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: At the Route 21/Indian Fork crossing (Station No. 3089+00) controls had not been maintained or enhanced allowing sediment laden water to leave the ROW and enter a roadside ditch that conveys to Indian Fork (S-H159). Section G.4.e.2.A.ii.j.-Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: Evidence that Sediment Laden water left the site was observed due to sediment deposits being observed past the LOD in the roadside ditch that parallels CR21 and coveys to Indian Fork (S-H159)/(Station No. 3089+00).
Sept 11, 2019	W19-17-030-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: At station No. 645+35 the dewatering structure used for the Stream S-B75 bore was not being maintained and operated properly causing the structure to not function as designed causing conditions not allowable in Stream S-B75 (Goose Run).

		Section G.4.e.2.A.ii.j.-Permittee has failed to prevent sediment laden water from leaving the site without going through an appropriate device: Sediment Laden water was observed leaving a dewatering structure used for the boring under Stream S-B75 (Goose Run). Section G.4.e.2.A.i.b. - Permittee has failed to provide interim stabilization on areas where construction activities have temporarily ceased for more than 21 days: At station No. 645+00 slopes had not been reseeded or re-stabilized after winter stabilization measures were no longer adequate.
Nov 7, 2019	W19-04-032-JTL	Section F.1.- Permittee failed to immediately notify WVDEP of impacts to a water of the state (Elliott Run/Stream S-L49) pursuant to 47CSR11-2 (Special Rules) of the West Virginia Legislative Rues promulgated pursuant to Chapter 22, Article 11. Section G.4.e.2. - Permittee has failed to implement controls appropriate for the project: A Waterbar above the slip that occurred and impacted Elliott Run at station No. 3946+00 was terminating onto the ROW and had no outlet controls present.
Dec 12, 2019	W19-45-034-JTL	Section D.1. - Permittee has failed to properly operate and maintain all systems of treatment and controls: At station No. 8433+50 run on from a seep and improper tracking of the slope caused downslope controls to be overwhelmed with SLW/Sediment deposits leading to SLW to be observed past the LOD and controls.
Aug 11, 2020	W20-34-003-JTL	Section D.1. - Permittee failed to properly operate and maintain all systems of treatment and controls: From station No.'s 6482+90 (Rt.39 crossing) to No. 6485+50 reseeding had not occurred after temporary seed mixes either didn't germinate and or dyed off having less than 70 percent coverage at the time of inspection. Controls in waterbars and fill slopes had been overwhelmed with sediment leading to sediment deposits being observed past the LOD near station No. 6485+50. Erosion was occurring on fill slopes between Station No.'s 6482+90 through 6485+50. Waterbars were terminating onto fill slopes causing enhanced erosion to occur. G.4.c. - Permittee failed to modify the SWPPP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activities. At stations No. 6482+90 through 6485+50 waterbars were terminating onto fill slopes lacking either slope drains and/or waterbar sumps at the outlets. G.4.e.2.A.i.c. – Permittee failed to reseed where the seed has failed to germinate adequately (uniform perennial vegetative cover with a density of 70%) within 30 days after seeding and mulching from Station No.'s 6482+90 through 6485+50 at the Route 39 crossing and fill slopes South of the crossing at Station No. 6485+50.

		G.4.e.2.A.ii.f. Permittee failed to protect fill slopes by measures used to divert runoff away from fill slopes to conveyance measures such as pipe slope drains or stable channels. At station No. 6482+90 fill slopes had rill and gully erosion present leading to controls being overwhelmed and sediment deposits present pas the LOD. G.4.e.2.A.ii.j. – Permittee allowed Sediment laden Water to leave the site without going through an appropriate best management practice. At station No. 6485+50 sediment deposits were observed past the LOD.
Aug 17, 2020	W20-34-004-JTL	Section D.1. - Permittee failed to properly operate and maintain all systems of treatment and controls: At Station No. 6613+00 a Waterbar was terminating onto the fill slope causing significant erosion downslope of the outlet leading to controls needing maintained and or enhanced. G.4.c.- Permittee failed to follow and or modify the SWPPP when it proved to be ineffective. At Station No. 6613+00 A Waterbar was terminating onto the slope causing significant erosion. Run-on was also leading to erosion at the side cut casing sediment to be deposited into the downslope Waterbar leading to concentrated flow in downslope waterbars. G.4.e.2.A.i.c. – Permittee failed to reseed where the seed has failed to germinate adequately (uniform perennial vegetative cover with a density of 70%) within 30 days after seeding and mulching at Station No. 6613+00. G.4.e.2.A.ii.f. Permittee failed to protect fill slopes by measures used to divert runoff away from fill slopes to conveyance measures such as pipe slope drains or stable channels. At station No. 6613+00 fill slopes had erosion present due to a Waterbar terminating onto the slope. Significant erosion was present leading to sediment being deposited into waterbars and sumps at the Waterbar outlets above Stream S-L35. Run on was causing erosion leading to sediment being deposited into waterbars downslope of the side cut.
Sept 9, 2020	W20-52-065-RDD	Section G.4.e.2.A.ii.j - MOUNTAIN VALLEY PIPELINE, LLC has failed to prevent sediment-laden water from leaving the site without going through an appropriate device. Sediment laden water was leaving the site near Stout Run Road through silt sock. Section D.1. - MOUNTAIN VALLEY PIPELINE, LLC has failed to properly operate and maintain all systems of treatment and controls- Sediment laden water was leaving the site near Stout Run Road through silt sock.
Sept 16, 2020	W20-34-005-JTL	Section D.1.- Permittee failed to properly operate and maintain all systems of treatment and controls: At Station No. 6657+00 through 6450+76 and at Stations 6707+00 through 6698+00 Erosion was occurring between and within the waterbars on slopes conveying run off onto fill slopes causing erosion downslope of the Waterbar outlets. Controls were either not

		being implemented to reduce sheet flow rates and/or if present not being maintained. G.4.e.2.A.i.c. – Permittee failed to reseed where the seed has failed to germinate adequately (uniform perennial vegetative cover with a density of 70%) within 30 days after seeding and mulching at Station No.’s 6657+00 through 6450+76 and at Stations 6707+00 through 6698+00. Reseeding had not occurred in these areas leading to slopes becoming destabilized causing erosion to occur. G.4.e.2.A.ii.f. Permittee failed to protect fill slopes by measures used to divert runoff away from fill slopes to conveyance measures such as pipe slope drains or stable channels. At station No.’s 6657+00 through 6450+76 and at Stations 6707+00 through 6698+00 fill slopes had erosion present due to lack of stabilization measures being implemented within the LOD.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 20

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Virginia Erosion and Sediment Control Handbook

Third Edition

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*Note: There is an index at the beginning of each chapter for further reference.

FOREWARD

Regulatory authority for the Erosion & Sediment Control Program was transferred to the Department of Environmental Quality on July 1, 2013. Anywhere in the handbook where the Department of Conservation or DCR are referenced, the reference should be replaced; respectively, with the Department of Environmental Quality or DEQ. Additionally, anywhere Soil and Water Conservation Board or "Board" are reference in the handbook, the reference should be replaced with State Water Control Board.

This handbook replaces the 1980 Virginia Erosion and Sediment Control Handbook and establishes new standards and guidelines for the control of soil erosion and sedimentation on "land-disturbing activities" (as defined in Section 62.1-44.15:51, Code of Virginia). The authority for the Department of Environmental Quality to undertake this handbook revision is provided under Section 62.1-44.15:52 of the Code.

This handbook is intended to serve as a technical guide in the effort to meet the requirements dictated by the Virginia Erosion and Sediment Control Law and the Virginia Erosion and Sediment Control Regulations *(9VAC25-840; previously 4VAC50-30)*. The use of the words such as "shall," "will," and "must" within the design standards in Chapter 3 is meant to emphasize the directions which will ensure that the control measure or design procedure will serve its intended purpose. The remaining chapters and sections of this handbook contain guidelines and support materials to assist users in the implementation of the technical standards in accordance with the provisions of the law and regulations.

Any questions or comments concerning this handbook or the Virginia Erosion and Sediment Control Program in general may be directed to the Virginia Department of Environmental Quality.

CHAPTER 1

Introduction

CHAPTER 1

INTRODUCTION

While all lands erode, not all land can be considered a source of sediment pollution. There has always been a certain amount of erosion that occurs naturally. However, major problems can occur when large amounts of sediment enter our waterways. This accelerated erosion is most often caused by surface mining, poorly managed croplands, construction sites, urban/suburban stream banks, and logging roads.

This publication focuses on one specific sediment pollution source: construction sites. The typical construction site erodes at a rate of up to 100,000 tons per square mile per year. This rate is 200 times greater than erosion from cropland and 2000 times greater than erosion from woodland (48).

The successful mitigation of soil losses on urban construction sites results in the reduction of on-site and off-site environmental damage and substantial savings to developers and their subcontractors. When implemented properly, erosion and sediment control (E&S) measures can control soil movement to a point where there is only minimal loss of this very precious resource; no appreciable damage to off-site receiving channels; enhanced project aesthetics before, during and after development; and fewer complaints from concerned government agencies and citizens. Notably, there is a state law and regulation which dictate the use of such measures.

A function of the Virginia Erosion and Sediment Control Handbook (hereafter referred to as "handbook") is to establish minimum design and implementation standards for these measures in the effort to control erosion and sedimentation from land-disturbing activities in Virginia. (The term "land-disturbing activity" in this book refers to the definition found in Section 10.1-560 in the Virginia Erosion and Sediment Control Law (VESCL) located in Chapter 8). The other function of the handbook is to provide guidelines for the implementation of those standards in accordance with the VESCL and the Virginia Erosion and Sediment Control Regulations (VESCR).

At the time the original handbook was developed in 1974, the emphasis was on local program establishment. That document served as a basis for the development and adoption of local E&S programs throughout the state. Once the program establishment phase had been completed, the emphasis was shifted to program implementation.

The handbook was revised in 1980 to improve the effectiveness of the statewide E&S program. This latest revision provides updated information on E&S measures, engineering methods, law and regulation changes and stresses proper program implementation to further enhance the state and local attempts to mitigate sediment loss as a result of urban construction.

HANDBOOK OBJECTIVES

* Revised Standards and Specifications: New conservation practices and methods have been introduced as well as improved criteria for designing and implementing existing practices. Site planners and engineers need to be aware of the most recent technological developments in the field to improve the effectiveness of their erosion and sediment control design.

* Present an Acceptable Level of Control: The handbook contains assistance for site planners and plan reviewers on the selection of conservation practices in order to achieve an acceptable level of control on a project. Specific guidance is also provided in the application of conservation practices.

* Address Stormwater Management: The handbook addresses post-development stormwater considerations associated with runoff from regulated activities. The design of a stormwater management system should receive high priority in site planning. Requirements for designing such systems which minimize adverse downstream effects of increased runoff are contained in the VESCR in Minimum Standard (MS) #19, and methods for meeting those requirements are contained within. Off-site erosion, flooding and nonpoint source pollution due to urban development in a watershed have become significant statewide problems which must be addressed.

* Compliance with Section 319 of the Clean Water Act of 1987 and the Virginia Nonpoint Source Pollution (NPS) Management Program: Since the development of the original handbook, Section 319 of the Federal Clean Water Act was created and dictated the creation of a Virginia NPS Management Program. The Virginia NPS Management Program identifies statewide programs designed to quantify, control and limit the detrimental effects of nonpoint source pollution. The state's Erosion and Sediment Control Program has been placed under the category of urban nonpoint source pollution control and will strive to meet the goals noted in the program. The Virginia Erosion and Sediment Control Handbook is one of three proposed urban nonpoint source pollution control manuals. The other two volumes will be developed in the near future.

* Make the Handbook More Usable: It is extremely important that the people who administer the VESCL be provided with useful information which is written in terms they can easily understand and pass on to those responsible for design or those involved in site implementation of E&S. While a certain amount of technical expertise is required to adequately prepare or review E&S plans and specifications, technical material which is presented in a manner which is more understandable tends to be more readily accepted and adhered to by the public.

* Provide Revised Information: Amendments to the VESCL have required the replacement of outdated and obsolete guidelines.

MAJOR CHANGES

The 1992 revision of the handbook is intended to incorporate changes in the VESCL that have been made in the last decade. In September of 1990, the VESCR were adopted and took the place of the 14 "General Criteria" which appeared in the 1980 edition. The format and style of the handbook have been maintained; however, an effort has been made to refine each chapter and include language that accurately reflects the parameters set forth by the VESCR.

EFFECT OF HANDBOOK REVISION ON LOCAL PROGRAMS

Local programs should benefit from the introduction of the VESCR into the handbook. The VESCR contain the "Minimum Standards" that more clearly define the intent of the VESCL and provide the framework for greater consistency among local programs in terms of administration, implementation and enforcement.

CHANGES IN CONSERVATION PRACTICES

Technical advances of the past decade have prompted the addition of new practices for the control of erosion and sedimentation and the refinement of existing practices. Also, improvements to some of the engineering methods used in the previous handbook have resulted in changes when appropriate.

HOW TO USE THIS HANDBOOK

This handbook is intended to serve as a technical guide in the effort to meet the requirements dictated by the VESCL and the VESCR. The use of words such as "shall," "will," and "must" within design or implementation standards (notably in Chapter 3) is meant to emphasize the directions which will ensure that the control measure or design procedure will serve its intended purpose. Innovative modifications to the control measures or design procedures are acceptable and encouraged, especially if they improve upon sediment-loss mitigation. However, <u>designers and plan reviewers should be sure that the modified practice or procedure will be at least as successful as those noted in this handbook in meeting the intent of the VESCL and the VESCR</u>.

ABBREVIATIONS/ACRONYMS

The following terms are abbreviated or appear as acronyms in the handbook:

Abbreviation/ Acronym	Term	Abbreviation/ Acronym	Term
approx.	approximate	N.C.	North Carolina
A.S.T.M.	American Society for Testing and Materials	pt.	point
avg.	average	R/W	right-of-way
cfs	cubic feet per second	sq.	square
csm/in.	cubic feet per second, per square mile, per inch	spec.	specification
corp.	corporation	std.	standard
cu.	cubic	tol.	tolerance
dept.	department	typ.	typical
dia.	diameter	USDA-SCS	U.S. Department of Agriculture, Soil Conservation Service
ed.	edition	USDI	U.S. Department of the Interior
elev.	elevation	Va. DSWC	Virginia Division of Soil and Water Conservation
E&S	erosion and sediment control	VCIA	Virginia Crop Improvement Association
fps	feet per second	VDOT	Virginia Department of Transportation
gal.	gallon	VESCL	Virginia Erosion and Sediment Control Law
inc.	incorporated	VESCR	Virginia Erosion and Sediment Control Regulations
lbs.	pounds	VHTRC	Virginia Highway and Transportation Research Council
max.	maximum	vol.	volume
min.	minimum	VPI&SU	Virginia Polytechnic Institute and State University
min	minute	VTM	Virginia Testing Methods
mm.	milimeter	yd.	yard
N/A	not applicable	yr.	year

FUTURE UPDATES

It is envisioned that modifications to the handbook will be necessary from time to time. The handbook has been designed to accommodate inclusion of information as needed.

CHAPTER 2

Erosion and Sediment Control Principles, Practices and Costs

INDEX

EROSION AND SEDIMENT CONTROL

PRINCIPLES, PRACTICES AND COSTS

CHAPTER 2

EROSION AND SEDIMENT CONTROL PRINCIPLES, PRACTICES AND COSTS

This chapter contains basic information on the principles, practices and costs of erosion and sediment control on urban land-disturbing projects. It is divided into three parts.

PART I - EROSION AND SEDIMENT CONTROL PRINCIPLES: Information on the causes and effects of erosion and sedimentation is presented along with a discussion of basic conservation principles for effectively controlling the problem.

PART II - OVERVIEW OF PRACTICES: The nature, purpose and distinguishing features of erosion and sediment control practices are briefly summarized to provide users with a quick reference and broad basis of comparison.

PART III - COSTS: Information on estimating the cost of implementing various vegetative and structural erosion and sediment control practices is provided.

WALL CHART: A large, folded wall chart is contained in a pocket at the end of this chapter to provide users with a single-sheet reference to all of the erosion and sediment control practices found within. This chart consolidates relevant information concerning the selection and application of the practices and presents a unified coding system for designers who will specify the practices on erosion and sediment control plans.

PART I

EROSION AND SEDIMENT CONTROL PRINCIPLES

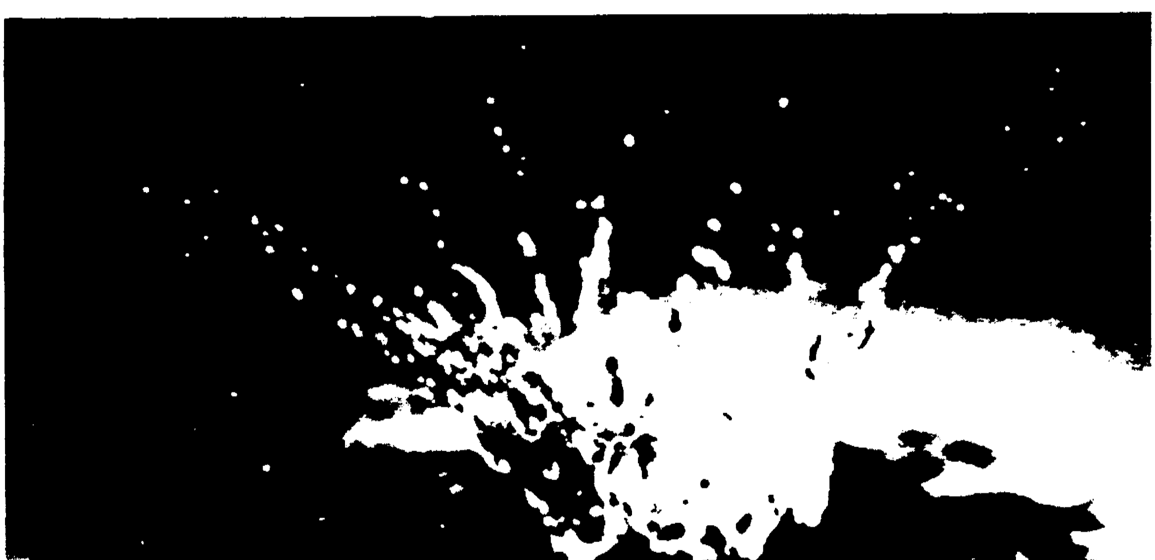
THE EROSION PROCESS

Soil erosion is the process by which the land's surface is worn away by the action of wind, water, ice and gravity. Natural, or geologic erosion has been occurring at a relatively slow rate since the earth was formed, and is a tremendous factor in creating the earth as we know it today. The picturesque mountains of the west, the rolling farmlands of the Piedmont, and the productive estuaries of the Coastal Zone are all products of geologic erosion and sedimentation in Virginia. Except for some cases of shoreline and stream channel erosion, natural erosion occurs at a very slow and uniform rate and remains a vital factor in maintaining environmental balance.

Water-generated erosion is unquestionably the most severe type of erosion, particularly in developing areas; it is, therefore, the problem to which this handbook is primarily addressed. It is helpful to think of the erosive action of water as the effects of the energy developed by rain as it falls, or as the energy derived from its motion as it runs off the land surface. The force of falling raindrops is applied vertically, and force of flowing water is applied horizontally. Although the direction of the forces created is different, they both perform work in detaching and moving soil particles.

Water-generated erosion can be broken down into the following types:

Raindrop erosion is the first effect of a rainstorm on the soil. Raindrop impact dislodges soil particles and splashes them into the air (see picture below). These detached particles are then vulnerable to the next type of erosion.



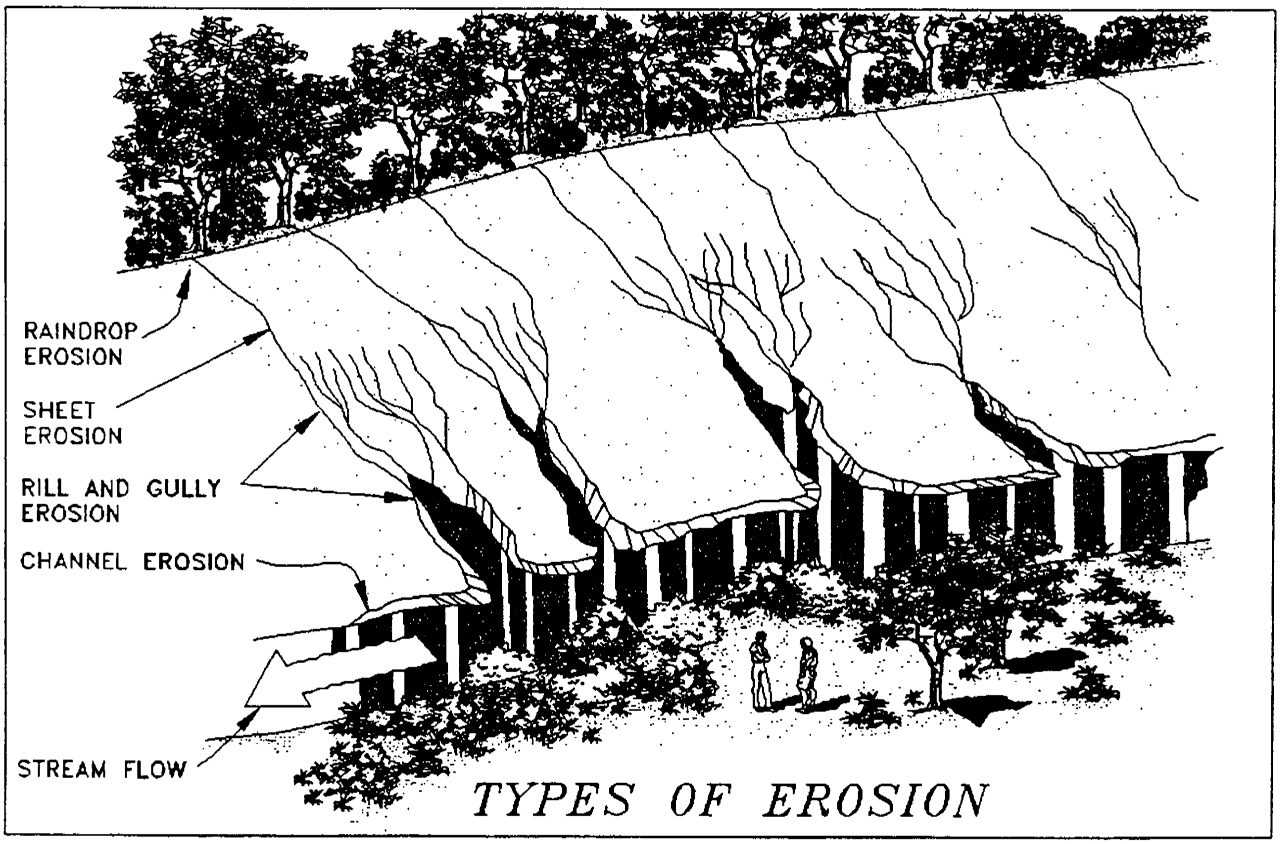
Source: Soil Conservation Society of America

<u>Sheet erosion</u> is the erosion caused by the shallow flow of water as it runs off the land. These very shallow moving sheets of water are seldom the detaching agent, but the flow transports soil particles which are detached by raindrop impact and splash. The shallow surface flow rarely moves as a uniform sheet for more than a few feet on land surfaces before concentrating in the surface irregularities.

<u>Rill erosion</u> is the erosion which develops as the shallow surface flow begins to concentrate in the low spots of the irregular contours of the surface. As the flow changes from the shallow sheet flow to deeper flow in these low areas, the velocity and turbulence of flow increase. The energy of this concentrated flow is able to both detach and transport soil materials. This action begins to cut small channels of its own. Rills are small but well-defined channels which are at most only a few inches in depth. They are easily obliterated by harrowing or other surface treatments.

<u>Gully erosion</u> occurs as the flow in rills comes together in larger and larger channels. The major difference between gully and rill erosion is a matter of magnitude. Gullies are too large to be repaired with conventional tillage equipment and usually require heavy equipment and special techniques for stabilization.

<u>Channel erosion</u> occurs as the volume and velocity of flow causes movement of the stream bed and bank materials. Plate 2-1 illustrates the five stages of erosion.



Source: <u>Michigan Soil Erosion and Sedimentation Guidebook</u> Plate 2-1

FACTORS INFLUENCING EROSION

The erosion potential of any area is determined by four principal factors: the characteristics of its soil, its vegetative cover, its topography and its climate. Although each of these factors is discussed separately herein, they are inter-related in determining erosion potential.

Soil characteristics which influence the potential for erosion by rainfall and runoff are those properties which affect the infiltration capacity of a soil and those which affect the resistance of the soil to detachment and being carried away by falling or flowing water. The following four factors are important in determining soil erodibility:

1. Soil texture (particle size and gradation)
2. Percentage of organic content
3. Soil structure
4. Soil permeability

Soils containing high percentages of fine sands and silt are normally the most erodible. As the clay and organic matter content of these soils increases, the erodibility decreases. Clays act as a binder to soil particles, thus reducing erodibility. However, while clays have tendency to resist erosion, once eroded, they are easily transported by water. Soils high in organic matter have a more stable structure which improves their permeability. Such soils resist raindrop detachment and infiltrate more rainwater. Clear, well-drained and well-graded gravel and gravel-sand mixtures are usually the least erodible soils. Soils with high infiltration rates and permeabilities either prevent or delay and reduce the amount of runoff.

Vegetative cover plays an extremely important role in controlling erosion as it provides the following five benefits:

1. Shields the soil surface from raindrop impact
2. Root systems hold soil particles in place
3. Maintains the soil's capacity to absorb water
4. Slows the velocity of runoff
5. Removes subsurface water between rainfalls through the process of evapotranspiration

By limiting and staging the removal of existing vegetation and by decreasing the area and duration of exposure, soil erosion and sedimentation can be significantly reduced. Special consideration should be given to the maintenance of existing vegetative cover on areas of high erosion potential such as moderately to highly erodible soils, steep slopes, drainageways, and the banks of streams.

Topography. The size, shape, and slope characteristics of a watershed influence the amount and rate of runoff. As both slope length and gradient increase, the rate of runoff increases and the potential for erosion is magnified. Slope orientation can also be a factor in determining erosion potential. For example, a slope that faces south and contains droughty soils may have such poor growing conditions that vegetative cover will be difficult to re-establish.

Climate. The frequency, intensity, and duration of rainfall are fundamental factors in determining the amounts of runoff produced in a given area. As both the volume and velocity of runoff increases, the capacity of runoff to detach and transport soil particles also increases. Where storms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature, as well as variations in rainfall, help to define the high erosion risk period of the year. When precipitation falls as snow, no erosion will take place. However, when the temperature rises, melting snow adds to runoff, and erosion hazards are high. Because the ground is still partially frozen, its absorptive capacity is reduced. Frozen soils are relatively erosion-resistant. However, soils with high moisture content are subject to uplift by freezing action and are usually very easily eroded upon thawing.

SEDIMENTATION

Normally, runoff builds up rapidly to a peak and then diminishes. Excessive quantities of sediment are derived by erosion, principally during the higher flows. During lower flows, as the velocity of runoff decreases, the transported materials are deposited to be picked up by later peak flows. In this way, sediments are carried downslope, or downstream, intermittently and progressively from their source or point of origin. A study of sedimentation due to highway construction and land development in Virginia, for instance, indicated that 99 percent of the sediment discharge occurred during periods of high flow which took place during only three percent of the period of measurement (77).

SEDIMENT POLLUTION AND DAMAGE

Sediment pollution is soil out of place. It is a product of the activities of man which lead to severe soil loss. When these large quantities of soil enter our waters, then sediment pollution occurs.

Over four billion tons of sediment are estimated to reach the ponds, rivers, and lakes of our country each year, and approximately one billion tons of this sediment is actually carried all the way to the ocean. Approximately 10 percent of this amount is contributed by erosion from land undergoing highway construction or land development (73). Although these latter quantities may appear to be small compared to the total, they could represent more than one-half of the sediment load carried by many streams draining small subwatersheds which are undergoing development (81).

Excessive quantities of sediment cause costly damage to waters and to private and public lands. Obstruction of stream channels and navigable rivers by masses of deposited sediment reduces their hydraulic capacity which, in turn, causes an increase in subsequent flood crests and a consequent increase in the frequency of damaging storm events.

Sediment fills drainage channels, especially along highways and railroads, and plugs culverts and storm drainage systems, thus necessitating frequent and costly maintenance. Municipal and industrial water supply reservoirs lose storage capacity, the usefulness of recreational impoundments is impaired or destroyed, navigable channels must be continually dredged and the cost of filtering muddy water preparatory to domestic or industrial use becomes excessive - and sometimes exorbitant. The added expense of water purification in the United States, because of sedimentation, amounts to millions of dollars each year.

In an aquatic environment, the general effect of fine-graded sediments such as clays, silts, and fine sands is to reduce drastically both the kinds and the amounts of organisms present. Sediments alter the existing aquatic environment by screening out sunlight and by changing the rate and the amount of heat radiation. Particles of silt settling on stream and lake bottoms form a blanket which creates a hostile environment for the organisms living there and literally smothers many of them and their eggs. The disastrous effect (upon commercially valuable finfish and shellfish populations) of excessive amounts of silt entering estuarine waters was widely publicized in the case of the Chesapeake Bay following flooding of its main tributary, the Susquehanna River, caused by Hurricane "Agnes" in 1972.

Coarser-grained materials also blanket bottom areas to suppress aquatic life found in these areas. Where currents are sufficiently strong to move the bedload, the abrasive action of these materials in motion accelerates channel scour and has an even more severely deleterious effect upon aquatic life. The aesthetic attraction of many steams, lakes, and reservoirs used for swimming, boating, fishing, and other water-related recreational activities has been seriously impaired or destroyed by bank cutting and channel scour - accelerated by a higher flood stages induced by sedimentation.

EROSION AND SEDIMENT HAZARDS ASSOCIATED WITH LAND DEVELOPMENT

The principal effect land development activities have on the natural or geologic erosion process consists of exposing disturbed soils to precipitation and to surface storm runoff. Shaping of land for construction or development purposes alters the soil cover and the soil in many ways, often detrimentally affecting on-site drainage and storm runoff patterns and eventually the off-site stream and streamflow characteristics. Protective vegetation is reduced or removed, excavations are made, topography is altered and the removed soil material is stockpiled - often without protective cover. In effect, the physical properties of the soil itself are changed. The development process is such that many citizens of a locality may be adversely affected even by development of areas of only limited size. Uncontrolled erosion and sediment from these areas often causes considerable economic damage to individuals and to society, in general. Surface water pollution, channel and reservoir siltation and damage to public facilities, as well as to private property, are some of many examples of problems caused by uncontrolled erosion and sedimentation.

Potential hazards associated with development include:

1. A large increase in areas exposed to storm runoff and soil erosion.

2. Increased volumes of storm runoff, accelerated soil erosion and sediment yield and higher peak flows caused by:

a. Removal of existing protective vegetative cover.
b. Exposure of underlying soil or geologic formations which are less pervious and/or more erodible than original soil surface.
c. Reduced capacity of exposed soils to absorb rainfall due to compaction caused by heavy equipment.
d. Enlarged drainage areas caused by grading operations, diversions, and street constructions.
e. Prolonged exposure of unprotected disturbed areas due to scheduling problems and/or delayed construction.
f. Shortened times of concentration of surface runoff caused by altering steepness, distance and surface roughness and through installation of "improved" storm drainage facilities.
g. Increased impervious surfaces associated with the construction of streets, buildings, sidewalks and paved driveways and parking lots.

3. Alteration of the groundwater regime that may adversely affect drainage systems, slope stability and survival of existing and/or newly established vegetation.

4. Creation of south and west directional exposure of property which may hinder plant growth due to adverse temperature and moisture conditions.

5. Exposure of subsurface materials that are rocky, acid, droughty or otherwise unfavorable to the establishment of vegetation.

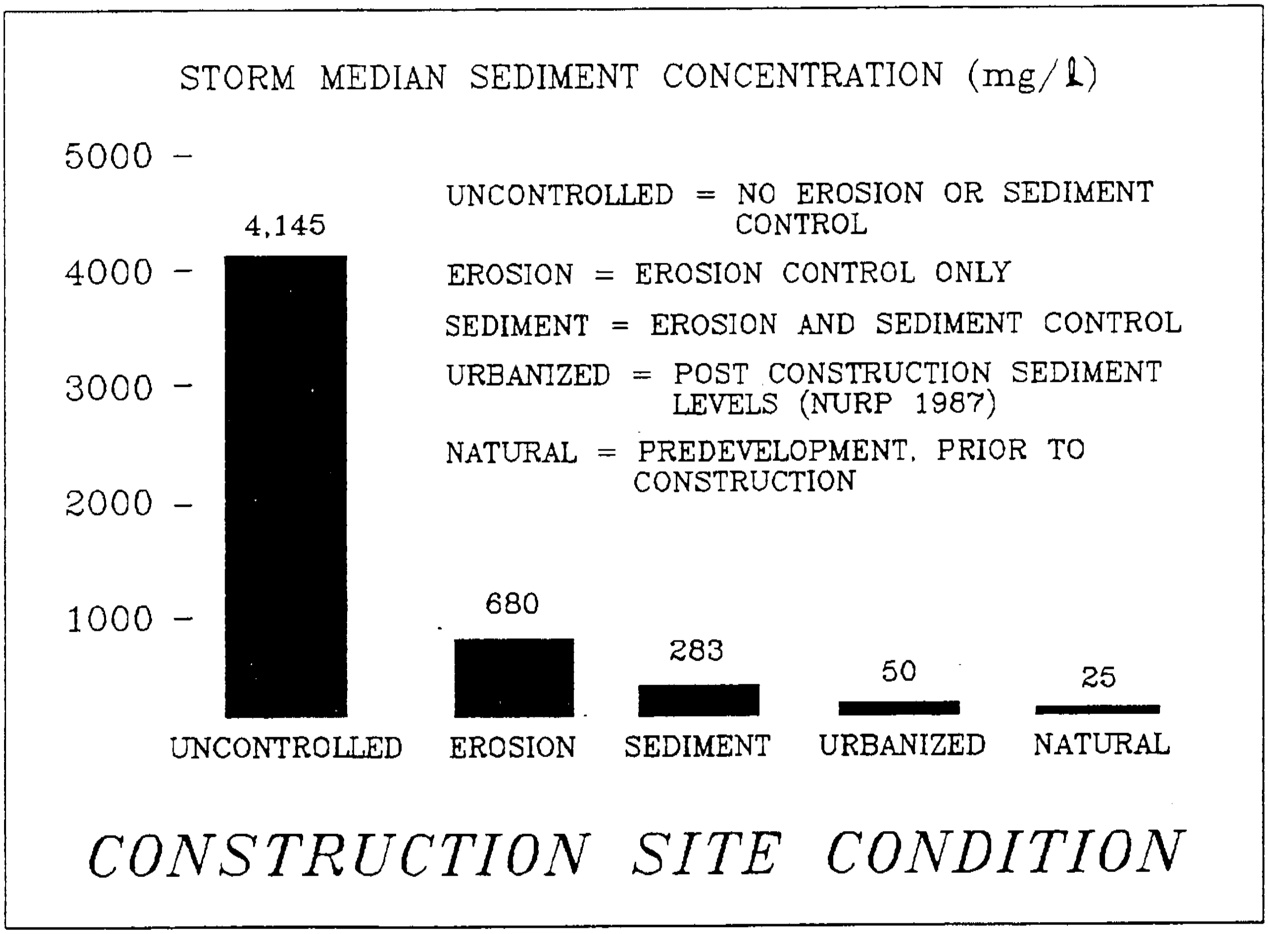
6. Adverse alteration of surface runoff patterns by construction and development.

Increases in sedimentation yield higher levels of nutrients and toxicants. The results of high sediment loading can have a profound effect on the environment. Sediment acts like a magnet to toxicants and trace metals. Additionally, the soil introduces nutrients into streams and groundwater. The net effect is to create a strata known as diagenesis. This activity decreases the oxygen available to support other aquatic life. Even more startling is the apparent ability of sediment to act as long term memory or storage media for toxicants. Studies show that pollutants such as DDT, DDE, PCBs and chlordane whose use has been banned or highly restricted, can still be found at detectable levels in sediment deposited years ago in the bottom of streams and rivers. It has been demonstrated that urbanization and associated sedimentation reduces the diversity of the fish populations in streams as well as the organisms that fish feed on.

The capacity of a stream to maintain its health can be related to the impervious areas within its watershed. Urbanization of a watershed increases the impervious surfaces and increases the pollutant load. One study suggests that once a watershed becomes 12% impervious, the quality of aquatic life has reached a critical threshold.

Responsible development requires that steps be taken to control erosion and sedimentation from construction sites. Plate 2-2 demonstrates the ability of good erosion and sediment controls, versus no controls, in minimizing the detrimental effects of sedimentation.

This chart also demonstrates the fact that once a naturally vegetated area has been developed, sediment levels can be twice the pre-development rate. It is well known that the erosion and sediment threat is greatest during construction; once development is complete (stabilization techniques implemented), there is a dramatic decrease in the pollutant level yield.



Source: Performance of Current Sediment Control Measures at Maryland Construction Sites, Metropolitan Washington Council of Governments

Plate 2-2

In the past, efforts have been made to quantify the damage caused by erosion and sedimentation in terms of dollars spent to dredge navigational channels, loss of reservoir capacity and so on. More recently, efforts have concentrated on the qualitative cost. It is very difficult to place a dollar figure on damage to the environment; however, we cannot escape the fact that human health and well-being is ultimately related to the environment in which we live.

DOLLARS AND SENSE

It is well known that urbanization has the following effects:

* Accelerated Rate of Soil Erosion
* Increase in the Peak Discharge and Total Volume of Stormwater
* Increased Potential for "Flash" Flooding
* Decreased Groundwater Recharge
* Increased Temperature in Natural Receiving Channels
* Increased Pollutant Loading to Receiving Waters

Each of these factors has an associated cost. The VESCL and the VESCR attempt to minimize these costs by regulating land-disturbing activities in the State of Virginia. All of the citizens of the Commonwealth stand to gain when local E&S programs are effective and developers follow responsible management procedures. The net results are dollars saved and a direct benefit to the environment.

COST TO THE DEVELOPER

The VESCL requires that land-disturbing activities have an approved E&S plan prior to commencement of work. The owner must provide the plan or pay someone else (i.e., engineer, architect, planner) to provide this plan. Once a plan is approved, generally a contractor places the controls. However, the owner is ultimately responsible and in fact must certify that the plan will be carried out. Once the project has moved through the bid process, the cost of implementation becomes the primary concern. Proper implementation of the E&S plan can save the developer and the contractor money in excavation costs. If denuded areas are stabilized initially, little or no additional work will be required later. This can speed up completion dates, and overall savings will be realized. This strategy requires that planning take on a more important role in the management of a project. Good management throughout the life of a project will lead to increased savings.

On the other hand, failure to implement an E&S plan or failure to maintain controls during construction of a project can mean additional costs to the developer and the contractor. These additional costs exist at three levels. The primary level is the cost of work being stopped for non-compliance with an approved plan; the secondary level is the cost of repairing damage to adjacent properties; the tertiary level would be the costs associated with missed deadlines, litigation with damaged parties and extra charges from the contractor for additional work. The perception of the public that the developer and the contractor were negligent in performing their responsibilities may also pose a negative cost -if not now, sometime in the future.

At least one engineer has tried to relate these costs to the developer and contractor, based on his own experience and his year of practice. In a seminar on E&S, Mr. Jack Rinker of Rinker-Detwiler and Associates, P.C. presents a scenario called the "Hidden Cost to Down Time from Construction Stops by Government." The following is an abbreviated version of this scenario:

> Assume that a 50-house subdivision is underway. During construction, a rainstorm occurs. This storm can be either moderate or severe. Accordingly, erosion and sedimentation damage from the storm, because E&S measures were never placed, can be either moderate or severe. After the storm, neighbors call the local building official's office to complain. The building official visits the site, observes sedimentation damage and the potential for more, and immediately stops work on the project. This hypothetical situation assumes that the chief administrative officer of the locality has delegated the ability to "stop work" to the building official and that this was deemed an "emergency situation." At this time, all land-disturbing activity on the project is stopped. Three crews are affected by the work stoppage: the grading crew, curb and gutter crew and the utilities contractor. The job superintendent has to divert all of his attention to the immediate erosion problem and calls his office. His office in-turn calls the owner and then the owner calls the engineer and his attorney. The job has come to a virtual standstill because everyone's attention is focused on "putting out the fire." The neighbors are now calling the developer and voicing their disgust. Action must be taken. On the advice of his attorney, the developer makes the decision to have the contractor remove the sediment that has moved onto the neighbors' property. At the request of the owner, the engineer visits the site to assess the damage. The next day, the developer meets with his attorney, the engineer and local government officials to see what must be done to get this job "back on track." The adjacent property owners are still complaining even though work to remove the sediment has begun. The engineer determines that the controls shown on the original E&S plan should have been installed during the first stage of grading to prevent damage to adjacent property. These controls could have prevented the problem in the first place, if they had been installed! Much of the attorney's costly time is spent trying to calm the mood of the neighbors and local officials.

At this point, let us look at the potential damage:

* <u>Moderate Damage</u>: 12 cubic yards of sediment must be removed from one neighbor's property and the lawn must be repaired.

* <u>Severe Damage</u>: 12 cubic yards of sediment must be removed from the neighbor's property; however, the sediment has moved past the property owner's fence and a large section of fence must be removed to gain access to the property with equipment. In the process of getting equipment in and out of the property, six trees and 20 shrubs are damaged. The neighbor is even more angry now!

Possible Costs

Item:	**Moderate Damage**	**Severe Damage**
Clean-up crew mobilization	$ 288.00	$ 288.00
Silt removal and hauling	153.00	153.00
Dumping charge at landfill	60.00	60.00
Grading work	133.00	133.00
Fertilizer and seed	111.00	------
Mulch and tack	150.00	------
Sod and fertilizer	------	640.00
Replace 20 shrubs	------	1,680.00
Replace 6 trees	------	1,476.00
Replace 50 feet of fence	------	640.00
Totals:	**$ 895.00**	**$5,070.00**

These items are a secondary cost to the developer. The primary cost still needs to be considered.

Item:	
Developer's infrastructure (cost attributed to the five-day delay of construction): $1,200 per day	$ 6,000.00
Attorney costs: 21 hours @ $150 per hour	3,150.00
Engineer and staff cost: 31 hours @ $75 per hour	2,325.00
Curb and gutter crew start-up cost	1,500.00
Utilities crew start-up cost	2,000.00
Grading crew start-up cost	2,000.00
Total:	**$16,975.00**

During the ten-day period that it took to repair the damage and get the project back on schedule, the developer incurred these expenses:

	Moderate Damage	Severe Damage
	$16,975.00	$16,975.00
	895.00	5,070.00
Totals:	**$17,870.00**	**$22,045.00**

Not reflected in these costs are the tertiary cost such as ten days of additional interest on the construction loan, lost sales of homes and possible litigation costs.

In this case, the cost of the controls shown on the original E&S plan that would have prevented the problem are as follows:

Item:	**Cost**
Silt fence, 350 feet @ $4.50/linear ft.	$ 1,575.00
Diversion dike, 50 feet @ $2.00/linear ft.	100.00
Sediment trap, 1 @ $240.00 each	240.00
Total:	$ 1,915.00

It should be noted that variation in the magnitude of the storm event could make these numbers vary and pose some required clean-up costs - even for a properly controlled site. However, the use of properly installed control measures will still help to mitigate damage caused by less frequent, larger storms.

BASIC PRINCIPLES OF DESIGN AND CONTROL

For an erosion and sediment control program to be effective, it is imperative that provisions for sediment control measures be made in the planning stage. These planned measures, when conscientiously and expeditiously applied during construction, will result in orderly development, which minimizes environmental degradation. From the previous discussion about erosion and sediment processes and the factors affecting erosion, basic technical principles can be formulated to assist the project planner or designer in providing for effective sediment control. These principles should be utilized to the maximum extent possible on all projects.

1. Plan the development to fit the particular topography, soils, drainage patterns and natural vegetation of the site.

   Detailed planning should be employed to assure that roadways, buildings, and other permanent features of the development conform to the natural characteristics of the site. Large graded areas should be located on the most level portion of the site. Areas subject to flooding should be avoided, and floodplains should be kept free from filling and other development. Areas with steep slopes, erodible soils and soils with severe limitations for the intended uses should not be utilized without first overcoming the limitations through sound engineering practices. For instance, long steep slopes can be broken by benching, terracing, or construction diversion structures and thus will not become an erosion problem or transfer a problem down the grade.

Erosion control, development and maintenance costs can be minimized by selecting a site suitable by its nature for a specific proposed activity, rather than by attempting to modify a site to conform to a proposed activity. This kind of planning can be more easily accomplished where there is a general land-use plan based upon a comprehensive inventory of soils, water and other related resources.

2. Minimize the extent of the area exposed at one time and duration of exposure.

When earth changes are required and the natural vegetation is removed, keep the area and the duration of exposure to a minimum. Plan the phases or stages of development so that only the area which are actively being developed are exposed. All other areas should have a good cover of temporary or permanent vegetation or mulch. Grading should be completed as soon as possible after it is begun. Immediately after grading is completed, permanent vegetative cover should be established in the area. As cut slopes are made and as fill slopes are brought up to grade, these areas should be revegetated as the work progresses. This is known as staged seeding. Minimizing grading of large or critical areas during the seasons of maximum erosion potential - spring thaw in February and March and the thunderstorm season from May through September reduces the risk of erosion (60).

3. Apply erosion control practices to prevent excessive on-site damage.

This third principle relates to using practices that control erosion on a site to prevent excessive sediment from being produced. Keep soil covered as much as possible with temporary or permanent vegetation or with various mulch materials. Special grading methods such as roughening a slope on the contour or tracking with a cleated dozer may be used. Other practices include diversion structures to divert surface runoff from exposed soils and grade stabilization structures to control surface water.

"Gross" erosion in the form of gullies must be prevented by these water control devices. Lesser types of erosion such as sheet and rill erosion should be prevented but, often, scheduling or the large number of practices required makes this impractical. However, when erosion is not adequately controlled at the source, sediment control for the project as a whole is more difficult and expensive.

4. Apply perimeter control practices to protect the disturbed area from off-site runoff and to prevent sedimentation damage to areas below the development site.

This principle relates to using practices that effectively isolate the development site from surrounding properties and especially to controlling sediment once it is produced and preventing its transport for the site.

Diversions, dikes, sediment traps, vegetative filters and sediment basins are examples of practices which control sediment. Vegetative and structural sediment control measures can be classified as either temporary or permanent depending on whether or not they will remain in use after development is complete. Generally, sediment can be retained by two methods: a) filtering runoff as it flows through an area, and b) impounding the sediment-laden runoff for a period of time so that the soil particles settle out. Many practices are combinations of these two methods. The best way to control sediment, however, is to prevent erosion as discussed in the third principle.

5. Keep runoff velocities low and retain runoff on the site.

The removal of existing vegetative cover and the resulting increase in impermeable surface area during development will increase both the volume and velocity of runoff. These increases must be taken into account when providing for erosion control. Keeping slope lengths short and gradients low and preserving natural vegetative cover can keep stormwater velocities low and limit erosion hazards. Runoff from the development should be safely conveyed to a stable outlet using storm drains, diversions, stable waterways, riprapped channels or similar measures. Consideration should be given to the installation of stormwater retention or detention structures when there is a potential for flooding and damage to downstream facilities resulting from increased runoff from the site. Conveyance systems should be designed to withstand the velocities of projected peak discharges. These facilities should be operational as soon as possible after the start of construction.

6. Stabilize disturbed areas immediately after final grade has been attained.

Permanent structures, temporary or permanent vegetation, and mulch, or a combination of these measures should be employed as quickly as possible after the land is disturbed. Temporary vegetation and mulches can be most effective where or when it is not practical to establish permanent vegetation. Such temporary measures should be employed immediately after rough grading is completed if a delay is anticipated in obtaining finished grade. The finished slope of a cut or fill should be stable, and ease of maintenance should be considered in the design. Stabilize roadways, parking areas, and paved areas with a gravel sub-base whenever possible.

7. Implement a thorough maintenance and follow-up program.

This last principle is vital to the success of the other six principles. A site cannot be effectively controlled without thorough, periodic checks of the erosion and sediment control practices.

These practices must be maintained just as construction equipment must be maintained and materials checked and inventoried. An example of applying this principle would be to start a routine "end of day check" to make sure that all control practices are working properly. Usually, these seven principles are integrated into a system of vegetative and structural measures along with management techniques and the "Minimum Standards" to develop a plan to prevent erosion and control sediment. In most cases, a combination of limited grading, limited time of exposure, and a judicious selection of erosion control practices and sediment trapping facilities will prove to be the most practical method of controlling erosion and the associated production and transport of sediment.

PART II

OVERVIEW OF PRACTICES

The following are summary overviews of the erosion and sediment control practices recommended for use in Virginia. Complete standards and specifications for these practices can be found in Chapter 3 of this handbook. The practices are numbered according to the following categories of use:

STRUCTURAL PRACTICES

- SAFETY (3.01)
- ROAD STABILIZATION (3.02 - 3.03)
- SEDIMENT BARRIERS (3.04 - 3.08)
- DIKES AND DIVERSIONS (3.09 - 3.12)
- SEDIMENT TRAPS AND BASINS (3.13 - 3.14)
- FLUMES (3.15 - 3.16)
- WATERWAY AND OUTLET PROTECTION (3.17 - 3.21)
- STREAM PROTECTION (3.22 - 3.27)
- SUBSURFACE DRAINAGE (3.28)

VEGETATIVE PRACTICES

- SITE PREPARATION FOR VEGETATION ESTABLISHMENT (3.29 - 3.30)
- GRASS ESTABLISHMENT (3.31 - 3.34)
- MULCHES (3.35 - 3.36)
- OTHER VEGETATIVE CONTROLS (3.37 - 3.38)
- DUST CONTROL (3.39)

3.01 SAFETY FENCE: A protective barrier installed to prohibit undesirable use of an erosion control measure.

3.02 TEMPORARY STONE CONSTRUCTION ENTRANCE: A stone pad, located at points of vehicular ingress and egress on a construction site, to reduce the soil transported onto public roads and other paved areas.

3.03 CONSTRUCTION ROAD STABILIZATION: Temporary stabilization with stone of access roads, subdivision streets, parking areas and other traffic areas immediately after grading to reduce erosion caused by vehicles during wet weather, and to prevent having to regrade permanent roadbeds between initial grading and final stabilization.

3.04 STRAW BALE BARRIER: A temporary sediment barrier composed of straw bales placed across or at the toe of a slope to intercept and detain sediment and decrease flow velocities from drainage areas of limited size; applicable where sheet and rill erosion may be a problem. Maximum effective life is 3 months.

3.05 SILT FENCE: A temporary sediment barrier constructed of posts, filter fabric and, in some cases, a wire support fence, placed across or at the toe of a slope or in a minor drainage way to intercept and detain sediment and decrease flow velocities from drainage areas of limited size; applicable where sheet and rill erosion or small concentrated flows may be a problem. Maximum effective life of 6 months.

3.06 BRUSH BARRIER: A temporary sediment barrier composed of limbs, weeds, vines, root mat, rock, and other cleared materials pushed together to form a berm; located across or at the toe of a slope to intercept and detain sediment and decrease flow velocities.

3.07 STORM DRAIN INLET PROTECTION: The installation of various kinds of sediment trapping measures around drop inlets or curb inlet structures prior to permanent stabilization of the disturbed area; limited to drainage areas not exceeding one acre, and not intended to control large, concentrated stormwater flows.

3.08 CULVERT INLET PROTECTION: A sediment filter located at the inlet to storm sewer culverts which prevents sediment from entering, accumulating in and being transferred by the culvert. It also provides erosion control at culverts during the phase of a project where elevations and drainage patterns are changing, causing original control measures to be ineffective.

3.09 TEMPORARY DIVERSION DIKE: A ridge of compacted soil constructed at the top or base of a sloping disturbed area which diverts off-site runoff away from unprotected slopes and to a stabilized outlet, or to divert sediment-laden runoff to a sediment trapping structure. Maximum effective life is 18 months.

3.10 TEMPORARY FILL DIVERSION: A channel with a supporting ridge on the lower side, constructed along the top of an active earth fill constructed in order to divert runoff away from the unprotected fill slope to a stabilized outlet or sediment trapping structure; applicable where the area at the top of the fill drains toward the exposed slope and continuous fill operations make the use of a TEMPORARY DIVERSION DIKE infeasible; maximum effective life is one week.

3.11 TEMPORARY RIGHT-OF-WAY DIVERSION: A ridge of compacted soil or loose gravel constructed across a disturbed right-of-way or similar sloping area to shorten the flow length within the disturbed strip and divert the runoff to a stabilized outlet. Earthen diversions are applicable where there will be little or no construction traffic within the right-of-way, and gravel structures are applicable where vehicular traffic must be accommodated.

3.12 DIVERSION: A permanent channel with a ridge on the lower side constructed across a slope to reduce slope length and intercept and divert stormwater runoff to a stabilized outlet at non-erosive velocities.

3.13 TEMPORARY SEDIMENT TRAP: A small ponding area, formed by constructing an earthen embankment with a stone outlet across a drainage swale, to detain sediment-laden runoff from small disturbed areas for enough time to allow most of the suspended solids to settle out. Maximum effective life is 18 months.

3.14 TEMPORARY SEDIMENT BASIN: A temporary barrier or dam with a controlled stormwater release structure which is formed by constructing an embankment of compacted soil across a drainageway. It is used to detain sediment-laden runoff from drainage areas 3 acres or greater for enough time to allow most of the suspended solids to settle out. It can be constructed only where there is sufficient space and appropriate topography. Maximum effective life is 18 months unless designed as a permanent pond by a qualified professional.

3.15 TEMPORARY SLOPE DRAIN: A flexible tubing or conduit, used before permanent drainage structures are installed, intended to conduct concentrated runoff safely from the top to the bottom of a disturbed slope without causing erosion on or below the slope.

3.16 PAVED FLUME: A permanent concrete-lined channel constructed to conduct concentrated runoff from the top to the bottom of a slope without causing erosion on or below the slope.

3.17 STORMWATER CONVEYANCE CHANNEL: A permanent channel designed to carry concentrated flows without erosion. Applicable to man-made channels, including roadside ditches, and natural channels that are modified to accommodate increased flows generated by land development; not generally applicable to major, continuous-flowing natural streams.

3.18 OUTLET PROTECTION: The installation of riprap channel sections and/or stilling basins below storm drain outlets to reduce erosion and under-cutting from scouring at outlets and to reduce flow velocities before stormwater enters receiving channels below these outlets.

3.19 RIPRAP: A permanent, erosion-resistant ground cover of large, loose, angular stone installed wherever soil conditions, water turbulence and velocity, expected vegetative cover, etc., are such that soil may erode under design flow conditions.

3.20 ROCK CHECK DAMS: Small, temporary stone dams constructed across a drainage ditch to reduce the velocity of concentrated flows, reducing erosion of the swale or ditch. Limited to use in small open channels which drain 10 acres or less; should not be used in live streams.

3.21 LEVEL SPREADER: An outlet for dikes and diversions consisting of an excavated depression constructed at zero grade across a slope to convert concentrated, sediment-free runoff to sheet flow and release it onto areas of undisturbed soil which is stabilized by existing vegetation.

3.22 VEGETATIVE STREAMBANK STABILIZATION: The establishment of appropriate vegetation on streambanks to protect the banks from erosion.

3.23 STRUCTURAL STREAMBANK STABILIZATION: Stabilizing the banks of live streams with permanent structural measures to protect them from erosion. Particularly applicable to watercourses which must pass increased flows due to upstream development; not applicable to tidal streams.

3.24 TEMPORARY VEHICULAR STREAM CROSSING: A temporary structural span across a live stream to provide vehicular access to construction activity on either side of the stream while keeping sediment out of the stream and preventing damage to the channel bed and banks.

3.25 UTILITY STREAM CROSSING: A strategy for crossing small waterways when in-stream utility construction is involved. The strategy helps to prevent sediment from entering the affected watercourse and minimizes the amount of disturbance within the stream itself.

3.26 DEWATERING STRUCTURE: A temporary settling and filtering device for water which is discharged from dewatering activities.

3.27 TURBIDITY CURTAIN: A floating geotextile material which minimizes sediment transport from a disturbed area adjacent to or within a body of water. It provides sedimentation protection for a watercourse from upslope land disturbance or from dredging or filling within the watercourse.

3.28 SUBSURFACE DRAIN: A perforated conduit installed beneath the ground to intercept and convey groundwater. Prevents sloping soils from becoming excessively wet and subject to sloughing, and improves the quality of the vegetative growth medium in excessively wet areas by lowering the water table. Can also be used to drain detention structures.

3.29 SURFACE ROUGHENING: Grading practices such as stair-stepping or grooving slopes or leaving slopes in a roughened condition by not fine-grading them. Reduces runoff velocity, provides sediment trapping and increases infiltration, all of which facilitate establishment of vegetation on exposed slopes. Applicable to all slopes steeper than 3:1 or that have received final grading but will not be stabilized immediately. Also recommended for other exposed slopes with flatter grades.

3.30 TOPSOILING: Preserving and using topsoil to provide a suitable growth medium for vegetation used to stabilize disturbed areas. Applicable where preservation or importation of topsoil is most cost-effective method of providing a suitable growth medium; not recommended for slopes steeper than 2:1 unless additional measures are taken to prevent sloughing and erosion.

3.31 TEMPORARY SEEDING: Establishment of temporary vegetative cover on disturbed areas that will not be brought to final grade for periods of 30 days to one year by seeding with appropriate rapidly-growing plants.

3.32 PERMANENT SEEDING: Establishment of perennial vegetative cover by planting seed on rough-graded areas that will not be brought to final grade for a year or more or where permanent, long-lived vegetative cover is needed on fine-graded areas.

3.33 SODDING: Stabilizing fine-graded areas by establishing permanent grass stands with sod. Provides immediate protection against erosion, and is especially effective in grassed swales and water-ways or in areas where an immediate aesthetic effect is desirable.

3.34 BERMUDAGRASS AND ZOYSIAGRASS ESTABLISHMENT: Establishment of vegetative cover with hybrid bermudagrass or zoysiagrass by planting sprigs, stolons or plugs to stabilize fine-graded areas where establishment by sod is not preferred.

3.35 MULCHING: Application of plant residues or other suitable materials to disturbed surfaces to prevent erosion and reduce overland flow velocities. Fosters plant growth by increasing available moisture and providing insulation against extreme heat or cold. Should be applied to all seeding operations, other plant materials which do not provide adequate soil protection by themselves, and bare areas which cannot be seeded due to the season but which still need protection to prevent soil loss.

3.36 SOIL STABILIZATION BLANKETS AND MATTING: The installation of a protective blanket (Treatment 1) or a soil stabilization mat (Treatment 2) on a prepared planting of a steep slope, channel or shoreline.

3.37 TREES, SHRUBS, VINES AND GROUND COVERS: Stabilizing disturbed areas by planting trees, shrubs, vines and ground covers where turf is not preferred. These plant materials also provide food and shelter for wildlife as well as many other environmental benefits. Especially effective where ornamental plants are desirable and turf maintenance is difficult.

3.38 TREE PRESERVATION AND PROTECTION: Protecting existing trees from mechanical and other injury during land-disturbing and construction activity to ensure the survival of desirable trees where they will be effective for erosion and sediment control and provide other environmental and aesthetic benefits.

3.39 DUST CONTROL: Reducing surface and air movement of dust during land disturbance, demolition or construction activities in areas subject to dust problems in order to prevent soil loss and reduce the presence of potentially harmful airborne substance.

PART III

COSTS

DATA LIMITATIONS

The cost of implementing erosion and sediment control practices is highly variable and dependent upon many factors including regional cost trends, availability and proximity of materials, time of year, prevailing labor rates, etc. It is therefore very difficult to develop cost estimates which are applicable statewide and year-round. The cost data contained in this chapter are based upon a February, 1991 survey of contractors and suppliers in mostly urban areas of the state. The following cost figures reflect statewide, average costs.

The intended use of this cost information is to provide an example format for local officials who have to calculate performance bond amounts or other guarantees. It may also aid project planners who seek to estimate E&S costs for feasibility studies.

The actual "dollar amounts" are not recommended for use in estimating and bidding construction contracts. It is advisable to check with local suppliers and contractors for this purpose.

COST vs. EFFECTIVENESS

The person who prepares an erosion and sediment control plan must pay careful attention to the selection of each practice. The practice with the least expensive initial cost may require a great deal of maintenance over the length of a project. Accessibility for maintenance can often be a factor that determines effectiveness. Silt fence for instance, requires regular maintenance. If placed in an area that drains too much disturbed area and is difficult to reach, maintenance potential for failure becomes a problem. In such a case, a diversion dike leading to a sediment trap would most likely be a better selection. The dike and trap are more suitable to handle larger runoff volume and would require less day-to-day maintenance if installed properly.

Once installed, the costs associated with a particular control can be kept to a minimum when maintenance is performed on a regular basis. Once a practice fails, the replacement cost can be double the initial cost of the practice. Regular maintenance also decreases the likelihood that damage to down slope property would be caused.

STRUCTURAL PRACTICE COSTS (Table 2-1)

The structural cost table consists of a numerical listing of the structural conservation practices with associated cost ranges for various applications. The cost estimates include materials (see end of Table 2-1), labor (at $6.00 per hour), equipment, and contractor's profit and overhead (figured at 30%).

VEGETATIVE PRACTICE COSTS (Table 2-2)

The cost items associated with vegetation establishment may include any combination of sod, seed, lime, fertilizer, equipment rental or purchase, soil testing, mulch, labor and maintenance. Due to the high potential for variability in actual total cost, Table 2-2 is primarily oriented for materials costs. Only estimates for sodding include installation costs. Users of the vegetative cost tables must add in cost for labor, fuel, machinery and other appropriate items. Examples using the cost data from Table 2-2 are given immediately following the table.

TABLE 2-1

STRUCTURAL PRACTICE COSTS

3.01	Safety Fence	
	Plastic - $1.50 - $2.50/linear ft. (including post)	
	Chain-link - $8 - $12/linear ft. (8 ft. height incl. post)	
3.02	Temporary Stone Construction Entrance	
	* Stone Pad	$3 - $6/yd.^{2}
	** Wash Rack	$500 - $1,000/unit
3.03	Construction Road Stabilization	
	Stone only	$3 - $6/yd.^{2}
	Stone with filter fabric	$6 - $9/yd.^{2}
3.04	Straw Bale Barrier	
	* $3 - $6/linear foot	
3.05	Silt Fence	
	* $2 - $5/linear foot	
3.06	Brush Barrier	
	* $2 - $5/linear foot	

* price does not reflect maintenance for long-term use.
** price does not reflect cost for hose-bib or personnel to man station.
*** price assumes hand placement with underliner according to specification.
**** installation is too site specific to offer accurate cost figures.

TABLE 2-1 (Continued)

3.07	Storm Drain Inlet Protection		
	* $25 - $100/inlet		
3.08	****Culvert Inlet Protection		
3.09	Temporary Diversion Dike		
	$3 - $5/linear foot		
3.10	Temporary Fill Diversion		
	$0.50 - $1/linear foot		
3.11	Temporary Right-of-Way Diversion		
	Stone:	$2 - $2.50/linear foot	
	Earth:	$1.50 - $2.50/linear foot	
3.12	Diversion		
	$6.50 - $12/linear foot		
3.13	Temporary Sediment Trap		
	Drainage Area (acres)		
		* 1	$500 - $700/unit
		* 2	$1,200 - $1,400/unit
		* 3	$1,800 - $2,100/unit
3.14	****Temporary Sediment Basin		
3.15	Temporary Slope Drain		
	$10 - $20/linear foot		

* price does not reflect maintenance for long-term use.
** price does not reflect cost for hose-bib or personnel to man station.
*** price assumes hand placement with underliner according to specification.
**** installation of structure is too site specific to offer accurate cost figures.

TABLE 2-1 (Continued)

3.16	Paved Flume	\$25 - \$30/yd.[2]
3.17	Stormwater Conveyance Channel	
	Grass-lined (seeded):	\$ 3 - \$ 7/yd.[2]
	Grass-lined (sodded):	\$ 8 - \$12/yd.[2]
	*** Riprap:	\$35 - \$50/yd.[2]
3.18	Outlet Protection	
	*** Non-Grouted Riprap:	\$35 - \$50/yd.[2]
	*** Grouted Riprap:	\$45 - \$65/yd.[2]
	Concrete:	\$25 - \$30/yd.[2]
3.19	Riprap	*** \$35 - \$50/yd.[2]
3.20	Rock Check Dam	
	* Log Check Dam:	\$400 - \$600/unit
	* Rock Check Dam:	\$13 - \$20/yd.[2]
3.21	Level Spreader:	\$3 - \$15/linear foot
3.23	Structural Streambank Protection	
	*** Non-Grouted Riprap:	\$35 - \$50/yd.[2]
	*** Grouted Riprap:	\$45 - 60/yd.[2]
	Gabions:	\$55 - \$90/yd.[3]
	Deflectors:	
	Timber and Pilings:	\$25 - \$50/linear foot
	Gabion or Rock:	\$60 - \$95/yd.[3]
	Log Cribbing:	\$60 - \$95/yd.[3]
	Grid Pavers:	\$30 - \$80/yd.[2]

* price does not reflect maintenance for long-term use.
** price does not reflect cost for hose-bib or personnel to man station.
*** price assumes hand placement with underliner according to specification.
**** installation of structure is too site specific to offer accurate cost figures.

TABLE 2-1 (Continued)

3.24	Temporary Vehicular Stream Crossing	
	Pipe Diameter (inches)	Cost of Crossing (per linear foot)
	12 - 24	\$20 - \$43
	24 - 48	\$43 - \$86
	48 - 72	\$86 - \$130
	72 - 96	\$130 - \$172
3.25	**** Utility Stream Crossing	
3.26	**** Dewatering Structure	
3.27	**** Turbidity Curtain	
3.28	Subsurface Drains:	\$1 - \$3/linear foot

Maintenance Costs (General)

Sediment Removal:	\$5 - \$10/yd^3
Repair Cost (most often):	same as original cost
Replacement Cost:	1½ - 2 times original cost due to the necessity for removal of old measure

Material Costs (General)

VDOT #1 Coarse Aggregate:	\$ 2 - \$3/ton
Filter Fabric (Silt Fence):	\$0.20 - \$0.30/linear foot
Straw Bales:	\$2 - \$3.50/unit

* price does not reflect maintenance for long-term use.
** price does not reflect cost for hose-bib or personnel to man station.
*** price assumes hand placement with underliner according to specification.
**** installation of structure is too site specific to offer accurate cost figures.

TABLE 2-1 (Continued)

Material Costs (General)

Wire, Chicken Wire (4' x 150' roll):	
1-inch mesh	\$54 - \$66
2-inch mesh	\$30 - \$42
Welded Wire (4' x 100' roll):	
2-inch x 4-inch mesh	\$65 - \$84
Concrete Masonry Block:	
8-inch	\$0.75 - \$.85/unit
10-inch	\$0.95 - \$1.15/unit
Riprap: 50 - 150 lb.	\$4.50 - \$5/ton (excludes transportation to site)
Filter Cloth Used with Riprap:	\$0.50 - \$.75/yd.^{2}
Concrete:	\$40 - \$80/yd.^{3}
Bituminous Paving:	\$40 - \$80/yd.^{3}
Gabions (12"-3' X 3' basket):	\$55 - \$66/unit

Pipe (Corrugated Metal Pipe)

Diameter (inches)	Cost (per linear foot)
12"	\$ 6 - \$ 7
15"	\$ 7 - \$ 8
18"	\$ 8 - \$ 9
24"	\$10 - \$11
36"	\$13 - \$14
48"	\$21 - \$22
60"	\$43 - \$44
72"	\$63 - \$65
78"	\$74 - \$76
84"	\$79 - \$81
90"	\$85 - \$88
96"	\$91 - \$93

TABLE 2-2

MATERIALS COSTS FOR VEGETATIVE EROSION CONTROLS

MATERIAL		UNIT COST	RATE	COST PER 1000 SQ. FT	COST PER ACRE
SOD	Kentucky Bluegrass blends	\$.80 - \$1.25/yd.^{2}, cut \$2 - \$3.50/yd.^{2}, installed	1 yd.^{2} = 9 ft.^{2}	\$140 installed	\$9,680 - \$16,940
	Tall Fescue	\$.80 - \$1.25/yd.^{2}, cut \$2 - \$3.50 yd.^{2}, installed	1 yd.^{2} = 9 ft.^{2}	\$140 installed	\$9,680 - \$16,940
	Bermudagrass	\$1.05 - \$1.30/yd.^{2}, cut \$2.25 - \$3.75/yd.^{2}, installed	1 yd.^{2} = 9 ft.^{2}	\$180 installed	\$10,890 - \$18,150
MULCH	Small grain straw (see Chemical Mulches for tack coat)	Average \$2/bale or \$100/ton (using 40 lb. bale)	2 tons/acre	\$5 (material cost only)	\$215 (material cost only)
	Fiber Mulch (50 lb. bale)	Average \$175/ton (plus shipping)	2000 lbs./acre	\$4 (material cost only)	\$175 plus shipping
NETS AND MATS	Jute Mesh	\$55/100 yd.^{2} roll; staples: \$7/100 yd.^{2}	100 yds.^{2} = .02 ac.	\$69 with staples	\$3000 w/ staples
	Excelsior blanket	\$39/80 yd.^{2} roll; staples: \$7/100 yd.^{2}	100 yds.^{2} = .02 ac.	\$46 with staples	\$2003 w/ staples
	Mulchnet (used over straw only)	\$.02 ft.^{2}; staples: \$7/100 yd.^{2}	100 yds.^{2} =.02 ac.	\$27 with staples	\$1200 w/ staples
	Plastic Soil Reinforcement Mat (light / heavy):	\$3.50 yd.^{2} / \$5 yd.^{2}	4840 yd.^{2}/acre	\$390 / \$556	\$17,000 / \$24,000

TABLE 2-2 (Continued)

MATERIALS COSTS FOR VEGETATIVE EROSION CONTROLS

MATERIAL		UNIT COST	RATE	COST PER 1000 FT.^{2}	COST PER ACRE
TACKIFIERS	Asphalt - average for all grades used (used as straw tack coat)	$0.80/gal. bulk $2/gal. applied	400 - 480 gal./acre	$8.80 bulk $22 applied	$384, bulk $960, applied
	Typical synthetic binders	$1.50 - $3/gal.	45 - 75 lbs. /acre	$1.50 - $2.50	$65 - $115
	Terra Tack (as used with wood fiber)	$123/acre package	1 pkg./acre	$2.80	$123
	Fiber mulch	$200/ton	750 lbs./ac.	$1.75	$75
SOIL AMENDMENTS	Lime - pulverized agricultural limestone or dolomite	$40 -$100/ton	2-3 tons/ac., or according to soil test results	$1.85 - $6.70	$80 - $300
	10-20-10	$200 - $250/ton	Dependent on type of seeding and soil test results	--	--
	10-10-10 Note: Many formulations may be used to provide the necessary nutrients	$150 - $200/ton			
SEED	Cereal Rye	$0.25/lb., $13.50/bushel	2 bu./acre (110 lbs.)	$0.63	$27.50
	Oats	$0.15/lb., $5/bushel	3 bu./acre (100 lbs.)	$0.34	$15
	Annual Ryegrass	$0.35 - $0.50/lb.	50 lbs./acre	$0.57	$25
	German Millet	$0.40 - $0.50/lb.	60 lbs./acre	$0.69	$30

EXAMPLES:

Temporary Seeding

Seed a one-acre site using a cereal and annual rye mixture and standard soil amendments. Assume the soil is already at rough grade and does not need further preparation. Standard agricultural machinery (drill) is used.

Item	Cost
50 lbs. Cereal Rye @ $0.27/lb.	$13.50
50 lbs. Annual Rye @ $0.35/lb.	$17.50
600 lbs. 10-20-10 fertilizer @ $200/ton	$60.00
1 ton lime @ $50/ton	$50.00
Straw mulch - 100 bales @ $2/unit	$200.00
Mulch anchoring using "Krimper" method	$25.00
Materials Cost Per Acre	**$366.00**
Total Cost Per Acre for Temporary Seeding (including labor, fuel, and machinery)	**$650 - $850**

Permanent Seeding - Lawn-Type (Low Maintenance)

Item	Cost
100% Kentucky 31 Fescue @ 200 lbs./acre @ $0.75/lb..	$150.00
Annual Rye @ 20 lbs./acre @ $.40/lb.	$8.00
1000 lbs. 10-20-10 fertilizer @ $200/ton	$100.00
2 tons lime @ $50/ton	$100.00
Straw mulch - 125 bales @ $2/unit	$250.00

Tack Coat - 750 lbs. @ $200/ton	$75.00
Materials Cost Per Acre	**$683.00**
Total Cost Per Acre for Permanent Seeding of Low-Maintenance Area (including labor, fuel, and machinery)	**$1000 - $1500**

Permanent Seeding - Lawn-Type (High Maintenance)

Item		Cost
90% Turf-type Tall Fescue	225 lbs. @ $1.25/lb.	$281.25
5% Kentucky Bluegrass	12.5 lbs. @ $2.50/lb.	$31.25
5% Turf-type Perennial Rye	12.5 lbs. @ $1/lb..	$12.50
	250 lbs.	$325.00
1000 lbs. 10-20-10 fertilizer @ $200/ton		$100.00
2 tons lime @ $50/ton		$100.00
1 ton fiber mulch @ $200/ton		$200.00
Materials Cost Per Acre		**$725.00**
Total Cost Per Acre for Permanent Seeding of High-Maintenance Area (including labor, fuel, and machinery)		**$1100 - $1700**

General Slope (Non-Legume)

Item		Cost
Kentucky 31 Fescue	128 lbs. @ $0.75/lb.	$96.00
Redtop	2 lbs. @ $3.50/lb.	$7.00
Annual Rye	20 lbs. @ $.40/lb.	$8.00
	150 lbs.	$111.00

1992

1000 lbs. 10-20-10 fertilizer @ $200/ton	$100.00
2 tons lime @ $50/ton	$100.00
Mulch (fiber)	$200.00
Materials Cost Per Acre	**$511.00**
Total Cost Per Acre for Permanent Seeding of General Slope with Non-Legume Mixture (including labor, fuel, and machinery)	**$800 - $1000**

General Slope (Legume)

Item		Cost
Kentucky 31 Fescue	108 lbs. @ $0.75/lb.	$81.00
Redtop	2 lbs. @ $3.50/lb.	$7.00
Annual Rye	20 lbs. @ $.40/lb.	$8.00
Crownvetch	20 lbs. @ $12.50 lb.	$250.00
	150 lbs.	$346.00
1000 lbs. 10-20-10 fertilizer @ $200/ton		$100.00
2 tons lime @ $50/ton		$100.00
Straw mulch - 125 bales @ $2/unit		$250.00
Tack Coat - 750 lbs. @ $200/ton		$75.00
Materials Cost Per Acre		**$871.00**
Total Cost Per Acre for Permanent Seeding of General Slope with Legume Mixture (including labor, fuel, and machinery)		**$1200 - $1600**

CHAPTER 4

Stormwater Runoff

INDEX

STORMWATER RUNOFF

Criteria Development Reasoning

The problems associated with stormwater runoff in rapidly urbanizing watersheds have become well-known. These problems relate to both the quantity and quality of stormwater runoff. Major problems include increased flooding magnitude and frequency, accelerated stream channel erosion, and water quality degradation.

The basic underlying cause of these problems is not difficult to understand. The hydrologic systems which have reached a natural equilibrium over centuries simply cannot adjust gracefully to the sudden impact of urban development. Flooding occurs because the increased volume and peak rate of runoff exceeds the natural carrying capacity of the streams more often. Stream channel erosion accelerates due to suddenly increased flow velocities and flooding frequency. The water quality itself is degraded by sedimentation and because numerous other pollutants become available to be washed off the land surface and into the streams, rivers and lakes.

Studies have shown that most natural stream channels are formed with a bankfull capacity to pass runoff from a storm with a 1.5- to 2-year recurrence interval. As upstream development occurs, the volume and velocity of flow from these relatively frequent storms increase. Consequently, even smaller storms with less than 1-year recurrence intervals begin to cause streams to flow full or flood.

According to Leopold (76), stream channels are subject to a 3- to 5-fold increase in the frequency of bankfull flows in a typical urbanizing watershed. This increase in the flooding frequency places a stress on the channel to adjust its shape and alignment to accommodate the increased flow. Unfortunately, this adjustment takes place in a very short time period (in geologic terms), and the transition is usually not a smooth one. Meandering stream channels which were once parabolic in shape and covered with vegetation, typically become straight, wide rectangular channels with barren vertical banks. This process of channel erosion often causes significant property damage, and the resulting sediment which is generated is transported downstream, further contributing to channel degradation.

One strategy for dealing with this problem is to increase the carrying capacity and stability of affected streams through channel modifications (e.g., straightening, widening, lining with non-erodible material, etc.). This strategy may be employed most effectively on man-made channels or small, intermittent streams. Significant modifications to natural, continuous flowing steams, however, can be the subject of intense local controversy.

Wherever modification to natural flowing streams are being considered, extreme care must be taken to weigh the benefits of such modifications against the cost and the concerns of the local citizens. Where channel modifications are necessary, an attempt should be made to incorporate conservation practices which will minimize adverse impacts to fish, wildlife, and the aesthetic quality of the stream.

The following stormwater runoff requirements were developed to provide localities with maximum flexibility to deal with their stormwater runoff problems according to local needs and priorities. The only condition which is imposed statewide is that all local stormwater runoff criteria must contain provisions for the control of off-site erosion and sedimentation.

Statewide Stormwater Runoff Standard

The Erosion and Sediment Control Regulations (Minimum Standard #19) require that properties and waterways downstream from new development sites shall be protected from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff. (See Chapter 8 for the text of the law and regulations.) In the absence of a local stormwater management program, the following criteria shall apply:

A. Increased volumes of sheet flow that may cause erosion or sedimentation on adjacent property must be diverted to a stable outlet, adequate channel or detention facility.

B. Concentrated stormwater runoff leaving a development site must be discharged directly into an adequate natural or manmade receiving channel, pipe or storm sewer system.

An adequate channel is defined as "a watercourse that will convey a chosen frequency storm event without overtopping its banks or causing erosive damage to the bed, banks and overbank sections of the watercourse."

A receiving channel may be considered adequate if the total drainage area to the point of analysis in the channel is 100 times greater than the contributing drainage area of the project site.

For natural channels, the two-year frequency storm is used to verify that stormwater will not overtop the channel banks nor cause erosion of the channel bed or banks.

For manmade channels, the ten-year frequency storm is used to verify that stormwater will not overtop the channel banks and the two-year storm is used to demonstrate that stormwater will not cause erosion of the channel bed or banks.

For pipes and storm sewer systems, the ten-year frequency storm is used to verify that stormwater will be contained within the pipe or storm sewer.

C. If existing natural receiving channels or previously constructed manmade channels or pipes are not adequate, the applicant must choose one of the following options.

1. Improve the channels to a condition where the ten-year frequency storm will not overtop the channel banks and the two-year frequency storm will not cause erosion to the channel bed or banks. The applicant must provide evidence of permission to make the improvements.

2. Improve the pipe or storm sewer system to a condition where the ten-year frequency storm is contained within the appurtenances. The applicant must provide evidence of permission to make the improvements.

3. Develop a site design that will not cause the pre-development peak runoff rate from a two-year frequency storm to increase when runoff discharges into a natural channel or will not cause the pre-development peak runoff rate from a ten-year storm to increase when runoff discharges into a manmade channel.

4. Provide a combination of channel improvements, stormwater detention or other measures which is satisfactory to the plan-approving authority to prevent downstream erosion.

D. If the applicant chooses an option that includes stormwater detention, the applicant must obtain approval from the locality of a plan for maintenance of the detention facility. The plan must establish the maintenance requirements of the facility and identify the person responsible for performing the maintenance.

E. All hydrologic analyses must be based on the existing watershed characteristics and the ultimate development condition of the project site.

F. In applying these stormwater runoff criteria, individual lots in a residential subdivision development are not considered separate development projects. Instead, the residential subdivision development, as a whole, is considered to be a single development project. Hydrologic parameters that reflect the ultimate subdivision development must be used in all engineering calculations.

G. Proposed commercial or industrial subdivisions must apply these stormwater runoff criteria to the development as a whole. Hydrologic parameters that reflect the ultimate subdivision development must be used in all engineering calculations.

Applying the Criteria

The following commentary is intended to aid the handbook user in understanding and applying the stormwater runoff criteria in the Erosion and Sediment Control Regulations (Minimum Standard #19) for localities which have not adopted comprehensive stormwater management programs.

The basic concept of the state criteria is simple. An applicant must show that the runoff from the development project, (from a 2-year frequency storm) will not damage adjacent properties, or exceed the capacity or cause erosion of receiving streams. This must be proven by engineering calculations in the erosion and sediment control plan. The following items should be considered when determining compliance:

1. The stormwater runoff requirements apply to all land development projects which require an erosion and sediment control plan under state law. With regard to residential subdivision projects, the criteria should be applied to the entire subdivision development, not to the individual lots.

2. The stormwater runoff criteria apply primarily at points of concentrated discharge along the perimeter of the development site. However, the project must also be designed so that increased sheet runoff (e.g., runoff from newly paved areas) will not cause damage to adjacent properties. Such increased sheet flows should be diverted to an outlet where the stormwater runoff criteria can be applied.

3. The applicant must show that, wherever concentrated stormwater will be discharged from the site (e.g., pipe or channel outlets), there is an adequate channel or pipe to receive the flow and carry it into the natural drainage system.

4. Each receiving channel must be tested for <u>adequacy</u>. A channel is considered adequate if any of the following conditions can be met:

    a. The bankfull capacity of the <u>natural</u> receiving channel is sufficient to pass the post development peak flow from the 2-year frequency storm <u>and</u> the channel velocity (2-year frequency storm) does not exceed the permissible (non-erodible) velocity of the channel lining.

    b. The bankfull capacity of the <u>manmade</u> receiving channel is sufficient to pass the post development peak flow from the 10-year frequency storm <u>and</u> the channel velocity (2-year frequency storm) does not exceed the permissible (non-erodible velocity of the channel lining.)

       [Engineering procedures for determining channel adequacy are contained in Chapter 5.]

    c. The 10-year frequency storm is contained within the pipe or storm sewer system.

    d. The contributing drainage area of the development site is less than 1% of the total drainage area to the point of consideration in the channel.

    e. There is no increase in the peak runoff rate for the 2-year frequency storm (for natural receiving channels) or the 10-year frequency storm (for manmade receiving channels) at the point of discharge after development

5. If the receiving channel is found to be <u>inadequate</u>, the applicant must incorporate measures to either improve the receiving channel to an adequate

condition, or detain runoff on his site so that the post-development peak runoff rate for the 2-year storm will not exceed the pre-development peak rate. The plan-approving authority may also approve a combination of channel improvements and detention or other measures deemed satisfactory to protect the channel.

6. If a channel-improvement option is chosen, the applicant must obtain necessary easements and comply with applicable regulations regarding channel modifications. Channel improvements must extend downstream until an adequate channel section is reached or until a point is reached where the total drainage area is at least 100-times greater than the drainage area of the development site.

7. If a stormwater detention option is chosen, the applicant must submit a plan for the continued maintenance requirements of the structure and designate someone who has consented to be responsible to carry out the maintenance. The local government may choose to accept the maintenance responsibility for detention structures. However, where this is not done, the responsibility must be borne by the landowner, a homeowners association, or other legal entity. In this case, a maintenance agreement should be executed between the responsible entity and the local government.

CHAPTER 5

Engineering Calculations

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PART III OPEN CHANNEL

CHAPTER 5

ENGINEERING CALCULATIONS

This chapter is intended to provide site planners and plan reviewers with basic engineering calculation procedures needed to design or evaluate erosion and sediment control and stormwater management structures and systems. The chapter is divided into three parts:

Part I - Estimating Runoff: An attempt is made to standardize the methods used to calculate runoff from a site or watershed. Criteria for selecting an appropriate calculation method are presented along with step-by-step procedures for using three different methods.

Part II - Stormwater Detention: The subject of flood routing is introduced, and a simplified procedure for sizing small, single-stage detention basins is presented.

Part III - Open Channel Flow: This part contains step-by-step procedures for designing new stormwater conveyance channels and for determining the capacity and stability of existing natural channels by using the Manning and Continuity Equations.

Use of the calculation methods outlined in this chapter is not mandated under the state program. Plan-approving authorities may use their discretion to require or accept any calculation method which they feel will best accomplish the desired objective under local conditions.

These engineering procedures are simplified primarily for the benefit of local officials without extensive engineering training who must review erosion and sediment control plans and check design adequacy. These procedures are not recommended for use by non-professionals to design permanent drainage systems or structures.

PART 1

ESTIMATING RUNOFF

Selecting a Calculation Method

Selection of the appropriate method of calculating runoff should be based upon the size of the drainage area and the output information required. Table 5-1 lists acceptable calculation methods for different drainage areas and output requirements. The plan approving authority may require or accept other calculation methods deemed more appropriate for local conditions.

TABLE 5-1

RUNOFF CALCULATION METHODS: SELECTION CRITERIA

Calculation Methods*

1. Rational Method
2. Peak Discharge Method
3. Tabular Method (TR-55)
4. Unit Hydrograph Method

Output Requirements	**Drainage Area**	**Appropriate Calculation Methods**
Peak Discharge only	up to 200 acres up to 2000 acres up to 20 sq. mi.	1, 2, 3, 4 2, 3, 4 3, 4
Peak Discharge and Total Runoff Volume	up to 2000 acres up to 20 sq. mi.	2, 3, 4 3, 4
Runoff Hydrograph	up to 20 sq. mi.	3, 4

* The Rational, Graphical Peak Discharge and Tabular methods of runoff determination are described in this chapter. The Unit Hydrograph method is described in the SCS National Engineering Handbook, Section 4, Hydrology.

RATIONAL METHOD

The rational formula is the most commonly used method of determining peak discharge from small drainage areas. This method is traditionally used to size storm sewers, channels, and other drainage structures which handle runoff from drainage areas less than 200 acres. This method is not recommended for routing stormwater through a basin or for developing a runoff hydrograph.

LIMITATIONS THAT AFFECT ACCURACY

(A) Drainage basin characteristics should be fairly homogeneous, otherwise another method should be selected.

(B) The method is less accurate for larger areas and is not recommended for use with drainage areas larger than 200 acres.

(C) The method becomes more accurate as the amount of impervious surface increases.

(D) For this method, it is assumed that a rainfall duration equal to the time of concentration results in the greatest peak discharge.

The rational formula is:

$$Q = CiA$$

where,

Q	=	Peak rate of runoff in cubic feet per second
C	=	Runoff coefficient, an empirical coefficient representing a relationship between rainfall and runoff
i	=	Average intensity of rainfall for the time of concentration (T_c) for a selected design storm
A	=	Drainage area in acres.

The rational method is based on empirical data and hypothetical rainfall-runoff events which are assumed to model natural storm events. During an actual storm event, the peak discharge is dependent on many factors including antecedent moisture conditions; rainfall magnitude, intensity, duration, and distribution; and, the effects of infiltration, detention, retention, and flow routing throughout the watershed.

The accuracy of the rational method is highly dependent upon the judgement and experience of the user. The method's simplicity belies the complexity in predicting a watershed's response to a rainfall event, especially when the rational method is used to predict post-development runoff. For that purpose, the user must select the appropriate runoff coefficient(s) and determine the time of concentration based on plan information (including proposed hydrologic changes) and experience in working with development and its effects on hydrology.

Runoff Coefficients

The engineer must use judgement in selecting the appropriate runoff coefficient within the range of values for the landuse. Generally, areas with permeable soils, flat slopes and dense vegetation should have the lowest values. Areas with dense soils, moderate to steep slopes, and sparse vegetation should be assigned the highest values.

Time of Concentration

Time of concentration is the time required for runoff to flow from the most hydraulically remote part of the drainage area to the point under consideration. The path that the runoff follows is called the hydraulic length or flow path. As the runoff moves down the flow path, the flow is characterized into flow types or flow regimes.

The three types of flow (or flow regimes) are presented below:

> **Overland flow** (or sheet flow) is shallow flow (usually less than one inch deep) over plane surfaces. For purposes of determining time of concentration, overland flow usually exists in the upper reaches of the hydraulic flow path. The recommended maximum length for this type of flow is 300 feet; however, many engineers agree that overland flow should be limited to 200 feet or less. The actual length of overland flow varies considerably according to actual field conditions. The length of overland flow should be verified by field investigation, if possible.
>
> **Shallow concentrated flow** usually begins where overland flow converges to form small rills or gullies and swales. Shallow concentrated flow can exist in small, man-made drainage ditches (paved and unpaved) and in curb and gutters. The recommended maximum length for shallow concentrated flow is 1000 feet.
>
> **Channel flow** occurs where flow converges in gullies, ditches, and natural or man-made water conveyances (including pipes not running full). Channel flow is assumed to exist in perennial streams or wherever there is a well-defined channel cross-section.

Calculation of Time of Concentration

Time of concentration equals the summation of the travel times for each flow regime. There are numerous methods used to calculate the travel time for each of the flow regimes. The following procedure outlines three methods for determining overland or sheet flow. These methods are: (1) Seelye method; (2) kinematic wave; (3) SCS-TR-55. The user must select the appropriate method for the site. A comprehensive discussion of each of these methods is beyond the scope of this handbook; the reader should consult other sources, such as SCS-TR-55, for more information. (See the reference section for a listing of other sources.)

General Procedure for the Rational Method

The general procedure for determining peak discharge using the rational method is as follows:

Step 1 - Determine the drainage area (in acres). Use survey information, USGS Quadrangle sheets, etc.

Step 2 - Determine the runoff coefficient (C) for the drainage area. Table 5-2 presents a range of runoff coefficient values for various landuses. If the landuse and soil cover are homogeneous for the entire drainage area, a runoff coefficient value can be determined directly from Table 5-2. If there are multiple landuses or soil conditions, a weighted average must be calculated as follows:

Weighted Average "C"	=	(area landuse_1) x "C" = CA_1	
		(area landuse_2) x "C" = CA_2	
		[continue for each landuse]	
		Total Area	Total CA

$$= \frac{\text{Total CA}}{\text{Total Area}}$$

Step 3 - Determine the hydraulic length or flow path that will be used to determine the time of concentration. Also, determine the types of flow (or flow regimes) that occur along the flow path.

Step 4 - Determine the time of concentration (T_c) for the drainage area.

(A) Overland Flow L_o

The travel time for overland flow may be determined by using the following methods as appropriate. If the ground cover conditions are not homogenous for the entire overland flow path, determine the travel time for each ground cover condition separately and add the travel times to get overland flow travel time. Do not use an average ground cover condition. **Note: the hydraulic length for overland flow should be determined for each site. Do not assume that the length of overland flow equals the maximum recommended length.**

(a) Seelye Method: Travel time for overland flow can be determined by using the Seelye chart (Plate 5-1). This method is perhaps the simplest and is most commonly used for small developments where a greater margin of error is acceptable.

Determine the length of overland flow and enter the nomograph on the left axis, "Length of Strip." Intersect the "Character of Ground" to determine the turn point on the "Pivot" line. Intersect the "Percent of slope" and read the travel time for overland flow.

(b) Kinematic Wave Method: This method allows for the input of rainfall intensity values, thereby providing the specific overland flow travel time for the selected design storm. The equation is:

$$T_t = \frac{(0.93)\ L^{0.6}\ n^{0.6}}{i^{0.4}\ S^{0.3}}$$

where,

L = length of overland flow in feet
n = Manning's roughness coefficient (from Table 5-3)
i = rainfall intensity (from Plates 5-4 to 5-18)
S = slope in feet/foot

Since the equation contains two unknown variables (travel time and rainfall intensity), a trial and error process is used to determine the overland flow time. First, assume a rainfall intensity value (from Plates 5-4 to 5-18) or use the Seelye chart for an approximate duration value) and solve the equation for travel time (T_t). Next, compare the assumed rainfall intensity value with the rainfall intensity value (from Plates 5-4 to 5-18) that corresponds with the travel time. If the assumed rainfall intensity value equals the corresponding rainfall intensity value, the process is complete. If not, adjust the assumed rainfall intensity value accordingly and repeat the procedure until the assumed value compares favorably with the corresponding rainfall intensity value. (See the VDOT Drainage Manual for more details.)

(c) SCS-TR-55 method: [See the Graphical Peak Discharge section or the SCS-TR-55 Manual for details.]

(B) Shallow Concentrated Flow L_{sc}
Determine the velocity of the flow by using Plate 5-2. Then calculate the travel time by the following equation:

$$Tt(\text{minutes}) = \frac{L}{60\ V}$$

where,

L = length of shallow concentrated flow in feet
V = velocity (in feet per second, from Plate 5-2)

Note: The calculation of shallow concentrated flow time is frequently not included when using the rational method. However, the procedure is included in this text for consistency with other runoff methods.

(C) Channel Flow L_c

For small drainage basins, Plate 5-3 can be used to calculate the travel time for the channel flow portion of the flow path.

For larger drainage areas, Manning's Equation is the preferable method for calculating channel flow. The following procedure is used:

$$V = \frac{1.49 \; r^{2/3} \; s^{1/2}}{n}$$

where,

V = average velocity (ft/s)
r = hydraulic radius (ft); $r = a/p_w$
a = cross sectional flow area (ft^2)
p_w = wetted perimeter (ft)
s = slope of the grade line (channel slope, ft/ft)
n = Manning's roughness coefficient.

Calculate the velocity (V), then calculate the travel time by using the following equation:

$$T_{t(minutes)} = \frac{L}{60\ V}$$

where,

L = Length of channel flow in feet
V = Velocity in feet per second

[For more information on use of the Manning Equation, see Part III, Open Channel Flow.]

Step 4 - Add all of the travel times to get the time of concentration (T_c) for the entire hydraulic length or flow path.

Step 5 - Determine the Rainfall Intensity Factor (i) for the selected design storm by using the Rainfall Intensity charts (Plates 5-4 to 5-18). Select the chart for the locality closest to project. Enter the "Duration" axis of the chart with the time of concentration (T_C). Move vertically to intersect the curve of the appropriate design storm, then move horizontally to read the Rainfall Intensity Factor (i) in inches per hour.

Step 6 - Determine the peak discharge (Q) in cubic feet per second by multiplying the runoff coefficient (or weighted average) (C), the rainfall intensity (i), and the drainage area (A):

$$Q = CiA$$

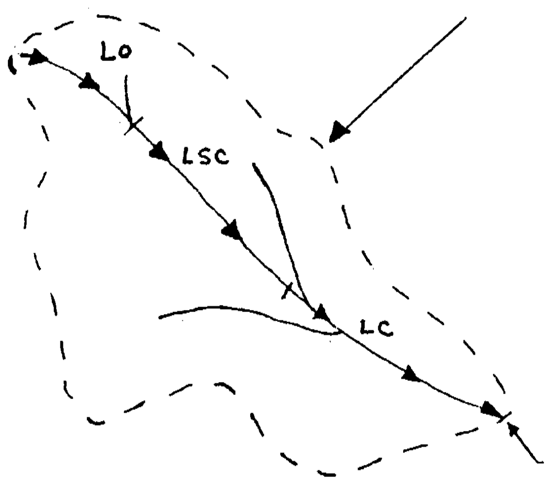
Example 5-1

A project is to be built in southwest Campbell County, Virginia. The following information was determined from field measurement and/or proposed design data:

Drainage Area: 80 acres

30% - Rooftops (24 acres)
10% - Streets and driveways (8 acres)
20% - Average lawns @ 5% slope on sandy soil (16 acres)
40% - Woodland (32 acres)

Watershed = 80 acres at the design point



Design Point

L_o = 200 ft. (4% slope or 0.04 ft./ft.); average grass lawn.

L_{sc} = 1000 ft. (4% slope or 0.04 ft./ft.); paved ditch.

L_c = 2000 ft. (1% slope or 0.01 ft./ft.); stream channel.

Find: Peak runoff rate from the 2-year frequency storm.

Solution:

1. Drainage Area (A) = 80 acres (given).

2. Determine runoff coefficient (C):

Calculate Weighted Average

	Area	x	C (Table 5-2)		
Rooftops	24	x	0.9	=	21.6
Streets	8	x	0.9	=	7.2
Lawns	16	x	0.15	=	2.4
Woodland	32	x	0.10	=	3.2
	80				34.4

$$C = \frac{34.4}{80} = 0.43$$

3. Determine the Time of Concentration (T_c) to the Design Point:

A. Overland flow (L_o)

Using Plate 5-1, T_t = 15 minutes

B. Shallow concentrated flow (L_{sc})

Using Plate 5-2 and the equation, $T_t = \frac{L}{60V}$

1000 ft. length, paved ditch, 4% slope (.04 ft./ft.);
V = 4 fps (from Plate 5-2)

$$L_{sc} = \frac{1100}{60(4)} = 4.2 \text{ minutes}$$

C. Channel Flow (L_c)

Using Plate 5-3:

2000 ft. length and 1% slope (.01 ft./ft.)

(2000) (.01) = 20 ft. height of most remote point of channel above outlet.

L_c = 16 minutes.

4. Add all the travel times to get T_c.

$$15 + 4.2 + 16 = 35.2$$

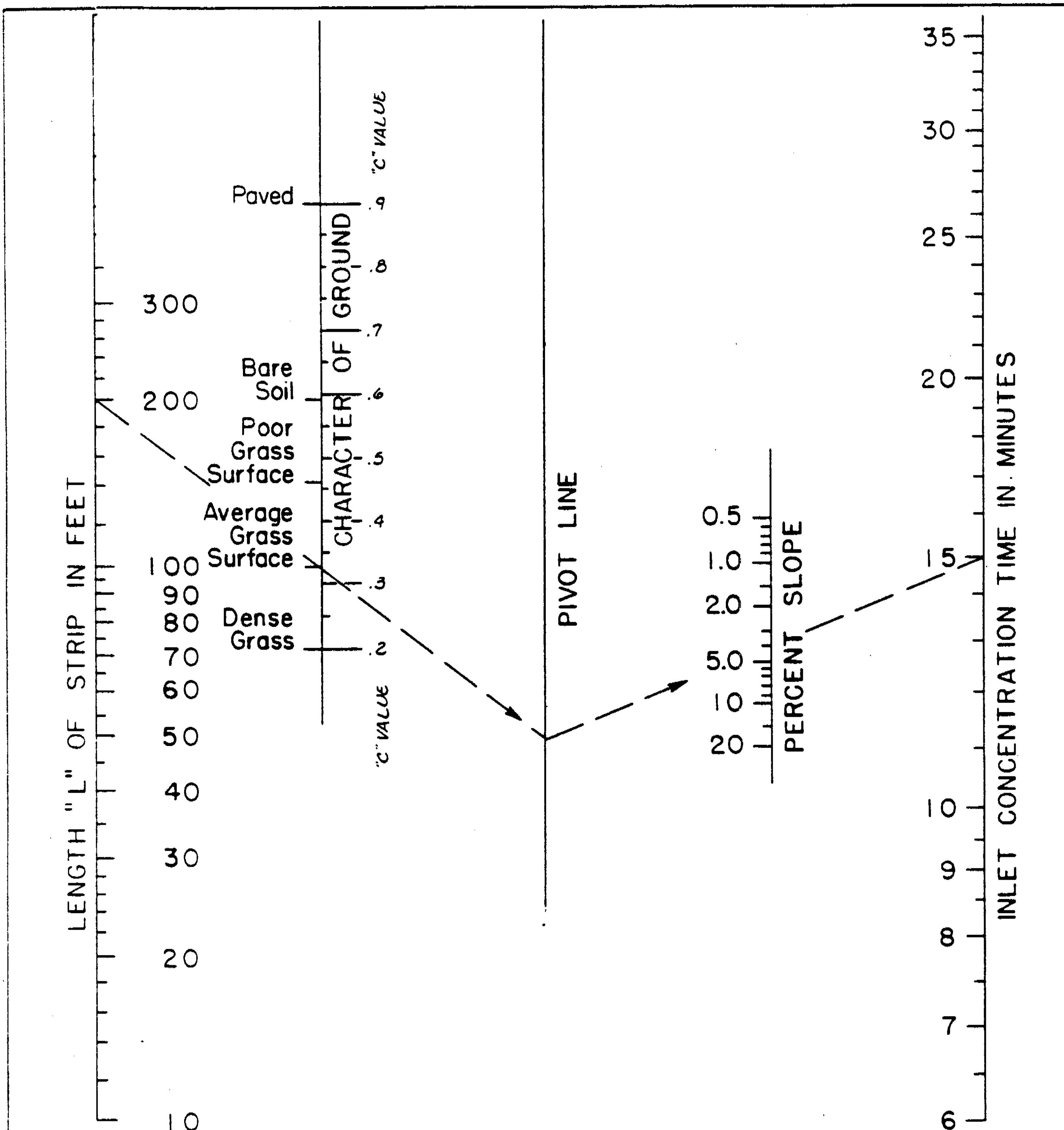
$$T_c = 35.2 \text{ minutes.}$$

5. Determine the Rainfall Intensity value (i) for the 2-year design storm (using Plate 5-4, Lynchburg Chart).

$$(i) = 2.1 \text{ inches per hour.}$$

6. Determine the peak discharge Q in cfs.

$$\begin{aligned} Q &= (C)\,(i)\,(A) \\ &= (.43)(2.1)(80) \\ &= 72.2 \text{ cfs} \end{aligned}$$



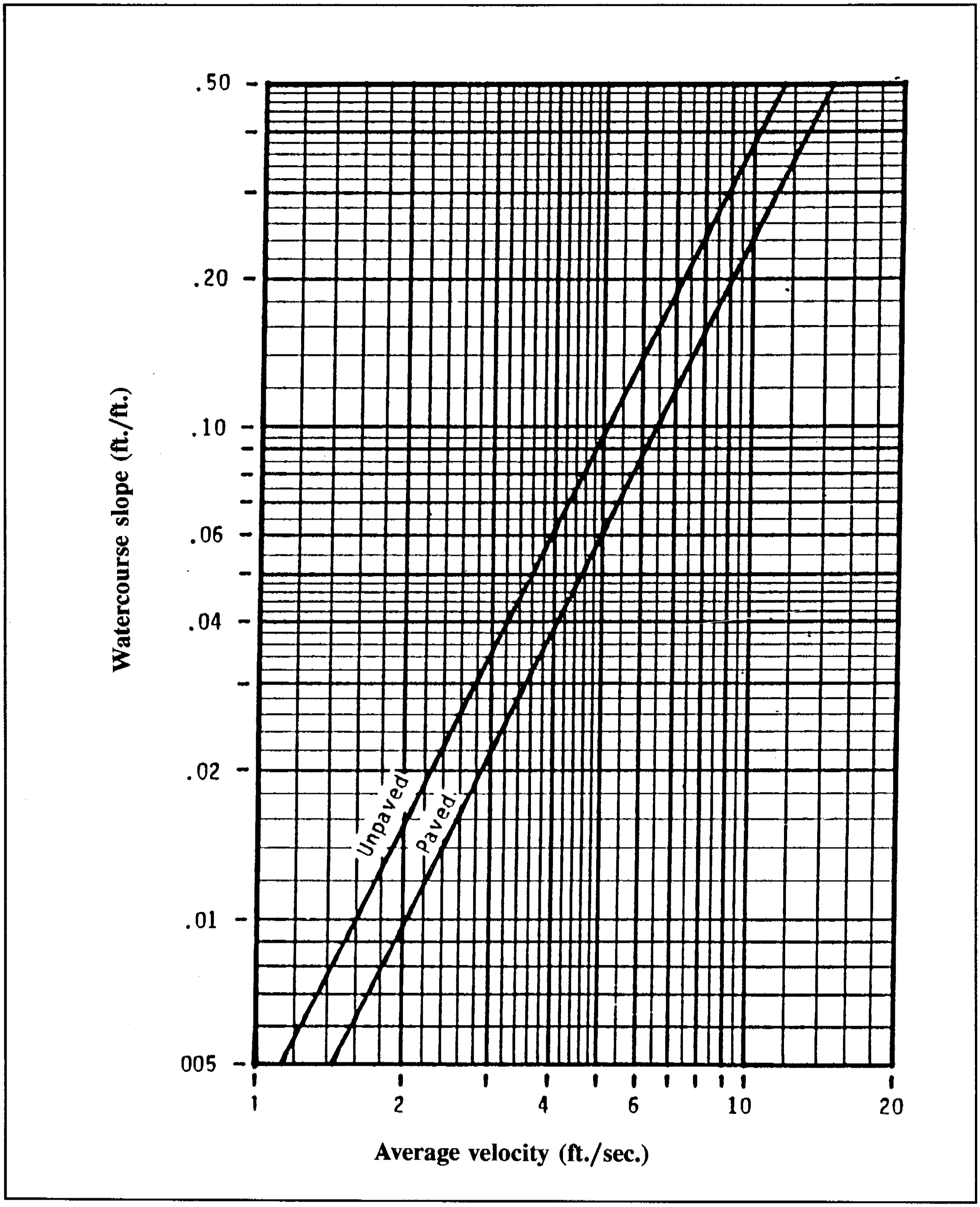
OVERLAND FLOW TIME

(Seelye Chart)

Source: Data Book for Civil Engineers, E.E. Seelye

Plate 5-1

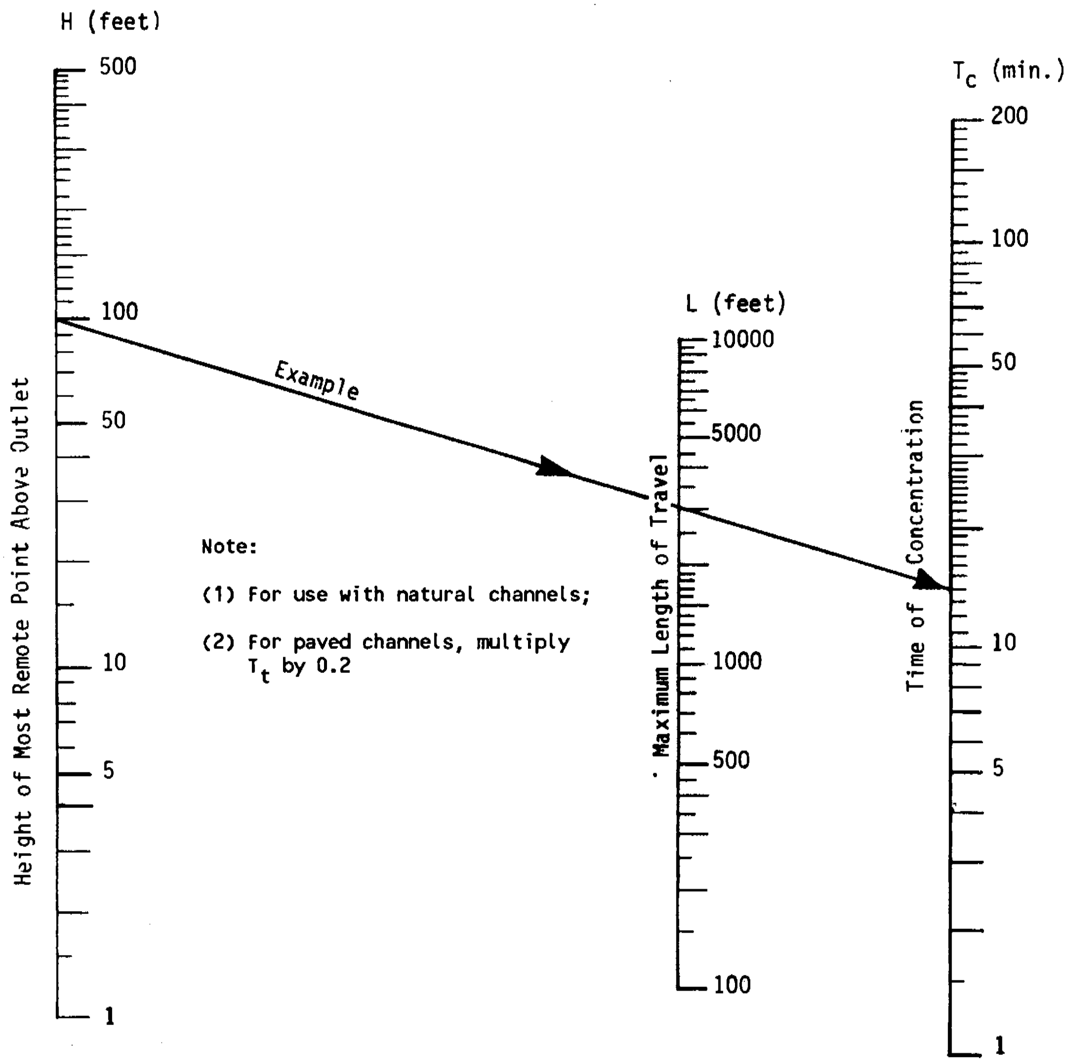
AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME FOR SHALLOW CONCENTRATED FLOW



Source: USDA-SCS

Plate 5-2

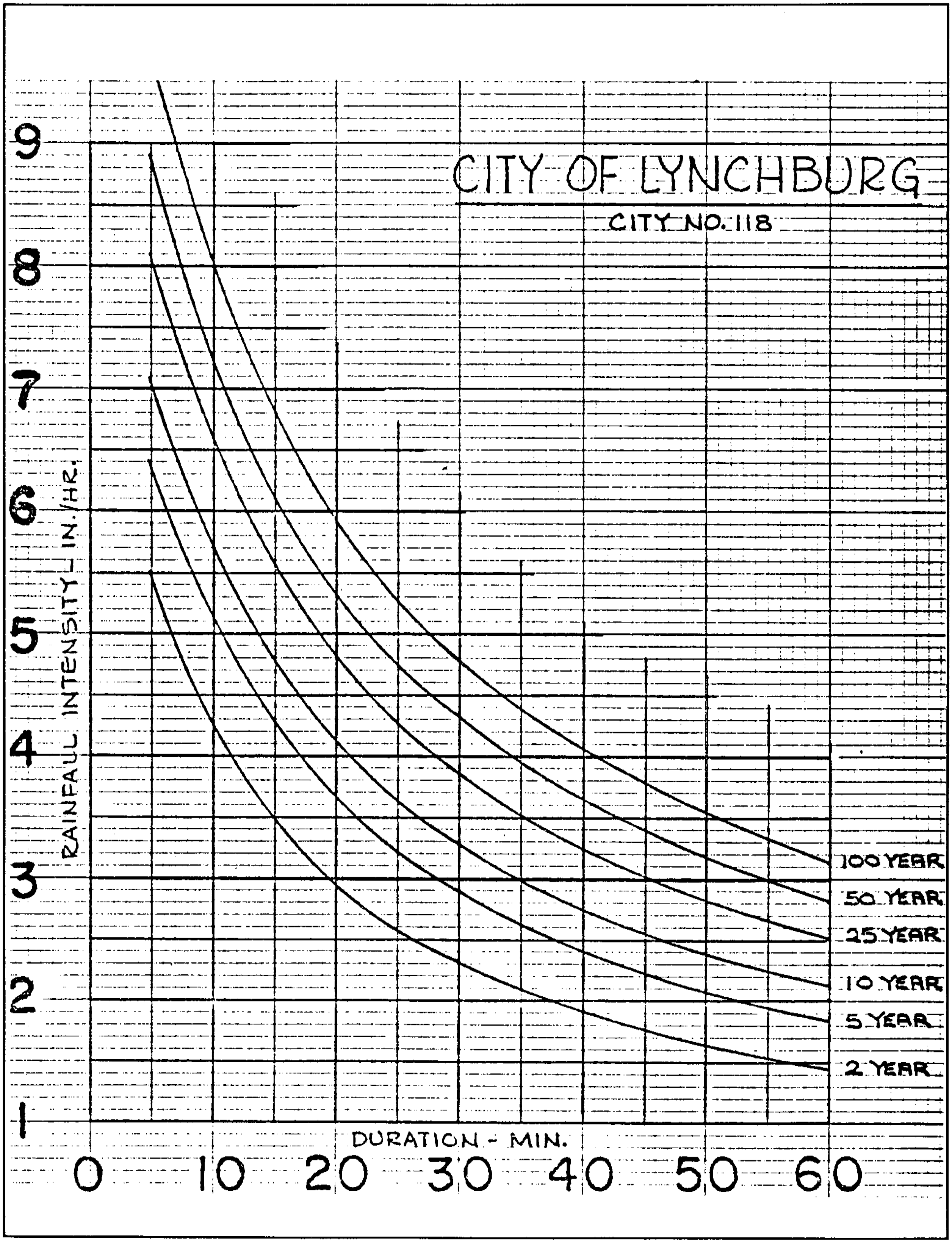
TRAVEL TIME FOR CHANNEL FLOW
(Kirpich Chart)



TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

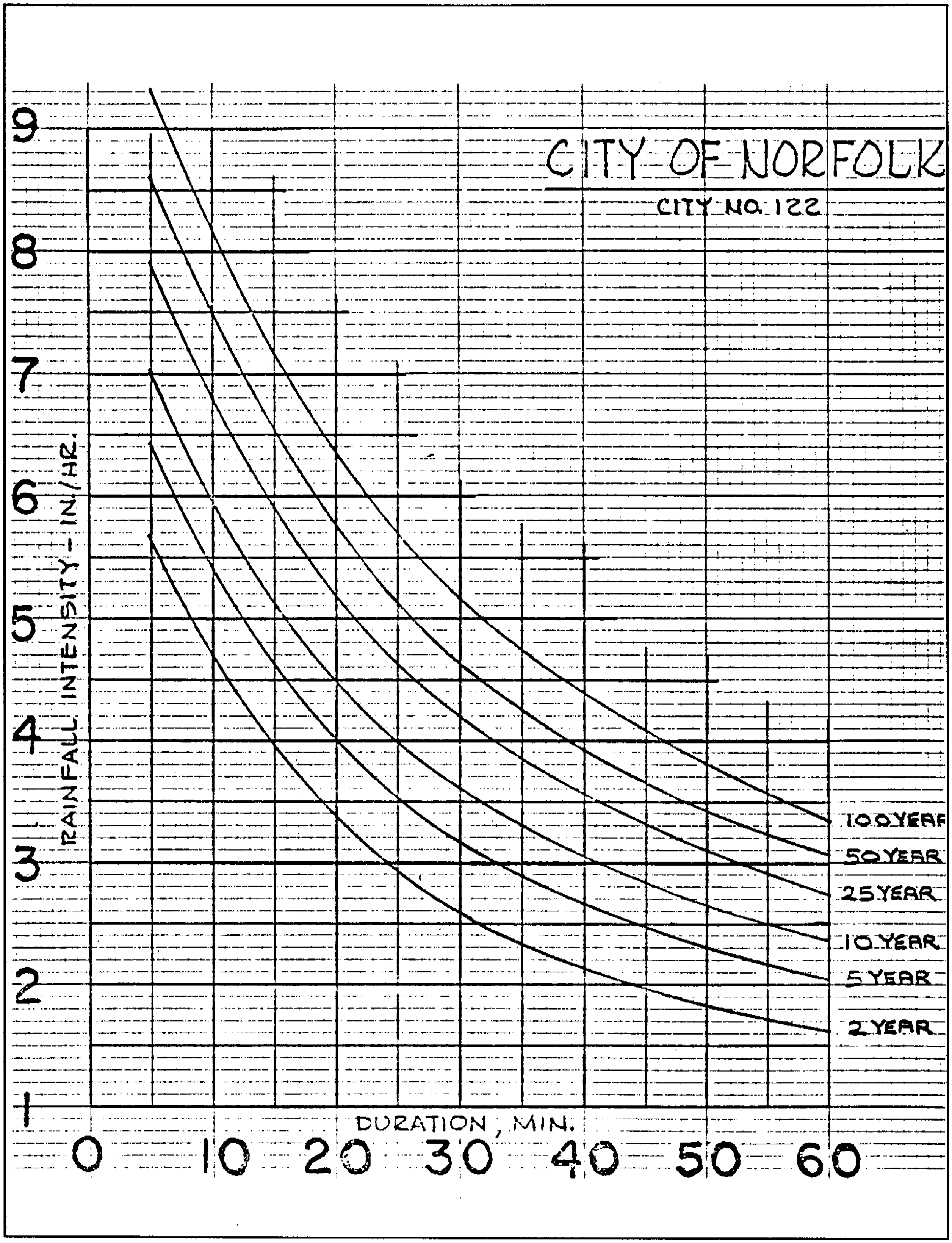
Source: VDOT

Plate 5-3



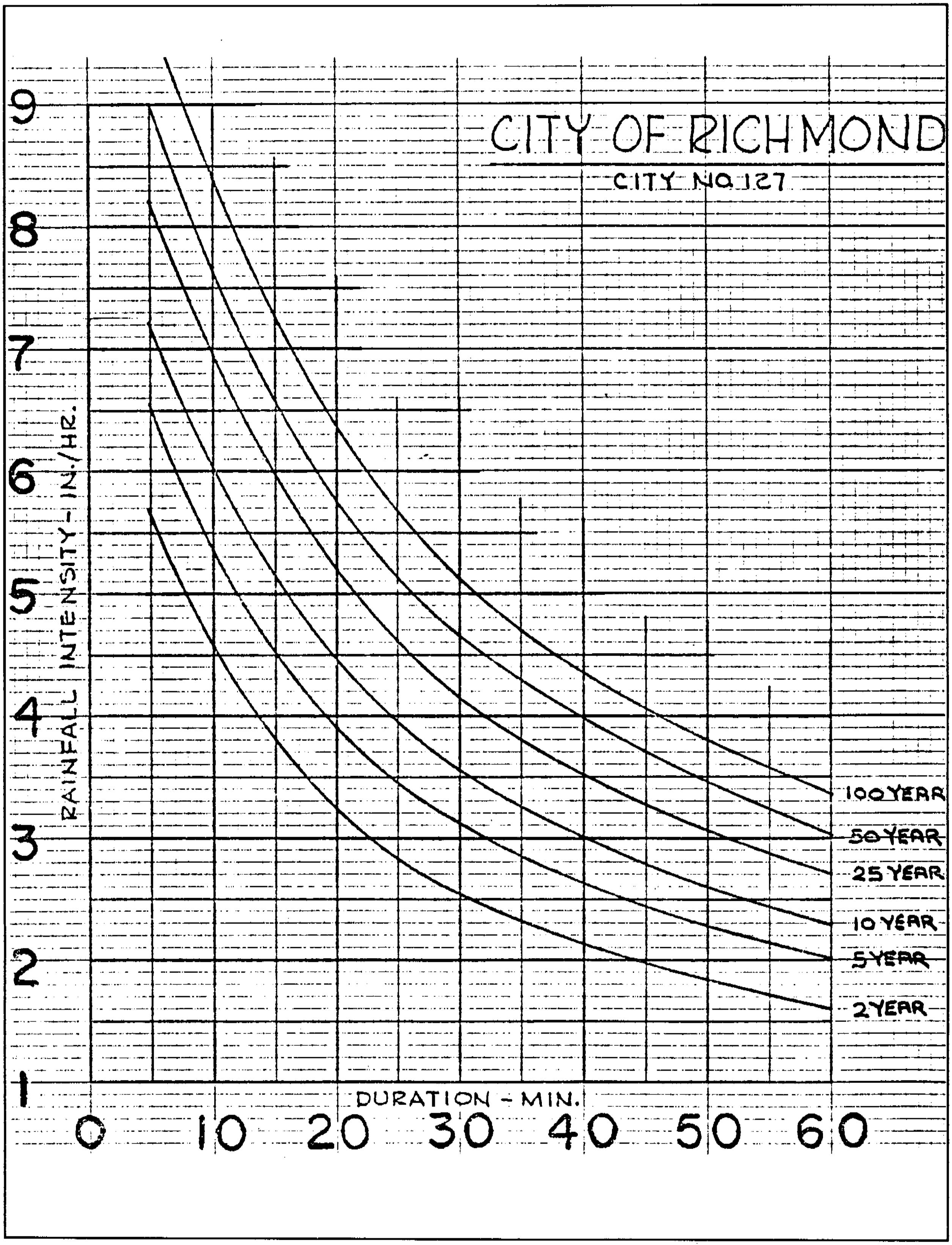
Source: VDOT

Plate 5-4



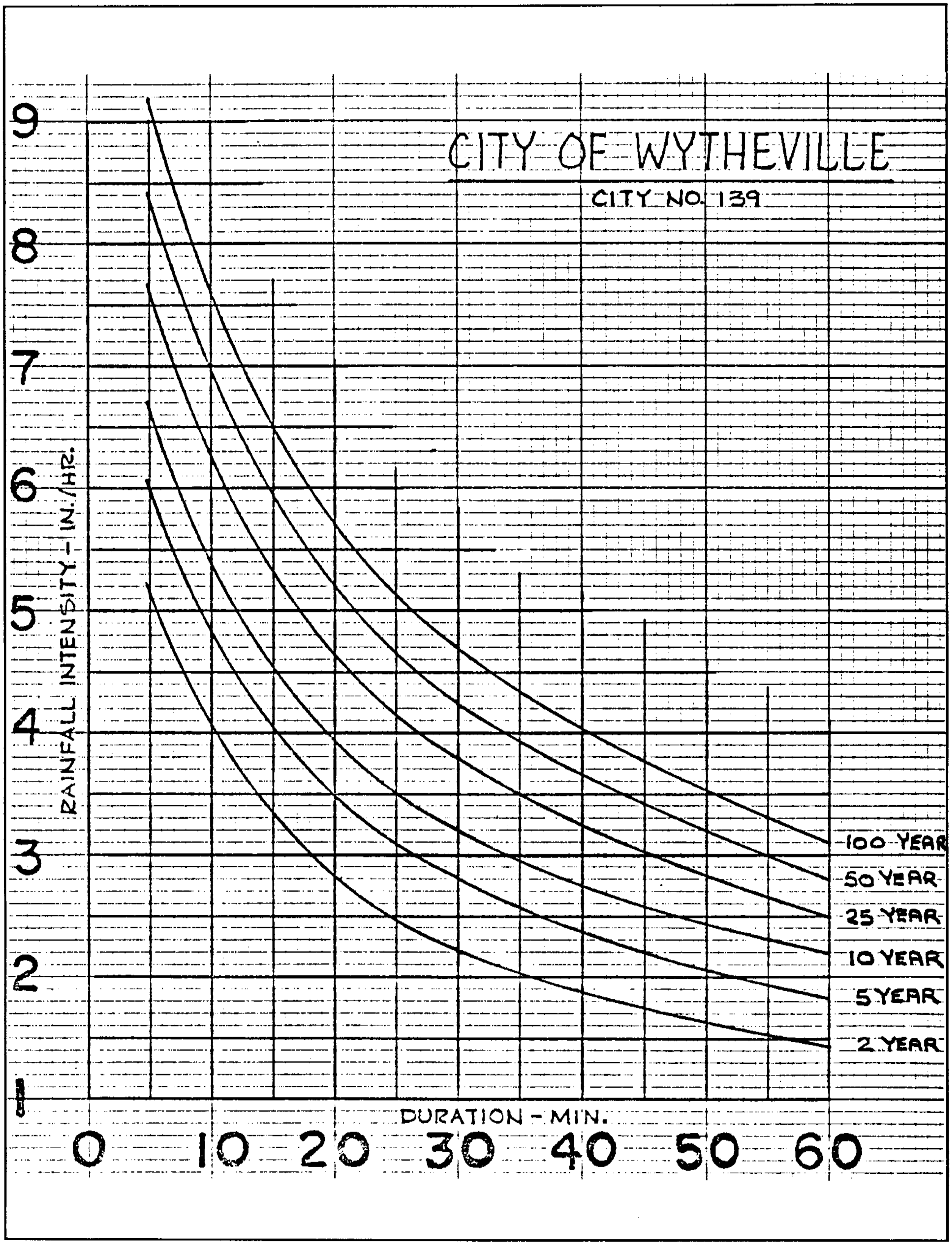
Source: VDOT

Plate 5-5



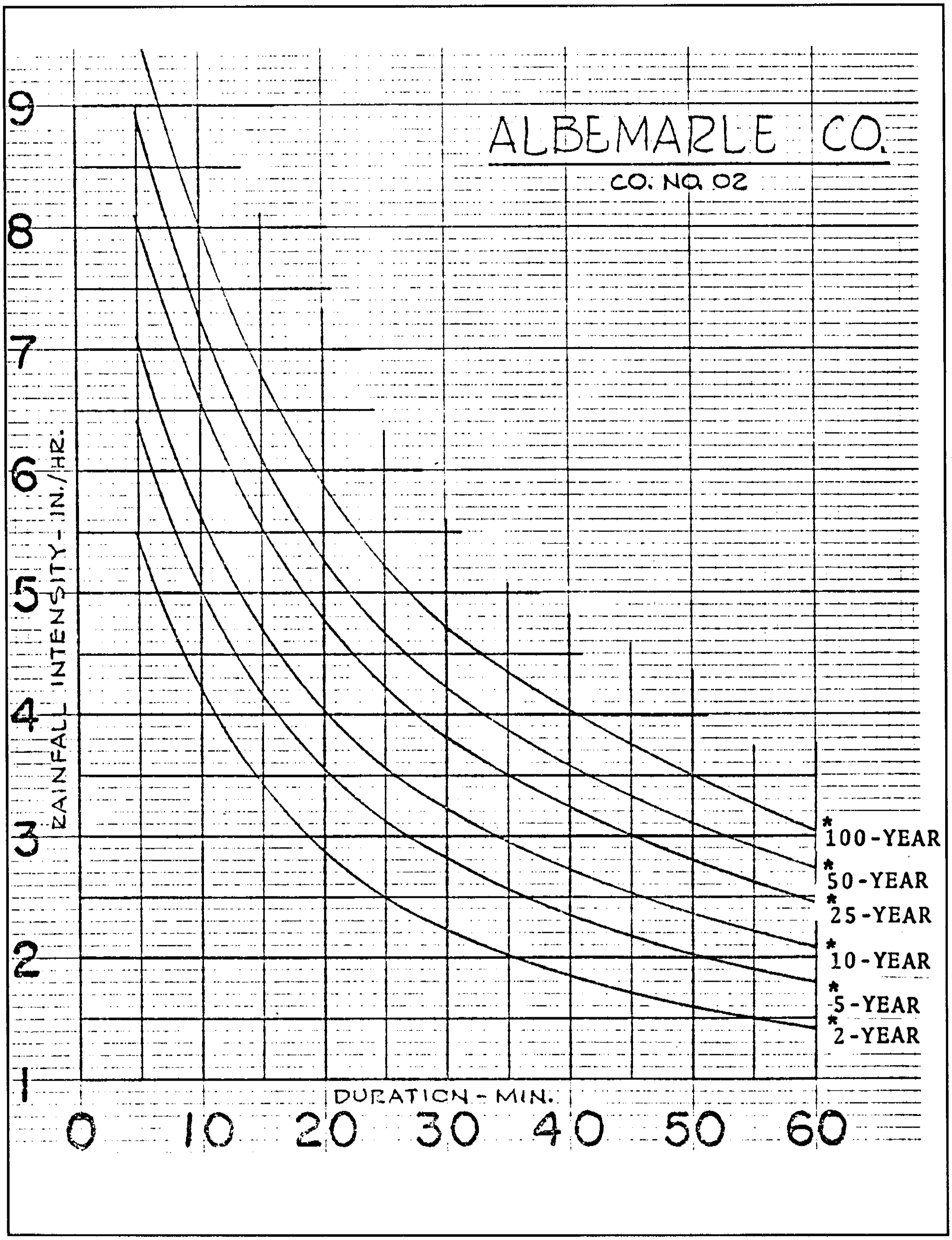
Source: VDOT

Plate 5-6



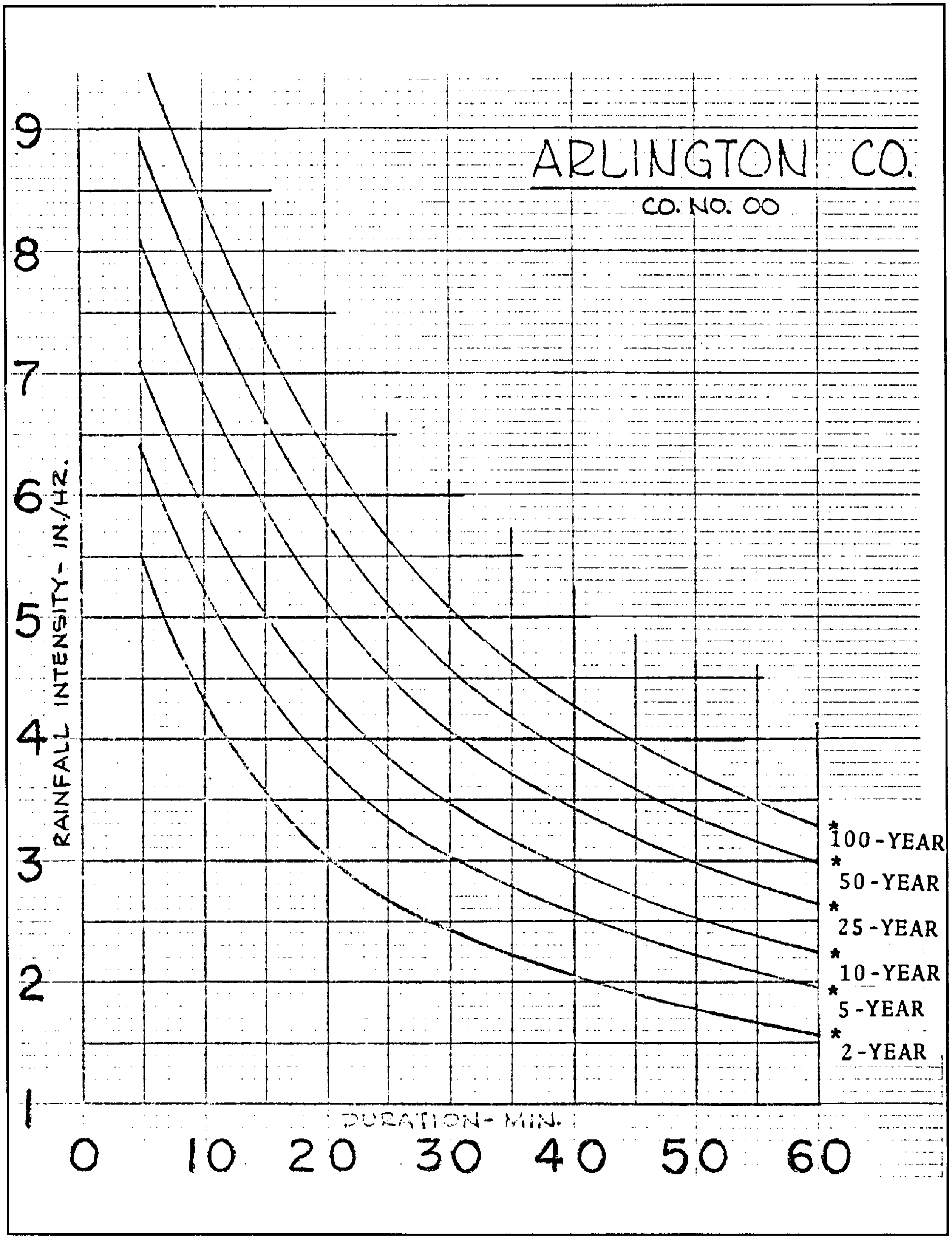
Source: VDOT

Plate 5-7



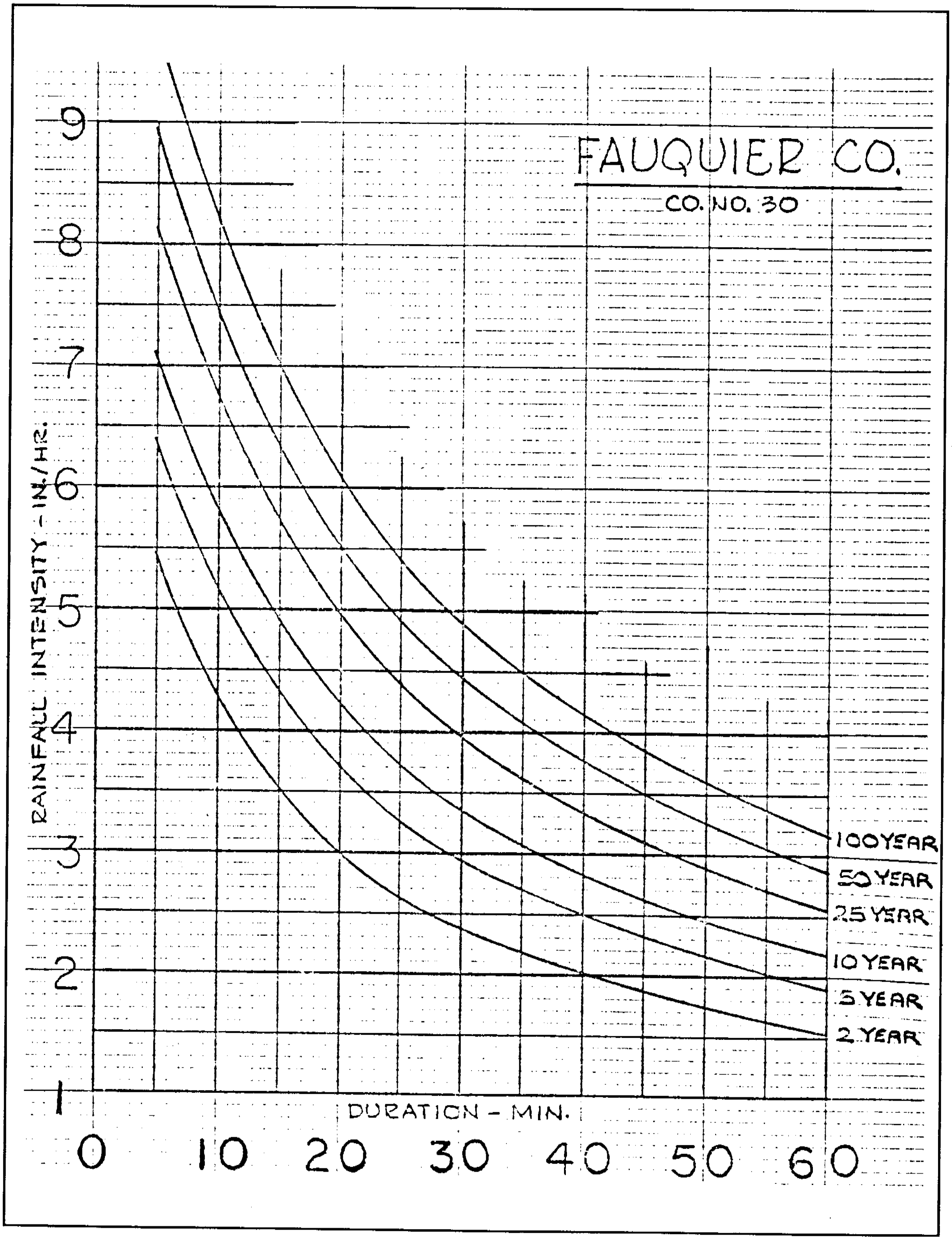
Source: VDOT

Plate 5-8



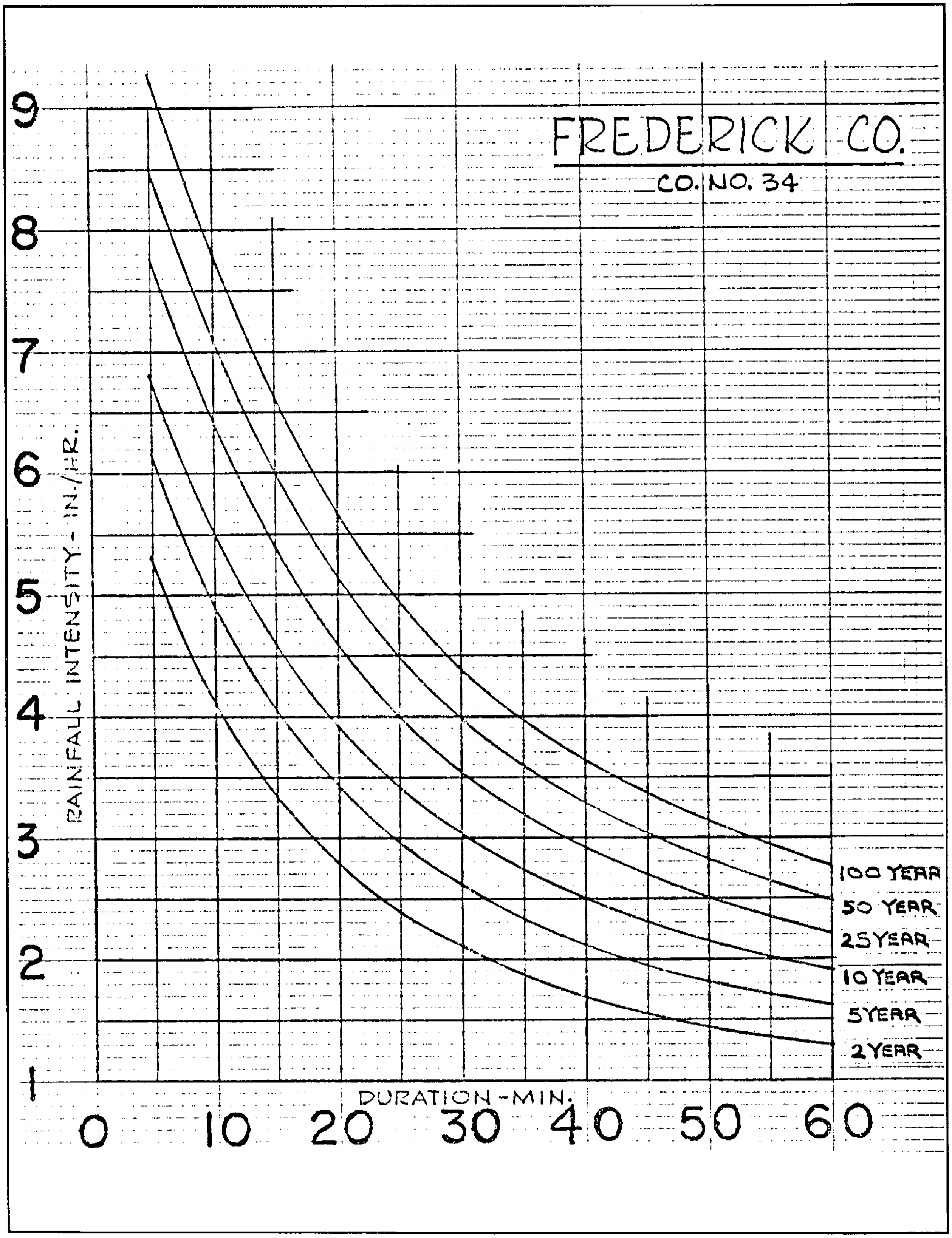
Source: VDOT

Plate 5-9



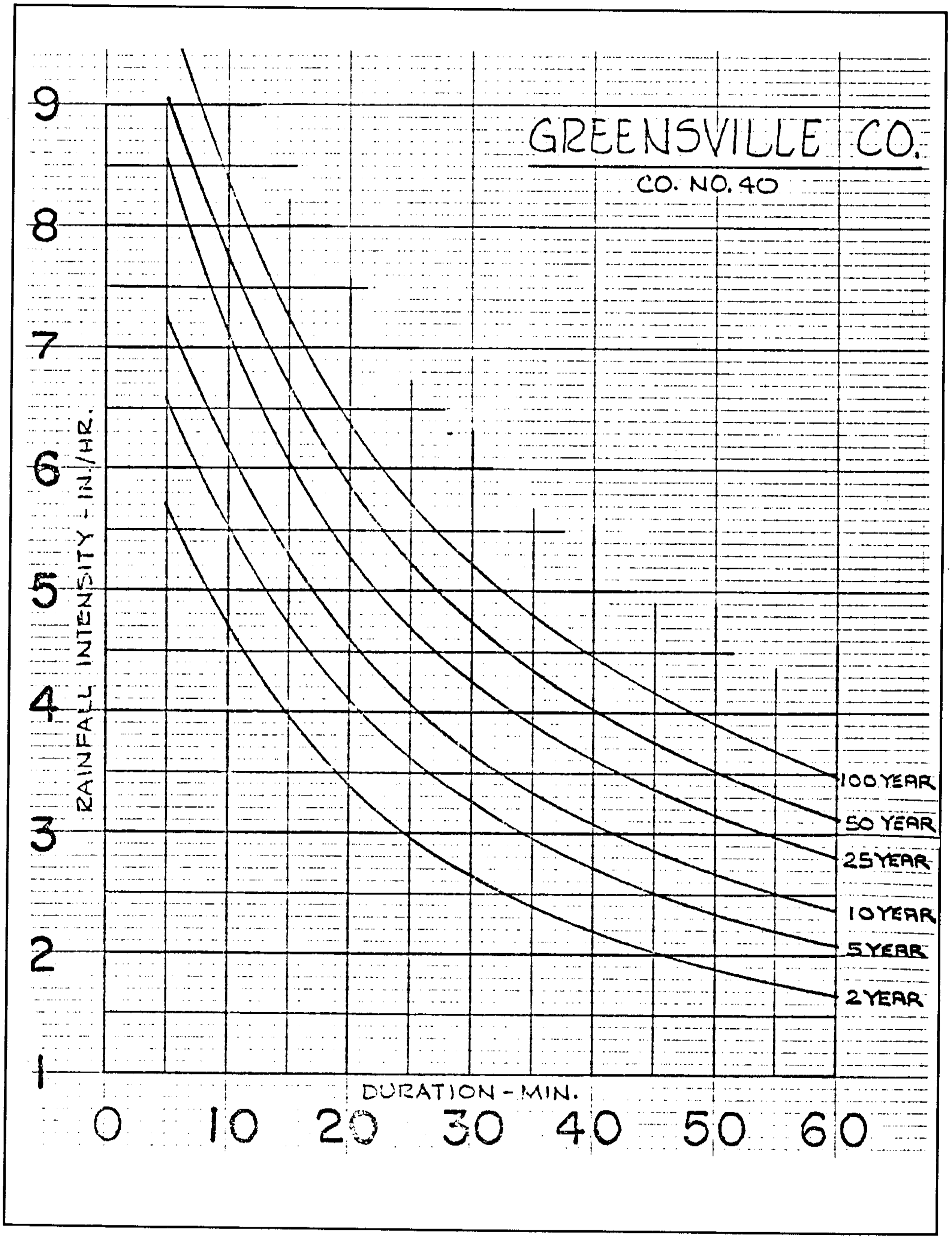
Source: VDOT

Plate 5-10



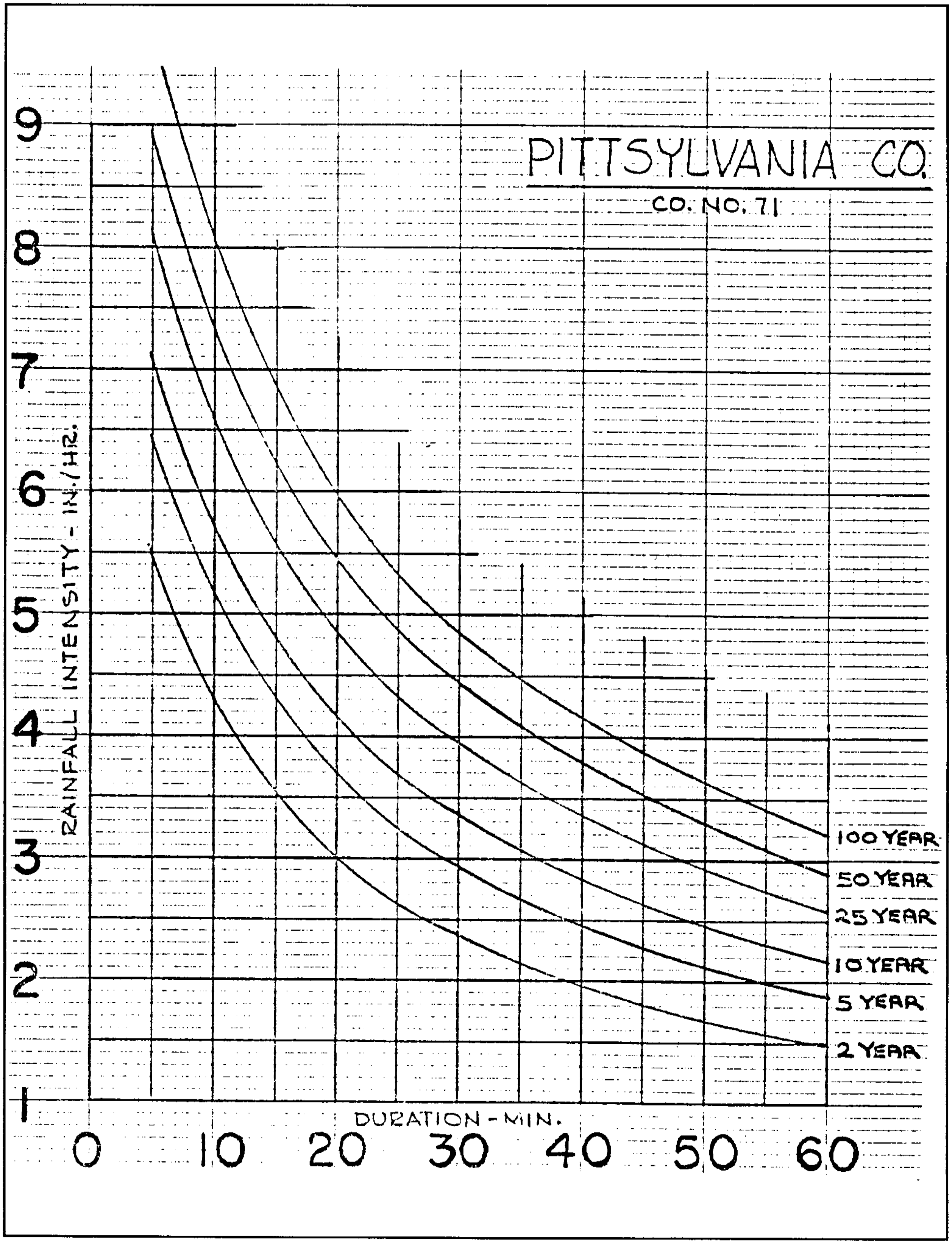
Source: VDOT

Plate 5-11



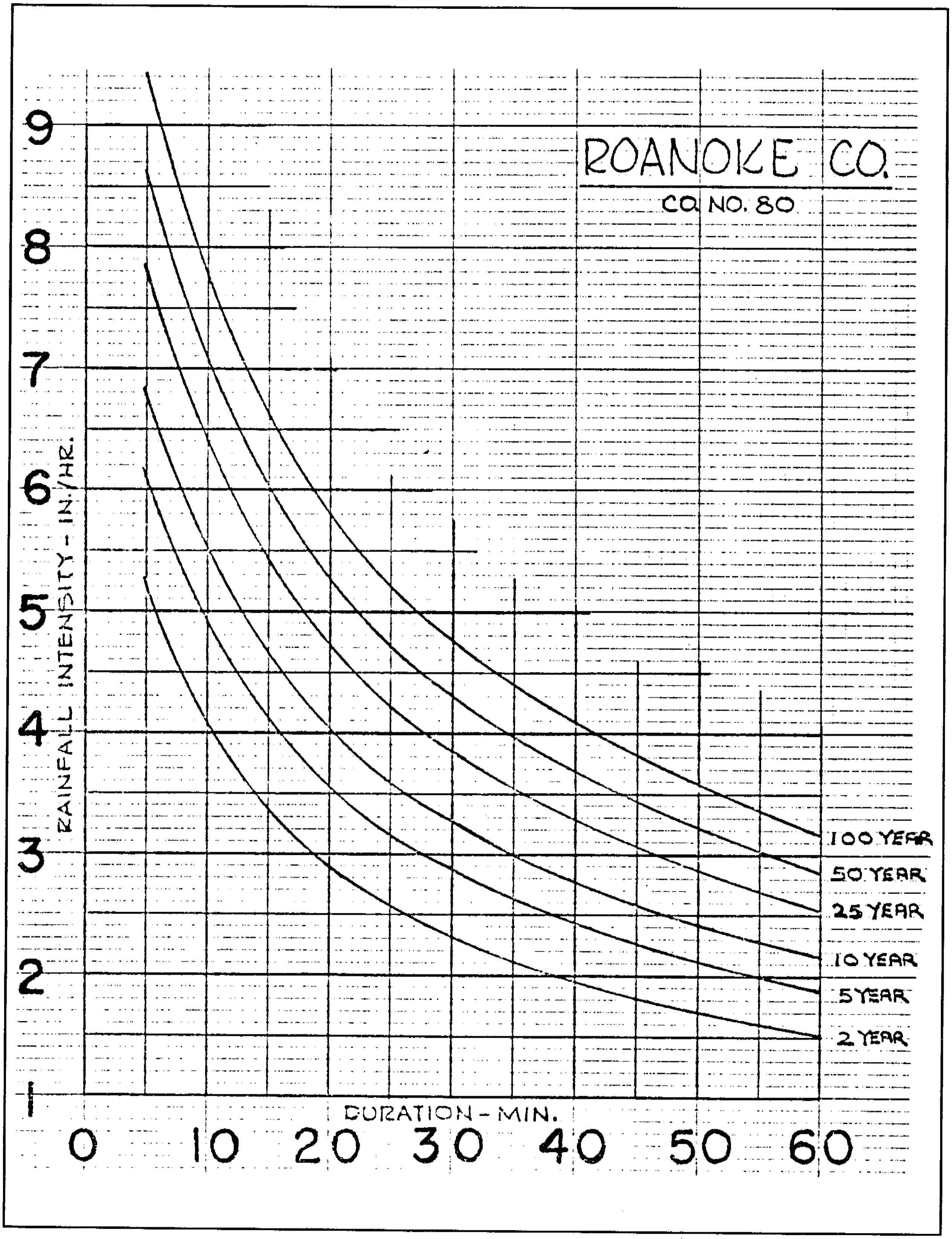
Source: VDOT

Plate 5-12



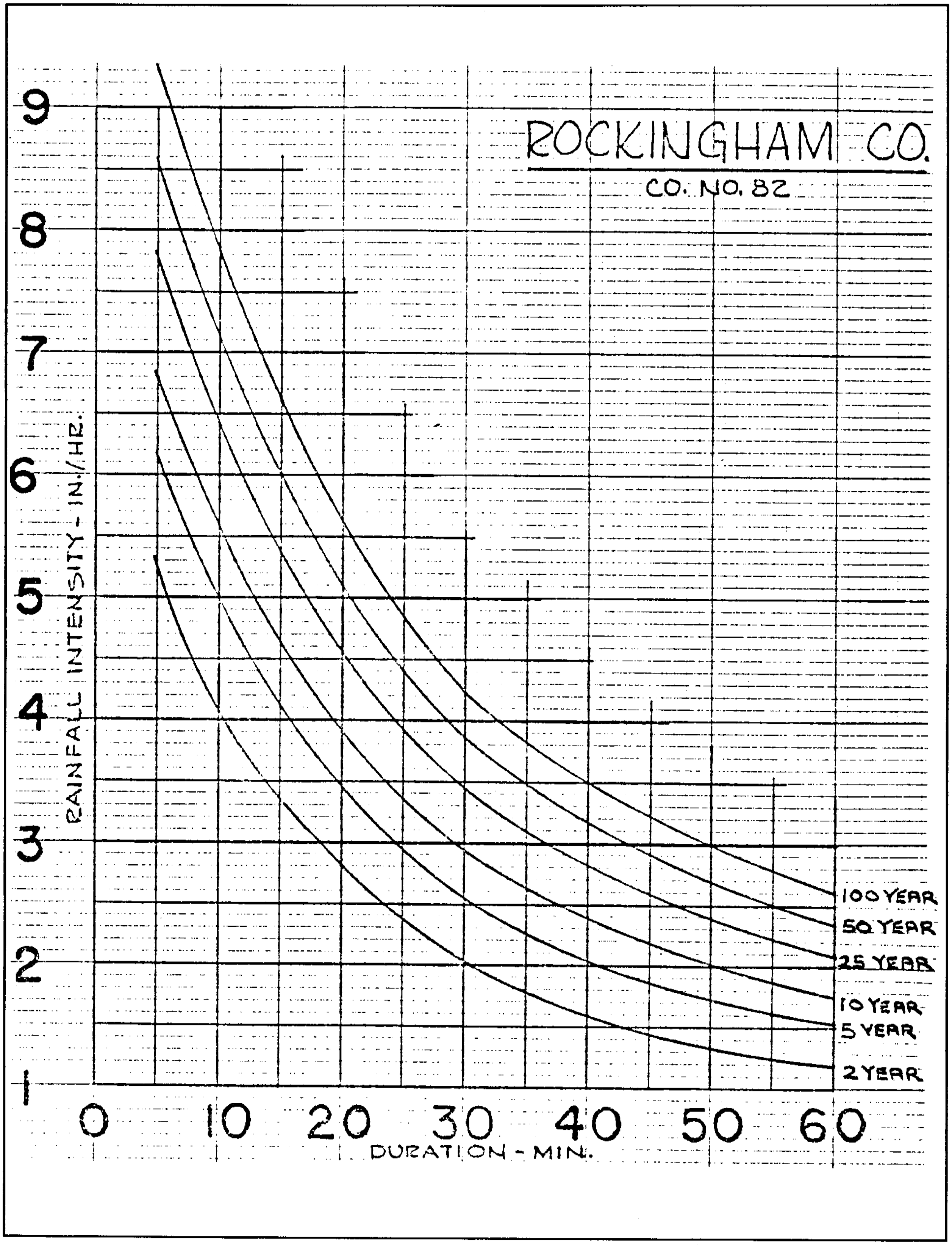
Source: VDOT

Plate 5-13



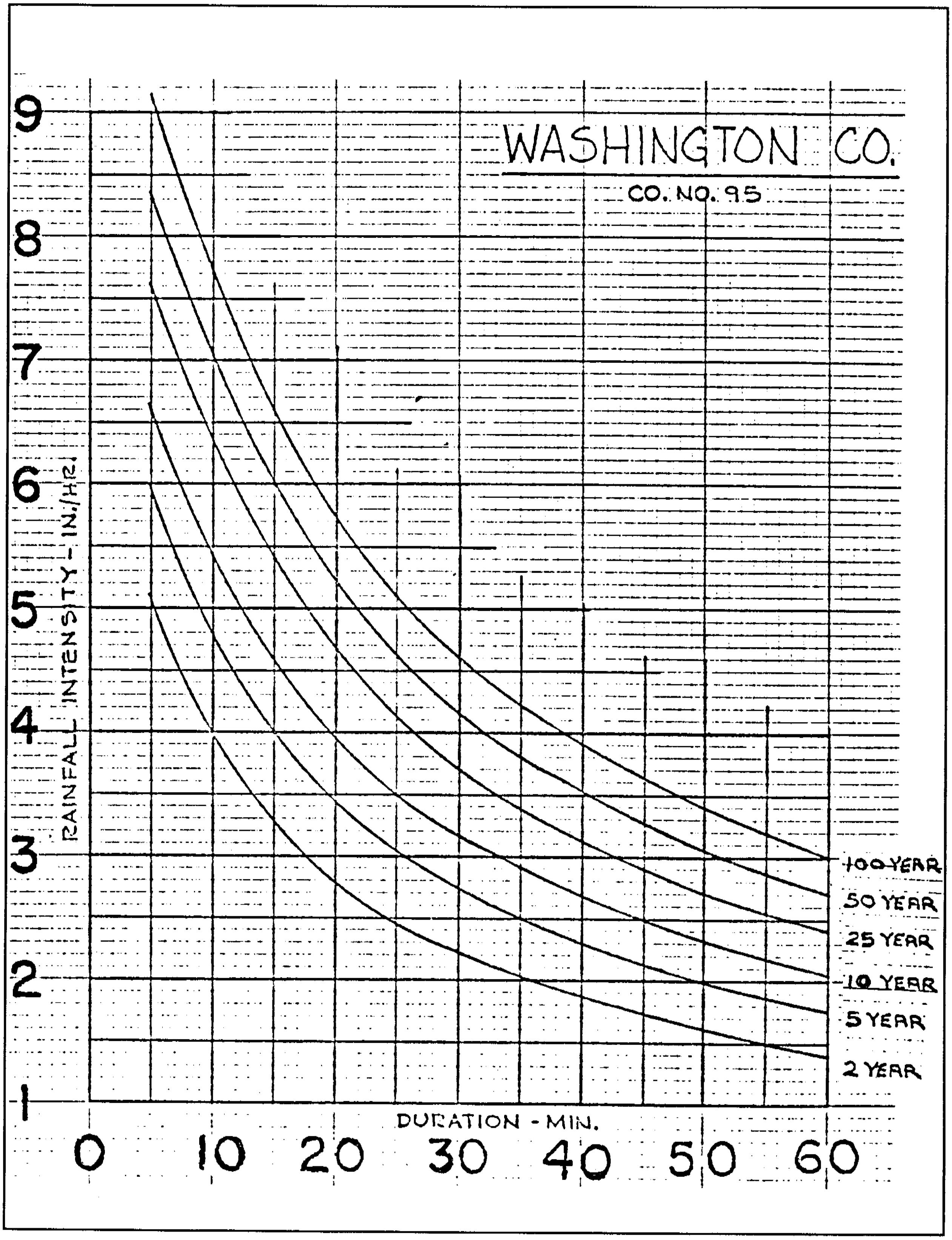
Source: VDOT

Plate 5-14



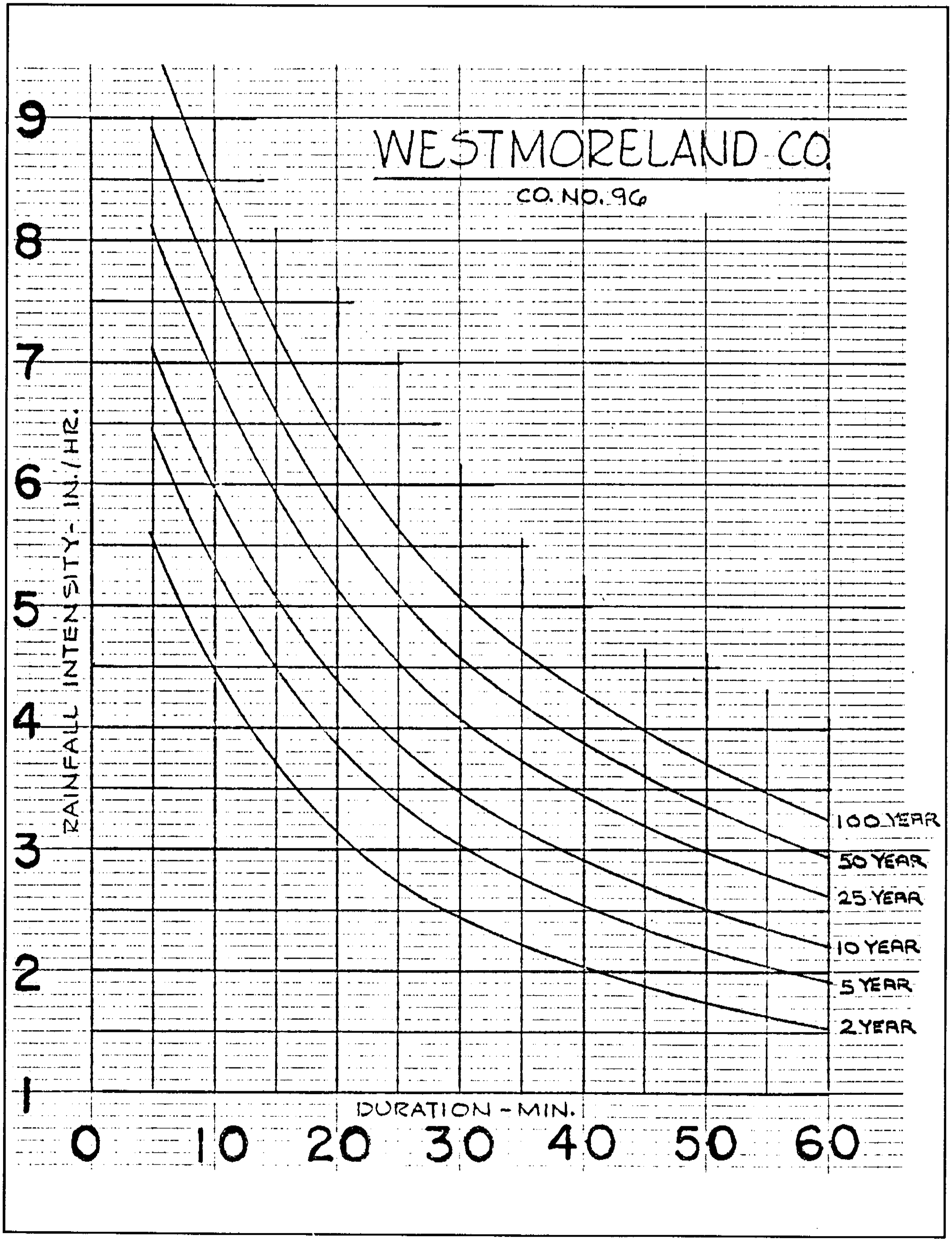
Source: VDOT

Plate 5-15



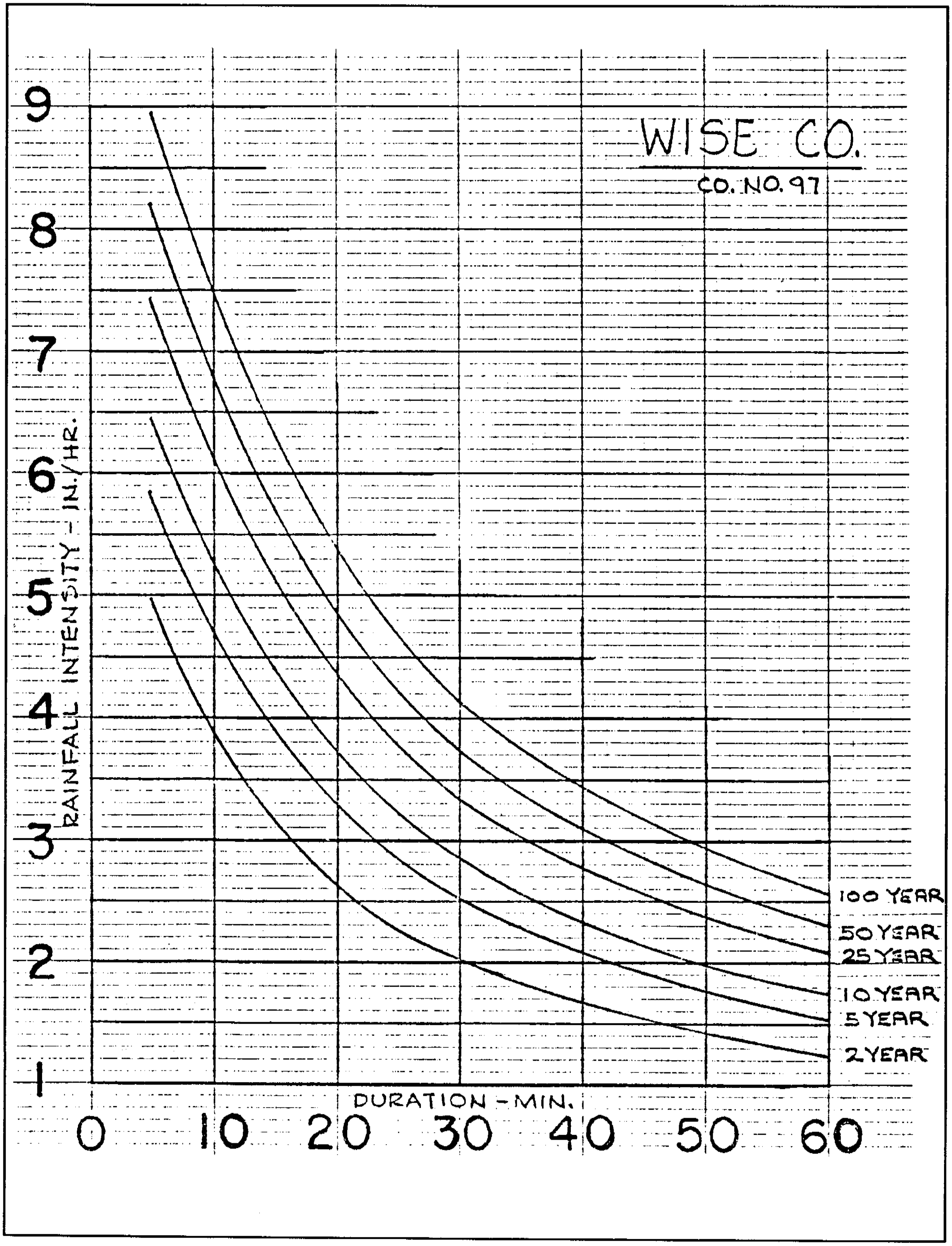
Source: VDOT

Plate 5-16



Source: VDOT

Plate 5-17



Source: VDOT

Plate 5-18

TABLE 5-2
VALUES OF RUNOFF COEFFICIENT (C) FOR RATIONAL FORMULA

Land Use	C	Land Use	C
Business:		Lawns:	
Downtown areas	0.70-0.95	Sandy soil, flat, 2%	0.05-0.10
Neighborhood areas	0.50-0.70	Sandy soil, average, 2-7%	0.10-0.15
		Sandy soil, steep, 7%	0.15-0.20
		Heavy soil, flat, 2%	0.13-0.17
		Heavy soil, average, 2-7%	0.18-0.22
		Heavy soil, steep, 7%	0.25-0.35
Residential:		Agricultural land:	
Single-family areas	0.30-0.50	Bare packed soil	
Multi units, detached	0.40-0.60	* Smooth	0.30-0.60
Multi units, attached	0.60-0.75	* Rough	0.20-0.50
Suburban	0.25-0.40	Cultivated rows	
		* Heavy soil, no crop	0.30-0.60
		* Heavy soil, with crop	0.20-0.50
		* Sandy soil, no crop	0.20-0.40
		* Sandy soil, with crop	0.10-0.25
		Pasture	
		* Heavy soil	0.15-0.45
		* Sandy soil	0.05-0.25
		Woodlands	0.05-0.25
Industrial:		Streets:	
Light areas	0.50-0.80	Asphaltic	0.70-0.95
Heavy areas	0.60-0.90	Concrete	0.80-0.95
		Brick	0.70-0.85
Parks, cemeteries	0.10-0.25	Unimproved areas	0.10-0.30
Playgrounds	0.20-0.35	Drives and walks	0.75-0.85
Railroad yard areas	0.20-0.40	Roofs	0.75-0.95

Note: The designer must use judgement to select the appropriate "C" value within the range. Generally, larger areas with permeable soils, flat slopes and dense vegetation should have the lowest C values. Smaller areas with dense soils, moderate to steep slopes, and sparse vegetation should be assigned the highest C values.

Source: American Society of Civil Engineers

TABLE 5-3
ROUGHNESS COEFFICIENTS
(MANNING'S "N") FOR SHEET FLOW

Surface Description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods[3]:	
Light underbrush	0.40
Dense underbrush	0.80

[1] The "n" values are a composite of information compiled by Engman (1986).

[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Source: USDA-SCS

Graphical Peak Discharge Method

The graphical peak discharge method of calculating runoff was developed by the USDA - Soil Conservation Service and is contained in SCS Technical Release No. 55 (210-VI-TR-55, Second Ed., June 1986) entitled Urban Hydrology for Small Watersheds. (62)

This method of runoff calculation yields a total runoff volume as well as a peak discharge. It takes into consideration infiltration rates of soils, as well as land cover and other losses to obtain the net runoff. As with the rational formula, it is an empirical model and its accuracy is dependent upon the judgement of the user.

The information presented in this section is intended as (1) an introduction to the graphical peak discharge method, and (2) an illustration of how the E&S program requirements should be applied to the method. This information should not be used as a set of guidelines in lieu of the source document.

Following is the procedure to use the peak discharge method of runoff determination:

Step 1 - Measure the drainage area. Use surveyed topography, USGS Quadrangle sheets, aerial photographs, soils maps, etc.

Step 2 - Calculate a curve number (CN) for the drainage area.

The curve number (CN) is similar to the runoff coefficient of the rational formula. It is an empirical value which establishes a relationship between rainfall and runoff based upon characteristics of the drainage area.

The soil type also influences the curve number. Each soil belongs to a different hydrologic soil group. Table 5-4 describes the hydrologic soil groups.

Appendix 6C (Chapter 6) lists various soil names and their corresponding hydrologic soil group. If the soil name is unknown, a judgement must be made based upon a knowledge of the soils and the soil group description. Soil names can be obtained from county soil surveys, the local Soil Conservation Service office, or analysis of actual soil borings.

Table 5-5 contains curve number values for different landuse/cover conditions and hydrologic soil groups.

TABLE 5-4

HYDROLOGIC SOIL GROUPS

Soil Group A	Represents soils having a low runoff potential due to high infiltration rates. These soils consist primarily of deep, well-drained sands and gravels.
Soil Group B	Represents soils having a moderately low runoff potential due to moderate infiltration rates. These soils consist primarily of moderately deep to deep, moderately well-drained to well-drained soils with moderately fine to moderately coarse textures.
Soil Group C	Represents soils having a moderately high runoff potential due to slow infiltration rates. These soils consist primarily of soils in which a layer exists near the surface that impedes the downward movement of water, or soils with moderately fine to fine texture.
Soil Group D	Represents soils having a high runoff potential due to very slow infiltration rates. These soils consist primarily of clays with high water tables, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious parent material.

If the watershed has uniform landuse and soils, the curve number value can be easily determined directly from Table 5-5. Curve numbers for non-homogeneous watersheds may be determined by dividing the watershed into homogeneous sub-areas and performing a weighted average.

$$CN = \frac{\Sigma\ (CN\ of\ sub\text{-}area\ \ x\ \ sub\text{-}area)}{Total\ Area}$$

Step 3 - Determine <u>runoff depth and volume</u> for the design storm.

a. The <u>rainfall depth</u> (in inches) can be determined from the maps contained on Plates 5-19 through 5-21 for the selected design storm. (For the examples in this section, the design storms are based upon the

SCS Type II 24-hour rainfall distribution. See the SCS-TR-55 document for other rainfall distributions.)

b. The runoff depth (in inches) can be determined from the graph contained on Plate 5-22. Enter the graph with the rainfall depth (inches) at the bottom, move vertically to intersect the appropriate curve, then move horizontally and read inches of runoff. The equations on Plate 5-22 can also be used, as well as Table 5-6 to determine runoff depth. The volume of runoff from the site can be calculated by simply multiplying the drainage area of the site by the runoff depth.

$$\frac{\text{(in. runoff)} \quad \text{x} \quad \text{acres}}{12 \text{ in./ft.}} = \text{acre-foot}$$

or

$$\frac{\text{(in. runoff)} \quad \text{x} \quad \text{sq. ft.}}{12 \text{ in./ft.}} = \text{cubic feet}$$

Step 4 - Determine time of concentration.

This can be done by using the method outlined in TR-55 or as in the rational method. (See Chapter 5, Part I, Rational Method.) In TR-55, Tc is a summation of travel time for sheet flow, shallow concentrated flow and channel flow as determined by the point of interest in the watershed.

Overland flow or sheet flow:

The maximum flow length (as defined by TR-55) for overland flow is 300 feet; however, it is generally accepted that overland flow is limited to flow paths of less than 200 feet. The engineer should use information from the site to make this determination.

Use Manning's kinematic equation to compute travel time:

$$T_t = \frac{0.007\ (nL)^{0.8}}{(P_2)^{0.5}\ s^{0.4}}$$

where:

T_t	=	travel time (hr)
n	=	Manning's roughness coefficient (Table 5-7)
L	=	flow length (ft)
P_2	=	2-year, 24-hour rainfall (in)
s	=	slope of hydraulic grade line (feet/foot).

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from Plate 5-23.

Open channels are well defined on the landscape and usually are represented by surveyed cross sections representing certain reach lengths. Manning's equation for open channel flow is used to calculate the average velocity for flow at bank-full elevation for the represented channel reach. A nomograph for solving Manning's equation is provided in Plate 5-24.

Manning's equation is:

$$V = \frac{1.49 \; r^{2/3} \; s^{1/2}}{n}$$

where:

V	=	average velocity (ft/s)
r	=	hydraulic radius (ft) and is equal to a/p_w
a	=	cross sectional flow area (ft^2)
p_w	=	wetted perimeter (ft)
s	=	slope of the hydraulic grade line (channel slope, ft/ft)
n	=	Manning's roughness coefficient for open channel flow. Manning's "n" values for open channel flow can be obtained from Table 5-8, or from standard textbooks such as Chow (1959) or Linsley et al. (1982). (See Chapter 5, Part III, Open Channel Flow, for details.)

After average velocity is obtained, travel time is computed using the following equation for shallow concentrated flow and for open channel flow:

$$T_t = \frac{L}{3600 \; V}$$

where:

T_t	=	travel time (hr.)
L	=	flow length (ft.)
V	=	average velocity (ft./sec.)
3600	=	conversion factor from seconds to hours.

Sometimes it is necessary to estimate the velocity of flow through a reservoir or lake at the outlet of a watershed. This travel time is normally very small and can be assumed to be zero.

Step 5 - Determine initial abstraction (I_a).

Initial abstraction (I_a) refers to all losses that occur before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation, and evaporation and infiltration. I_a is highly variable but generally is correlated with soil and cover parameters. The relationship of I_a to curve number is presented in Table 5-9.

Step 6 - Determine the unit peak discharge.

Divide the initial abstraction by the rainfall to obtain the I_a/P ratio. Enter Plate 5-25 with the calculated T_c in hours, move up to the I_a/P ratio (this can be a linear interpolation) and read the unit peak discharge (q_u) on the left in cubic-feet per second per square mile of drainage area per inch of runoff (csm/in).

To determine the peak discharge (q), multiply the value obtained from Plate 5-25 (q_u) by the drainage area in square miles and by the runoff in inches.

$$q \quad = \quad Q_u \ A_m \ Q$$

where:

q	=	peak discharge in cfs
q_u	=	unit peak discharge in cfs/sq.mi./in. (csm/in.),
A_m	=	drainage area in square miles, and
Q	=	runoff in inches.

Step 7 - Determine whether ponding and swampy conditions in the watershed area will affect the peak discharge. This adjustment is not always needed. Ponds or swamps on the main stream or that are in the path used for calculating time of concentration (T_c) are not considered here. Only ponds and swamps scattered throughout the watershed that are not in the T_c path are considered.

Table 5-10 contains the adjustment factors for ponds and swamps spread throughout the watershed. Measure or estimate the area covered by ponds and/or swamps, convert to percentage of the watershed drainage area, enter the Table and read (or interpolate) the multiplying factor (F_p).

If the F_p adjustment is needed, then the discharge from step 5 is multiplied by the Table value to obtain the final peak discharge (q_p).

$$q_p \quad = \quad (q)\ (F_p)$$

Example 5-2 (present or pre-development condition)

The watershed is located in eastern Campbell County, Virginia and covers 250 acres. Fifty percent of the watershed is Appling soil which is hydrologic soil group B. Fifty percent is Helena soil which is hydrologic soil group C.

Given: Landuse cover and treatment by soil group

Row crops, contour, good	- B soils - 10%
Pasture, good	- C Soils - 30%
Woods, fair	- B Soils - 40%
Woods, good	- C Soils - 20%

Find: Composite (weighted) curve numbers (CN) and runoff volume (Q) in watershed inches for the 2-year and 10-year, 24 hour storms.

Solution:

1. See worksheet 2 (at the end of solution for Example 5-2) for runoff curve number and runoff depth.

2. Determine hydrologic soil group by using Appendix 6C in Chapter 6.

Soil Name	Hydrologic Soil Group
Appling	B
Helena	C

3. Determine runoff curve number for each cover and condition for each hydrologic soil group from Table 5-5.

Cover Description	Soil Group	CN
Row crops, contour, good	B	75
Pasture, good condition	C	74
Woods, fair condition	B	60
Woods, good condition	C	70

4. Perform weighted average curve number computation.

	% Area	x	CN		
Row crops, contour, good	10	x	75	=	750
Pasture, good	30	x	74	=	2200
Woods, fair	40	x	60	=	2400
Woods, good	20	x	70	=	1400
	100				6770

$$CN = \frac{6770}{100} = 67.70 \text{ or } 68$$

5. Determine rainfall (P) on Plates 5-19 and 5-20 in eastern Campbell County for the 2-year and 10-year storms.

   2-year P = 3.5 inches and 10-year P = 5.5 inches.

6. Determine runoff (Q) in watershed inches from Table 5-6, Plate 5-22 or the equations on Plate 5-22.

   2-year Q = 0.90 inches and 10-year Q = 2.24 inches

Worksheet 2: Runoff curve number and runoff

Project Defiance Ridge By ESC Date 2-4-91

Location Campbell County, Virginia Checked SWM Date 2-5-91

Circle one: Present Developed D.A. 250 Acres

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix 6C	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 5.5	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi^2 ☑ %	Product of CN x area
Appling, B	Row Crop, Contour, Good	75			10	750
Helena, C	Pasture, Good Condition	74			30	2220
Appling, B	Woods, Fair Condition	60			40	2400
Helena, C	Woods, Good Condition	70			20	1400
					Totals = 100	6770

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{6770}{100} = 67.7$; Use CN = $\boxed{68}$

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .... yr	2	10	
Rainfall, P (24-hour) (Plates 5-19, 5-20) .... in	3.5	5.5	
Runoff, Q .... in (Use P and CN with table 5-6, Plate 5-22 or eqs. on Plate 5-22	0.90	2.24	

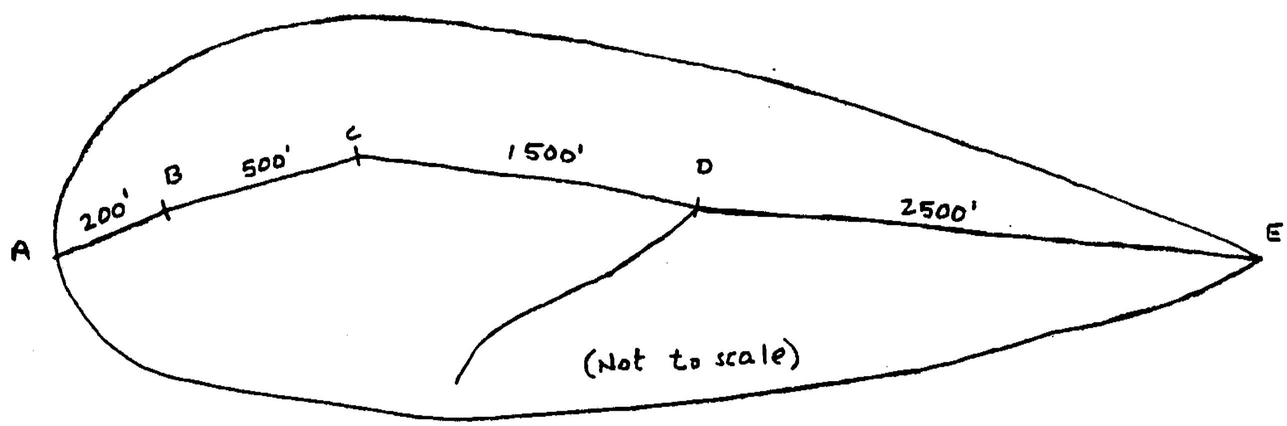
Example 5-3

Given: For present conditions, the flow path was determined to be 4700 feet long by using field surveys and topographic maps. Reach AB is 200 feet of sheet flow in woods and light brush at 2% slope.

Reach BC is 500 feet of shallow concentrated flow at 4% slope.

Reach CD is 1500 feet in a natural channel with 8 square feet cross sectional area, 7.6 feet wetted perimeter, 2% slope and a Manning's "n" of 0.08.

Reach DE is 2500 feet in a natural channel with 27 square feet cross sectional area 21.6 feet wetted perimeter, 0.5% slope and a Manning's "n" of 0.06.



Find: Time of concentration (T_c) for the watershed for the present or pre-developed condition. (See worksheet 3 at the end of solution for Example 5-3.)

Solution:

1. Calculate sheet flow travel time by using Manning's kinematic equation.

$$T_t = \frac{0.007\,(nL)^{0.8}}{(P_2)^{0.5}\ s^{0.4}}$$

where,

n = 0.40 (from Table 5-7)
L = 200 ft.
P_2 = 3.5 in. (from Plate 5-19)
s = 0.02 ft./ft.

$$T_t = \frac{0.007\ (0.40 \times 200)^{0.8}}{(3.5)^{0.5}\ (0.02)^{0.4}} = 0.60\ hr.\ \ (Reach\ AB)$$

2. Calculate travel time for shallow concentrated flow.
Surface description: unpaved

$$T_t = \frac{L}{3600V}$$

where,

L = 500 ft.
S = 0.04 ft./ft.
V = 3.2 ft./s (Plate 5-23)

$$T_t = \frac{500}{3600(3.2)} = 0.04 \text{ hr. (Reach BC)}$$

3. Calculate travel time for first channel reach, using Manning's equation for open channel flow. (See also Plate 5-24 for nomograph solution to equation.)

$$V = \frac{1.49 r^{2/3} s^{1/2}}{n}$$

where,

a = 8 $ft.^2$
p_w = 7.6 ft.
r = a/p_w = 8/7.6 = 1.05 ft.
s = 0.02 ft/ft
n = 0.08

$$V = \frac{1.49(1.05)^{2/3}(0.02)^{1/2}}{.08} = 2.72 \text{ ft./s}$$

$$T_t = \frac{L}{3600V}$$

$$L = 1500 \text{ ft.}$$

$$T_t = \frac{1500}{3600(2.72)} = 0.15 \text{ hr. (Reach CD)}$$

4. Calculate travel time for second channel reach, using Manning's equation for open channel flow.

$$V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$$

where,

$a = 27 \text{ ft.}^2$

$p_w = 21.6 \text{ ft.}$

$r = a/p_w = 27/21.6 = 1.25$

$s = 0.005 \text{ ft/ft}$

$n = 0.06$

$$V = \frac{1.49\,(1.25)^{2/3}(0.005)^{1/2}}{0.06} = 2.04 \text{ ft./s}$$

$$T_t = \frac{L}{3600V}$$

$$L = 2500 \text{ ft.}$$

$$T_t = \frac{2500}{3600\,(2.04)} = 0.34 \text{ hr. (Reach DE)}$$

5. Find T_c by adding the travel times (T_t):

$$T_c = \Sigma T_t = 0.60 + 0.04 + 0.15 + 0.34 = 1.13 \text{ hr.}$$

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

1992

Project Defiance Ridge By ESC Date 2-4-91

Location Campbell County, Virginia Checked SWM Date 2-5-91

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)		Segment ID	AB			
1.	Surface description (table 5-7)		Woods, lt.brush			
2.	Manning's roughness coeff., n (table 5-7)		0.40			
3.	Flow length, L (total L ≤ 300 ft)	ft	200			
4.	Two-yr 24-hr rainfall, P_2 (worksheet 2)	in	3.5			
5.	Land slope, s	ft/ft	0.02			
6.	$T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\, s^{0.4}}$ Compute T_t	hr	0.60	+		= 0.60

Shallow concentrated flow		Segment ID	BC			
7.	Surface description (paved or unpaved)		Unpaved			
8.	Flow length, L	ft	500			
9.	Watercourse slope, s	ft/ft	0.04			
10.	Average velocity, V (Plate 5-23)	ft/s	3.2			
11.	$T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.04	+		= 0.04

Channel flow		Segment ID	CD		DE	
12.	Cross sectional flow area, a	ft^2	8.0		27	
13.	Wetted perimeter, p_w	ft	7.6		21.6	
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.05		1.25	
15.	Channel slope, s	ft/ft	0.02		0.005	
16.	Manning's roughness coeff., n		0.08		0.06	
17.	$V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$ Compute V	ft/s	2.72		2.04	
18.	Flow length, L	ft	1500		2500	
19.	$T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.15	+	0.34	= 0.49
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				1.13

Example 5-4

Given: Drainage Area = 250 Acs. (0.39 mi^2)

$CN = 68$
$T_c = 1.13$ hr.

Find: Pre-developed peak discharge for 2-year and 10-year storms.

Solution: (See worksheet 4 at the end of solution for Example 5-4.)

2-year storm	10-year storm
P_2 = 3.5 in. (Plate 5-19)	P_{10} = 5.5 in. (Plate 5-20)
I_a = 0.941 in.	I_a = 0.941 in. (Table 5-9)
$I_a/P_2 = \frac{0.941}{3.5} = 0.27$	$I_a/P_{10} = \frac{0.941}{5.5} = 0.17$

Peak discharge: $q = q_u A_m Q$ $A_m = 250/640 = 0.39$ mile^2

2-year storm	10-year storm
q_{u2} = 290 csm/in	q_{u10} = 320 csm/in (Plate 5-25)
Q_2 = 0.90	Q_{10} = 2.24 (Plate 5-22)
q_2 = 290 x 0.39 x 0.90 = 102 cfs	q_{10} = 320 x 0.39 x 2.24 = 280cfs

Since there are no ponds or swamps, the correction factor (F_p) is 1.0. Therefore, peak discharges are correct as computed above.

Worksheet 4: Graphical Peak Discharge method

Project Defiance Ridge By ESC Date 2-4-91

Location Campbell County, Virginia Checked SWM Date 2-5-91

Circle one: Present Developed

1. Data:

Drainage area .... A_m = 0.39 mi^2 (acres/640)

Runoff curve number .... CN = 68 (From worksheet 2)

Time of concentration .. T_c = 1.13 hr (From worksheet 3)

Rainfall distribution type = II (I, IA, II, III) (From Plate 5-27)

Pond and swamp areas spread throughout watershed ...... = 0 percent of A_m (0 acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	
3. Rainfall, P (24-hour) (Worksheet 2)........	in	3.5	5.5	
4. Initial abstraction, I_a .... (Use CN with table 5-5 .)	in	0.941	0.941	
5. Compute I_a/P		0.27	0.17	
6. Unit peak discharge, q_u .... (Use T_c and I_a/P with Plate 5-25)	csm/in	290	320	
7. Runoff, Q .... (From worksheet 2).	in	0.90	2.24	
8. Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 5-10. Factor is 1.0 for zero percent pond and swamp area.)		1.0	1.0	
9. Peak discharge, q_p .... (Where $q_p = q_u A_m Q F_p$)	cfs	102	280	

Example 5-5 (developed condition):

The same watershed as in the previous examples is subdivided and developed. The project is named Defiance Ridge. 40% of the 250 acres is 1/2 acre lots on the Appling soil; 10% is commercial on the Appling soil; 30% is 1/2 acre lots on the Helena soil; and 20% is open space on the Helena soil. All hydrologic conditions are good cover. The streets are paved with curb and gutter. They are laid out in such a way as to decrease overland flow to 100' in a lawn. Then water flows onto the streets and paved gutters and continues until it reaches the natural channel. (This is the same point at which channel flow began in pre-developed conditions.) Total length of street and gutter flow is 700' at an average of 3% grade.

Find: The post-development runoff curve number for the drainage area, the runoff for the 2-year and 10-year storms, the time of concentration, and the peak discharges for the 2-year and 10-year storms.

Solution: See worksheets 2, 3, and 4, labeled example 5-5 "developed condition," (next three pages) for the solutions.

Since the development of Defiance Ridge will increase the peak discharge of the 2-year storm over the pre-developed conditions, provisions must be made to address the increase in runoff. (The 1/100 rule does not apply since the project area is greater than one percent of total drainage area at the discharge end of the project. See Chapter 4 for more details.)

The site design could include measures that would reduce the volume of runoff (by using infiltration and retention), reduce the peak discharge rate (detention), or improve the receiving channel to convey the increased runoff. Note that any improvements to the channel should be based on the post-development hydrology. See Chapter 4 and the E&S Regulations, Minimum Standard #19, for more details. Detention storage can be provided at the lower end of the development to store and release the post-development 2-year storm runoff at the pre-development 2-year storm peak. See Chapter 5, Part II, Stormwater Detention, for more information.

Worksheet 2: Runoff curve number and runoff

Project Defiance Ridge By ESC Date 2-4-91

Location Campbell County, Virginia Checked SWM Date 2-5-91

Circle one: Present Developed D.A. 250 acs.

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 5-5	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi^2 ☑ %	Product of CN x area
Appendix 6C						
Appling, B	1/2 Ac. Lots, Good Condition	70			40	2800
Appling, B	Commercial	92			10	920
Helena, C	1/2 Ac. Lots, Good Condition	80			30	2400
Helena, C	Open Space, Good Condition	74			20	1480
				Totals =	100	7600

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{7600}{100} = 76$; Use CN = $\boxed{76}$

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .... yr	2	10	
Rainfall, P (24-hour) (Plates 5-19, 5-20) in	3.5	5.5	
Runoff, Q .... in (Use P and CN with table 5-6, Plate 5-20 or eqs. Plate 5-22)	1.36	2.95	

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

Project Defiance Ridge   By ESC   Date 2-4-91

Location Campbell County, Virginia   Checked SWM   Date 2-5-91

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)

		Segment ID	AB		
1.	Surface description (table 5-7)		Lawn		
2.	Manning's roughness coeff., n (table 5-7) ..		0.24		
3.	Flow length, L (total L ≤ 300 ft)	ft	100		
4.	Two-yr 24-hr rainfall, P_2 (Worksheet 2)	in	3.5		
5.	Land slope, s (From Problem # 5-3)	ft/ft	0.02		
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{\ 0.5}\ s^{0.4}}$ Compute T_t	hr	0.23	+	= 0.23

Shallow concentrated flow

		Segment ID	BC		
7.	Surface description (paved or unpaved)		Paved		
8.	Flow length, L	ft	700		
9.	Watercourse slope, s	ft/ft	0.03		
10.	Average velocity, V (Plate 5-23)..........	ft/s	3.5		
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.06	+	= 0.06

Channel flow

		Segment ID	CD	DE	
12.	Cross sectional flow area, a	ft^2	8	27	
13.	Wetted perimeter, p_w	ft	7.6	21.6	
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.05	1.25	
15.	Channel slope, s	ft/ft	0.02	0.005	
16.	Manning's roughness coeff., n		0.08	0.06	
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	2.70	2.04	
18.	Flow length, L	ft	1500	2500	
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.15	+ 0.34	= 0.49

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr 0.78

Worksheet 4: Graphical Peak Discharge method

Project Defiance Ridge By ESC Date 2-4-91

Location Campbell County, Virginia Checked SWM Date 2-5-91

Circle one: Present (Developed)

1. Data:

Drainage area .... A_m = 0.39 mi^2 (acres/640)

Runoff curve number .... CN = 76 (From worksheet 2)

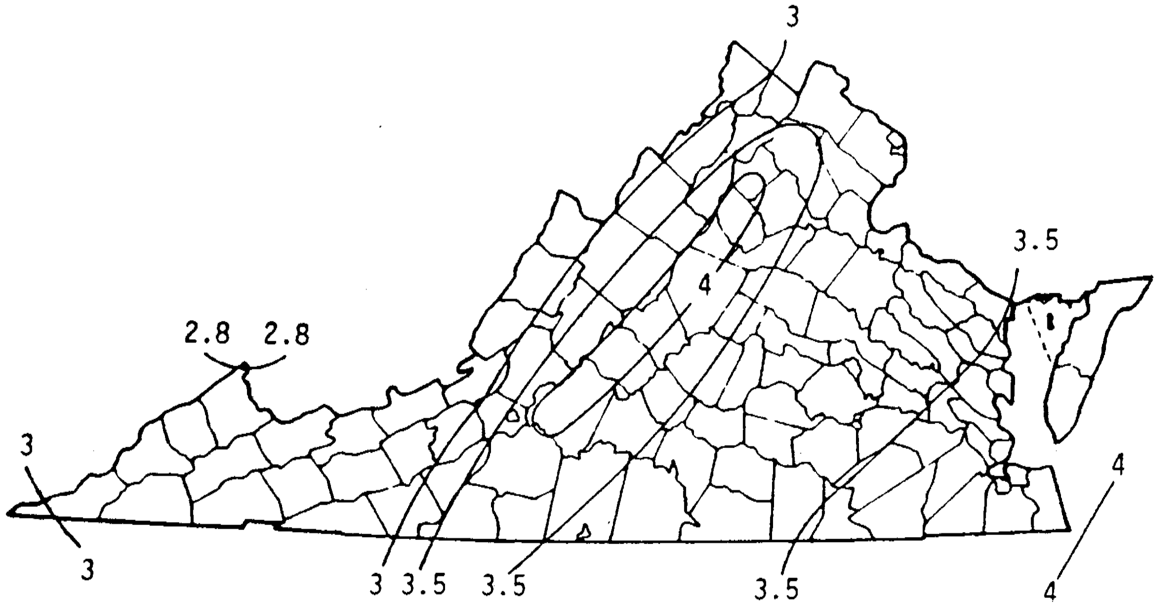
Time of concentration .. T_c = 0.78 hr (From worksheet 3)

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

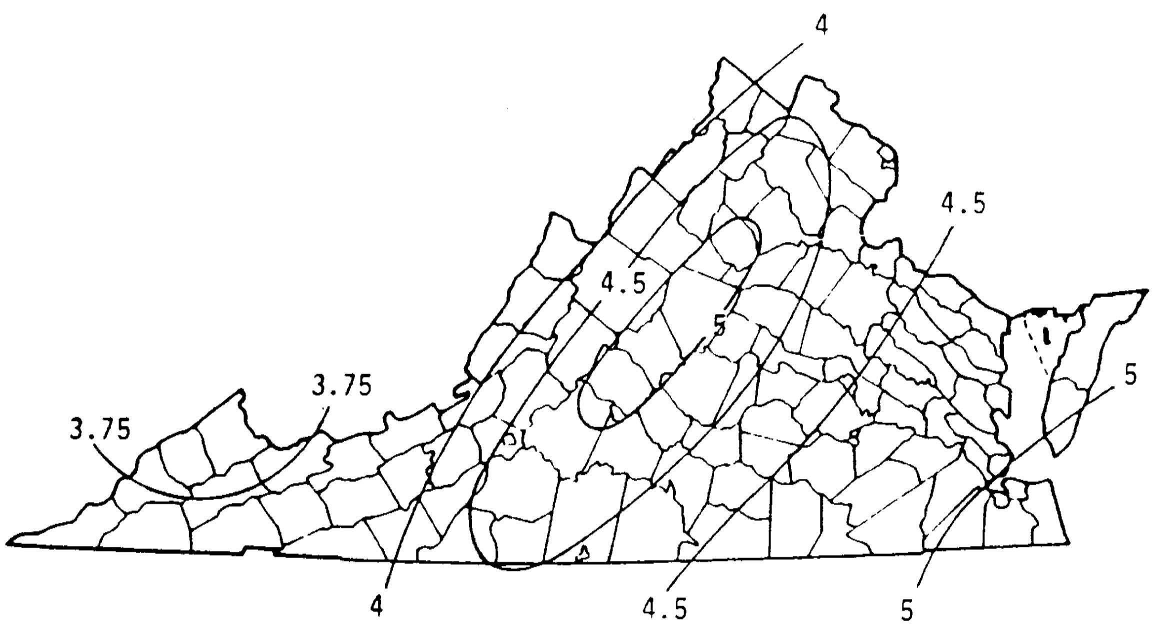
Pond and swamp areas spread throughout watershed ...... = 0 percent of A_m (0 acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	
3. Rainfall, P (24-hour) ..(Worksheet 2)...	in	3.5	5.5	
4. Initial abstraction, I_a .... (Use CN with table 5-5)	in	0.632	0.632	
5. Compute I_a/P		0.18	0.11	
6. Unit peak discharge, q_u .... (Use T_c and I_a/P with Plate 5-25)	csm/in	380	410	
7. Runoff, Q .... (From worksheet 2).	in	1.36	2.95	
8. Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 5-10. Factor is 1.0 for zero percent pond and swamp area.)		1.0	1.0	
9. Peak discharge, q_p .... (Where $q_p = q_u A_m Q F_p$)	cfs	202	472	

RAINFALL DEPTHS FOR SELECTED DESIGN STORMS



2-YEAR 24-HOUR RAINFALL (INCHES)

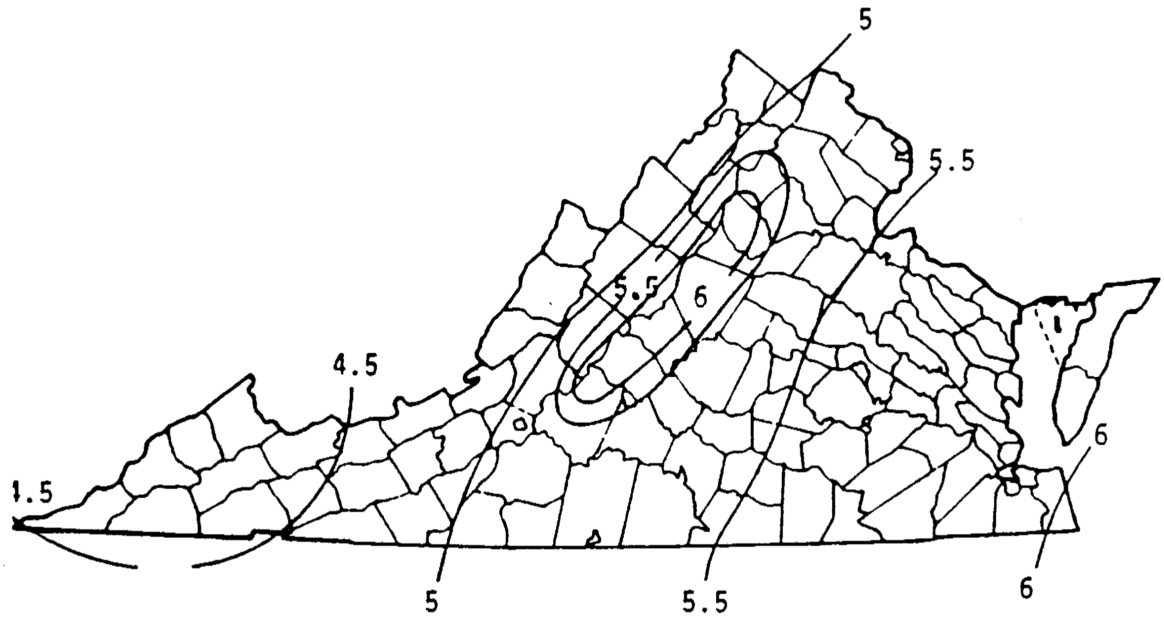


5-YEAR 24-HOUR RAINFALL (INCHES)

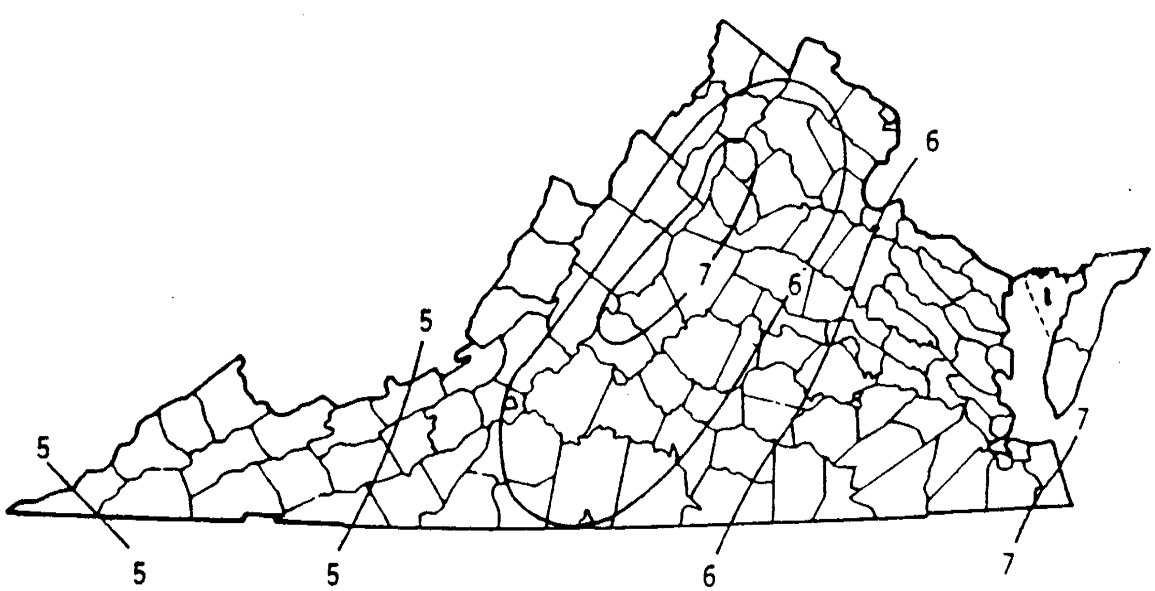
Source: USDA-SCS and U.S. Weather Bureau

Plate 5-19

RAINFALL DEPTHS FOR SELECTED DESIGN STORMS (continued)



10-YEAR 24-HOUR RAINFALL (INCHES)

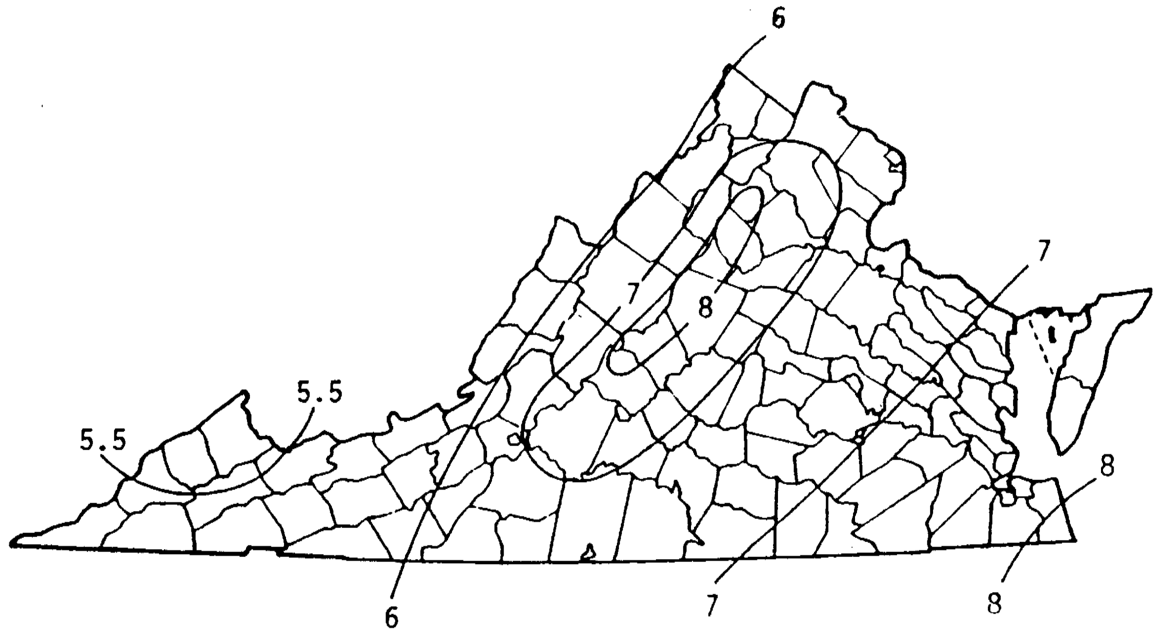


25-YEAR 24-HOUR RAINFALL (INCHES)

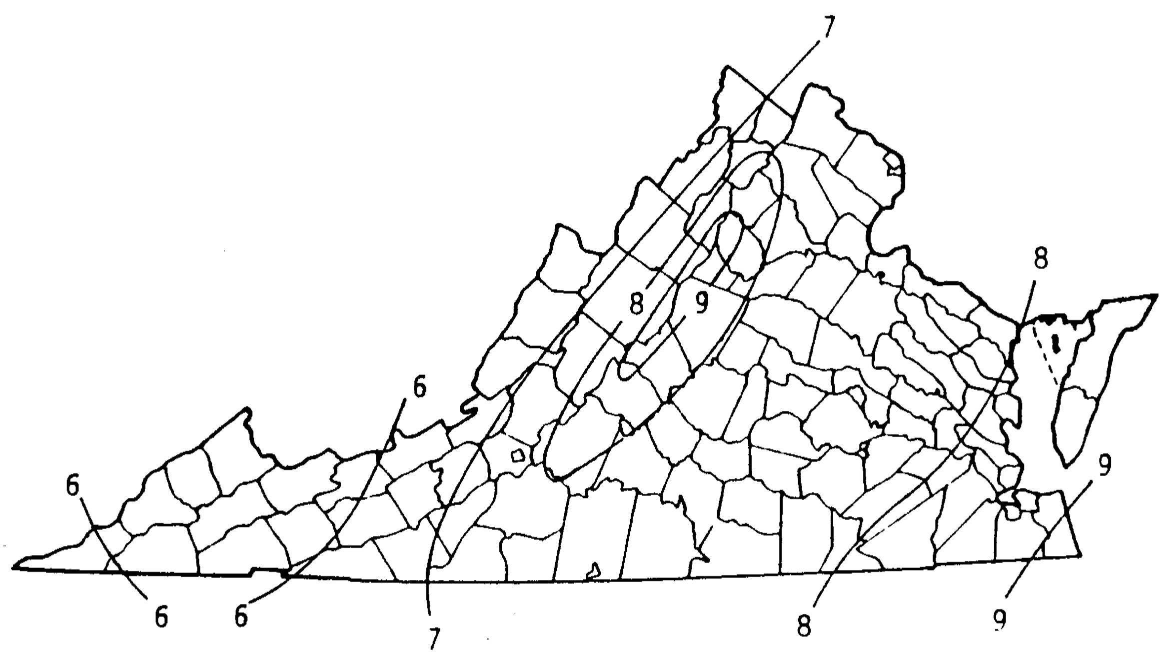
Source: USDA-SCS and U.S. Weather Bureau

Plate 5-20

RAINFALL DEPTHS FOR SELECTED DESIGN STORMS (continued)



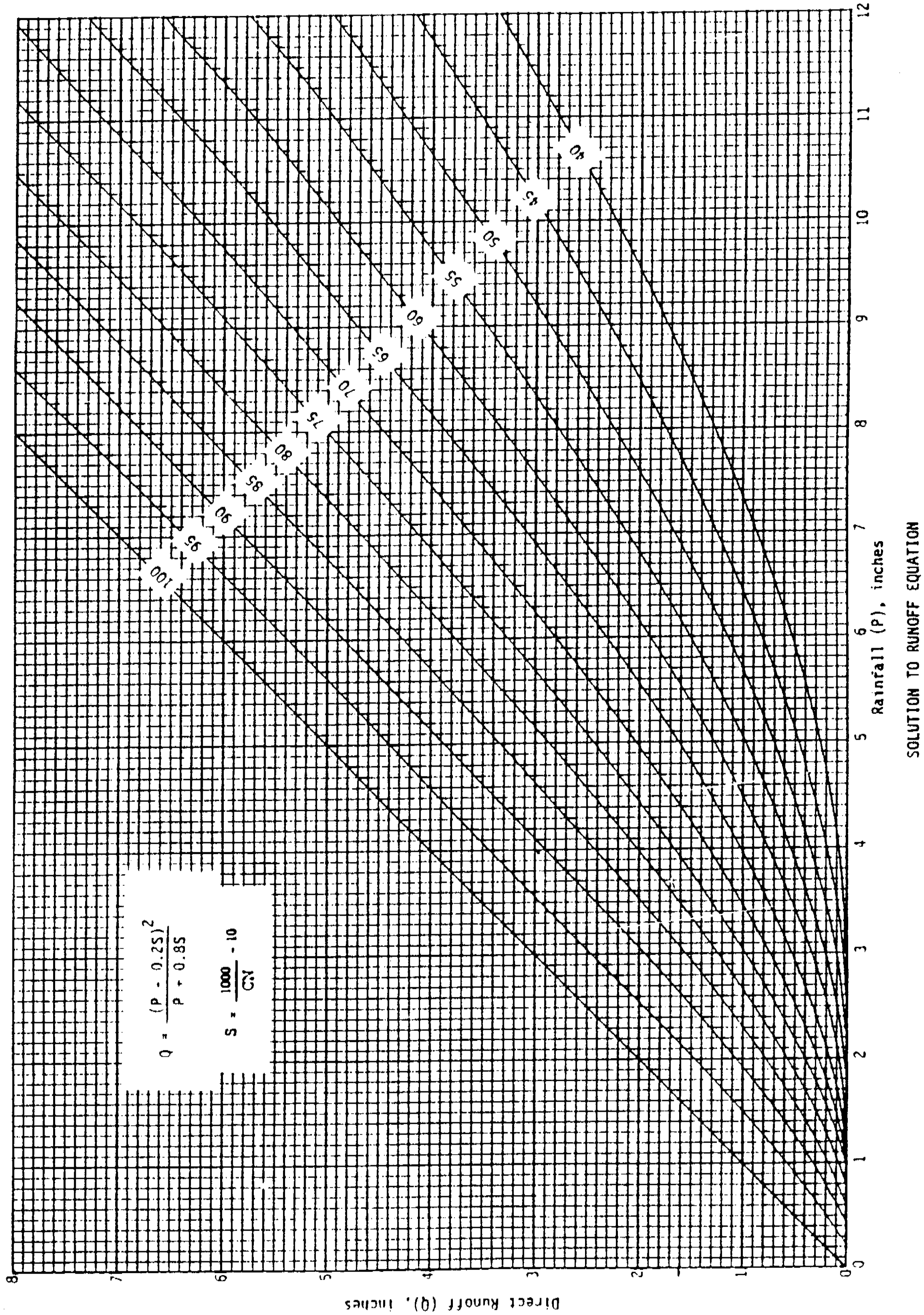
50-YEAR 24-HOUR RAINFALL (INCHES)



100-YEAR 24-HOUR RAINFALL (INCHES)

Source: USDA-SCS and U.S. Weather Bureau

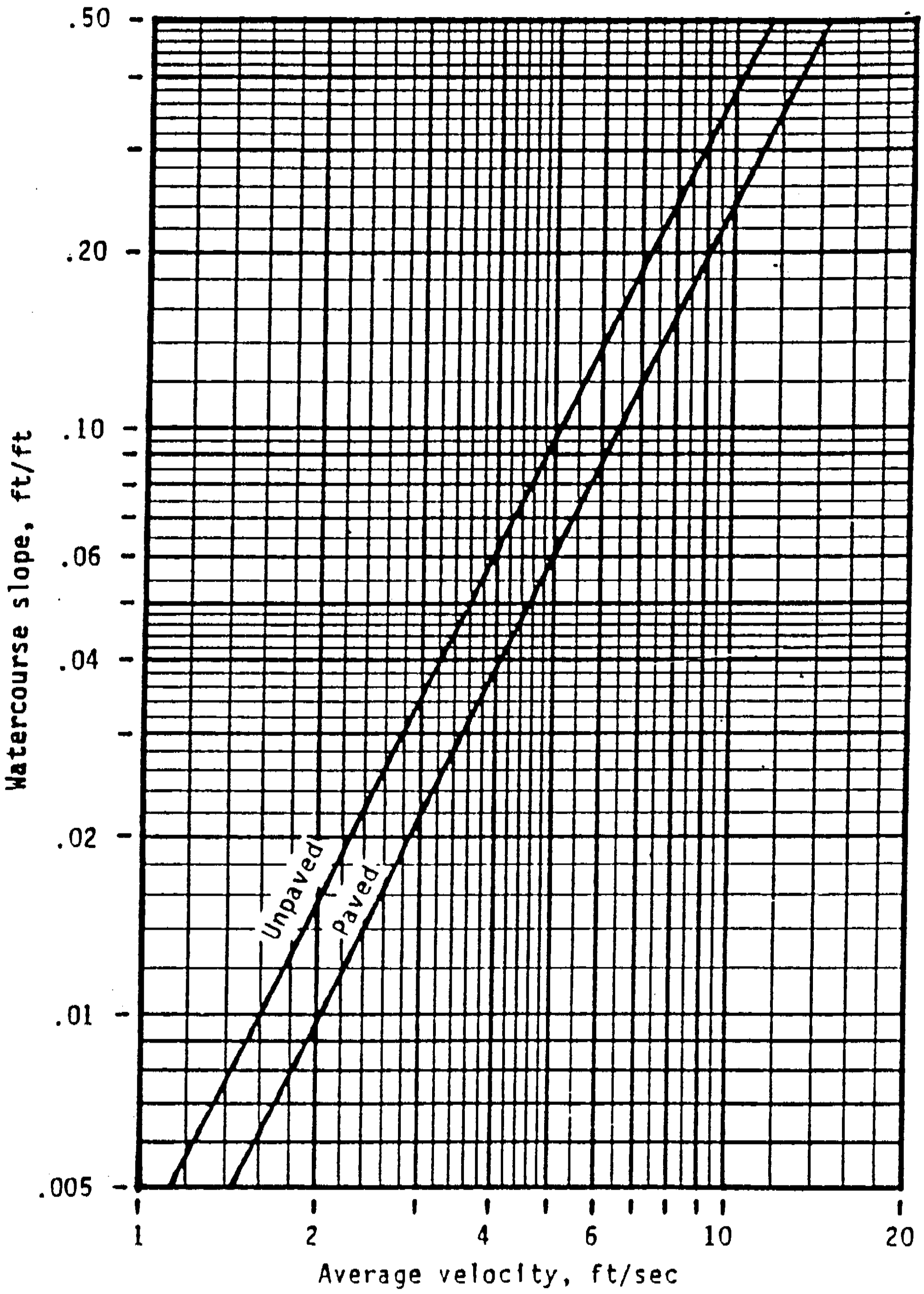
Plate 5-21



Source: USDA-SCS

Plate 5-22

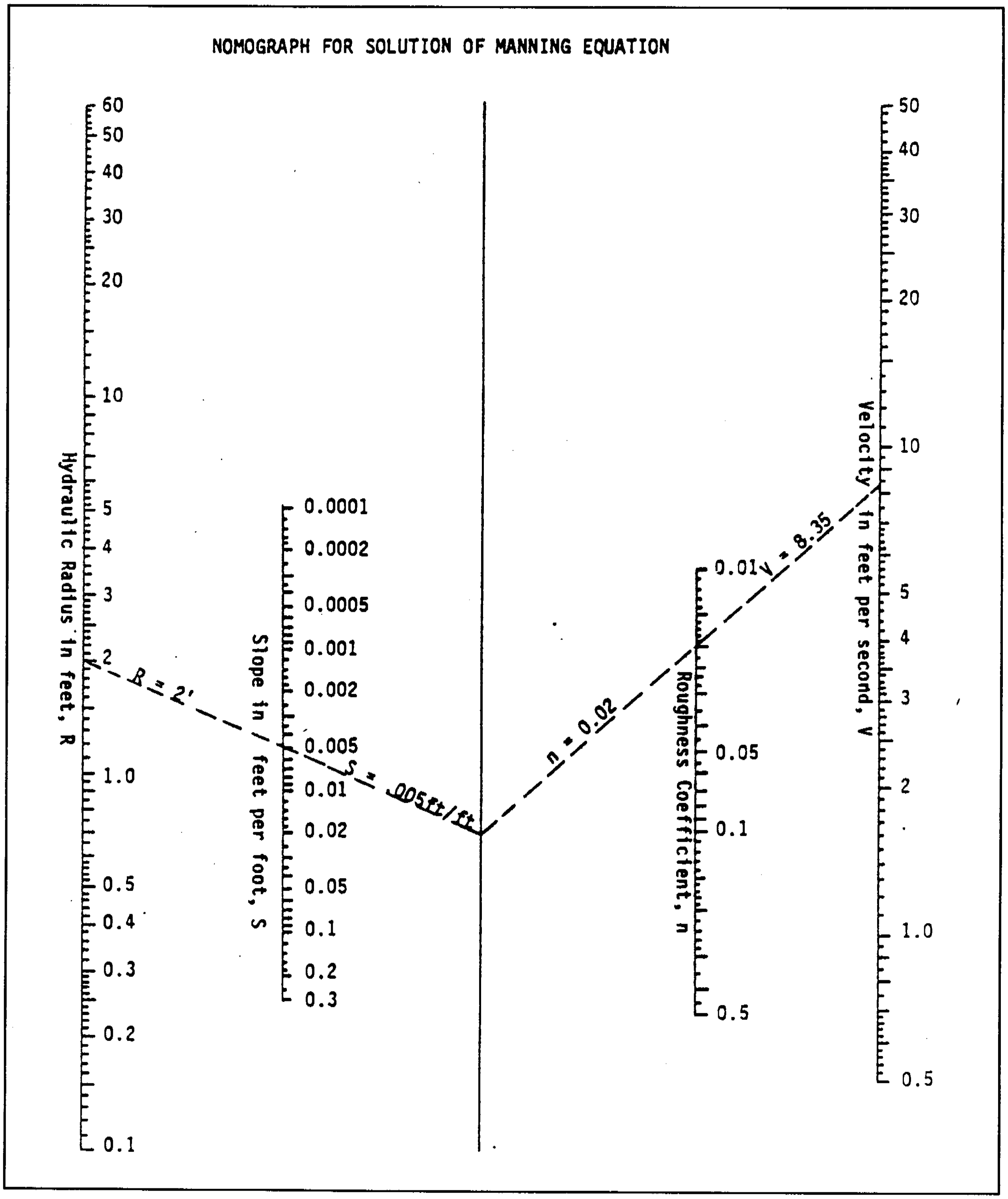
AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME FOR SHALLOW CONCENTRATED FLOW



Source: USDA-SCS

Plate 5-23

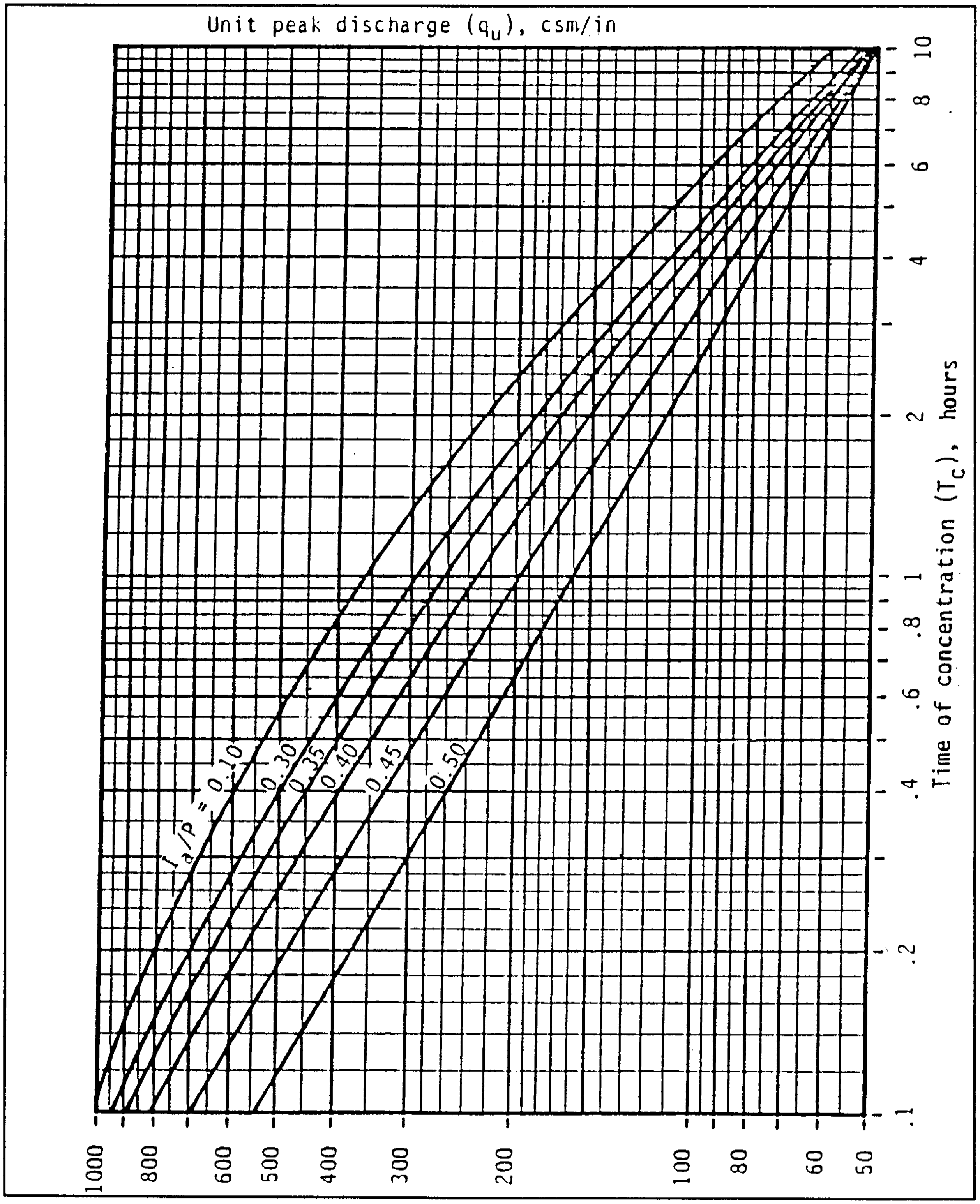
NOMOGRAPH FOR SOLUTION OF MANNING EQUATION



Source: VDOT

Plate 5-24

UNIT PEAK DISCHARGE (q_u) FOR SCS TYPE II RAINFALL DISTRIBUTION



Source: USDA-SCS

Plate 5-25

TABLE 5-5*

RUNOFF CURVE NUMBERS
FOR GRAPHICAL PEAK DISCHARGE METHOD

COVER DESCRIPTION			HYDROLOGIC SOIL GROUP A	B	C	D
Fully Developed Urban Areas (Vegetation Established)						
Open Space (lawns, parks, etc.)	Poor Condition; Grass		68	79	86	89
	Fair Condition; Grass 50 - 75% cover		49	69	79	84
	Good Condition; Grass > 75% cover		39	61	74	80
Impervious Areas	Paved parking lots, roofs, driveways		98	98	98	98
Streets and Roads	Paved; curbs and storm sewers		98	98	98	98
	Paved; open ditches (w/right-of-way)		83	89	92	93
	Gravel (with right-of-way)		76	85	89	91
	Dirt (with right-of-way)		72	82	87	89
Urban Districts		Average % Impervious				
	Commercial and Business	85	89	92	94	95
	Industrial	72	81	88	91	93

* Refer to the TR-55 document for a complete table of runoff curve numbers and additional information on selecting the runoff curve number.

Source: USDA-SCS

TABLE 5-5* (continued)
RUNOFF CURVE NUMBERS FOR
GRAPHICAL PEAK DISCHARGE METHOD

COVER DESCRIPTION			HYDROLOGIC SOIL GROUP A	B	C	D
Residential Districts (by average lot size)		Average % Impervious				
	1/8 acre (town house)	65	77	85	90	92
	1/4 acre	38	61	75	83	87
	1/3 acre	30	57	72	81	86
	1/2 acre	25	54	70	80	85
	1 acre	20	51	68	79	84
	2 acres	12	46	65	77	82
Urban Areas - Development Underway, No Vegetation Established						
Newly graded area			81	89	93	95
Pavement and Roofs, Commercial & Business Areas			98	98	98	98
Row Houses, Town Houses and Residential w/lot sizes:	1/8 acre or less		93	96	97	98
	1/4 acre		88	93	95	97
	1/2 acre		85	91	94	96
	1 acre		82	90	93	95
	2 acres		81	89	92	94
Cultivated Agricultural Lands						
Fallow:	Bare Soil		77	86	91	94
	Crop Residue (CR) poor		76	85	90	93
	Crop Residue (CR) good		74	83	88	90

* Refer to the TR-55 document for a complete table of runoff curve numbers and additional information on selecting the runoff curve number.

TABLE 5-5* (continued)

RUNOFF CURVE NUMBERS FOR GRAPHICAL PEAK DISCHARGE METHOD

COVER DESCRIPTION		HYDROLOGIC SOIL GROUP			
		A	B	C	D
Cultivated Agricultural Lands (continued)					
Row Crops:	Straight row (SR) poor	72	81	88	91
	Straight row (SR) good	67	78	85	89
	Contoured (C) poor	70	79	84	88
	Contoured (C) good	65	75	82	86
	Contoured and Terraced (C&T) poor	66	74	80	82
	Contoured and Terraced (C&T) good	62	71	78	81
Other Agricultural Lands					
Pasture, grassland or range	poor	68	79	86	89
	fair	49	69	79	84
	good	39	61	74	80
Meadow		30	58	71	78
Brush - brush, weed, grass mix	poor	48	67	77	83
	fair	35	56	70	77
	good	30	48	65	73
Woods - grass combination	poor	57	73	82	86
	fair	43	65	76	82
	good	32	58	72	79

* Refer to the TR-55 document for a complete table of runoff curve numbers and additional information selecting the runoff curve number.

TABLE 5-5* (continued)

RUNOFF CURVE NUMBERS FOR GRAPHICAL PEAK DISCHARGE METHOD

COVER DESCRIPTION		HYDROLOGIC SOIL GROUP A	B	C	D
Other Agricultural Lands (continued)					
Woods	poor	45	66	77	83
	fair	36	60	73	79
	good	30	55	70	77
Porous Pavement**					
	Gravel Subbase Thickness (inches)				
Porous Pavement (Properly Maintained)	10	57	66	69	75
	18	53	61	64	69
	24	52	58	61	66
	36	47	52	55	58
Porous Pavement (Not Properly Maintained)	10 - 36	98	98	98	98

* Refer to the TR-55 document for a complete table of runoff curve numbers and additional information on selecting runoff curve number.

** This information is not intended for design purposes.

TABLE 5-6
RUNOFF DEPTH FOR SELECTED CN's AND RAINFALL AMOUNTS[1]

	Runoff depth for curve number of ____												
Rainfall	40	45	50	55	60	65	70	75	80	85	90	95	98
							inches						
1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.17	0.32	0.56	0.79
1.2	.00	.00	.00	.00	.00	.00	.03	.07	.15	.27	.46	.74	.99
1.4	.00	.00	.00	.00	.00	.02	.06	.13	.24	.39	.61	.92	1.18
1.6	.00	.00	.00	.00	.01	.05	.11	.20	.34	.52	.76	1.11	1.38
1.8	.00	.00	.00	.00	.03	.09	.17	.29	.44	.65	.93	1.29	1.58
2.0	.00	.00	.00	.02	.06	.14	.24	.38	.56	.80	1.09	1.48	1.77
2.5	.00	.00	.02	.08	.17	.30	.46	.65	.89	1.18	1.53	1.96	2.27
3.0	.00	.02	.09	.19	.33	.51	.71	.96	1.25	1.59	1.98	2.45	2.77
3.5	.02	.08	.20	.35	.53	.75	1.01	1.30	1.64	2.02	2.45	2.94	3.27
4.0	.06	.18	.33	.53	.76	1.03	1.33	1.67	2.04	2.46	2.92	3.43	3.77
4.5	.14	.30	.50	.74	1.02	1.33	1.67	2.05	2.46	2.91	3.40	3.92	4.26
5.0	.24	.44	.69	.98	1.30	1.65	2.04	2.45	2.89	3.37	3.88	4.42	4.76
6.0	.50	.80	1.14	1.52	1.92	2.35	2.81	3.28	3.78	4.30	4.85	5.41	5.76
7.0	.84	1.24	1.68	2.12	2.60	3.10	3.62	4.15	4.69	5.25	5.82	6.41	6.76
8.0	1.25	1.74	2.25	2.78	3.33	3.89	4.46	5.04	5.63	6.21	6.81	7.40	7.76
9.0	1.71	2.29	2.88	3.49	4.10	4.72	5.33	5.95	6.57	7.18	7.79	8.40	8.76
10.0	2.23	2.89	3.56	4.23	4.90	5.56	6.22	6.88	7.52	8.16	8.78	9.40	9.76
11.0	2.78	3.52	4.26	5.00	5.72	6.43	7.13	7.81	8.48	9.13	9.77	10.39	10.76
12.0	3.38	4.19	5.00	5.79	6.56	7.32	8.05	8.76	9.45	10.11	10.76	11.39	11.76
13.0	4.00	4.89	5.76	6.61	7.42	8.21	8.98	9.71	10.42	11.10	11.76	12.39	12.76
14.0	4.65	5.62	6.55	7.44	8.30	9.12	9.91	10.67	11.39	12.08	12.75	13.39	13.76
15.0	5.33	6.36	7.35	8.29	9.19	10.04	10.85	11.63	12.37	13.07	13.74	14.39	14.76

[1] Interpolate the values shown to obtain runoff depths for CN's or rainfall amounts not shown.

Source: USDA-SCS

TABLE 5-7
ROUGHNESS COEFFICIENTS
(MANNING'S "n") FOR SHEET FLOW

Surface Description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods[3]:	
Light underbrush	0.40
Dense underbrush	0.80

[1] The "n" values are a composite of information compiled by Engman (1986).

[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Source: USDA-SCS

TABLE 5-8

MANNING'S "n" VALUES

Surface	Best	Good	Fair	Bad
Uncoated cast-iron pipe	0.012	0.013	0.014	0.015
Coated cast-iron pipe	0.011	0.012*	0.013*	
Commercial wrought-iron pipe, black	0.012	0.013	0.014	0.015
Commercial wrought-iron pipe, galvanized	0.013	0.014	0.015	0.017
Riveted and spiral steel pipe	0.013	0.015*	0.017*	
Common clay drainage tile	0.011	0.012*	0.014*	0.017
Neat cement surfaces	0.010	0.011	0.012	0.013
Cement mortar surfaces	0.011	0.012	0.013*	0.015
Concrete pipe	0.012	0.013	0.015*	0.016
Concrete-lined channels	0.012	0.014*	0.016*	0.018
Cement-rubble surface	0.017	0.020	0.025	0.030
Dry-rubble surface	0.025	0.030	0.033	0.035
Canals and ditches:				
Earth, straight and uniform	0.017	0.020	0.0225*	0.025
Rock cuts, smooth and uniform	0.025	0.030	0.033	0.035
Rock cuts, jagged and irregular	0.035	0.040	0.045	
Winding sluggish canals	0.0225	0.025*	0.0275	0.030
Dredged earth channels	0.025	0.0275*	0.030	0.033
Canals with rough stony beds, weeds on earth banks	0.025	0.030	0.035*	0.040
Earth bottom, rubble sides	0.028	0.030*	0.033*	0.035

* Values commonly used in designing.

Source: King

TABLE 5-8 (continued)

MANNING'S "n" VALUES

Surface	Best	Good	Fair	Bad
Natural Stream Channels:				
1. Clean, straight bank, full stage, no rifts or deep pools	0.025	0.0275	0.030	0.033
2. Same as #1, but some weeds and stones	0.030	0.033	0.035	0.040
3. Winding, some pools and shoals, clean	0.033	0.035	0.040	0.045
4. Same as #3, lower stages, more ineffective slope and sections	0.040	0.045	0.050	0.055
5. Same as #3, some weeds and stones	0.035	0.040	0.045	0.050
6. Same as #4, stony sections	0.045	0.050	0.055	0.060
7. Sluggish river reaches, rather weedy or with very deep pools	0.050	0.060	0.070	0.080
8. Very weedy reaches	0.075	0.100	0.125	0.150

* Values commonly used in designing.

Source: King

TABLE 5-9

I_a VALUES FOR RUNOFF CURVE NUMBERS

Curve Number	I_a (inches)	Curve Number	I_a (inches)	Curve Number	I_a (inches)
40	3.000	60	1.333	80	0.500
41	2.878	61	1.279	81	0.469
42	2.762	62	1.226	82	0.439
43	2.651	63	1.175	83	0.410
44	2.545	64	1.125	84	0.381
45	2.444	65	1.077	85	0.353
46	2.348	66	1.030	86	0.326
47	2.255	67	0.985	87	0.299
48	2.167	68	0.941	88	0.273
49	2.082	69	0.899	89	0.247
50	2.000	70	0.857	90	0.222
51	1.922	71	0.817	91	0.198
52	1.846	72	0.778	92	0.174
53	1.774	73	0.740	93	0.151
54	1.704	74	0.703	94	0.128
55	1.636	75	0.667	95	0.105
56	1.571	76	0.632	96	0.083
57	1.509	77	0.597	97	0.062
58	1.448	78	0.564	98	0.041
59	1.390	79	0.532		

Source: USDA-SCS

TABLE 5-10

ADJUSTMENT FACTOR (F_p) FOR POND AND SWAMP AREAS SPREAD THROUGHOUT THE WATERSHED

Percentage of pond and swamp areas	F_p
0	1.00
0.2	0.97
1.0	0.87
3.0	0.75
5.0	0.72

Source: USDA-SCS

Tabular Method

The Tabular Method of runoff calculation is also described in TR-55 Urban Hydrology for Small Watersheds (62). This method may be used to develop a runoff hydrograph that shows the rate of runoff from the watershed with respect to time for a selected design storm.

The Tabular Method can be used when hydrographs are needed to measure runoff from watersheds which are divided into sub-areas. It is especially applicable for measuring the effects of changed landuse in a part of the watershed. It can also be used to determine the effects of structures and combinations of structures, including channel modifications, at different locations in a watershed. In this procedure, timing of the flow from the different sub-areas becomes very important.

The accuracy of the Tabular Method decreases as the complexity of the watershed increases. Drainage areas of individual sub-areas should not differ by a factor of five (5) or more. For most watershed conditions, however, this procedure is adequate to determine the effects of urbanization on peak rates of discharge for drainage areas up to approximately 20 square miles in size.

It is recommended that the user become familiar with the Peak Discharge Method before attempting the Tabular Method. The user is encouraged to refer to TR-55 for a complete presentation of the Tabular Method.

The basic data needed to use the Tabular Method include:

1. The drainage area of each sub-area.
2. The time of concentration (T_c) for each sub-area.
3. The travel time (T_t) for each routing reach.
4. The runoff curve number (CN) for each sub-area.
5. The 24-hour rainfall for the selected frequency design storm.
6. The runoff depth (in inches) from each sub-area.
7. The initial abstraction (I_a) for each sub-area.

Tables in Exhibit 5-II contain the tabular discharge values for the Type II rainfall distribution used in Example 5-6. Tabular discharges, in terms of CSM (cubic feet per second per square mile) per inch of runoff, are given for a range of T_c values from 0.1 to 2.0 hours and T_t values from 0 to 3.0 hours. (Tables for Type I, IA, and III distributions can be found in SCS-TR-55 but are not included here.)

The general procedure for generating a composite hydrograph using the Tabular Method is as follows:

Step 1 - Prepare worksheet 5a, as in example 5-6, which provides a summary of all basic data needed for the tabular hydrograph. The following basic information is needed for the worksheet:

a. Define the drainage areas and determine the area of each sub-area in square miles (A_m). Also define the main channel reaches that drain each sub-area.

b. Determine the time of concentration (T_c) for each sub-area (e.g., the time of flow from the most remote point in the sub-area to the outlet of sub-area, in hours).

c. Determine a runoff curve number (CN) for each sub-area. (See step 2 of the graphical peak discharge method.)

d. List rainfall (P) from Plates 5-19 through 5-21 and determine the runoff depth (in inches) for each sub-area. (See step 3a and 3b of the graphical peak discharge method.)

e. Determine the travel time (T_t) in the main channel reaches of sub-areas through which runoff from other sub-areas is routed.

f. Determine I_a from Table 5-9 and divide by rainfall (P) for each sub-area.

Step 2 - On worksheet 5b, place the basic watershed data used by rounding T_c, T_t, and I_a/P values to the nearest Table values in Exhibit 5-II. Use the value that is closest to the sum of the actual values of the sum of T_c and T_t. I_a/P can be the nearest Table value or unit discharge (CSM/in) interpolation between I_a/P values.

Step 3 - Develop individual hydrographs for each sub-area at the point of interest by multiplying the tabular value by the drainage area (A_m) and the runoff (Q). (A_mQ were previously determined on worksheet 5a, so all that remains is to multiply A_mQ by each tabular value under each time selected on Worksheet 5b.)

Note: Time values should be selected from Exhibit 5-II that will produce the composite hydrograph peak. **The composite hydrograph peak does not necessarily coincide with the peak of the individual sub-area at the point of interest in the watershed.**

Step 4 - The composite hydrograph is the summation of the individual hydrographs for each sub-area that have been routed to the point of interest in the watershed. Develop the composite hydrograph by summation of each column on worksheet 5b.

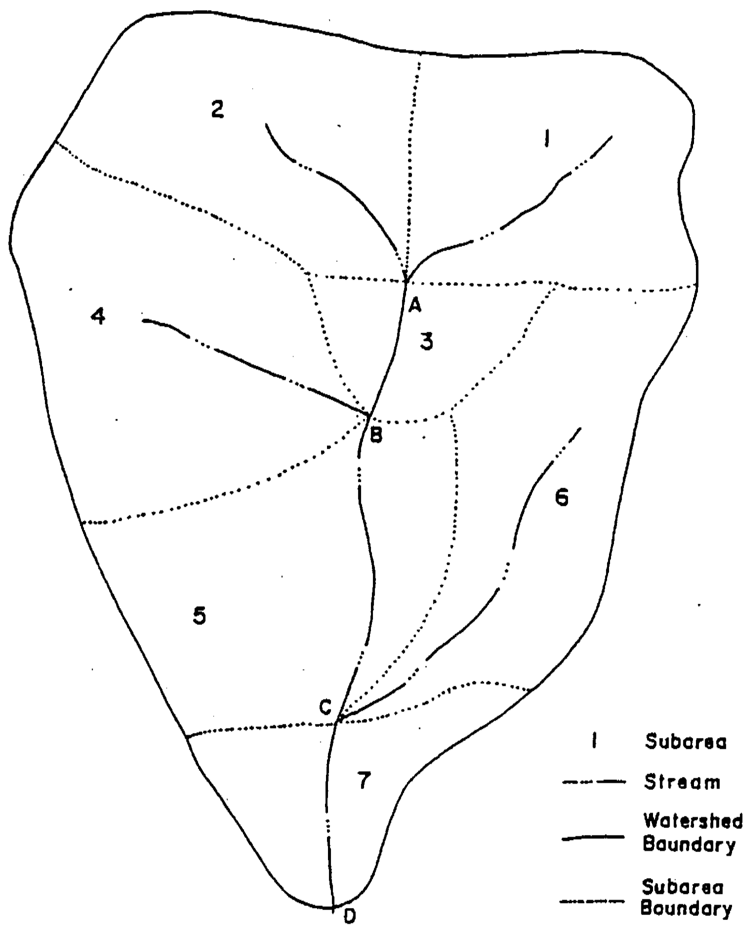
Example 5-6

The 1.65 square mile watershed (shown below) is to be developed according to a pre-conceived landuse plan. The current proposal is to develop sub-areas 5,6 and 7. The development includes a variety of landuses ranging from single-family dwellings and industrial parks.

Find: The effect of the development would have on the 2-year discharge at the lower end of sub-area 7.

EXAMPLE 5-6

The 1.65-square-mile watershed below is to be developed according to a pre-conceived land use plan. Proposed land use ranges from one-half acre residential lots in sub-area 1 to an industrial district in sub-area 7. Determine what effect the development would have on the 2-year discharge at the lower end of sub-area 7.



In solving example 5-6, the following information should be noted:

1. Information required in steps 1a-f was determined for both the "present" condition and the "developed" condition of the watershed for the 2-year frequency design storm. The data was measured from the map and derived from a landuse plan for the watershed and is summarized on worksheet 5a. Separate worksheets are used for "present" and "developed" conditions.

2. Drainage areas (A_m) were multiplied by runoff (Q) and placed on Worksheet 5a and later transferred to Worksheet 5b.

3. Sub-area T_c and ΣT_t used were the computed values as no rounding was necessary to fit the values in the Tables. I_a/P values were rounded to the nearest values in the Tables.

4. The appropriate sheet from Exhibit 5-II was selected for each sub-area based on T_c listed in the middle of that sheet. The I_a/P value was then selected and a straight edge placed on the line for the appropriate travel time (ΣT_t) on the left edge of the sheet.

5. Hydrograph time values were selected to best define the composite hydrograph from the top of the sheet and placed at the top of Worksheet 5b.

6. Unit discharge values (CSM/in) for each time value were selected at the straight edge and multiplied by the A_mQ value determined in 2 above. This process was followed for each sub-area.

7. The columns under each hydrograph time were added to produce the composite hydrograph at the lower end of sub-area 7.

Worksheet 5a: Basic watershed data

Project Sugar Hill Location Campbell County, Va. By EC Date 2-5-91

Circle one: Present Developed Frequency (yr) 2 Checked SM Date 2-6-91

Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
1	0.30	1.50	--	3, 5, 7	2.50	3.5	65	0.75	0.23	1.077	0.31
2	0.20	1.25	--	3, 5, 7	2.50	3.5	70	1.01	0.20	0.857	0.24
3	0.10	0.50	0.50	5, 7	2.00	3.5	75	1.30	0.13	0.667	0.19
4	0.25	0.75	--	5, 7	2.00	3.5	70	1.01	0.25	0.857	0.24
5	0.20	1.50	1.25	7	0.75	3.5	75	1.30	0.26	0.667	0.19
6	0.40	1.50	--	7	0.75	3.5	70	1.01	0.40	0.857	0.24
7	0.20	1.25	0.75	--	0	3.5	75	1.30	0.26	0.667	0.19

↑ From worksheet 3 (Time of concentration, Travel time through subarea)

↑ From worksheet 2 (Runoff curve number, Runoff)

↑ From table 5-7 (Initial abstraction)

Worksheet 5b: Tabular hydrograph discharge summary

Project Sugar Hill Location Campbell County, Va. By EC Date 2-5-91

Circle one: Present Developed ¹Frequency (yr) 2 Checked SM Date 2-6-91

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
	Subarea T_c (hr)	ΣT_t to outlet (hr)	I_a/P	$A_m Q$ (mi^2-in)	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5
					Discharges at selected hydrograph times 3/ (cfs)											
1	1.50	2.50	0.3	0.23	0	0	0	0	0	0	0	0	2	7	20	37
2	1.25	2.50	0.3	0.20	0	0	0	0	0	0	0	1	3	9	24	37
3	0.50	2.00	0.1	0.13	2	2	2	3	5	8	16	26	39	36	24	11
4	0.75	2.00	0.3	0.25	0	0	0	0	1	3	10	21	44	57	50	32
5	1.50	0.75	0.1	0.26	8	11	20	33	47	58	62	61	50	38	27	17
6	1.50	0.75	0.3	0.40	2	4	16	27	46	64	76	79	72	59	44	32
7	1.25	0	0.1	0.26	67	74	81	69	55	42	34	27	20	16	12	10
Composite hydrograph at outlet					79	91	119	132	154	175	198	215	230	222	201	176

1/ Worksheet 5a. Rounded as needed for use with exhibit 5-II

2/ Enter rainfall distribution type used.

3/ Hydrograph discharge for selected times is $A_m Q$ multiplied by tabular discharge from appropriate exhibit 5-II

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Worksheet 5a: Basic watershed data

Project Sugar Hill Location Campbell County, Va. By EC Date 2-5-91

Circle one: Present Developed Frequency (yr) 2 Checked SM Date 2-6-91

Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	A_mQ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
1	0.30	1.50	--	3,5,7	2.00	3.5	65	0.75	0.23	1.077	.31
2	0.20	1.25	--	3,5,7	2.00	3.5	70	1.01	0.20	0.857	.24
3	0.10	0.50	0.50	5,7	1.50	3.5	75	1.30	0.13	0.667	.19
4	0.25	0.75	--	5,7	1.50	3.5	70	1.01	0.25	0.857	.24
5	0.20	1.50	1.00	7	0.50	3.5	85	2.02	0.40	0.353	.10
6	0.40	1.00	--	7	0.50	3.5	75	1.30	0.52	0.667	.19
7	0.20	0.75	0.50	--	0	3.5	90	2.45	0.49	0.198	.06

↑↑↑ From worksheet 3 (Time of concentration, Travel time through subarea) ↑↑↑ From worksheet 2 (Runoff curve number, Runoff) ↑↑↑ From table 5-7 (Initial abstraction)

Worksheet 5b: Tabular hydrograph discharge summary

Project Sugar Hill   Location Campbell County, Va.   By EC   Date 2-5-91

Circle one: Present (Developed)   [1]Frequency (yr) 2   Checked SM   Date 2-6-91

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
	Subarea T_c (hr)	ΣT_t to outlet (hr)	I_a/P	$A_m Q$ (mi^2-in)	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5
					Discharges at selected hydrograph times 3/ (cfs)											
1	1.50	2.00	0.3	0.23	0	0	0	0	0	0	1	3	10	22	37	41
2	1.25	2.00	0.3	0.20	0	0	0	0	0	0	1	4	13	26	39	35
3	0.50	1.50	0.1	0.13	3	4	6	12	23	35	42	40	29	18	10	6
4	0.75	1.50	0.3	0.25		0	0	2	9	23	41	55	60	49	33	21
5	1.50	0.50	0.1	0.40	24	32	54	78	95	100	94	82	62	46	32	22
6	1.00	0.50	0.1	0.52	59	83	132	162	156	131	101	77	53	38	28	21
7	0.75	0	0.1	0.49	201	181	123	84	60	46	36	30	24	20	17	15
Composite hydrograph at outlet					287	300	315	338	343	335	316	291	251	219	196	161

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_m Q$ multiplied by tabular discharge from appropriate exhibit 5.

Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10 * * * TC =0.1 HR * * *																																
0.0	24	34	53	334	647	1010	623	217	147	123	104	86	76	66	57	51	46	42	38	34	32	29	26	23	21	20	19	18	15	13	12	0
.10	21	29	43	134	267	520	847	701	378	224	157	122	98	75	64	56	50	45	41	36	33	30	27	24	21	20	19	18	16	13	12	0
.20	18	25	35	61	110	215	418	704	702	486	312	209	151	94	73	62	54	49	44	38	34	31	28	25	22	21	19	18	16	14	12	0
.30	17	23	33	56	92	174	337	582	662	545	359	269	190	109	79	65	56	50	45	39	35	32	29	25	22	21	20	18	16	14	12	0
.40	15	20	28	41	51	78	142	272	478	601	563	447	328	172	104	76	63	55	49	42	37	33	29	26	23	21	20	19	17	14	12	0
.50	14	19	26	39	47	68	117	220	392	531	553	482	380	209	121	84	67	57	51	43	38	33	30	27	23	21	20	19	17	14	12	0
.75	12	15	21	29	33	38	49	73	126	224	343	432	464	385	252	156	103	76	62	50	43	36	31	28	25	22	21	19	17	15	12	0
1.0	9	12	15	21	23	26	29	33	40	55	86	148	238	406	434	317	205	130	89	62	50	41	34	30	27	24	22	20	18	16	12	0
1.5	7	8	10	14	15	16	18	20	22	25	29	34	45	101	220	339	373	320	234	131	80	53	40	34	30	27	24	21	19	17	12	2
2.0	4	6	7	9	9	10	11	12	13	15	16	18	20	25	37	72	150	252	336	312	216	109	58	42	34	30	27	24	20	18	13	8
2.5	3	4	5	6	7	7	8	8	9	10	11	12	13	16	19	25	39	75	142	262	303	229	108	58	41	34	30	27	22	19	14	11
3.0	1	2	3	4	4	5	5	6	6	7	7	8	8	10	12	14	17	22	31	76	169	288	236	122	64	43	35	30	24	20	16	11
IA/P = 0.30 * * * TC =0.1 HR * * *																																
0.0	0	0	0	154	568	936	524	217	172	149	126	107	97	86	76	69	63	58	53	48	46	42	38	34	31	30	28	27	24	20	19	0
.10	0	0	0	19	109	415	762	603	346	230	176	143	119	96	84	74	68	62	57	50	47	44	40	35	32	30	29	27	24	21	19	0
.20	0	0	0	0	13	77	302	609	605	432	297	217	167	115	94	81	73	66	60	53	48	45	41	37	33	31	29	28	25	21	19	0
.30	0	0	0	0	9	54	219	479	563	476	357	263	199	129	99	85	75	68	62	54	49	45	41	37	33	31	29	28	25	21	19	0
.40	0	0	0	0	0	6	38	159	372	500	484	399	309	183	123	96	82	73	66	58	51	46	42	38	34	31	30	28	25	22	19	0
.50	0	0	0	0	0	4	27	115	287	429	465	421	346	213	138	103	86	76	68	59	52	47	43	39	34	32	30	29	25	22	19	0
.75	0	0	0	0	0	0	1	10	46	132	246	338	381	341	243	165	119	94	80	67	58	50	45	41	37	33	31	29	26	23	19	0
1.0	0	0	0	0	0	0	0	1	4	22	69	149	241	357	331	246	170	122	96	76	64	54	47	42	38	34	32	30	27	24	19	0
1.5	0	0	0	0	0	0	0	0	0	0	0	1	4	41	142	258	310	285	224	142	97	71	55	47	43	39	35	32	29	25	20	4
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	49	130	221	279	255	182	108	70	55	47	42	38	34	30	27	20	11
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	52	119	224	256	193	107	70	55	47	42	38	32	28	22	17
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	52	141	240	199	117	74	56	48	43	35	30	24	18
IA/P = 0.50 * * * TC =0.1 HR * * *																																
0.0	0	0	0	0	70	539	377	196	171	154	134	117	108	99	89	83	77	72	67	61	59	56	51	46	43	42	40	38	34	30	28	0
.10	0	0	0	0	47	375	376	256	199	169	146	126	114	102	92	85	79	73	68	62	59	56	52	47	43	42	40	38	34	30	28	0
.20	0	0	0	0	0	31	260	338	283	227	189	160	138	112	99	90	83	77	72	64	60	57	53	48	44	42	41	39	35	30	28	0
.30	0	0	0	0	0	0	21	180	285	284	246	208	176	131	110	97	88	82	76	68	62	59	54	50	45	43	41	39	36	31	28	0
.40	0	0	0	0	0	0	14	125	232	266	253	223	192	142	115	100	91	83	77	69	63	59	55	50	45	43	41	40	36	31	28	0
.50	0	0	0	0	0	0	9	86	183	239	248	231	205	154	122	104	93	85	79	71	64	59	55	51	46	43	41	40	36	31	28	0
.75	0	0	0	0	0	0	3	31	87	147	190	211	213	184	147	121	103	92	84	75	67	61	57	52	47	44	42	40	37	32	28	0
1.0	0	0	0	0	0	0	0	0	1	13	45	92	141	205	197	165	134	112	98	84	75	65	[illegible]	55	50	46	43	41	38	34	28	0
1.5	0	0	0	0	0	0	0	0	0	0	0	2	9	51	118	170	183	167	143	111	92	77	65	59	54	50	45	43	39	35	28	2
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	15	51	103	148	168	156	127	96	76	65	58	54	49	45	41	37	29	12
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	31	69	131	159	140	101	78	66	59	54	50	43	39	31	24
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	46	101	151	134	99	77	65	59	54	45	41	33	26

RAINFALL TYPE = II * * * TC = 0.1 HR * * * SHEET 1 OF 10

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =0.2 HR * * *														IA/P = 0.10				
0.0	23	31	47	209	403	739	800	481	250	166	128	102	86	70	61	54	49	44	40	35	33	30	27	24	21	20	19	18	16	13	12	0
.10	19	26	39	86	168	325	601	733	565	355	229	161	122	83	69	59	53	47	43	37	34	31	28	25	22	21	19	18	16	14	12	0
.20	17	23	32	49	74	136	262	488	652	594	435	298	207	115	81	67	58	51	46	40	35	32	29	26	23	21	20	19	16	14	12	0
.30	16	22	30	46	64	112	212	396	566	585	485	360	258	139	90	71	60	53	48	41	36	32	29	26	23	21	20	19	16	14	12	0
.40	14	19	25	37	43	57	94	173	322	485	551	507	409	227	129	87	68	58	52	44	38	33	30	27	24	21	20	19	17	14	12	0
.50	13	18	24	35	40	52	80	142	262	410	504	506	441	269	153	98	73	61	53	45	39	34	30	27	24	22	20	19	17	15	12	0
.75	10	13	17	23	26	30	34	40	55	86	150	247	349	438	360	240	151	101	75	57	47	39	33	29	26	23	21	20	18	15	12	0
1.0	9	11	14	19	21	24	26	30	35	44	62	101	167	337	413	353	245	157	104	68	53	42	35	31	28	24	22	20	18	16	12	0
1.5	6	8	10	13	14	15	17	19	21	23	26	30	37	73	166	288	356	337	264	154	91	57	42	35	30	27	24	22	19	17	13	3
2.0	4	5	7	8	9	10	10	11	12	14	15	16	18	23	31	55	114	206	291	324	239	125	63	44	35	31	28	24	20	18	14	9
2.5	3	4	5	6	6	7	7	8	9	9	10	11	12	15	18	22	32	58	111	227	298	246	122	63	43	35	31	27	22	19	15	11
3.0	1	2	3	4	4	4	5	5	6	6	7	7	8	9	11	13	16	19	27	59	138	280	248	137	70	46	36	31	25	21	16	11
IA/P = 0.30														* * * TC =0.2 HR * * *														IA/P = 0.30				
0.0	0	0	0	39	180	545	697	497	276	198	158	130	110	93	81	73	67	61	56	49	46	43	39	35	32	30	29	27	24	21	19	0
.10	0	0	0	2	27	129	407	600	532	361	252	190	150	108	90	79	71	65	59	52	48	44	41	36	32	31	29	28	25	21	19	0
.20	0	0	0	2	19	92	302	501	521	415	306	228	176	119	95	82	73	67	61	53	48	45	41	37	33	31	29	28	25	21	19	0
.30	0	0	0	0	1	13	66	223	408	484	438	350	269	163	114	93	80	72	65	57	51	46	42	38	34	31	30	28	25	22	19	0
.40	0	0	0	0	1	9	47	164	327	431	436	379	306	189	127	98	83	74	67	58	52	47	43	38	34	31	30	28	25	22	19	0
.50	0	0	0	0	0	0	6	33	120	258	374	415	391	271	173	121	95	81	72	62	55	48	44	40	35	32	30	29	26	22	19	0
.75	0	0	0	0	0	0	2	13	50	126	221	302	348	323	240	167	121	96	81	68	59	50	45	41	37	33	31	29	26	23	19	0
1.0	0	0	0	0	0	0	0	0	1	6	24	69	139	285	331	280	204	145	109	82	68	56	48	43	39	35	32	30	27	24	19	0
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	16	79	186	271	288	247	165	110	76	58	49	44	40	35	32	29	26	20	5
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	24	80	163	235	262	202	123	76	58	49	43	39	35	30	27	21	13
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	28	77	179	242	207	120	75	57	48	43	39	32	29	22	17
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	30	101	207	227	130	80	59	49	44	35	30	24	18
IA/P = 0.50														* * * TC =0.2 HR * * *														IA/P = 0.50				
0.0	0	0	0	0	7	98	371	322	221	182	158	137	120	104	94	86	80	74	69	62	60	57	52	47	44	42	40	39	35	30	29	0
.10	0	0	0	0	4	67	270	305	249	204	174	149	130	108	97	88	82	76	71	64	60	57	53	48	44	42	41	39	35	30	28	0
.20	0	0	0	0	0	3	45	195	268	255	221	189	163	125	106	95	87	80	75	67	62	58	54	49	45	43	41	39	35	31	28	0
.30	0	0	0	0	0	2	31	140	226	245	229	203	176	134	111	98	89	82	76	68	62	59	55	50	45	43	41	39	36	31	28	0
.40	0	0	0	0	0	1	21	101	184	225	228	211	183	144	117	101	91	84	78	69	63	59	55	50	45	43	41	40	36	31	28	0
.50	0	0	0	0	0	0	1	14	72	146	199	218	213	175	137	113	99	89	82	73	66	60	56	52	47	43	42	40	36	32	28	0
.75	0	0	0	0	0	0	0	5	28	71	121	162	186	193	161	133	112	98	88	78	70	62	57	53	48	44	42	41	37	33	28	0
1.0	0	0	0	0	0	0	0	0	0	2	13	38	77	154	186	174	147	122	105	89	78	68	60	56	51	46	43	42	38	34	28	0
1.5	0	0	0	0	0	0	0	0	0	0	0	0	2	22	71	129	163	168	150	120	98	80	67	60	55	51	46	43	40	36	28	4
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	25	65	112	146	157	134	103	79	67	60	55	50	46	41	38	29	14
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	26	60	117	148	136	101	79	66	59	54	50	43	39	31	24
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	40	90	142	130	99	78	66	59	54	45	41	33	26
RAINFALL TYPE = II														* * * TC = 0.2 HR * * *														SHEET 2 OF 10				

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =0.3 HR * * *														IA/P = 0.10				
0.0	20	28	41	118	235	447	676	676	459	283	196	146	114	80	66	57	51	46	42	37	33	31	28	24	22	20	19	18	16	13	12	0
.10	19	26	39	99	189	361	571	641	520	362	251	181	136	89	70	60	53	48	43	37	34	31	28	25	22	21	19	18	16	14	12	0
.20	17	23	32	53	83	154	292	478	587	542	422	308	223	127	86	68	58	52	46	40	35	32	29	26	23	21	20	19	16	14	12	0
.30	16	22	30	49	72	127	237	398	524	536	460	359	268	151	97	73	61	53	48	41	36	32	29	26	23	21	20	19	16	14	12	0
.40	14	19	25	37	45	63	105	193	330	459	510	477	398	237	139	92	70	59	52	44	38	34	30	27	24	21	20	19	17	14	12	0
.50	13	18	24	35	42	56	89	158	272	397	472	475	424	274	163	104	76	62	54	46	39	34	30	27	24	22	20	19	17	15	12	0
.75	11	14	19	26	30	34	42	59	95	160	250	339	417	398	299	196	128	89	69	54	45	37	32	29	26	23	21	20	17	15	12	0
1.0	9	11	14	19	21	24	27	30	36	46	68	109	174	328	396	346	248	163	109	70	54	43	35	31	28	24	22	20	18	16	12	0
1.5	6	8	10	13	14	15	17	19	21	23	26	31	38	77	169	282	347	330	264	158	94	58	42	35	31	27	24	22	19	17	13	3
2.0	4	5	7	8	9	10	10	11	12	14	15	16	18	23	32	57	116	205	285	317	239	128	64	44	36	31	28	25	20	18	14	9
2.5	2	4	5	6	6	7	7	8	9	9	10	11	12	15	18	23	33	60	113	223	293	245	125	65	44	35	31	27	22	19	15	11
3.0	1	2	3	4	4	4	5	5	6	6	7	7	8	9	11	13	16	20	27	61	138	275	246	139	72	46	36	31	25	21	16	11
IA/P = 0.30														* * * TC =0.3 HR * * *														IA/P = 0.30				
0.0	0	0	0	11	64	251	525	574	454	303	221	173	140	104	88	77	70	64	58	51	47	44	40	36	32	31	29	28	24	21	19	0
.10	0	0	0	0	7	45	183	411	520	476	360	268	205	133	101	85	76	69	62	55	49	45	41	37	33	31	30	28	25	21	19	0
.20	0	0	0	0	5	32	132	318	452	468	396	310	240	151	109	90	78	70	64	56	50	46	42	38	33	31	30	28	25	22	19	0
.30	0	0	0	0	0	3	22	96	244	383	440	411	344	217	142	105	87	76	69	60	53	47	43	39	35	32	30	29	26	22	19	0
.40	0	0	0	0	0	2	16	69	186	317	399	407	365	246	160	115	92	79	71	61	54	48	43	39	35	32	30	29	26	22	19	0
.50	0	0	0	0	0	0	2	11	50	140	258	352	389	327	223	149	110	89	77	66	57	50	45	41	36	33	31	29	26	23	19	0
.75	0	0	0	0	0	0	1	4	20	63	135	219	290	335	281	205	146	110	89	72	62	52	46	42	38	34	31	30	27	23	19	0
1.0	0	0	0	0	0	0	0	0	0	2	9	32	78	216	320	306	243	176	128	90	72	59	49	44	40	36	33	31	28	24	19	1
1.5	0	0	0	0	0	0	0	0	0	0	0	0	2	20	84	185	264	281	246	168	112	77	58	49	44	40	36	32	29	26	20	5
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12	50	121	200	257	224	141	83	61	50	44	40	36	31	28	21	14
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	16	51	145	239	223	137	82	60	50	44	40	33	29	22	17
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	74	184	224	146	89	63	51	45	36	31	24	18
IA/P = 0.50														* * * TC =0.3 HR * * *														IA/P = 0.50				
0.0	0	0	0	0	1	25	151	299	277	219	187	162	141	113	100	90	84	78	72	65	61	58	53	48	44	42	41	39	35	31	28	0
.10	0	0	0	0	1	17	106	235	263	234	202	175	152	120	104	93	85	79	73	66	61	58	54	49	44	42	41	39	35	31	28	0
.20	0	0	0	0	0	0	12	75	182	236	234	213	188	144	116	101	91	84	78	70	63	59	55	50	45	43	41	40	36	31	28	0
.30	0	0	0	0	0	0	8	52	138	203	224	217	197	154	123	105	94	86	79	71	64	59	55	51	46	43	42	40	36	32	28	0
.40	0	0	0	0	0	0	5	37	105	170	206	213	203	164	131	110	97	88	81	72	65	60	56	51	46	43	42	40	36	32	28	0
.50	0	0	0	0	0	0	0	4	26	78	140	184	203	191	155	126	107	95	86	76	69	62	57	53	48	44	42	41	37	33	28	0
.75	0	0	0	0	0	0	0	1	10	34	73	117	153	184	173	146	122	105	94	82	73	64	58	54	49	45	43	41	37	33	28	0
1.0	0	0	0	0	0	0	0	0	0	0	4	17	42	114	168	178	159	134	114	94	82	70	61	57	52	47	44	42	39	35	28	0
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	10	44	98	144	163	157	130	105	84	69	61	56	52	47	44	40	36	29	6
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	44	87	127	153	141	110	83	69	61	56	51	47	42	38	30	17
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	16	42	97	138	145	107	82	68	60	55	51	43	40	32	25
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	27	71	127	139	105	81	68	60	55	46	41	33	27

RAINFALL TYPE = II   * * * TC = 0.3 HR * * *   SHEET 3 OF 10

Source: USDA-SCS

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR) / HYDROGRAPH TIME (HOURS)

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =0.4 HR * * *														IA/P = 0.10				
0.0	18	25	36	77	141	271	468	592	574	431	298	216	163	104	77	63	55	49	44	38	34	31	28	25	22	21	20	18	16	14	12	0
.10	18	24	34	67	116	219	385	523	557	473	357	263	196	119	84	67	57	51	46	39	35	32	29	25	22	21	20	19	16	14	12	0
.20	15	20	28	44	59	97	179	316	454	523	489	401	309	178	112	81	65	56	49	42	37	33	30	26	23	21	20	19	17	14	12	0
.30	15	20	27	41	53	82	147	260	389	478	486	429	349	210	129	89	69	58	51	43	38	33	30	27	24	21	20	19	17	14	12	0
.40	13	17	23	33	38	48	71	121	214	331	429	467	442	308	189	120	85	66	56	47	41	35	31	28	24	22	20	19	17	15	12	0
.50	12	16	22	31	36	44	62	102	176	279	379	438	440	339	218	137	94	71	59	49	42	35	31	28	25	22	21	19	17	15	12	0
.75	10	13	17	24	26	30	35	45	65	106	170	251	326	393	341	245	164	112	81	59	48	39	33	30	26	23	21	20	18	15	12	0
1.0	8	10	13	17	19	21	24	27	31	37	50	75	118	251	360	376	292	205	138	83	60	45	36	32	28	25	22	21	18	16	12	1
1.5	6	7	9	12	13	14	15	17	19	21	23	26	31	56	121	224	311	333	293	192	115	66	45	36	31	28	25	22	19	17	13	4
2.0	4	5	6	8	8	9	10	10	11	12	14	15	16	20	27	43	85	159	243	306	264	154	74	47	37	32	28	25	21	18	14	9
2.5	2	3	4	5	6	6	7	7	8	9	9	10	11	13	16	20	27	46	85	184	285	262	147	74	47	37	32	28	22	19	15	11
3.0	1	2	2	3	4	4	4	5	5	6	6	7	7	8	10	12	14	17	23	47	109	227	268	160	83	50	38	32	25	21	16	11
IA/P = 0.30														* * * TC =0.4 HR * * *														IA/P = 0.30				
0.0	0	0	0	4	26	113	296	480	495	413	306	234	186	127	100	84	74	67	61	54	49	45	41	37	33	31	29	28	25	21	19	0
.10	0	0	0	0	2	18	81	224	395	462	430	347	272	172	121	96	82	73	66	57	51	46	42	38	34	31	30	28	25	22	19	0
.20	0	0	0	0	2	13	59	169	320	414	424	373	305	196	134	103	85	75	67	59	52	47	43	39	34	32	30	29	25	22	19	0
.30	0	0	0	0	0	1	9	42	127	255	361	403	383	274	181	127	99	83	73	63	55	48	44	40	36	32	30	29	26	23	19	0
.40	0	0	0	0	0	1	6	30	94	202	308	372	379	298	203	141	106	87	76	65	56	49	44	40	36	32	31	29	26	23	19	0
.50	0	0	0	0	0	0	0	4	21	70	158	258	334	364	270	187	133	102	85	70	60	51	46	41	37	33	31	30	26	23	19	0
.75	0	0	0	0	0	0	0	2	8	30	76	145	219	321	305	241	177	130	102	78	65	55	47	43	38	34	32	30	27	24	19	0
1.0	0	0	0	0	0	0	0	0	0	1	4	15	42	150	267	308	272	209	154	103	79	62	51	45	41	37	33	31	28	25	19	1
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	10	51	136	226	274	263	195	131	85	62	51	45	41	36	33	29	26	20	6
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	31	86	162	252	239	162	93	64	52	45	41	37	31	28	21	15
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	33	112	202	235	155	92	64	52	45	41	33	29	23	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	21	76	182	221	148	90	63	51	45	36	31	24	13
IA/P = 0.50														* * * TC =0.4 HR * * *														IA/P = 0.50				
0.0	0	0	0	0	0	7	59	168	245	257	213	186	163	128	109	96	88	81	75	67	62	58	54	50	45	43	41	39	35	31	28	0
.10	0	0	0	0	0	0	5	41	125	205	240	222	198	154	123	106	94	86	79	71	64	60	56	51	46	43	42	40	36	32	28	0
.20	0	0	0	0	0	0	3	28	93	168	216	220	205	164	131	110	97	88	81	72	65	60	56	51	46	43	42	40	36	32	28	0
.30	0	0	0	0	0	0	0	2	20	69	135	189	209	192	155	126	107	95	86	77	69	62	57	53	48	44	42	41	37	33	28	0
.40	0	0	0	0	0	0	0	1	14	50	106	161	193	202	163	133	112	98	89	78	70	62	58	53	48	44	42	41	37	33	28	0
.50	0	0	0	0	0	0	0	1	9	37	83	135	174	194	171	140	117	102	91	80	71	63	58	54	49	45	43	41	37	33	28	0
.75	0	0	0	0	0	0	0	0	0	3	15	40	76	147	177	169	146	124	107	90	79	68	60	56	51	47	43	42	38	34	28	0
1.0	0	0	0	0	0	0	0	0	0	0	1	7	21	78	141	173	167	146	125	101	86	73	63	58	53	48	45	42	39	35	28	1
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	26	71	121	153	159	139	113	89	72	63	57	53	48	44	40	37	29	7
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	16	45	86	138	150	125	93	74	64	58	53	48	42	39	31	20
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	17	59	112	143	121	91	73	63	57	53	45	40	32	26
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	40	101	138	117	90	73	63	57	48	42	34	27

RAINFALL TYPE = II   * * * TC = 0.4 HR * * *   SHEET 4 OF 10

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10																* * * TC =0.5 HR * * *													IA/P = 0.10			
0.0	17	23	32	57	94	170	309	467	529	507	402	297	226	140	96	74	61	53	47	41	36	32	29	26	23	21	20	19	16	14	12	0
.10	16	22	30	51	80	140	252	395	484	499	434	343	265	162	109	80	65	55	49	42	36	33	29	26	23	21	20	19	16	14	12	0
.20	14	19	25	38	47	69	116	207	332	434	477	449	378	238	149	101	77	62	53	45	39	34	30	27	24	22	20	19	17	14	12	0
.30	13	18	24	35	43	60	97	170	278	382	446	448	401	270	171	114	83	66	56	46	40	34	31	27	24	22	20	19	17	15	12	0
.40	12	15	21	29	33	40	53	83	141	233	332	408	434	361	243	157	107	79	64	51	43	36	32	28	25	22	21	20	17	15	12	0
.50	11	15	20	28	31	37	48	71	118	194	286	367	412	378	271	178	119	86	68	53	44	37	32	29	25	23	21	20	17	15	12	0
.75	9	11	14	19	21	24	27	31	37	49	74	118	182	319	374	328	244	169	117	76	56	43	35	31	28	25	22	21	18	16	12	1
1.0	7	9	12	16	17	19	21	24	27	32	40	55	83	188	309	359	322	245	172	102	69	49	38	32	29	26	23	21	19	16	12	1
1.5	5	7	8	11	12	13	14	15	17	19	21	23	27	43	89	175	269	322	309	225	140	77	49	38	32	29	25	23	20	17	13	5
2.0	3	4	6	7	8	8	9	10	10	11	12	14	15	18	23	35	65	123	202	297	280	181	88	52	39	33	29	26	21	19	14	10
2.5	2	3	4	5	5	6	6	7	7	8	9	[illegible]	10	12	15	18	24	36	66	150	244	278	171	87	52	39	33	29	23	20	15	11
3.0	1	1	2	3	3	4	4	4	5	5	6	6	7	8	9	11	13	16	20	37	86	198	263	182	96	56	40	33	26	21	16	11
IA/P = 0.30																* * * TC =0.5 HR * * *													IA/P = 0.30			
0.0	0	0	0	1	9	53	157	314	433	439	379	299	237	159	118	95	81	71	65	56	50	46	42	38	34	31	30	28	25	22	19	0
.10	0	0	0	0	1	6	37	117	248	372	416	391	330	218	150	113	92	79	70	60	53	47	43	39	35	32	30	29	26	22	19	0
.20	0	0	0	0	1	4	26	87	194	313	382	388	349	244	167	122	97	82	72	62	54	47	43	39	35	32	30	29	26	22	19	0
.30	0	0	0	0	0	0	3	19	64	151	259	341	372	316	223	156	117	94	80	67	58	50	45	41	36	33	31	29	26	23	19	0
.40	0	0	0	0	0	0	2	13	47	116	211	298	354	328	245	172	127	100	83	69	59	51	45	41	37	33	31	29	26	23	19	0
.50	0	0	0	0	0	0	0	1	9	34	89	170	255	341	303	225	161	120	96	76	64	54	47	42	38	34	31	30	27	24	19	0
.75	0	0	0	0	0	0	0	1	4	14	41	89	152	270	305	268	207	155	118	87	70	57	48	44	39	35	32	30	27	24	19	0
1.0	0	0	0	0	0	0	0	0	0	0	2	7	22	98	212	295	285	237	181	120	88	67	53	46	42	38	34	31	28	25	19	2
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	30	95	183	249	265	217	152	96	66	53	46	41	37	34	30	26	20	8
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	18	59	125	221	245	182	105	69	54	47	42	38	32	28	22	16
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	21	84	174	230	172	103	69	54	46	42	34	30	23	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	56	157	217	163	101	68	53	46	37	31	25	18
IA/P = 0.50																* * * TC =0.5 HR * * *													IA/P = 0.50			
0.0	0	0	0	0	0	2	26	89	170	217	229	200	179	144	119	104	93	85	78	70	64	59	55	51	46	43	41	40	36	32	28	0
.10	0	0	0	0	0	0	1	18	65	135	190	216	205	170	137	115	101	91	83	74	67	61	56	52	47	44	42	40	36	32	28	0
.20	0	0	0	0	0	0	1	12	47	106	162	198	203	178	145	121	105	94	85	76	68	61	57	52	48	44	42	40	37	32	28	0
.30	0	0	0	0	0	0	0	1	8	34	82	135	177	194	168	139	117	102	92	80	71	63	58	54	49	45	43	41	37	33	28	0
.40	0	0	0	0	0	0	0	0	6	25	63	111	155	189	174	146	122	106	94	82	73	64	58	54	50	45	43	41	37	33	28	0
.50	0	0	0	0	0	0	0	0	4	18	48	90	133	184	177	152	128	110	97	84	74	65	59	55	50	45	43	41	38	33	28	0
.75	0	0	0	0	0	0	0	0	1	7	22	47	80	142	169	164	144	124	108	91	79	68	61	56	51	47	44	42	38	34	28	0
1.0	0	0	0	0	0	0	0	0	0	0	1	3	11	51	112	155	166	154	134	109	91	76	65	59	54	49	45	43	39	35	28	2
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	50	97	136	154	145	121	95	75	64	58	54	49	45	41	37	29	10
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	18	47	86	134	146	125	94	75	64	58	53	49	42	39	31	21
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	11	44	95	140	127	97	77	65	58	54	45	41	33	26
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	29	86	135	122	95	76	65	58	49	43	35	27

RAINFALL TYPE = II

* * * TC = 0.5 HR * * *

SHEET 5 OF 10

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =0.75 HR * * *															IA/P = 0.10			
0.0	13	18	24	36	46	68	115	194	294	380	424	410	369	252	172	123	93	74	61	49	41	35	31	27	24	22	20	19	17	15	12	0
.10	13	17	23	34	42	59	97	162	250	337	395	405	381	279	191	135	100	79	65	51	42	36	31	28	25	22	21	19	17	15	12	0
.20	11	15	20	28	32	39	52	82	135	211	295	362	391	351	255	178	127	95	75	57	46	38	32	29	26	23	21	20	17	15	12	0
.30	11	14	19	26	30	36	47	70	113	179	256	326	379	360	277	196	140	103	80	60	48	38	33	29	26	23	21	20	18	15	12	0
.40	10	12	16	22	25	28	33	42	61	96	151	221	291	367	336	255	182	131	98	69	54	42	34	30	27	24	22	20	18	16	12	0
.50	9	12	16	21	24	27	31	39	53	82	128	190	258	358	343	274	200	144	106	74	56	43	35	30	27	24	22	20	18	16	12	0
.75	8	10	13	17	18	21	23	26	31	39	55	82	122	230	314	329	281	217	161	104	72	51	38	33	29	26	23	21	19	16	12	1
1.0	6	8	10	13	14	15	17	19	21	23	27	32	42	89	177	272	319	303	249	163	105	66	45	36	31	27	24	22	19	17	13	3
1.5	4	6	7	9	10	10	11	12	14	15	16	18	20	27	46	90	163	241	295	275	204	119	66	45	35	31	27	24	20	18	13	7
2.0	3	4	5	6	7	7	8	9	9	10	11	12	13	16	20	28	48	89	151	245	274	213	115	65	44	35	30	27	22	19	14	10
2.5	1	2	3	4	4	5	5	6	6	7	7	8	8	10	12	14	17	24	37	86	170	260	219	127	71	47	36	31	24	20	16	11
3.0	1	1	2	3	3	3	4	4	4	5	5	5	6	7	8	10	11	14	17	30	64	157	247	205	122	70	46	36	27	22	17	12
IA/P = 0.30														* * * TC =0.75 HR * * *															IA/P = 0.30			
0.0	0	0	0	0	1	6	30	86	174	266	326	348	328	246	181	138	110	92	79	66	57	49	44	40	36	32	31	29	26	23	19	0
.10	0	0	0	0	0	1	4	22	65	137	223	292	329	303	228	170	131	106	89	73	61	52	46	41	37	33	31	29	26	23	19	0
.20	0	0	0	0	0	0	3	15	48	108	185	256	305	321	245	184	141	112	93	75	63	53	46	42	37	34	31	30	27	23	19	0
.30	0	0	0	0	0	0	2	11	36	84	151	221	277	308	260	199	152	120	98	78	65	54	47	42	38	34	31	30	27	23	19	0
.40	0	0	0	0	0	0	0	1	8	27	65	122	188	286	301	243	187	144	114	87	71	57	48	43	39	35	32	30	27	24	19	1
.50	0	0	0	0	0	0	0	1	6	20	50	98	158	263	292	254	200	155	122	91	74	59	49	44	40	35	32	30	27	24	19	1
.75	0	0	0	0	0	0	0	0	0	2	8	23	51	140	231	269	253	211	167	119	90	68	53	46	42	37	34	31	28	25	19	2
1.0	0	0	0	0	0	0	0	0	0	0	0	1	4	29	96	186	249	261	231	169	120	84	61	50	44	40	36	33	29	26	20	5
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	34	91	163	220	241	197	131	83	61	50	44	40	35	31	27	21	12
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	36	85	174	226	200	127	82	60	49	44	39	32	29	22	17
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	37	105	196	214	135	87	62	51	44	36	31	24	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	24	96	205	189	130	85	62	50	39	32	26	18
IA/P = 0.50														* * * TC =0.75 HR * * *															IA/P = 0.50			
0.0	0	0	0	0	0	0	2	16	45	92	137	166	185	170	146	125	110	98	89	79	70	63	58	53	48	44	42	41	37	33	28	0
.10	0	0	0	0	0	0	0	1	11	34	73	115	149	180	163	141	122	107	96	84	74	65	59	54	50	45	43	41	38	33	28	0
.20	0	0	0	0	0	0	0	1	8	25	57	96	131	173	166	146	126	111	99	86	76	66	59	55	50	46	43	41	38	34	28	0
.30	0	0	0	0	0	0	0	0	1	5	18	44	79	143	170	160	141	122	108	92	81	69	61	56	52	47	44	42	38	34	28	1
.40	0	0	0	0	0	0	0	0	0	4	14	34	64	127	166	162	145	127	111	95	82	70	62	57	52	47	44	42	38	34	28	1
.50	0	0	0	0	0	0	0	0	0	0	2	10	26	82	138	162	157	140	123	103	88	75	64	58	53	49	45	43	39	35	28	2
.75	0	0	0	0	0	0	0	0	0	0	1	4	12	47	98	139	154	148	135	113	96	80	67	60	55	50	46	43	39	36	29	3
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	30	73	119	146	151	134	113	91	74	63	58	53	48	45	41	37	29	7
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	30	66	105	143	143	117	90	73	63	57	52	48	42	39	30	18
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	30	77	121	137	114	88	72	63	57	52	44	40	32	25
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	19	55	111	132	111	87	71	62	56	47	42	34	27
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12	51	112	128	108	86	71	62	51	44	36	27

RAINFALL TYPE = II * * * TC = 0.75 HR * * * SHEET 6 OF 10

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR)	HYDROGRAPH TIME (HOURS) 11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =1.0 HR * * *														IA/P = 0.10				
0.0	11	15	20	29	35	47	72	112	168	231	289	329	357	313	239	175	133	103	83	63	50	40	33	29	26	23	21	20	17	15	12	0
.10	10	13	17	24	27	33	42	62	95	144	202	260	306	340	293	222	165	126	98	72	56	43	35	30	27	24	22	20	18	15	12	0
.20	10	13	17	23	26	30	38	54	82	123	176	232	281	332	303	238	179	136	105	76	59	45	35	30	27	24	22	20	18	16	12	1
.30	9	12	16	22	24	28	35	48	70	105	152	205	256	323	310	254	193	146	113	81	61	46	36	31	27	24	22	20	18	16	12	1
.40	8	11	14	19	21	23	27	32	42	61	91	132	181	276	318	294	237	181	138	95	70	51	39	32	28	25	23	21	18	16	12	1
.50	8	10	13	18	20	22	25	30	38	53	78	114	159	253	311	300	251	195	149	102	74	53	40	33	29	25	23	21	18	16	12	1
.75	7	8	11	14	16	17	19	21	25	30	38	53	76	146	228	284	293	256	208	143	99	66	46	36	31	27	24	22	19	17	13	2
1.0	5	7	8	11	12	13	14	16	17	19	22	25	31	57	111	188	256	286	272	208	144	90	56	41	33	29	26	23	20	17	13	4
1.5	4	5	6	8	8	9	10	11	12	13	14	15	17	22	33	59	107	171	231	268	235	157	88	56	41	33	29	25	21	18	14	8
2.0	2	3	4	5	5	6	6	7	7	8	9	9	10	12	15	19	27	44	78	157	231	252	167	96	59	42	34	29	23	20	15	11
2.5	1	2	2	3	4	4	4	5	5	6	6	7	7	8	10	12	15	19	27	58	120	214	241	159	94	59	42	34	26	21	16	11
3.0	0	1	1	2	2	3	3	3	4	4	4	5	5	6	7	8	10	12	14	22	44	113	214	231	152	91	58	42	29	23	17	12
IA/P = 0.30														* * * TC =1.0 HR * * *														IA/P = 0.30				
0.0	0	0	0	0	1	4	16	42	83	137	195	243	271	292	227	178	143	117	98	79	66	55	47	42	38	34	31	30	27	23	19	0
.10	0	0	0	0	0	0	3	12	32	66	113	168	218	279	260	213	169	136	113	88	72	59	49	43	39	35	32	30	27	24	19	1
.20	0	0	0	0	0	0	2	9	24	52	93	143	193	271	271	225	180	145	119	92	75	60	50	44	39	35	32	30	27	24	19	1
.30	0	0	0	0	0	0	1	6	18	41	75	120	169	246	264	234	191	153	125	96	78	62	51	44	40	36	33	31	27	24	19	1
.40	0	0	0	0	0	0	0	1	4	14	32	61	100	190	251	259	222	181	146	109	86	67	53	46	41	37	33	31	28	25	19	2
.50	0	0	0	0	0	0	0	1	3	10	24	49	83	168	237	254	230	191	155	115	90	69	54	47	42	37	34	31	28	25	19	2
.75	0	0	0	0	0	0	0	0	0	1	4	12	25	76	150	213	239	228	198	149	112	82	61	50	44	39	35	32	29	26	20	4
1.0	0	0	0	0	0	0	0	0	0	0	0	1	2	15	51	113	182	226	234	197	150	104	72	56	47	42	38	34	30	27	20	7
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	18	51	104	162	220	210	158	102	71	56	47	42	37	31	28	22	13
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	20	49	121	187	209	152	100	70	55	47	41	34	29	23	17
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	32	87	171	199	146	98	69	54	46	37	31	24	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	62	158	192	151	103	73	56	41	34	26	18
IA/P = 0.50														* * * TC =1.0 HR * * *														IA/P = 0.50				
0.0	0	0	0	0	0	0	1	7	21	42	71	101	126	160	154	138	123	110	100	87	77	67	60	55	50	46	43	41	38	34	28	1
.10	0	0	0	0	0	0	0	1	5	15	33	58	87	134	156	149	134	120	108	93	82	71	62	57	52	47	44	42	38	34	28	1
.20	0	0	0	0	0	0	0	1	4	12	26	48	74	123	153	153	137	123	111	95	84	72	63	57	52	47	44	42	38	34	28	1
.30	0	0	0	0	0	0	0	0	3	9	20	38	62	111	143	150	140	127	114	98	86	73	63	58	53	48	45	42	39	35	28	1
.40	0	0	0	0	0	0	0	0	0	2	6	16	31	75	120	145	148	137	123	106	91	77	66	59	54	49	45	43	39	35	29	2
.50	0	0	0	0	0	0	0	0	0	1	5	12	25	64	109	139	146	139	127	108	94	79	67	60	55	50	46	43	39	36	29	3
.75	0	0	0	0	0	0	0	0	0	0	2	5	12	39	78	115	136	140	134	117	101	84	70	62	56	51	47	44	40	36	29	4
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	26	59	96	125	139	133	117	97	78	66	59	54	49	46	41	37	29	8
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	26	54	86	123	133	119	95	77	66	59	54	49	43	39	31	17
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	25	64	104	129	116	93	76	65	58	53	45	41	33	24
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	34	84	125	117	96	78	66	59	49	43	35	27
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	32	89	122	114	94	77	66	53	45	37	27

RAINFALL TYPE = II * * * TC = 1.0 HR * * * SHEET 7 OF 10

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =1.25 HR * * *														IA/P = 0.10				
0.0	10	13	18	25	29	38	54	81	118	163	213	256	284	311	266	212	163	129	104	78	61	47	37	31	27	24	22	20	18	16	12	1
.10	10	13	17	23	27	34	47	69	102	143	189	234	267	297	274	226	175	138	111	82	64	48	38	31	27	24	22	20	18	16	12	1
.20	9	11	15	20	22	26	31	42	60	88	124	168	212	280	292	261	212	166	131	95	72	53	40	33	28	25	23	21	18	16	12	1
.30	8	11	14	19	21	24	29	38	53	76	108	148	190	263	288	268	224	177	140	101	76	55	41	34	29	25	23	21	18	16	12	2
.40	8	10	13	18	20	23	27	34	46	66	94	130	170	245	282	273	235	188	149	107	80	58	42	34	29	26	23	21	19	16	12	2
.50	7	9	12	16	17	19	22	25	31	41	58	82	114	190	256	279	262	222	178	127	93	65	46	36	31	27	24	22	19	17	13	2
.75	6	8	10	14	15	17	19	21	25	31	41	56	78	139	207	254	265	245	208	152	110	75	51	39	32	28	25	22	19	17	13	3
1.0	5	6	8	10	11	13	14	15	17	19	22	26	33	60	109	173	230	261	255	208	153	100	64	46	36	30	26	24	20	18	13	5
1.5	3	4	5	7	7	8	9	9	10	11	12	13	15	19	27	45	79	130	186	247	239	180	108	68	48	37	31	27	22	19	14	10
2.0	2	3	4	5	6	6	7	7	8	8	9	10	11	13	16	22	35	59	98	171	236	236	156	95	62	44	35	30	23	20	15	11
2.5	1	2	2	3	4	4	4	5	5	5	6	6	7	8	10	12	14	19	28	58	114	197	226	163	102	65	46	36	26	21	16	11
3.0	0	1	1	2	2	2	2	3	3	3	4	4	4	5	6	7	9	10	13	19	35	88	184	218	169	109	70	49	31	24	18	12
IA/P = 0.30														* * * TC =1.25 HR * * *														IA/P = 0,30				
0.0	0	0	0	0	0	2	9	25	50	86	130	174	208	253	235	201	164	136	115	92	76	61	51	44	39	35	32	30	27	24	19	1
.10	0	0	0	0	0	0	1	6	19	40	71	110	153	217	247	227	191	157	131	103	84	66	53	46	41	36	33	31	28	24	19	2
.20	0	0	0	0	0	0	1	4	14	31	58	93	133	202	239	231	199	165	138	108	87	68	55	47	41	37	33	31	28	25	19	2
.30	0	0	0	0	0	0	0	1	3	10	24	46	77	152	210	236	222	190	158	122	97	74	58	49	43	38	34	32	28	25	20	3
.40	0	0	0	0	0	0	0	0	2	8	19	37	64	134	196	232	225	198	166	127	101	77	59	50	43	38	35	32	28	25	20	3
.50	0	0	0	0	0	0	0	0	0	2	6	14	30	82	151	206	228	217	189	146	113	85	64	52	45	40	36	33	29	26	20	5
.75	0	0	0	0	0	0	0	0	0	1	2	7	15	49	105	164	205	218	205	166	129	95	69	55	47	41	37	33	29	26	20	6
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	32	77	134	185	214	203	166	120	83	63	52	45	39	35	30	27	21	10
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	33	72	121	184	203	171	117	82	62	51	44	39	32	29	22	15
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	21	67	132	194	174	123	86	64	52	45	35	31	24	18
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	46	121	187	166	119	84	63	52	39	32	25	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	44	129	180	160	116	83	63	44	35	27	18
IA/P = 0.50														* * * TC =1.25 HR * * *														IA/P = 0.50				
0.0	0	0	0	0	0	0	1	5	13	26	44	68	91	125	142	142	128	117	107	94	83	72	63	57	52	47	44	42	38	34	28	2
.10	0	0	0	0	0	0	0	0	3	10	20	36	57	100	129	140	136	125	114	100	88	76	65	59	54	49	45	43	39	35	29	3
.20	0	0	0	0	0	0	0	0	2	7	16	30	48	90	122	139	139	127	117	102	90	77	66	60	54	49	45	43	39	35	29	3
.30	0	0	0	0	0	0	0	0	0	2	5	12	24	59	98	126	137	134	125	109	96	82	69	61	56	51	46	44	40	36	29	4
.40	0	0	0	0	0	0	0	0	0	1	4	10	19	51	89	119	134	136	127	112	98	83	70	62	56	51	47	44	40	36	29	5
.50	0	0	0	0	0	0	0	0	0	1	3	7	15	43	79	112	131	135	129	114	100	85	71	63	57	52	47	44	40	36	29	6
.75	0	0	0	0	0	0	0	0	0	0	0	1	3	15	39	71	102	123	130	125	112	94	78	67	60	54	49	46	41	37	29	9
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	17	40	71	101	121	129	121	103	84	71	62	56	51	47	42	38	30	13
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	26	51	92	119	125	105	86	72	63	57	52	44	40	32	23
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	11	35	72	112	122	103	85	71	63	56	47	42	34	26
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	24	66	111	119	101	83	71	62	51	44	36	27
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	23	71	110	116	99	82	70	55	46	37	27
RAINFALL TYPE = II														* * * TC = 1.25 HR * * *														SHEET 8 OF 10				

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (HR) / HYDROGRAPH TIME (HOURS)

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =1.5 HR * * *															IA/P = 0.10			
0.0	9	11	15	21	25	31	41	58	32	112	147	184	216	255	275	236	198	159	129	98	76	57	43	35	30	25	23	21	18	16	12	1
.10	9	10	13	18	20	23	28	37	51	72	98	131	166	226	265	254	226	187	151	113	86	63	46	37	31	26	23	21	19	16	13	2
.20	8	10	13	17	19	22	26	33	45	63	87	116	149	212	259	259	233	197	160	119	90	66	48	38	32	27	24	22	19	16	13	2
.30	7	9	12	16	18	21	24	30	40	55	76	103	134	197	244	255	238	206	169	125	95	68	49	38	32	27	24	22	19	17	13	2
.40	7	8	11	14	15	17	19	23	28	36	49	67	91	151	208	247	252	230	196	146	109	77	54	41	34	29	25	22	19	17	13	3
.50	6	8	10	13	15	16	18	21	26	33	43	59	80	136	194	238	249	235	204	154	115	81	56	42	34	29	25	23	20	17	13	3
.75	5	7	8	11	12	13	14	16	18	21	25	32	42	76	125	179	222	240	233	193	148	102	67	48	38	32	27	24	20	18	13	5
1.0	4	5	7	8	9	10	11	12	13	14	16	18	22	34	59	101	152	201	236	230	193	135	86	59	44	35	30	26	21	18	14	7
1.5	3	4	5	6	6	7	8	8	9	10	11	12	13	16	22	34	58	95	141	203	226	197	131	84	58	43	35	29	23	20	15	10
2.0	1	2	3	4	4	5	5	6	6	7	7	8	9	10	12	16	22	34	56	110	172	218	187	126	82	57	43	34	25	21	16	11
2.5	1	1	2	2	3	3	3	4	4	4	5	5	6	7	8	9	11	14	18	34	69	141	210	190	133	87	60	44	30	23	17	12
3.0	0	0	1	1	2	2	2	2	3	3	3	3	4	5	5	6	8	9	11	16	27	66	149	204	181	128	85	58	35	25	18	12
IA/P = 0.30														* * * TC =1.5 HR * * *															IA/P = 0.30			
0.0	0	0	0	0	0	1	6	15	31	53	80	112	144	193	225	208	186	157	134	108	89	70	56	48	42	37	34	31	28	25	20	2
.10	0	0	0	0	0	0	1	4	12	25	43	68	97	157	198	219	203	178	151	120	98	77	60	50	44	38	35	32	28	25	20	3
.20	0	0	0	0	0	0	0	1	3	9	19	35	57	114	168	201	213	196	171	135	108	84	64	53	46	40	36	33	29	26	20	4
.30	0	0	0	0	0	0	0	1	2	7	15	29	48	100	155	193	210	200	177	140	113	87	66	54	46	41	36	33	29	26	20	5
.40	0	0	0	0	0	0	0	0	2	5	12	23	39	87	141	184	207	202	182	146	117	89	68	55	47	41	36	33	29	26	20	5
.50	0	0	0	0	0	0	0	0	0	1	4	9	18	51	101	153	190	205	197	164	131	99	73	58	49	43	38	34	30	26	20	7
.75	0	0	0	0	0	0	0	0	0	0	2	4	9	30	68	116	160	189	197	179	147	110	80	62	52	45	39	35	30	27	21	8
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	20	49	92	138	175	195	178	137	97	72	57	48	42	37	31	28	21	12
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	21	47	85	145	187	178	133	95	71	57	48	42	34	29	23	16
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	45	97	162	180	138	99	74	58	49	38	32	25	18
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	31	89	161	174	133	97	72	58	42	34	26	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	29	98	160	169	129	95	71	48	37	28	19
IA/P = 0.50														* * * TC =1.5 HR * * *															IA/P = 0.50			
0.0	0	0	0	0	0	0	0	3	8	16	27	42	59	92	115	128	130	121	112	100	90	78	67	60	55	50	46	43	39	35	29	4
.10	0	0	0	0	0	0	0	2	6	12	22	35	51	84	110	125	128	123	114	102	91	79	68	61	55	50	46	43	39	35	29	4
.20	0	0	0	0	0	0	0	0	1	4	10	18	29	60	91	114	126	128	120	108	97	83	71	63	57	52	47	44	40	36	29	5
.30	0	0	0	0	0	0	0	0	1	3	8	14	24	52	83	108	123	126	122	110	98	85	72	63	57	52	48	44	40	36	29	6
.40	0	0	0	0	0	0	0	0	0	1	2	6	12	31	60	90	112	124	126	116	104	90	75	66	59	54	49	45	41	37	29	8
.50	0	0	0	0	0	0	0	0	0	0	2	4	9	26	53	83	106	121	125	118	106	91	77	67	60	54	49	46	41	37	29	8
.75	0	0	0	0	0	0	0	0	0	0	1	2	5	16	36	62	88	108	119	122	112	97	81	69	62	56	51	47	42	38	30	11
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	26	49	75	98	118	121	108	90	76	66	59	54	49	43	39	31	16
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	11	25	45	80	107	118	106	89	75	65	59	53	45	41	32	23
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	32	63	100	115	104	87	74	65	58	48	42	34	26
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	16	48	94	113	105	89	76	66	53	45	36	27
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	15	54	96	111	103	88	75	58	48	38	28

RAINFALL TYPE = II * * * TC = 1.5 HR * * * SHEET 9 OF 10

Exhibit 5-II, continued: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

HYDROGRAPH TIME (HOURS)

TRVL TIME (HR)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10														* * * TC =2.0 HR * * *														IA/P = 0.10				
0.0	7	9	12	16	18	21	27	36	49	64	82	104	127	171	201	226	208	193	171	132	105	79	58	45	36	30	26	23	20	17	13	3
.10	6	8	10	14	15	17	20	25	33	43	57	74	94	139	179	204	218	205	188	150	118	88	63	48	38	32	27	24	20	17	13	4
.20	6	8	10	13	14	16	19	23	29	39	51	66	84	128	169	198	213	207	192	157	123	91	65	49	39	33	28	24	20	17	13	4
.30	6	7	9	12	14	15	18	21	27	35	45	59	76	117	159	191	211	208	196	163	128	95	68	51	40	33	28	25	20	18	13	4
.40	5	6	8	11	12	13	15	17	20	24	31	41	53	87	128	167	197	209	205	180	145	106	75	55	43	35	30	26	21	18	14	5
.50	5	6	8	10	11	13	14	16	18	22	28	37	48	78	118	158	190	208	208	185	151	111	77	57	44	36	30	26	21	18	14	5
.75	4	6	7	9	10	11	12	13	15	18	22	27	35	58	91	129	164	191	202	194	167	125	87	63	48	38	32	27	22	18	14	6
1.0	3	4	6	7	8	8	9	10	11	12	14	16	18	28	46	74	110	147	178	201	193	156	108	76	56	43	35	30	23	19	14	8
1.5	2	3	3	5	5	5	6	6	7	8	8	9	10	12	16	23	36	57	86	137	178	195	160	113	79	58	45	36	26	21	16	11
2.0	1	2	2	3	3	4	4	4	5	5	6	6	7	8	10	12	16	23	35	67	112	169	190	154	110	78	57	44	30	23	17	11
2.5	0	1	1	2	2	2	3	3	3	4	4	4	5	6	7	8	9	12	16	28	52	105	170	185	149	107	76	56	35	26	18	12
3.0	0	0	1	1	1	1	1	2	2	2	2	3	3	3	4	5	6	7	8	12	18	41	99	161	180	152	112	80	45	30	19	12
IA/P = 0.30														* * * TC =2.0 HR * * *														IA/P = 0.30				
0.0	0	0	0	0	0	1	3	8	15	25	38	54	74	115	148	168	185	170	159	131	110	89	70	57	49	42	38	34	29	26	20	5
.10	0	0	0	0	0	0	0	2	6	12	21	32	47	85	124	153	169	180	168	145	120	96	75	60	51	44	39	35	30	26	20	6
.20	0	0	0	0	0	0	0	2	4	10	17	27	41	75	114	146	165	175	170	149	124	99	76	62	52	45	39	35	30	27	21	6
.30	0	0	0	0	0	0	0	0	1	3	7	14	23	49	86	122	151	170	174	160	136	107	82	66	54	47	41	37	31	27	21	8
.40	0	0	0	0	0	0	0	0	1	2	6	11	19	43	77	113	144	165	173	163	140	111	85	67	55	47	41	37	31	27	21	8
.50	0	0	0	0	0	0	0	0	1	2	4	9	16	37	68	104	136	160	171	165	144	114	87	69	56	48	42	37	31	27	21	9
.75	0	0	0	0	0	0	0	0	0	0	1	2	5	15	34	62	96	127	152	167	160	132	100	77	62	52	45	40	32	28	22	11
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	24	48	79	111	150	166	153	118	90	71	58	49	43	34	29	23	14
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	10	24	45	98	130	161	148	115	88	70	57	48	37	31	24	17
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	32	68	122	157	143	113	87	68	56	42	34	26	18
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	16	51	114	153	144	116	89	70	49	38	27	19
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	15	59	118	150	140	113	88	57	42	29	19
IA/P = 0.50														* * * TC =2.0 HR * * *														IA/P = 0.50				
0.0	0	0	0	0	0	0	0	1	4	8	13	20	28	51	73	92	104	111	112	106	97	86	75	66	60	54	49	46	41	37	30	7
.10	0	0	0	0	0	0	0	1	3	6	11	17	24	45	68	87	101	109	112	107	98	88	76	67	60	55	50	46	41	37	30	8
.20	0	0	0	0	0	0	0	1	2	5	9	14	21	40	62	82	98	107	111	108	100	89	77	68	61	55	50	47	41	37	30	8
.30	0	0	0	0	0	0	0	0	0	2	4	7	12	26	46	67	86	100	108	111	104	93	80	70	63	57	52	48	42	38	30	10
.40	0	0	0	0	0	0	0	0	0	1	3	6	10	22	41	62	81	96	106	110	105	94	81	71	63	57	52	48	42	38	30	11
.50	0	0	0	0	0	0	0	0	0	0	1	2	4	13	27	46	67	85	99	110	108	98	85	74	66	59	54	49	43	39	31	13
.75	0	0	0	0	0	0	0	0	0	0	0	1	2	7	18	33	52	71	88	104	108	102	89	77	68	61	55	50	44	39	31	15
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	13	25	43	62	87	103	108	97	84	73	65	59	53	45	41	32	20
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	12	24	48	74	99	106	95	83	72	64	58	48	43	34	25
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	17	37	69	99	104	94	82	72	64	52	45	36	27
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	27	65	95	102	95	83	73	58	49	38	28
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	32	68	95	101	93	82	64	52	40	28

RAINFALL TYPE = II * * * TC = 2.0 HR * * * SHEET 10 OF 10

PART II

STORMWATER DETENTION

Flow Routing

A stormwater detention basin acts as a constriction in the stream. When the capacity of the outlet structure is exceeded, a portion of the flow backs up and is temporarily stored. Flow routing (or flood routing) is the procedure used to determine the volume of water that will be stored behind the detention structure during a rainfall event. In order to design a detention basin, a flow routing procedure must be used to determine the required storage volume for the selected design storm and the allowable release rate.

Storage-Indication Method

One of the most widely used methods of determining the required storage volume in detention basins is the Storage-Indication Method. This mathematical flow routing procedure consists of a trial and error process based upon the Continuity Equation. The basic premise is that the volume of water entering the basin minus the volume of water leaving the basin (over a given time interval) equals the required storage volume. The design procedure for implementing the Storage-Indication Method can be quite lengthy and time consuming when done manually.

Rather than present an in-depth explanation or an over-simplified version of the subject of flood routing in this handbook, the reader is referred to the Soil Conservation Service National Engineering Handbook, Section 4, Chapter 17 (68). That reference provides a good explanation of flood routing along with design procedures for the Storage-Indication Method and other acceptable techniques of calculating detention storage volumes.

Graphical Storage Method

A simpler, but less accurate method of estimating detention storage volume is the Graphical Storage Method. This method was developed by the Soil Conservation Service and is explained fully in the SCS Technical Release No. 55 (62). It involves the use of one graph which was developed based upon average storage and routing effects of many structures using the Storage-Indication Method of flood routing.

The primary advantages of this method are its simplicity and its compatibility with SCS runoff calculation procedures described in Part I of this chapter. It is particularly suited for small detention basin design and for estimating the required size of basins during the project planning phase.

A design procedure for the Graphical Storage Method is presented here; however, its use is subject to the following limitations:

1. Failure of the structure must not endanger or result in loss of life or major property damage.

2. An error in calculated storage volume of +/- 25% must be tolerable.

3. This method may be used for single- and multiple- stage outflow devices providing: (a) each stage requires a design storm and a computation of the related storage; (b) the discharge of the upper stage(s) includes the discharge of the lower stage(s).

The following design procedure will only determine the required storage volume of the basin. The design of an appropriate discharge structure, which will maintain the allowable release rate at the design storage elevation, should be done by a qualified engineer.

DESIGN PROCEDURE - GRAPHICAL STORAGE METHOD

Step 1: Determine the allowable peak release rate (Q_o) for the basin in CFS or CSM.

The most common procedure in determining Q_o is to limit the downstream discharge rate to the 2-year pre-developed discharge rate. (See Chapter 4 for a more detailed discussion of the runoff criteria of the E&S Regulations.)

Step 2: Calculate the peak inflow rate (Q_i) for the "developed" conditions.

Step 3: Calculate the ratio Q_o/Q_i of design release rate (Q_o) to the inflow rate (Q_i) in the same units.

Step 4: Using Graph (Plate 5-27), enter the graph with Q_o/Q_i; move vertically to intersect the curve; then move horizontally to read the value for the ratio V_s/V_r.

Step 5: Calculate the required storage volume (V_s) in watershed inches by multiplying the V_s/V_r ratio by the volume of runoff (V_r) in inches for the "developed" condition.

Step 6: Convert V_s from watershed inches to acre-ft. by multiplying V_s (inches) by the watershed area (acres) and dividing by 12 in./ft.

Step 7: Proportion the storage basin and design the discharge structure so that the allowable release rate is not exceeded and the maximum water storage elevation is known.

Design Examples

The following examples represent three typical design problems. Example 5-7 and 5-8 require the use of the graph (Plate 5-27) to design a single-site detention basin. Example 5-9 requires the use of the same graph for a multi-site design in a watershed with seven sub-areas. In the following examples, the required storage volumes are determined, but the actual basin sizing and discharge structure design are beyond the scope of this text and are not included.

Example 5-7

A developer proposes to develop a 75-acre tract of woodland into a residential subdivision. The 75-acre tract is the entire drainage area of a main channel which intersects a natural stream at the property boundary. The developer is required to detain stormwater in a basin to be constructed on the main channel below the development so that the peak rate of runoff entering the natural stream after development does not exceed the pre-development peak runoff rate for a 2-year frequency design storm. This example uses the Type II storm distribution since the project is located in south-central Virginia.

Find: The required storage volume of the basin.

Step 1: Determine the allowable release rate, Q_o.

The peak discharge method was used to calculate the pre-development and post-development peak flow rates and runoff depths for a 2-year storm. The results are as follows:

Pre-development		Post-development	
Q_{peak} =	35 cfs	Q_{peak} =	90 cfs
V_r =	1 inch	V_r =	2 inches

Therefore,

Q_o = 35 cfs $\qquad$ Q_i = 90 cfs

Step 2: Determine the post-development peak discharge, Q_i.

In this example, Q_i is given. $\qquad$ Q_i = 90 cfs

Step 3: Determine $\frac{Q_0}{Q_i}$.

$$\frac{Q_0}{Q_i} = \frac{35\ cfs}{90\ cfs} = 0.389$$

Step 4: From the graph (Plate 5-27), determine, $\frac{V_s}{V_r}$.

Entering the graph with $\frac{Q_0}{Q_i} = 0.389$ and intersecting the curve,

$$\frac{V_s}{V_r} = 0.326$$

Step 5: Calculate the required storage volume, V_S.

$$\frac{V_s}{V_r} = 0.326 \quad and \quad V_r = 2\ inches$$

$$V_s = (V_r)\left(\frac{V_s}{V_r}\right) = (2\ inches)\ (.326)$$

$$V_s = .652\ inches$$

Step 6: Convert V_S to acre-feet.

$$V_s = (.652\ inches)\left(\frac{75\ acres}{12\ in./ft.}\right) = 4.1\ acre\text{-}feet$$

Note: The next step would require the development of an elevation-storage curve for the basin, and an elevation-discharge curve for the proposed outlet structures. The objective would be to select an outlet structure which will discharge at the allowable release rate when the water reaches the maximum storage elevation. This step is beyond the scope of this text and, therefore, is not included.

Example 5-8

The developer is required to detain the stormwater runoff calculated in example 5-4 so that the peak rate of runoff after development does not exceed the peak pre-development rate of runoff for a 2-year frequency design storm.

Examples 5-4 and 5-5 use the graphical peak discharge method to determine the following:

Pre-development	Post-development
$Q_{peak} = 102$ cfs	$Q_{peak} = 202$ cfs
$V_r = 0.9$ in.	$V_r = 1.36$ in.

Therefore,

$Q_o = 102$ cfs	$Q_i = 202$ cfs

Find: The required storage volume of the basin.

Step 1: Determine Q_o

In this example, Q_o is given. $Q_o = 102$ cfs.

Step 2: Determine Q_i

Again, this value is given. $Q_i = 202$ cfs.

Step 3: Determine $\frac{Q_o}{Q_i}$.

$$\frac{Q_o}{Q_i} = \frac{102\ cfs}{202\ cfs} = 0.50$$

Step 4: From the graph (Plate 5-27), determine $\frac{V_s}{V_r}$.

Entering the graph with $\frac{Q_o}{Q_i} = 0.50$ and intersecting the curve,

$$\frac{V_s}{V_r} = 0.278$$

Step 5: Calculate the required storage volume V_s.

$$\frac{V_s}{V_r} = 0.278 \quad and\ V_r = 1.36\ inches$$

$$V_s = (V_r)\left(\frac{V_s}{V_r}\right) = (1.36\ in.)\ (0.278)$$

$$V_s = 0.378\ inches$$

Step 6: Convert V_s to acre-feet.

$$V_s = (0.378\ in.)(0.39\ sq.mi.)\left(\frac{53.33\ ac.ft.}{in.-sq.mi.}\right)$$

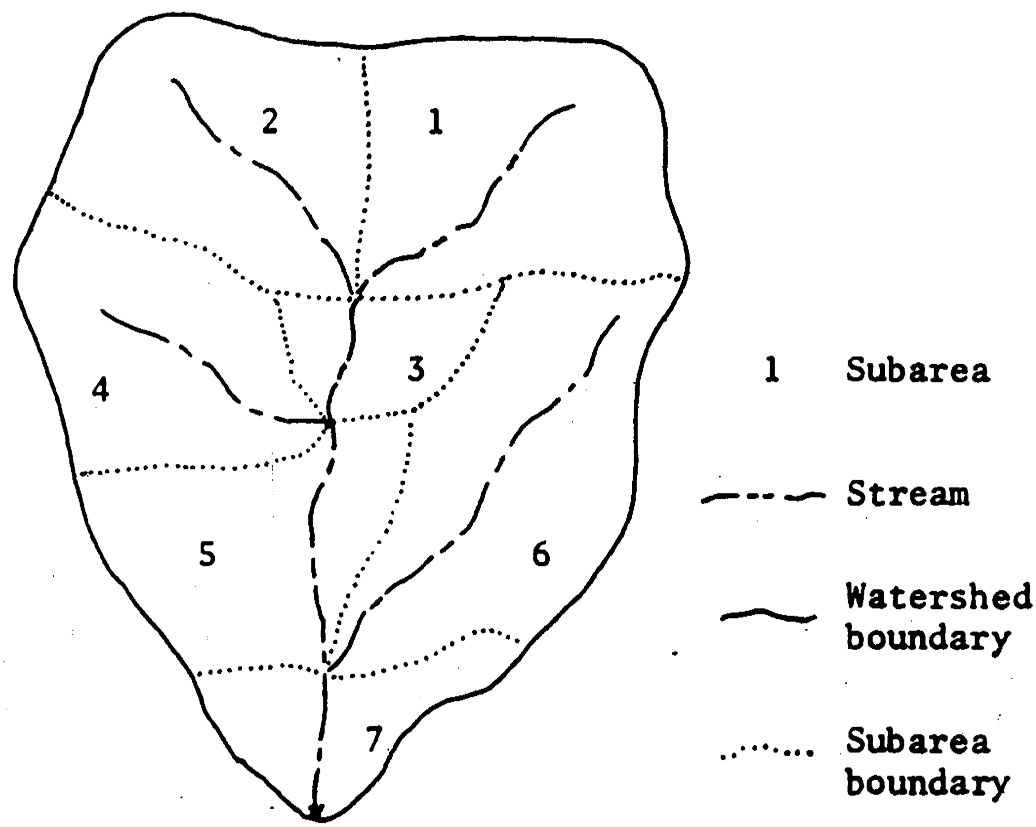
$$V_s = 7.86\ acre\text{-}feet$$

Note: This step would require the development of an elevation-storage curve for the detention basin, and an elevation-discharge curve for the proposed outlet structures. The objective would be to select an outlet structure which would discharge at the allowable release rate when the water reaches the maximum storage elevation. This step is beyond the scope of this handbook and, therefore, is not included.

Example 5-9

The watershed illustrated below is to be developed according to a predetermined plan. The tabular method was used in Example 5-6 to develop the tabular hydrographs shown on Worksheet 5b for both the present and future watershed conditions.

Find: Determine the peak release rates and required storage volumes for stormwater detention basins located at the outlets of sub-areas 4 and 6 so that the composite peak discharge rate at the outlet of sub-area 7 will not increase after development for the selected design storm.



In order to determine the allowable release rates for the detention basins in this example, an analysis of the appropriate tabular hydrographs is necessary. The future flow condition contributions by sub-areas 4 and 6 are subtracted from the future composite hydrograph as follows:

(SUB) AREA NAME	Time (in hours)				
	13.2	13.4	13.6	13.8	14.0
	Discharges (cfs)				
Composite Discharge	338	343	335	316	291
Sub-Area 4 Discharge	2	9	23	41	55
Sub-Area 6 Discharge	162	156	131	101	77
Composite minus sub-areas 4 & 6:	174	178	**181**	174	159

The partial composite peak discharge is 181 cfs. From Worksheet 5B in example 5-6, the present condition composite hydrograph shows an allowable peak release rate of 230 cfs. Therefore, the allowable release rate from sub-areas 4 and 6 combined is:

$$230 \text{ cfs} - 181 \text{ cfs} = \underline{49 \text{ cfs}}.$$

It is now necessary to decide the distribution of the 49 cfs release rate between the two detention basins. For a first trial, assume the basin at the outlet of sub-area 6 (structure 6A) to have a 30 cfs release rate, and the basin at the outlet of sub-area 4 (structure 4A) to have a 19 cfs release rate.

DETERMINE STORAGE REQUIRED IN STRUCTURE 6A

1. $Q_o = 30 \text{ cfs} = \dfrac{30 \text{ cfs}}{0.4 \text{ mi}^2} = 75 \text{ CSM}$

2. Q_i must be determined for sub-area 6. Do not use the peak rate of 162 cfs shown on the tabular hydrograph (Worksheet 5b for developed conditions), because that discharge represents only the sub-area contribution at the outlet of sub-area 7, not the peak discharge at the sub-area 6.

   Go to Exhibit 5-II for Type II rainfall, T_c = 1.00 hr. and T_t = 0. Interpolate between Ia/p values to obtain Q_i for Ia/p = 0.19, read Q_i = 318 CSM per inch of runoff.

   Therefore, $Q_i = 318 \dfrac{\text{CSM}}{\text{in.}} (V_r) = 318 \dfrac{\text{CSM}}{\text{in.}} (1.3 \text{ in.}) = 413 \text{ CSM}.$

3. $$\frac{Q_o}{Q_i} = \frac{75\ CSM}{413\ CSM} = 0.18$$

4. From the Graph (Plate 5-27, Type II rainfall distribution)

$$\frac{V_s}{V_r} = 0.47$$

5. Since the future condition runoff volume V_r = 1.30 in. (from Worksheet 5a for developed conditions):

$$V_s = (V_r)\left(\frac{V_s}{V_r}\right) = 1.30\ (0.47) = 0.61\ in.$$

6. $$V_s = \frac{0.61\ in.\ (640\ acre/mi.^2)(0.40\ mi.^2)}{12\ in./ft.}$$

$$V_s = 13.0\ acre\text{-}feet$$

DETERMINE STORAGE REQUIRED IN STRUCTURE 4A

1. $Q_o = 19\text{ cfs} = \dfrac{19\text{ cfs}}{0.25\text{ mi}^2} = 76\text{ CSM}$

2. Find Q_i by using Exhibit 5-II for Type II rainfall, T_c = 0.75 and T_t = 0. Interpolate between Ia/p values to obtain Q_i for Ia/p = 0.24. Read Q_i = 367 CSM per inch of runoff.

Therefore, $Q_i = 367\ \dfrac{\text{CSM}}{\text{in.}}\ (V_r) = 367\ \dfrac{\text{CSM}}{\text{in.}}\ (1.01\text{ in.}) = 371\text{ CSM}$

3. $$\frac{Q_o}{Q_i} = \frac{76\ CSM}{371\ CSM} = 0.2$$

4. From the Graph (Plate 5-27)

$$\frac{V_s}{V_r} = 0.455$$

5. Since V_r = 1.01 (From Worksheet 5a for developed conditions)

$$V_s = 1.01(0.455) = 0.46 \text{ in.}$$

6. $$V_s = \frac{0.46\ \textit{in.}\ (640\ \textit{acre/mi.}^2)(0.25\ \textit{mi.}^2)}{12\ \textit{in./ft.}}$$

$$V_s = 6.1\ \textit{acre-feet}$$

SUMMARY

Structure	Drainage Area	Q_o	Storage Volume
4A	0.25 mi.^{2}	19 cfs	6.1 acre-ft.
6A	0.40 mi.^{2}	30 cfs	13.0 acre-ft.
Total		49 cfs	19.1 acre-ft.

The structures may now be designed using elevation storage curves for the impoundment sites and elevation-discharge curves for the selected discharge structures.

Other trial calculations can be made, if desired, to determine the most economical allocation of storage between the two detention basins that still maintain a combined release rate of 49 cfs.

* Note: Curve for types I and IA is not applicable in the State of Virginia.

APPROXIMATE GEOGRAPHIC BOUNDARIES FOR SCS RAINFALL DISTRIBUTION

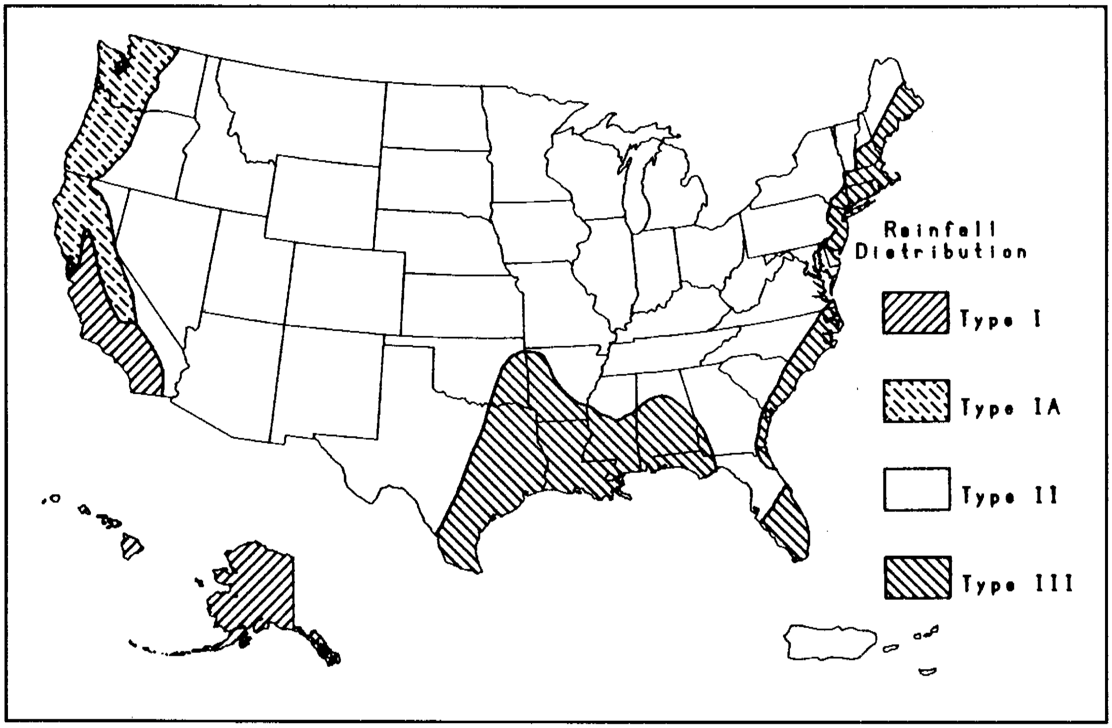
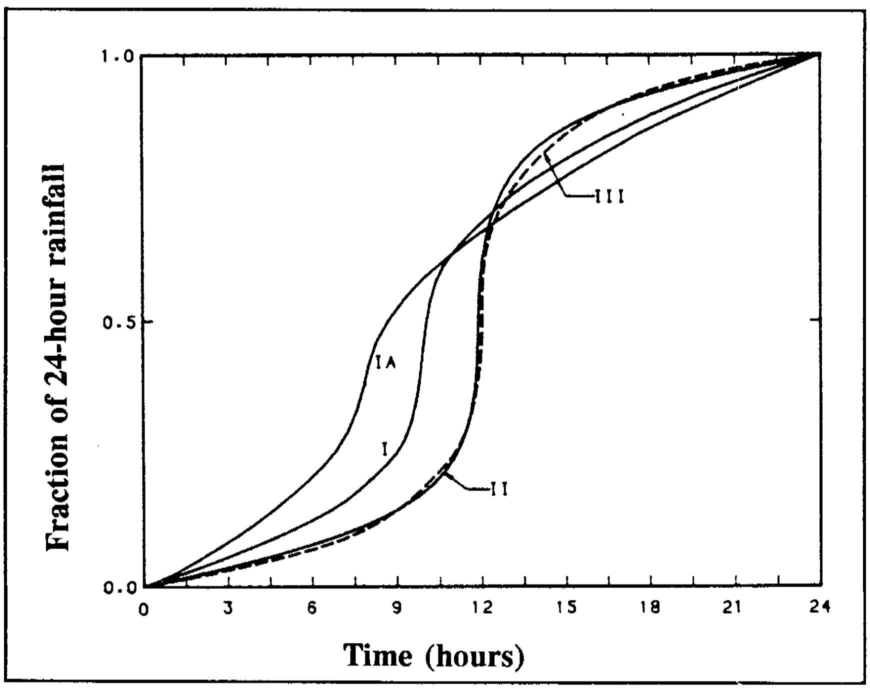


Plate 5-26A

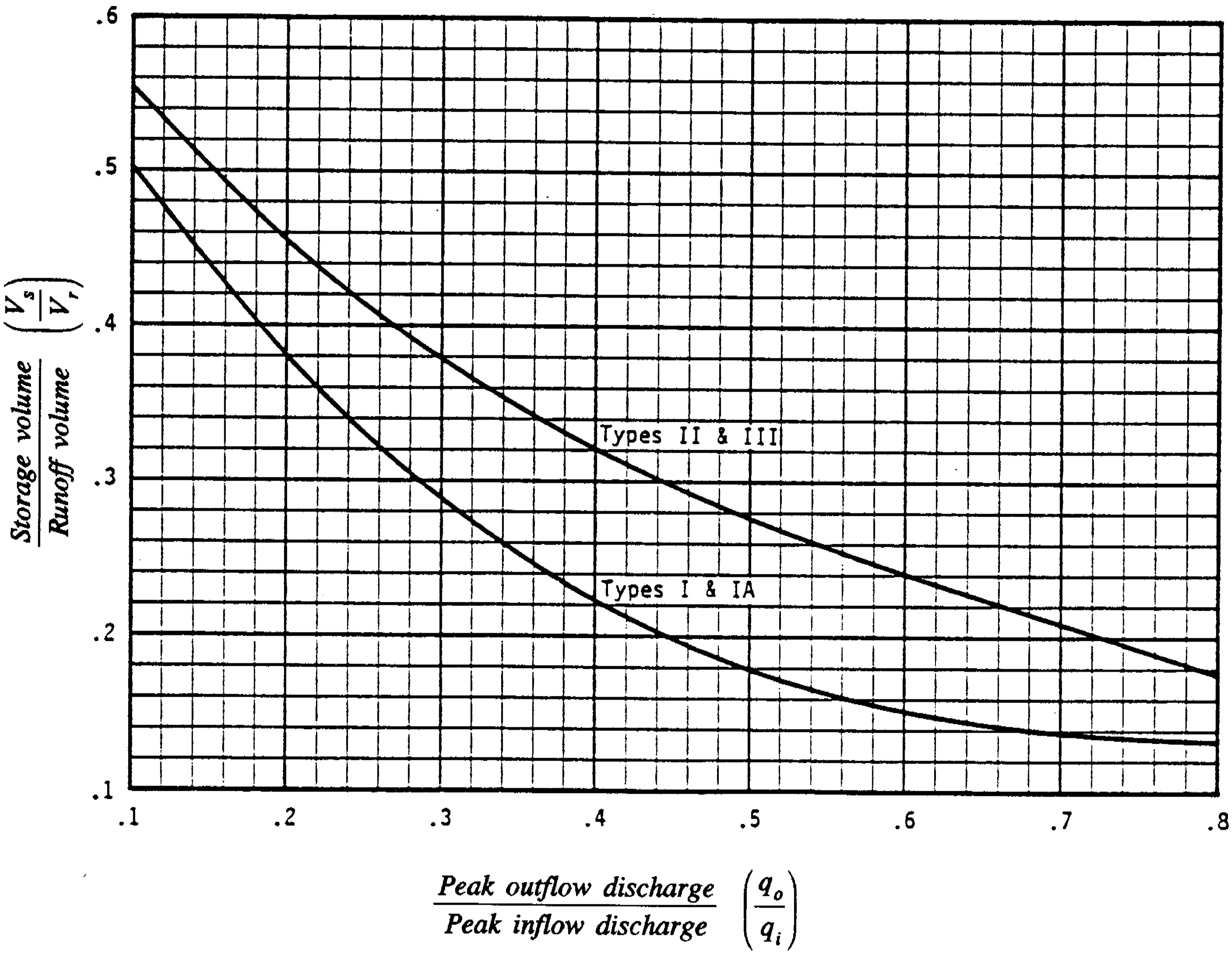
SCS 24-HOUR RAINFALL DISTRIBUTIONS



Source: USDA-SCS, TR-55

Plate 5-26B

APPROXIMATE DETENTION BASIN ROUTING FOR RAINFALL TYPES I, IA, II, AND III



Source: USDA-SCS, TR-55

Plate 5-27

PART III

OPEN CHANNEL FLOW

INTRODUCTION

Discussion of open channel flow has been divided into two sections. The first section, Constructed Stormwater Conveyance Channels, deals with the design of new stormwater conveyance channels in accordance with the Virginia Erosion and Sediment Control Handbook. The second section, Natural Channels, deals with undisturbed natural stream channels. Both of these sections provide information to allow the determination of an adequate channel as required by the Erosion and Sediment Control Regulations, Minimum Standard #19.

In order to simplify the hydraulic calculations, it is assumed that the channel can be divided into segments in which uniform flow exists. Uniform flow describes a condition where the depth of flow, area, velocity and discharge at every section of the channel segment are constant. In reality, these conditions are seldom met. The channel can, however, be divided into segments which have similar cross-sections and slope, and the flow can be considered at one point in time, such as the peak flow, when the quantity of flow would be more or less constant.

The two methods of analyzing the erosion resistance of a channel are the Maximum Permissible Velocity method and the Tractive Force method. An explanation of the Maximum Permissible Velocity method is given in the following pages of this chapter.

The following information is based on the assumption that the reader has some basic knowledge of hydraulic engineering principles and terms.

Design Criteria for Constructed Channels

The Virginia Erosion and Sediment Control Regulations (VESCR) contain two primary requirements for the design of man-made channels. First, the channel must have sufficient capacity to convey the peak flow expected from the 10-year frequency storm. Second, the channel lining must be resistant to erosion for the velocity of flow expected from the 2-year storm. These are statewide minimum requirements. The designer should investigate the specific drainage area to determine if more stringent design criteria are required.

Both the capacity of the channel and the velocity of flow are functions of the channel lining, cross-sectional area and slope. The channel must have a cross-section and lining that will provide sufficient capacity, erosion resistance, and stability to convey the runoff.

Channel Slope

The slope of the channel is generally fixed by the topography and proposed route of the channel. Often, there is little a designer can do to alter the slope. A field survey can provide accurate information on slope.

Channel Cross-Section

The most commonly used channel cross-sections are vee, parabolic, and trapezoidal shapes. Chapter 3 (Std. & Spec. 3.17) contains guidelines for selecting an appropriate shape based upon size, intended use, and lining of the channel. Selection of the proper channel design is a trial and error process by which the designer attempts to accommodate the flow without exceeding the maximum permissible velocity for the lining.

Channel Lining

There are a number of possible channel linings from which to choose. Commonly used channel linings include grass, riprap and concrete.

For design purposes, erosion resistance of a particular lining is stated in terms of the maximum velocity that the lining can withstand without experiencing erosion problems. Other factors should also be considered such as the duration of flow, impact of extreme storm events, flooding problems, etc.

Concrete and similar structural linings generally do not erode and the design is not restricted by maximum permissible flow velocities. However, riprap and grass-lined channels do have maximum permissible velocities above which erosion will occur.

For grass lined channels, the maximum permissible velocity is usually based upon the erosion resistance of a mature stand of vegetation. Newly seeded areas or areas with immature vegetation are very susceptible to erosion damage. Therefore, it is recommended that a temporary channel lining should be used to prevent channel erosion until the vegetation is established. When used properly, temporary lining materials can greatly increase the success in achieving an adequate stand of vegetation. (See Chapter 3 for more information on temporary lining materials.)

DESIGNING A STORMWATER CONVEYANCE CHANNEL

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

In this section, the following two equations are used to calculate flow and velocity in open channels:

(A) Manning's Equation

$$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$$

where,

V = the average velocity in the channel (ft./sec.)
n = Manning's roughness coefficient, based on channel lining
R = the hydraulic radius (feet) = A/P
S = the slope of the channel (feet/foot).

(B) Continuity Equation - Initial estimates of the required cross-sectional area of the channel can be made by manipulating this equation.

$$Q = V A$$

where,

Q	=	Flow rate (ft.^{3}/sec.) in the channel
V	=	Average velocity in the channel (ft./sec.) from Manning's equation
A	=	Cross-sectional area of the channel (ft.^{2}). See Plate 5-28 for formulas used to calculate cross-sectional area and hydraulic radius.

Additional design aids have also been placed at the end of this section for channel velocity calculation, and calculation of flow capacities based on various channel linings and configurations.

Manning's "n"

Manning's "n" value is a dimensionless number used to assign a value to the roughness of a channel. The Manning "n" value is dependent on a number of variables, the most important of which is the channel roughness, or hydraulic resistance of the material forming the channel side walls and bed. For some smooth channel lining materials such as concrete, the Manning "n" is taken to be a constant value based only on the estimated surface roughness. For bed materials such as rock riprap, the Manning "n" varies with the average size of the rock exposed to the flow. Grass and other vegetative linings produce a very complex relationship between Manning "n" and a variety of factors because the vegetation behaves in various ways depending on the type and height of the vegetation and the velocity of flow.

In addition to the bed roughness, the Manning "n" also tends to vary slightly with channel size. While this variation can normally be neglected, it should be kept in mind that the Manning "n" for small channels, such as street gutters, is larger than the Manning "n" for larger drainage ditches lined with similar material. Similarly, the Manning "n" for small drainage ditches is larger than the "n" for very large ditches. For determination of the "n" factor used in solving the Manning Equation, see the Channel Lining Design unit.

CHANNEL LINING DESIGN

Channel linings are used to help stabilize channels, thus preventing erosion and sedimentation damages. Linings may be installed in either natural or man-made channels, and can be utilized either in the initial design of the channel or as a remedy to an existing erosion problem.

Channel linings may be classified generally as either rigid (concrete or asphalt) or flexible (rock riprap or vegetation). Each of these lining types has certain advantages and disadvantages. Some of these are outlined in the following table.

TABLE 5-11

ADVANTAGES AND DISADVANTAGES OF RIGID AND FLEXIBLE CHANNEL LININGS

Type of Channel Lining	Advantages	Disadvantages
Rigid	Good capacity Low flow resistance Can be used for steep channels Can be used when width is restricted Underlying soil is completely protected	High velocities at outlet Unnatural appearance Prevent infiltration Hydrostatic pressure failure May be destroyed by undercutting
Flexible	Generally less expensive Safer for roadsides Self-healing Permit infiltration and exfiltration Filter contaminants Provide energy dissipation (higher Manning "n") Lower velocity at outlet Natural appearance	Higher depth of flow Require wider right-of-way Lower flow capacity Some erosion damage may occur during high floods

Source: Va. DSWC

Determination of "n" Values

Ranges of values for Mannings "n" have been determined for various types of channel linings. The lower the Manning value, the more hydraulically efficient the lining is. For example, the range of values for formed concrete is between .013 and .017. Therefore, .013 represents the best attainable "n" value and the most hydraulically efficient value for formed concrete, while .017 represents the least hydraulically efficient.

It is good practice to use a higher "n" value within the range of a lining material in order to achieve a conservative design. It is usually unacceptable to use the lowest value since some minor imperfections in the channel lining are likely and the lining will become somewhat less hydraulically efficient over time.

Rigid Channel Linings

Table 5-12 lists the Mannings "n" values for many of the commonly used channel linings.

Flexible Channel Linings

Riprap:

The Manning "n" value varies with mean stone size, as follows:

$$n = 0.0395 \ (d_{50})^{1/6}$$

where,

d_{50} = the median size (feet) of the stone riprap.

Thus, the following "n" values apply for common stone sizes:

d_{50} (ft.)	n
0.25	0.0314
0.50	0.0352
0.75	0.0377
1.00	0.0395
1.50	0.0423

Vegetative Linings:

Manning "n" values vary with hydraulic radius, velocity, as well as roughness. While usually not considered important for moderate size rigid-lined channels, the effect of velocity on Manning "n" values is considered especially significant when related to vegetative linings. Accordingly, curves have been developed to represent the interaction between hydraulic radius, velocity and roughness coefficient as related to various vegetative retardances. (See Plate 5-29 and Table 5-13.)

For grass-lined channels, Mannings "n" value can be determined by the following procedure:

1. Determine the maximum permissible velocity (V) for the grass to be used. (See Table 5-14 and Plate 5-30.)

2. Calculate the hydraulic radius (R) of the channel. (See Plate 5-28.)

3. From Table 5-13, determine the retardance class of the grass to be used. When calculating channel capacity, the highest retardance class of the grass should be used (e.g., long condition). When calculating velocity, the lowest retardance class should be used (e.g., mowed condition).

4. Enter Plate 5-29 with the product of: V x R. Move vertically until the correct retardance curve is intersected. Read "n" on the left axis.

Determination of Maximum Permissible Velocity

Once Mannings "n" has been selected and the average velocity has been determined, the velocity is compared with the maximum permissible velocity for the selected channel lining. If the velocity is less than the permissible velocity, then the channel design is considered to be acceptable with respect to erosion resistance.

When properly constructed, rigid channel linings can resist very high velocities without erosion damage or failure. Therefore, hydraulic capacity is usually the primary design consideration. However, the overall design should include measures to prevent erosion damage to the receiving channel due to excessive discharge velocities. (See Chapter 3 for details on outlet protection.)

For channels with flexible channel linings, selection of the proper channel lining is critical. Both the hydraulic capacity of the channel and its erosion resistance (the maximum permissible velocity) are directly related to the channel lining. Because of the variability of conditions within the watershed, it is good design practice to maintain a safety margin between the maximum permissible velocity of the channel lining and the calculated channel velocity.

Flexible Channel Linings

The method described below is adapted from Hydraulic Engineering Circular No. 15 of the Federal Highway Administration. It is applicable to both straight and curved sections of channel where the flow is parallel to the bank of the channel.

For Straight Sections of Channel:

This design method determines a stable rock size for straight and curved sections of channels. It is assumed that the shape, depth of flow, and slope of channel are known. A stone size is chosen based on the maximum depth of flow. If the sides of the channel are steeper than 3:1, the stone size must be modified accordingly. The final design size will be stable on both the sides and bottom of the channel.

1. Enter Plate 5-31 with the maximum depth of flow (feet) and channel slope (feet/foot). Where the two lines intersect, choose the d_{50} size of stone. (Select the d_{50} for the diagonal line above the point of intersection.)

2. If channel side slopes are steeper than 3:1, continue with step 3; if not, the procedure is complete.

3. Enter Plate 5-32 with the side slope and the base width to maximum depth ratio (B/d). Where the two lines intersect, move horizontally left to read K_1.

4. Determine from Plate 5-33 the angle of repose for the d_{50} size of stone. (Use 42° for d_{50} greater than 1.0 feet ±.) Do not use riprap on slopes steeper than the angle of repose for the size of stone.

5. Enter Plate 5-34 with the side slope of the channel and the angle of repose for the d_{50} size of stone. Where the two lines intersect, move vertically down to read K_2.

6. Compute $d_{50} \times K_1/K_2 = d'_{50}$. to determine the correct size stone for the bottom and side slopes of straight sections of channel.

For Curved Sections of Channel:

1. Compute the radius of the curve (Ro) measured at the outside edge of the bottom.

2. Compute the ratio of the top width of water surface (Bs) to the radius of the curve (Ro), Bs/Ro.

3. Enter Plate 5-35 with the ratio Bs/Ro. Move vertically until the curve is intersected. Move horizontally left to read K_3.

4. Compute $d'_{50} \times K_3 = d_{50c}$ to determine the correct size stone for bottom and side slopes of curved sections of channel.

Other Design Considerations

1. Adjustment for average channel depth. When other conditions are the same, a deep channel can convey water at a higher mean velocity, without erosion, than a shallow one. Thus, a correction for flow depth should be applied to the permissible velocity. Plate 5-30 shows the suggested correction factors.

2. Side Slopes. When riprap-lined channels have side slopes steeper than 3:1 or the channel is curved (or is sinuous), the rock size must be adjusted accordingly. (Follow the procedure outlined in the Flexible Lining Section.) Minimum side slopes for channels excavated in various materials are shown in Table 5-15.

3. Freeboard and Height of Bank. For lined channels (other than vegetative linings), the channel lining should extend above the expected surface water

elevation. The recommended height of the channel lining above the water surface depends on several factors related to the particular watershed under consideration. The channel should be designed to convey a larger (or less frequent) storm event if the 10-year storm design is not adequate to prevent flooding or property damage during these events.

CHANNEL DESIGN PROCEDURE

Rigid Linings

For rigid channel linings, the design procedure is as follows:

Step 1 - Determine the flow into the channel. Perform hydrologic computations for peak Q_{10} and Q_2 flows.

Step 2 - Determine the slope of the existing or proposed channel.

$$\frac{Rise\ (ft.)}{Run\ (ft.)} = Slope\ \frac{feet}{foot}$$

Step 3 - Determine the minimum side slope necessary to maintain channel stability (from Table 5-15 in subsection titled "Other Design Considerations").

Step 4 - Choose a channel shape from Plate 5-28 (e.g., vee, parabolic, or trapezoidal). If vee or trapezoidal configuration, choose the angle of the channel wall side slope.

Step 5 - Select a channel lining, then determine the Mannings "n" value (from subsection titled "Determination of "n" Values for Use in the Mannings Equation").

Step 6 - Choose a desirable design depth.

Step 7 - For the channel slope, geometry and depth of flow, calculate the channel capacity by using a combination of the Mannings/Continuity Equation.

Determine by trial and error that the cross-sectional channel is adequate to carry the peak Q_{10} flow. Compare each calculated cross-sectional area to the area required to provide adequate Q_{10} capacity.

$$\frac{Q_{10}\ n}{1.49\ s^{1/2}} = A\ R^{2/3}$$

Note: At a minimum, man-made channels must convey the flow from the 10-year frequency storm without overtopping its banks. If the channel capacity is less than the peak 10-year runoff flow, increase the width and/or depth, and recheck the capacity. Repeat until the channel capacity is adequate.

Step 8 - Check to ensure that recommended freeboard, if necessary, exists above Q_{10} water surface elevation. Make channel adjustment as necessary.

Step 9 - Using the 2-year frequency storm velocity, verify that the designed channel will not erode.

$$V_2 = \frac{Q_2}{A_2}$$

(A_2 is also determined by trial and error.)

Also, if outlet velocity exceeds the maximum permissible velocity of the receiving stream, outlet protection must be used in accordance with Chapter 3, Section 3.18.

Flexible Linings

The following procedure can be used for the design of flexible channel linings:

Step 1 - Determine the flow into the channel. Perform hydrologic computations for the peak Q_{10} and Q_2 flows.

Step 2 - Determine the slope of the existing or proposed channel:

$$\frac{Rise\ (ft.)}{Run\ (ft.)} = Slope\ \frac{feet}{foot}$$

Step 3 - Determine the minimum side slope necessary to maintain channel stability from Table 5-15 in subsection titled "Other Design Considerations."

Step 4 - Choose a channel shape from Plate 5-28 (e.g., vee, parabolic or trapezoidal).

Step 5 - Select a channel lining and determine maximum permissible velocity of the lining.

Step 6 - Make an initial estimate of the cross-sectional area that is required to carry the Q_{10} flow by using the Continuity Equation:

$$A = \frac{Q}{V}$$

where,

Q = flow into channel
V = M.P.V. of lining selected in Step 5.

Step 7 - Select initial channel dimensions that will provide the cross-sectional area estimated in Step 6.

Step 8 - Calculate Hydraulic Radius (R) of the channel from the formulas listed on Plate 5-28.

Step 9 - Multiply the maximum permissible velocity (of the selected lining) by the hydraulic radius.

Step 10 - Determine the roughness coefficient "n" for the lining to be used (from the subsection titled "Determination of "n" Values for Use in Mannings Equation").

Note: If a vegetated lining is used, assume a retardance (from Table 5-13) for an unmowed or uncut condition to calculate capacity and retardance for a mowed or cut condition to check velocity.

Step 11 - Check Q_{10} capacity using the combined equations: Manning/ Continuity.

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

where,

A = cross-sectional area required to carry Q_{10} flow (from Step 6).

Step 12 - Check velocity (for the 2-year storm) by using the Manning Equation: (Use the hydraulic radius for the flow depth of the 2-year storm.)

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

Compare velocity to maximum permissible velocity of the selected channel lining.

Step 13 - If capacity is adequate and the velocity does not exceed the maximum permissible velocity, proceed to Step 14. If capacity or lining is not adequate, make the appropriate design modifications and repeat the procedure.

Step 14 - Check to ensure the recommended freeboard, if necessary, exists above Q_{10} water surface elevation. Make channel adjustments as necessary.

Note: The solution to the following problems are provided for illustrative purposes. There may be numerous designs which would solve these problems.)

Example 5-10: Rigid linings

Given: Peak Q_{10} flow = 255 cfs. Peak Q_2 flow = 200 cfs. Slope of the proposed channel = 1% or .01 ft./ft.

Find: An adequate channel design to convey the 10-year storm flow.

Solution:

Step 1 - Choose channel shape from Plate 5-28. Trapezoidal configuration with 2:1 side slopes was selected.

Step 2 - Select a channel lining and determine "n" value. Concrete ("n" = .014) was selected.

Step 3 - Determine depth of flow. Use 1.5 depth.

Step 4 - Using the Manning/Continuity Equation, determine by trial and error the bottom width (B) required to convey the Q_{10} flow.

$$\frac{Qn}{1.49\ S^{1/2}} = AR^{2/3}$$

where,

Q	=	255 cfs
n	=	0.014 (Float Finish Concrete)
S	=	0.010 ft./ft.
A	=	$Bd + Zd^2 = B(1.5) + 2(1.5)^2 = 1.5B + 4.5$ (formula from Plate 5-28 for determining cross-sectional area of trapezoidal section).
R	=	A/P
P	=	$B + 2(Z^2 + 1)^{1/2}\ (d)$
	=	$B + 2(2^2 + 1)^{1/2}\ (1.5)$
	=	$B + 6.7$

$$\frac{Qn}{1.49\ S^{1/2}} = \frac{255\ (.014)}{1.49\ (.010)^{1/2}} = 24.0$$

Trial	B	A = 1.5B + 4.5	P = B + 6.7	R = A/P	$R^{2/3}$	$AR^{2/3}$
1	11	21	17.7	1.19	1.12	23.5 < 24.0 cross-section insufficient
2	12	22.5	18.7	1.20	1.13	25.4 > 24.0 cross-section too large
3	11.5	21.75	18.2	1.20	1.13	24.5 ≈ 24.0 cross-section adequate

Therefore, a trapezoidal channel with an 11.5 ft. bottom width and 2:1 side slope will be adequate to convey 255 cfs with a depth of 1.5 ft. No check for erosion resistance capability is necessary, since rigid channel linings are not subject to scour at velocities up to about 20 feet per second.

Step 5 - Check velocity in the channel. Note that it is rather high (A_2 = 18.2; V = Q_2/A_2 = 200/18.2 = 11.0 fps.) and that a scour-control device will probably be necessary to re-adjust the flow at the downstream end of the proposed channel.

Example 5-11: Flexible Lining

Given: A trapezoidal channel: 3-feet deep, 8-feet bottom, 2:1 side slopes, and a 2% slope.

Find: Riprap size for the bottom and side slopes of channel.

Solution:

Step 1 - From Plate 5-31, for a 3-foot deep channel on a 2% grade, d_{50} = 0.75 feet or 9 inches.

Step 2 - Since the side slopes are steeper than 3:1, continue with Step 3.

Step 3 - From Plate 5-32, B/d = 8/3 = 2.67; Z = 2; K_1 = 0.82.

Step 4 - From Plate 5-33, for d_{50} = 9 inches, o = 41°.

Step 5 - From Plate 5-34, for Z = 2 and o = 41°, K_2 = 0.73.

Step 6 - d_{50} x K_1/K_2 = d'_{50} = 0.75 x 0.82/0.73 = .84 feet.

$$0.84\ ft.\ x\ \frac{12\ inches}{1\ foot} = 10.08 \quad (Use\ d_{50} = 10\ inches.)$$

Given: The preceding channel has a curved section with a radius of 50 feet.

Find: A stable riprap size for the bottom and side slopes of the curved section of channel.

Solution:

Step 1 - Ro = 50 feet

Step 2 - Bs/Ro = 20/50 = 0.40.

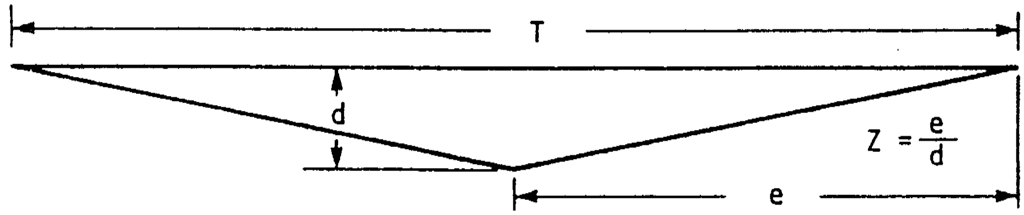
Step 3 - From Plate 5-35, for Bs/Ro = 0.40, K_3 = 1.1.

Step 4 - d'_{50} x K_3 = d_{50c} = 0.84 x 1.1 = 0.92 ft.

$$0.92\ ft.\ x\ \frac{12\ inches}{1\ foot} = 11.0\ inches$$

CHANNEL GEOMETRY

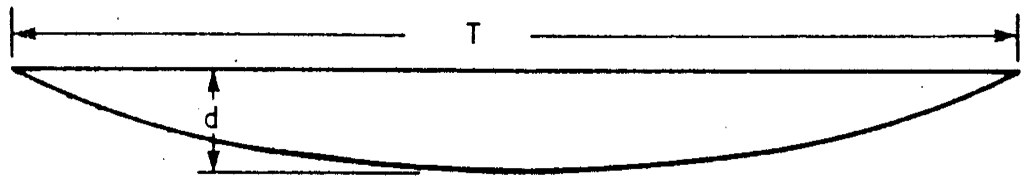
V - Shape



Cross-Sectional Area (A) = Zd^2
Top Width (T) = $2dZ$

Hydraulic Radius (R) = $\dfrac{Zd}{2\sqrt{Z^2 + 1}}$

Parabolic Shape

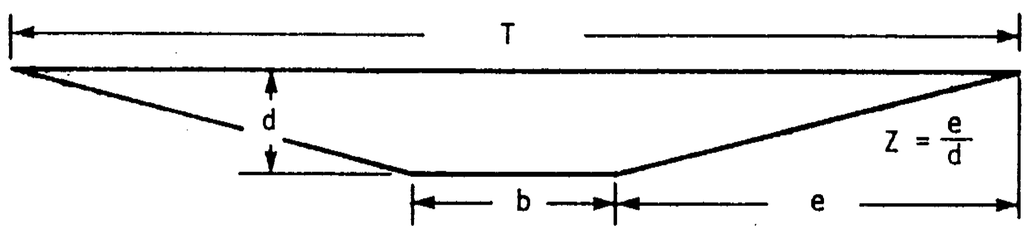


Cross-Sectional Area (A) = $\frac{2}{3}Td$

Top Width (T) = $\dfrac{1.5\,A}{d}$

Hydraulic Radius = $\dfrac{T^2 d}{1.5T^2 + 4d^2}$

Trapezoidal Shape

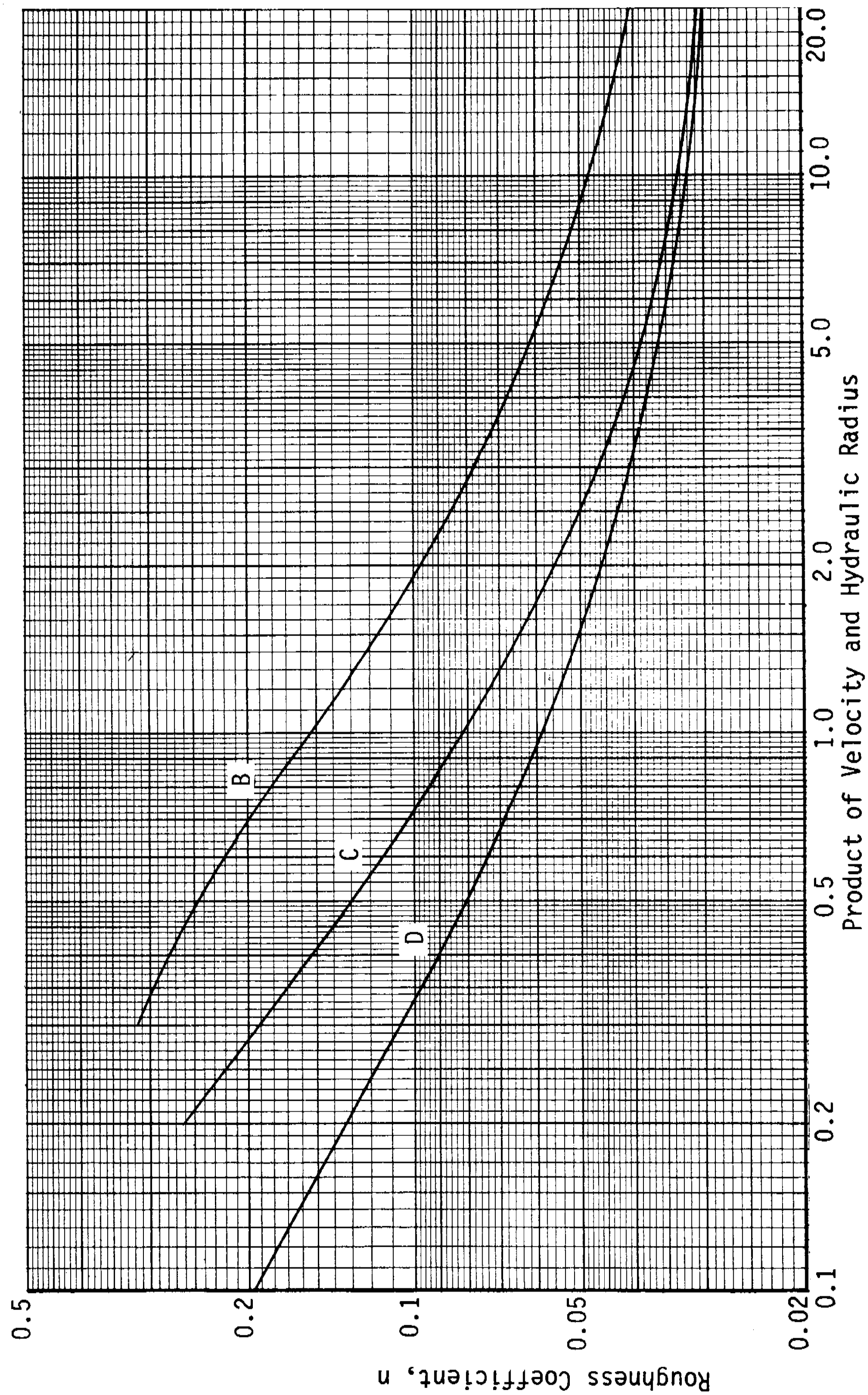


Cross-Sectional Area (A) = $bd + Zd^2$
Top Width (T) = $b + 2dZ$

Hydraulic Radius = $\dfrac{bd + Zd^2}{b + 2d\sqrt{Z^2 + 1}}$

Source: USDA-SCS

Plate 5-28



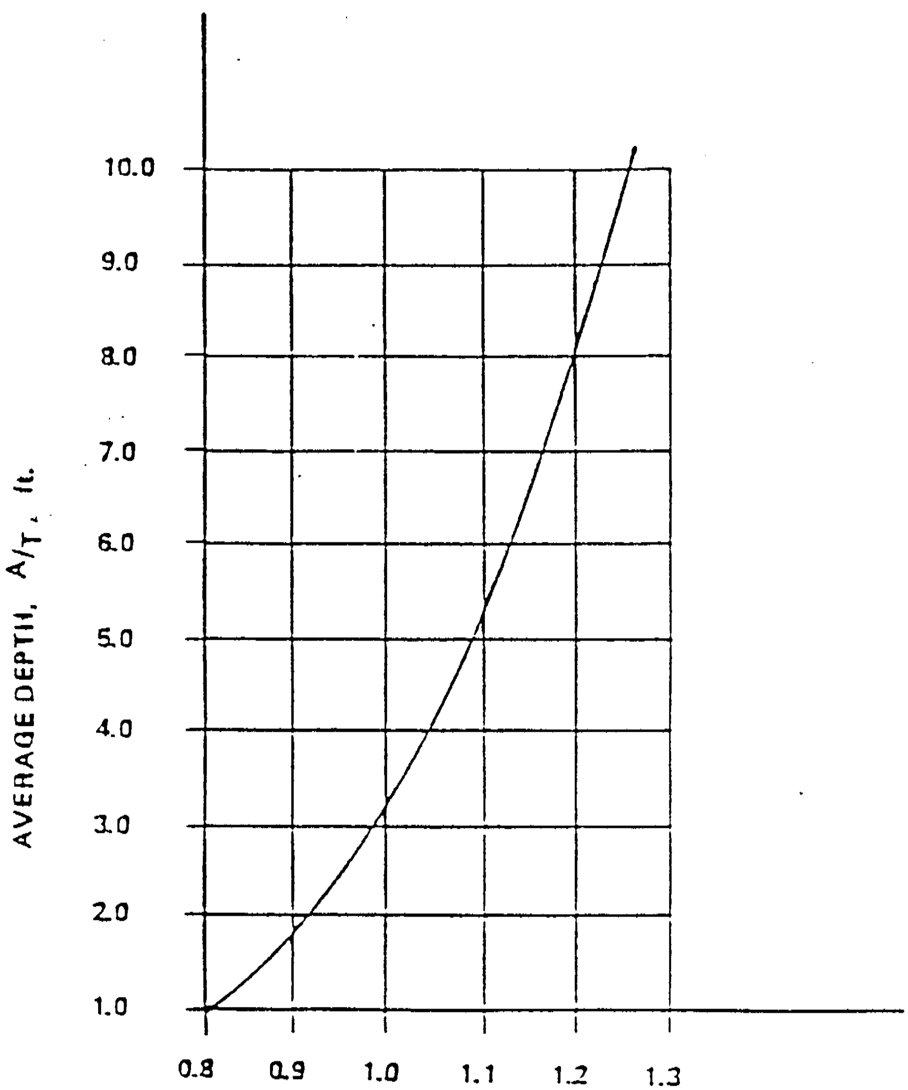
ROUGHNESS COEFFICIENT AS A FUNCTION OF v x R FOR VARIOUS RETARDANCE CLASSES

Source: USDA-SCS

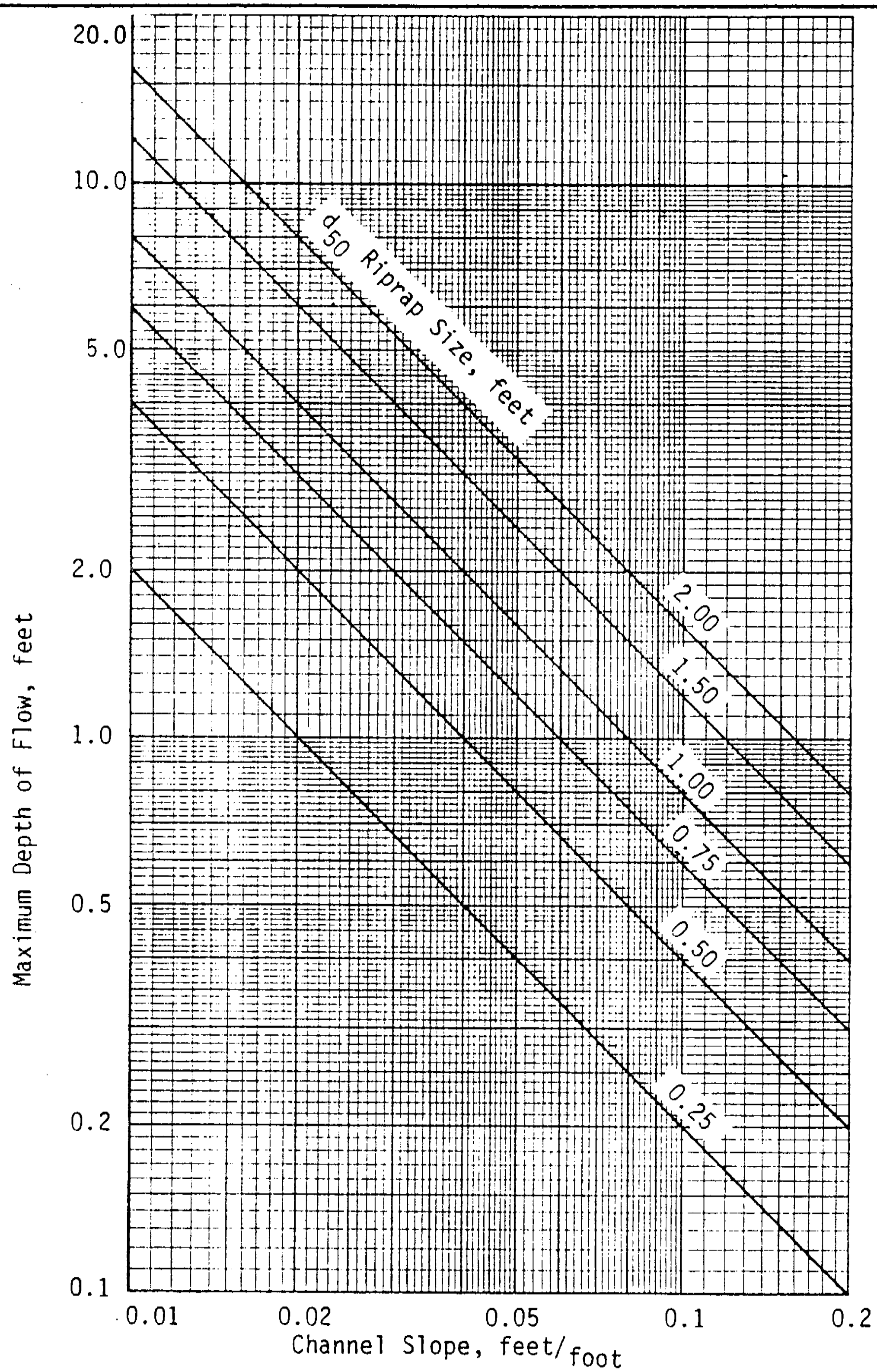
Plate 5-29

PLATE 5-30

CORRECTION FACTORS BASED FOR PERMISSIBLE VELOCITY BASED ON AVERAGE DEPTH OF FLOW



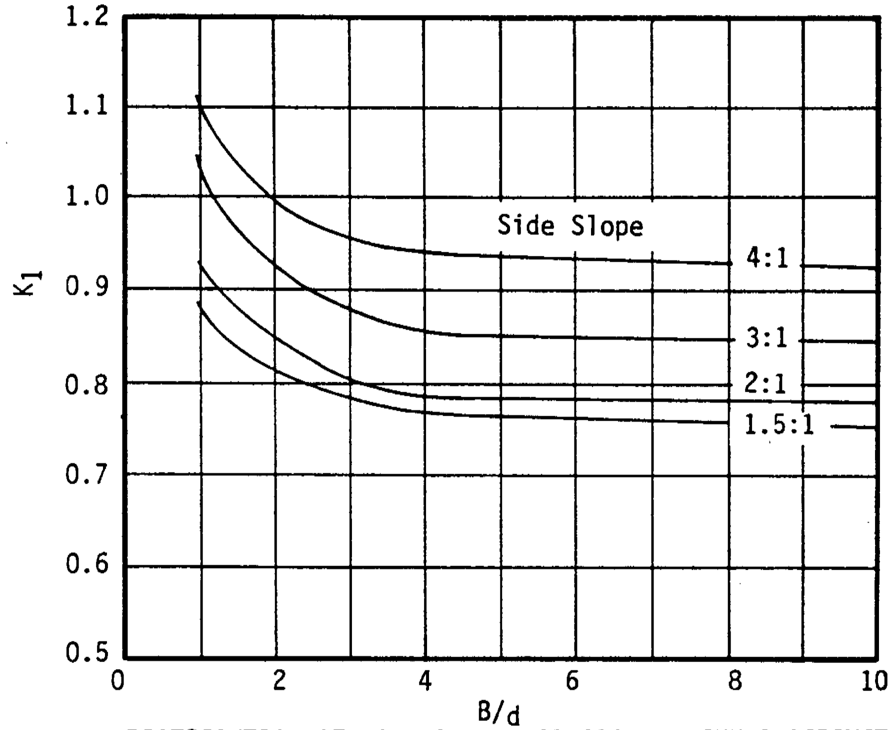
Source: Va. DSWC



MAXIMUM DEPTH OF FLOW FOR RIPRAP LINED CHANNELS

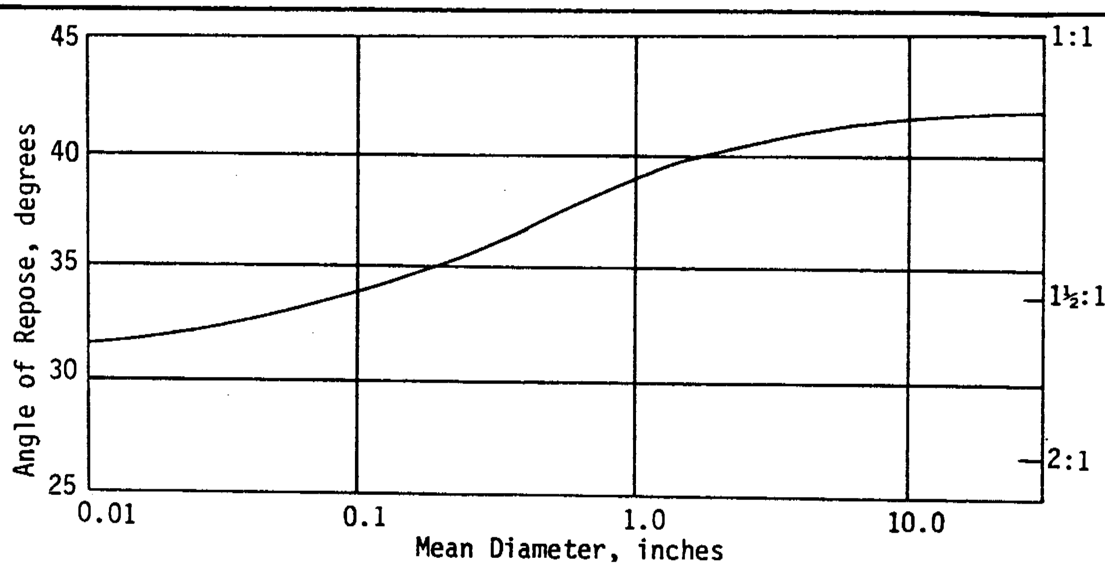
Source: VDOT Drainage Manual

Plate 5-31



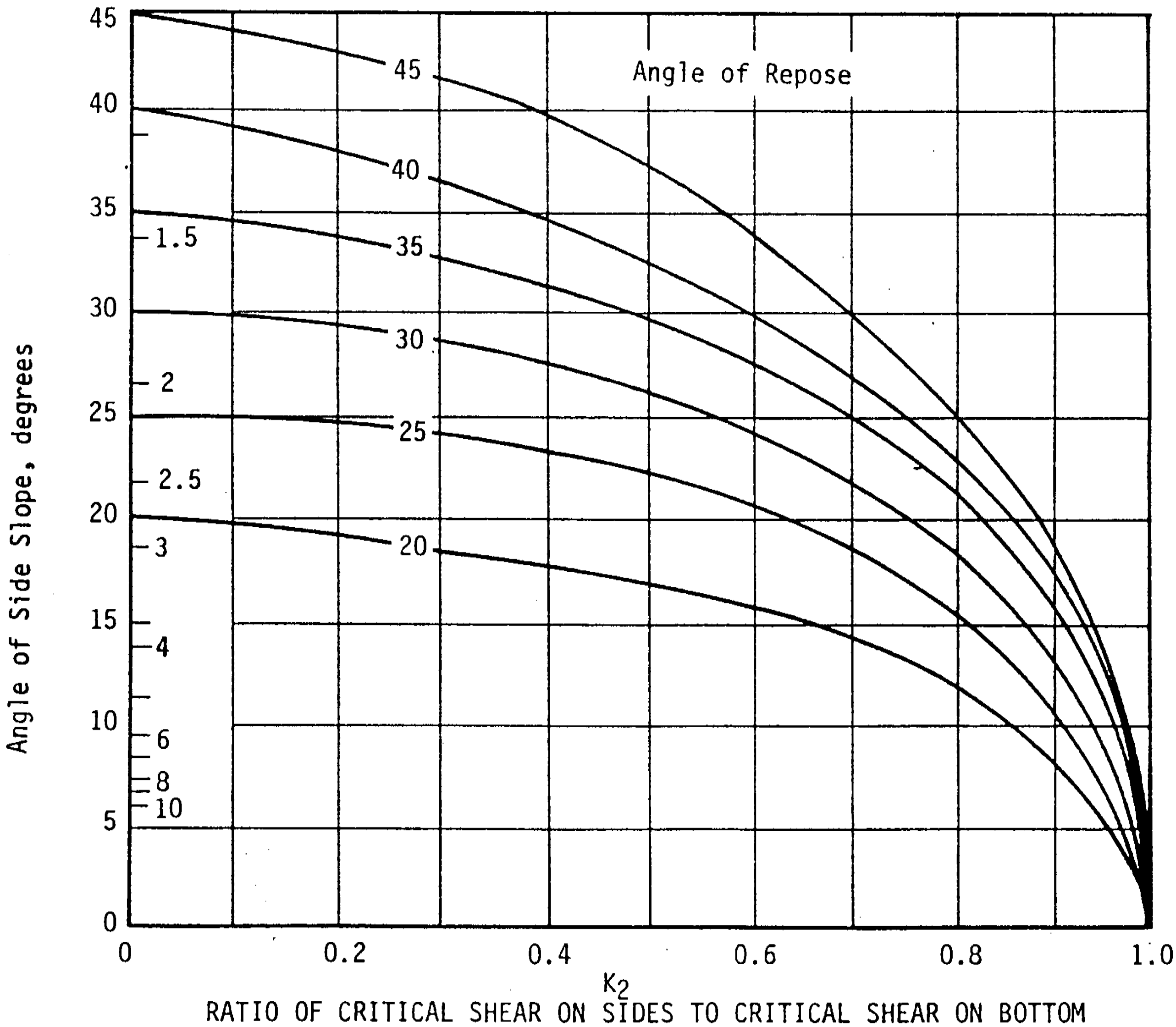
DISTRIBUTION OF BOUNDARY SHEAR AROUND WETTED PERIMETER OF TRAPEZOIDAL CHANNEL

Source: VDOT Drainage Manual Plate 5-32



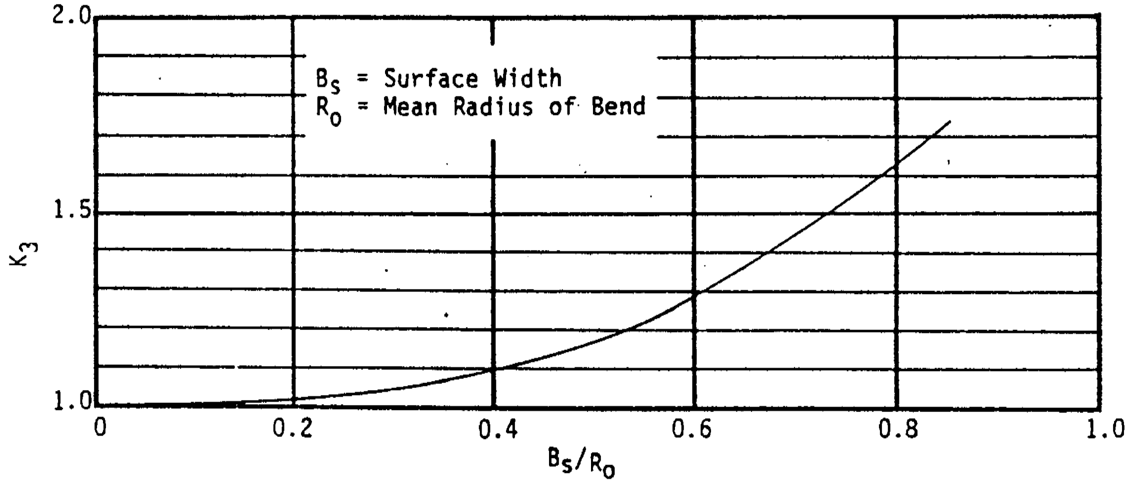
ANGLE OF REPOSE FOR RIPRAP STONES

Source: VDOT Drainage Manual Plate 5-33



Source: VDOT Drainage Manual

Plate 5-34



RATIO OF MAXIMUM BOUNDARY SHEAR IN BENDS TO MAXIMUM BOTTOM SHEAR IN STRAIGHT REACHES

Source: VDOT Drainage Manual

Plate 5-35

TABLE 5-12

MANNING "n" VALUES FOR SELECTED CHANNEL LINING MATERIALS

Material	Range of "n" Values
Concrete	
- Formed	0.013 - 0.017
- Trowel Finish	0.012 - 0.014
- Float Finish	0.013 - 0.015
- Gunite	0.016 - 0.022
Gravel Bed, Formed Concrete Sides	0.017 - 0.020
Asphalt Concrete	
- Smooth	0.013
- Rough	0.016
Corrugated Metal	
- 2-2/3" x 1/2" Corrugations	0.024
- 6" x 2" Corrugations	0.032
Concrete Pipe	0.011 - 0.013

Source: Va. DSWC

TABLE 5-13

RETARDANCE CLASSIFICATIONS FOR VEGETATIVE CHANNEL LININGS

Retardance		Stand	Condition
B	Tall fescue	Good	Unmowed - 18"
	Sericea lespedeza	Good	Unmowed - 18"
	Grass-legume mixture	Good	Unmowed - 20"
	Small grains, mature	Good	Uncut - 19"
	Bermudagrass	Good	Tall - 12"
	Reed Canarygrass	Good	Mowed - 14"
C	Bermudagrass	Good	Mowed - 6"
	Redtop	Good	Headed - 18"
	Grass-legume mix., summer	Good	Unmowed - 7"
	Kentucky bluegrass	Good	Headed - 9"
	Small grains, mature	Poor	Uncut - 19"
	Tall fescue	Good	Mowed - 6"
D	Bermudagrass	Good	Mowed - 2.5"
	Red fescue	Good	Headed - 15"
	Grass-legume mixture, spring and fall	Good	Unmowed - 5"
	Sericea lespedeza	Good	Mowed - 2"

Source: USDA-SCS

TABLE 5-14

PERMISSIBLE VELOCITIES FOR GRASS-LINED CHANNELS

Channel Slope	Lining	Velocity* (ft./sec.)
0 - 5%	Bermudagrass	6
	Reed canarygrass Tall fescue Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains Temporary vegetation	2.5
5 - 10%	Bermudagrass	5
	Reed canarygrass Tall fescue Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Bermudagrass	4
	Reed canarygrass Tall fescue Kentucky bluegrass	3

* For highly erodible soils, decrease permissible velocities by 25%.

Source: <u>Soil and Water Conservation Engineering, Schwab, et. al.</u> and American Society of Civil Engineers.

TABLE 5-15

MINIMUM SIDE SLOPES FOR CHANNELS EXCAVATED IN VARIOUS MATERIALS

Material	Side Slope
Rock	Nearly vertical
Earth w/stone riprap lining	2:1
Firm clay or earth w/vegetative lining	2:1
Loose sandy earth, sandy loam or porous clay w/vegetative lining	3:1
Earth w/concrete lining extending to top of channel banks	1½:1

DETERMINATION OF AN "ADEQUATE CHANNEL"

The Virginia Erosion and Sediment Control Regulations (Minimum Standard #19) require that runoff from new development must be discharged into an "adequate channel." An adequate channel is defined as a watercourse that will convey a chosen frequency storm event without overtopping its banks or causing erosive damage to the bed, banks and overbanks sections of the channel.

Determination of flow capacity and velocity in a natural channel involves considerable judgement. The results cannot be determined with as great a certainty as for a man-made channel. Variations in cross-section, alignment and roughness in the channel, and the changing quantities of flowing water make the determination of capacity and velocity an approximation, at best.

The following procedure involves the use of the Manning's Equation, the Continuity Equation and the Maximum Permissible Velocity method of calculation. The procedure is not exact and will yield only capacity and velocity estimates for each channel reach without regard to backwater effects due to channel constrictions such as culverts or bridges. If the purpose of the channel investigation is to determine a flood plain or profile, a more sophisticated analysis should be undertaken. However, to determine channel capacity and stability, which is the primary objective here, this procedure will be considered adequate.

Survey of the Stream Channel

A survey must first be made of each channel segment (called a reach) to determine the relevant channel characteristics (e.g., slope, cross section, roughness, etc.). This data is then utilized in a design procedure to check the adequacy of the stream channel. Following are recommended elements of such a survey:

Survey Procedure

1. Develop a profile of the channel bottom along the centerline of the stream. Such a profile can be developed from a good topographic map, if available, or from a field level run, if necessary.

2. Control points should be selected along the centerline to define independent stream channel reaches to be tested. Good control points would include points of entry of major tributaries, points of significant change in grade or cross-section, or bridges or culverts which obstruct the design flow.

3. Obtain sufficient cross-sections, at right angles to the centerline in each reach, to determine the average channel cross-section. This portion of the survey should be done in the field, not from a map.

4. Note the relevant physical characteristics of the stream channel between control

points (including significance of meanders, the material comprising the channel bed and banks, vegetation, obstructions and other factors needed to determine a roughness coefficient "n"). This information must also be obtained in the field.

Note that an "n" factor for each stream channel reach must be determined. If the channel is man-made, "n" can be determined by one of the methods described in the section for design of constructed stormwater conveyance channels. If the channel is natural, the following procedure should be used.

This procedure assumes that "n" is influenced by several factors. Each of these factors should be evaluated independently without regard to each other. The roughness coefficient "n" can be computed as follows:

A. Selection of a basic "n" value, (n_1): Select a basic "n" value from Table 5-16 for a straight, uniform, smooth channel cut into the natural material involved. The channel of each reach should be visualized as straight and uniform in cross-section, with smooth sides and bottom, and cut into the natural material of the channel.

B. Selection of modifying values for surface irregularity, (n_2): Select a modifying value from Table 5-17. Consider surface irregularity, first, in relation to the degree of smoothness attainable in the natural materials involved and, second, in relation to the depths of flow under consideration. A value of zero would correspond to the best surface attainable in the materials involved.

C. Selection of modifying values for variations in the and shape of cross-section, (n_3): Select the modifying value from Table 5-18. The effect of changes in size may be best visualized by considering, primarily, the frequency with which large and small sections alternate and, secondarily, on the magnitude of the changes. Shape variations depend upon the degree to which the changes cause the greatest depth of flow to shift from one side of the channel to the other in the shortest distance.

D. Selection of modifying values for obstructions, (n_4): (Select modifying values from Table 5-19). Care should be taken not to re-evaluate effects already considered in Steps B and C (above). The obstruction should be judged by:

1. The degree to which the obstructions occupy or reduce the average cross-sectional area.

2. The character of the obstructions. (Sharp-edged or angular objects induce greater turbulence than curved, smooth-surfaced objects.)

3. The position and spacing of obstructions laterally and longitudinally in the reach under consideration.

E. Selection of modifying values for vegetation, (n_5): (Select modifying values from

Table 5-20). The retarding effect of vegetation should be judged by the following criteria:

1. Height in relation to depth of flow.
2. Capacity to resist bending.
3. The degree to which the cross-section is occupied or blocked out.
4. The lateral and longitudinal distribution of different types of vegetation.
5. The density and height of vegetation in the reach considered.

F. Selection of a modifying value for the degree meandering, (n_6): Select the appropriate value from Table 5-21. Calculate the ratio of meandering length to straight length in the reach considered.

G. Sum the values found in Steps A-E. Multiply the sum by the value found in Step F. Add this to the sum of Steps A-E to compute the composite "n" for the reach.

$$n = (n_1 + n_2 + n_3 + n_4 + n_5) \times (n_6) + (n_1 + n_2 + n_3 + n_4 + n_5)$$

Design Procedure

After the channel has been divided into reaches, the following procedure may be used to determine adequacy. The procedure should be applied to each reach, beginning at the outlet of the development site, and progressing downstream until the total drainage area is at least 100 times greater than the area of the development site under consideration. (See Chapter 8 for a discussion of Minimum Standard #19.)

Step 1 - Determine the peak runoff rate for the stream channel using the 2-year storm. Calculate runoff from the entire contributing drainage area (including the proposed development site) at the bottom end (outlet) of the reach. (See Part 1 of this chapter for appropriate method(s) of calculating peak runoff rates.)

Step 2 - Determine the average bankfull cross-sectional area, hydraulic radius, slope and permissible velocity in the channel reach. (See survey procedure, Steps 1 through 3, for determining slope and average cross-section.)

Use Plate 5-16 for calculation of cross-sectional area and hydraulic radius.

The permissible velocity in natural channels should be determined for the most erodible condition along the reach, (e.g., exposed soil). Table 5-22 gives permissible velocities for channels cut into different types of soil.

Use Table 5-23 to determine if a reduction in permissible velocity is required due to channel sinuosity.

Note: Even though a channel may be fairly straight, it is recommended to assume slight sinuosity and use a 5% reduction in the permissible velocity.

Plate 5-39 is used to determine adjustment in permissible velocity based on average depth of flow.

Step 3 - Determine the roughness coefficient (n) for the reach. (See Survey Procedure, Step 4.)

Step 4 - Calculate bankfull velocity (V) and capacity (Q) using the Manning and Continuity Equations. These equations are explained in the section "Constructed Stormwater Conveyance Channels."

Step 5 - Compare actual channel capacity (Q) with the peak rate of runoff (from Step 1); and compare the actual flow velocity (V) with the permissible velocity (from Step 2). If the capacity of the channel is greater than the peak runoff rate from a 2-year storm, the velocity (V) should be computed using the actual depth of the 2-year storm flow.

If the existing channel is adequate with respect to both capacity and erosion resistance, the channel can be considered adequate to convey the increased discharge. If not, on-site measures and/or channel improvements must be incorporated into the site design.

Stream Channel Improvements (Modifications)

A. Design/Construction Requirements

1. If channel improvements are to be used, then MS #19 requires that:

    (a) the channel be capable of containing the 10-year frequency design storm within its banks; and

    (b) a 2-year frequency storm will not cause erosion to the channel bed or bank.

2. Improvement of the channel shall continue downstream until channel adequacy can be demonstrated, or to the point where the total drainage area above the improved channel section is 100 times greater than the contributing drainage area of the project-area watershed.

3. Prior written permission of all property owners is required prior to

constructing any channel improvements or modifications.

4. Evidence of approval from all applicable regulatory agencies to undertake channel improvements is required. Approval may require the acquisition of permits to complete the proposed work.

B. Channel Modification (Practices and Restrictions)

VEGETATIVE STREAMBANK STABILIZATION (Std. & Spec. 3.22) and/or STRUCTURAL STREAMBANK STABILIZATION (Std. & Spec. 3.23) may be used to reduce or eliminate erosion potential. Stable rock sizes for riprap linings can be determined from procedures outlined in the section titled "Designing a Stormwater Conveyance Channel."

[Refer to the previous sections (Part III, Open Channel Flow) for techniques that could be utilized in the improvement of natural stream channels.]

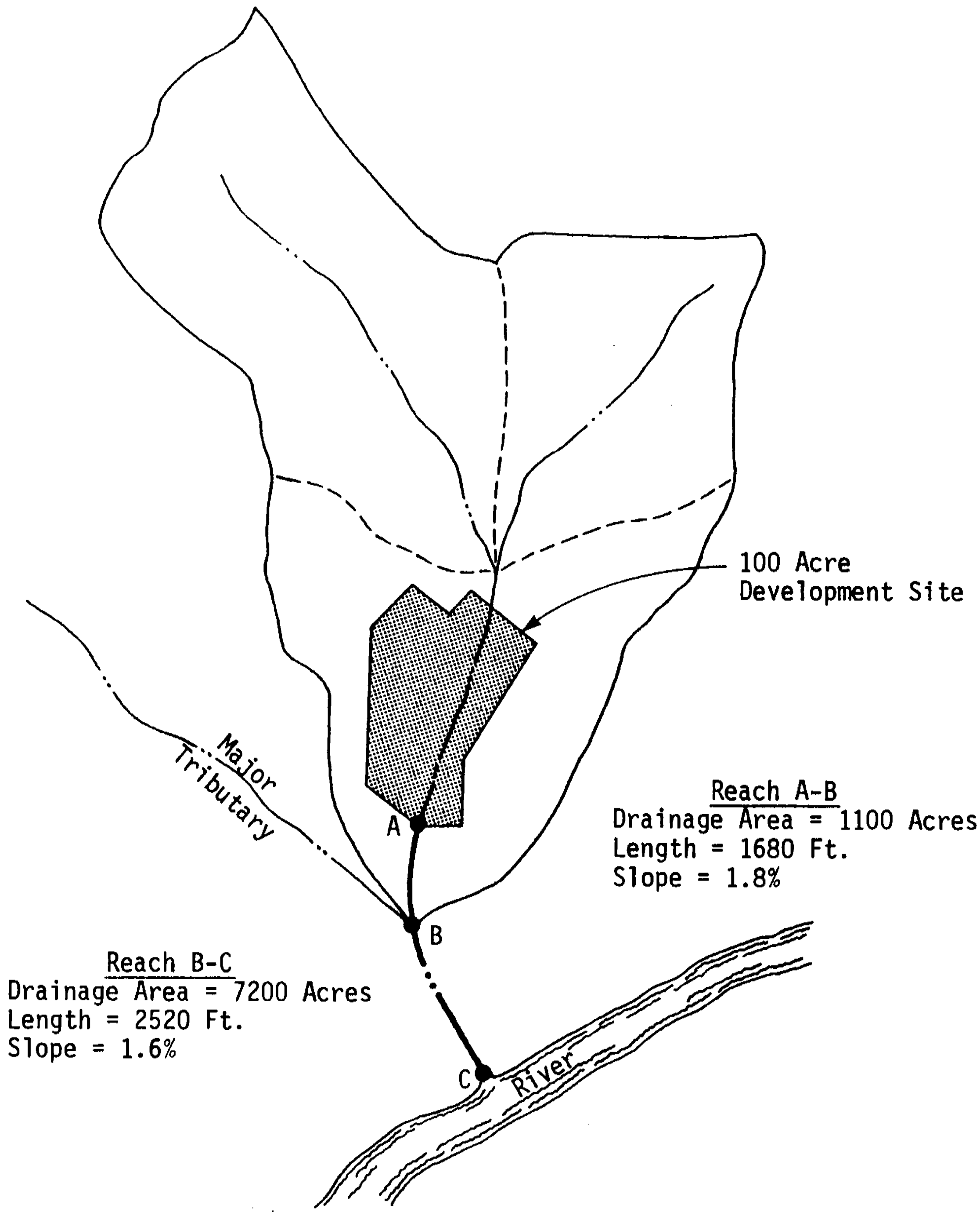
Channel modification should be undertaken only when necessary. Poorly planned and designed modifications can have an adverse impact on:

1. Aesthetics
2. Water quality
3. Aquatic life
4. Terrestrial life
5. Recreation
6. Groundwater

When a channel modification must be performed, care should be taken to attempt to duplicate the natural stream characteristics. Otherwise, the result may be unsightly, a constant source of maintenance problems, and an ecological disaster.

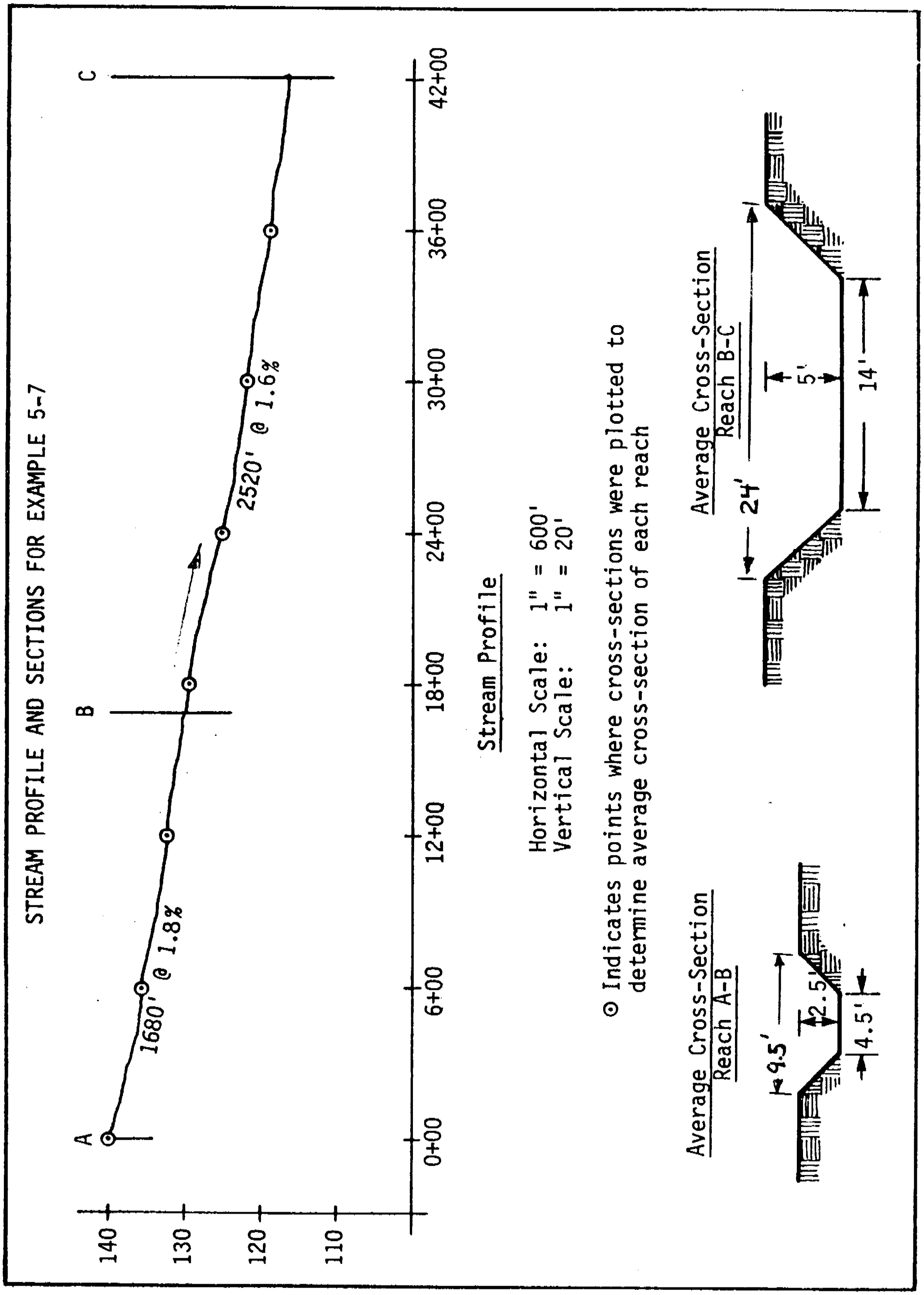
Example 5-12

A 100-acre shopping mall is to be constructed in a watershed as shown on Plate 5-36. The developer wants to analyze the existing stream channels before incorporating on-site runoff measures into the development plan. The following information represents the procedure and conclusion of the channel analysis.



Source: Va DSWC

Plate 5-36



Source: Va DSWC

Plate 5-37

The natural stream channel receiving runoff from the site has been divided into two reaches. Reach A-B extends from the outlet of the development (point A) to the confluence of a major tributary (point B). Reach B-C extends from point B to the confluence with a river (point C). The analysis ends at the river since the drainage area of the river is at least 100 times greater than the drainage area of the development site.

A field survey and watershed analysis provides the following information about each channel reach.

Reach A-B

1. Peak runoff (2-year storm) at point B:

   Pre-development = 95 cfs; Post-development = 170 cfs

2. Channel length = 1680 ft.

3. Channel slope = 1.8%

4. An average channel cross-section is approximated by a trapezoidal section with a 4.5-ft. bottom width, 2.5 ft. depth; and 1:1 side slopes. (See Plate 5-37.)

5. The channel is described as having a fine gravel bed with stiff clay banks; a fairly constant cross-section; few obstructions; very little vegetation in the channel; and slight meandering.

Reach B-C

1. Peak runoff (2-year storm) at point C:

   Pre-development = 500 cfs; Post-development = 585 cfs

2. Channel length = 2520 ft.

3. Channel slope = 1.6%.

4. An average channel cross-section is approximated by a trapezoidal section with a 14-ft. bottom width; 5 ft. depth; and 1:1 side slopes. (See Plate 5-37.)

5. The basic channel roughness characteristics are the same as Reach A-B except there is moderate meandering (e.g., the ratio of meandering length to straight length equals 1.3:1).

The information from the stream channel survey (above) is analyzed and presented in the following steps. Note that the post-development peak discharge rate is used since the purpose of this analysis is to determine whether or not the existing stream channel is adequate to convey the increased runoff from the proposed development. The 2-year storm is used in the analysis because the receiving channel is a natural stream presumedly with an established floodplain. [If the receiving stream channel were a man-made channel, the E&S Regulations (MS-19) would require an analysis using the 2-year storm for erosion resistance and the 10-year storm for capacity.]

Test Reach A-B for Adequacy

Step 1 - Required Q = 170 cfs

Step 2 -
- a. A = 17.5 $ft.^2$
- b. Slope = 1.8%
- c. R = 1.53 (Plate 5-38)
- d. Permissible Velocity (V) = 5 ft./sec. (Table 5-22)
- e. Adjusted Permissible Velocity (V) = 4.3 ft./sec. (Table 5-23 & Plate 5-39).

Step 3 - From the procedure for determining "n" for a natural channel:

- a. The channel is cut into fine gravel, n_1 = 0.024
- b. Moderate surface irregularities, n_2 = 0.010
- c. Changes in cross-section gradual, n_3 = 0.0
- d. Obstructions have minor effect, n_4 = 0.012
- e. Very little vegetation in channel, n_5 = 0.0
- f. Meandering minor, n_6 = 0

$$n = (0.024 + 0.010 + 0.012) = 0.046$$

Step 4 - Calculate (V) and (Q).

$$V = \frac{1.49}{0.046} (1.53)^{2/3} (.018)^{1/2} = 5.77 \, ft./sec.$$

$$Q = VA = (5.77)(17.5) = 101 \, cfs$$

Step 5 - The channel reach is <u>inadequate</u> since the permissible velocity is exceeded (5.77 > 4.3 ft./sec.) and the capacity is insufficient (170 > 101 cfs).

Test Reach B-C for Adequacy

Step 1 - Required Q = 585 cfs

Step 2 -
a. A = 95 ft.^{2}
b. Slope = 1.6%
c. R = 3.38 (Plate 5-38)
d. Permissible Velocity (V) = 5 ft./sec. (Table 5-27)
e. Adjusted Permissible Velocity (V) = 4.6 ft./sec. (Table 5-28 & Plate 5-39)

Step 3 -

$$\left.\begin{aligned} n_1 &= 0.024 \\ n_2 &= 0.010 \\ n_3 &= 0.0 \\ n_4 &= 0.012 \\ n_5 &= 0.0 \\ n_6 &= 0.15 \end{aligned}\right\} \text{ same as Reach B-C}$$

$$n = (0.024 + 0.010 + 0.012)\ (0.15) + (0.024 + 0.010 + 0.012) = 0.053$$

Step 4 - Calculate (V) and (Q)

$$V = \frac{1.49}{.053}\ (3.38)^{2/3}\ (.016)^{1/2} = 8.04\ \textit{ft./sec.}$$

$$Q = 763.8$$

Step 5 - The capacity of the channel is adequate (763.8 > 585 cfs). However, the velocity should be re-tested using a depth which represents the flow from the 2-year storm.

Try 3.5 ft. depth

New R = 2.56 ft.^{2}

New A = 61.25 ft.

$$V = \frac{1.49}{.053}\ (2.56)^{2/3}\ (.016)^{1/2} = 6.67\ \textit{ft./sec.} \quad \text{(still too high)}$$

Q = 6.67 ft./sec. x 61.25 ft.^{2}

Q = 408 cfs (too low)

Therefore, the channel is <u>not</u> adequate from a velocity standpoint (6.67 > 5 ft./sec.). Note that choosing the correct (or actual) depth is a trial and error process. The 2-year flow depth would yield a discharge (Q) equal to the 2-year discharge. For this example, additional trials are not necessary since the actual velocity would be within the range of velocities in trials above, and, subsequently, would exceed the allowable velocity.

Conclusion

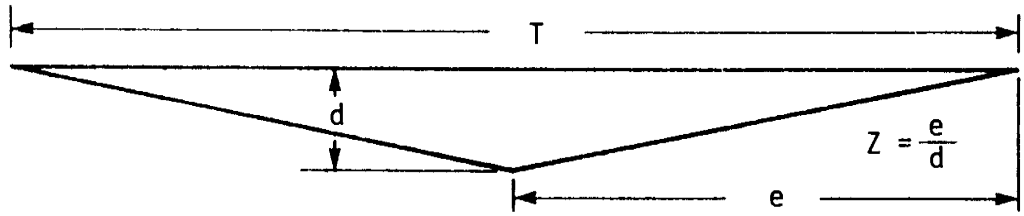
Reach A-B is inadequate for both capacity and velocity; Reach B-C is inadequate for velocity only. Therefore, the developer may choose the option of improving the entire stream channel (4200 ft.) to an "adequate" condition to contain the 10-year storm peak discharge, and with erosion resistance compatible with the 2-year storm.[1] Or, the developer may choose to detain runoff on the site so that the 2-year post-development discharge rate does not exceed the 2-year pre-development discharge rate.[2]

[1] The developer must have permission from the property owners before any off-site channel modifications can be made. Channel modifications may require other permits as well.

[2] A typical design solution might include an on-site, multi-purpose basin that provides sediment control and runoff quantity control during the land-disturbing phase and provides runoff quantity control as well as water quality benefits after adequate stabilization has been achieved.

CHANNEL GEOMETRY

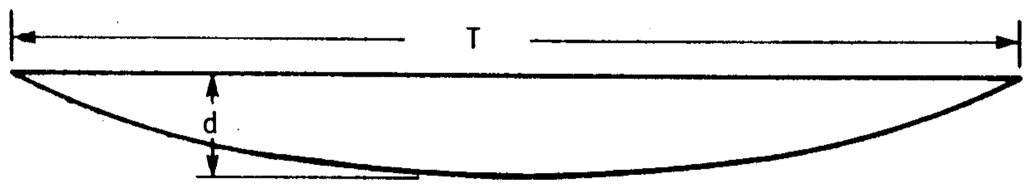
V - Shape



Cross-Sectional Area (A) = Zd^2
Top Width (T) = $2dZ$

Hydraulic Radius (R) = $\dfrac{Zd}{2\sqrt{Z^2 + 1}}$

Parabolic Shape

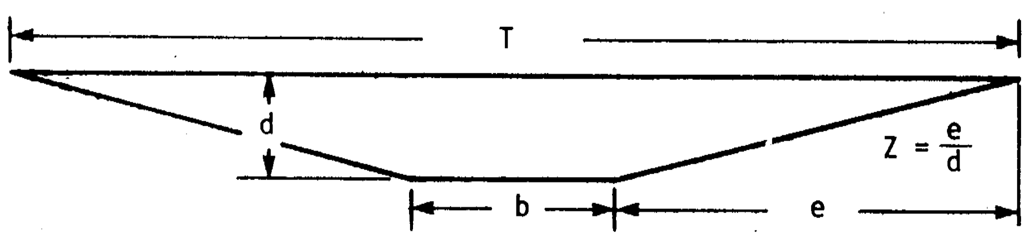


Cross-Sectional Area (A) = $\dfrac{2}{3}Td$

Top Width (T) = $\dfrac{1.5\,A}{d}$

Hydraulic Radius = $\dfrac{T^2d}{1.5T^2 + 4d^2}$

Trapezoidal Shape



Cross-Sectional Area (A) = $bd + Zd^2$
Top Width (T) = $b + 2dZ$

Hydraulic Radius = $\dfrac{bd + Zd^2}{b + 2d\sqrt{Z^2 + 1}}$

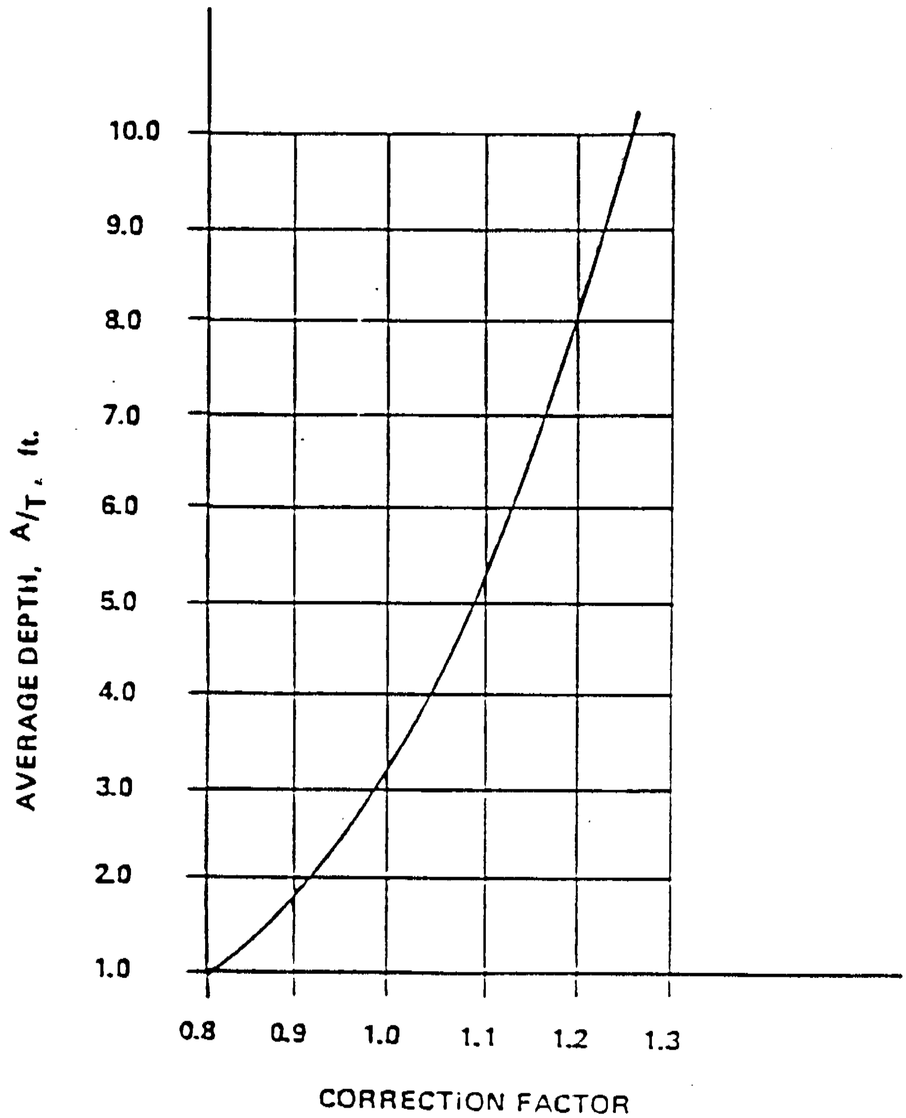
Source: USDA-SCS

Plate 5-38

When other conditions are the same, a deep channel will convey water at a higher mean velocity (without erosion) than a shallow one. Thus, a correction for flow depth should also be applied to the permissible velocity. Plate 5-39 shows the suggested correction factors to be applied.

CORRECTION FACTORS FOR PERMISSIBLE VELOCITY BASED ON AVERAGE DEPTH OF FLOW

$$\frac{\textit{Cross-Sectional Area of Channel}}{\textit{Top Width of Channel}} = \frac{A}{T}$$



Source: Va DSWC

Plate 5-39

MANNING'S ROUGHNESS COEFFICIENT MODIFYING TABLES FOR NATURAL CHANNELS

Table 5-16
ROUGHNESS COEFFICIENT MODIFIER (n_1)

Character of Channel	Basic n
Channels in earth	0.02
Channels cut into rock	0.025
Channels in fine gravel	0.024
Channels in coarse gravel	0.028

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-17
ROUGHNESS COEFFICIENT MODIFIER (n_2)

Degree of Irregularity	Surface Comparable To	Modifying Value
Smooth	The best attainable for the materials involved	0.000
Minor	Good dredged channels, slightly eroded or scoured side slopes of canals or drainage channels	0.005
Moderate	Fair to poor dredged channels, moderately sloughed or eroded side slopes of canals or drainage channels	0.010
Severe	Badly sloughed banks of natural streams; badly eroded or sloughed sides of canals or drainage channels; unshaped, jagged and irregular surfaces of channels excavated in rock	0.020

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-18
ROUGHNESS COEFFICIENT MODIFIER (n_3)

Character of Variations of Size and Shape of Channel Cross Sections	Modifying Value
Change in size or shape occurring gradually	0.000
Large and small sections alternating occasionally or shape changes causing occasional shifting of main flow from side to side	0.005
Large and small sections alternating frequently or shape changes causing frequent shifting of main flow from side to side	0.010 to 0.015

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-19
ROUGHNESS COEFFICIENT MODIFIER (n_4)

Relative effect of obstructions	Modifying value
Negligible	0.000
Minor	0.010 to 0.015
Appreciable	0.020 to 0.030
Severe	0.040 to 0.060

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-20

ROUGHNESS COEFFICIENT MODIFIER (n_5)

Vegetation and Flow Conditions Comparable To:	Degree of Effect on "n"	Range in Modifying Value
Dense growths of flexible turf grasses or weeds, of which bermudagrass and bluegrass are examples, where the average depth of flow is two or more times the height of the vegetation.	Low	0.005 to 0.010
Supple seedling tree switches such as willow, cottonwood or salt cedar where the average depth of flow is three or more times the height of the vegetation.		
Turf grasses where the average depth of flow is one to two times the height of the vegetation.	Medium	0.010 to 0.020
Stemmy grasses, weeds or tree seedlings with moderate cover where the average depth of flow is two to three times the height of the vegetation.		
Bushy growths, moderately dense, similar to willows one to two years old, dormant season, along side slopes with no significant vegetation along bottom, where the hydraulic radius is greater than two.		

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-20 (continued)
ROUGHNESS COEFFICIENT MODIFIER (n_5)

Vegetation and Flow Conditions Comparable To:	Degree of Effect on "n"	Range in Modifying Value
Turf grasses where the average depth of flow is about equal to the height of vegetation.	High	0.025 to 0.050
Willow or cottonwood trees 8- to 10-years old intergrown with some weeds and brush, dormant season, where the hydraulic radius is 2 to 4 ft.		
Bushy willows about one year old interwoven with some weeds is full foliage along side slopes, no significant vegetation along channel bottom where hydraulic radius is 2 to 4 ft.		
Turf grasses where the average depth of flow is less than one-half the height of the vegetation.	Very High	0.050 to 0.100
Bushy willows about one year old intergrown with weeds along side slopes, dense growth of cattails along channel bottom, all vegetation is full foliage, any value of hydraulic radius up to 10 or 12 ft.		
Trees intergrown with weeds and brush, all vegetation in full foliage, any value of hydraulic radius up to 10 to 12 ft.		

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-21
ROUGHNESS COEFFICIENT MODIFIER (n_6)

(Sinuosity) Ratio of meander length to straight length	Degree of meander	Modifying Value
1.0 to 1.2	Minor	0.000
1.2 to 1.5	Appreciable	* $0.15n_s$
1.5 and greater	Severe	* $0.30n_s$

* $n_s = (n_1 + n_2 + n_3 + n_4 + n_5)$

Source: "Estimating Hydraulic Roughness Coefficients," Cowan.

TABLE 5-22

PERMISSIBLE VELOCITIES FOR UNLINED EARTHEN CHANNELS

Soil Types	Permissible Velocity (ft./sec.)
Fine Sand (noncolloidal)	2.5
Sandy Loam (noncolloidal)	2.5
Silt Loam (noncolloidal)	3.0
Ordinary Firm Loam	3.5
Fine Gravel	5.0
Stiff Clay (very colloidal)	5.0
Graded, Loam to Cobbles (noncolloidal)	5.0
Graded, Silt to Cobbles (noncolloidal)	5.5
Alluvial Silts (noncolloidal)	3.5
Alluvial Silts (colloidal)	5.0
Coarse Gravel (noncolloidal)	6.0
Cobbles and Shingles	5.5
Shales and Hard Pans	6.0

Source: American Society of Civil Engineers

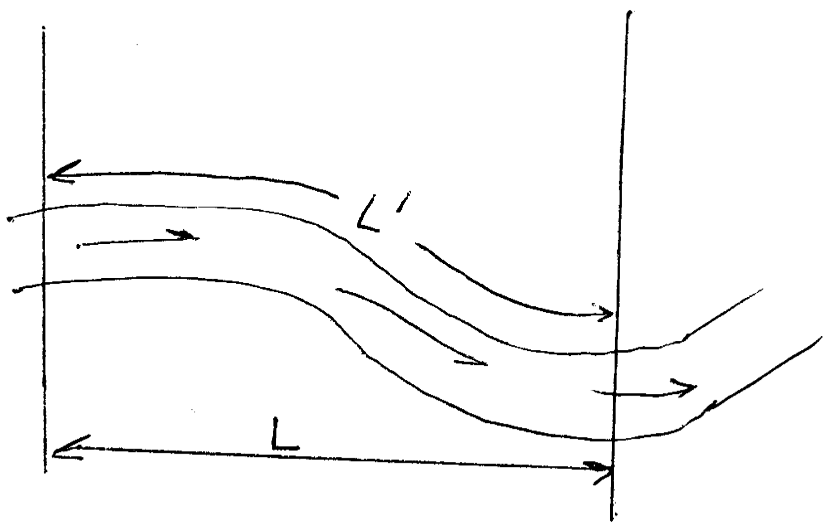
Maximum permissible velocities from Table 5-22 are for straight channels. For curved (sinuous) channels, the reductions shown in Table 5-23 should be applied to the maximum permissible velocities:

TABLE 5-23

REDUCTION IN PERMISSIBLE VELOCITY BASED ON SINUOSITY

Sinuosity*	Percent Reduction in Permissible Velocity
Slight (1.0 to 1.2)	5%
Moderate (1.2 to 1.5)	13%
Very Sinuous (1.5 and greater)	22%

* Sinuosity - degree of curvature of channel.



Sinuosity = L'/L

Source: Chow

CHAPTER 6

Preparing an Erosion and Sediment Control Plan

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PREPARING AN EROSION AND SEDIMENT CONTROL PLAN

PAGE

CHAPTER 6

PREPARING AN EROSION AND SEDIMENT CONTROL PLAN

This chapter is intended as a complete guide for preparing an erosion and sediment control plan for a construction project. It is divided into three parts:

PART I - GENERAL GUIDELINES: Part I contains the basic information with which all site planners and plan reviewers should be familiar. It describes criteria for plan content and format, ideas for improving planning effectiveness, and sources of technical assistance.

PART II - STEP-BY-STEP PROCEDURE: Part II outlines and describes a step-by-step procedure for developing an erosion and sediment control plan. The procedure covers the steps from data collection through plan preparation. The procedure is written in general terms to be applicable to all types of projects.

PART III - SAMPLE PLAN: A sample plan is developed according to the step-by-step procedure outlined in Part II. This sample plan was developed for a proposed state construction project.

Site planners, as well as local plan approving authorities, are urged to become familiar with the contents of this chapter so that plans will become more standardized, and thus more effective, statewide.

PART I

GENERAL GUIDELINES

What is an Erosion and Sediment Control Plan?

Simply stated, an erosion and sediment control plan is a document which describes the potential for erosion and sedimentation on a construction project. The plan also explains and illustrates the measures which are to be taken to control those problems. The plan has a written portion known as the narrative and a illustrative portion known as a plan.

The erosion and sediment control plan should be an independent entity from the working or construction drawings of the project. While it is a good idea to include erosion and sediment control standards and specifications in contract documents, the erosion and sediment control plan itself should contain notes to ensure that the controls are installed, inspected and maintained properly.

A Narrative Is Important

A narrative is a written statement which explains the erosion and sediment control decisions made for a particular project and the justification for those decisions. The narrative is especially important to the plan approving authority because it contains concise information concerning existing site conditions, construction schedules, and other pertinent items which are not apparent in a typical site plan. Since a plan reviewer cannot always visit the site or discuss the project at length with the site planner, it is essential that the necessary information be provided for the plan review.

The narrative is also important to the construction superintendent and inspector who are responsible for seeing that the plan is implemented properly. It provides them with a single report which describes where and when the various erosion and sediment control practices should be installed.

What Is an "Adequate" Plan ?

An erosion and sediment control plan must contain sufficient information to satisfy the plan approving authority that the problems of erosion and sedimentation have been adequately addressed for a proposed project. The length and complexity of the plan should be commensurate with the size of the project, the severity of site conditions, and the potential for off-site damage.

Obviously, a plan for constructing a house on a single subdivision lot does not need to be as complex as a plan for a shopping center development. Also, plans for projects undertaken on flat terrain will generally be less complicated than plans for projects constructed on steep slopes where erosion potential is greater. The greatest level of planning and detail should be evident on plans for projects which are directly adjacent to flowing streams, dense population centers, or high value properties where damage may be particularly costly or detrimental to the environment.

The primary guidelines for determining the adequacy of a plan are the Virginia Erosion and Sediment Control Regulations (VESCR). Each of the "Minimum Standards" in Section **40** of the Regulations should be satisfied in the E&S plan, unless a specific variance is granted by the plan approving authority. Variance procedures are contained in Section **50** of the Regulations. Maintenance and inspection requirements are contained in Section **60** of the Regulations. (The "Minimum Standards" are listed at the beginning of Chapter 3, or see Chapter 8 for the law and regulations in their entirety.)

As a guide to E&S plan content, the site planners and plan reviewers should use the checklist contained in Part II of this chapter. If the proposed project is subject to local program jurisdiction, the plan preparer should contact the locality since some localities have adopted more stringent requirements. The step-by-step procedure outlined in Part II is recommended for the development of all plans.

Practice Standards and Specifications

Chapter 3 of the Virginia Erosion and Sediment Control Handbook (handbook) contains minimum state standards and specifications for conservation practices. Wherever any of these practices are to be employed on a site, the specific title and number of the practice should be clearly marked on the plan. By referencing the handbook properly, the site planner can reduce the need for lengthy descriptions of the practices in the plan. The plan should contain sketches and notes related to the installation and maintenance of the practices.

Modifications to state standard practices or new innovative conservation practices may also be employed, but such practices must be thoroughly described in detail to the satisfaction of the plan approving authority. Variances from state standards should also be submitted at the time of plan submission.

Standard Practice Coding System

Site planners are urged to use the standard numbering and coding system for conservation practices contained in this handbook. Chapter 2 contains a large fold-out chart which lists each practice with its designated number, symbol and code. This chart can be placed on the wall for fast and easy reference. Use of this coding system will result in increased uniformity of plans and thus increase their readability to plan reviewers, job superintendents, and inspectors statewide.

Comprehensive Site Planning

Erosion and sediment control planning should be an integral part of the site planning process, not an afterthought. The potential for soil erosion should be a significant consideration when deciding upon the layout of buildings, parking lots, roads and other facilities. Costly erosion and sediment control measures can be minimized if the site design can be adapted to existing site conditions and good conservation principles are used.

Who is Responsible for Preparing a Plan ?

The owner or lessee of the land being developed has the responsibility for plan preparation and submission. The owner or lessee may designate someone (e.g., an engineer, architect, contractor, etc.) to prepare the plan, but the owner or lessee retains the ultimate responsibility.

Technical Assistance

There are a number of possible sources of erosion and sediment control planning assistance within the state.

1. Soil and Water Conservation Districts: There are 45 soil and water conservation districts throughout the state serving 94 counties and 13 cities. These districts have elected representatives (directors) from each locality. One of the primary functions of these districts is to provide assistance to landowners for soil conservation planning and implementation. The USDA-Soil Conservation Service provides conservation districts with technical assistance. Requests for assistance in preparing an erosion and sediment control plan for a construction site can be made through the local district.

2. USDA-Soil Conservation Service: The Soil Conservation Service (SCS) provides technical assistance or conservation planning through local soil and water conservation districts to landowners throughout the country. In addition, the SCS, with the Agronomy Department of Virginia Polytechnic Institute and State University (VPI & SU) is involved in soil surveys throughout the state.

   Requests can be made through a SCS field office or a VPI & SU soil survey field office for soil survey on a specific site. Request will be acted upon according to local priorities.

3. Virginia Cooperative Extension Service: The Extension Service can provide valuable information on site planning and establishment of lawns and plant materials. The extension service has a number of useful publications and in addition will have soil samples analyzed upon request to determine fertilization and liming needs for establishing vegetation on a particular site.

4. Virginia Division of Soil and Water Conservation: Division staff members are available to answer any questions concerning the Virginia Erosion and Sediment Control Law (VESCL), the VESCR, and minimum standards and specifications for erosion and sediment control practices. Write or call the Division office in Richmond, or call your local regional office.

Richmond Central Office - 804-786-2064
203 Governor Street, Suite 206
Richmond, Virginia 23219

Regional Offices:

Abingdon	**540/676-5529**	Chase City	804-372-2191
Dublin	**540/674-2937**	Richmond	**804/527-4481**
Staunton	**540/332-9991**	Suffolk	**757/925-2467**
Tappahannock	804-443-6752	Warrenton	**540-347-6420**

5. Local government offices: Many localities have a separate department that is responsible for administering the local erosion and sediment control program. Local staff can be a valuable resource for technical assistance and information concerning local requirements.

PART II

STEP-BY-STEP PROCEDURE

STEP 1 - <u>DATA COLLECTION</u>

A. Topography
B. Drainage
C. Soils
D. Ground Cover
E. Adjacent Areas
F. Requirements

STEP 2 - <u>DATA ANALYSIS</u>

A. Topography - Slope gradients, lengths
B. Drainage - Existing drainage patterns
C. Soil - erodibility, permeability
D. Ground Cover - Trees, grassy areas, unique vegetation
E. Adjacent Areas - Streams, roads, buildings, etc.

STEP 3 - <u>SITE PLAN DEVELOPMENT</u>

A. Develop Site Plan
    1. Fit development to terrain
    2. Locate construction in least critical areas
    3. Utilize cluster development whenever possible
    4. Minimize paved areas
    5. Utilize natural drainage systems
B. Calculate Runoff

STEP 4 - <u>PLAN FOR EROSION AND SEDIMENT CONTROL</u>

A. Determine limits of clearing and grading
B. Divide the site into drainage areas
C. Select erosion and sediment control practices for each drainage area
    1. Vegetative
    2. Structural
    3. Management measures

STEP 5 - <u>PREPARE THE PLAN</u>

A. Narrative
B. Site Plan

STEP 1 - DATA COLLECTION

Inventory the existing site conditions to gather information which will help you develop the most effective erosion and sediment control plan. The information obtained should be plotted on a map and verbally explained in the narrative portion of the plan.

A. TOPOGRAPHY - A small scale topographic map of the site should be prepared to show the existing contour elevations at intervals of from 1 to 5 feet depending upon the slope of the terrain. Existing topographic maps (e.g., USGS or local government topos) can be a good starting point, however, the information should be verified by a field investigation.

B. DRAINAGE PATTERNS - All existing drainage swales and patterns on the site should be located and clearly marked on the topographic map. Live or intermittent streams should be shown on the map.

C. SOILS - Major soil type(s) on the site should be determined and shown on the topographic map. Soils information can be obtained from a soil survey if one has been published for your county. If a soil survey is not available, a request can be made to a district SCS office or the VPI & SU Agronomy Department for a soil survey of your site. Commercial soils evaluations are also available. Soils information should be plotted directly onto the map or an overlay of the same scale for ease of interpretation.

D. GROUND COVER - The existing vegetation such as tree clusters, grassy areas, and unique vegetation should be shown on the map. In addition, existing denuded or exposed soil areas should be indicated.

E. ADJACENT AREAS - Areas adjacent to the site should be delineated on the topographic map. Such features as streams, roads, houses or other buildings, wooded areas, etc. should be shown. Streams which will receive runoff from the site should be surveyed to determine their carrying capacity.

F. REQUIREMENTS - Sources of information include the handbook, the VESCL and VESCR, as well as any information on the local E&S program requirements (e.g, ordinance, handbook, guidelines, etc.).

STEP 2 - DATA ANALYSIS

When all of the data in Step 1 are considered together, a picture of the site potentials and limitations should begin to emerge. The site planner should be able to determine those areas which have potentially critical erosion hazards. The following are some important points to consider in site analysis:

A. Topography - The primary topographic considerations are slope steepness and slope length. Because of the effect of accumulated runoff, erosion potential is greater on long, steep slopes. When the percent of slope has been determined, areas of similar steepness should be outlined. Slope gradients can be grouped into three general ranges of soil erodibility:

0-7%	--	Low erosion hazard
7-15%	--	Moderate erosion hazard
> 15%	--	High erosion hazard

Within these slope gradient ranges, the erosion hazard becomes greater as the slope length increases. Therefore, in determining potential critical areas, the site planner should be aware of excessively long slopes. As a general rule, the erosion hazard will become critical if the slope exceeds the following criteria:

0-7%	--	300 feet
7-15%	--	150 feet
> 15%	--	75 feet

B. Natural Drainage - The existing drainage patterns, which consist of overland flow, swales and depressions, and natural watercourses, should be identified in order to plan around critical areas where water will concentrate. Where possible, natural drainageways should be used to convey runoff over and off the site to avoid the expense and problems of constructing an artificial drainage system. Man-made ditches and waterways can become part of the erosion problem if they are not properly designed and constructed. Care should also be taken to be sure that the increased runoff from the site will not erode or flood the existing natural drainage system. Possible sites for stormwater detention should be located at this time.

C. Soils - Such soils properties as natural drainage, depth to bedrock, depth to seasonal watertable, permeability, shrink-swell potential, texture, and erodibility should exert a strong influence on land development decisions. Appendix 6A contains basic guidelines for using soils information for site planning. A list of Virginia soils and their hydrologic soil groups is included in Appendix 6A.

D. Ground cover - Ground cover is the most important factor in terms of preventing erosion. Any existing vegetation which can be saved will help prevent erosion. Trees and other vegetation protect the soil as well as beautify the site after construction. If the existing vegetation cannot be saved, the planner should consider staging construction and using temporary seeding, or temporary mulching.

Staging of construction involves stabilizing one part of the site before disturbing another. In this way, the entire site is not disturbed at once and the time without ground cover is minimized. Temporary seeding and mulching involve seeding or mulching areas which would otherwise lie exposed for long periods of time. The time of exposure is limited, thus the erosion hazard is reduced.

E. Adjacent Areas - An analysis of adjacent properties should focus on areas downslope from the construction project. Of major concern should be watercourses which will receive direct runoff from the site. The potential for sediment pollution of these watercourses should be considered as well as the potential for downstream channel erosion due to increased volume, velocity and peak flow rate of stormwater runoff from the site. (See Minimum Standard 19.) The potential for sediment deposition on adjacent properties due to sheet and rill erosion should also be analyzed so that appropriate sediment trapping measures can be planned and installed prior to any land-disturbing activity.

F. Requirements - Find out what the requirements are for the development. State agencies that undertake land-disturbing activities are regulated directly by DSWC. Private land-disturbing activities or activities undertaken by localities are regulated by the local E&S program. Contact the appropriate authority for information regarding permits, fees and plan submission, as well as any other requirements.

STEP 3 - SITE PLAN DEVELOPMENT

A. Develop the site plan. After analyzing the data and determining the site limitations, the planner can develop a site plan. When designing the site plan, keep in mind that increases in runoff may require structural runoff control measures or channel improvements. Both items are expensive, and even more so when the site plan has to be re-designed to accommodate the runoff control measures. Therefore, try to minimize the increase in runoff or include runoff control measures in the initial design.

The following are some points to consider when developing the site plan:

1. Fit development to terrain. The development of an area should be tailored to the existing site conditions. This will avoid unnecessary land disturbance, thereby minimizing the erosion hazards and costs. Cutting and filling should be avoided if possible. Slopes should be at a maximum of 2:1 to provide for final stabilization.

2. Confine construction activities to the least critical areas. Any land disturbance in the critically erodible areas will necessitate the installation of more costly control measures.

3. Cluster buildings together. This minimizes the amount of disturbed area, concentrates utility lines and connections in one area, and provides more open natural space. The cluster concept not only lessens the erodible area, but it reduces runoff and generally reduces development costs.

4. Minimize impervious areas. Keep paved areas such as parking lots and roads to a minimum. This goes hand in hand with cluster development in

eliminating the need for duplicating parking areas, access roads, etc. The more land that is kept in vegetative cover, the more water will infiltrate, thus reducing runoff and erosion.

5. Utilize the natural drainage system. If the natural drainage system of a site can be preserved instead of being replaced with storm sewers or concrete channels, the potential for downstream damages due to increased runoff can be minimized.

B. Calculate runoff. Runoff calculations must be done to determine the effect of the development on the existing hydrologic system. Refer to Chapters 4 and 5 for more information on the VESCR and calculation procedures. Also, contact the locality to determine if the locality has adopted more stringent runoff requirements. After the calculations have been done, make the necessary changes to achieve compliance with the runoff requirements.

STEP 4 - PLAN FOR EROSION AND SEDIMENT CONTROL

When the layout of the site has been determined, a plan to control erosion and sedimentation from the disturbed areas must be formulated.

The site planner should be guided by the Minimum Standards in Section 40 of the VESCR. These minimum standards establish a level of control for all projects. The site planner should determine which of the "Minimum Standards" are applicable to the site and select conservation practices which can be used to comply with these regulations. If the site planner feels that any of the "Minimum Standards" are not justified on a given project, the site planner should apply for a variance in accordance with the procedures in the VESCR, Section 50. (See Chapter 8.)

The following procedure is recommended for erosion and sediment control planning:

A. Determine the limits of clearing and grading. Decide which areas must be disturbed in order to accommodate the proposed construction. Pay special attention to critical areas which must be disturbed.

B. Divide the site into drainage areas. Determine how runoff will travel over the developed site. Consider how erosion and sedimentation can be controlled in each small drainage area before looking at the entire site. Remember, it is easier to control erosion than to contend with sediment after it has been carried downstream.

C. Select erosion and sediment control practices. Erosion and sediment control practices can be divided into three broad categories: vegetative controls, structural controls, and management measures. Each of these categories have temporary and permanent control measures to be considered. Vegetative and structural practices should be selected and designed in accordance with Chapter 3. Management measures are construction management techniques which, if properly utilized, can minimize the need for physical controls and possibly reduce costs.

1. Vegetative Controls - Keep in mind that the first line of defense is to prevent erosion. This is accomplished by protecting the soil surface from raindrop impact and overland flow of runoff. The best way to protect the soil surface is to preserve the existing ground cover. Where land disturbance is necessary, temporary seeding or mulching should be used on areas which will be exposed for long periods of time. (See section 40 of "Minimum Standards".)

   Erosion and sediment control plans must contain provisions for permanent stabilization of denuded areas. Selection of permanent vegetation should include the following considerations:

   a. applicability to site conditions
   b. establishment requirements
   c. maintenance requirements
   d. aesthetics.

2. Structural Controls - Structural control practices are generally more costly than vegetative controls. However, they are usually necessary since not all disturbed areas can be protected with vegetation. Structural controls are often used as a second or third line of defense to capture sediment before it leaves the site.

   It is very important that structural practices be selected, designed and constructed according to the standards and specifications in Chapter 3 of this handbook. Improper use or inadequate installation can result in failure of the control and subsequent release of any trapped sediment.

3. Management Measures - Good construction management is as important as structural and vegetative practices for erosion and sediment control, and there is generally little or no cost involved. Following are some management considerations which can be employed:

   a. Include erosion and sediment control as an agenda item for the pre-construction meeting.

   b. Sequence construction so that no area remains exposed for unnecessarily long periods of time.
      - Work in a logical sequence, especially for drainage items.
      - Anticipate the site conditions that will exist as the construction progresses toward the final product.
      - Have the materials on-hand to complete the work without delay.
      - Apply temporary stabilization immediately after grading.

c. On large projects, stage the construction if possible, so that one area can be stabilized before another is disturbed.

d. Consider the time of year:
   - Be prepared for sudden thunderstorms.
   - Install E&S controls immediately.
   - Use straw mulch, especially during poor germination periods.

e. Physically mark off limits of land disturbance on the site with tape, signs or other methods, so that workers can see areas to be protected.

f. Develop and carry out a regular maintenance schedule for erosion and sediment control practices.

g. Designate one individual (preferably the job superintendent) responsible for implementing the erosion and sediment control plan. Make sure that all workers understand the major provisions of the erosion and sediment control plan. Establish reporting procedures for problems identified by workers.

D. Plan for stormwater management. Where increased runoff will cause the carrying capacity of a receiving channel to be exceeded, the site planner must select appropriate stormwater management measures. "Minimum Standard 19" describes the conditions which must be satisfied. (See Chapter 4 for more details.)

STEP 5 - PREPARE THE PLAN

All of the necessary planning work has been done in steps 1-4. The final step consists of consolidating the pertinent information and developing it into a specific erosion and sediment control plan for the project.

The plan consists of two parts: a narrative and site plan. The narrative verbally explains the problems and their solutions with all necessary documentation. The site plan is a map(s) or drawing(s) that depicts information contained in the narrative. Table 6-1 lists some recommended notes that could be placed on the site plan.

The checklist (on the next two pages) should be submitted with the plan. This checklist can be used by a site planner, as well as the plan reviewer, as a quick reference to determine if all the major items are included in the erosion and sediment control plan.

CHECKLIST

FOR EROSION AND SEDIMENT CONTROL PLANS

_____ Minimum Standards - All applicable Minimum Standards must be addressed.

NARRATIVE

_____ Project description - Briefly describes the nature and purpose of the land-disturbing activity, and the area (acres) to be disturbed.

_____ Existing site conditions - A description of the existing topography, vegetation and drainage.

_____ Adjacent areas - A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance.

_____ Off-site areas - Describe any off-site land-disturbing activities that will occur (including borrow sites, waste or surplus areas, etc.). Will any other areas be disturbed?

_____ Soils - A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture and soil structure.

_____ Critical areas - A description of areas on the site which have potentially serious erosion problems (e.g., steep slopes, channels, wet weather/ underground springs, etc.).

_____ Erosion and sediment control measures - A description of the methods which will be used to control erosion and sedimentation on the site. (Controls should meet the specifications in Chapter 3.)

_____ Permanent stabilization - A brief description, including specifications, of how the site will be stabilized after construction is completed.

_____ Stormwater runoff considerations - Will the development site cause an increase in peak runoff rates? Will the increase in runoff cause flooding or channel degradation downstream? Describe the strategy to control stormwater runoff.

_____ Calculations - Detailed calculations for the design of temporary sediment basins, permanent stormwater detention basins, diversions, channels, etc. Include calculations for pre- and post-development runoff.

Checklist (continued)

SITE PLAN

______ Vicinity map - A small map locating the site in relation to the surrounding area. Include any landmarks which might assist in locating the site.

______ Indicate north - The direction of north in relation to the site.

______ Limits of clearing and grading - Areas which are to be cleared and graded.

______ Existing contours - The existing contours of the site.

______ Final contours - Changes to the existing contours, including final drainage patterns.

______ Existing vegetation - The existing tree lines, grassed areas, or unique vegetation.

______ Soils - The boundaries of different soil types.

______ Existing drainage patterns - The dividing lines and the direction of flow for the different drainage areas. Include the size (acreage) of each drainage area.

______ Critical erosion areas - Areas with potentially serious erosion problems. (See Chapter 6 for criteria.)

______ Site Development - Show all improvements such as buildings, parking lots, access roads, utility construction, etc.

______ Location of practices - The locations of erosion and sediment controls and stormwater management practices used on the site. Use the standard symbols and abbreviations in Chapter 3 of this handbook.

______ Off-site areas - Identify any off-site land-disturbing activities (e.g., borrow sites, waste areas, etc.). Show location of erosion controls. (Is there sufficient information to assure adequate protection and stabilization?)

______ Detail drawings - Any structural practices used that are not referenced to the E&S handbook or local handbooks should be explained and illustrated with detail drawings.

______ Maintenance - A schedule of regular inspections and repair of erosion and sediment control structures should be set forth.

TABLE 6-1

GENERAL EROSION AND SEDIMENT CONTROL NOTES

ES-1: Unless otherwise indicated, all vegetative and structural erosion and sediment control practices will be constructed and maintained according to minimum standards and specifications of the Virginia Erosion and Sediment Control Handbook and Virginia Regulations **4VAC50-30** Erosion and Sediment Control Regulations.

ES-2: The plan approving authority must be notified one week prior to the pre-construction conference, one week prior to the commencement of land disturbing activity, and one week prior to the final inspection.

ES-3: All erosion and sediment control measures are to be placed prior to or as the first step in clearing.

ES-4: A copy of the approved erosion and sediment control plan shall be maintained on the site at all times.

ES-5: Prior to commencing land disturbing activities in areas other than indicated on these plans (including, but not limited to, off-site borrow or waste areas), the contractor shall submit a supplementary erosion control plan to the owner for review and approval by the plan approving authority.

ES-6: The contractor is responsible for installation of any additional erosion control measures necessary to prevent erosion and sedimentation as determined by the plan approving authority.

ES-7: All disturbed areas are to drain to approved sediment control measures at all times during land disturbing activities and during site development until final stabilization is achieved.

ES-8: During dewatering operations, water will be pumped into an approved filtering device.

ES-9: The contractor shall inspect all erosion control measures periodically and after each runoff-producing rainfall event. Any necessary repairs or cleanup to maintain the effectiveness of the erosion control devices shall be made immediately.

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.

CRITICAL EROSION AREAS

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.

EROSION AND SEDIMENT CONTROL MEASURES

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.

STRUCTURAL PRACTICES

1. Temporary Diversion Dike - 3.09 and Sediment Trap - 3.13
   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 ☐ mi^2 ☐ %	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 = $\boxed{64}$

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)		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 $\leq$ 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		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		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	Fig. 2-3	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 = $\boxed{83}$

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 ID			
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 ≤ 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 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 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 E&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
.	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. $\frac{\text{Length of Flow}}{\text{Effective Width}}$ $\frac{L}{We}$ = $\frac{200}{70}$

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.

APPENDIX 6A

SOILS INFORMATION

In many instances, a major soil-related problem is discovered after a site has been selected and construction is either well under way or in some cases completed. These problems often necessitate delays in construction and ultimately increase the total cost of the project. By consulting a soil survey during early in the planning process, designs can be prepared to address soil characteristics or alternate sites can be selected. Knowing the types of soil, the topography, and surface drainage patterns will prove very beneficial in planning and designing almost any type of land development project and is essential for erosion control planning.

Reference to soil maps and accompanying supportive data contained in soil surveys enables planners to determine the soil conditions in proposed construction areas. Soil surveys have proven to be of great savings in time and money, and their use has resulted in improved designs, more effective planning, and more accurate preliminary estimates of construction costs. In many cases, the survey will provide adequate information, but in other situations, it may only provide warnings or indications of soil-related problems likely to be encountered. In such cases, a more in-depth, on-site investigation may be needed.

Soil surveys are helpful in providing interpretations of the effect of soil properties on various land uses. This information can aid in determining soil suitability as a source of topsoil, fill for highway subgrade, or sand and gravel. The interpretations also show the degree of limitation of soils used for such purposes as: building foundations, highways, streets, roads, parking lots, pipelines, underground utility lines, and septic tank absorption fields.

Soil surveys describe soil properties that become important in erosion and sediment control planning for construction sites. These properties include the following:

<u>Erodibility</u> - The major soil consideration from an erosion and sediment control standpoint is its erodibility. An erodibility factor (K) indicates the susceptibility of different soils to the forces of erosion. A soil survey report includes the K factor for each soil found in the survey area. These K factors are used in the Universal Soil Loss Equation to determine soil loss from an area over a period of time due to splash, sheet, and rill erosion. K factors in Virginia range from about .10 (lowest erodibility) to about .50 (highest erodibility). K factors can be grouped into three general ranges:

0.23 and lower	-	low erodibility
0.23 to 0.36	-	moderate erodibility
0.36 and up	-	high erodibility

Cohesiveness of soil particles varies with different layers of the same soil, causing varying degrees of erodibility at different depths. Therefore, depth of excavation must be considered in determining soil erodibility on a construction site.

Table 6-1 lists the majority of currently known soil types in Virginia along with their corresponding erodibility factors at various depths.

Slope - Slope ranges are recorded in soil surveys. Cut and fill slopes can be identified by studying soil maps. The erosion potential increases as the slope becomes longer and steeper.

Soil Permeability - Permeability is one of the major factors influencing erosion. Soil permeability is a charactistic of the soil that enables it to transmit water or air. Deep, permeable soils are less erodible simply because more of the rainfall soaks in, reducing surface runoff. Permeability also varies with different layers and must be considered when excavating.

Hydrologic Soil Group - The hydrologic soil group is a direct reflection of the infiltration rate of the soil. The hydrologic soil groups, based on the infiltration and transmission rates of the soil, are:

A. (Low runoff potential) Soils having high infiltration rates even when thoroughly wetted.

B. Soils having moderate infiltration rates when thoroughly wetted.

C. Soils having slow infiltration rates when thoroughly wetted.

D. (High runoff potential) Soils having very slow infiltration rates when thoroughly wetted.

Texture - Soil texture refers specifically to the proportions of clay, silt, and sand below 2 millimeters in diameter contained in a mass of soil. Plate 6-5 shows the percentages of clay, silt, and sand in the basic soil textural classes.

Soil texture is a primary factor affecting soil erodibility and is reflected in the erodibility factor (K). Erodibility tends to increase with greater silt and very fine sand content. Soils with high clay content are generally more resistant to detachment, but once detached, the clay particles are easily transported.

Shrink-Swell Potential - Certain soils have clays that shrink when dry and swell when wet. In this situation, special foundations are required to allow for this variation. By consulting the soil survey, soils with these problems can be identified and the necessary precautions can be taken.

Flood Hazard - Although soil survey information does not take the place of hydrologic studies, it does provide estimates of where floods are most likely to occur. The hazards of flooding and ponding are rated in soil surveys, and flood-prone areas are shown on soil maps.

Soil Reaction (pH) - Soil survey information includes the pH of the individual layers of each soil. This factor becomes very helpful when planning the establishment of vegetation on a construction site.

Wetness - Data indicating natural soil drainage, depth to seasonal water table, and suitability for winter grading for various kinds of soils are available in soil surveys. With this information such things as seasonal limitations on the use of heavy earth-moving machinery and the hazard estimation of flooding or damage to underground structures due to soil wetness can be determined.

Depth to Bedrock - Soil surveys indicate the type of bedrock and the areas where bedrock will be encountered at a depth of less than 5 to 6 feet. This factor becomes very helpful in determining time and cost of excavation.

APPENDIX 6B

SOIL SURVEY INFORMATION

Soil surveys in Virginia are conducted as a joint effort by the USDA-Soil Conservation Service, VPI & SU Agronomy Department, and the Virginia Division of Soil and Water Conservation. Additional soils information may be obtained by contacting the local representative of any of these agencies in your area.

The following report details the status of soil surveys in Virginia.

VIRGINIA COOPERATIVE SOIL SURVEY PROGRESS REPORT through March 31, 1992

Published Modern Soil Surveys (year of publication shown):

Total 55

1985 Albemarle
1979 Augusta
1989 Bedford
1977 Campbell and City of Lynchburg
1967 Carroll
1974 Charlotte
1959 Chesapeake (Norfolk County)
1979 Chesterfield
1982 Clarke
1952 Culpeper
1989 Essex
1963 Fairfax
1956 Fauquier
1958 Fluvanna
1987 Frederick
1985 Giles
1980 Gloucester
1980 Goochland
1986 Greene
1989 Greensville
1980 Hanover
1975 Henrico
1986 Isle of Wight
1985 James City
1974 King George
1963 Lancaster
1960 Loudoun
1976 Louisa
1981 Lunenburg
1975 Madison
1962 Mathews
1956 Mecklenburg
1985 Middlesex
1985 Montgomery
1990 New Kent
1990 Northampton
1963 Northumberland
1960 Nottoway
1961 Orange
1988 Powhatan
1958 Prince Edward
1985 Prince George
1990 Prince William
1985 Pulaski
1961 Rappahannock
1982 Richmond
1982 Rockingham
1991 Shenandoah
1985 Spotsylvania
1974 Stafford
1981 Suffolk
1985 Virginia Beach
1984 Warren
1981 Westmoreland
1985 York

Modern Soil Surveys Completed but not Published (year field work completed):

1988 Accomack
1990 Amelia
1990 Appomattox
1988 Botetourt
1988 Charles City
1988 Dinwiddie
1990 King and Queen
1989 King William
1989 Nelson
1989 Roanoke
1989 Rockbridge
1988 Pittsylvania
1991 Smyth
1988 Wythe

Progressive Surveys Underway:

County	Size Acres	Acres Mapped	Approximate % Completed as of 3/31/92	Other Comments
Alleghany	290,300	125,629	43%	
Amherst	306,300	166,880	54%	
Bath	344,100	127,486	37%	
Brunswick	364,400	98,069	30%	
Buckingham	373,600	56,064	15%	
Caroline	345,300	143,824	42%	
Cumberland	192,400	39,824	21%	
Floyd	244,000	103,926	43%	
Franklin	455,300	153,585	34%	
Grayson	252,900	32,700	13%	
Halifax	530,800	243,755	46%	
Henry	252,700	218,517	86%	
Lee	260,600	-	%	Preliminary
Page	202,400	202,400	100%	
Patrick	311,100	177,704	57%	
Southampton	390,800	256,375	66%	
Surry	198,500	151,392	76%	
Sussex	315,600	92,298	29%	
Tazewell	325,100	153,328	47%	
Tidewater	243,400	54,720	22%	6 Cities
Washington	349,000	335,627	96%	
Jefferson Nat'l Forest:				
South -	385,095	202,647	53%	
North -	306,684	301,479	98%	
Total state:	**26,090,600**	**20,171,650**	**77%**	**5,918,950**

Note: Mapping in progressive survey areas was 235,910 acres from January 1, 1992 through March 31, 1992.

Requests: Total 2

Requests with Priorities: Total 2

Russell
Scott

Remaining Counties without Soil Surveys: Total 6

Bland
Buchanan
Craig
Dickenson
Highland
Wise

Prepared by: Department of Conservation and Recreation
Division of Soil and Water Conservation
203 Governor Street, Suite 206
Richmond, Virginia 23219-2094
Telephone (804)786-2064

APPENDIX 6C

LISTING OF SOIL TYPES IN VIRGINIA

The majority of soils currently found in Virginia along with their corresponding Hydrologic Soil Group designation are listed on the following pages.

The following key explains some of the abbreviations found the on attached soils list. For abbreviations not listed here, consult your local soil survey.

CL	- clay loam	LS	- loamy sand
FS	- fine sand	SICL	- silt clay loam
FSL	- fine sandy loam	SIL	- silt loam
L	- loam	SL	- sandy loam
LFS	- loamy fine sand	VFSL	- very fine sandy loam

WTDEPL and WTDEPH refer to range of depths to the surface of the groundwater.

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
ABELL	FSL	B	0.28	2.00	3.50
ABELL	L	B	0.32	2.00	3.50
ABELL	SIL	B	0.32	2.00	3.50
ABELL	SL	B	0.28	2.00	3.50
ABELL VARIANT	L	B	0.32	2.00	3.50
ACKWATER	SICL	D	0.37	1.50	3.00
ACKWATER	SIL	D	0.43	1.50	3.00
ACREDALE	SIL	D	0.37	0.00	1.00
ADEN	SIL	C	0.43	0.00	1.00
AIRMONT	FLV-L	C	0.10	1.50	3.00
ALAGA	FS	A	0.10	6.00	6.00
ALAGA	LS	A	0.10	4.00	6.00
ALAGA	LS	A	0.10	6.00	6.00
ALAGA	S	A	0.10	6.00	6.00
ALBANO	SIL	D	0.37	0.00	1.50
ALBEMARLE	FSL	B	0.20	6.00	6.00
ALBEMARLE	L	B	0.32	6.00	6.00
ALBEMARLE	STV-FSL	B	0.20	6.00	6.00
ALDERFLATS	SIL	D	0.43	0.00	1.00
ALDIE	SIL	D	0.37	1.50	2.50
ALDINO	SIL	C	0.43	1.50	2.50
ALLEGHENY	CB-FSL	B	0.20	6.00	6.00
ALLEGHENY	CB-L	B	0.20	6.00	6.00
ALLEGHENY	FSL	B	0.28	6.00	6.00
ALLEGHENY	L	B	0.32	6.00	6.00
ALLEGHENY	SIL	B	0.32	6.00	6.00
ALONZVILLE	CB-L	B	0.20	6.00	6.00
ALONZVILLE	CB-L	B	0.32	6.00	6.00
ALONZVILLE	FSL	B	0.20	6.00	6.00
ALONZVILLE	L	B	0.32	6.00	6.00
ALTAVISTA	FSL	C	0.24	1.50	2.50
ALTAVISTA	FSL	C	0.37	1.00	2.50
ALTAVISTA	L	C	0.24	1.50	2.50
ALTAVISTA	LS	C	0.17	1.50	2.50
ALTAVISTA	SIL	C	0.32	1.50	2.50
ALTAVISTA	SIL	C	0.37	1.00	2.50
ALTAVISTA	SL	C	0.24	1.50	2.50
ALTAVISTA VARIANT	L	C	0.24	1.50	2.50
ALTICREST	FSL	B	0.24	6.00	6.00
ALTICREST	RB-FSL	B	0.24	6.00	6.00
ALTICREST	SL	B	0.24	6.00	6.00
ANGIE	L	D	0.32	3.00	5.00
ANGIE VARIANT	L	D	0.32	3.00	5.00
APPLING	CL	B	0.24	6.00	6.00
APPLING	CL	B	0.28	6.00	6.00
APPLING	FSL	B	0.24	6.00	6.00
APPLING	GR-COSL	B	0.15	6.00	6.00
APPLING	GR-FSL	B	0.24	6.00	6.00
APPLING	GR-SL	B	0.15	6.00	6.00
APPLING	L	B	0.32	6.00	6.00
APPLING	SCL	B	0.28	6.00	6.00
APPLING	SL	B	0.24	6.00	6.00
APPLING	SL	B	0.28	6.00	6.00
APPLING	VFSL	B	0.24	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
APPLING FINE SANDY L	FSL	B	0.24	6.00	6.00
APPLING GRITTY	GR-SL	B	0.15	6.00	6.00
APPOMATTOX	FSL	B	0.20	4.00	4.00
APPOMATTOX	SL	B	0.20	4.00	4.00
AQUENTS	L	D	0.32	0.00	1.00
AQUULTS	FSL	D	0.28	0.00	1.00
ARAPAHOE	MK-L	B/D	0.15	0.00	1.00
ARCOLA	GR-SIL	C	0.24	6.00	6.00
ARCOLA	SIL	C	0.37	6.00	6.00
ARGENT	SIL	D	0.32	0.00	1.00
ASHBURN*	SIL	C	0.43	1.50	3.00
ASHE	L	B	0.24	6.00	6.00
ASHE	SL	B	0.24	6.00	6.00
ASHE	STV-L	B	0.15	6.00	6.00
ASHE	STV-SL	B	0.15	6.00	6.00
ASHLAR	FSL	B	0.24	6.00	6.00
ASHLAR	GR-SL	B	0.24	6.00	6.00
ASHLAR	LCOS	B	0.20	6.00	6.00
ASHLAR	SL	B	0.24	6.00	6.00
ASHLAR FINE SANDY LO	FSL	B	0.24	6.00	6.00
ASSATEAGUE	FS	A	0.10	6.00	6.00
ASSATEAGUE	S	A	0.10	6.00	6.00
ATKINS	FSL	D	0.28	0.00	1.00
ATKINS	L	D	0.28	0.00	1.00
ATKINS	SIL	D	0.32	0.00	1.00
ATLEE	L	C	0.37	1.50	2.50
ATLEE	SIL	C	0.37	1.50	2.50
ATLEE	VFSL	C	0.37	1.50	2.50
AUGUSTA	FSL	C	0.20	1.00	2.00
AUGUSTA	L	C	0.24	1.00	2.00
AUGUSTA	SIL	C	0.24	1.00	2.00
AUGUSTA	SIL	C	0.43	0.00	1.00
AUGUSTA	SL	C	0.20	1.00	2.00
AUGUSTA VARIANT	SIL	C	0.24	1.00	2.00
AURA	GR-SL	B	0.37	6.00	6.00
AUSTINVILLE	CL	B	4.20	6.00	6.00
AUSTINVILLE	SICL	B	4.20	6.00	6.00
AXIS	VFSL	D	0.24		
AYCOCK	SIL	B	0.37	4.00	6.00
BACKBAY	MPT	D			
BADIN	SIL	B	0.32	6.00	6.00
BAILE	L	D	0.43	0.00	0.50
BAILE	SIL	D	0.43	0.00	0.50
BAILE	ST-SIL	D	0.43	0.00	0.50
BAILEGAP	CB-FSL	B	0.17	6.00	6.00
BAILEGAP	FSL	B	0.24	6.00	6.00
BAILEGAP	FSL	B	0.28	3.00	3.00
BAILEGAP	SL	B	0.24	6.00	6.00
BAILEGAP	STV-FSL	B	0.28	6.00	6.00
BAILEGAP	STV-FSL	B	0.32	6.00	6.00
BAILEGAP	STV-L	B	0.28	6.00	6.00
BAILEGAP	STX-L	B	0.15	6.00	6.00
BAMA	L	B	0.24	6.00	6.00
BAMA	SL	B	0.24	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
BAYBORO	L	D	0.17	0.00	1.00
BAYBORO	MK-L	D	0.10	0.00	1.00
BEACHES	S	D	0.05	0.00	6.00
BECKHAM	CL	B	0.20	6.00	6.00
BELHAVEN	MUCK	D		0.00	1.00
BELTSVILLE	L	C	0.32	1.00	2.50
BELTSVILLE	L	C	0.43	1.50	2.50
BELTSVILLE	SIL	C	0.43	1.50	2.50
BELTSVILLE	SL	C	0.15	1.00	2.50
BELVOIR	L	C	0.37	1.00	2.00
BELVOIR	SL	C	0.37	1.00	2.00
BERKS	CN-L	C	0.17	6.00	6.00
BERKS	CN-SIL	C	0.17	6.00	6.00
BERKS	CNV-SIL	C	0.17	6.00	6.00
BERKS	SIL	C	0.24	6.00	6.00
BERKS	STV-L	C	0.17	6.00	6.00
BERKS	STV-SIL	C	0.17	6.00	6.00
BERKS VARIANT	CN-SIL	D	0.32	0.00	0.50
BERMUDIAN	SIL	B	0.37	3.00	6.00
BERTIE	FSL	B	0.20	1.50	2.50
BERTIE	VFSL	B	0.17	1.50	2.50
BERTIE VARIANT	FSL	B	0.20	1.50	2.50
BETHERA	SIL	D	0.28		
BIBB	FSL	D	0.20	0.50	1.50
BIBB	L	D	0.28	0.50	1.50
BIBB	LS	D	0.15	0.50	1.50
BIBB	SL	D	0.20	0.50	1.50
BILTMORE	FSL	A	0.15	3.50	6.00
BILTMORE	LS	A	0.10	3.50	6.00
BIRDSBORO	L	B	0.37	2.00	6.00
BIRDSBORO	SIL	B	0.37	2.00	6.00
BIRDSBORO*	L	C	0.37	6.00	6.00
BLADEN	L	D	0.37	0.00	1.00
BLADEN	SIL	D	0.37	0.00	1.00
BLAIRTON	SIL	C	0.43	0.50	3.00
BLAND	SICL	C	0.43	6.00	6.00
BLEAKHILL	FSL	C	0.28	1.50	3.00
BLUEMONT*	CB-SIL	B	0.24	6.00	6.00
BOHICKET	MK-SICL	D	0.28		
BOHICKET	MUCK	D	0.28		
BOHICKET	SICL	D	0.28		
BOJAC	FSL	B	0.24	4.00	6.00
BOJAC	FSL	C	0.28	3.00	4.50
BOJAC	GR-LS	B	0.15	4.00	6.00
BOJAC	GR-LS	B	0.24	4.00	6.00
BOJAC	LFS	B	0.17	4.00	6.00
BOJAC	LS	B	0.17	4.00	6.00
BOJAC	SL	B	0.24	4.00	6.00
BOLLING	FSL	C	0.28	1.50	2.50
BOLLING	L	C	0.28	1.50	2.50
BOLLING	SIL	C	0.28	1.50	2.50
BOLLING VARIANT	GR-SL	C	0.20	2.00	3.00
BOLTON	FSL	B	0.28	6.00	6.00
BOLTON	L	B	0.37	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
BOLTON	STV-FSL	B	0.28	6.00	6.00
BOLTON VARIANT	STV-FSL	B	0.28	6.00	6.00
BONNEAU	LS	A	0.15	3.50	5.00
BOOKWOOD	SIL	B	0.32	6.00	6.00
BOTETOURT	L	C	0.32	1.50	2.50
BOTETOURT	SIL	C	0.32	1.50	2.50
BOURNE	FSL	C	0.28	1.50	2.50
BOURNE	L	C	0.37	1.50	2.50
BOURNE	SL	C	0.28	1.50	2.50
BOURNE VARIANT	FSL	C	0.28	1.50	2.50
BOWMANSVILLE	SIL	B/D	0.32	0.00	1.50
BRADDOCK	CB-CL	B	0.24	6.00	6.00
BRADDOCK	CB-FSL	B	0.10	6.00	6.00
BRADDOCK	CB-FSL	B	0.24	6.00	6.00
BRADDOCK	CB-L	B	0.24	6.00	6.00
BRADDOCK	CL	B	0.32	6.00	6.00
BRADDOCK	FSL	B	0.32	6.00	6.00
BRADDOCK	GR-L	B	0.24	6.00	6.00
BRADDOCK	L	B	0.32	6.00	6.00
BRADDOCK	SL	B	0.32	6.00	6.00
BRADDOCK	ST-L	B	0.28	6.00	6.00
BRADDOCK	STV-FSL	B	0.24	6.00	6.00
BRADDOCK	STV-L	B	0.24	6.00	6.00
BRADLEY	FSL	C	0.32	6.00	6.00
BRANDYWINE	GRF-L	C	0.24	6.00	6.00
BRANDYWINE	L	A	0.24	6.00	6.00
BRANDYWINE	L	C	0.24	6.00	6.00
BRANDYWINE	SIL	C	0.24	6.00	6.00
BRANDYWINE	SL	A	0.24	6.00	6.00
BRANDYWINE	ST-L	C	0.24	6.00	6.00
BRANDYWINE GRITTY	GR-L	C	0.20	6.00	6.00
BRECKNOCK	L	B	0.32	6.00	6.00
BRECKNOCK	SIL	B	0.32	6.00	6.00
BREMO	L	C	0.28	6.00	6.00
BREMO	SIL	C	0.28	6.00	6.00
BRENTSVILLE	L	C	0.32	6.00	6.00
BRENTSVILLE	SL	C	0.28	6.00	6.00
BROADWAY	SIL	B	0.28	6.00	6.00
BROCKROAD	L	C	0.32	6.00	6.00
BROCKROAD	SIL	C	0.32	6.00	6.00
BRUSHY	CN-L	B	0.17	6.00	6.00
BRUSHY	CR-L	B	0.17	6.00	6.00
BRUSHY	GR-L	B	0.20	6.00	6.00
BRUSHY	GRV-SIL	B	0.17	6.00	6.00
BRUSHY	GRV-SIL	C	0.20	6.00	6.00
BRUSHY	GRX-L	B	0.17	6.00	6.00
BRUSHY	GRX-L	B	0.20	6.00	6.00
BRUSHY	GRX-SIL	B	0.20	6.00	6.00
BUCHANAN	CB-FSL	C	0.24	0.50	3.00
BUCHANAN	FSL	C	0.32	0.50	3.00
BUCHANAN	L	C	0.32	0.50	3.00
BUCHANAN	SIL	C	0.32	0.50	3.00
BUCHANAN	STV-FSL	C	0.20	0.50	3.00
BUCHANAN	STV-SL	C	0.20	0.50	3.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
BUCHANAN	STX-FSL	C	0.24	0.50	3.00
BUCKHALL	L	B	0.32	6.00	6.00
BUCKHALL	SL	B	0.28	6.00	6.00
BUCKS	L	B	0.32	6.00	6.00
BUCKS	SICL	B	0.32	6.00	6.00
BUCKS	SIL	B	0.32	6.00	6.00
BUCKS	SIL	B	0.37	6.00	6.00
BUCKS	SIL	C	0.37	6.00	6.00
BUCKTON	L	B	0.37	6.00	6.00
BUCKTON	SICL	B	0.37	6.00	6.00
BUCKTON	SIL	B	0.37	6.00	6.00
BUFFSTAT	GR-L	B	0.24	6.00	6.00
BUFFSTAT	SIL	C	0.37	6.00	6.00
BUGLEY	CN-SIL	C/D	0.20	6.00	6.00
BUNCOMBE	LFS	A	0.10	6.00	6.00
BUNCOMBE	LS	A	0.10	6.00	6.00
BURKETOWN	FSL	C	0.28	2.00	3.50
BURROWSVILLE	LS	C	0.32	1.50	3.00
BURROWSVILLE	SL	C	0.32	1.50	3.00
CALVERTON	L	C	0.43	1.00	2.00
CALVERTON	SIL	C	0.43	1.00	2.00
CALVIN	CB-L	C	0.20	6.00	6.00
CALVIN	CN-SIL	C	0.20	6.00	6.00
CALVIN	SIL	C	0.24	6.00	6.00
CALVIN	STV-L	C	0.15	6.00	6.00
CALVIN	STV-SIL	C	0.15	6.00	6.00
CAMOCCA	FS	A/D	0.10	0.00	1.00
CANEYVILLE	SIL	C	0.43	6.00	6.00
CARBO	SICL	C	0.37	6.00	6.00
CARBO	SIL	C	0.37	6.00	6.00
CARDIFF	SY-L	B	0.28	6.00	6.00
CAROLINE	CL	C	0.43	3.50	5.00
CAROLINE	CL	C	0.43	6.00	6.00
CAROLINE	FSL	C	0.43	3.50	5.00
CAROLINE	FSL	C	0.43	6.00	6.00
CAROLINE	L	C	0.43	6.00	6.00
CAROLINE	SIL	C	0.43	3.50	5.00
CAROLINE	SL	C	0.43	6.00	6.00
CAROLINE	VFSL	C	0.43	3.50	5.00
CARRVALE	SIL	D	0.32	1.00	2.00
CARTECAY	FSL	C	0.24	0.50	1.50
CARTECAY	SL	C	0.24	0.50	1.50
CATASKA	CN-SIL	D	0.20	6.00	6.00
CATASKA	STV-L	D	0.15	6.00	6.00
CATASKA	STV-SIL	D	0.15	6.00	6.00
CATASKA	SY-SIL	D	0.20	6.00	6.00
CATHARPIN	SIL	C	0.32	6.00	6.00
CATLETT	GR-SIL	C/D	0.20	6.00	6.00
CATLETT	SIL	C/D	0.32	6.00	6.00
CATOCTIN	CB-SIL	C	0.17	6.00	6.00
CATOCTIN	SIL	C	0.32	6.00	6.00
CATOCTIN	ST-SIL	C	0.17	6.00	6.00
CATOCTIN	STV-L	C	0.32	6.00	6.00
CATOCTIN	STV-SIL	C	0.32	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
CATOCTIN	STX-SIL	C	0.20	6.00	6.00
CATPOINT	FS	A	0.10	4.00	6.00
CATPOINT	LS	A	0.10	4.00	6.00
CAVERNS	SL	B	0.20	6.00	6.00
CECIL	CB-FSL	B	0.28	6.00	6.00
CECIL	CL	B	0.24	6.00	6.00
CECIL	CL	B	0.28	6.00	6.00
CECIL	FSL	B	0.20	6.00	6.00
CECIL	FSL	B	0.28	6.00	6.00
CECIL	GR-FSL	B	0.15	6.00	6.00
CECIL	GR-SL	B	0.15	6.00	6.00
CECIL	GRF-SL	B	0.28	6.00	6.00
CECIL	L	B	0.28	6.00	6.00
CECIL	SCL	B	0.28	6.00	6.00
CECIL	SL	B	0.28	6.00	6.00
CECIL	VFSL	B	0.28	6.00	6.00
CHAGRIN	FSL	B	0.32	4.00	6.00
CHAGRIN	L	B	0.32	4.00	6.00
CHAGRIN	SIL	B	0.32	4.00	6.00
CHAGRIN VARIANT	LS	A	0.10	6.00	6.00
CHAPANOKE	SIL	C	0.43	0.50	1.50
CHASTAIN	L	D	0.32	0.00	1.00
CHASTAIN	SICL	D	0.32	0.00	1.00
CHASTAIN	SIL	D	0.32	0.00	1.00
CHATUGE	L	D	0.32	1.00	2.00
CHATUGE	SL	D	0.32	1.00	2.00
CHAVIES	FSL	B	0.24	6.00	6.00
CHAVIES	SL	B	0.24	6.00	6.00
CHAVIES VARIANT	SL	B	0.24	3.50	3.50
CHENNEBY	L	C	0.37	1.00	2.50
CHENNEBY	SIL	C	0.37	1.00	2.50
CHESTER	CB-L	B	0.32	6.00	6.00
CHESTER	CN-L	B	0.28	6.00	6.00
CHESTER	L	B	0.32	6.00	6.00
CHESTER	SIL	B	0.32	6.00	6.00
CHESTER	SL	B	0.32	6.00	6.00
CHESTER	STV-L	B	0.24	5.00	5.00
CHESTER	STV-L	B	0.32	5.00	5.00
CHESTER LOAM	L	B	0.32	6.00	6.00
CHEWACLA	FSL	C	0.24	0.50	1.50
CHEWACLA	L	C	0.28	0.50	1.50
CHEWACLA	L	C	0.49	1.00	2.00
CHEWACLA	SIL	C	0.28	0.50	1.50
CHEWACLA	SIL	C	0.49	1.00	2.00
CHICKAHOMINY	L	D	0.37		
CHICKAHOMINY	L	D	0.37	0.00	0.50
CHICKAHOMINY	SIL	D	0.37	0.00	0.50
CHILHOWIE	C	C	0.37	6.00	6.00
CHILHOWIE	CN-SICL	C	0.20	6.00	6.00
CHILHOWIE	CN-SICL	C	0.37	6.00	6.00
CHILHOWIE	SIC	C	0.37	6.00	6.00
CHILHOWIE	SICL	C	0.37	6.00	6.00
CHINCOTEAGUE	SIL	D	0.32		
CHIPLEY	S	C	0.10	2.00	3.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
CHISWELL	CN-SIL	D	0.24	6.00	6.00
CHISWELL	CNV-SIL	D	0.20	6.00	6.00
CHISWELL	SIL	D	0.37	6.00	6.00
CHRISTIAN	FSL	C	0.37	6.00	6.00
CHRISTIAN	GR-SIL	C	0.20	6.00	6.00
CHRISTIAN	GRV-SIL	C	0.20	6.00	6.00
CHRISTIAN	SICL	C	0.37	6.00	6.00
CHRISTIAN	SIL	C	0.37	6.00	6.00
CID	L	C	0.37	1.50	2.50
CLAPHAM*	SIL	C	0.43	2.00	3.00
CLEARBROOK	CN-SIL	D	0.32	0.00	0.50
CLIFTON	ST-L	C	0.17	6.00	6.00
CLUBCAF	SIL	D	0.28	0.00	1.50
CLYMER	CN-L	B	0.20	6.00	6.00
CLYMER	FSL	B	0.24	6.00	6.00
CLYMER	L	B	0.24	6.00	6.00
CLYMER	RB-FSL	B	0.10	6.00	6.00
CLYMER	RB-SL	B	0.10	6.00	6.00
CLYMER	RB-SL	B	0.17	6.00	6.00
CLYMER	SL	B	0.24	6.00	6.00
CLYMER	STV-FSL	B	0.17	6.00	6.00
CLYMER	STV-SL	B	0.17	6.00	6.00
CLYMER VARIANT	RB-SL	B	0.10	6.00	6.00
CLYMER VARIANT	STV-SL	B	0.17	6.00	6.00
COASTAL BEACH		D	0.05	0.00	6.00
CODORUS	FSL	C	0.49	1.00	2.00
CODORUS	L	C	0.49	1.00	2.00
CODORUS	SIL	C	0.49	1.00	2.00
CODORUS VARIANT	L	C	0.49	1.00	2.00
COLFAX	FSL	C	0.17	0.50	1.50
COLFAX	FSL	C	0.28	0.50	1.50
COLFAX	L	C	0.32	0.50	1.50
COLFAX	SL	C	0.17	0.50	1.50
COLFAX VARIANT	FSL	C	0.17	0.50	1.50
COLLEEN	GR-L	C	0.24	6.00	6.00
COLLEEN	L	C	0.20	6.00	6.00
COLVARD	FSL	B	0.15	4.00	6.00
COMBS	FSL	B	0.24	6.00	6.00
COMBS	FSL	B	0.28	6.00	6.00
COMBS	L	B	0.28	6.00	6.00
COMBS	SL	B	0.24	6.00	6.00
COMUS	FSL	B	0.43	6.00	6.00
COMUS	L	B	0.43	6.00	6.00
COMUS	SIL	B	0.43	6.00	6.00
CONETOE	LFS	A	0.15	6.00	6.00
CONETOE	LS	A	0.15	6.00	6.00
CONGAREE	FSL	B	0.24	2.50	4.00
CONGAREE	FSL	B	0.43	6.00	6.00
CONGAREE	L	B	0.37	2.50	4.00
CONGAREE	SIL	B	0.37	2.50	4.00
CONGAREE	SIL	B	0.43	6.00	6.00
COOSAW	LS	B	0.10	2.00	3.00
COROLLA	FS	D	0.10	1.50	3.00
CORYDON	SICL	D	0.32	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
COTACO	CB-FSL	C	0.24	1.50	2.50
COTACO	FSL	C	0.37	1.50	2.50
COTACO	L	C	0.37	1.50	2.50
COTACO	SIL	C	0.37	1.50	2.50
COTACO VARIANT	CB-L	C	0.24	2.00	3.00
COTACO VARIANT	SIL	C	0.43	2.00	3.00
COURSEY	L	C	0.32	2.00	3.00
COWEE	CH-L	B	0.20	6.00	6.00
COXVILLE	FSL	D	0.24	0.00	1.50
COXVILLE	L	D	0.24	0.00	1.50
CRAIGSVILLE	CB-FSL	B	0.28	6.00	6.00
CRAIGSVILLE	CB-SL	B	0.20	6.00	6.00
CRAIGSVILLE	CB-SL	B	0.28	6.00	6.00
CRAIGSVILLE	CBV-L	B	0.10	6.00	6.00
CRAIGSVILLE	GR-FSL	B	0.17	6.00	6.00
CRAIGSVILLE	L	B	0.28	6.00	6.00
CRAIGSVILLE	SL	B	0.17	6.00	6.00
CRAVEN	CL	C	0.37	2.00	3.00
CRAVEN	FSL	C	0.32	2.00	3.00
CRAVEN	L	C	0.32	2.00	3.00
CRAVEN	SCL	C	0.37	2.00	3.00
CRAVEN	SIL	C	0.32	2.00	3.00
CREEDMOOR	FSL	C	0.28	1.50	2.00
CREEDMOOR	GR-FSL	C	0.28	1.50	2.00
CREEDMOOR	GRV-SL	C	0.28	1.50	2.00
CREEDMOOR	L	C	0.28	1.50	2.00
CREEDMOOR	SL	C	0.28	1.50	2.00
CREEDMOOR VARIANT	FSL	C	0.37	0.50	1.50
CREEDMORE	FSL	C	0.28	1.50	2.00
CROTON	SIL	D	0.37	0.00	1.50
CROTON	SIL	D	0.43	0.00	0.50
CULLEN	CL	C	0.24	6.00	6.00
CULLEN	L	C	0.37	6.00	6.00
CULPEPER	CL	C	0.37	6.00	6.00
CULPEPER	FSL	C	0.37	6.00	6.00
CULPEPER	L	C	0.37	6.00	6.00
DALEVILLE	L	D	0.32	0.00	1.00
DALEVILLE	SIL	D	0.32	0.00	1.00
DANDRIDGE	SH-SICL	D	0.17	6.00	6.00
DAVIDSON	C	B	0.28	6.00	6.00
DAVIDSON	CL	B	0.24	6.00	6.00
DAVIDSON	CL	B	0.28	6.00	6.00
DAVIDSON	CL	B	0.37	6.00	6.00
DAVIDSON	ST-CL	B	0.20	6.00	6.00
DAWHOO VARIANT	FSL		0.17		
DECATUR	CL	B	0.32	6.00	6.00
DEKALB	CB-FSL	C	0.17	6.00	6.00
DEKALB	CB-L	C	0.17	6.00	6.00
DEKALB	CB-SL	C	0.17	6.00	6.00
DEKALB	CN-FSL	C	0.17	6.00	6.00
DEKALB	CN-L	C	0.17	6.00	6.00
DEKALB	CN-SL	C	0.17	6.00	6.00
DEKALB	FSL	C	0.24	6.00	6.00
DEKALB	RB-FSL	C	0.17	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
DEKALB	SL	C	0.24	6.00	6.00
DEKALB	ST-FSL	C	0.17	6.00	6.00
DEKALB	STV-FSL	C	0.17	6.00	6.00
DEKALB	STV-L	C	0.17	6.00	6.00
DEKALB	STV-SL	C	0.17	6.00	6.00
DEKALB	STX-FSL	C	0.17	6.00	6.00
DEKALB	STX-SL	C	0.17	6.00	6.00
DELANCO	FSL	C	0.37	1.00	2.50
DELANCO	L	C	0.37	1.00	2.50
DELANCO	SIL	C	0.37	1.00	2.50
DELOSS	MK-L	B/D	0.15		
DERROC	CB-FSL	B	0.17	6.00	6.00
DERROC	CB-L	B	0.17	6.00	6.00
DERROC	CB-SL	B	0.17	6.00	6.00
DERROC	CBV-L	B	0.17	6.00	6.00
DERROC	CBV-SL	B	0.17	6.00	6.00
DILLARD	L	C	0.32	2.00	3.00
DOGUE	FSL	C	0.28	1.50	3.00
DOGUE	L	C	0.37	1.50	3.00
DOGUE	SIL	C	0.37	1.50	3.00
DOGUE	SL	C	0.28	1.50	3.00
DOGUE VARIANT	L	C	0.37	1.50	3.00
DOROVAN	MPT	D			
DOTHAN	LS	B	0.15	3.00	5.00
DRAGSTON	FSL	C	0.20	1.00	2.50
DRAGSTON	LFS	C	0.17	1.00	2.50
DRAGSTON	SL	C	0.20	1.00	2.50
DRALL	CN-SL	B	0.17	6.00	6.00
DRALL	STV-LS	B	0.17	6.00	6.00
DRALL	STX-SL	B	0.17	6.00	6.00
DRYPOND	CN-L	D	0.17	6.00	6.00
DRYPOND	CN-SL	D	0.17	6.00	6.00
DRYPOND	GR-SL	D	0.17	6.00	6.00
DRYPOND	GRV-SL	D	0.15	6.00	6.00
DRYPOND	RB-SL	D	0.17	6.00	6.00
DRYPOND	SL	D	0.17	6.00	6.00
DUCKSTON	FS	A/D	0.10	0.00	1.00
DUFFIELD	SIL	B	0.32	6.00	6.00
DULLES	SIL	D	0.43	1.00	2.50
DUMFRIES	SL	B	0.28	6.00	6.00
DUMPS				6.00	6.00
DUMPS	VAR			6.00	6.00
DUMPS, MINES	VAR			6.00	6.00
DUNBAR	FSL	D	0.32	1.00	2.50
DUNNING	SICL	D	0.32	0.00	0.50
DUPLIN	CL	C	0.24	2.00	3.00
DUPLIN	FSL	C	0.24	2.00	3.00
DUPLIN	SIL	C	0.24	2.00	3.00
DUPLIN	VFSL	C	0.24	2.00	3.00
DURHAM	FSL	B	0.24	6.00	6.00
DURHAM	FSL	C	0.28	0.50	1.50
DURHAM	LCOS	B	0.17	6.00	6.00
DURHAM	SL	B	0.24	6.00	6.00
DYKE	CL	B	0.37	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
DYKE	L	B	0.37	6.00	6.00
DYKE	SIL	B	0.37	6.00	6.00
EBBING	L	C	0.37	1.50	3.00
EDGEHILL	GRV-FSL	C	0.15	6.00	6.00
EDGEHILL	GRV-SL	C	0.15	6.00	6.00
EDGEHILL VARIANT	GRV-SL	B	0.24	6.00	6.00
EDGEMONT	CN-FSL	B	0.15	6.00	6.00
EDGEMONT	CN-SL	B	0.15	6.00	6.00
EDGEMONT	STV-SL	B	0.15	6.00	6.00
EDGEMONT	STX-SL	B	0.15	6.00	6.00
EDNEDYTOWN	L	B	0.20	6.00	6.00
EDNEYTOWN	L	B	0.15	6.00	6.00
EDNEYTOWN	L	B	0.20	6.00	6.00
EDNEYTOWN	STV-L	B	0.15	6.00	6.00
EDNEYTOWN	STX-L	B	0.10	6.00	6.00
EDNEYTOWN	STX-L	B	0.15	6.00	6.00
EDNEYVILLE	FSL	B	0.24	6.00	6.00
EDNEYVILLE	L	B	0.24	6.00	6.00
EDNEYVILLE	RB-SL	B	0.17	6.00	6.00
EDNEYVILLE	SL	B	0.17	6.00	6.00
EDNEYVILLE	SL	B	0.24	6.00	6.00
EDNEYVILLE	ST-FSL	B	0.17	6.00	6.00
EDNEYVILLE	STV-L	B	0.15	6.00	6.00
EDNEYVILLE	STV-L	B	0.17	6.00	6.00
EDNEYVILLE	STV-SL	B	0.15	6.00	6.00
EDNEYVILLE	STX-FSL	B	0.17	6.00	6.00
EDNEYVILLE	STX-L	B	0.17	6.00	6.00
EDNEYVILLE	STX-SL	B	0.17	6.00	6.00
EDOM	SH-SICL	C	0.28	6.00	6.00
EDOM	SICL	C	0.28	6.00	6.00
EDOM	SIL	C	0.28	6.00	6.00
ELBERT	L	D	0.37	0.00	1.00
ELBERT	SIL	D	0.43	0.00	1.00
ELBERT VARIANT	SIL	D	0.43	0.00	1.00
ELIOAK	CL	C	0.28	6.00	6.00
ELIOAK	FSL	C	0.32	6.00	6.00
ELIOAK	L	C	0.32	6.00	6.00
ELIOAK	SCL	C	0.32	6.00	6.00
ELIOAK	SICL	C	0.28	6.00	6.00
ELIOAK	SIL	C	0.32	6.00	6.00
ELIOAK	STV-SCL	C	0.32	6.00	6.00
ELIOK	CL	C	0.28	6.00	6.00
ELIOK	FSL	C	0.32	6.00	6.00
ELKTON	SIL	C/D	0.43		
ELLIBER	CRV-SIL	A	0.17	6.00	6.00
ELLIBER	CRV-SIL	A	0.24	6.00	6.00
ELLIBER	GR-L	A	0.24	6.00	6.00
ELSINBORO	L	B	0.37	5.00	5.00
ELSINBORO	SL	B	0.37	5.00	5.00
EMPORIA	FSL	C	0.28	3.00	4.50
EMPORIA	GR-FSL	C	0.28	3.00	4.50
EMPORIA	L	C	0.28	3.00	4.50
EMPORIA	LFS	C	0.28	3.00	4.50
EMPORIA	LS	C	0.28	3.00	4.50

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
EMPORIA	LS	C	0.43	6.00	6.00
EMPORIA	SL	C	0.28	3.00	4.50
ENDCAV	SICL	C	0.37	6.00	6.00
ENDCAV	SIL	C	0.37	6.00	6.00
ENON	CL	C	0.24	6.00	6.00
ENON	FSL	C	0.28	6.00	6.00
ENON	L	C	0.32	6.00	6.00
ENON	SL	C	0.28	6.00	6.00
ENOTT	FSL	C	0.20	6.00	6.00
ENOTT	L	C	0.32	6.00	6.00
ENOTT	SL	C	0.20	6.00	6.00
ERNEST	L	C	0.43	1.50	3.00
ERNEST	SIL	C	0.43	1.50	3.00
ERNEST	STV-L	C	0.32	1.50	3.00
EUBANKS	CL	B	0.32	6.00	6.00
EUBANKS	GRF-L	B	0.24	6.00	6.00
EUBANKS	L	B	0.32	6.00	6.00
EUBANKS	SIL	B	0.32	6.00	6.00
EUBANKS	ST-L	B	0.28	6.00	6.00
EUBANKS	ST-SIL	B	0.28	6.00	6.00
EULONIA	L	C	0.15	1.50	3.50
EULONIA	SL	C	0.24	1.50	3.50
EUNOLA	FSL	C	0.20	1.50	2.50
EUNOLA	L	C	0.20	1.50	2.50
EUNOLA	LFS	C	0.15	1.50	2.50
EUNOLA	SL	C	0.20	1.50	2.50
EVANSHAM	SICL	D	0.20	0.00	0.50
EVARD	FSL	B	0.24	6.00	6.00
EVARD	GRV-SL	B	0.24	6.00	6.00
EVARD	L	B	0.28	6.00	6.00
EVARD	SL	B	0.24	6.00	6.00
EVERGREEN	SIL	B	0.37	2.00	3.00
EXUM	SIL	C	0.37	2.00	3.00
FACEVILLE	FSL	B	0.28	6.00	6.00
FACEVILLE	GR-FSL	B	0.17	6.00	6.00
FACEVILLE	L	B	0.17	6.00	6.00
FACEVILLE	LS	B	0.17	6.00	6.00
FACEVILLE	SL	B	0.28	6.00	6.00
FAIRFAX	L	B	0.43	6.00	6.00
FAIRFAX	SIL	B	0.43	6.00	6.00
FALLSINGTON	FSL	B/D	0.24	0.00	1.00
FALLSINGTON	VFSL	B/D	0.24	0.00	1.00
FAUGUIER	SICL	C	0.32	6.00	6.00
FAUQUIER	L	C	0.32	6.00	6.00
FAUQUIER	SIC	C	0.32	6.00	6.00
FAUQUIER	SICL	C	0.32	6.00	6.00
FAUQUIER	SIL	C	0.32	6.00	6.00
FAUQUIER	ST-SIL	C	0.32	6.00	6.00
FAUQUIER	STV-L	C	0.28	6.00	6.00
FAUQUIER	STV-SIL	C	0.28	6.00	6.00
FAYWOOD	SICL	C	0.37	6.00	6.00
FAYWOOD	SIL	C	0.37	6.00	6.00
FEATHERSTONE	MK-SIL	D	0.49		
FISHERMAN	FS	D	0.10	1.50	3.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
FLATWOODS	SIL	C	0.28	1.50	3.00
FLETCHER	L	B	0.43	6.00	6.00
FLUVANNA	CL	C	0.37	6.00	6.00
FLUVANNA	FSL	C	0.37	6.00	6.00
FLUVANNA	L	C	0.37	6.00	6.00
FLUVANNA	SIL	C	0.37	6.00	6.00
FLUVANNA	STV-SIL	C	0.24	6.00	6.00
FLUVAQUENTS	FSL	D	0.37		
FLUVAQUENTS	SIL	C	0.28	0.50	1.50
FLUVAQUENTS	SIL	D	0.32	0.00	1.00
FORESTDALE	FSL	D	0.37	0.50	2.00
FORESTDALE	L	D	0.43	0.50	2.00
FORESTDALE	SICL	D	0.37	0.50	2.00
FORESTDALE	SIL	D	0.37	0.50	2.00
FORESTDALE	SIL	D	0.43	0.50	2.00
FORK	FSL	C	0.37	1.00	2.00
FORK VARIANT	SIL	C	0.43	1.00	2.00
FRANKSTOWN	CN-SIL	B	0.37	6.00	6.00
FREDERICK	GR-L	B	0.28	6.00	6.00
FREDERICK	GR-L	C	0.15	1.00	2.50
FREDERICK	GR-SIL	B	0.28	6.00	6.00
FREDERICK	GR-SL	B	0.28	6.00	6.00
FREDERICK	GRV-L	B	0.28	6.00	6.00
FREDERICK	GRV-SIL	B	0.28	6.00	6.00
FREDERICK	L	B	0.32	6.00	6.00
FREDERICK	SICL	B	0.32	6.00	6.00
FREDERICK	SIL	B	0.32	6.00	6.00
FREDERICK	STV-SIL	B	0.32	6.00	6.00
FRENCH	L	C	0.28	1.00	2.50
FRERDERICK	GR-L	B	0.28	6.00	6.00
FRIPP	S	A	0.10	6.00	6.00
GAILA	SL	B	0.28	6.00	6.00
GAINESBORO	SIL	C	0.32	6.00	6.00
GALESTOWN	LS	A	0.17	6.00	6.00
GEORGEVILLE	CL	B	0.49	6.00	6.00
GEORGEVILLE	FSL	B	0.43	6.00	6.00
GEORGEVILLE	L	B	0.43	6.00	6.00
GEORGEVILLE	SICL	B	0.49	6.00	6.00
GEORGEVILLE	SIL	B	0.49	6.00	6.00
GEORGEVILLE	VFSL	B	0.43	6.00	6.00
GILPIN	CN-L	C	0.24	6.00	6.00
GILPIN	CN-SIL	C	0.24	6.00	6.00
GILPIN	L	C	0.32	6.00	6.00
GILPIN	SIL	C	0.32	6.00	6.00
GILPIN	ST-SIL	C	0.24	6.00	6.00
GILPIN	STV-SIL	C	0.24	6.00	6.00
GLADEHILL	FSL	B	0.20	6.00	6.00
GLENELG	CB-L	B	0.32	6.00	6.00
GLENELG	CN-L	B	0.28	6.00	6.00
GLENELG	L	B	0.32	6.00	6.00
GLENELG	SIL	B	0.32	6.00	6.00
GLENELG	STV-L	C	0.43	1.50	2.50
GLENVILLE	L	C	0.32	0.50	3.00
GLENVILLE	SIL	C	0.32	0.50	3.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
GLENWOOD	CB-L	B	0.20	6.00	6.00
GLENWOOD VARIANT	RB-L	B	0.05	6.00	6.00
GOLDSBORO	FSL	B	0.20	2.00	3.00
GOLDSBORO	SL	B	0.20	2.00	3.00
GOLDSTON	CN-L	C	0.15	6.00	6.00
GOLDSTON	CN-SIL	C	0.15	6.00	6.00
GOLDSTON	CNV-SIL	C	0.05	6.00	6.00
GOLDSTON	SIL	C	0.15	6.00	6.00
GOLDVEIN	GRF-SIL	C	0.28	1.00	2.00
GOLDVEIN GRITTY	GRF-SIL	C	0.28	1.00	2.00
GORESVILLE*	GR-SIL	B	0.24	6.00	6.00
GREENLEE	STV-L	B	0.10	6.00	6.00
GRIMSLEY	CB-L	B	0.20	6.00	6.00
GRIMSLEY	CB-SL	B	0.20	6.00	6.00
GRIMSLEY	ST-L	B	0.20	6.00	6.00
GRIMSLEY	STX-L	B	0.20	6.00	6.00
GRITNEY	FSL	C	0.20	6.00	6.00
GRITNEY	GR-FSL	C	0.15	6.00	6.00
GROSECLOSE	GR-L	C	0.28	6.00	6.00
GROSECLOSE	GR-SIL	C	0.28	6.00	6.00
GROSECLOSE	L	C	0.43	6.00	6.00
GROSECLOSE	SICL	C	0.32	6.00	6.00
GROSECLOSE	SIL	C	0.43	6.00	6.00
GROVER	FSL	B	0.24	6.00	6.00
GROVER	SCL	B	0.28	6.00	6.00
GROVER	SL	B	0.24	6.00	6.00
GUERNSEY	SIL	C	0.43	1.50	3.00
GULLIED LAND	VAR			6.00	6.00
GULLION	L	C	0.32	1.50	3.00
GULLION	SIL	C	0.32	1.50	3.00
GUNSTOCK	CN-L	C	0.37	6.00	6.00
GUNSTOCK	SL	C	0.28	6.00	6.00
GUYAN	SIL	C	0.32	0.50	1.50
GWINNETT VARIANT	CL	B	0.28	6.00	6.00
HAGERSTOWN	SIL	C	0.32	6.00	6.00
HAGERSTWON	SIL	C	0.32	6.00	6.00
HALEWOOD	L	B	0.32	6.00	6.00
HALEWOOD	STV-FSL	C	0.24	6.00	6.00
HARTLETON	CN-L	B	0.20	6.00	6.00
HARTLETON	STV-L	B	0.15	6.00	6.00
HATBORO	L	D	0.49	0.00	0.50
HATBORO	SIL	D	0.49	0.00	0.50
HAWKSBILL	CB-L	B	0.17	6.00	6.00
HAWKSBILL	CBV-L	B	0.17	6.00	6.00
HAWKSBILL	STX-L	B	0.17	6.00	6.00
HAYESVILE	L	B	0.20	6.00	6.00
HAYESVILLE	CB-L	B	0.20	6.00	6.00
HAYESVILLE	CL	B	0.20	6.00	6.00
HAYESVILLE	CL	B	0.24	6.00	6.00
HAYESVILLE	FSL	B	0.20	6.00	6.00
HAYESVILLE	GR-FSL	B	0.20	6.00	6.00
HAYESVILLE	L	B	0.20	6.00	6.00
HAYESVILLE	STV-FSL	C	0.15	6.00	6.00
HAYESVILLE	STV-L	C	0.15	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
HAYESVILLE	STV-L	C	0.24	6.00	6.00
HAYESVILLE	STV-SCL	C	0.32	6.00	6.00
HAYMARKET	SIL	D	0.32	6.00	6.00
HAYTER	CB-L	B	0.20	6.00	6.00
HAYTER	CBV-L	B	0.15	6.00	6.00
HAYTER	L	B	0.28	6.00	6.00
HAYWOOD	L	B	0.24	6.00	6.00
HAZEL	CN-L	C	0.24	6.00	6.00
HAZEL	L	C	0.32	6.00	6.00
HAZEL	SIL	C	0.32	6.00	6.00
HAZEL	ST-L	C	0.24	6.00	6.00
HAZEL	STV-L	C	0.24	6.00	6.00
HAZEL CHANNERY	CN-SIL	C	0.32	6.00	6.00
HAZELTON	STV-L	B	0.15	6.00	6.00
HAZLETON	CN-SL	B	0.17	6.00	6.00
HAZLETON	ST-SL	B	0.15	6.00	6.00
HAZLETON	STV-SL	B	0.15	6.00	6.00
HAZLETON	STX-SL	B	0.15	6.00	6.00
HELENA	CL	C	0.28	1.50	2.50
HELENA	FSL	C	0.20	1.50	2.50
HELENA	FSL	C	0.24	1.50	2.50
HELENA	GR-COSL	C	0.15	1.50	2.50
HELENA	GRF-FSL	C	0.15	1.50	2.50
HELENA	L	C	0.20	1.50	2.50
HELENA	L	C	0.24	1.50	2.50
HELENA	SL	C	0.20	1.50	2.50
HELENA	SL	C	0.24	1.50	2.50
HERNDON	L	B	0.43	6.00	6.00
HERNDON	SICL	B	0.49	6.00	6.00
HERNDON	SIL	B	0.43	6.00	6.00
HERNDON	VFSL	B	0.43	6.00	6.00
HIWASSEE	CB-FSL	B	0.28	6.00	6.00
HIWASSEE	CB-SL	B	0.24	6.00	6.00
HIWASSEE	CL	B	0.28	6.00	6.00
HIWASSEE	FSL	B	0.28	6.00	6.00
HIWASSEE	GR-L	B	0.24	6.00	6.00
HIWASSEE	L	B	0.28	6.00	6.00
HIWASSEE	SIL	B	0.32	6.00	6.00
HIWASSEE VARIANT	L	B	0.32	6.00	6.00
HOADLY	L	C	0.28	0.50	1.50
HOBUCKEN	L	D	0.10		
HOGELAND*	CB-SIL	C	0.24	6.00	6.00
HOLLYWOOD	CL	D	0.32	6.00	6.00
HUNTINGTON	L	B	0.28	6.00	6.00
HUNTINGTON	SIL	B	0.28	6.00	6.00
HYATTSVILLE	FSL	B	0.28	4.00	6.00
HYDE	SIL	B/D	0.17	0.00	1.50
HYDRAQUENTS	SL	B	0.37	4.00	6.00
HYDRAQUENTS	SL	D	0.37		
INGLEDOVE	L	B	0.32	6.00	6.00
IREDELL	CL	C/D	0.32	1.00	2.00
IREDELL	FSL	C/D	0.28	1.00	2.00
IREDELL	L	C/D	0.32	1.00	2.00
IREDELL	SIL	C/D	0.32	1.00	2.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
IREDELL	SIL	D	0.32	1.00	2.00
IREDELL	SL	C/D	0.28	1.00	2.00
IREDELL	ST-L	C/D	0.24	1.00	2.00
IREDELL	ST-SIL	D	0.28	1.00	2.00
IREDELL VARIANT	SIL	C/D	0.32	1.00	2.00
IRONGATE	L	B	0.37	1.50	3.00
IRONGATE	SL	B	0.37	1.50	3.00
IUKA	FSL	C	0.24	1.00	3.00
IUKA	SL	C	0.24	1.00	3.00
IZAGORA	L	C	0.37	2.00	3.00
IZAGORA	SIL	C	0.37	2.00	3.00
JACKLAND	GR-L	D	0.32	1.00	2.00
JACKLAND	GR-SIL	D	0.32	1.00	2.00
JACKLAND	L	D	0.32	1.00	2.00
JACKLAND	SIL	D	0.32	1.00	2.00
JACKLAND	STV-SIL	D	0.32	1.00	2.00
JEDBURG	L	C	0.32	0.50	1.50
JEFFERSON	CB-FSL	B	0.17	6.00	6.00
JEFFERSON	CB-L	B	0.17	6.00	6.00
JEFFERSON	FSL	B	0.24	6.00	6.00
JEFFERSON	GRV-FSL	B	0.28	6.00	6.00
JEFFERSON	L	B	0.24	6.00	6.00
JEFFERSON	SL	B	0.10	6.00	6.00
JEFFERSON	SL	B	0.24	6.00	6.00
JEFFERSON	STV-FSL	B	0.10	6.00	6.00
JEFFERSON	STV-L	B	0.10	6.00	6.00
JEFFERSON	STV-SL	B	0.10	6.00	6.00
JEFFERSON	STX-L	B	0.10	6.00	6.00
JEFFERSON VARIANT	STV-SL	B	0.24	6.00	6.00
JOHNS	SL	C	0.20	1.50	3.00
JOHNS VARIANT	LS	C	0.43	1.00	2.00
JOHNSTON	L	D	0.20		
JOHNSTON	MK-L	D	0.17		
JUNALUSKA	CN-L	B	0.15	6.00	6.00
KALMIA	FSL	B	0.15	4.00	6.00
KALMIA	FSL	B	0.20	6.00	6.00
KALMIA	SL	B	0.20	6.00	6.00
KELLY	SIL	D	0.37	1.50	2.50
KEMPSVILLE	FSL	B	0.28	6.00	6.00
KEMPSVILLE	GR-FSL	B	0.24	6.00	6.00
KEMPSVILLE	GR-SL	B	0.24	6.00	6.00
KEMPSVILLE	L	B	0.32	6.00	6.00
KEMPSVILLE	LS	B	0.28	6.00	6.00
KEMPSVILLE	SL	B	0.28	6.00	6.00
KEMPSVILLE	VFSL	B	0.32	6.00	6.00
KEMPSVILLE FINE SAND	FSL	B	0.28	6.00	6.00
KENANSVILLE	FS	A	0.15	4.00	6.00
KENANSVILLE	FS	A	0.15	6.00	6.00
KENANSVILLE	LFS	A	0.15	4.00	6.00
KENANSVILLE	LFS	A	0.15	6.00	6.00
KENANSVILLE	LS	A	0.15	4.00	6.00
KENANSVILLE	LS	A	0.15	6.00	6.00
KENANSVILLE	S	A	0.15	6.00	6.00
KENANSVILLE VARIANT	LS	C		3.50	4.50

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
KEYPORT	FSL	C	0.37	1.50	4.00
KEYPORT	SIL	C	0.43	1.50	4.00
KINKORA	L	D	0.43	0.00	0.50
KINKORA	SIL	D	0.43	0.00	0.50
KINSTON	FSL	B/D	0.24	0.00	1.00
KINSTON	L	B/D	0.37	0.00	1.00
KINSTON	SIL	B/D	0.37	0.00	1.00
KLEJ	LFS	B	0.17	1.50	2.00
KLINESVILLE	CN-SIL	C/D	0.20	6.00	6.00
KLINESVILLE	SIL	C/D	0.20	6.00	6.00
KOANNAROCK	CN-SIL	C	0.17	6.00	6.00
KONNAROCK	CN-SIL	C	0.17	6.00	6.00
KONNAROCK	CNV-SIL	C	0.17	6.00	6.00
LAIDIG	CB-FSL	C	0.28	2.50	4.00
LAIDIG	CB-SL	C	0.28	2.50	4.00
LAIDIG	CN-FSL	C	0.24	2.50	4.00
LAIDIG	CN-L	C	0.28	2.50	4.00
LAIDIG	CN-SL	C	0.32	2.50	4.00
LAIDIG	FL-FSL	C	0.24	2.50	4.00
LAIDIG	FSL	C	0.24	2.50	4.00
LAIDIG	FSL	C	0.28	2.50	4.00
LAIDIG	GR-FSL	C	0.24	2.50	4.00
LAIDIG	RB-FSL	C	0.24	2.50	4.00
LAIDIG	RB-SL	C	0.24	2.50	4.00
LAIDIG	SL	C	0.24	2.50	4.00
LAIDIG	STV-FSL	C	0.28	2.50	4.00
LAIDIG	STV-L	C	0.28	2.50	4.00
LAIDIG	STV-SL	C	0.28	2.50	4.00
LAIDIG	STX-SL	C	0.24	2.50	4.00
LAKEHURST VARIANT	S	A	0.10	1.50	3.00
LAKELAND	FS	A	0.10	6.00	6.00
LAKIN	LS	A	0.17	6.00	6.00
LANEXA	MK-SIC	D	0.32		
LANSDALE	L	B	0.28	6.00	6.00
LAROQUE	L	B	0.37	6.00	6.00
LAWNES	MK-SL	D	0.20		
LAWNES	MUCK	D			
LEAF	SIL	D	0.32	0.50	1.50
LEAKSVILLE	SIL	D	0.43	0.00	2.00
LECK KILL	SIL	B	0.32	6.00	6.00
LEEDSVILLE*	CB-L	B	0.28	6.00	6.00
LEETONIA	STV-LS	C	0.17	6.00	6.00
LEETONIA	STX-LS	C	0.17	6.00	6.00
LEGORE	L	B	0.24	6.00	6.00
LEGORE	STV-SIL	B	0.24	6.00	6.00
LEHEW	CB-L	C	0.24	6.00	6.00
LEHEW	CB-SL	C	0.17	6.00	6.00
LEHEW	CN-FSL	C	0.17	6.00	6.00
LEHEW	CN-L	C	0.17	6.00	6.00
LEHEW	CNV-L	C	0.24	6.00	6.00
LEHEW	FL-FSL	C	0.17	6.00	6.00
LEHEW	FSL	C	0.24	6.00	6.00
LEHEW	RB-L	C	0.17	6.00	6.00
LEHEW	STV-L	C	0.17	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
LEHEW	STV-SL	C	0.17	6.00	6.00
LEHEW	STX-FSL	C	0.17	6.00	6.00
LEHEW	STX-L	C	0.17	6.00	6.00
LEHEW	STX-L	C	0.24	6.00	6.00
LENOIR	L	D	0.37	1.00	2.50
LENOIR	SIL	D	0.37	1.00	2.50
LENOIR	VFSL	D	0.37	1.00	2.50
LEON	S	B/D	0.10	0.00	1.00
LEON	S	B/D	0.10	0.50	1.50
LEVY	MK-SIC	D	0.37		
LEVY	SIC	D	0.32		
LEVY	SICL	D	0.37		
LEVY	SIL	D	0.37		
LEW	BY-SIL	B	0.17	6.00	6.00
LEW	CB-SIL	B	0.17	6.00	6.00
LEW	CN-L	B	0.15	6.00	6.00
LEW	SIL	B	0.37	6.00	6.00
LEW	STV-L	B	0.17	6.00	6.00
LEW	STV-SIL	B	0.17	6.00	6.00
LEW	STX-L	B	0.10	6.00	6.00
LEW	STX-SIL	B	0.10	6.00	6.00
LEWISBERRY	SL	B	0.20	6.00	6.00
LIBRARY	SIL	D	0.37	0.50	1.50
LIGNUM	L	C	0.43	1.00	2.50
LIGNUM	SIL	C	0.37	1.00	2.50
LIGNUM	SIL	C	0.43	1.00	2.50
LILY	GR-FSL	B	0.28	6.00	6.00
LILY	GR-SL	B	0.28	6.00	6.00
LILY	L	B	0.28	6.00	6.00
LILY	RB-FSL	B	0.24	6.00	6.00
LILY	SL	B	0.28	6.00	6.00
LILY	STV-FSL	B	0.24	6.00	6.00
LILY	STV-L	B	0.24	6.00	6.00
LILY	STV-SL	B	0.24	6.00	6.00
LILY	STX-SL	B	0.17	6.00	6.00
LINDSIDE	SIL	C	0.32	1.50	3.00
LITTLEJOE	GR-L	B	0.20	6.00	6.00
LITTLEJOE	L	B	0.37	6.00	6.00
LITTLEJOE	SIL	B	0.37	6.00	6.00
LITZ	CN-SIL	C	0.32	6.00	6.00
LITZ	SIL	C	0.37	6.00	6.00
LLOYD	CL	C	0.24	6.00	6.00
LLOYD	FSL	C	0.20	6.00	6.00
LLOYD	L	C	0.37	6.00	6.00
LLOYD	SIL	C	0.37	6.00	6.00
LLOYD VARIANT	L	C	0.37	6.00	6.00
LOBDELL	L	B	0.37	2.00	3.50
LOBDELL	SIL	B	0.37	2.00	3.50
LODI	GR-L	B	0.20	6.00	6.00
LODI	GR-SIL	B	0.20	6.00	6.00
LODI	GRV-SIL	B	0.17	6.00	6.00
LODI	L	B	0.37	6.00	6.00
LODI	SICL	B	0.28	6.00	6.00
LODI	SIL	B	0.37	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
LOUISA	FSL	B	0.28	6.00	6.00
LOUISA	L	B	0.28	6.00	6.00
LOUISA	SL	B	0.28	6.00	6.00
LOUISA VARIANT	L	B	0.28	6.00	6.00
LOUISBURG	FSL	B	0.24	6.00	6.00
LOUISBURG	GR-COSL	B	0.24	6.00	6.00
LOUISBURG	SL	B	0.20	6.00	6.00
LOUISBURG	SL	B	0.24	6.00	6.00
LOUISBURG	ST-SL	B	0.10	6.00	6.00
LOUISBURG	STV-SL	B	0.10	6.00	6.00
LOWELL	SIL	C	0.37	6.00	6.00
LUCKETTS	SIL	B	0.32	6.00	6.00
LUCKETTS*	SIL	B	0.32	6.00	6.00
LUCY	LS	A	0.10	6.00	6.00
LUGNUM	SIL	C	0.43	1.00	2.50
LUMBEE	L	B/D	0.24	0.00	1.50
LUMBEE	SIL	B/D	0.24	0.00	1.50
LUMBEE	SL	B/D	0.24	0.00	1.50
LUMBEE VARIANT	SL	D	0.24	0.00	0.50
LUNT	FSL	C	0.32	6.00	6.00
LUNT	L	C	0.32	6.00	6.00
LYNCHBURG	FSL	C	0.20	0.50	1.50
LYNCHBURG	L	C	0.20	0.50	1.50
MACOVE	CB-SIL	B	0.20	6.00	6.00
MACOVE	CNV-SIL	B	0.20	6.00	6.00
MACOVE	GR-SIL	B	0.20	6.00	6.00
MACOVE	RB-SIL	B	0.05	6.00	6.00
MACOVE	RB-SIL	B	0.20	6.00	6.00
MADE LAND				6.00	6.00
MADELAND				6.00	6.00
MADISON	CB-FSL	B	0.24	6.00	6.00
MADISON	CL	B	0.28	6.00	6.00
MADISON	FSL	B	0.24	6.00	6.00
MADISON	L	B	0.24	6.00	6.00
MADISON	SCL	B	0.28	6.00	6.00
MADISON	SL	B	0.24	6.00	6.00
MAGOTHA	FSL	D	0.28	0.00	1.00
MANASSAS	SIL	B	0.37	2.00	3.00
MANOR	L	B	0.37	6.00	6.00
MANOR	SIL	B	0.37	6.00	6.00
MANOR	STV-L	B	0.32	6.00	6.00
MANTACHIE	L	C	0.28	1.00	1.50
MANTEO	CN-L	C/D	0.28	6.00	6.00
MANTEO	CN-SIL	C/D	0.28	6.00	6.00
MANTEO	CNV-L	C/D	0.28	6.00	6.00
MANTEO	CNV-SIL	C/D	0.28	6.00	6.00
MANTEO	SIL	C/D	0.28	6.00	6.00
MARBIE	SIL	C	0.37	2.00	4.00
MARGO	L	B	0.37	1.00	3.00
MARLBORO	FSL	B	0.20	6.00	6.00
MARR	VFSL	B	0.32	6.00	6.00
MARUMSCO	L	C	0.32	1.00	1.50
MASADA	FSL	C	0.32	6.00	6.00
MASADA	GR-FSL	C	0.24	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
MASADA	GR-L	C	0.24	6.00	6.00
MASADA	L	C	0.32	6.00	6.00
MASADA	SCL	C	0.24	6.00	6.00
MASADA	SCL	C	0.32	6.00	6.00
MASSADA	FSL	C	0.32	6.00	6.00
MASSANETTA	L	B	0.37	2.00	3.50
MASSANETTA	SIL	B	0.37	2.00	3.50
MASSANUTTEN	CN-SIL	B	0.24	6.00	6.00
MASSANUTTEN	STV-L	B	0.24	6.00	6.00
MASSANUTTEN	STV-SIL	B	0.24	6.00	6.00
MATAPEAKE	FSL	B	0.24	6.00	6.00
MATAPEAKE	FSL	B	0.28	4.00	6.00
MATAPEAKE	FSL	B	0.37	6.00	6.00
MATAPEAKE	SIL	B	0.49	6.00	6.00
MATNEFLAT	ST-SL	B	0.15	6.00	6.00
MATTAN	MK-CL	D			
MATTAN	MK-L	D	0.32		
MATTAN	MK-SICL	D	0.32		
MATTAN	MUCK	D			
MATTAPEX	FSL	C	0.37	1.50	2.50
MATTAPEX	L	C	0.32	1.00	1.50
MATTAPEX	SIL	C	0.37	1.50	2.50
MATTAPONI	FSL	C	0.28	3.00	6.00
MATTAPONI	GR-SL	C	0.28	3.00	6.00
MATTAPONI	SCL	C	0.28	3.00	6.00
MATTAPONI	SL	C	0.28	3.00	6.00
MATTAPONI	SL	C	0.32	3.00	6.00
MAURERTOWN	SICL	D	0.37	0.00	0.50
MAURERTOWN	SIL	D	0.43	0.00	0.50
MAYODAN	FSL	B	0.24	6.00	6.00
MAYODAN	GR-FSL	B	0.15	6.00	6.00
MAYODAN	GR-SL	B	0.15	6.00	6.00
MAYODAN	GRV-SL	B	0.24	6.00	6.00
MAYODAN	L	B	0.24	6.00	6.00
MAYODAN	SIL	B	0.24	6.00	6.00
MAYODAN	SL	B	0.24	6.00	6.00
MAYODAN	STV-FSL	B	0.17	6.00	6.00
MAYODAN, CLAYEY SUBS	SL	B	0.24	6.00	6.00
MCGARY	SICL	C	0.43	1.00	3.00
MCGARY	SIL	C	0.43	1.00	3.00
MCQUEEN	L	C	0.37	5.00	6.00
MEADOWS	GR-L	D	0.20	6.00	6.00
MEADOWS	GR-SIL	D	0.20	6.00	6.00
MEADOWVILLE	FSL	B	0.37	3.00	5.00
MEADOWVILLE	L	B	0.37	3.00	5.00
MEADOWVILLE	SIL	B	0.37	3.00	5.00
MEADOWVILLE	STV-SIL	B	0.37	3.00	5.00
MECKLENBURG	CL	C	0.28	6.00	6.00
MECKLENBURG	FSL	C	0.24	6.00	6.00
MECKLENBURG	GR-L	C	0.17	6.00	6.00
MECKLENBURG	L	C	0.24	6.00	6.00
MECKLENBURG	L	D	0.32	6.00	6.00
MECKLENBURG	SIL	C	0.24	6.00	6.00
MECKLENBURG VARIANT	L	C	0.24	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
MEGGETT	SL	D	0.24	0.00	1.00
MELFA	MPT	D		0.00	1.00
MELVIN	SIL	D	0.43	0.00	1.00
MILLROCK	LFS	A	0.17	6.00	6.00
MILLROCK	LS	A	0.17	6.00	6.00
MINE DUMP				6.00	6.00
MINES		A	0.17	6.00	6.00
MINNIEVILLE	CL	C	0.28	6.00	6.00
MINNIEVILLE	L	C	0.37	6.00	6.00
MIXED ALLUVIUM	SL	D	0.24	0.00	1.00
MOLENA	LFS	A	0.10	6.00	6.00
MOLENA	LS	A	0.10	6.00	6.00
MONACAN	SIL	C	0.43	0.50	2.00
MONGLE	L	C	0.37	0.50	1.50
MONONGAHELA	CB-FSL	C	0.37	1.50	3.00
MONONGAHELA	CB-L	C	0.37	1.50	3.00
MONONGAHELA	FSL	C	0.43	1.50	3.00
MONONGAHELA	GR-L	C	0.37	1.50	3.00
MONONGAHELA	L	C	0.43	1.50	3.00
MONONGAHELA	SIL	C	0.43	1.50	3.00
MONTALTO	L	C	0.32	5.00	5.00
MONTALTO	SICL	B	0.28	6.00	6.00
MONTALTO	SICL	C	0.32	5.00	5.00
MONTALTO	SIL	B	0.32	6.00	6.00
MONTALTO	SIL	C	0.32	5.00	5.00
MONTALTO	SIL	C	0.32	6.00	6.00
MONTALTO	ST-SIL	B	0.24	6.00	6.00
MONTALTO	STV-L	C	0.28	6.00	6.00
MONTRESSOR*	GR-SIL	B	0.24	4.00	6.00
MONTROSS	SIL	C	0.49	1.00	2.50
MOOMAW	CB-FSL	C	0.24	1.50	3.00
MOOMAW	FSL	C	0.17	1.50	3.00
MOOMAW	L	C	0.28	1.50	3.00
MORRISONVILLE*	SIL	B	0.32	6.00	6.00
MORRISONVILLE*	STV-SIL	B	0.28	6.00	6.00
MORRISONVILLE*	STV-SIL	B	0.32	6.00	6.00
MORVEN*	SIL	B	0.37	5.00	6.00
MOUNT LUCAS	SIL	C	0.32	0.50	3.00
MT WEATHER*	STV-SIL	B	0.17	6.00	6.00
MUCKALEE	L	D	0.20	0.50	1.50
MUNDEN	FSL	B	0.20	1.50	2.50
MUNDEN	LFS	B	0.17	1.50	2.50
MUNDEN	LS	B	0.17	1.50	2.50
MUNDEN	SL	B	0.20	1.50	2.50
MURRILL	CN-FSL	B	0.32	6.00	6.00
MURRILL	CN-SIL	B	0.28	6.00	6.00
MURRILL	L	B	0.32	6.00	6.00
MURRILL	STV-FSL	B	0.24	6.00	6.00
MURRILL	STV-L	B	0.24	6.00	6.00
MURRILL	STV-SL	B	0.24	6.00	6.00
MYATT	FSL	D	0.28	0.00	1.00
MYATT	L	D	0.32	0.00	1.00
MYATT	SIL	D	0.32	0.00	1.00
MYATT	SL	D	0.28	0.00	1.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
MYATT VARIANT	FSL	D		0.00	1.00
MYERSVILLE	CN-SIL	B	0.20	6.00	6.00
MYERSVILLE	L	B	0.37	6.00	6.00
MYERSVILLE	SIL	B	0.37	6.00	6.00
MYERSVILLE	ST-L	B	0.32	6.00	6.00
MYERSVILLE	ST-SIL	B	0.32	6.00	6.00
MYERSVILLE	STV-L	B	0.28	6.00	6.00
MYERSVILLE	STV-L	B	0.32	6.00	6.00
MYERSVILLE	STV-SIL	B	0.28	6.00	6.00
MYERSVILLE	STV-SIL	B	0.32	6.00	6.00
MYERSVILLE	STX-SIL	B	0.32	6.00	6.00
MYSERSVILLE	STV-L	B	0.28	6.00	6.00
NAHUNTA	SIL	C	0.43	1.00	2.50
NANSEMOND	FSL	C	0.20	1.50	2.50
NANSEMOND	LFS	C	0.15	1.50	2.50
NANSEMOND	LS	C	0.15	1.50	2.50
NANSEMOND	SL	C	0.20	1.50	2.50
NASON	GR-L	B	0.24	6.00	6.00
NASON	GR-SIL	B	0.24	6.00	6.00
NASON	L	C	0.43	6.00	6.00
NASON	SICL	C	0.49	6.00	6.00
NASON	SIL	C	0.43	6.00	6.00
NAWNEY	L	D	0.24	0.00	0.50
NAWNEY	SIL	D	0.32		
NAWNEY	SIL	D	0.32	0.00	0.50
NEABSCO	L	C	0.32	1.00	2.50
NESTORIA	GR-SIL	C/D	0.28	6.00	6.00
NEVARC	CL	C	0.32	1.50	3.00
NEVARC	FSL	C	0.32	1.50	3.00
NEVARC	L	C	0.37	1.50	3.00
NEVARC	SIL	C	0.37	1.50	3.00
NEVARC	SL	C	0.32	1.50	3.00
NEVRAC	SL	C	0.32	1.50	3.00
NEWARK	SIL	C	0.43	0.50	1.50
NEWARK VARIANT	SIL	C	0.43	0.50	1.50
NEWBERN	SIL	C	0.28	6.00	6.00
NEWFLAT	SIL	D	0.37	0.50	1.50
NEWHAN	FS	A	0.10	6.00	6.00
NEWMARC	SIL	C	0.32	0.50	1.50
NICHOLSON	SIL	C	0.43	1.50	2.50
NIMMO	FSL	D	0.20	0.00	1.00
NIMMO	L	D	0.20	0.00	1.00
NIMMO	SL	D	0.20	0.00	1.00
NIXA	CRV-SIL	C	0.32	6.00	6.00
NIXA	GR-L	C	0.32	6.00	6.00
NOLICHUCKY	GR-SL	B	0.15	6.00	6.00
NOLICHUCKY	L	B	0.28	6.00	6.00
NOLICHUCKY	STV-SL	B	0.20	6.00	6.00
NOLIN	SIL	B	0.43	3.00	6.00
NOMBERVILLE	L	B	0.28	6.00	6.00
NOMBERVILLE	SIL	B	0.28	6.00	6.00
NORFOLK	FSL	B	0.20	4.00	6.00
OAKHILL	GR-SIL	B	0.20	6.00	6.00
OAKLET	SIL	C	0.37	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
OATLANDS	L	B	0.32	6.00	6.00
OCCOQUAN	L	B	0.37	6.00	6.00
OCCOQUAN	SL	B	0.24	6.00	6.00
OCCOQUAN	STV-L	B	0.20	6.00	6.00
OCHLOCKONEE	SIL	B	0.24	3.00	5.00
OCHLOCKONEE	SL	B	0.20	3.00	5.00
OCHLOCKONEE VARIANT	SL	C		2.00	4.50
OKEETEE	SL	D	0.24	0.50	1.00
OPEQUON	SIC	C	0.37	6.00	6.00
OPEQUON	SICL	C	0.37	6.00	6.00
OPEQUON	SIL	C	0.43	6.00	6.00
ORAGNE	SIL	D	0.28	1.00	3.00
ORANGE	FSL	D	0.15	1.00	3.00
ORANGE	L	D	0.28	1.00	3.00
ORANGE	SIL	D	0.28	1.00	3.00
ORANGE	SIL	D	0.32	1.00	2.00
ORANGE	SL	D	0.15	1.00	3.00
ORANGE	STV-SIL	D	0.24	1.00	3.00
ORANGE VARIANT	SIL	D	0.28	1.00	3.00
ORANGEBURG	FSL	B	0.20	6.00	6.00
ORANGEBURG	LS	B	0.10	6.00	6.00
ORANGEBURG	SL	B	0.20	6.00	6.00
ORENDA	L	B	0.37	6.00	6.00
ORISKANY	BYX-SL	B	0.10	6.00	6.00
ORISKANY	L	B	0.15	6.00	6.00
ORISKANY	RB-L	B	0.05	6.00	6.00
ORISKANY	RB-SL	B	0.05	6.00	6.00
ORISKANY	STV-L	B	0.15	6.00	6.00
ORISKANY	STV-SL	B	0.15	6.00	6.00
OSIER	LFS	A/D	0.15	0.00	1.00
OTHELLO	FSL	C/D	0.37	0.00	1.00
OTHELLO	SIL	C/D	0.37	0.00	1.00
PACOLET	CL	B	0.24	6.00	6.00
PACOLET	FSL	B	0.20	6.00	6.00
PACOLET	GR-FSL	B	0.15	6.00	6.00
PACOLET	GR-SL	B	0.15	6.00	6.00
PACOLET	SCL	B	0.24	6.00	6.00
PACOLET	SL	B	0.15	6.00	6.00
PACOLET	SL	B	0.20	6.00	6.00
PACTOLUS	FS	A	0.10	1.50	3.00
PACTOLUS	LFS	A	0.10	1.50	3.00
PACTOLUS	LS	A	0.10	1.50	3.00
PAGEBROOK	SICL	D	0.37	2.00	4.00
PAGEBROOK	SIL	D	0.37	2.00	4.00
PAMLICO	MUCK	D			
PAMLICO	MUCK	D		0.00	1.00
PAMUNKEY	CL	B	0.28	6.00	6.00
PAMUNKEY	FSL	B	0.28	4.00	6.00
PAMUNKEY	FSL	B	0.28	6.00	6.00
PAMUNKEY	L	B	0.28	4.00	6.00
PAMUNKEY	L	B	0.28	6.00	6.00
PAMUNKEY	LS	B	0.28	6.00	6.00
PAMUNKEY	SL	B	0.28	6.00	6.00
PAMUNKEY VARIANT	GR-SL	A	0.20	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
PANORAMA	SIL	B	0.37	6.00	6.00
PARKER	CB-L	B	0.17	6.00	6.00
PARKER	STV-L	B	0.17	6.00	6.00
PARKER	STV-SL	B	0.17	6.00	6.00
PARKER	STX-L	B	0.17	6.00	6.00
PARTLOW	FSL	D	0.28	0.00	1.00
PARTLOW	L	D	0.32	0.00	1.00
PARTLOW	SL	D	0.28	0.00	1.00
PASQUOTANK	VFSL	B/D	0.43	1.00	2.00
PEAKS	BY-SIL	C	0.15	6.00	6.00
PEAKS	CN-SIL	C	0.17	6.00	6.00
PEAKS	GR-FSL	C	0.17	6.00	6.00
PEAKS	GR-L	C	0.17	6.00	6.00
PEAKS	GR-SL	C	0.17	6.00	6.00
PEAKS	RB-SIL	C	0.15	6.00	6.00
PEAKS	RB-SL	C	0.15	6.00	6.00
PEAKS	STV-FSL	C	0.15	6.00	6.00
PEAKS	STV-L	C	0.15	6.00	6.00
PEAKS	STV-SL	C	0.15	6.00	6.00
PEAKS	STX-SL	C	0.15	6.00	6.00
PEAWICK	CL	D	0.37	1.50	3.00
PEAWICK	L	D	0.37	1.50	3.00
PEAWICK	SIL	D	0.37	1.50	3.00
PENN	CN-SIL	C/D	0.17	6.00	6.00
PENN	GR-L	C/D	0.28	6.00	6.00
PENN	L	C	0.32	6.00	6.00
PENN	SH-SIL	C	0.28	6.00	6.00
PENN	SIL	C	0.32	6.00	6.00
PENN	SIL	C	0.37	6.00	6.00
PENN	SIL	C/D	0.28	6.00	6.00
PENNN	L	C	0.32	6.00	6.00
PHILO	SIL	B	0.37	1.50	3.00
PHILO	SL	B	0.28	1.50	3.00
PHILOMOMT*	STV-SIL	B	0.32	6.00	6.00
PHILOMONT	SL	B	0.32	6.00	6.00
PINEYWOODS	L	D	0.37	0.00	1.00
PINEYWOODS	SIL	D	0.37	0.00	1.00
PINKSTON	CB-SL	B	0.17	6.00	6.00
PINKSTON	FSL	B	0.20	6.00	6.00
PINKSTON	GR-SL	B	0.10	6.00	6.00
PINKSTON	SL	B	0.20	6.00	6.00
PINKSTON	STV-SL	B	0.15	6.00	6.00
PISGAH	SIL	C	0.37	6.00	6.00
PITS				6.00	6.00
PITS		A	0.02	6.00	6.00
PITS		A	0.17	6.00	6.00
PITS	UWB			6.00	6.00
PITS	VAR			6.00	6.00
PITS AND DUMPS				6.00	6.00
PITS QUARRIES	VAR			6.00	6.00
PITS, BEDROCK	UWB			6.00	6.00
PITS, GRAVEL		A	0.02	6.00	6.00
PITS, GRAVEL	GRX-COS	A	0.02	6.00	6.00
PITS, GRAVELLY	GRX-S	A	0.02	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
PITS, QUARRIES	VAR			6.00	6.00
PITS, QUARRIES, LAND				6.00	6.00
PITS, QUARRY				6.00	6.00
PITS, QUARRY	UWB			6.00	6.00
POCATY	MUCK	D			
POCATY	PEAT	D			
POCOMOKE	FSL	B/D	0.20		
POINDEXTER	FSL	B	0.28	6.00	6.00
POINDEXTER	GR-SIL	B	0.32	6.00	6.00
POINDEXTER	L	B	0.37	6.00	6.00
POINDEXTER	SIL	B	0.37	6.00	6.00
POINDEXTER	SL	B	0.28	6.00	6.00
POLAWANA	LS	A/D	0.10		
POLAWANA	MK-SL	A/D	0.10		
POOLER VARIANT	L	D	0.24	0.00	1.00
POPE	FSL	B	0.28	6.00	6.00
POPE	GR-FSL	B	0.28	6.00	6.00
POPLIMENTO	GR-L	C	0.32	6.00	6.00
POPLIMENTO	GR-SIL	C	0.24	6.00	6.00
POPLIMENTO	GRV-L	C	0.24	6.00	6.00
POPLIMENTO	L	C	0.32	6.00	6.00
POPLIMENTO	SIL	C	0.32	6.00	6.00
PORTERS	CB-L	B	0.17	6.00	6.00
PORTERS	L	B	0.28	6.00	6.00
PORTERS	RB-L	B	0.17	6.00	6.00
PORTERS	SL	B	0.24	6.00	6.00
PORTERS	ST-L	B	0.17	6.00	6.00
PORTERS	STV-FSL	B	0.17	6.00	6.00
PORTERS	STV-L	B	0.17	6.00	6.00
PORTSMOUTH	L	B/D	0.24	0.00	1.00
PORTSMOUTH	MK-L	B/D	0.24	0.00	1.00
PORTSMOUTH	SIL	B/D	0.32	0.00	1.00
PORTSMOUTH	SL	B/D	0.24	0.00	1.00
POUNCEY	FSL	D	0.28	0.00	0.00
POUNCEY	SL	D	0.28	0.00	0.00
POYNER	GRV-SIL	B	0.28	6.00	6.00
POYNOR	GRV-SIL	B	0.28	6.00	6.00
POYNOR	GRX-L	B	0.28	6.00	6.00
POYNOR	GRX-SIL	B	0.28	6.00	6.00
PUNGO	MUCK	D		0.00	1.00
PURCELLVILLE	SIL	B	0.32	6.00	6.00
PURDY	L	D	0.43		
PURDY	SICL	D	0.43		
PURDY	SIL	D	0.43		
QUANTICO	L	B	0.32	6.00	6.00
QUANTICO	SL	B	0.32	6.00	6.00
QUARRIES				6.00	6.00
QUARRY				6.00	6.00
RABUM	SIL	B	0.32	6.00	6.00
RABUN	C	B	0.32	6.00	6.00
RABUN	CL	B	0.32	6.00	6.00
RABUN	SIL	B	0.32	6.00	6.00
RABUN	STV-CL	B	0.20	6.00	6.00
RAINS	FSL	B/D	0.20	0.00	1.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
RAINS	L	B/D	0.15	0.00	1.00
RAINS	VFSL	B/D	0.20	0.00	1.00
RAMSEY	ST-FSL	D	0.17	6.00	6.00
RAMSEY	ST-SL	D	0.17	6.00	6.00
RAMSEY	STV-L	D	0.20	6.00	6.00
RAMSEY	STV-SL	D	0.10	6.00	6.00
RAPIDAN	SICL	B	0.37	6.00	6.00
RAPIDAN	SIL	B	0.37	6.00	6.00
RAPPAHANNOCK	M-PT	D			
RAPPAHANNOCK	MUCK	D			
RAPPAHANNOCK	SICL	D	0.32		
RAPPAHANNOCK	SP	D			
RARITAN	SIL	C	0.37	0.50	3.00
RARITAN	SIL	C	0.43	0.50	3.00
RAYNE	CN-L	B	0.20	6.00	6.00
RAYNE	SIL	B	0.28	6.00	6.00
READINGTON	SIL	C	0.43	1.50	3.00
REAVILLE	SIL	C	0.43	0.50	3.00
REMLIK	FS	A	0.10	4.00	6.00
REMLIK	GR-LS	A	0.10	4.00	6.00
REMLIK	LFS	A	0.10	4.00	6.00
REMLIK	LS	A	0.10	4.00	6.00
RIGLEY	STV-SL	B	0.24	6.00	6.00
RION	FSL	B	0.24	6.00	6.00
RIVERVIEW	L	B	0.32	3.00	5.00
RIVERVIEW	LFS	B	0.20	3.00	5.00
RIVERVIEW	SIL	B	0.32	3.00	5.00
RIVERVIEW	SL	B	0.24	3.00	5.00
RIVERWASH	CBX-SL	D		0.00	2.00
ROANOKE	FSL	D	0.28	0.00	1.00
ROANOKE	L	D	0.37	0.00	1.00
ROANOKE	SIL	D	0.37		
ROANOKE	SIL	D	0.37	0.00	1.00
ROCK LAND		D		6.00	6.00
ROCK LAND BASIC		D		6.00	6.00
ROCK OURCROP	UWB	D		6.00	6.00
ROCK OUTCROP		D		6.00	6.00
ROCK OUTCROP	UWB	D		6.00	6.00
ROCK OUTCROP	VAR	D		6.00	6.00
ROHRERSVILLE	SIL	D	0.43	0.50	1.50
ROHRERSVILLE	STV-SIL	D	0.43	0.50	1.50
ROHRESVILLE	SIL	D	0.43	0.50	1.50
ROSS	L	B	0.32	4.00	6.00
ROWLAND	SIL	C	0.43	1.00	3.00
RUBBLE LAND	FRAG	A		6.00	6.00
RUBBLELAND	FRAG	A		6.00	6.00
RUMFORD	FSL	B	0.24	6.00	6.00
RUMFORD	LFS	B	0.17	6.00	6.00
RUMFORD	LS	B	0.17	6.00	6.00
RUSHTOWN	CN-SIL	A	0.24	6.00	6.00
RUSHTOWN	CNV-SIL	A	0.17	6.00	6.00
RUSTON	FSL	B	0.28	6.00	6.00
SAFELL	FSL	B	0.24	6.00	6.00
SASSAFRAS	FSL	B	0.24	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
SASSAFRAS	FSL	B	0.28	6.00	6.00
SASSAFRAS	LFS	B	0.17	6.00	6.00
SASSAFRAS	SL	B	0.24	6.00	6.00
SASSFRAS	FSL	B	0.24	6.00	6.00
SAUNOOK	L	B	0.24	6.00	6.00
SAUNOOK	STV-L	B	0.24	6.00	6.00
SAVANNAH	FSL	C	0.24	1.50	3.00
SAVANNAH	L	C	0.37	1.50	3.00
SAVANNAH	SL	C	0.28	1.50	2.50
SCATTERSVILLE*	GR-L	C	0.37	1.50	3.00
SCHAFFENAKER	STV-LS	A	0.17	6.00	6.00
SEABROOK	LFS	C	0.10	2.00	4.00
SEABROOK	LS	C	0.10	2.00	4.00
SEDGEFIELD	FSL	C	0.28	1.00	1.50
SEKIL	SL	B	0.32	6.00	6.00
SENECA	FSL	B	0.28	2.00	3.50
SENECA	FSL	B	0.37	3.00	5.00
SENECA	L	B	0.37	3.00	5.00
SENECA	SIL	B	0.32	2.00	3.50
SENECA	SL	B	0.28	2.00	3.50
SEQUOIA	L	C	0.37	6.00	6.00
SEQUOIA	SIL	C	0.37	6.00	6.00
SEQUOIA	STV-L	C	0.17	6.00	6.00
SHELOCTA	CB-FSL	B	0.32	6.00	6.00
SHELOCTA	CN-SIL	B	0.28	6.00	6.00
SHELOCTA	FSL	B	0.32	6.00	6.00
SHELOCTA	GR-SIL	B	0.28	6.00	6.00
SHELOCTA	RB-SIL	B	0.32	6.00	6.00
SHELOCTA	SIL	B	0.32	6.00	6.00
SHELOCTA VARIANT	ST-L		0.32	5.00	5.00
SHELOCTA VARIANT	STV-L		0.32	5.00	5.00
SHENVAL	CB-L	B	0.24	6.00	6.00
SHENVAL	L	B	0.32	6.00	6.00
SHERANDO	CB-FSL	B	0.20	6.00	6.00
SHERANDO	CB-SL	B	0.20	6.00	6.00
SHERANDO	CBV-FSL	B	0.10	6.00	6.00
SHERANDO	CBV-SL	B	0.10	6.00	6.00
SHERANDO	GR-SL	B	0.28	6.00	6.00
SHERANDO	RB-SL		0.32	5.00	5.00
SHERANDO	RB-SL	B	0.10	6.00	6.00
SHERANDO	RB-SL	B	0.20	6.00	6.00
SHERANDO	SL	B	0.28	6.00	6.00
SHEVA	FSL	C	0.20	1.50	2.00
SHOTTOWER	CB-L	B	0.24	6.00	6.00
SHOTTOWER	L	B	0.32	6.00	6.00
SINDION	L	B	0.32	1.50	3.00
SINDION	SIL	B	0.32	1.50	3.00
SKETERVILLE	L	C	0.37	1.50	2.50
SKETERVILLE	SIL	C	0.37	1.50	2.50
SLABTOWN	SIL	B	0.43	1.50	3.00
SLAGLE	FSL	C	0.28	1.50	3.00
SLAGLE	L	C	0.37	1.50	3.00
SLAGLE	LS	C	0.24	1.50	3.00
SLAGLE	SIL	C	0.37	1.50	3.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
SLAGLE	SL	C	0.28	1.50	3.00
SLICKENS		B	0.64	0.00	2.00
SNICKERSVILLE*	GR-L	B	0.24	4.00	6.00
SPEEDWELL	FSL	B	0.17	6.00	6.00
SPEEDWELL	L	B	0.32	6.00	6.00
SPEEDWELL	SL	B	0.17	6.00	6.00
SPESSARD	LS	A	0.10	6.00	6.00
SPIVEY	BY-L	B	0.17	6.00	6.00
SPIVEY	GR-L	B	0.17	6.00	6.00
SPIVEY	RB-L	B	0.17	6.00	6.00
SPOTSYLVANIA	FSL	C	0.32	6.00	6.00
SPOTSYLVANIA	SL	C	0.32	6.00	6.00
SPRIGGS	GR-L	C	0.37	6.00	6.00
SPRIGGS	L	C	0.37	6.00	6.00
SPRIGGS	SIL	C	0.37	6.00	6.00
SPRIGGS	STV-L	C	0.20	6.00	6.00
SPRIGGS	STV-L	C	0.37	6.00	6.00
SPRINGWOOD	SIL	B	0.32	6.00	6.00
SPRINGWOOD*	SIL	B	0.32	6.00	6.00
STANTON	SIL	D	0.43	0.00	0.50
STARR	L	C	0.28	6.00	6.00
STARR	SICL	C	0.28	6.00	6.00
STARR	SIL	B	0.37	3.00	5.00
STARR	SIL	C	0.28	6.00	6.00
STATE	FSL	B	0.28	4.00	6.00
STATE	GR-FSL	B	0.28	4.00	6.00
STATE	L	B	0.24	6.00	6.00
STATE	L	B	0.28	4.00	6.00
STATE	L	B	0.37	5.00	5.00
STATE	LFS	B	0.28	4.00	6.00
STATE	LS	B	0.28	4.00	6.00
STATE	SIL	B	0.28	4.00	6.00
STATE	SL	B	0.28	4.00	6.00
STATE	VFSL	B	0.28	4.00	6.00
STEINSBURG	FSL	C	0.28	6.00	6.00
STONEVILLE	SIL	B	0.32	6.00	6.00
STONY ALLUVIAL LAND		D		0.00	2.00
STONY COLLUVIAL LAND		A		6.00	6.00
STONY LOCAL ALLUVIAL	ST-L	D		0.00	2.00
STUART	L	C	0.37	1.50	3.00
STUMPTOWN	FL-L	B	0.20	6.00	6.00
STUMPTOWN	FLV-L	B	0.20	6.00	6.00
SUCHES	FSL	B	0.24	2.50	4.00
SUCHES	L	B	0.24	2.50	4.00
SUDLEY	L	B	0.37	6.00	6.00
SUEQUEHANNA	L	D	0.37	6.00	6.00
SUFFOLK	FSL	B	0.28	6.00	6.00
SUFFOLK	LFS	B	0.24	6.00	6.00
SUFFOLK	LS	B	0.24	6.00	6.00
SUFFOLK	SL	B	0.28	6.00	6.00
SUSDLEY	L	B	0.37	6.00	6.00
SUSQUEHANNA	L	D	0.37	6.00	6.00
SWAMP	L	D	0.28	0.50	1.50
SWEETAPPLE	FSL	B	0.28	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
SWIMLEY	SICL	C	0.37	6.00	6.00
SWIMLEY	SIL	C	0.37	6.00	6.00
SYCOLINE	SIL	D	0.32	1.50	3.00
SYCOLINE	SIL	D	0.43	1.50	3.00
SYLCO	CN-SIL	C	0.24	6.00	6.00
SYLCO	FL-SIL	C	0.24	6.00	6.00
SYLCO	STV-L	C	0.20	6.00	6.00
SYLCO	STV-SIL	C	0.20	6.00	6.00
SYLCO	STX-SIL	C	0.20	6.00	6.00
SYLVATUS	CN-SIL	D	0.26	6.00	6.00
SYLVATUS	CN-SIL	D	0.28	6.00	6.00
SYLVATUS	CNV-SIL	D	0.16	6.00	6.00
SYLVATUS	STV-L	D	0.26	6.00	6.00
SYLVATUS	STX-L	D	0.28	6.00	6.00
SYLVATUS	STX-SIL	D	0.12	6.00	6.00
SYLVATUS	STX-SIL	D	0.28	6.00	6.00
TALLADEGA	CN-L	C	0.28	6.00	6.00
TALLADEGA	CN-SIL	C	0.28	6.00	6.00
TALLADEGA	SIL	C	0.32	6.00	6.00
TALLAPOOSA	L	C	0.32	6.00	6.00
TALLAPOOSA VARIANT	FSL	C	0.28	6.00	6.00
TALLEDEGA	CN-L	C	0.28	6.00	6.00
TARBORO	LS	A	0.10	6.00	6.00
TARBORO	S	A	0.10	6.00	6.00
TATE	L	B	0.24	6.00	6.00
TATE	ST-L	B	0.17	6.00	6.00
TATUM	CL	B	0.32	6.00	6.00
TATUM	GR-L	B	0.20	6.00	6.00
TATUM	GR-SIL	B	0.20	6.00	6.00
TATUM	L	B	0.37	6.00	6.00
TATUM	SICL	B	0.32	6.00	6.00
TATUM	SIL	B	0.20	6.00	6.00
TATUM	SIL	B	0.37	6.00	6.00
TETOTUM	FSL	C	0.28	1.50	2.50
TETOTUM	L	C	0.37	1.50	2.50
TETOTUM	SIL	C	0.37	1.50	2.50
TETOTUM	SL	C	0.28	1.50	2.50
TETOTUM VARIANT	L	C	0.24	1.50	2.50
THUNDER	BY-L	B	0.05	6.00	6.00
THUNDER	CBV-L	B	0.05	6.00	6.00
THUNDER	GR-L	B	0.05	6.00	6.00
THUNDER	RB-L	B	0.05	6.00	6.00
THUNDER	STV-L	B	0.05	6.00	6.00
THURMONT	CB-L	B	0.20	4.00	6.00
THURMONT	FSL	B	0.32	4.00	6.00
THURMONT	GR-L	B	0.24	4.00	6.00
THURMONT	L	B	0.32	4.00	6.00
THURMONT	SL	B	0.32	4.00	6.00
THURMONT	ST-L	B	0.28	4.00	6.00
THURMONT	STV-L	B	0.24		6.00
THURMONT	STV-L	B	0.24	4.00	6.00
TIDAL MARSH	MK-L	D	0.49		
TIMBERVILLE	FSL	B	0.17	6.00	6.00
TIMBERVILLE	GR-SIL	B	0.24	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
TIMBERVILLE	L	B		6.00	6.00
TIMBERVILLE	L	B	0.28	3.00	3.00
TIMBERVILLE	L	B	0.32	6.00	6.00
TIMBERVILLE	SIL	B		6.00	6.00
TIMBERVILLE	SIL	B	0.32	6.00	6.00
TIMBERVILLE VARIANT	L	B	0.28	3.00	3.00
TIMBERVILLE VARIANT	SIL	B		6.00	6.00
TIOGA	FSL	B	0.37	3.00	6.00
TOCCOA	FSL	B	0.10	2.50	5.00
TOCCOA	FSL	B	0.24	2.50	5.00
TOCCOA	L	B	0.24	2.50	5.00
TOCCOA	LFS	B	0.24	2.50	5.00
TOCCOA	LS	B	0.10	2.50	5.00
TOCCOA	SIL	B	0.24	2.50	5.00
TOCCOA	SL	B	0.10	2.50	5.00
TODDSTAV	SIL	D	0.32		
TOMOTLEY	FSL	B/D	0.20	0.00	1.00
TOMOTLEY	L	B/D	0.24	0.00	1.00
TOMOTLEY	SL	B/D	0.20	0.00	1.00
TOMS	SIL	C	0.43	0.50	1.50
TORHUNTA	L	C	0.15	0.50	1.50
TOTIER	SICL	C	0.37	6.00	6.00
TOTIER	SIL	C	0.37	6.00	6.00
TOXAWAY	SIL	B/D	0.17	0.00	1.00
TRAPPIST	SIL	C	0.37	6.00	6.00
TREGO	L	B	0.32	6.00	6.00
TRENHOLM	SL	D	0.32	1.00	3.00
TUCKAHOE	L	B	0.37	6.00	6.00
TUMBLING	BYV-L	B	0.24	6.00	6.00
TUMBLING	CB-L	B	0.22	6.00	6.00
TUMBLING	CB-L	B	0.24	6.00	6.00
TUMBLING	FSL	B	0.24	6.00	6.00
TUMBLING	L	B	0.32	6.00	6.00
TUMBLING	STV-L	B	0.24	6.00	6.00
TURBEVILLE	CB-FSL	C	0.28	6.00	6.00
TURBEVILLE	CL	C	0.28	6.00	6.00
TURBEVILLE	FSL	C	0.32	6.00	6.00
TURBEVILLE	GR-FSL	C	0.24	6.00	6.00
TURBEVILLE	L	C	0.37	6.00	6.00
TURBEVILLE	SCL	C	0.28	6.00	6.00
TURBEVILLE	SIL	C	0.37	6.00	6.00
TUSQUITEE	CB-L	B	0.24	6.00	6.00
TUSQUITEE	L	B	0.28	6.00	6.00
TUSQUITEE	ST-L	B	0.17	6.00	6.00
TUSQUITEE	STV-L	B	0.17	6.00	6.00
TYGART	L	C	0.37	1.50	2.50
TYGART	L	D	0.43	0.50	1.50
TYGART	SIL	D	0.43	0.50	1.50
UCHEE	LFS	A	0.10	3.50	5.00
UCHEE	LS	A	0.10	3.50	5.00
UDIFLUVENTS	FSL	B	0.10	2.50	5.00
UNISON	CB-FSL	B	0.24	6.00	6.00
UNISON	CB-L	B	0.24	6.00	6.00
UNISON	FSL	B	0.32	6.00	6.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
UNISON	GR-L	B	0.24	6.00	6.00
UNISON	L	B	0.32	6.00	6.00
UNISON	SIL	B	0.32	6.00	6.00
UNISON	STV-L	B	0.24	6.00	6.00
UNISON	STV-SIL	B	0.24	6.00	6.00
UNISON VARIANT	L	B	0.32	6.00	6.00
URBAN LAND				2.00	2.00
URBAN LAND	0-30			2.00	2.00
URBAN LAND	VAR			2.00	2.00
URBANLAND	VAR			2.00	2.00
VANCE	CL	C	0.28	6.00	6.00
VANCE	FSL	C	0.24	6.00	6.00
VANCE	GR-SL	C	0.15	6.00	6.00
VANCE	GRF-SL	C	0.24	6.00	6.00
VANCE	SL	C	0.24	6.00	6.00
VARINA	FSL	C	0.15	4.00	5.00
VARINA	GR-SL	C	0.17	4.00	5.00
VARINA	SL	C	0.17	4.00	5.00
VAUCLUSE	SL	C	0.24	6.00	6.00
VERTREES	CR-SIL	B	0.24	6.00	6.00
VERTREES	SIL	B	0.37	6.00	6.00
VERY ROCKY LAND		D		6.00	6.00
WADESBORO	CL	B	0.32	6.00	6.00
WADESBORO	FSL	B	0.24	6.00	6.00
WADESBORO	FSL	B	0.37	6.00	6.00
WADESBORO	SIL	B	0.24	6.00	6.00
WADESBORO	SIL	B	0.37	6.00	6.00
WAHEE	FSL	D	0.24	0.50	1.50
WAHEE	L	D	0.28	0.50	1.50
WAHEE	SIL	D	0.28	0.50	1.50
WAHEE	SL	D	0.24	0.50	1.50
WAKULLA	LS	A	0.10	6.00	6.00
WALLEN	CN-SL	B	0.17	6.00	6.00
WALLEN	STV-SL	B	0.17	6.00	6.00
WALLEN	STX-SL	B	0.17	6.00	6.00
WARMINSTER	L	C	0.37	6.00	6.00
WATAUGA	CB-SIL	B	0.17	6.00	6.00
WATAUGA	SIL	B	0.24	6.00	6.00
WATER			0.28		
WATEREE	FSL	B	0.20	6.00	6.00
WATT	CN-SIL	D	0.32	6.00	6.00
WATT	SIL	D	0.32	6.00	6.00
WATT VARIANT	SIL	D	0.32	6.00	6.00
WAXPOOL	SIL	D	0.43	0.00	1.00
WEAVER	SIL	C	0.32	1.50	2.50
WEAVERTON*	FLV-L	C	0.10	1.50	3.00
WEBBTOWN	CN-SIL	C	0.32	6.00	6.00
WEDOWEE	CL	B	0.28	6.00	6.00
WEDOWEE	FSL	B	0.24	6.00	6.00
WEDOWEE	GR-FSL	B	0.15	6.00	6.00
WEDOWEE	GR-SL	B	0.15	6.00	6.00
WEDOWEE	SCL	B	0.28	6.00	6.00
WEDOWEE	SL	B	0.24	6.00	6.00
WEEKSVILLE	SIL	B/D	0.43	0.00	1.00

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
WEHADKEE	FSL	D	0.24	0.00	1.00
WEHADKEE	L	C	0.28	1.50	2.00
WEHADKEE	L	D	0.24	0.00	1.00
WEHADKEE	L	D	0.24	0.00	2.50
WEHADKEE	L	D	0.49	0.00	0.50
WEHADKEE	SIL	D	0.32	0.00	1.00
WEHADKEE	SIL	D	0.32	0.00	2.50
WEHADKEE	SIL	D	0.49	0.00	0.50
WEHADKEE	VFSL	D	0.24	0.00	2.50
WEIKERT	CN-SIL	C/D	0.28	6.00	6.00
WEIKERT	CNV-SIL	C/D	0.28	6.00	6.00
WEIKERT	SHV-SIL	C/D	0.28	6.00	6.00
WEIKERT	SIL	C/D	0.37	6.00	6.00
WEIKERT	STV-SIL	C/D	0.20	6.00	6.00
WEKERT	CNV-SIL	C/D	0.28	6.00	6.00
WESTMORELAND	L	B	0.37	6.00	6.00
WESTMORELAND	SIL	B	0.37	6.00	6.00
WESTON	FSL	D	0.24	0.00	1.00
WESTON	SL	D	0.24	0.50	1.50
WESTPHALIA	LVFS	B	0.49	6.00	6.00
WEVERTON	FLV-L	B	0.15	6.00	6.00
WHEELING	FSL	B	0.28	6.00	6.00
WHEELING	FSL	B	0.37	6.00	6.00
WHEELING	GR-L	B	0.28	6.00	6.00
WHEELING	L	B	0.37	6.00	6.00
WHEELING	SIL	B	0.37	6.00	6.00
WHEELING	SL	B	0.37	6.00	6.00
WHITE STORE	FSL	D	0.28	1.00	1.50
WHITE STORE	L	D	0.43	1.00	1.50
WHITE STORE VARIANT	L	D	0.43	1.00	1.50
WHITEFORD	SIL	B	0.32	6.00	6.00
WICHKAM	FSL	B	0.24	6.00	6.00
WICKHAM	FSL	B	0.24	6.00	6.00
WICKHAM	L	B	0.24	6.00	6.00
WICKHAM	LFS	B	0.15	6.00	6.00
WICKHAM	SL	B	0.24	6.00	6.00
WICKHAM VARIANT	L	B	0.24	6.00	6.00
WICKHAM VARIANT	SL	B	0.24	6.00	6.00
WILKES	CL	C	0.28	6.00	6.00
WILKES	FSL	C	0.24	6.00	6.00
WILKES	GR-FSL	C	0.17	6.00	6.00
WILKES	L	C	0.24	6.00	6.00
WILKES	SL	C	0.24	6.00	6.00
WINTON	SL	C	0.20	2.00	4.00
WOLFGAP	CL	B	0.32	6.00	6.00
WOLFGAP	FSL	B	0.17	6.00	6.00
WOLFGAP	L	B	0.32	6.00	6.00
WOODINGTON	FSL	B/D	0.20	0.50	1.00
WOODSTOWN	FSL	C	0.24	1.50	2.50
WORSHAM	FSL	D	0.28	0.00	1.00
WORSHAM	L	D	0.37	0.00	1.00
WORSHAM	L	D	0.43	0.00	0.50
WORSHAM	SIL	D	0.37	0.00	1.00
WORSHAM	SIL	D	0.43	0.00	0.50

Soil name	surftex	hydgrp	kfact	wtdepl	wtdeph
WORSHAM	SL	D	0.28	0.00	1.00
WORSHAM VARIANT	FSL	D	0.28	0.00	1.00
WRIGHTSBORO	FSL	C	0.28	2.00	3.00
WRIGHTSBORO	FSL	D	0.43	1.50	3.00
WRYICK	L	B	0.32	6.00	6.00
WURNO	CN-L	C	0.28	6.00	6.00
WURNO	CN-SIL	C	0.28	6.00	6.00
WURNO	SIL	C	0.28	6.00	6.00
WYRICK	L	B	0.32	6.00	6.00
WYRICK	SIL	B	0.32	6.00	6.00
YADKIN	L	C/D	0.32	6.00	6.00
YEMASSEE	FSL	C	0.20	1.00	1.50
YEMASSEE	SL	C	0.20	1.00	1.50
YEOPIM	SIL	B	0.37	1.50	3.00
YORK	SIL	C	0.43	1.50	3.00
ZEPP	STV-L	B	0.17	6.00	6.00
ZEPP	STV-SL	B	0.10	6.00	6.00
ZEPP	STX-L	B	0.15	6.00	6.00
ZEPP	STX-SL	B	0.10	6.00	6.00
ZION		C	0.37	6.00	6.00
ZION	L	C	0.37	6.00	6.00
ZION	SIL	C	0.37	6.00	6.00
ZION	SIL	D	0.43	1.00	2.50
ZION SILT LOAM	SIL	C	0.37	6.00	6.00
ZION VARIANT	L	C	0.37	6.00	6.00
ZOAR	L	C	0.43	1.50	2.50
ZOAR	SIL	C	0.43	1.50	2.50

CHAPTER 7

Administrative Guidelines

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CHAPTER 7

ADMINISTRATIVE GUIDELINES

The Virginia Erosion and Sediment Control Law (VESCL) provides the authority and administrative guidelines for the Virginia Erosion and Sediment Control Program. Counties, cities, and towns are authorized to administer a local erosion and sediment control (E&S) program which is consistent with the state program. These local E&S programs have jurisdiction over land-disturbing activities except for those activities which are otherwise provided for by the VESCL.

The VESCL contains several provisions which place certain land-disturbing activities under the jurisdiction of the Board or the Department of Conservation and Recreation's Division of Soil and Water Conservation (DSWC). Generally, these activities include land-disturbing activities undertaken by state agencies and other activities which are multijurisdictional in nature. (Part II of this chapter contains a thorough presentation of these activities.)

A minimum level of consistency for state and local E&S programs is provided by state guidelines, regulations, and other publications such as the Virginia Erosion and Sediment Handbook. In addition, DSWC functions in an oversight capacity to insure the acceptability of state and local programs. DSWC is directly involved in individual project regulation only when such projects are undertaken by state agencies or other institutions specified in VESCL (Sec. 10.1-563), or if they are multijurisdictional in nature and the applicant requests DSWC involvement.

This chapter is divided into two parts in order to present the administrative guidelines which are applicable to local and state level programs:

PART I - Local Programs: Provides information concerning the minimum administrative criteria which must be met in all local programs, along with ideas and suggestions which may be used to improve local program effectiveness. Also, procedures for multijurisdictional land-disturbing activities are presented.

PART II - State Agency Projects: Provides basic information and administrative guidelines which apply to state agencies and institutions that propose to undertake land-disturbing activities.

The guidelines and standards contained in this chapter are based upon provisions of the VESCL as amended through 1991, including the Erosion and Sediment Control Regulations. Later amendments may affect the applicability of this chapter. Handbook users should therefore be aware of all subsequent amendments to the VESCL and Regulations.

PART I: LOCAL PROGRAMS

There are 170 separate local E&S programs which were adopted by 95 counties, 41 cities, 34 incorporated towns, and one Soil and Water Conservation District (district). Every county, city, and incorporated town in the state is covered by one of these programs. Before local adoption, each of these programs was reviewed by DSWC and deemed to be in compliance with the state program. Each program included a set of administrative procedures which outlined specific local implementation mechanisms.

Local administrative procedures are often subject to variation due to turnover in personnel, changes in governmental structure, amendments to the state program, and other factors. For these reasons, the local programs are reviewed periodically to ensure consistency with the state program and their relevance and effectiveness under current local conditions. Even if the original procedures are being implemented as originally adopted, local conditions may have changed to the degree that the program is no longer serving its intended purpose.

Local administrative procedures may be changed without the permission or approval of DSWC. However, such changes should be documented, and they must be consistent with the criteria set forth in the VESCL. Localities are therefore advised to keep DSWC informed of significant program changes and to seek advice when there is a question of compatibility with the state program.

Local Program Reviews

DSWC periodically reviews and evaluates each local program. These reviews provide assistance to localities in maintaining effective E&S programs which are consistent with the state program and to provide state oversight of the local programs. Program reviews are conducted by the DSWC regional E&S Specialists who visit localities and meet with the appropriate personnel involved with the erosion and sediment control program.

The first part of a program review consists of a meeting with local program officials. Administrative aspects of the program are reviewed and discussed. Discussion topics include the local ordinance, plan review, inspection, and enforcement procedures. Also, revisions in the state program and available options which may be beneficial to the locality are discussed.

The second part consists of a field tour to assess the implementation of the program in the field. Sample plans are reviewed and, if possible, current construction sites are inspected.

Finally, DSWC prepares a program review letter that documents the findings of the program review. This letter outlines the local program and makes recommendations in order to achieve consistency with the state program and to improve local program effectiveness. DSWC intends to review all local programs on a periodic basis.

Funding and Staffing Local Programs

The problem of funding local E&S programs has been brought to the attention of the General Assembly a number of times since the passage of the VESCL in 1973. The Assembly's response has been to adopt amendments to the VESCL allowing localities to charge plan review or permit fees to cover the cost of program administration. A 1976 amendment, Section 21-89.5(e), allowed localities to charge applicants a fee of up to $25.00. This section was amended again in 1978 to allow a maximum $150.00 fee. The most recent amendment in 1988, Section 10.1-562(e), allows localities to charge a fee up to $1000.00. However, these fees must not exceed the actual costs of the services provided. It is apparent by these amendments that the local programs are intended to be funded by revenues from fees charged to persons who undertake land-disturbing activities.

Many rural localities have difficulty funding and staffing their programs. The small number of plans reviewed each year does not usually generate sufficient revenue to support a separate position to run the program. Consequently, most rural localities have given this responsibility to an existing local official such as the building inspector. Many of these local officials do not feel qualified or do not have the time to carry out the additional responsibilities of the E&S program.

Fortunately, there are sources of assistance available. Many localities utilize the expertise of Soil and Water Conservation Districts. The role of the districts in the local E&S programs varies according to mutual agreements between the district and the locality. Frequently, the districts are involved with plan review and inspection. Oftentimes, this arrangement also includes the technical expertise of the Soil Conservation Service (SCS).

Enforcement of a local program is, at least, partially the responsibility of the local Commonwealth's Attorney. According to Section 10.1-569(g) of the VESCL, the local Commonwealth's Attorney shall take legal action against violators upon request of the locality. If the services of the districts and the Commonwealth's Attorney are fully utilized, the burden of administering the E&S program will be greatly reduced.

Local officials can learn to perform inspections adequately with proper training. Such training is made available periodically by DSWC through statewide seminars. Oftentimes, a local training seminar can be arranged through the cooperative efforts of the local government, the DSWC regional E&S Specialist and the district. Training may also be available through local community colleges which can offer erosion and sediment control courses if sufficient local interest is shown.

The following suggestions are made to rural localities which are attempting to carry out local E&S programs on limited budgets:

1. Send local program officials to statewide training seminars or to any applicable courses available through the community college system.

2. Increase plan review or permit fees to cover a greater portion of administrative costs.

3. Fully utilize the services of districts for plan review and/or inspection assistance where available.

Certification Program

DSWC offers a program for certification of Erosion and Sediment Control Inspectors, Stormwater Management Inspectors, and Program Administrators. The objectives of this program are to encourage a higher standard of performance of duties, to promote updated education and training, to promote employer and public awareness of necessary skills, and to establish a code of consistency and competency among administrators and inspectors. Specific requirements for certification include experience and/or education in addition to a passing score on the examination. DSWC recommends that at least one E&S official in each local program be certified.

LOCAL PROGRAM ADMINISTRATION

The remainder of Part I is devoted to discussion of various elements of local program administration. The requirements of the VESCL and the Virginia Erosion and Sediment Control Regulations are outlined and referenced. Also, there are suggestions which may improve local program effectiveness. Appendix 7A contains sample forms which may be modified for use in the local E&S program.

Plan Submission

Requirements

VESCL Sec. 10.1-563(A): ... *no person may engage in any land-disturbing activity until he has submitted to the district or locality an erosion and sediment control plan for the land-disturbing activity and the plan has been reviewed and approved by the plan-approving authority.*

VESCL Sec. 10.1-563(F): ... *the preparation, submission, and approval of an erosion and sediment control plan shall be the responsibility of the owner.*

Discussion

The following items are recommended:

1. The public should be informed of the requirements for plan submission. It is advisable to prepare a brochure or handout sheet which lists the procedures necessary for land development. Include names, addresses and telephone numbers

of local government bodies involved, number of plans to be submitted, time required for review, and schedules of fees. (See Appendix 7A-1.)

2. Provide information on how to obtain copies of the appropriate handbooks or other technical information such as the Virginia E&S Handbook or local E&S handbook. Include a "Checklist for Plan Preparation" (Appendix 7A-2).

3. When the applicant first contacts the locality concerning a proposed development, a screening form may be used to determine whether an E&S plan is required for the project site (Appendix 7A-3).

4. At the time of plan submission, the applicant should fill out an application for a land-disturbing permit or for plan approval, if the locality does not issue such a permit. This application will eventually constitute an agreement between the applicant and the locality. The following items should be included:

    a. Identification of the landowner of record and the person responsible for carrying out the plan.

    b. Certification that the plan will be carried out as approved.

    c. A statement granting right-of-entry to the locality's inspectors or other personnel concerned with the plan (Appendix 7A-4).

5. At the time of plan submission, the E&S plan should be dated, stamped or marked with the date received to establish the 45-day deadline date.

Plan Review and Approval

Requirements

VESCL Sec. 10.1-563(B): ... *The plan-approving authority shall review the conservation plans submitted to it and grant written approval within forty-five days of the receipt of the plan if it determines that the plan meets the requirements of the Board's regulations. ...*

When a plan is determined to be inadequate, written notice of disapproval stating the specific reasons for disapproval shall be communicated to the applicant within forty-five days. The notice shall specify such modifications, terms, and conditions that will permit approval of the plan. If no action is taken by the plan-approving authority within the time specified above, the plan shall be deemed approved and the person authorized to proceed with the proposed activity.

E&S Regulations Sec. 50: *The plan approving authority may waive or modify any of the regulations that are deemed inappropriate or too restrictive for site conditions, by granting a variance. A variance may be granted under these conditions:*

1. *At the time of plan submission, an applicant may request a variance to become part of the approved erosion and sediment control plan. The applicant shall explain the reasons for requesting variances in writing. Specific variances which are allowed by the plan approving authority shall be documented in the plan.*

2. *During construction ... the plan approving authority shall respond in writing either approving or disapproving such a request. If the plan approving authority does not approve a variance within 10 days of receipt of the request, the request shall be considered to be disapproved. ...*

3. *The plan approving authority shall consider variance requests judiciously, keeping in mind both the need of the applicant to maximize cost effectiveness and the need to protect off-site properties and resources from damage.*

Note: The minimum standards contained in the E&S Regulations (or other more stringent regulations adopted by the locality) should be satisfied on all E&S plans. These regulations also apply to any land-disturbing activity which might evolve from a construction project (e.g., borrow site, disposal areas, etc.).

Discussion

1. When reviewing a plan, use the "Checklist for Plan Preparation" (Appendix 7A-2) to be sure that no items are overlooked. Variances must be requested in writing with reasons to support the variance.

   Note: A site plan without a narrative is usually unacceptable. The narrative may be on separate sheets or may be included as notes on the site plan. Construction specifications usually are not acceptable substitutes for the E&S Narrative.

2. Plan review by more than one reviewer is encouraged. Utilize the expertise and knowledge of other departments or staff. Make plans available to other reviewers quickly and streamline procedures to facilitate meeting the 45-day deadline.

3. On-site inspection of the project location (pre-approval site visit) should be an integral part of the review process.

4. If the plan is adequate, the plan sheet should be stamped or marked "APPROVED," signed and dated.

5. If the plan is inadequate, the applicant must be notified in writing within 45 days of what changes should be made to render the plan acceptable. To expedite the review and any subsequent revisions, the plan reviewer may prefer to discuss the plan with the applicant. **However, the law requires a written communication either approving or disapproving the plan with reasons for disapproval within 45 days.**

6. Consider developing a procedure to abbreviate the re-submitting process so that the plan can reach the reviewer quickly and not delay the applicant for an undue period of time.

   Note: At the time of re-submission, another 45-day review period is begun.

7. Appropriate fees may be charged to cover the costs of permit issuance, plan review and inspection. The VESCL limits the total fee to a maximum of $1000 (Sec. 10.1-562(e), 1990). Many localities charge a fee amount based on the size of the project.

Activities Under State Jurisdiction

Requirements

VESCL Sec. 10.1-563 (D): *Electric and telephone utility companies and railroad companies shall file general erosion and sediment control specifications annually with the Board for review and written comments. The specifications shall apply to:*

> *1. Construction, installation and maintenance of electric and telephone utility lines; and*
> *2. Construction of the tracks, rights-of-ways, bridges, communication facilities and other related structures and facilities of the railroad company. ...*

VESCL Sec. 10.1-564: *Any state agency that undertakes a project involving a land-disturbing activity shall file specifications annually or a conservation plan for each project with the Department for review and written comments. ...*

Discussion

These agencies/institutions submit either annual E&S specifications or individual plans to DSWC. Approval of individual projects is not necessary when the approved annual specifications are followed. The activities listed above are not subject to the requirements of local E&S programs. Projects not included in subsections 1 and 2 (above) must comply with the local program requirements.

DSWC staff oversees the implementation of the E&S program on state agency projects.

Residential Subdivisions

VESCL Sec. 10.1-560: Definitions

> *"Land-Disturbing Activity" means any land change ... except that the term shall not include: ... Preparation for single-family residences separately built, unless in conjunction with multiple construction in subdivision development; however, the governing body of any county which has adopted the urban county executive form of government, any city adjacent to such county, and any county contiguous to such county with the county*

executive form of government or any town within the contiguous county, and any city completely surrounded by such county, and portions of the Counties of Bedford, Franklin, and Pittsylvania which lie in the Smith Mountain Lake drainage area may regulate land-disturbing activities related to single-family residences separately built whether or not they are developed in conjunction with multiple construction in subdivision development. ...

Discussion

Preparation for single-family residences NOT IN A SUBDIVISION are exempt from E&S law, except as ~~provided for above~~. [To date, the County of Fairfax is the only county in Virginia with the urban executive form of government.] The portions of the counties of Bedford, Franklin and Pittsylvania that drain into Smith Mountain Lake may regulate single-family residences which are not in a subdivision.

Requirements

E&S Regulations Sec. 1.8:

B. *If individual lots or sections in a residential development are being developed by different property owners, all land-disturbing activities related to the building construction shall be covered by an erosion and sediment control plan or an "Agreement in Lieu of a Plan" signed by the property owner.*

C. *Land-disturbing activity of less than 10,000 square feet on individual lots in a residential development shall not be considered exempt from the provisions of the act and these regulations.*

D. *The construction of permanent roads or driveways that disturb in excess of 10,000 square feet and that serve more than one single-family residence separately built is not exempt. ...*

Discussion

Land-disturbing activities on individual lots of a residential development (subdivision) must have an erosion control plan or an agreement in lieu of a plan signed by the lot owner and the locality.

Usually, E&S plans are developed in two phases. The first plan addresses the initial construction of the infrastructure for the development. This plan would include the construction of roads, storm sewers, utilities, and any grading activity that involves more than one lot. The plan would also include stormwater runoff considerations based on the expected final development.

The second phase of construction begins with the construction of houses or buildings on individual lots. Individual E&S plans are required for land-disturbing activities on individual lots; however, many times an "agreement in lieu of an E&S plan" is acceptable. (See Appendix 7A-5.) This agreement reduces the burden on the homeowner of having to prepare an individual plan. The agreement states the conditions to be maintained during construction, such as keeping public streets clean, maintaining perimeter controls, and establishing permanent stabilization.

This requirement applies to land-disturbing activities of less than 10,000 square feet when the activity occurs in a residential development. The intent is to regulate activities which would be considered a part of the development process such as construction of individual houses, outbuildings, garages, driveways, etc.

Agricultural Activities

Requirement
VESCL Sec. 10.1-560(7): *Tilling, planting, harvesting of agricultural, horticultural, or forest crops, or livestock feedlot operations; including engineering operations as follows: construction of terraces, terrace outlets, check dams, desilting basins, dikes, ponds, ditches, strip cropping, lister furrowing, contour cultivating, contour furrowing, land drainage and land irrigation.*

Discussion
The definition of land-disturbing activities specifies which agricultural activities are exempted. The construction of agricultural buildings is not included. Therefore, the agricultural exemption does not apply to the construction of farm buildings, such as barns, livestock houses, etc. The reference to ponds applies to ponds that are used primarily for agricultural purposes such as irrigating crops, watering livestock, etc.

Requirement
E&S Regulations Sec. 1.9:
A. A property owner who disturbs 10,000 square feet, or more, of land and claims that the activity is exempted from the requirements ... shall have one year from the date of commencement of the activity to demonstrate to the erosion and sediment control enforcement authority that the activity is exempt. As soon as a nonexempt status is determined, the requirements of the Act shall be immediately enforced.

Discussion
Many agricultural and forestry activities require a reasonable period of time to clearly establish the intent of the activity. Therefore, the one year period was provided.

Claims that an activity is exempt should be consistent with landuse regulations, zoning or other regulations. Several of the exemptions from the E&S program are regulated by another program. For example, surface mining and oil and gas operations are regulated by programs administered by the Department of Mines, Minerals, and Energy. Projects claiming an exemption such as surface mining should be able to substantiate the claim with documentation from the appropriate agency.

Issuing Permits

Requirements
VESCL Sec. 10.1-565: *Agencies authorized ... to issue grading, building, or other permits for activities involving land-disturbing activities may not issue any such permit unless the applicant*

submits with his application an approved erosion and sediment control plan and certification that the plan will be followed.

Discussion

It is strongly recommended that a land-disturbing permit be issued. The permit clearly defines the land disturbance as a separate activity from building construction. By issuing a separate permit for the land-disturbing activity, the agency prevents any misunderstanding that the land-disturbing activity was permitted under another permit. Performance guarantees (e.g., bonds, credit, etc.) and certification should be made specifically for the land-disturbing activity, or at least a specified portion of the overall guarantee should be for the land-disturbing activity.

Changing An Approved Plan

Requirements

VESCL Sec.10.1-563(C): *An approved plan may be changed by the authority that approved the plan in the following cases:*

1. *Where inspection has revealed that the plan is inadequate to satisfy applicable regulations; or*
2. *Where the person responsible for carrying out the approved plan finds that because of changed circumstances or for other reasons the approved plan cannot be effectively carried out, and proposed amendments to the plan, consistent with the requirements of this article, are agreed to by the plan-approving authority and the person responsible for carrying out the plan.*

Discussion

Even though these procedures allow plans to be changed after initial approval, it is often difficult and troublesome to make changes in the field. Change orders are usually costly and time-consuming. Therefore, the original plan should be as thorough as possible.

Performance Guarantees

Requirements

VESCL Sec. 10.1-565: ... *Prior to issuance of any permit, the agency may also require an applicant to submit a reasonable performance bond with surety, cash escrow, letter of credit, any combination thereof, or such other legal arrangement acceptable to the agency, to ensure that measures could be taken by the agency at the applicant's expense should he fail, after proper notice, ... to initiate or maintain appropriate conservation action. ... If the agency takes such conservation action upon such failure by the permittee, the agency may collect from the permittee for the difference should the amount of the reasonable cost of such action exceed the amount of the security held. Within sixty days of the achievement of adequate stabilization of the land-disturbing activity, such bond, ... shall be refunded to the applicant or terminated.*

<u>Discussion</u>
The amount of coverage required as a guarantee for a project should be based on what it would cost the locality to implement the plan, should the applicant fail to do so. If the cost of the unfinished work is more than the amount of the performance guarantee, the locality may collect the additional cost from the permittee. A performance guarantee may be required for issuance of building, grading, land disturbing, or other permits. It is recommended that an E&S performance guarantee be collected separately from other guarantees.

Chapter Two of this handbook contains cost figures which may be used to help determine the amount of performance guarantee needed. At a minimum, the guarantee should be sufficient provide permanent stabilization for the entire disturbance in the event that the proposed development is not completed. The locality is responsible for determining the bond, escrow, etc. and administering these requirements unless stated otherwise in the local E&S ordinance.

Following are brief descriptions of various types of performance guarantees:

a. <u>Bonding</u> - If a bond is used, the bonding company agrees to complete the erosion and sediment control requirements of the plan, should the applicant fail to do so.

b. <u>Escrow Accounts</u> - Under an escrow arrangement, the applicant would pay funds into a bank under an agreement among the applicants, the permit issuing authority, and the bank. If the E&S plan was properly carried out, the applicant and the authority would sign a joint letter to the bank directing the bank to pay the money back to the applicant as specified in the agreement. Otherwise, the money would go to the permit issuing authority to pay for completing the unfinished portion of the plan, with any excess money being returned to the applicant.

c. <u>Letters of Credit</u> - A letter of credit is an agreement by a bank to pay a fixed sum of money upon the happening of a specified contingency. While a letter of credit is sometimes used alone, it is frequently used where a bonding company refuses to issue a bond unless it is provided with a letter of credit. The advantage of having a letter of credit in favor of a bonding company instead of the permit issuing authority is that if the work is not done, the bonding company will undertake to have it finished.

Localities should keep in mind the risk involved in accepting personal checks as performance guarantees. Checks should be deposited into escrow as soon as possible.

The performance guarantee must be returned to the applicant within 60 days of the achievement of adequate stabilization of the land-disturbing activity. Adequate stabilization should be determined by the Program Administrator or his designated agent. Localities should have a means of tracking the expiration dates of bonds and letters of credit. Extensions should be obtained when needed.

Inspections

Requirements

VESCL Sec. 10.1-566(A): *The plan-approving authority or, ... the permit-issuing authority (i) shall provide for periodic inspections of land-disturbing activity and (ii) may require monitoring and reports from the person responsible for carrying out the plan, to ensure compliance with the approved plan and to determine whether the measures required in the plan are effective in controlling erosion and sediment. The owner, occupier or operator shall be given notice of the inspection and an opportunity to accompany the inspectors.*

E&S Regulations Sec. 1.7:

A. *All erosion and sediment control structures and systems shall be maintained, inspected and repaired as needed to insure continued performance of their intended function. A statement describing the maintenance responsibilities of the permittee shall be included in the approved erosion and sediment control plan.*

B. *Periodic inspections are required on all projects by the enforcement authority. An inspection shall be made during or immediately following initial installation of erosion and sediment controls, at least once in every two-week period, within 48 hours following any runoff producing storm event, and at the completion of the project prior to the release of any performance bonds.*

Discussion

1. Pre-construction conferences are recommended, especially for large projects. During this meeting, the plan should be discussed, any problems or misconceptions resolved, and a basis for clear communication and good working relations established. Installation and maintenance of E&S control measures should be discussed.

2. All inspections should be documented by a written report or log. (See Appendix 7A-6 and 7A-7.) These reports should contain the date and time of inspection, comments concerning compliance or non-compliance, and notes on any verbal communications concerning the project. Localities may require the contractor to maintain an inspection log that can be reviewed by the local staff.

Violations And Enforcement

Requirements

VESCL Sec. 10.1-562(F): *The governing body of any [locality which has adopted its own local program] may adopt an ordinance establishing a uniform schedule of civil penalties for violations. ... [T]he civil penalty for any one violation shall not exceed $100. [I]n no event shall specified violations arising from the same operative set of facts be charged more frequently than once in any ten-day period, and in no event shall a series of specified violations arising from the same operative set of facts result in civil penalties which exceed a total of $3,000. ...*

VESCL Sec. 10.1-566(A): *... If the permit issuing authority or plan-approving authority determines that there is a failure to comply with the plan, notice shall be served upon the* *permittee. ... The notice shall specify the measures needed to comply with the plan and shall specify the time within which such measures shall by completed. Upon failure to comply within the time specified, the permit may be revoked and the permittee or person responsible for carrying out the plan shall be deemed to be in violation of this article and shall be subject to the penalties provided in Sec. 10.1-569.*

VESCL Sec. 10.1-569:

(A): *Violators ... shall be guilty of a misdemeanor and subject to a fine not exceeding $1,000 or thirty days imprisonment for each violation or both.*

(B): *If a locality has adopted an ordinance establishing a uniform schedule of civil penalties ... any [violator] shall, upon a finding of an appropriate general district court, be assessed a civil penalty in accordance with the schedule. ...*

(C): *The appropriate permit-issuing authority ... may apply to the circuit court in any jurisdiction wherein the land lies to enjoin a violation or a threatened violation ... without the necessity of showing that an adequate remedy at law does not exist.*

(D): *In addition to any criminal or civil penalties provided under this chapter, any person who violates any provision of this chapter may be liable to the locality, or the Board, as appropriate, in a civil action for damages.*

(E): *Without limiting the remedies which may be obtained in this section, any person violating or failing, neglecting or refusing to obey any injunction, mandamus or other remedy obtained pursuant to this section shall be subject, in the discretion of the court, to a civil penalty not to exceed $2,000 for each violation. ...*

(F): *With the consent of any person who has violated or failed, neglected or refused to obey any regulation or order of the Board, or any condition of a permit or any provision of this article, the ... authority may provide ... for the payment of civil charges for violations in specific sums, not to exceed the limit specified in subsection D of this section. Such civil charges shall be instead of any appropriate civil penalty which could be imposed under subsection E. ...*

<u>Discussion</u>

Violations include, but are not limited to, failure to comply with an approved plan or undertaking a land-disturbing activity without an approved plan. When a violation is noted, the following steps should be considered to secure compliance: (Also see "Enforcement Flow Chart" in Appendix 7B.)

1. <u>Informal Contact/Verbal Warning</u> - The inspector should complete a standard inspection report form detailing the observed violation and circumstances pertaining to it. (See Appendix 7A-7.) The report should specify the measures needed for compliance and a time frame for completion. The on-site job superintendent should be notified verbally, if possible, and asked to sign the inspection report to verify that

verbal notification has been given. Copies of the inspection report should be given or sent to the permittee and other concerned parties.

2. Notice to Comply - If the informal contact is unsuccessful, the plan approving or permit issuing authority should issue a "Notice to Comply" as required by Sec. 10.1-566(a). This notice should specify the measures required for compliance and the deadline for completion. The notice must be sent to the permittee by registered or certified mail (return receipt requested) to the address specified by the permittee in his application (Appendix 7A-8) or the notice can be delivered to the person supervising the activity.

3. Enforcement Options - If the permittee fails to respond adequately to the "Notice to Comply," the locality should consider the following actions:

   a. Utilize Performance Guarantee (where applicable) - The local authorities may utilize the performance guarantee to complete the required work according to the terms specified in the guarantee. Many times, a letter of intent to utilize the guarantee, sent by certified mail to the permittee, is sufficient to prompt the desired results. Such a letter should be cleared by the locality's attorney. If the cost of the unfinished work is more than the amount of the performance guarantee, the locality may also collect the additional amount from the permittee.

   b. Permit Revocation - Upon failure to complete the measures within the deadlines specified in the notice to comply, the land-disturbing permit can be revoked and the permittee can be considered in violation of the law.

   c. Stop Work Order - This highly recommended enforcement option allows the chief administrative officer of the locality to issue an order requiring all or part of the land-disturbing activities on the site be stopped until the specified corrective measures have been taken. (See Appendix 7A-9.) This order is issued either with or after a "Notice to Comply." The order shall be in effect for seven days allowing the locality time to pursue other means of legal action if problems are not corrected. A notice or card may be posted at the site notifying the public that a Stop Work Order has been issued for the project.

   d. Legal Action - Legal action against the violator is recommended when other enforcement options have failed or if a land disturbance poses a serious threat of damage to downstream or downslope property owners or the environment. There are four types of legal action which may be considered by the locality:

      1) Criminal Penalties - A misdemeanor charge subject to a fine up to $1000 or thirty days imprisonment for each violation;

2) Civil Penalties - (1) Civil penalties in accordance with the schedule of penalties up to $3,000; (2) Civil action charge subject to a fine up to $2000 for each violation;

3) Administrative Fines - With the consent of the violator, the payment of a civil charge for violations instead of the civil penalty;

4) Injunctive Relief - A suit for an injunction is a civil action, but it is possible to ask for an injunction and for penalties in the same action. Because of the length of time needed to decide the penalty question, it is advisable to always file for an injunction as well as a penalty unless the land-disturbing activity has already been completed.

   There are principally three types of injunctions, depending upon the amount of speed required:

   a) Temporary Restraining Order - This is the quickest form of injunction, usually issued for a limited time. It is issued to prevent irreparable harm to the plaintiff by preserving the status quo until the defendant can be notified and a preliminary hearing held.

   b) Preliminary or Temporary Injunction - This injunction provides a short period of notice to the defendant and is issued on a temporary basis until a full hearing and decision can be made.

   c) Permanent Injunction - This finally disposes of the matter at issue. It is issued only after a full hearing of the evidence and argument has occurred.

   An injunction will not be issued automatically. The court will probably weigh the damage to the environment against the damage to the builder. If it is just a question of enforcing the law with no great danger of sediment damage, the court might refuse the injunction and leave the enforcement to the penalty provisions of the law.

Projects Commenced Without an Approved Plan

Requirement

VESCL Sec 10.1-563(E): ... [No] person may engage in any land-disturbing activity until he has submitted to ... [the] locality an erosion and sediment control plan for the land-disturbing activity and the plan has been reviewed and approved by the plan-approving authority.

Discussion

If a land-disturbing activity is detected for which no E&S plan has been approved, an attempt should be made to contact the owner and advise him that he is in violation of the VESCL. He should be asked to stop all land disturbance until an approved plan is obtained, unless he agrees to perform work toward satisfactorily controlling erosion and sedimentation. A "Notice of Permit Requirement" should be sent to the owner by certified mail to establish that a warning was given. (See Appendix 7A-10.) Since there may be no permits issued or performance guarantees for the project at this early stage of development, the only enforcement options may be a stop work order or legal action. It is advisable to seek an injunction in accordance with Sec. 10.1-569(c) so that the problem will be addressed quickly.

Erosion Impact Area

Requirements

VESCL Sec. 10.1-560: *"Erosion Impact Area" means an area of land not associated with current land-disturbing activity but subject to persistent soil erosion resulting in the delivery of sediment onto neighboring properties or into state waters. This definition shall not apply to any lot or parcel of land of one acre or less used for residential purposes or to shorelines where the erosion results from wave action or other coastal processes.*

VESCL Sec. 10.1-563(E): *In order to prevent further erosion a local program may require approval of a conservation plan for any land identified in the local program as an erosion impact area.*

Discussion

A locality may declare a site to be an Erosion Impact Area and require the property owner to submit an E&S plan. A formal notice should be sent to the owner informing him of this requirement with a deadline for compliance. (See Appendix 7A-11.) Upon failure to comply with this notice, appropriate legal actions should be taken.

Records And Files

Discussion

1. For each project requiring an E&S plan, there should be a project file containing the following:

    a. permit application
    b. records of performance guarantee (bond, etc.)
    c. approved plan
    d. reviewer's comments
    e. inspection reports
    f. any photos taken
    g. any correspondence

2. Assign a project number to each plan, record the project number on each item in the file and cross-reference to other departments. The project number might also be the permit number (if permits are issued). This procedure will prevent confusion caused by changes in the name of the project or other projects with similar names.

Citizen Complaints

Discussion

Being involved in controlling a highly visible form of pollution, local program personnel will be recipients of many complaints and comments concerning drainage, erosion, stormwater, flooding, and sediment problems.

Develop procedures or steps to handle these inquiries efficiently. If the problem is related to a project under the jurisdiction of the local program, keep a record of all activity pertaining to the problem in the project file or provide a cross-reference to the appropriate file. If the problem pertains to some other program or agency, refer it to that organization. If the problem is not regulated, make that clear to the citizen and suggest legal alternatives or some means by which the citizen can obtain more information. (See Appendix 7A-12.)

The DSWC and districts are also available for technical assistance on E&S complaints.

Education And Information

Discussion

Local programs should consider the following steps:

1. Inform developers and other land disturbers of the requirements of the local program and develop printed material for this purpose. (See Appendix 7A-1 and 2.) Some localities hold annual meetings that address local development concerns and requirements for developers, consultants, contractors, etc.

2. Prepare training sessions or workshops for developers, engineers, landscape architects, consultants, contractors, excavators and others involved in the technical aspects of the program. Community college courses may be available for this purpose. Check with your local college for more information.

3. Conduct periodic workshops for local government and district personnel having responsibilities in the program, such as inspection, plan review or administrative duties. Inspectors and administrators should be certified by the state E&S certification program.

4. Prepare an orientation program for new employees and for cross-training inspectors in other departments. Assistance in training programs is available from the DSWC,

districts, SCS, other state agencies and other sources. These programs may be conducted on a regional or local basis.

Multijurisdictional Projects

Requirements

VESCL Sec. 10.1-563(A): *Where land-disturbing activities involve lands under the jurisdiction of more than one local control program an erosion and sediment control plan may, at the option of the applicant, be submitted to the Board for review and approval rather than to each jurisdiction concerned.*

Discussion

When a land-disturbing activity involves two or more local programs, the person responsible for plan submission has the option of submitting the plan for review and approval to: (1) each local program in which the project lies; or, (2) to DSWC.

1. Submission of Plans to Localities for Review - If this option is chosen, the applicant must contact each locality in which the project lies and comply with each set of local administrative procedures separately.

2. Submission of Plans to DSWC for Review - Under this option, the following procedures will apply:

    a. Plan Submission and Review

    Plans shall be submitted to the DSWC Central Office in Richmond or to the appropriate Regional Office. (See Appendix 7C.) Four copies of the plan must be provided. After the plan is approved, additional copies of the approved plan, if necessary, will be requested by DSWC (one for each locality). The plan should include the name, address and phone number of the landowner, the person responsible for implementing the plan, and the person preparing the plan.

    The plan should be prepared according to the guidelines in Chapter 6 of this handbook. The plan should include a precise location of the project and a listing of all localities in which it lies.

    DSWC shall review the plan within 45 days of submission. Localities will have the opportunity to review the plan and comment. Where localities have adopted more stringent standards in accordance with Section 10.1-570, DSWC will consider and apply those standards where deemed appropriate for local conditions.

    If the plan is not approved, the applicant will be notified in writing of the modifications needed to gain approval. If DSWC takes no action to approve or disapprove the plan within 45 days, the plan is automatically approved as submitted.

DSWC will notify all localities in which the project lies of any action it takes for approval or disapproval of the plan. If the plan is finally approved, each locality will receive a copy of the approved plan. Upon receipt of the approved plan, each locality may issue applicable permits, collect appropriate fees for permits, and obtain performance guarantees as provided under local administrative procedures.

Approved plans may be changed under the following conditions:

1) Where inspection (by the locality or localities) has revealed the inadequacy of the plan to accomplish the erosion and sediment control objectives of the plan, and proposed amendments are agreed to by the locality or DSWC;

or,

2) Where the person responsible for carrying out the approved plan finds that, because of changed circumstances or for other reasons, the approved plan cannot be effectively carried out, and proposed amendments to the plan, consistent with the requirements of the VESCL, are agreed to by the locality or DSWC.

b. Inspections

Inspections shall be the responsibility of the locality (or localities). The person responsible for implementing the plan shall notify the localities when land disturbing commences. DSWC may also periodically monitor the project to ensure that the plan is properly implemented. Before making any on-site visits, DSWC will notify the locality involved.

c. Enforcement

Responsibility for enforcement of the approved plan rests with the locality (or localities). The locality may require performance bonds, cash escrow accounts, letters of credit or other appropriate guarantees to ensure that the plan is properly carried out.

d. Appeals

Appeals shall be carried out in the following manner:

1) Appeals on acts or decisions of a locality shall be filed in accordance with the E&S ordinance of that locality.

2) Appeals on the requirements of the plan or other action or proposed action by DSWC shall be subject to the review of the Board, provided an appeal is filed within thirty days from the date of the written decision.

3) Final decisions of the Board shall be subject to judicial review in accordance with the provisions of the Administrative Process Act (Sec. 9-6.14:1 et seq.).

Discussion

Some localities have agreements with adjacent localities regarding multijurisdictional projects. Frequently, the locality which contains the greater portion of the project area will handle all or part of the E&S administrative procedures (plan review, permit issuance, fee collection, inspection and enforcement).

Conclusions

To help localities reduce erosion and sedimentation from urban construction, DSWC recommends the following measures*:

1. Ensure that no land-disturbing activity is allowed to commence grading or receive any other permits for construction prior to the approval of the project's E&S plan.

2. Provide the necessary staff and resources, including adequate education and training for program personnel, to effectively implement the local E&S Program.

3. Conduct periodic inspections of all active construction projects to ensure that the Law, program regulations and approved E&S plans are being followed.

4. Establish a clear, efficient enforcement procedure to ensure that E&S violations and other problems are corrected quickly. Enlist the support of the Commonwealth and municipal attorneys and local judges in enforcing the program.

5. Periodically conduct information programs for the general public as well as for those in the land-development industry to explain program requirements and promote compliance.

6. Ensure that all local government-funded construction (schools, fire stations, industrial parks, landfills, etc.) have approved E&S plans that are effectively implemented. Generally conduct E&S activities in an exemplary manner to provide a model of compliance for private sector projects.

7. Ensure that at least one, preferably all, local E&S officials become certified under the DSWC's certification program.

8. Identify all "erosion impact areas" (as defined in the VESCL) and require them to be stabilized.

* From Nonpoint Source Pollution Management Program, Revised 1989

PART II: STATE AGENCY PROJECTS

The VESCL requires that DSWC must review E&S plans or specifications for all state-sponsored land-disturbing activities. This may be accomplished in one of two ways: (1) annual E&S specifications, or (2) E&S plans for each project.

Submission of Annual E&S Specifications

State agencies may prepare their own standards and specifications for erosion and sediment control. These standards and specifications must be reviewed and approved annually by DSWC. The agency is then responsible for the preparation of plans for individual projects and the inspection and enforcement of the plans.

State agencies which choose this option must submit standards and specifications at least annually for review by DSWC. The standards and specifications should be submitted by November 1 of each year. DSWC will promptly review the standards and specifications and notify the agency within 60 days of its approval or disapproval.

To use this option, the agency must have sufficient capabilities to prepare E&S plans for each land-disturbing activity and to properly inspect and enforce the plans. DSWC will periodically inspect active construction sites to ensure that the program is effective and administered adequately.

Submission of Erosion and Sediment Control Plans

State agencies which have not submitted annual standards and specifications must submit an E&S plan for each land-disturbing activity to DSWC for approval. This E&S plan requirement applies to capital improvement projects as well as other land-disturbing activities as defined by VESCL (Sec. 10.1-560).

Note: When determining the amount of land disturbance for a project, the agency should include the project site, staging areas and any off-site areas such as borrow sites and surplus material disposal areas. In the event that off-site areas were not included in the original site plan, contact the appropriate DSWC regional office for approval before commencing the off-site activity.

The E&S plan should be prepared in accordance with the guidelines in Chapter 6 of this handbook. Plans should be sent to the appropriate regional office. (See Appendix 7C.) Four copies of the plan must be submitted by the agency or by its designated representative, such as an engineer or architect. All replies will be made to the person submitting the plan.

To facilitate planning, preliminary plans may also be submitted to DSWC. Comments will be made concerning erosion and sediment controls on the plan; however, the comments will not be binding and final approval will be granted only on final working drawings.

Minimum Standards - When determining plan adequacy, DSWC will generally apply the Minimum Standards contained in the E&S Regulations. The standards and specifications in Chapter 3 of this handbook (with standard symbols and abbreviations) should be used in the design of the E&S plan.

Note: State agency projects must comply with the Virginia Stormwater Management Program (SWM). With regard to stormwater runoff, the plan shall comply with the more stringent regulation of either the E&S or SWM program as determined by DSWC.

Approval or Disapproval - DSWC will promptly review all E&S plans submitted. Reviews will be conducted expeditiously, and, in all cases, the review will be completed within 60 days. The person submitting the plan will be notified in writing of its approval or disapproval. If the project is disapproved, the applicant will be notified of the modifications necessary to obtain approval. DSWC will provide copies of all final correspondence concerning each project to the Department of General Services' Division of Engineering and Buildings and the local E&S program administrator.

Modifications to an Approved Plan - An approved E&S plan may be changed under the following circumstances:

a. Where inspection has revealed the inadequacy of the plan to accomplish the erosion and sediment control objectives of the plan;

or

b. Where the agency responsible for carrying out the approved plan finds that because of changed circumstances or for other reasons the approved plan cannot be effectively carried out, and proposed amendments to the plan, consistent with the requirements of the E&S program, are agreed to by DSWC.

Inspection - A state agency which engages in a land-disturbing activity is responsible for inspection and enforcement of each E&S plan. This task may be delegated to someone such as an engineer or architect, but the agency retains the ultimate responsibility. The DSWC's Regional E&S Specialists will monitor state-sponsored construction sites to ensure that the plans are being properly carried out.

DSWC Assistance - DSWC will assist state agencies in formulating E&S plans on both capital and non-capital improvement projects upon request. As time and manpower permit, DSWC will also make its personnel and other resources available for inspections, workshops, research, and other activities to improve the effectiveness of erosion and sediment control on state construction projects.

Appeals - Appeals of any final decisions of DSWC shall be reviewed by the Soil and Water Conservation Board (Board). Appeals must be filed with the Board within 30 days from the date of the written decision. Decisions by the Board are subject to the appeals process provided by VESCL (Sec. 10.1-568 (c)).

APPENDIX 7A

SAMPLE ADMINISTRATIVE FORMS

The following sample forms are intended to streamline and improve efficiency of program administration. They are intended as suggestions, not requirements. Most localities have already developed forms for some of these procedures. We suggest that you review these and incorporate them into your program. Each one may be modified to fit your local program.

1. Brochure - "Obtaining a Land-Disturbing Permit" (for land developers/general public).
2. Checklist for Erosion and Sediment Control Plans (to assist with plan preparation and review).
3. Screening Form for Land-Disturbing Permit (for determining whether or not an E&S plan is required).
4. Application for Land-Disturbing Permit (or E&S Plan Approval) (for those submitting E&S plans).
5. Agreement in Lieu of an E&S Plan (option for those disturbing individual lots in residential subdivision development).
6. Inspector's Daily Log Entry (for E&S inspectors).
7. Inspection Report Form - Erosion and Sediment Control.
8. Notice to Comply (to be sent to violators).
9. Stop Work Order (to be sent to violators).
10. Notice of Permit Requirement (to be sent to violators).
11. Erosion Impact Area (to officially declare property such).
12. Citizen Request for Assistance (to record pertinent information).

OBTAINING A LAND-DISTURBING PERMIT

Before you grade, excavate, fill, or clear land, you may have to obtain a Land-Disturbing Permit. To find out if you need one, contact:

(Local Program Administrator)
(Address)
(Phone Number)

You will be asked what type of project you plan, location, and the total area of the property and number of square feet to be disturbed.

If Your Project Requires an Erosion and Sediment Control Plan:

You must:

a. Fill out an application;

b. Submit a plan, consisting of a narrative and site plan. (Obtain a copy of the E&S Handbook; it will tell you how to prepare a plan);

c. Pay a plan review fee of ________________.

Your plan will be reviewed and evaluated. If changes are required, you will be notified and advised of them. A revised plan may be required.

Upon final approval of the plan, you will be required to post a bond (surety bond, cash escrow, letter of credit) and sign certain agreements connected with the permit.

Your land-disturbing permit will then be issued. Building permits can be issued and the approved construction may commence.

CHECKLIST

FOR EROSION AND SEDIMENT CONTROL PLANS

_____ Minimum Standards - All applicable Minimum Standards must be addressed.

NARRATIVE

_____ Project description - Briefly describes the nature and purpose of the land-disturbing activity, and the area (acres) to be disturbed.

_____ Existing site conditions - A description of the existing topography, vegetation and drainage.

_____ Adjacent areas - A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance.

_____ Off-site areas - Describe any off-site land-disturbing activities that will occur (including borrow sites, waste or surplus areas, etc.). Will any other areas be disturbed?

_____ Soils - A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture and soil structure.

_____ Critical areas - A description of areas on the site which have potentially serious erosion problems (e.g., steep slopes, channels, wet weather/ underground springs, etc.).

_____ Erosion and sediment control measures - A description of the methods which will be used to control erosion and sedimentation on the site. (Controls should satisfy minimum standards in Chapter 3.)

_____ Permanent stabilization - A brief description, including specifications, of how the site will be stabilized after construction is completed.

_____ Stormwater runoff considerations - Will the development site cause an increase in peak runoff rates? Will the increase in runoff cause flooding or channel degradation downstream? Describe the strategy to control stormwater runoff.

_____ Calculations - Detailed calculations for the design of temporary sediment basins, permanent stormwater detention basins, diversions, channels, etc. Include calculations for pre- and post-development runoff.

SITE PLAN

______ Vicinity map - A small map locating the site in relation to the surrounding area. Include any landmarks which might assist in locating the site.

______ Indicate north - The direction of north in relation to the site.

______ Limits of clearing and grading - Areas which are to be cleared and graded.

______ Existing contours - The existing contours of the site.

______ Final contours - Changes to the existing contours, including final drainage patterns.

______ Existing vegetation - The existing tree lines, grassed areas, or unique vegetation.

______ Soils - The boundaries of different soil types.

______ Existing drainage patterns - The dividing lines and the direction of flow for the different drainage areas. Include the size (acreage) of each drainage area.

______ Critical erosion areas - Areas with potentially serious erosion problems. (See Chapter 6 for criteria.)

______ Site Development - Show all improvements such as buildings, parking lots, access roads, utility construction, etc.

______ Location of practices - The locations of erosion and sediment control and stormwater management practices used on the site. Use the standard symbols and abbreviations in Chapter 3 of the E&S Handbook.

______ Off-site areas - Identify any off-site land-disturbing activities (e.g., borrow sites, waste areas, etc.). Show location of erosion controls. (Is there sufficient information to assure adequate protection and stabilization?)

______ Detail drawings - Any structural practices used that are not referenced to the E&S Handbook or local handbooks should be explained and illustrated with detail drawings.

______ Maintenance - A schedule of regular inspections and repair of erosion and sediment control structures should be set forth.

SCREENING FORM

Project: ______________________ Project File#: ________

Applicant: ____
(Name)

____
(Address)

Will project require grading, excavating, clearing,
filling, or other land-disturbing activity of any kind? YES NO

If YES, complete this form:

Purpose: ____

____

Location: ____

____

Area to be disturbed: ________ acres; ____________ sq. ft.

Total area of the property: ________ acres; ____________ sq. ft.

Is structure a single family dwelling? YES NO

If yes, is it located in a residential subdivision? YES NO

==

(FOR OFFICE USE ONLY)

Checked by ________________________ Date ______________

________ Requires an Erosion and Sediment Control Plan

________ Requires an Agreement in Lieu of an E&S Plan

________ Exempt

APPLICATION FOR LAND-DISTURBING PERMIT

Project File#: ____________________
Date of Application: ____________________
Permit Effective Date: ____________________
Permit Expires: ____________________

Applicant: ____
(Name) (Business Phone)

____
(Address)

Landowner: ____
(Name) (Business Phone)

____
(Address)

Plan prepared by: ____

Project: ____
(Name and Description)

Location: ____

Tax Map: ____________ Parcel ____________ Area = ____________ sq.ft.

I, **[applicant]**, hereby certify that I fully understand the provisions of the **[locality]** Erosion and Sediment Control Ordinance and Program, and that I accept responsibility for carrying out the Erosion and Sediment Control Plan for the above-referenced project as approved.

I further grant the right-of-entry onto this property, as described above, to the designated personnel of **[locality]** for the purpose of inspecting and monitoring for compliance with the aforesaid Ordinance.

The following general statements shall apply to all permits:

1. All projects shall conform to the standards and specifications and other criteria adopted by **[locality]** unless a variance has been granted in writing by this locality.

2. This permit must be kept on the work site and shown on request.

3. The locality must be notified when work commences and when the project is completed.

4. Other work (grading, excavating, construction) on the project shall not commence until the appropriate erosion and sediment controls are in-place as specified on the plan.

5. Applicant agrees to be responsible for any and all damages to any other conservation measures already in-place as a result of work covered by this permit.

6. Applicant agrees to maintain the conservation measures in satisfactory operating condition until final, permanent stabilization is achieved.

7. The land-disturbing permit may be revoked, should the locality determine that the project is not in compliance with the conditions of the approved plan.

I, applicant, certify that I have read and understand the above requirements of this permit.

Section ________ of the ________________________ Code requires that a Performance Guarantee be posted with the Commonwealth's Attorney in the amount determined by the Program Administrator. Such Performance Guarantee shall be conditioned to conform any work to approved standards and specifications as specified in the approved Erosion and Sediment Control Plan.

Final inspection of the project shall be made by the Program Administrator or designated agent. The release of any Performance Guarantee is contingent upon the findings of such inspection. Release of the Performance Guarantee shall occur within 60 days after the project site is deemed adequately stabilized by the Program Administrator. The amount of such Performance Guarantee is hereby set at $____________. The fee for plan review and inspection for this project is hereby stated to be $__________.

SUBMITTED:

______________________________ ______________

(Applicant signature) (Date)

APPROVED:

______________________________ ______________

(Program Administrator) (Date)

______________________________ ______________

(Plan Approving Authority) (Date)

Attachments: ( ) copies of E&S plan
Fee Payment
Performance Guarantee

AGREEMENT IN LIEU OF AN EROSION AND SEDIMENT CONTROL PLAN FOR A SINGLE FAMILY RESIDENCE

Land-Disturbing Permit No.: ____________________
Building Permit Number: ____________________
Subdivision: ____________________
Lot Number: ____________________

In lieu of submission of an erosion and sediment control plan for the construction of this single family dwelling, I agree to comply with any reasonable requirements determined necessary by employees of ____**[Locality]**______, representing the Erosion and Sediment Control Program Administrator. Such requirements shall be based on the conservation standards contained in the ____**[Locality]**__ ___ Erosion and Sediment Control Ordinance, and shall represent the minimum practices necessary to provide adequate control of erosion and sedimentation on or resulting from this project.

As a minimum, all denuded areas on the lot shall be stabilized within 7 days of final grading with permanent vegetation or a protective ground cover suitable for the time of year.

I further understand that failure to comply with such requirements within three working days following notice by the representatives of ____**[Locality]**____ could result in citation for violation of the ____**[Locality]**____ Erosion and Sediment Control Ordinance.

Measures Specified by the Plan Approving Authority: ______________________________

____

____

____

Signature of Landowner: ____

Party Responsible for Erosion and
Sediment Control (if different from landowner): ______________________________

Approved By: ______________________________ Date: ____________________

INSPECTOR'S DAILY LOG ENTRY

Date: ______________

Time: ______________

Project: ____

Stage of Project:

Condition of Site:

Verbal Comments (Violations, potential problems, etc.):

Initialed _____

INSPECTION REPORT

Sheet ____ of____

Project Name:____ File No.____________

Inspection Date:________________ Time:____________ Inspected by: ________________________

STAGE OF CONSTRUCTION

____ Pre-Construction Conference ____ Rough Grading ____ Finish Grading
____ Clearing and Grubbing ____ Building Construction ____ Final Stabilization

==

INSPECTION CHECKLIST

Yes	No	NA		
[]	[]	[]	*MS-1	Have all denuded areas requiring temporary or permanent stabilization been stabilized? Seeded? yes/no Mulched? yes/no Graveled? yes/no
[]	[]	[]	MS-2	Are soil stockpiles adequately stabilized with seeding and/or sediment trapping measures?
[]	[]	[]	MS-3	Does permanent vegetation provide adequate stabilization?
[]	[]	[]	MS-4	Have sediment trapping facilities been constructed as a first step in LDA?
[]	[]	[]	MS-5	For perimeter sediment trapping measures, are earthen structures stabilized?
[]	[]	[]	MS-6	Are sediment basins installed where needed?
[]	[]	[]	MS-7	Are finished cut and fill slopes adequately stabilized?
[]	[]	[]	MS-8&9	Are on-site channels and outlets adequately stabilized?
[]	[]	[]	MS-10	Do all operational storm sewer inlets have adequate inlet protection?
[]	[]	[]	MS-11	Are stormwater conveyance channels adequately stabilized with channel lining and/or outlet protection?
[]	[]	[]	MS-12	Is in-stream construction conducted using measures to minimize channel damage?
[]	[]	[]	MS-13	Are temporary stream crossings of non-erodible material installed where applicable?
[]	[]	[]	MS-15	Is necessary restabilization of in-stream construction complete?
[]	[]	[]	MS-16	Are utility trenches stabilized properly?
[]	[]	[]	MS-17	Are soil and mud kept off public roadways at intersections with site access roads?
[]	[]	[]	MS-18	Have all temporary control structures that are no longer needed been removed?
[]	[]	[]		Have all control structure repairs and sediment removal been performed?
[]	[]	[]	MS-19	Are properties and waterways downstream from development adequately protected from erosion and sediment deposition due to increases in peak stormwater runoff?

*** Refers to the minimum standards of the Virginia Erosion and Sediment Control Regulations (VR 625-02-00).**

==

Comments: ____

____

____

____

Verbal/Written notification given to: ____

Report by: ____________________________________ Date: ____________________

NOTICE TO COMPLY

Project File #: __________

Date: ______________

To: ____

Re: ____
(Project Name)

An inspection of the above-referenced project on [date] revealed that the following violations are present: ____
____
____

The following recommendations are made regarding the necessary corrections:
____
____
____

Notice is hereby given that these violations shall be corrected in accordance with the approved Erosion and Sediment Control Plan on or before [date]. The site will be re-inspected at that time.

Failure to comply with this notice will result in necessary legal enforcement action by the locality to effect the implementation of the approved plan. Please contact this department if there are any questions.

Inspector: ____
(Signature)

Program Administrator: ______________________________________
(Signature)

Copies to: Commonwealth's Attorney
Board of Supervisors/Town or City Council
Plan Approving Authority

STOP WORK ORDER

To: ______________________________ Date: __________

Address: ____

____

Project File#: ____________ Name: ______________________

Project Location: ______________________________________

The above-referenced project is in violation of the __**[locality]**__ Erosion and Sediment Control Ordinance. A "Notice to Comply" was issued on __**[date]**__. Corrective measures specified for compliance were not performed.

This order requires that all land-disturbing activities on the above-referenced site be stopped until the specified corrective measures have been taken. If work is not begun to correct this violation by __**[date]**__, further legal action will be taken. Upon completion of the corrective action, the order shall immediately be lifted.

Program Administrator ____________________ Date ______________

Chief Administrative
Officer **[of locality]** ____________________ Date ______________

cc: Commonwealth's Attorney
Plan Approving Authority

NOTICE OF PERMIT REQUIREMENT

Date:________

To: ____
(Name)

____
(Address)

Re: ____
(Project Name)

It has come to the attention of this department that a land-disturbing activity is occurring on your property located at __**[location]**__.

This activity requires a Land-Disturbing Permit. Pursuing the activity without such a permit is a violation of the ____**[locality]**_____ Erosion and Sediment Control Ordinance.

It is hereby requested that you cease the land-disturbing activity until a permit has been obtained from this office. Contact us as soon as possible so that we may assist you in bringing your project into compliance with the Law.

Signed: ______________________________
(Program Administrator)

cc: Commonwealth's Attorney
Board of Supervisors/Town or City Council
Plan Approving Authority

EROSION IMPACT AREA

To: ______________________________ Date: __________

Address: ______________________________________

____

__[Locality]__ has identified the property located ______________________

as an Erosion Impact Area. You, as the property owner, are required to submit an Erosion and Sediment Control Plan to this office by __[date]__. Failure to comply with this notice is a violation of the __[locality]__ Erosion and Sediment Control Ordinance.

If you have any questions regarding the content of the required Erosion and Sediment Control Plan, please contact the Program Administrator as listed below.

Program Administrator ____________________ Date __________
(signature)

cc: Commonwealth's Attorney
Plan Approving Authority

* An Erosion Impact Area is defined as "an area of land not associated with current land-disturbing activity but subject to persistent soil erosion resulting in the delivery of sediment onto neighboring properties or into state waters" (Sec. 10.1-560 in the Virginia Erosion and Sediment Control Law, Code of Virginia).

REQUEST FOR ASSISTANCE

Received By: ______________________ Date: ______________

Referred To: ______________________ Date: ______________

Assistance Requested By: ____

Street Address/P. O. Box: ____

City/Town/Zip: ____

Telephone:

Location of Problem: ____

Description of Problem: ____

____

____

____

Is the problem related to a land-disturbing activity? _____________________

If yes, Project File# _____________

Problem Satisfactorily Resolved? __________________ Date ___________

Chronological Summary of Actions Taken: ______________________________

____

____

____

____

APPENDIX 7C

DCR/DSWC URBAN PROGRAMS CONTACT INFORMATION

Erosion and Sediment Control (ESC) and Stormwater Management (SWM) Programs

URBAN PROGRAMS HOME PAGES

http://www.state.va.us/~dcr/sw/e&s.htm http://www.state.va.us/~dcr/sw/stormwat.htm

TRAINING & CERTIFICATION HOME PAGE

http://www.state.va.us/~dcr/sw/estr&crt.htm

LINKS TO LOCAL GOVERNMENTS

http://www.vipnet.org/vipnet/government/local-government.html

DCR CENTRAL OFFICE

203 Governor Street, Suite 206
Richmond, VA 23219

Program Support Technician **Regina Greene** (804) 371-7533 fax 786-1978	**Assistant Program Support Technician** **Nicole Gordon** (804) 371-7489 fax 786-1978
Urban Programs Training/Certification Coordinator VACANT (804)371-7532 fax 786-1978	**Urban Programs Regulatory Coordinator** Michael C. Gerel (804) 371-7440 fax 786-1978
Urban Programs Engineer - VACANT (804) 786-4508 fax 371-2630	
Stormwater Management Program Manager Joseph G. Battiata (804) 371-7492 fax 371-2630	**Erosion and Sediment Control Program Manager** Jacob A. Porter (804) 786-3997 fax 371-2630

DCR WATERSHED OFFICES*

Urban Program Compliance Engineer (UPCE), Urban Program Engineer (UPE), and Urban Program Planner (UPP) Field Representatives

Shenandoah Watershed Office Manager - Charlie Wade Tamara Keeler (UPCE) John S. Mlnarcik (UPE) Lynn A. Snyder (UPCE – Shen-James West) Route 4, Box 99-J **Staunton**, VA 24401 (540) 332-9991 fax: 332-8956	**James Watershed Office** Manager - Michael Bowman Robert E. Cooper (UPE) John McCutcheon (UPCE - James East) David Aho (UPCE - James Central) 3800 Stillman Parkway, Suite 102 **Richmond**, VA 23233 (804) 527-4484 fax: 527-4483	**Potomac Watershed Office** Manager - Mary Apostolico VACANT (UPCE) Jamie B. Lowery (UPE) 98 Alexandria Pike, Suite 33 **Warrenton**, VA 22186 (540) 347-6420 fax: 347-6423
Rappahannock Watershed Office Manager - Matthew Criblez VACANT (UPP) Michael J. Lee (UPCE) Commonwealth Building, 2601Princess Anne St., Suite 101 **Fredericksburg**, VA 24401 (540) 899-4074 fax 899-4389	**York Watershed Office** Manager - Darryl Glover Kenny W. Harper (UPCE) Post Office Box 1425 **Tappahannock**, VA 22560 (804) 443-6752 fax: 443-4534	**Upper Tennessee & Big Sandy (UTBS) Watershed Office** Manager - Neal Kilgore Phyllis A. Hinch (UPCE) 252 W. Main St., Suite 3 **Abingdon**, VA 24210 (540) 676-5529 fax: 676-5527
Roanoke Watershed Office Manager - Tim Ott VACANT (UPP) Clarence F. Huff (UPCE) 411 Boyd Street **Chase City**, VA 23924 (804) 372-2191/2192 fax: 372-4962	**New River Watershed Office** Manager – Charlotte Burnett Vacant (UPE) Vacant (UPCE) Post Office Box 1506 148 Broad Street **Dublin**, VA 24084 (540) 643-2590 fax: 643-2597	**Chowan & Albermarle Watersheds Office** Manager - Ernie Brown Vacant (UPE) Jeffrey T. Hancock (UPCE) 1548-A Holland Road **Suffolk**, VA 23434 (757) 925-2468 fax: 925-2388

APPENDIX 7C
LOCAL GOVERNMENT JURSIDICTIONS AND CORRESPONDING URBAN PROGRAMS CONTACTS

COUNTIES

County	Watershed Office*	County	Watershed Office*
Accomack	Chowan/Albermarle	King & Queen	York
Albemarle	James Central	King William	York
Alleghany	Shen – James West	Lancaster	Rappahannock
Amelia	James East	Lee	UTBS
Amherst	James Central	Loudoun	Potomac
Appomattox	James Central	Louisa	James Central
Arlington	Potomac	Lunenburg	Roanoke
Augusta	Shen – James West	Madison	Rappahannock
Bath	Shen - James West	Mathews	York
Bedford	Roanoke	Mecklenburg	Roanoke
Bland	New River	Middlesex	York
Botetourt	Shen - James West	Montgomery	New River
Brunswick	Roanoke	Nelson	James Central
Buchanan	UTBS	New Kent	York
Buckingham	James Central	Northampton	Chowan/Albermarle
Campbell	James Central	Northumberland	Rappahannock
Caroline	York	Nottoway	James East
Carroll	New River	Orange	Rappahannock
Charles City	York	Page	Shenandoah
Charlotte	Roanoke	Patrick	New River
Chesterfield	James East	Pittsylvania	Roanoke
Clarke	Shenandoah	Powhatan	James East
Craig	Shen - James West	Prince Edward	James East
Culpeper	Rappahannock	Prince George	James East
Cumberland	James East	Prince William	Potomac
Dickenson	UTBS	Pulaski	New River
Dinwiddie	Chowan/Albermarle	Rappahannock	Rappahannock
Essex	York	Richmond	Rappahannock
Fairfax	Potomac	Roanoke	Roanoke
Fauquier	Potomac	Rockbridge	Shen - James West
Floyd	New River	Rockingham	Shenandoah
Fluvanna	James Central	Russell	UTBS
Franklin	Roanoke	Scott	UTBS
Frederick	Shenandoah	Shenandoah	Shenandoah
Giles	New River	Smyth	UTBS
Gloucester	York	Southampton	Chowan/Albermarle
Goochland	James East	Spotsylvania	Rappahannock
Grayson	New River	Stafford	Rappahannock
Greene	Rappahannock	Surry	Chowan/Albermarle
Greensville	Chowan/Albermarle	Sussex	Chowan/Albermarle
Halifax	Roanoke	Tazewell	New River
Hanover	York	Warren	Shenandoah
Henrico	James East	Washington	UTBS
Henry	Roanoke	Westmoreland	Rappahannock
Highland	Shen – James West	Wise	UTBS
Isle of Wight	Chowan/Albermarle	Wythe	New River
James City	York	York	York
King George	Rappahannock		

***see Page VII-39**

APPENDIX 7C
LOCAL GOVERNMENT JURSIDICTIONS AND CORRESPONDING URBAN PROGRAMS CONTACTS

CITIES

City	Watershed Office*	City	Watershed Office*
Alexandria	Potomac	Manassas	Potomac
Bedford	Roanoke	Manassas Park	Potomac
Bristol	UTBS	Martinsville	Roanoke
Buena Vista	Shen – James West	Newport News	Chowan/Albermarle
Charlottesville	James Central	Norfolk	Chowan/Albermarle
Chesapeake	Chowan/Albermarle	Norton	UTBS
Clifton Forge	Shen – James West	Petersburg	Chowan/Albermarle
Colonial Heights	James East	Poquoson	York
Covington	Shen – James West	Portsmouth	Chowan/Albermarle
Danville	Roanoke	Radford	New River
Emporia	Chowan/Albermarle	Richmond	James East
Fairfax	Potomac	Roanoke	Roanoke
Falls Church	Potomac	Salem	Roanoke
Franklin	Chowan/Albermarle	Staunton	Shen - James West
Fredericksburg	Rappahannock	Suffolk	Chowan/Albermarle
Galax	New River	Virginia Beach	Chowan/Albermarle
Hampton	Chowan/Albermarle	Waynesboro	Shen - James West
Harrisonburg	Shenandoah	Williamsburg	York
Hopewell	James East	Winchester	Shenandoah
Lexington	Shen – James West		
Lynchburg	James Central		

TOWNS

Town	Watershed Office*	Town	Watershed Office*
Abingdon	UTBS	Haymarket	Potomac
Alta Vista	Roanoke	Herndon	Potomac
Ashland	York	Narrows	New River
Berryville	Shenandoah	Occoquan	Potomac
Blacksburg	New River	Pearisburg	New River
Bluefield	New River	Pulaski	New River
Bridgewater	Shenandoah	Scottsville	James Central
Cape Charles	Chowan/Albermarle	South Boston	Roanoke
Chase City	Roanoke	South Hill	Roanoke
Christiansburg	New River	Stephens City	Shenandoah
Culpeper	Rappahannock	Tappahannock	York
Dayton	Shenandoah	Vienna	Potomac
Dublin	New River	Warrenton	Potomac
Dumfries	Potomac	West Point	York
Farmville	James East	Woodstock	Shenandoah
		Wytheville	New River

***see Page VII-39**

GLOSSARY

GLOSSARY

The list of terms that follows is representative of those used by public works officials, planners and other urban specialists, water pollution specialists, engineers, developers, soil scientists, conservationist planners, etc. Not all the terms are necessarily used in the text, but they are in common use in urban conservation and environmental matters. The aim of this glossary is representativeness, not completeness.

AASHTO classification - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway and Transportation Officials.

Acid soil - A soil with a preponderance of hydrogen ions, and probably of aluminum in proportion to hydroxyl ions. Specifically, soil with a pH value less than 7.0. For most practical purposes, a soil with a pH value less than 6.6.

Acre-foot - The volume of water that will cover 1 acre to a depth of 1 foot.

Aggradation - The process of building up a surface by deposition. This is a long-term or geologic trend in sedimentation.

Alluvial - Pertaining to material that is transported and deposited by running water.

Alluvial land - Areas of unconsolidated alluvium, generally stratified and varying widely in texture, recently deposited by streams, and subject to flooding.

Alluvial soils - Soils developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes.

Alluvium - A general term for all detrital material deposited or in transit by streams, including gravel, sand, silt, clay and all variations and mixtures of these. Unless otherwise noted, alluvium is unconsolidated.

Annual flood - The highest peak discharge which can be expected in any given year.

Antecedent Moisture Conditions (AMC) - The degree of wetness of a watershed at the beginning of a storm.

Antecedent Precipitation Index (API) - An indicator of the amount of water (in inches) present in the soil at any given time. The calculation of the API is based on the assumption that, during time periods of no precipitation, the soil moisture decreases logarithmically with time.

Anti-seep collar - A device constructed around a pipe or other conduit and placed through a dam, levee, or dike for the purpose of reducing seepage losses and piping failures.

Anti-vortex device - A facility placed at the entrance to a pipe conduit structure such as a drop inlet spillway or hood inlet spillway to prevent air from entering the structure when the pipe is flowing full.

Aquifer - An underground porous, water-bearing geological formation. The term is generally restricted to materials capable of yielding an appreciable supply of water.

Artificial Recharge - The addition of water to the groundwater reservoir by activities of man, such as irrigation or induced infiltration from streams, wells or spreading basins.

Base flow - Stream discharge derived from groundwater sources. Sometimes considered to include flows from regulated lakes or reservoirs. Fluctuates much less than storm runoff.

Bearing capacity - The maximum load that a material can support before failing.

Bedrock - The more or less solid rock in place either on or beneath the surface of the earth. It may be soft, medium or hard and have a smooth or irregular surface.

Benthic region - The bottom of a body of water which supports the benthos.

Benthos - The plant and animal life whose habitat is the bottom of a sea, lake or river.

Bentonite - A highly plastic clay consisting of the minerals montmorillonite and beidellite that swells extensively when wet.

Berm - A narrow shelf or flat area that breaks the continuity of a slope.

Borrow area - A source of earth fill material used in the construction of embankments or other earth fill structures.

California bearing ratio (CBR) - The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio and multiplied by 100; first standardized in California. A soil with a ratio of 16 will support 16 percent of the load that would be supported by the standard crushed limestone per unit area and with the same degree of distortion.

Capillary action - In hydrology, the tendency of dry soil particles to attract moisture from wetter portions of soil.

Castellated - Built or formed like a castle, with "battlements."

Catch basin - A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.

Catchment - Surface drainage area.

Channel - A natural stream that conveys water. A ditch or channel excavated for the flow of water. VESCR: A natural stream or manmade waterway.

Channel stabilization - Erosion prevention and stabilization of velocity distribution in a channel using drops, revetments, vegetation and other measures.

Channel storage - Water temporarily stored in channels while en route to an outlet.

Channelization - Alteration of a stream channel by widening, deepening, straightening, cleaning, or paving certain areas to improve flow characteristics.

Check dam - Small dam constructed in a gully or other small channel to decrease the flow velocity, minimize channel scour, and promote deposition of sediment.

Chute - A high-velocity, open channel for conveying water to a lower level without erosion.

Cohesion - The capacity of a soil to resist shearing stress, exclusive or functional resistance.

Cohesive soil - A soil that, when unconfined, has considerable strength when air-dried and significant cohesion when submerged.

Compost - Organic residue or a mixture of organic residues and soil, that has undergone biological decomposition until it has become relatively stable humus.

Composting - A controlled process of degrading organic matter by micro-organisms. Present-day composting is the aerobic, thermophilic decomposing of organic waste to relatively stable humus. Humus with no more than 25 percent dead or living organisms is stable enough not to reheat or cause odor or fly problems. It can undergo further, slower decay.

Comprehensive planning - Planning that takes into account all aspects of water, air and land resources and their uses and limits.

Cone of depression - Cone-shaped depression in the water table created by pumping at a well head.

Conservation - The protection, improvement and use of natural resources according to principles that will assure their highest economic or social benefits.

Conservation district - A public organization created under state enabling law as a special-purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries, usually a subdivision of state government with a local governing body and always with limited authorities. Often called a soil conservation district or a soil and water conservation district. VESCL: a political subdivision of this Commonwealth organized in accordance with the provisions of Article 3 (§ 10.1-506 et. seq.) of this chapter.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation.

Cool season grasses - In Virginia, a grass which experiences most of its growth in the spring and fall, but may remain green all year long. Cool season grasses tend to turn brown and become dormant during mid-summer.

Cut - Portion of land surface or area from which earth has been removed or will be removed by excavating; the depth below original ground surface of excavated surface.

Cutting - A leaf, stem or branch cut from a plant to establish a new plant.

Cut-and-fill - Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.

Cutoff trench - A long, narrow excavation constructed along the center line of a dam, dike, levee or embankment and filled with relatively impervious material intended to reduce seepage of water through porous strata.

Dam - A barrier to confine or raise water for storage or diversion, to create a hydraulic head, to prevent gully erosion, or for retention of soil, rock, or other debris.

Debris dam - A barrier built across a stream channel to retain rock, sand, gravel, silt or other material.

Debris guard - Screen or grate at the intake of a channel or a drainage or pump structure for the purpose of stopping debris.

Depression storage - Watershed capacity to retain in puddles, ditches, depressions or on foliage.

Design highwater - The elevation of the water surface as determined by the flow conditions of the design floods.

Design life - The period of time for which a facility is expected to perform its intended function.

Design storm - A selected rainfall pattern of specified amount, intensity, duration and frequency that is used as a basis for design.

Desilting area - An area of grass, shrubs, or other vegetation used for inducing deposition of silt and other debris from flowing water; located above a stock tank, pond, field or other area needing protection from sediment accumulation.

Detention - Managing stormwater runoff or sewer flows through temporary holding and controlled release.

Detention dam - A dam constructed for the purpose of temporary storage of streamflow or surface runoff and for releasing the stored water at controlled rates.

Detention time - The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge).

Detritus - Loose material (soil and organic particles) that results from the disintegration, destruction or wearing away of the earth's surface: debris.

Dibble bar - A heavy metal tool with a blade and a foot pedal used to open holes for planting seeds or small seedlings.

Dike - (Engineering) An embankment to confine or control water, especially one built along the banks of a river to prevent overflow of lowlands; a levee.

Discharge - Outflow; the flow of a stream, canal or aquifer. One may also speak of the discharge of a canal or stream into a lake, river or ocean. (Hydraulics) Rate of flow, especially fluid flow; a volume of fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day.

Discharge coefficient (Hydraulics) - The ratio of actual rate of flow to the theoretical rate of flow through orifices, weirs or other hydraulic structures.

Dispersion, Soil - The breaking down of soil aggregates into individual particles, resulting in single-grain structure. Ease of dispersion is an important factor influencing the erodibility of soils. Generally speaking, the more easily dispersed the soil, the more erodible it is.

Diversion - A channel with a supporting ridge on the lower side constructed across or at the bottom of a slope for the purpose of intercepting surface runoff. See Terrace.

Diversion dam - A barrier built to divert part or all of the water from a stream into a different course.

Diversion terrace - Diversions, which differ from terraces in that they consist of individually designed channels across a hillside, may be used to protect bottomland from hillside runoff or may be needed above a terrace system for protection against runoff from an unterraced area. They may also divert water out of active gullies, protect buildings from runoff, or reduce the number of waterways, and are sometimes used in connection with stripcropping to shorten the length of slope so that the strips can effectively control erosion. See Terrace.

Divide, Drainage Divide - The boundary between one drainage basin and another.

Drain - A buried pipe or other conduit (closed drain). A ditch (open drain) for carrying off surplus surface water or groundwater.

Drainage - The removal of excess surface water or groundwater from land by means of surface or subsurface drains. Soil characteristics that affect natural drainage.

Drainage basin - A geographical area or region that is so sloped and contoured that surface runoff from streams and other natural watercourses is carried away by a single drainage system by gravity to a common outlet or outlets. Also referred to as a watershed or drainage area.

Drainage, Soil - As a natural condition of the soil, soil drainage refers to the frequency and duration of periods when the soil is free of saturation; for example, in well-drained soils the water is removed readily but not rapidly; in poorly drained soils the root zone is waterlogged for long periods unless artificially drained, and the roots of ordinary crop plants cannot get enough oxygen; in excessively drained soils the water is removed so completely that most crop plants suffer from lack of water. Strictly speaking, excessively drained soils are a result of excessive runoff due to the steep slopes or low water-holding capacity due to small amounts of silt and clay in the soil material. The following classes are used to express soil drainage:

Well drained - Excess water drains away rapidly and no mottling occurs within 36 inches of the surface.

Moderately well drained - Water is removed from the soil somewhat slowly, resulting in small but significant periods of wetness. Mottling occurs between 18 and 36 inches.

Somewhat poorly drained - Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Mottling occurs between 8 and 18 inches.

Poorly drained - Water is removed so slowly that the soil is wet for a large part of the time. Mottling occurs between 0 and 8 inches.

Very poorly drained - Water is removed so slowly that the water table remains at or near the surface of the greater part of the time. There may also be periods of surface ponding. The soil has a black to gray surface layer with mottles up to the surface.

Drawdown - Lowering of the water surface (in open channel flow), water table or piezometric surface (in groundwater flow) resulting from a withdrawal of water.

Drop-inlet spillway - Overall structure in which the water drops through a vertical riser connected to a discharge conduit.

Drop spillway - Overall structure in which the water drops over a vertical wall onto an apron at a lower elevation.

Drop Structure - A structure for dropping water to a lower level and dissipating its surplus energy; a fall. A drop may be vertical or inclined.

Dry storage - Volume within a basin (e.g., sediment basin) which is allotted for temporary ponding of stormwater runoff. It will undergo drawdown over a period of time, re-establishing the initial storage volume.

Dry weather flow - The combination of sanitary sewage, and industrial and commercial wastes normally found in the sanitary sewers during the dry weather season of the year. Also, that flow which exists in streams during dry seasons.

Earth dam - Dam constructed of compacted soil materials.

Effective precipitation - That portion of total precipitation that becomes available for plant growth. It does not include precipitation lost to deep percolation below the root zone or to surface runoff.

Embankment - A man-made deposit of soil, rock or other material used to form an impoundment.

Emergency spillway - A vegetated earth channel used to safely convey flood discharges in excess of the capacity of the principal spillway.

Energy dissipator - A device used to reduce the energy of flowing water.

Environment - The sum total of all the external conditions that may act upon an emergency or community to influence its development or existence.

Erodible - Susceptible to erosion.

Erosion - The wearing away of the land surface by running water, wind, ice or other geological agents, including such processes of gravitational creep. Detachment and movement of soil or rock fragments by water, wind, ice or gravity. The following terms are used to describe different types of water erosion:

Accelerated erosion - Erosion much rapid than normal or geologic erosion, primarily as a result of the influence of the activities of man, or, in some cases, of the animals or natural catastrophes that expose bare surfaces (e.g., fires).

Channel erosion - The erosion process whereby the volume and velocity of a concentrated flow wears away the bed and banks of well-defined channel.

Geological erosion - The normal or natural erosion caused by geological processes acting over long geologic periods and resulting in the wearing away of mountains, the building up of floodplains, coastal plans, etc. Synonymous to natural erosion.

Gully erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 to 2 feet to as much as 75 to 100 feet.

Natural erosion - Wearing away of the earth's surface by water, ice or other natural agents under natural environmental conditions of climate, vegetation, etc., undisturbed by man. Synonymous to geological erosion.

Normal erosion - The gradual erosion of land used by man which does not greatly exceed natural erosion. See <u>Erosion, natural</u>.

Rill erosion - An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils. See <u>Rill</u>.

Raindrop erosion - The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not be subsequently removed by surface runoff.

Sheet erosion - The removal of a fairly uniform layer of soil from the land surface by runoff water.

Erosion classes (soil survey) - A grouping of erosion conditions based on the degree of erosion or on characteristic patterns. Applied to accelerated erosion, not to normal, natural, or geological erosion. Four erosion classes are recognized for water erosion and three for wind erosion.

Estuary - Area where fresh water meets salt water, where the tide meets the river current (e.g., bays, mouths of rivers, salt marshes and lagoons). Estuaries serve as nurseries and spawning the feeding grounds for large groups of marine life and provide shelter and food for birds and wildlife.

Evapotranspiration - The combined loss of water from a given area and during a specific period of time, by evaporation from the soil surface and by transpiration from plants.

Excess rainfall - Direct runoff at the place where it originates.

Filter blanket - A layer of sand and/or gravel designed to prevent the movement of fine-grained soils.

Filter fabric - A woven, water-permeable material generally made of synthetic products such as polypropylene and used in stormwater management and erosion and sediment control applications to trap sediment or prevent the clogging of aggregates by fine soil particles.

Filter strip - A long, narrow vegetative planting used to retard or collect sediment for the protection of watercourses, diversions, drainage basins or adjacent properties.

First flush - The first portion of runoff generated by rainfall event and containing the main portion of the pollutant load resulting from the storm.

Flood - An overflow or inundation that comes from a river or other body of water. Any relatively high stream flow overtopping the natural or artificial banks in any reach of a stream.

Flood control - Methods or facilities for reducing flood flows.

Floodgate - A gate placed in a channel or closed conduit to keep out floodwater or tidal backwater.

Flood peak - The highest value of the stage or discharge attained by a flood; thus, peak stage or peak discharge.

Flood plain - The lowland that borders a stream and is subject to flooding when the stream overflows its banks.

Flood routing - Determining the changes in the rise and fall of floodwater as it proceeds downstream through a valley or reservoir.

Flood stage - The stage at which overflow of the natural banks of a stream begins.

Floodwater retarding structure - A structure providing for temporary storage of floodwater and for its controlled release.

Floodway - A channel, either natural, excavated or bounded by dikes and levees, used to carry excessive flood flows to reduce flooding. Sometimes considered to be the transitional area between the active channel and the floodplain.

Flume - A constructed device lined with erosion-resistant materials intended to convey water on steep grades.

Fluvial sediment - Those deposits produced by stream or river action.

Foundation drain - A pipe or series of pipes which collects groundwater from the foundation or footing of structures and discharges this water into sewers or other points of disposal.

Fragipan - A natural subsurface soil horizon with high bulk density relative to the solum above, seemingly cemented when dry but showing a moderate to weak brittleness when moist. The layer is low in organic matter, mottled, slowly or very slowly permeable to water, and usually shows occasional or frequent bleached cracks forming polygons. It may be found in profiles of either cultivated or virgin soils, but not in calcareous material.

Freeboard - A vertical distance between the elevation of the design highwater and the top of a dam, levee or diversion ridge.

Frequency of storm (design storm frequency) - The anticipated period in years that will elapse, based on average probability of storms in the design region, before a storm or a given intensity and/or total volume will recur; thus a 10-year storm can be expected to occur on the average once every 10 years. Sewers designed to handle flows which occur under such storm conditions would be expected to be surcharged by any storms of greater amount or intensity.

Froude number (F) - A calculated number of classifying water flow as critical (F = 1), supercritical (F > 1) or subcritical (F < 1).

Gabion - A rectangular or cylindrical wire mesh cage filled with rock and used as a protecting agent, revetment, etc., against erosion.

Gage or gauge - Device for registering precipitation, water level, discharge velocity, pressure, temperature, etc. A measure of the thickness of metal; e.g., diameter of wire, wall thickness of steel pipe.

Gaging station - A selected section of a stream channel equipped with a gage, recorder or other facilities for determining stream discharge.

Graduation (geology) - The bringing of a surface or a stream bed to grade, by running water. As used in connection with sedimentation and fragmental products for engineering evaluation, the term gradation refers to the frequency distribution of the various sized grains that constitute a sediment, soil or other material.

Grade - The slope of a road, channel, or natural ground. The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared for the support of construction such as paving or the laying of a conduit.

(To) Grade - To finish the surface of a canal bed, top of embankment or bottom of excavation.

Graded stream - A stream in which, over a period of years, the slope is delicately adjusted to provide, with available discharge and with prevailing channel characteristics, just the velocity required for transportation of the load (of sediment) supplied from the drainage basin.

Graded stabilization structure - A structure for the purpose of stabilizing the grade of a gully or other watercourse, thereby preventing further head-cutting or lowering of the channel grade.

Gradient - Change of elevation, velocity, pressure or other characteristics per unit length; slope.

Grading - Any stripping, cutting, filling, stockpiling or any combination thereof, including the land in its cut-and-filled condition.

Grass - A member of the botanical family Gramineae, characterized by bladelike leaves arranged on the culm or stem in two ranks.

Grassed waterway - A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from an area at reduced flow rate.

Greenbelt - A strip of land reserved around the periphery of an urban area by official authority for park land, farms, etc.

Groundwater infiltration - The seepage of groundwater into an opening in a sewer.

Groundwater recharge - Inflow to a groundwater reservoir.

Groundwater runoff - That part of groundwater that is discharged into a stream channel as spring or seepage water.

Groundwater table - The free surface of the groundwater. It is seldom static, generally rising and falling with the season, subject to atmospheric pressure under the ground, the rate of withdrawal, the rate of restoration, and other conditions.

Habitat - The environment in which the life needs of a plant or animal are supplied.

Head (Hydraulics) - The height of water above any plain or reference. The energy either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various compound terms such as pressure head, velocity head and head loss.

Head gate - Water control structure; the gate at the entrance to a conduit.

Head loss - Energy loss due to friction, eddies, changes in velocity or direction of flow.

Headwater - The source of a stream. The water upstream from a structure or point on a stream.

Hydrograph - A graph showing for a given point on a stream or for a given point in any drainage system the discharge, stage (depth), velocity or other property of water with respect to time.

Hydrology - The science of the behavior of water in the atmosphere, on the surface of the earth, and underground.

Hydrologic cycle - The circuit of water movement from the atmosphere to the earth and back to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation and transpiration.

Impact basin - A device used to dissipate the energy of flowing water. Generally constructed of concrete in the form of a partially depressed or partially submerge vessel, and may utilize baffles to dissipate velocities.

Impervious - Not allowing infiltration.

Impoundment - Generally, an artificial collection or storage of water, as a reservoir, pit, dugout, sump, etc.

Indirect runoff - That portion of runoff that contributes to the runoff pollution that enters receiving water as point discharges from separate storm sewer systems and as general surface runoff.

Infiltration/inflow - A combination of infiltration and inflow waste water volumes in sewer lines that permits no distinction between the two basic sources which have the same effect of usurping the capacities of sewer systems and other sewerage system facilities.

Infiltration-percolation - An approach to wastewater treatment in which large volumes of wastewater are applied to the land, and subsequently, infiltrates the surface and percolates through the soil pores.

Infiltration rate - A soil characteristic determining or describing the maximum rate at which water can enter the soil under specified conditions including the presence of an excess of water.

Initial abstraction - Initial precipitation loss including interception and depression storage.

Intercepted surface runoff - That portion of surface runoff that enters a sewer, either storm or combined, directly through catch basins, inlets, etc.

Interception (Hydraulics) - The process by which precipitation is caught and held by foliage, twigs and branches of trees, shrubs and other vegetation. Often used for "interception loss" or the amount of water evaporated from the precipitation intercepted.

Interception channel - A channel excavated at the top of earth cuts, at the foot of slopes or at other critical places to intercept surface flow; a catch basin. Synonymous to interception ditch.

Interflow - That portion of rainfall that infiltrates into the soil and moves laterally through the upper soil horizons until intercepted by a stream channel or until it returns to the surface at some point downslope from its point of infiltration.

Intermittent stream - A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. It is dry for a large part of the year, ordinarily more than 3 months.

Internal soil drainage - The downward movement of water through the soil profile. The rate of movement is determined by the textile, structure and other characteristics of the soil profile and underlying layers and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are: none, very slow, slow, medium, rapid, and very rapid.

Invert - The lowest point on the inside of a sewer or other conduit.

Junction - In rivers, the point of connection of two upstream stretches or segments. In some estuary models, a junction is a segment of the estuary.

Lag time - The interval between the center of mass of the storm precipitation and the peak flow of the resultant runoff.

Land capability - The suitability of land for use without permanent damage. Land capability, as ordinarily used in the United States, is an expression of the effect of physical land conditions, including climate, on the total suitability for use without damage for crops that require regular tillage, for grazing, for woodland and for wildlife. Land capability involves consideration of (1) the risks of land damage from erosion and other causes and (2) the difficulties in land use owing to physical land characteristics, including climate.

Land capability classification - A grouping of kinds of soils into special units, classes, and subclasses according to their capability for intensive use and the treatments required for sustained use; prepared by the Soil Conservation Service, USDA.

Land capability map - A map showing land capability units, classes and subclasses, or a soil survey map colored to show land capability classes.

Land use controls - Methods for regulating the uses to which a given land area may be put, including such things as zoning, subdivision regulation and floodplain regulation.

Legume - A member of the legume or pulse family, Leguminosae, one of the most important and widely distributed plant families. The fruit is a "legume" or pod that opens along two sutures when ripe. The flowers are usually papilionaceous (butterfly-like). Leaves are alternate, have stipules, and are usually compound. Includes many valuable food and forage species, such as the peas, beans, peanuts, clovers, alfalfas, sweet clovers, lespedezas, vetches and kudzu. Practically all legumes are nitrogen-fixing plants.

Liquefaction, Spontaneous - The sudden large decrease of the shearing resistance of a cohesionless soil caused by a collapse of the structure from shock or other type of strain and associated with a sudden but temporary increase in the pore-fluid pressure. It involves a temporary transformation of the material into a fluid mass.

Liquid limit - The moisture content at which the soil passes from plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and low capacity for supporting loads.

Manning's equation (Hydraulics) - An equation used to predict the velocity of water flow in an open channel or pipelines:

$$V = \frac{1.486\, r^{2/3}\, S^{1/2}}{n}$$

where:

V = the mean velocity of flow in feet per second;
r = the hydraulic radius in feet;
S = the slope of the energy gradient or, for assumed uniform flow, the slope of the channel in feet per foot;
n = the roughness coefficient or retardance factor of the channel lining.

Mean depth (Hydraulics) - Average depth; cross-sectional area of a steam or channel divided by its surface or top width.

Mean velocity - The average velocity of a stream flowing in a channel or conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-sectional area of the reach.

Merlon - In a castellated concrete grid pavement unit, one of the protruding portions which alternate with depressed portions (crenels) to form the surface geometry of the unit.

Mottled - A soil characteristic denoting spots or blotches of different colors.

Mulch - A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover and minimizes temperature fluctuations.

Natural Drainage - The flow patterns of stormwater runoff over the land in its pre-development state. Elements of natural drainage include overland flow, swales, depressions, rills, gullies, natural watercourses, etc.

Nonpoint source pollution - Pollution that enters a water body from diffuse origins on the watershed and does not result from discernible, confined or discrete conveyances.

Non-sewered urban runoff - Surface runoff in an urban drainage area which drains into a receiving stream without passing through a sewer system.

Normal depth - Depth of flow in an open conduit during uniform flow for the given conditions.

Nutrient(s) - A substance necessary for the growth and reproduction of organisms. In water, those substances that promote growth of algae and bacteria; chiefly nitrates and phosphates.

Open drain - Natural watercourse or constructed open channel that conveys drainage water.

Outfall - The point, location, or structure where wastewater or drainage discharges from a sewer to a receiving body of water.

Outlet - Point of water disposal from a stream, river, lake, tidewater or artificial drain.

Outlet channel - A waterway constructed or altered primarily to carry water from man-made structures, such as terraces, tile lines and diversions.

Overflow - A pipeline or conduit device, together with an outlet pipe, that provides for the discharge of portions of combined sewer flows into receiving waters or other points of disposal, after a regular device has allowed the portion of the flow which can be handled by interceptor sewer lines and pumping and treatment facilities to be carried by and to such water pollution control structures.

Overland flow irrigation - A process of land application of wastewater that provides spray distribution onto gently sloping soil of relatively impervious nature, such as clays, for the purpose of attaining aerobic bio-treatment of the exposed flow in contact with ground cover vegetation, followed by the collection of runoff waters in interception ditches or channels and the return of the wastewater back to the spray system or its discharge into receiving waters; sometimes called spray runoff.

Peak discharge - The maximum instantaneous flow from a given storm condition at a specific location.

Percolation - The movement of water through soil.

Percolation rate - The rate, usually expressed as a velocity, at which water moves through saturated granular material.

Percolation test - A determination of the rate of percolation or seepage of water through natural soils expressed as time in minutes for a 1-inch fall of water in a test hole.

Perennial stream - A stream that maintains water in its channel throughout the year.

Permeability coefficient - The volume of water, in cubic feet, under a head of one foot, that will pass through a square foot of porous surface in one day.

Permeability, Soil - The quality of a soil horizon that enable water or air to move through it. The permeability of a soil may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

Permeability rate - The rate at which water will move through a saturated soil. Permeability rates are classified as follows:

(a) Very slow - Less than 0.06 inches per hour.
(b) Slow - 0.06 to 0.20 inches per hour.
(c) Moderately slow - 0.20 to 0.63 inches per hour.
(d) Moderate - 0.63 to 2.0 inches per hour.
(e) Moderately rapid - 2.0 to 6.3 inches per hour.
(f) Rapid - 6.3 to 20.0 inches per hour.
(g) Very rapid - More than 20.0 inches per hour.

Pervious - Allowing movement of water.

Pesticides - Chemical compounds used for the control of undesirable plants, animals or insects. The term includes insecticides, herbicides, algalcides, rodenticides, nematicides, fungicides and growth regulators.

pH - A numerical measure of acidity of hydrogen ion activity and of alkalinity. The neutral point is pH 7.0. All pH values below 7.0 are acid and all above 7.0 are alkaline.

Phosphorus, Available - Inorganic phosphorus that is readily available for plant growth.

Photosynthesis - The basic process of plant life, by which chlorophyll, in the presence of sunlight and nutrients, converts carbon dioxide and water to carbohydrates, with oxygen as a by-product.

Physiographic province - A region, all parts of which are similar in geologic structure and climate, which consequently has a unified geomorphic history.

Planned unit development (PUD) - A special classification authorized in some zoning ordinances, where a unit of land under control of a single developer may be used for a variety of uses and densities, subject to review and approval by the local governing body. The locations of the zones are usually decided on a case-by-case basis.

Plasticity index - The numerical difference between the liquid limit and the plastic limit of soil; the range of moisture content within which the soil remains plastic.

Plastic limit - The moisture content at which a soil changes from a semisolid to a plastic state.

Plunge pool - A device used to dissipate the energy of flowing water that may be constructed or made by the action of flowing. These facilities may be protected by various lining materials.

Point source - Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. (P.L. 92-500, Section 502(14)).

Pollutant - "Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water." (P.L. 92-500, Section 502(6)).

Pollution - The presence in a body of water (or soil or air) of substances of such character and in such qualities that the natural quality of the environment is impaired or rendered harmful to health and life or offensive to the senses.

Porosity - The volume of pore space in a rock.

Porous pavement - A pavement through which water can flow at significant rates.

Principal spillway - A dam spillway generally constructed of permanent material and designed to regulate the normal water level, provide flood protection and/or reduce the frequency of operation of the emergency spillway.

Rainfall intensity - The rate a which rain is falling at any given instant, usually expressed in inches per hour.

Rational method - A means of computing storm drainage flow rates (Q) by use of the formula Q = CIA, where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area.

Reach - The smallest subdivision of the drainage system consisting of a uniform length of open channel or underground conduit. Also, a discrete portion of river, stream or creek. For modeling purposes, a reach is somewhat homogeneous in its physical characteristics.

Receiving stream - The body of water into which runoff or effluent is discharged.

Recharge - Replenishment of groundwater reservoirs by infiltration and transmission from the outcrop of an aquifer or from permeable soils.

Recharge basin - A basin provided to increase infiltration for the purpose of replenishing groundwater supply.

Retention - The storage of stormwater to prevent it from entering the sewer system; may be temporary or permanent. VESCR: the process by which an impoundment structure stores the total runoff of a given storm and then releases the flow at a controlled rate over an extended period.

Retention structure - A natural or artificial basin that functions similar to a detention structure except that it maintains a permanent water supply.

Rhizome - A modified plant stem that grows horizontally underground.

Riffles - Fast sections of a stream where shallow water races over stones and gravel. They usually support a wider variety of bottom organisms than other stream sections.

Rill - A small intermittent watercourse with steep sides, usually only a few inches deep.

Riparian rights - A principle of common law which requires that any user of waters adjoining or flowing through his lands must so use and protect them that he will enable his neighbor to utilize the same waters undiminished in quantity and undefiled in quality.

Riprap - Broken rock, cobbles or boulders placed on earth surfaces, such as the face of a dam of a stream, for protection against the action of water (waves). Also applied to brush or pole mattresses, brush and stone, or other similar materials used for soil erosion control.

Riser - The inlet portions of a drop inlet spillway that extend vertically from the pipe conduit barrel to the water surface.

River basin - A major water resource region. The U.S. has been divided into 20 major water resource regions (river basins). See <u>Drainage Basin</u>.

Rock-fill-dam - A dam composed of loose rock usually dumped in place, often with the upstream part constructed of hand-placed or derrick-placed rock and faced with rolled earth or with an impervious surface of concrete, timber or steel.

Routing - Storing, regulating, diverting or otherwise controlling the peak flows of runoff or wastewater through a collection system according to some predetermined plan.

Runoff - That portion of precipitation that flows from a drainage area on the land surface, in open channels or in stormwater conveyance systems.

Saturation point - In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.

Scour - The clearing and digging action of flowing air or water, especially the downward erosion caused by stream water in sweeping away mud and silt from the outside bank of a curved channel or during a flood.

Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.

Sediment basin - A depression formed from the construction of a barrier or dam built to retain sediment and debris.

Sediment delivery ratio - The fraction of the soil eroded from upland sources that actually reaches a continuous stream channel or storage reservoir.

Sediment discharge - The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.

Sediment grade - Measurements of sediment and soil particles that can be separated by screening. A committee on sedimentation of the National Research Council has established a classification of textural grade sizes for standard use.

Sediment pool - The reservoir space allotted to the accumulation of submerged sediment during the life of the structure.

Seedbed - The soil prepared by natural or artificial means to promote the germination of seed and the growth of seedlings.

Seedling - A young plant grown from seed.

Septic tank - An underground tank used for the deposition of domestic wastes. Bacteria in the wastes decompose the organic matter, and the sludge settles to the bottom. The effluent flows through drains into the ground. Sludge is pumped out at regular intervals.

Settlings basin - An enlargement in the channel of a stream to permit the settling of debris carried in suspension.

Shoot - The above-ground portion of a plant.

Silt - A soil consisting of particles between 0.05 and 0.002 millimeter in equivalent diameter. A soil textural class. See Soil Texture.

Silt loam - A soil textural class containing a large amount of silt and small quantities of sand and clay. See Soil Texture.

Silty clay - A soil textural class containing a relatively large amount of silt and clay and a small amount of sand. See Soil Texture.

Silty clay loam - A soil textural class containing a relatively large amount of silt, a lesser quantity of clay, and a still smaller quantity of sand. See Soil Texture.

Slope - Degree of deviation of a surface from the horizontal; measured as a numerical ratio, percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise), as 2:1. A 2:1 slope is a 50 percent slope. Expressed in degrees, the slope is the angle from the horizontal plan with a 90° slope being vertical (maximum) and 45° being a 1:1 or 100 percent slope.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil conservation - Using the soil within the limits of its physical characteristics and protecting it from unalterable limitations of climate and topography.

Soil horizon - A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming factors.

Soil profile - A vertical section of the soil from the surface through all horizons, including C horizons.

Soil structure - The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; Some types are crumb structure, block structure, platy structure, and columnar structure.

Soil texture - The physical structure or character of soil determined by the relative proportions of the soil separates (sand, silt and clay) of which it is composed.

Spillway - A passage such as a paved apron or channel for surplus water over or around a dam or similar obstruction. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of excess water.

Storm frequency - The time interval between major storms of predetermined intensity and volumes of runoff which storm and combined sewers and such appurtenant structures as swirl concentrator chambers are designed and constructed to handle hydraulically without surcharging and backflooding, e.g., a 5-year, 10-year or 20-year storm.

Storm sewer - A sewer that carries stormwater and surface water, street wash and other wash waters or drainage, but excludes sewage and industrial wastes. Also called a storm drain.

Stormwater infiltration - The entrance of stormwater into a sanitary sewer.

Stormwater management - (1) The control, regulation, or treatment of stormwater runoff, especially relating to the effects of land development on the natural hydrology. (2) A program which deals with quantity and quality of stormwater runoff.

Stormwater runoff - See Runoff.

Streambanks - The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.

Stream gaging - The quantitative determination of stream flow using gages, current meters, weirs or other measuring instruments at selected locations. See Gaging station.

Sub-basin - A physical division of a larger basin, associated with one reach of the storm drainage system.

Subcatchment - A subdivision of a drainage basin (generally determined by topography and pipe network configuration).

Subdrain - A pervious backfilled trench containing stone or a pipe for intercepting groundwater or seepage.

Subsoil - The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil), in which roots normally grow. Although a common term, it cannot be defined accurately. It has been carried over from early days when "soil" was conceived only as the plowed soil and that under it as the "subsoil".

Subwatershed - A watershed subdivision of unspecified size that forms a convenient natural unit.

Surcharge - The flow condition occurring in closed conduits when the hydraulic grade line is above the crown of the sewer.

Surface runoff - Precipitation that falls onto the surfaces of roofs, streets, ground, etc., and is not absorbed or retained by that surface, but collects and runs off.

Surface water - All water the surface of which is exposed to the atmosphere.

Suspended solids - Solids either floating or suspended in water, sewage or other liquid wastes.

Swale - An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales conduct stormwater into primary drainage channels and provide some groundwater recharge.

Tailwater depth - The depth of flow immediately downstream from a discharge structure.

Terrace - An embankment or combination of an embankment and channel across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.

Terrace interval - Distance measured either vertically or horizontally between corresponding points on two adjacent terraces.

Terrace outlet channel - Channel, usually having a vegetative cover, into which the flow from one or more terraces is discharged and conveyed from the terrace system.

Terrace system - A series of terraces occupying a slope and discharging runoff into one or more outlet channels.

Thermophilic - Of, or relating to, an organism growing at high temperatures.

Tile, Drain - Pipe made of burned clay, concrete, or similar material, in short lengths, usually laid with open joints to collect and carry excess water from the soil.

Tile drainage - Land drainage by means of a series of tile lines laid at a specified depth and grade.

Toe drain - A drainage system constructed in the downstream portion of an earth dam or levee to prevent excessive hydrostatic pressure.

Topography - General term to include characteristics of the ground surface such as plains, hills, mountains, degree of relief, steepness of slopes and other physiographic features.

Toxicity - The characteristic of being poisonous or harmful to plant or animal life; the relative degree or severity of this characteristic.

Transpiration - The process by which water vapor escapes from living plants and enters the atmosphere.

Trash rack - A structural device used to prevent debris from entering a spillway or other hydraulic structure.

Turbidity - Cloudiness of a liquid, caused by suspended solids; a measure of the suspended solids in a liquid.

Unified soil classification system (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Uniform flow - A state of steady flow when the mean velocity and cross-sectional area remain constant in all sections of a reach.

Urban runoff - Surface runoff from an urban drainage area that reaches a stream or other body of water or a sewer.

Urbanized area - Central city, or cities, and surrounding closely settled territory.

Vegetative protection - Stabilization of erosion or sediment-producing areas by covering the soil with:

(a) Permanent seeding, producing long-term vegetative cover;
(b) Short-term seeding, producing temporary vegetative cover; or,
(c) Sodding, producing areas covered with a turf of perennial sodforming grass.

Warm season grasses - In Virginia, a grass which experiences most of its growth during the warm summer months (June, July and August) of the year. The onset of freezing temperatures turns warm season grasses brown and they remain dormant until late spring. Significantly more heat and drought tolerant than cool season grasses.

Watercourse - A definite channel with bed and banks within which concentrated water flows, either continuously or intermittently.

Water quality - A term used to describe the chemical, physical and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Water resources - The supply of groundwater and surface water in a given area.

Watershed - The region drained by or contributing water to a stream, lake or other body of water. See <u>Drainage Basin</u>.

Watershed area - All land and water within the confines of a drainage divide or a water problem area consisting in whole or in part of land needing drainage or irrigation.

Watershed lag - Time from center of mass of effective rainfall to peak of hydrograph.

Watershed management - Use, regulation and treatment of water and land resources of a watershed to accomplish stated objectives.

Watershed planning - Formulation of a plan to use and treat water and land resources.

Water table - The upper surface of the free groundwater in a zone of saturation; locus of points in subsurface water at which hydraulic pressure is equal to atmospheric pressure.

Weir - Device of measuring or regulating the flow of water.

Weir notch - The opening in a weir for the passage of water.

Wet storage - Volume within a basin (e.g., sediment basin) which is allotted for pooling or ponding of stormwater runoff.

Wet weather flow - A combination of dry weather flows and infiltration, inflow and/or runoff, which occurs as a result of rainstorms.

Zoning ordinance - An ordinance based on the police power of government to protect the public health, safety and general welfare. It may regulate the type of use and intensity of development of land and structures to the extent necessary for a public purpose. Requirements may vary among various geographically defined areas called zones. Regulations generally cover such items as height and bulk of buildings, density of dwelling units, off-street parking, control of signs and use of land for residential, commercial, industrial or agricultural purposes. A zoning ordinance is one of the major methods of implementation of a comprehensive plan.

COMMONWEALTH of VIRGINIA

Erosion and Sediment Control and Stormwater Management Certification Regulations

Erosion and Sediment Control Law

Erosion and Sediment Control Regulations

Note: This document was updated on June 7, 2017 with the removal of the first "OR" used in 9VAC25-840-40 19 c on page 42 of this document.

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CHAPTER 850
EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT CERTIFICATION REGULATIONS

9VAC25-850-10. Definitions.

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

"Applicant" means any person submitting a request to be considered for certification.
"Board" means the State Water Control Board.

"Certification" means the process whereby the board, on behalf of the Commonwealth, issues a certificate to persons who have completed board-approved training programs and met any additional eligibility requirements of 9VAC25-850-50 related to the specified classifications (9VAC25-850-40) within the areas of ESC or SWM or in other ways demonstrated adequate knowledge and experience in accordance with the eligibility requirements of 9VAC25-850-50 in the specified classifications within the areas of ESC or SWM.

"Certified combined administrator for ESC" means an employee or agent of a VESCP authority who holds a certificate of competence from the board in the combined ESC classifications of program administrator, plan reviewer, and project inspector in the area of ESC.

"Certified combined administrator for SWM" means an employee or agent of a VSMP authority who holds a certificate of competence from the board in the combined classifications of program administrator, plan reviewer, and project inspector in the area of SWM.

"Certified plan reviewer for ESC" means an employee or agent of a VESCP authority who: (i) holds a certificate of competence from the board in the classification of plan reviewer in the area of ESC; (ii) is licensed as a professional engineer, architect, certified landscape architect, or land surveyor pursuant to Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1 of the Code of Virginia; or (iii) is a professional soil scientist as defined in Chapter 22 (§ 54.1-2200 et seq.) of Title 54.1 of the Code of Virginia.

"Certified plan reviewer for SWM" means an employee or agent of a VSMP authority who holds a certificate of competence from the board in the classification of plan reviewer in the area of SWM.

"Certified program administrator for ESC" means an employee or agent of a VESCP authority who holds a certificate of competence from the board in the classification of program administrator in the area of ESC.

"Certified program administrator for SWM" means an employee or agent of a VSMP authority who holds a certificate of competence from the board in the classification of program administrator in the area of SWM.

"Certified project inspector for ESC" means an employee or agent of a VESCP authority who holds a certificate of competence from the board in the classification of project inspector in the area of ESC.

"Certified project inspector for SWM" means an employee or agent of a VSMP authority who holds a certificate of competence from the board in the classification of project inspector in the area of SWM.

"Classification" means the four specific certificate of competence classifications within the areas of ESC or SWM that make up activities being performed (program administrator, plan reviewer, project inspector, and combined administrator).

"Combined administrator for ESC" means anyone who is responsible for performing the combined duties of a program administrator, plan reviewer and project inspector of a VESCP authority.

"Combined administrator for SWM" means anyone who is responsible for performing the combined duties of a program administrator, plan reviewer and project inspector of a VSMP authority.

"Department" means the Department of Environmental Quality.

"Erosion and sediment control plan" or "ESC plan" means a document containing material for the conservation of soil and water resources of a unit or group of units of land. It may include appropriate maps, an appropriate soil and water plan inventory and management information with needed interpretations, and a record of all decisions contributing to conservation treatment. The plan shall contain all major conservation decisions to ensure that the entire unit or units of land will be so treated to achieve the conservation objective.

"ESC" means erosion and sediment control.

"ESC Act" means the Erosion and Sediment Control Law, Article 2.4 (§ 62.144.15:51 et seq.) of Chapter 3.1 of Title 62.1 of the Code of Virginia.

"Plan reviewer" means anyone who is responsible for determining the accuracy of ESC plans and supporting documents or SWM plans and supporting documents for approval by a VESCP authority or a VSMP authority as may be applicable in the areas of ESC or SWM.

"Program administrator" means the person or persons responsible for administering and enforcing the VESCP or VSMP of a VESCP authority or a VSMP authority as may be applicable in the areas of ESC or SWM.

"Project inspector" means anyone who, as a representative of a VESCP authority or a VSMP authority, is responsible for periodically examining the ESC or SWM activities and premises of a land-disturbing activity for compliance with the ESC Act and Regulations or the SWM Act and Regulations as may be applicable.

"Responsible land disturber" or "RLD" means an individual holding a certificate issued by the department who is responsible for carrying out the land-disturbing activity in accordance with the approved ESC plan. The RLD may be the owner, applicant, permittee, designer, superintendent, project manager, contractor, or any other project or development team member. The RLD must be designated on the ESC plan or permit as a prerequisite for engaging in land disturbance.

"Stormwater management plan" or "SWM plan" means a document containing material describing methods for complying with the requirements of a VSMP and the SWM Act and its attendant regulations.

"SWM" means stormwater management.

"SWM Act" means the Virginia Stormwater Management Act, Article 2.3 (§ 62.144.15:24 et seq.) of Chapter 3.1 of Title 62.1 of the Code of Virginia.

"Virginia Erosion and Sediment Control Program" or "VESCP" means a program approved by the board that has been established by a VESCP authority for the effective control of soil erosion, sediment deposition, and nonagricultural runoff associated with a land-disturbing activity to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources and shall include such items where applicable as local ordinances, rules, permit requirements, annual standards and specifications, policies and guidelines, technical materials, and requirements for plan review, inspection, enforcement where authorized in the ESC Act and this chapter, and evaluation consistent with the requirements of the ESC Act and this chapter.

"Virginia Erosion and Sediment Control Program authority" or "VESCP authority" means an authority approved by the board to operate a Virginia erosion and sediment control program. An authority may include a state entity, including the department; a federal entity; a district, county, city, or town; or for linear projects subject to annual standards and specifications, electric, natural gas and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to § 15.2-5102 of the Code of Virginia.

"Virginia Stormwater Management Program" or "VSMP" means a program approved by the board after September 13, 2011, that has been established by a VSMP authority to manage the quality and quantity of runoff resulting from land-disturbing activities and shall include such items as local ordinances, rules, permit requirements, annual standards and specifications, policies and guidelines, technical materials, and requirements for plan review, inspection, enforcement, where authorized in the SWM

Act and associated regulations, and evaluation consistent with the requirements of the SWM Act and associated regulations.

"Virginia Stormwater Management Program authority" or "VSMP authority" means an authority approved by the board after September 13, 2011, to operate a Virginia Stormwater Management Program or, until such approval is given, the department. An authority may include a locality; state entity, including the department; federal entity; or, for linear projects subject to annual standards and specifications in accordance with subsection B of § 62.1-44.15:31 of the Code of Virginia, electric, natural gas, and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to § 15.2-5102 of the Code of Virginia.

9VAC25-850-20. Purpose.

The purpose of this chapter is to guide the issuance of certificates of competence required by §§ 62.1-44.15:52 E and 62.1-44.15:53 of the ESC Act and § 62.1-44.15:30 of the SWM Act.

9VAC25-850-30. Applicability.

This chapter is applicable to:

1. Every VESCP authority or VSMP authority that administers a VESCP or VSMP as may be applicable. Staff of a VESCP authority must be certified in accordance with §§ 62.1-44.15:51 E and 62.1-44.15:53 of the ESC Act. Staff of a VSMP authority must be certified in accordance with § 62.1-44.15:30 of the SWM Act.

2. Anyone who is contracted by a VESCP authority or a VSMP authority to perform any or all of the functions of that authority as may be applicable. This person will be subject to the same certification requirements as the authority.

3. Anyone voluntarily seeking certificates of competence from the board for classifications described in 9VAC25-850-40.

9VAC25-850-40. Certificates.

A. Certificates of competence shall be issued by the board in accordance with the requirements of 9VAC25-850-50 for the following classifications:

1. Program administrator for ESC. The person employed as the VESCP administrator.

2. Plan reviewer for ESC. The person who reviews ESC plans to be approved by the VESCP authority.

3. Project inspector for ESC. The person responsible for inspecting erosion and sediment control practices to ensure compliance with the Virginia Erosion and Sediment Control Law and Regulations.

4. Combined administrator for ESC. The person responsible for performing the combined duties of program administrator, plan reviewer and project inspector for a VESCP authority.

5. Program administrator for SWM. The person employed as the VSMP administrator.

6. Plan reviewer for SWM. The person who reviews SWM plans to be approved by the VSMP authority.

7. Project inspector for SWM. The person responsible for inspecting regulated activities to ensure compliance with the SWM Act and Regulations.

8. Combined administrator for SWM. The person responsible for performing the combined duties of program administrator, plan reviewer, and project inspector for a VSMP authority.

B. A certificate shall be issued by the board for the responsible land disturber or RLD for ESC. The RLD is the person responsible for carrying out the land-disturbing activity.

C. Any person employed as a plan reviewer who is licensed as a professional engineer, architect, certified landscape architect, or land surveyor pursuant to Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1 of the Code of Virginia or as a professional soil scientist as defined in Chapter 22 (§ 54.1-2200 et seq.) of Title 54.1 of the Code of Virginia shall qualify as a certified plan reviewer for ESC and will not require a certificate of competence from the board. In lieu of a person holding this board certificate of competence, such person shall produce a current professional license or certification upon request of the department.

D. Any person who holds a valid and unexpired certificate of competence issued by the board in the classification of ESC or SWM, or who obtains such a certificate, and who later successfully obtains an additional certificate of competence from the board in the parallel ESC or SWM classification may surrender both certificates of competence to the board and request in writing issuance of a dual certificate showing certification in both classifications. Such a request must be made while both of the ESC and SWM certificates of competence obtained are valid and unexpired. The expiration date of the dual certificate shall be three years from the date of expiration of the additional certificate acquired.

9VAC25-850-50. Eligibility requirements.

A. Certification may be obtained by satisfactorily completing and submitting an application to the department in accordance with 9VAC25-850-80 and:

1. By obtaining a total of 800 hours of experience as an ESC or SWM plan reviewer, project inspector, or combined administrator and obtaining a passing score on the certification examination administered by the department in the applicable ESC or SWM area; or

2. By enrolling in and completing, within 12 months, a board-approved training program in the classifications of program administrator, plan reviewer, project inspector, or combined administrator and obtaining within one year of completion of the training program a passing score on the certification examination administered by the department in the applicable ESC or SWM area.

   a. The training program for project inspectors for ESC will consist of attending and completing courses/seminars in "Basic Erosion and Sediment Control in Virginia" and "Erosion and Sediment Control for Inspectors."

   b. The training program for plan reviewers for ESC will consist of attending and completing courses/seminars in "Basic Erosion and Sediment Control in Virginia" and "Erosion and Sediment Control for Plan Reviewers."

   c. The training program for program administrators for ESC will consist of attending the course "Basic Erosion and Sediment Control in Virginia."

   d. The training program for combined administrators for ESC will consist of attending the courses/seminars "Basic Erosion and Sediment Control in Virginia," "Erosion and Sediment Control for Inspectors," and "Erosion and Sediment Control for Plan Reviewers."

   e. The training program for project inspectors for SWM will consist of attending and completing courses/seminars in "Basic Stormwater Management in Virginia" and "Stormwater Management for Inspectors."

   f. The training program for plan reviewers for SWM will consist of attending and completing courses/seminars in "Basic Stormwater Management in Virginia" and "Stormwater Management for Plan Reviewers."

   g. The training program for program administrators for SWM will consist of attending the seminar "Basic Stormwater Management in Virginia."

   h. The training program for combined administrators for SWM will consist of attending the courses/seminars "Basic Stormwater Management in Virginia," "Stormwater Management for Inspectors," and "Stormwater Management for

Plan Reviewers."

3. By enrolling in and completing the training program and obtaining a passing score on the certification examination administered by the department for responsible land disturbers for ESC.

B. Certification and recertification shall be valid for three years and will expire on the last day of the expiration month except as otherwise set out in 9VAC25-850-40 D or 9VAC25-850-90.

C. Recertification may be obtained for classifications outlined in 9VAC25-850-40 of this chapter prior to the expiration date of a certification by:

1. Obtaining a passing score on the recertification examination;

2. Successfully completing a board-approved training program during the last 12 months of the term of the certificate but prior to its expiration date;

3. Being a professional registered in the Commonwealth pursuant to Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1 of the Code of Virginia or a professional soil scientist as defined in Chapter 22 (§ 54.1-2200 et seq.) of Title 54.1, and paying the required fee for recertification. Such professionals shall be deemed to satisfy the provisions of this subsection for classifications in subdivisions A 1 through 4 and subsection B of 9VAC25-850-40. However, such professionals when in the classification of plan reviewer for ESC shall be exempt from the recertification requirements and fees of this chapter provided they maintain their professional license;

4. Being a professional registered in the Commonwealth pursuant to Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1 of the Code of Virginia and paying the required fee for recertification. Such professionals shall be deemed to satisfy the provisions of this subsection for classifications in subdivisions A 5 through 8 and subsection B of 9VAC25-850-40; or

5. Completing continuing professional education hours in accordance with department guidance.

9VAC25-850-55. Classification acknowledgement for the purposes of program compliance reviews.

For the purposes of VESCP or VSMP compliance reviews and evaluations, the certification requirements of §§ 62.1-44.15:53 and 62.1-44.15:30 of the Code of Virginia shall be deemed to have been met if the VESCP or the VSMP authority has a person or persons enrolled in the board's ESC or SWM training programs set forth in 9VAC25-850-50 A 1 and A 2 a through h for the necessary classifications and such person or persons obtains certification within one year of completing the necessary training programs.

9VAC25-850-60. Fees.

A. Certification, recertification, and dual certificate issuance fees shall be collected to cover the administrative cost for the certification program.

B. A fee will also be charged to present education and training program courses/seminars which support the certification program.

C. Fees are nonrefundable and shall not be prorated.

9VAC25-850-70. Examination.

A. A board-approved examination shall be administered at least twice a year.

B. An individual may take the certification examination for the desired certificate of competence after fulfilling the prerequisite experience requirement or completing a board-approved training program in accordance with 9VAC25-850-50.

C. An individual who is unable to take an examination at the time scheduled shall notify the department within 48 hours prior to the date of the examination unless a later time is established by the department; such an individual may be rescheduled for the next examination. Failure to notify the department may require an individual to submit a new application and payment of fees in accordance with this chapter.

D. An applicant who is unsuccessful in passing an examination will be allowed to pay the appropriate fee and retake the appropriate exam within one year without resubmitting an application. After the one-year period has elapsed, an applicant will be required to submit a new application with the appropriate fee in accordance with this chapter in order to take the examination. Application for examination must be received at least 60 days prior to the scheduled examination unless a later date is established by the department to be eligible to sit for the examination.

E. A minimum passing score of 70% will be required on the appropriate certification exam(s).

F. All applicants will be notified within 60 days of the results of the examination.

9VAC25-850-80. Application.

A. Any person seeking certification or recertification by a combination of experience and examination or by the combination of completion of the training program and examination shall submit a completed application in a manner prescribed by the department with the appropriate fee(s). The application shall contain the following:

1. The applicant's name, address, daytime phone number, email address, and name and address of business or organization as well as the date the application was filled out.

2. The classification of certification the applicant is applying for as set forth in 9VAC25-850-40, and designation whether the applicant is applying for initial certification or recertification.

3. If any special arrangements must be provided for because of a handicap.

4. A verification of all work experience signed and dated by applicant's supervisor, if required.

5. A signed statement that the information provided in the application is true and accurate.

Incomplete applications will be returned to the applicant. All applications must be received by the department at least 60 days prior to the scheduled examination date, unless a later date is established by the department, in order to be able to sit for the examination.

The department may establish other acceptable forms of documentation for the components of the application that provide similar assurances as those set forth in this subsection.

B. All complete applications of candidates will be reviewed by the department to determine eligibility for certification. All applicants will be notified of the results of the review. Any applicant may appeal the review, in writing, to the board within 30 days of the department's determination. No applicant will be approved for certification unless he meets the requirements of this chapter.

C. Applicants who have been found ineligible to sit for an examination may request further consideration by submitting a letter to the board with the necessary evidence of additional qualifications. No additional fee will be required provided that all requirements for certification are met within one year from the date of original application.

9VAC25-850-90. Discipline of certified personnel.

The board may suspend, revoke or refuse to grant or renew the certification of any person if the board, in an informal fact finding under § 2.2-4019 of the Code of Virginia, finds that:

1. The certification was obtained or renewed thorough fraud or misinterpretation;

2. The certified person has violated or cooperated with others in violating any provision of this chapter;

3. The certified person has not demonstrated reasonable care, judgment, or application of his knowledge and ability in the performance of his duties; or

4. The certified person has made any material misrepresentation in the course of performing his duties.

9VAC25-850-100. Delegation of authority.

The director, or his designee, may perform any act of the board provided under this chapter, except as limited by § 62.1-44.14 of the Code of Virginia.

EROSION AND SEDIMENT CONTROL LAW

Code of Virginia
Title 62.1
Chapter 3.1
Article 2.3

NOTE: This copy of the act is up-to-date as of July 1, 2015. The most recent version of the act can always be found on the Virginia General Assembly's Legislative Information System website: http://law.lis.virginia.gov/vacode/title62.1/chapter3.1/

§ 62.1-44.15:51. Definitions.

As used in this article, unless the context requires a different meaning:

"Agreement in lieu of a plan" means a contract between the plan-approving authority and the owner that specifies conservation measures that must be implemented in the construction of a single-family residence; this contract may be executed by the plan-approving authority in lieu of a formal site plan.

"Applicant" means any person submitting an erosion and sediment control plan for approval or requesting the issuance of a permit, when required, authorizing land-disturbing activities to commence.

"Certified inspector" means an employee or agent of a VESCP authority who (i) holds a certificate of competence from the Board in the area of project inspection or (ii) is enrolled in the Board's training program for project inspection and successfully completes such program within one year after enrollment.

"Certified plan reviewer" means an employee or agent of a VESCP authority who (i) holds a certificate of competence from the Board in the area of plan review, (ii) is enrolled in the Board's training program for plan review and successfully completes such program within one year after enrollment, or (iii) is licensed as a professional engineer, architect, landscape architect, land surveyor pursuant to Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1, or professional soil scientist as defined in § 54.1-2200.

"Certified program administrator" means an employee or agent of a VESCP authority who (i) holds a certificate of competence from the Board in the area of program administration or (ii) is enrolled in the Board's training program for program administration and successfully completes such program within one year after enrollment.

"Department" means the Department of Environmental Quality.

"Director" means the Director of the Department of Environmental Quality.

"District" or "soil and water conservation district" means a political subdivision of the Commonwealth organized in accordance with the provisions of Article 1.5 (§ 10.1-1187.21 et seq.) of Chapter 11.1 of Title 10.1.

"Erosion and sediment control plan" or "plan" means a document containing material for the conservation of soil and water resources of a unit or group of units of land. It may include appropriate maps, an appropriate soil and water plan inventory and management information with needed interpretations, and a record of decisions contributing to conservation treatment. The plan shall contain all major conservation decisions to ensure that the entire unit or units of land will be so treated to achieve the conservation objectives.

"Erosion impact area" means an area of land not associated with current land-disturbing activity but subject to persistent soil erosion resulting in the delivery of sediment onto neighboring properties or into state waters. This definition shall not apply to any lot or parcel of land of 10,000 square feet or less used for residential purposes or to shorelines where the erosion results from wave action or other coastal processes.

"Land-disturbing activity" means any man-made change to the land surface that may result in soil erosion from water or wind and the movement of sediments into state waters or onto lands in the Commonwealth, including, but not limited to, clearing, grading, excavating, transporting, and filling of land, except that the term shall not include:

1. Minor land-disturbing activities such as home gardens and individual home landscaping, repairs, and maintenance work;

2. Individual service connections;

3. Installation, maintenance, or repair of any underground public utility lines when such activity occurs on an existing hard surfaced road, street, or sidewalk, provided the land-disturbing activity is confined to the area of the road, street, or sidewalk that is hard surfaced;

4. Septic tank lines or drainage fields unless included in an overall plan for land-disturbing activity relating to construction of the building to be served by the septic tank system;

5. Permitted surface or deep mining operations and projects, or oil and gas operations and projects conducted pursuant to Title 45.1;

6. Tilling, planting, or harvesting of agricultural, horticultural, or forest crops, livestock feedlot operations, or as additionally set forth by the Board in regulation, including engineering operations as follows: construction of terraces, terrace outlets, check dams, desilting basins, dikes, ponds, ditches, strip cropping, lister furrowing, contour cultivating, contour furrowing, land drainage, and land irrigation; however, this exception shall not apply to harvesting of forest crops unless the area on which harvesting occurs is reforested artificially or naturally in accordance with the provisions of Chapter 11 (§ 10.1-1100 et seq.) of Title 10.1 or is converted to bona fide agricultural or improved pasture use as described in subsection B of § 10.1-1163;

7. Repair or rebuilding of the tracks, rights-of-way, bridges, communication facilities, and other related structures and facilities of a railroad company;

8. Agricultural engineering operations, including but not limited to the construction of terraces, terrace outlets, check dams, desilting basins, dikes, ponds not required to comply with the provisions of the Dam Safety Act (§ 10.1-604 et seq.), ditches, strip cropping, lister furrowing, contour cultivating, contour furrowing, land drainage, and land irrigation;

9. Disturbed land areas of less than 10,000 square feet in size or 2,500 square feet in all areas of the jurisdictions designated as subject to the Chesapeake Bay Preservation Area Designation and Management Regulations; however, the governing body of the program authority may reduce this exception to a smaller area of disturbed land or qualify the conditions under which this exception shall apply;

10. Installation of fence and sign posts or telephone and electric poles and other kinds of posts or poles;

11. Shoreline erosion control projects on tidal waters when all of the land-disturbing activities are within the regulatory authority of and approved by local wetlands boards, the Marine Resources Commission, or the United States Army Corps of Engineers; however, any associated land that is disturbed outside of this exempted area shall remain subject to this article and the regulations adopted pursuant thereto; and

12. Emergency work to protect life, limb, or property, and emergency repairs; however, if the land-disturbing activity would have required an approved erosion and sediment

control plan, if the activity were not an emergency, then the land area disturbed shall be shaped and stabilized in accordance with the requirements of the VESCP authority.

"Natural channel design concepts" means the utilization of engineering analysis and fluvial geomorphic processes to create, rehabilitate, restore, or stabilize an open conveyance system for the purpose of creating or recreating a stream that conveys its bankfull storm event within its banks and allows larger flows to access its bankfull bench and its floodplain.

"Owner" means the owner or owners of the freehold of the premises or lesser estate therein, mortgagee or vendee in possession, assignee of rents, receiver, executor, trustee, lessee, or other person, firm, or corporation in control of a property.

"Peak flow rate" means the maximum instantaneous flow from a given storm condition at a particular location.

"Permittee" means the person to whom the local permit authorizing land-disturbing activities is issued or the person who certifies that the approved erosion and sediment control plan will be followed.

"Person" means any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town, or other political subdivision of the Commonwealth, governmental body, including a federal or state entity as applicable, any interstate body, or any other legal entity.

"Runoff volume" means the volume of water that runs off the land development project from a prescribed storm event.

"Town" means an incorporated town.

"Virginia Erosion and Sediment Control Program" or "VESCP" means a program approved by the Board that has been established by a VESCP authority for the effective control of soil erosion, sediment deposition, and nonagricultural runoff associated with a land-disturbing activity to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources and shall include such items where applicable as local ordinances, rules, permit requirements, annual standards and specifications, policies and guidelines, technical materials, and requirements for plan review, inspection, enforcement where authorized in this article, and evaluation consistent with the requirements of this article and its associated regulations.

"Virginia Erosion and Sediment Control Program authority" or "VESCP authority" means an authority approved by the Board to operate a Virginia Erosion and Sediment Control Program. An authority may include a state entity, including the Department; a federal entity; a district, county, city, or town; or for linear projects subject to annual standards and specifications, electric, natural gas, and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to § 15.2-5102.

"Water quality volume" means the volume equal to the first one-half inch of runoff multiplied by the impervious surface of the land development project.

§ 62.1-44.15:52. Virginia Erosion and Sediment Control Program.

A. The Board shall develop a program and adopt regulations in accordance with the Administrative Process Act (§ 2.2-4000 et seq.) for the effective control of soil erosion, sediment deposition, and nonagricultural runoff that shall be met in any control program to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources. Stream restoration and relocation projects that incorporate natural channel design concepts are not man-made channels and shall be exempt from any flow rate capacity and velocity requirements for natural or man-made channels as defined in any regulations promulgated pursuant to this section or § 62.1-44.15:54 or 62.1-44.15:65. Any plan approved prior to July 1, 2014, that provides for stormwater management that addresses any flow rate capacity and velocity requirements for natural or man-made channels shall satisfy the flow rate capacity and velocity requirements for natural or man-made channels if the practices are designed to (i) detain the water quality volume and to release it over 48 hours; (ii) detain and release over a 24-hour period the expected rainfall resulting from the one-year, 24-hour storm; and (iii) reduce the allowable peak flow rate resulting from the 1.5-year, two-year, and 10-year, 24-hour storms to a level that is less than or equal to the peak flow rate from the site assuming it was in a good forested condition, achieved through multiplication of the forested peak flow rate by a reduction factor that is equal to the runoff volume from the site when it was in a good forested condition divided by the runoff volume from the site in its proposed condition, and shall be exempt from any flow rate capacity and velocity requirement for natural or man-made channels as defined in regulations promulgated pursuant to § 62.1-44.15:54 or 62.1-44.15:65. For plans approved on and after July 1, 2014, the flow rate capacity and velocity requirements of this subsection shall be satisfied by compliance with water quantity requirements in the Stormwater Management Act (§ 62.1-44.15:24 et seq.) and attendant regulations, unless such land-disturbing activities are in accordance with the grandfathering provisions of the Virginia Stormwater Management Program (VSMP) Permit Regulations or exempt pursuant to subdivision C 7 of § 62.1-44.15:34.

The regulations shall:

1. Be based upon relevant physical and developmental information concerning the watersheds and drainage basins of the Commonwealth, including, but not limited to, data relating to land use, soils, hydrology, geology, size of land area being disturbed, proximate water bodies and their characteristics, transportation, and public facilities and services;

2. Include such survey of lands and waters as may be deemed appropriate by the Board or required by any applicable law to identify areas, including multijurisdictional and watershed areas, with critical erosion and sediment problems; and

3. Contain conservation standards for various types of soils and land uses, which shall include criteria, techniques, and methods for the control of erosion and sediment resulting from land-disturbing activities.

B. The Board shall provide technical assistance and advice to, and conduct and supervise educational programs for VESCP authorities.

C. The Board shall adopt regulations establishing minimum standards of effectiveness of erosion and sediment control programs, and criteria and procedures for reviewing and evaluating the effectiveness of VESCPs. In developing minimum standards for program effectiveness, the Board shall consider information and standards on which the regulations promulgated pursuant to subsection A are based.

D. The Board shall approve VESCP authorities and shall periodically conduct a comprehensive program compliance review and evaluation to ensure that all VESCPs operating under the jurisdiction of this article meet minimum standards of effectiveness in controlling soil erosion, sediment deposition, and nonagricultural runoff. The Department shall develop a schedule for conducting periodic reviews and evaluations of the effectiveness of VESCPs unless otherwise directed by the Board. Such reviews where applicable shall be coordinated with those being implemented in accordance with the Stormwater Management Act (§ 62.1-44.15:24 et seq.) and associated regulations and the Chesapeake Bay Preservation Act (§ 62.1-44.15:67 et seq.) and associated regulations. The Department may also conduct a comprehensive or partial program compliance review and evaluation of a VESCP at a greater frequency than the standard schedule.

E. The Board shall issue certificates of competence concerning the content, application, and intent of specified subject areas of this article and accompanying regulations, including program administration, plan review, and project inspection, to personnel of program authorities and to any other persons who have completed training programs or in other ways demonstrated adequate knowledge. The Department shall administer education and training programs for specified subject areas of this article and accompanying regulations, and is authorized to charge persons attending such programs reasonable fees to cover the costs of administering the programs. Such education and training programs shall also contain expanded components to address plan review and project inspection elements of the Stormwater Management Act (§ 62.1-44.15:24 et seq.) and attendant regulations in accordance with § 62.1-44.15:30.

F. Department personnel conducting inspections pursuant to this article shall hold a certificate of competence as provided in subsection E.

§ 62.1-44.15:53. Certification of program personnel.

A. The minimum standards of VESCP effectiveness established by the Board pursuant to subsection C of § 62.1-44.15:52 shall provide that (i) an erosion and sediment control plan shall not be approved until it is reviewed by a certified plan reviewer; (ii) inspections of land-disturbing activities shall be conducted by a certified inspector; and (iii) a VESCP shall contain a certified program administrator, a certified plan reviewer, and a certified project inspector, who may be the same person.

B. Any person who holds a certificate of competence from the Board in the area of plan review, project inspection, or program administration that was attained prior to the adoption of the mandatory certification provisions of subsection A shall be deemed to satisfy the requirements of that area of certification.

C. Professionals registered in the Commonwealth pursuant to Article 1 (§ 54.1-400 et seq.) of Chapter 4 of Title 54.1 or a professional soil scientist as defined in § 54.1-2200 shall be deemed to satisfy the certification requirements for the purposes of renewals.

§ 62.1-44.15:54. Establishment of Virginia Erosion and Sediment Control Program.

A. Counties and cities shall adopt and administer a VESCP.

Any town lying within a county that has adopted its own VESCP may adopt its own program or shall become subject to the county program. If a town lies within the boundaries of more than one county, the town shall be considered for the purposes of this article to be wholly within the county in which the larger portion of the town lies.

B. A VESCP authority may enter into agreements or contracts with soil and water conservation districts, adjacent localities, or other public or private entities to assist with carrying out the provisions of this article, including the review and determination of adequacy of erosion and sediment control plans submitted for land-disturbing activities on a unit or units of land as well as for monitoring, reports, inspections, and enforcement where authorized in this article, of such land-disturbing activities.

C. Any VESCP adopted by a county, city, or town shall be approved by the Board if it establishes by ordinance requirements that are consistent with this article and associated regulations.

D. Each approved VESCP operated by a county, city, or town shall include provisions for the integration of the VESCP with Virginia stormwater management, flood insurance, flood plain management, and other programs requiring compliance prior to authorizing a land-disturbing activity in order to make the submission and approval of plans, issuance of permits, payment of fees, and coordination of inspection and enforcement activities more convenient and efficient both for the local governments and those responsible for compliance with the programs.

E. The Board may approve a state entity, federal entity, or, for linear projects subject to annual standards and specifications, electric, natural gas, and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to § 15.2-5102 to operate a VESCP consistent with the requirements of this article and its associated regulations and the VESCP authority's Department-approved annual standards and specifications. For these programs, enforcement shall be administered by the Department and the Board where applicable in accordance with the provisions of this article.

F. Following completion of a compliance review of a VESCP in accordance with subsection D of § 62.1-44.15:52, the Department shall provide results and compliance recommendations to the Board in the form of a corrective action agreement if deficiencies are found; otherwise, the Board may find the program compliant. If a comprehensive or partial program compliance review conducted by the Department of a VESCP indicates that the VESCP authority has not administered, enforced where authorized to do so, or conducted its VESCP in a manner that satisfies the minimum standards of effectiveness established pursuant to subsection C of § 62.1-44.15:52, the Board shall establish a schedule for the VESCP authority to come into compliance. The Board shall provide a copy of its decision to the VESCP authority that specifies the deficiencies, actions needed to be taken, and the approved compliance schedule required to attain the minimum standard of effectiveness and shall include an offer to provide technical assistance to implement the corrective action. If the VESCP authority has not implemented the necessary compliance actions identified by the Board within 30 days following receipt of the corrective action agreement, or such additional period as is granted to complete the implementation of the corrective action, then the Board shall have the authority to (i) issue a special order to any VESCP, imposing a civil penalty not to exceed $5,000 per day with the maximum amount not to exceed $20,000 per violation for noncompliance with the state program, to be paid into the state treasury and deposited in the Virginia Stormwater Management Fund established by § 62.1-44.15:29 or (ii) revoke its approval of the VESCP. The Administrative Process Act (§ 2.2-4000 et seq.) shall govern the activities and proceedings of the Board and the judicial review thereof.

In lieu of issuing a special order or revoking the program, the Board is authorized to take legal action against a VESCP to ensure compliance.

G. If the Board revokes its approval of the VESCP of a county, city, or town, and the locality is in a district, the district, upon approval of the Board, shall adopt and administer a VESCP for the locality. To carry out its program, the district shall adopt regulations in accordance with the Administrative Process Act (§ 2.2-4000 et seq.) consistent with this article and associated regulations. The regulations may be revised from time to time as necessary. The program and regulations shall be available for public inspection at the principal office of the district.

H. If the Board (i) revokes its approval of a VESCP of a district, or of a county, city, or town not in a district, or (ii) finds that a local program consistent with this article and associated regulations has not been adopted by a district or a county, city, or town that is required to adopt and administer a VESCP, the Board shall find the VESCP authority provisional, and have the Department assist with the administration of the program until the Board finds the VESCP authority compliant with the requirements of this article and associated regulations. "Assisting with administration" includes but is not limited to the ability to review and comment on plans to the VESCP authority, to conduct inspections with the VESCP authority, and to conduct enforcement in accordance with this article and associated regulations.

I. If the Board revokes its approval of a state entity, federal entity, or, for linear projects subject to annual standards and specifications, electric, natural gas, and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to § 15.2-5102, the Board shall find the VESCP authority provisional, and have the Department assist with the administration of the program until the Board finds the VESCP authority compliant with the requirements of this article and associated regulations. Assisting with administration includes the ability to review and comment on plans to the VESCP authority and to conduct inspections with the VESCP authority in accordance with this article and associated regulations.

J. Any VESCP authority that administers an erosion and sediment control program may charge applicants a reasonable fee to defray the cost of program administration. Such fee may be in addition to any fee charged for administration of a Virginia Stormwater Management Program, although payment of fees may be consolidated in order to provide greater convenience and efficiency for those responsible for compliance with the programs. A VESCP authority shall hold a public hearing prior to establishing a schedule of fees. The fee shall not exceed an amount commensurate with the services rendered, taking into consideration the time, skill, and the VESCP authority's expense involved.

K. The governing body of any county, city, or town, or a district board that is authorized to administer a VESCP, may adopt an ordinance or regulation where applicable providing that violations of any regulation or order of the Board, any provision of its program, any condition of a permit, or any provision of this article shall be subject to a civil penalty. The civil penalty for any one violation shall be not less than $100 nor more than $1,000. Each day during which the violation is found to have existed shall constitute a separate offense. In no event shall a series of specified violations arising from the same operative set of facts result in civil penalties that exceed a total of $10,000, except that a series of violations arising from the commencement of land-disturbing activities without an approved plan for any site shall not result in civil penalties that exceed a total of $10,000. Adoption of such an ordinance providing that violations are subject to a civil penalty shall be in lieu of criminal sanctions and shall preclude the prosecution of such violation as a misdemeanor under subsection A of § 62.1-44.15:63. The penalties set out in this subsection are also available to the Board in its enforcement actions.

§ 62.1-44.15:55. Regulated land-disturbing activities; submission and approval of erosion and sediment control plan.

A. Except as provided in § 62.1-44.15:56 for state agency and federal entity land-disturbing activities, no person shall engage in any land-disturbing activity until he has submitted to the VESCP authority an erosion and sediment control plan for the land-disturbing activity and the plan has been reviewed and approved. Upon the development of an online reporting system by the Department, but no later than July 1, 2014, a VESCP authority shall then be required to obtain evidence of Virginia Stormwater Management Program permit coverage where it is required prior to providing approval to begin land disturbance. Where land-disturbing activities involve lands under the jurisdiction of more than one VESCP, an erosion and sediment control plan may, at the request of one or all of the VESCP authorities, be submitted to the Department for review and approval rather than to each jurisdiction concerned. The Department may charge the jurisdictions requesting the review a fee sufficient to cover the cost associated with conducting the review. A VESCP may enter into an agreement with an adjacent VESCP regarding the administration of multijurisdictional projects whereby the jurisdiction that contains the greater portion of the project shall be responsible for all or part of the administrative procedures. Where the land-disturbing activity results from the construction of a single-family residence, an agreement in lieu of a plan may be substituted for an erosion and sediment control plan if executed by the VESCP authority.

B. The VESCP authority shall review erosion and sediment control plans submitted to it and grant written approval within 60 days of the receipt of the plan if it determines that the plan meets the requirements of this article and the Board's regulations and if the person responsible for carrying out the plan certifies that he will properly perform the erosion and sediment control measures included in the plan and shall comply with the provisions of this article. In addition, as a prerequisite to engaging in the land-disturbing activities shown on the approved plan, the person responsible for carrying out the plan shall provide the name of an individual holding a certificate of competence to the VESCP authority, as provided by § 62.1-44.15:52, who will be in charge of and responsible for carrying out the land-disturbing activity. However, any VESCP authority may waive the certificate of competence requirement for an agreement in lieu of a plan for construction of a single-family residence. If a violation occurs during the land-disturbing activity, then the person responsible for carrying out the agreement in lieu of a plan shall correct the violation and provide the name of an individual holding a certificate of competence, as provided by § 62.1-44.15:52. Failure to provide the name of an individual holding a certificate of competence prior to engaging in land-disturbing activities may result in revocation of the approval of the plan and the person responsible for carrying out the plan shall be subject to the penalties provided in this article.

When a plan is determined to be inadequate, written notice of disapproval stating the specific reasons for disapproval shall be communicated to the applicant within 45 days. The notice shall specify the modifications, terms, and conditions that will permit approval of the plan. If no action is taken by the VESCP authority within the time specified in this subsection, the plan shall be deemed approved and the person authorized to proceed with the proposed activity. The VESCP authority shall act on any erosion and sediment control plan that has been previously disapproved within 45 days after the plan has been revised, resubmitted for approval, and deemed adequate.

C. The VESCP authority may require changes to an approved plan in the following cases:

1. Where inspection has revealed that the plan is inadequate to satisfy applicable regulations; or

2. Where the person responsible for carrying out the approved plan finds that because of changed circumstances or for other reasons the approved plan cannot be effectively carried out, and proposed amendments to the plan, consistent with the requirements of this article and associated regulations, are agreed to by the VESCP authority and the person responsible for carrying out the plan.

D. Electric, natural gas, and telephone utility companies, interstate and intrastate natural gas pipeline companies, and railroad companies shall, and authorities created pursuant to § 15.2-5102 may, file general erosion and sediment control standards and specifications annually with the Department for review and approval. Such standards and specifications shall be consistent with the requirements of this article and associated regulations and the Stormwater Management Act (§ 62.1-44.15:24 et seq.) and associated regulations where applicable. The specifications shall apply to:

1. Construction, installation, or maintenance of electric transmission, natural gas, and telephone utility lines and pipelines, and water and sewer lines; and

2. Construction of the tracks, rights-of-way, bridges, communication facilities, and other related structures and facilities of the railroad company.

The Department shall have 60 days in which to approve the standards and specifications. If no action is taken by the Department within 60 days, the standards and specifications shall be deemed approved. Individual approval of separate projects within subdivisions 1 and 2 is not necessary when approved specifications are followed. Projects not included in subdivisions 1 and 2 shall comply with the requirements of the appropriate VESCP. The Board shall have the authority to enforce approved specifications and charge fees equal to the lower of (i) $1,000 or (ii) an amount sufficient to cover the costs associated with standard and specification review and approval, project inspections, and compliance.

E. Any person engaging, in more than one jurisdiction, in the creation and operation of a wetland mitigation or stream restoration bank or banks, which have been approved and are operated in accordance with applicable federal and state guidance, laws, or regulations for the establishment, use, and operation of wetlands mitigation or stream restoration banks, pursuant to a mitigation banking instrument signed by the Department of Environmental Quality, the Marine Resources Commission, or the U.S. Army Corps of Engineers, may, at the option of that person, file general erosion and sediment control standards and specifications for wetland mitigation or stream restoration banks annually with the Department for review and approval consistent with guidelines established by the Board.

The Department shall have 60 days in which to approve the specifications. If no action is taken by the Department within 60 days, the specifications shall be deemed approved. Individual approval of separate projects under this subsection is not necessary when approved specifications are implemented through a project-specific erosion and sediment control plan. Projects not included in this subsection shall comply with the requirements of the appropriate local erosion and sediment control program. The Board shall have the authority to enforce approved specifications and charge fees equal to the lower of (i) $1,000 or (ii) an amount sufficient to cover the costs associated with standard and specification review and approval, projection inspections, and compliance. Approval of general erosion and sediment control specifications by the Department does not relieve the owner or operator from compliance with any other local ordinances and regulations including requirements to submit plans and obtain permits as may be required by such ordinances and regulations.

F. In order to prevent further erosion, a VESCP authority may require approval of an erosion and sediment control plan for any land identified by the VESCP authority as an erosion impact area.

G. For the purposes of subsections A and B, when land-disturbing activity will be required of a contractor performing construction work pursuant to a construction contract, the preparation, submission, and approval of an erosion and sediment control plan shall be the responsibility of the owner.

§ 62.1-44.15:56. State agency and federal entity projects.

A. A state agency shall not undertake a project involving a land-disturbing activity unless (i) the state agency has submitted annual standards and specifications for its conduct of land-disturbing activities that have been reviewed and approved by the Department as being consistent with this article and associated regulations or (ii) the state agency has submitted an erosion and sediment control plan for the project that has been reviewed and approved by the Department. When a federal entity submits an erosion and sediment control plan for a project, land disturbance shall not commence until the Department has reviewed and approved the plan.

B. The Department shall not approve an erosion and sediment control plan submitted by a state agency or federal entity for a project involving a land-disturbing activity (i) in any locality that has not adopted a local program with more stringent regulations than those of the state program or (ii) in multiple jurisdictions with separate local programs, unless the erosion and sediment control plan is consistent with the requirements of the state program.

C. The Department shall not approve an erosion and sediment control plan submitted by a state agency or federal entity for a project involving a land-disturbing activity in one locality with a local program with more stringent ordinances than those of the state program unless the erosion and sediment control plan is consistent with the requirements of the local program. If a locality has not submitted a copy of its local program regulations to the Department, the provisions of subsection B shall apply.

D. The Department shall have 60 days in which to comment on any standards and specifications or erosion and sediment control plan submitted to it for review, and its comments shall be binding on the state agency and any private business hired by the state agency.

E. As onsite changes occur, the state agency shall submit changes in an erosion and sediment control plan to the Department.

F. The state agency responsible for the land-disturbing activity shall ensure compliance with an approved plan, and the Department and Board, where applicable, shall provide project oversight and enforcement as necessary.

G. If the state agency or federal entity has developed, and the Department has approved, annual standards and specifications, and the state agency or federal entity has been approved by the Board to operate a VESCP as a VESCP authority, erosion and sediment control plan review and approval and land-disturbing activity inspections shall be conducted by such entity. The Department and the Board, where applicable, shall provide project oversight and enforcement as necessary and comprehensive program compliance review and evaluation. Such standards and specifications shall be consistent with the requirements of this article and associated regulations and the Stormwater Management Act (§ 62.1-44.15:24 et seq.) and associated regulations when applicable.

§ 62.1-44.15:57. Approved plan required for issuance of grading, building, or other permits; security for performance.

Agencies authorized under any other law to issue grading, building, or other permits for activities involving land-disturbing activities regulated under this article shall not issue any such permit unless the applicant submits with his application an approved erosion and sediment control plan and certification that the plan will be followed and, upon the development of an online reporting system by the Department but no later than July 1, 2014, evidence of Virginia Stormwater Management Program permit coverage where it is required. Prior to issuance of any permit, the agency may also require an applicant to submit a reasonable performance bond with surety, cash escrow, letter of credit, any combination thereof, or such other legal arrangement acceptable to the agency, to ensure that measures could be taken by the agency at the applicant's expense should he fail, after proper notice, within the time specified to initiate or maintain appropriate conservation action that may be required of him by the approved plan as a result of his land-disturbing activity. The amount of the bond or other security for performance shall not exceed the total of the estimated cost to initiate and maintain appropriate conservation action based on unit price for new public or private sector construction in the locality and a reasonable allowance for estimated administrative costs and inflation, which shall not exceed 25 percent of the estimated cost of the conservation action. If the agency takes such conservation action upon such failure by the permittee, the agency may collect from the permittee the difference should the amount of the reasonable cost of such action exceed the amount of the security held. Within 60 days of the achievement of adequate stabilization of the land-disturbing activity in any project or section thereof, the bond, cash escrow, letter of credit, or other legal arrangement, or the unexpended or unobligated portion thereof, shall be refunded to the applicant or terminated based upon the percentage of stabilization accomplished in the project or section thereof. These requirements are in addition to all other provisions of law relating to the issuance of such permits and are not intended to otherwise affect the requirements for such permits.

§ 62.1-44.15:58. Monitoring, reports, and inspections.

A. The VESCP authority (i) shall provide for periodic inspections of the land-disturbing activity and require that an individual holding a certificate of competence, as provided by § 62.1-44.15:52, who will be in charge of and responsible for carrying out the land-disturbing activity and (ii) may require monitoring and reports from the person responsible for carrying out the erosion and sediment control plan, to ensure compliance with the approved plan and to determine whether the measures required in the plan are effective in controlling erosion and sediment. However, any VESCP authority may waive the certificate of competence requirement for an agreement in lieu of a plan for construction of a single-family residence. The owner, permittee, or person responsible for carrying out the plan shall be given notice of the inspection. If the VESCP authority, where authorized to enforce this article, or the Department determines that there is a failure to comply with the plan following an inspection, notice shall be served upon the permittee or person responsible for carrying out the plan by mailing with confirmation of delivery to the address specified in the permit application or in the plan certification, or by delivery at the site of the land-disturbing activities to the agent or employee supervising such activities. The notice shall specify the measures needed to comply with the plan and shall specify the time within which such measures shall be completed. Upon failure to comply within the time specified, the permit may be revoked and the VESCP authority, where authorized to enforce this article, the Department, or the Board may pursue enforcement as provided by § 62.1-44.15:63.

B. Notwithstanding the provisions of subsection A, a VESCP authority is authorized to enter into agreements or contracts with districts, adjacent localities, or other public or private entities to assist with the responsibilities of this article, including but not limited to the review and determination of adequacy of erosion and sediment control plans submitted for land-disturbing activities as well as monitoring, reports, inspections, and enforcement where an authority is granted such powers by this article.

C. Upon issuance of an inspection report denoting a violation of this section, § 62.1-44.15:55 or 62.1-44.15:56, in conjunction with or subsequent to a notice to comply as specified in subsection A, a VESCP authority, where authorized to enforce this article, or the Department may issue an order requiring that all or part of the land-disturbing activities permitted on the site be stopped until the specified corrective measures have been taken or, if land-disturbing activities have commenced without an approved plan as provided in § 62.1-44.15:55, requiring that all of the land-disturbing activities be stopped until an approved plan or any required permits are obtained. Where the alleged noncompliance is causing or is in imminent danger of causing harmful erosion of lands or sediment deposition in waters within the watersheds of the Commonwealth, or where the land-disturbing activities have commenced without an approved erosion and sediment control plan or any required permits, such an order may be issued whether or not the alleged violator has been issued a notice to comply as specified in subsection A. Otherwise, such an order may be issued only after the alleged violator has failed to comply with a notice to comply. The order for noncompliance with a plan shall be served in the same manner as a notice to comply, and shall remain in effect for seven days from the date of service pending application by the VESCP authority, the Department, or alleged violator for appropriate relief to the circuit court of the jurisdiction wherein the violation was alleged to have occurred or other appropriate court. The order for disturbance without an approved plan or permits shall be served upon the owner by mailing with confirmation of delivery to the address specified in the land records of the locality, shall be posted on the site where the disturbance is occurring, and shall remain in effect until such time as permits and plan approvals are secured, except in such situations where an agricultural exemption applies. If the alleged violator has not obtained an approved erosion and sediment control plan or any required permit within seven days from the date of service of the order, the Department or the chief administrative officer or his designee on behalf of the VESCP authority may issue a subsequent order to the owner requiring that all construction and other work on the site, other than corrective measures, be stopped until an approved erosion and sediment control plan and any required permits have been obtained. The subsequent order shall be served upon the owner by mailing with confirmation of delivery to the address specified in the permit application or the land records of the locality in which the site is located. The owner may appeal the issuance of any order to the circuit court of the jurisdiction wherein the violation was alleged to have occurred or other appropriate court. Any person violating or failing, neglecting, or refusing to obey an order issued by the Department or the chief administrative officer or his designee on behalf of the VESCP authority may be compelled in a proceeding instituted in the circuit court of the jurisdiction wherein the violation was alleged to have occurred or other appropriate court to obey same and to comply therewith by injunction, mandamus, or other appropriate remedy. Upon completion and approval of corrective action or obtaining an approved plan or any required permits, the order shall immediately be lifted. Nothing in this section shall prevent the Department, the Board, or the chief administrative officer or his designee on behalf of the VESCP authority from taking any other action specified in § 62.1-44.15:63.

§ 62.1-44.15:59. Reporting.

Each VESCP authority shall report to the Department, in a method such as an online reporting system and on a time schedule established by the Department, a listing of each land-disturbing activity for which a plan has been approved by the VESCP under this article.

§ 62.1-44.15:60. Right of entry.

The Department, the VESCP authority, where authorized to enforce this article, or any duly authorized agent of the Department or such VESCP authority may, at reasonable times and under reasonable circumstances, enter any establishment or upon any property, public or private, for the purpose of obtaining information or conducting surveys or investigations necessary in the enforcement of the provisions of this article.

In accordance with a performance bond with surety, cash escrow, letter of credit, any combination thereof, or such other legal arrangement, a VESCP authority may also enter any establishment or upon any property, public or private, for the purpose of initiating or maintaining appropriate actions that are required by the permit conditions associated with a land-disturbing activity when a permittee, after proper notice, has failed to take acceptable action within the time specified.

§ 62.1-44.15:61. Cooperation with federal and state agencies.

A VESCP authority and the Board are authorized to cooperate and enter into agreements with any federal or state agency in connection with the requirements for erosion and sediment control with respect to land-disturbing activities.

§ 62.1-44.15:62. Judicial appeals.

A. A final decision by a county, city, or town, when serving as a VESCP authority under this article, shall be subject to judicial review, provided that an appeal is filed within 30 days from the date of any written decision adversely affecting the rights, duties, or privileges of the person engaging in or proposing to engage in land-disturbing activities.

B. Final decisions of the Board, Department, or district shall be subject to judicial review in accordance with the provisions of the Administrative Process Act (§ 2.2-4000 et seq.).

§ 62.1-44.15:63. Penalties, injunctions and other legal actions.

A. Violators of § 62.1-44.15:55, 62.1-44.15:56, or 62.1-44.15:58 shall be guilty of a Class 1 misdemeanor.

B. Any person who has violated or failed, neglected, or refused to obey any regulation or order of the Board, any order, notice, or requirement of the Department or VESCP authority, any condition of a permit, or any provision of this article or associated regulation shall, upon a finding of an appropriate court, be assessed a civil penalty. If a locality or district serving as a VESCP authority has adopted a uniform schedule of civil penalties as permitted by subsection K of § 62.1-44.15:54, such assessment shall be in accordance with the schedule. The VESCP authority or the Department may issue a summons for collection of the civil penalty. In any trial for a scheduled violation, it shall be the burden of the locality or Department to show the liability of the violator by a preponderance of the evidence. An admission or finding of liability shall not be a criminal conviction for any purpose. Any civil penalties assessed by a court shall be paid into the treasury of the locality wherein the land lies, except that where the violator is the locality itself, or its agent, or where the Department is issuing the summons, the court shall direct the penalty to be paid into the state treasury.

C. The VESCP authority, the Department, or the owner of property that has sustained damage or which is in imminent danger of being damaged may apply to the circuit court in any jurisdiction wherein the land lies or other appropriate court to enjoin a violation or a threatened violation under § 62.1-44.15:55, 62.1-44.15:56, or 62.1-44.15:58 without the necessity of showing that an adequate remedy at law does not exist; however, an owner of property shall not apply for injunctive relief unless (i) he has notified in writing the person who has violated the VESCP, the Department, and the VESCP authority that a violation of the VESCP has caused, or creates a probability of causing, damage to his property, and (ii) neither the person who has violated the VESCP, the Department, nor the VESCP authority has taken corrective action within 15 days to eliminate the conditions that have caused, or create the probability of causing, damage to his property.

D. In addition to any criminal or civil penalties provided under this article, any person who violates any provision of this article may be liable to the VESCP authority or the Department, as appropriate, in a civil action for damages.

E. Without limiting the remedies that may be obtained in this section, any person violating or failing, neglecting, or refusing to obey any injunction, mandamus, or other remedy obtained pursuant to this section shall be subject, in the discretion of the court, to a civil penalty not to exceed $2,000 for each violation. A civil action for such violation or failure may be brought by the VESCP authority wherein the land lies or the Department. Any civil penalties assessed by a court shall be paid into the treasury of the locality wherein the land lies, except that where the violator is the locality itself, or its agent, or other VESCP authority, or where the penalties are assessed as the result of an enforcement action brought by the Department, the court shall direct the penalty to be paid into the state treasury.

F. With the consent of any person who has violated or failed, neglected, or refused to obey any regulation or order of the Board, any order, notice, or requirement of the Department or VESCP authority, any condition of a permit, or any provision of this article or associated regulations, the Board, the Director, or VESCP authority may provide, in an order issued by the Board or VESCP authority against such person, for the payment of civil charges for violations in specific sums, not to exceed the limit specified in subsection E. Such civil charges shall be instead of any appropriate civil penalty that could be imposed under subsection B or E.

G. Upon request of a VESCP authority, the attorney for the Commonwealth shall take legal action to enforce the provisions of this article. Upon request of the Board, the Department, or the district, the Attorney General shall take appropriate legal action on behalf of the Board, the Department, or the district to enforce the provisions of this article.

H. Compliance with the provisions of this article shall be prima facie evidence in any legal or equitable proceeding for damages caused by erosion or sedimentation that all requirements of law have been met and the complaining party must show negligence in order to recover any damages.

§ 62.1-44.15:64. Stop work orders by Department; civil penalties.

A. An aggrieved owner of property sustaining pecuniary damage resulting from a violation of an approved erosion and sediment control plan or required permit, or from the conduct of land-disturbing activities commenced without an approved plan or required permit, may give written notice of the alleged violation to the VESCP authority and to the Director.

B. Upon receipt of the notice from the aggrieved owner and notification to the VESCP authority, the Director shall conduct an investigation of the aggrieved owner's complaint.

C. If the VESCP authority has not responded to the alleged violation in a manner that causes the violation to cease and abates the damage to the aggrieved owner's property within 30 days following receipt of the notice from the aggrieved owner, the aggrieved owner may request that the Director require the violator to stop the violation and abate the damage to his property.

D. If (i) the Director's investigation of the complaint indicates that the VESCP authority has not responded to the alleged violation as required by the VESCP, (ii) the VESCP authority has not responded to the alleged violation within 30 days from the date of the notice given pursuant to subsection A, and (iii) the Director is requested by the aggrieved owner to require the violator to cease the violation, then the Director shall give written notice to the VESCP authority that the Department intends to issue an order pursuant to subsection E.

E. If the VESCP authority has not instituted action to stop the violation and abate the damage to the aggrieved owner's property within 10 days following receipt of the notice from the Director, the Department is authorized to issue an order requiring the owner, permittee, person responsible for carrying out an approved erosion and sediment control plan, or person conducting the land-disturbing activities without an approved plan or required permit to cease all land-disturbing activities until the violation of the plan or permit has ceased or an approved plan and required permits are obtained, as appropriate, and specified corrective measures have been completed. The Department also may immediately initiate a program review of the VESCP.

F. Such orders are to be issued after a hearing held in accordance with the requirements of the Administrative Process Act (§ 2.2-4000 et seq.), and they shall become effective upon service on the person by mailing with confirmation of delivery, sent to his address specified in the land records of the locality, or by personal delivery by an agent of the Director. Any subsequent identical mail or notice that is sent by the Department may be sent by regular mail. However, if the Department finds that any such violation is grossly affecting or presents an imminent and substantial danger of causing harmful erosion of lands or sediment deposition in waters within the watersheds of the Commonwealth, it may issue, without advance notice or hearing, an emergency order directing such person to cease all land-disturbing activities on the site immediately and shall provide an opportunity for a hearing, after reasonable notice as to the time and place thereof, to such person, to affirm, modify, amend, or cancel such emergency order.

G. If a person who has been issued an order or emergency order is not complying with the terms thereof, the Board may institute a proceeding in the appropriate circuit court for an injunction, mandamus, or other appropriate remedy compelling the person to comply with such order.

H. Any person violating or failing, neglecting, or refusing to obey any injunction, mandamus, or other remedy obtained pursuant to subsection G shall be subject, in the discretion of the court, to a civil penalty not to exceed $2,000 for each violation. Any civil penalties assessed by a court shall be paid into the state treasury.

§ 62.1-44.15:65. Authorization for more stringent regulations.

A. As part of a VESCP, a district or locality is authorized to adopt more stringent soil erosion and sediment control regulations or ordinances than those necessary to ensure compliance with the Board's regulations, provided that the more stringent regulations or ordinances are based upon factual findings of local or regional comprehensive watershed management studies or findings developed through the implementation of an MS4 permit or a locally adopted watershed management study and are determined by the district or locality to be necessary to prevent any further degradation to water resources, to address total maximum daily load requirements, to protect exceptional state waters, or to address specific existing water pollution including nutrient and sediment loadings, stream channel erosion, depleted groundwater resources, or excessive localized flooding within the watershed and that prior to adopting more stringent regulations or ordinances, a public hearing is held after giving due notice. The VESCP authority shall report to the Board when more stringent stormwater management regulations or ordinances are determined to be necessary pursuant to this section. However, this section shall not be construed to authorize any district or locality to impose any more stringent regulations for plan approval or permit issuance than those specified in §§ 62.1-44.15:55 and 62.1-44.15:57.

B. Any provisions of an erosion and sediment control program in existence before July 1, 2012, that contains more stringent provisions than this article shall be exempt from the analysis requirements of subsection A.

§ 62.1-44.15:66. No limitation on authority Department of Mines, Minerals and Energy.

The provisions of this article shall not limit the powers or duties of the Department of Mines, Minerals and Energy as they relate to strip mine reclamation under Chapters 16 (§ 45.1-180 et seq.) and 19 (§ 45.1-226 et seq.) of Title 45.1 or oil or gas exploration under the Virginia Gas and Oil Act (§ 45.1-361.1 et seq.).

EROSION AND SEDIMENT CONTROL REGULATIONS
CHAPTER 840

NOTE: This copy is up-to-date as of June 6, 2017. The most recent version can always be found on the Virginia General Assembly's Legislative Information System website: http://law.lis.virginia.gov/admincode/title9/agency25/chapter840

9VAC25-840-10. Definitions.

The following words and terms when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise. In addition, some terms not defined herein are defined in § 62.1-44.15:51 of the Erosion and Sediment Control Law.

"Act" means the Erosion and Sediment Control Law, Article 2.4 (§ 62.1-44.15:51 et seq.) of Chapter 3.1 of Title 62.1 of the Code of Virginia.

"Adequate channel" means a watercourse that will convey the designated frequency storm event without overtopping its banks or causing erosive damage to the bed, banks and overbank sections of the same.

"Agreement in lieu of a plan" means a contract between the VESCP authority and the owner that specifies conservation measures that must be implemented in the construction of a single-family residence; this contract may be executed by the VESCP authority in lieu of an erosion and sediment control plan.

"Applicant" means any person submitting an erosion and sediment control plan or an agreement in lieu of a plan for approval or requesting the issuance of a permit, when required, authorizing land-disturbing activities to commence.

"Board" means the State Water Control Board.

"Causeway" means a temporary structural span constructed across a flowing watercourse or wetland to allow construction traffic to access the area without causing erosion damage.

"Channel" means a natural stream or manmade waterway.

"Cofferdam" means a watertight temporary structure in a river, lake, etc., for keeping the water from an enclosed area that has been pumped dry so that bridge foundations, dams, etc., may be constructed.

"Dam" means a barrier to confine or raise water for storage or diversion, to create a hydraulic head, to prevent gully erosion, or to retain soil, rock or other debris.

"Denuded" means a term applied to land that has been physically disturbed and no longer supports vegetative cover.

"Department" means the Department of Environmental Quality.

"Development" means a tract or parcel of land developed or to be developed as a single unit under single ownership or unified control which is to be used for any business or industrial purpose or is to contain three or more residential dwelling units.

"Dike" means an earthen embankment constructed to confine or control water, especially one built along the banks of a river to prevent overflow of lowlands; levee.

"Director" means the Director of the Department of Environmental Quality.

"District" or "soil and water conservation district" means a political subdivision of the Commonwealth organized in accordance with the provisions of Article 3 (§ 10.1- 506 et seq.) of Chapter 5 of Title 10.1 of the Code of Virginia.

"Diversion" means a channel with a supporting ridge on the lower side constructed across or at the bottom of a slope for the purpose of intercepting surface runoff.

"Dormant" means denuded land that is not actively being brought to a desired grade or condition.

"Energy dissipator" means a nonerodible structure which reduces the velocity of concentrated flow to reduce its erosive effects.

"Erosion and Sediment Control Plan" or "plan" means a document containing material for the conservation of soil and water resources of a unit or group of units of land. It may include appropriate maps, an appropriate soil and water plan inventory and management information with needed interpretations, and a record of decisions contributing to conservation treatment. The plan shall contain all major conservation decisions and all information deemed necessary by the plan-approving authority to assure that the entire unit or units of land will be so treated to achieve the conservation objectives.

"Flume" means a constructed device lined with erosion-resistant materials intended to convey water on steep grades.

"Live watercourse" means a definite channel with bed and banks within which concentrated water flows continuously.

"Locality" means a county, city or town.

"Natural stream" means nontidal waterways that are part of the natural topography. They usually maintain a continuous or seasonal flow during the year and are characterized as being irregular in cross-section with a meandering course. Constructed channels such as drainage ditches or swales shall not be considered natural streams.

"Nonerodible" means a material, e.g., riprap, concrete, plastic, etc., that will not experience surface wear due to natural forces.

"Person" means any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town or other political subdivision of the Commonwealth, governmental body, including a federal or state entity as applicable, any interstate body, or any other legal entity.

"Post-development" means conditions that may be reasonably expected or anticipated to exist after completion of the land development activity on a specific site or tract of land.

"Program administrator" means the person or persons responsible for administering and enforcing the erosion and sediment control program of a VESCP authority.

"Pre-development" means conditions at the time the erosion and sediment control plan is submitted to the VESCP authority. Where phased development or plan approval occurs (preliminary grading, roads and utilities, etc.), the existing conditions at the time the erosion and sediment control plan for the initial phase is submitted for approval shall establish pre-development conditions.

"Sediment basin" means a temporary impoundment built to retain sediment and debris with a controlled stormwater release structure.

"Sediment trap" means a temporary impoundment built to retain sediment and debris which is formed by constructing an earthen embankment with a stone outlet.

"Sheet flow" (also called overland flow) means shallow, unconcentrated and irregular flow down a slope. The length of strip for overland flow usually does not exceed 200 feet under natural conditions.

"Shore erosion control project" means an erosion control project approved by local wetlands boards, the Virginia Marine Resources Commission, the department, or the United States Army Corps of Engineers and located on tidal waters and within nonvegetated or vegetated wetlands as defined in Title 28.2 of the Code of Virginia.

"Slope drain" means tubing or conduit made of nonerosive material extending from the top to the bottom of a cut or fill slope with an energy dissipator at the outlet end.

"Stabilized" means land that has been treated to withstand normal exposure to natural forces without incurring erosion damage.

"Storm sewer inlet" means a structure through which stormwater is introduced into an underground conveyance system.

"Stormwater detention" means the process of temporarily impounding runoff and discharging it through a hydraulic outlet structure to a downstream conveyance system.

"Temporary vehicular stream crossing" means a temporary nonerodible structural span installed across a flowing watercourse for use by construction traffic. Structures may include bridges, round pipes or pipe arches constructed on or through nonerodible material.

"Ten-year storm" means a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in 10 years. It may also be expressed as an exceedance probability with a 10% chance of being equaled or exceeded in any given year.

"Two-year storm" means a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in two years. It may also be expressed as an exceedance probability with a 50% chance of being equaled or exceeded in any given year.

"Twenty-five-year storm" means a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in 25 years. It may also be expressed as exceedance probability with a 4.0% chance of being equaled or exceeded in any given year.

"Virginia Erosion and Sediment Control Program" or "VESCP" means a program approved by the board that has been established by a VESCP authority for the effective control of soil erosion, sediment deposition, and nonagricultural runoff associated with a land-disturbing activity to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources and shall include such items where applicable as local ordinances, rules, permit requirements, annual standards and specifications, policies and guidelines, technical materials, and requirements for plan review, inspection, enforcement where authorized in this article, and evaluation consistent with the requirements of the Act and this chapter.

"Virginia Erosion and Sediment Control Program authority" or "VESCP authority" means an authority approved by the board to operate a Virginia Erosion and Sediment Control Program. An authority may include a state entity, including the department; a federal entity; a district, county, city, or town; or for linear projects subject to annual standards and specifications, electric, natural gas and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to § 15.2-5102 of the Code of Virginia.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.
Historical Notes

Former 4VAC50-30-10, derived from VR625-02-00 § 1, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-20. Purpose.

The purpose of this chapter is to form the basis for the administration, implementation and enforcement of the Act. The intent of this chapter is to establish the framework for compliance with the Act while at the same time providing flexibility for innovative solutions to erosion and sediment control concerns.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.
Historical Notes

Former 4VAC50-30-20, derived from VR625-02-00 § 2, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-30. Scope and applicability.

A. This chapter sets forth minimum standards for the effective control of soil erosion, sediment deposition, and nonagricultural runoff that must be met:

1. In VESCPs adopted under § 62.1-44.15:54 of the Act;

2. In erosion and sediment control plans that may be submitted directly to the department pursuant to § 62.1-44.15:55 A of the Act;

3. In annual general erosion and sediment control standards and specifications that electric, natural gas, and telephone utility companies, interstate and intrastate natural gas pipeline companies, and railroad companies are required to file, and authorities created pursuant to § 15.2-5102 of the Code of Virginia may file with the department pursuant to § 2.1-44.15:55 D of the Act;

4. In erosion and sediment control plans or annual standards and specifications that state agencies are required to file with the department pursuant to § 62.1-44.15:56 of the Act; and

5. In erosion and sediment control plans or annual standards and specifications that federal agencies may submit to the department pursuant to § 62.1-44.15:56 of the Act.

B. The submission of annual standards and specifications to the department does not eliminate the need where applicable for a project specific Erosion and Sediment Control Plan.

C. In accordance with Item 360 I1 of Chapter 3 of the 2012 Virginia Acts of Assembly, Special Session 1, public institutions of higher education, including community colleges, colleges, and universities, shall be subject to project review and compliance for state erosion and sediment control requirements by the VESCP authority of the locality within which the land-disturbing activity is located, unless such institution submits annual specifications to the department in accordance with § 62.1-44.15:56 A (i) of the Code of Virginia.

D. Any VESCP authority that administers a VESCP may charge applicants a reasonable fee to defray the costs of program administration. Such fee may be in addition to any fee charged for administration of a Virginia stormwater management program, although payment of fees may be consolidated in order to provide greater convenience and efficiency for those responsible for compliance with the programs. A VESCP authority shall hold a public hearing prior to establishing a schedule of fees. The fee shall not exceed an amount commensurate with the services rendered, taking into consideration the time, skill, and the VESCP authority's expense involved.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-30, derived from VR625-02-00 § 3, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-40. Minimum standards.

A VESCP must be consistent with the following criteria, techniques and methods:

1. Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site. Temporary soil stabilization shall be applied within seven days to denuded areas that may not be at final grade but will remain dormant for longer than 14 days. Permanent stabilization shall be applied to areas that are to be left dormant for more than one year.

2. During construction of the project, soil stock piles and borrow areas shall be stabilized or protected with sediment trapping measures. The applicant is responsible for the temporary protection and permanent stabilization of all soil stockpiles on site as well as borrow areas and soil intentionally transported from the project site.

3. A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved that is uniform, mature enough to survive and will inhibit erosion.

4. Sediment basins and traps, perimeter dikes, sediment barriers and other measures intended to trap sediment shall be constructed as a first step in any land-disturbing activity and shall be made functional before upslope land disturbance takes place.

5. Stabilization measures shall be applied to earthen structures such as dams, dikes and diversions immediately after installation.

6. Sediment traps and sediment basins shall be designed and constructed based upon the total drainage area to be served by the trap or basin.

    a. The minimum storage capacity of a sediment trap shall be 134 cubic yards per acre of drainage area and the trap shall only control drainage areas less than three acres.

b. Surface runoff from disturbed areas that is comprised of flow from drainage areas greater than or equal to three acres shall be controlled by a sediment basin. The minimum storage capacity of a sediment basin shall be 134 cubic yards per acre of drainage area. The outfall system shall, at a minimum, maintain the structural integrity of the basin during a 25-year storm of 24-hour duration. Runoff coefficients used in runoff calculations shall correspond to a bare earth condition or those conditions expected to exist while the sediment basin is utilized.

7. Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. Slopes that are found to be eroding excessively within one year of permanent stabilization shall be provided with additional slope stabilizing measures until the problem is corrected.

8. Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume or slope drain structure.

9. Whenever water seeps from a slope face, adequate drainage or other protection shall be provided.

10. All storm sewer inlets that are made operable during construction shall be protected so that sediment-laden water cannot enter the conveyance system without first being filtered or otherwise treated to remove sediment.

11. Before newly constructed stormwater conveyance channels or pipes are made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.

12. When work in a live watercourse is performed, precautions shall be taken to minimize encroachment, control sediment transport and stabilize the work area to the greatest extent possible during construction. Nonerodible material shall be used for the construction of causeways and cofferdams. Earthen fill may be used for these structures if armored by nonerodible cover materials.

13. When a live watercourse must be crossed by construction vehicles more than twice in any six-month period, a temporary vehicular stream crossing constructed of nonerodible material shall be provided.

14. All applicable federal, state and local requirements pertaining to working in or crossing live watercourses shall be met.

15. The bed and banks of a watercourse shall be stabilized immediately after work in the watercourse is completed.

16. Underground utility lines shall be installed in accordance with the following standards in addition to other applicable criteria:

a. No more than 500 linear feet of trench may be opened at one time.

b. Excavated material shall be placed on the uphill side of trenches.

c. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property.

d. Material used for backfilling trenches shall be properly compacted in order to minimize erosion and promote stabilization.

e. Restabilization shall be accomplished in accordance with this chapter.

f. Applicable safety requirements shall be complied with.

17. Where construction vehicle access routes intersect paved or public roads, provisions shall be made to minimize the transport of sediment by vehicular tracking onto the paved surface. Where sediment is transported onto a paved or public road surface, the road surface shall be cleaned thoroughly at the end of each day. Sediment shall be removed from the roads by shoveling or sweeping and transported to a sediment control disposal area. Street washing shall be allowed only after sediment is removed in this manner. This provision shall apply to individual development lots as well as to larger land-disturbing activities.

18. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization or after the temporary measures are no longer needed, unless otherwise authorized by the VESCP authority. Trapped sediment and the disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion and sedimentation.

19. Properties and waterways downstream from development sites shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff for the stated frequency storm of 24-hour

duration in accordance with the following standards and criteria. Stream restoration and relocation projects that incorporate natural channel design concepts are not man-made channels and shall be exempt from any flow rate capacity and velocity requirements for natural or man-made channels:

a. Concentrated stormwater runoff leaving a development site shall be discharged directly into an adequate natural or man-made receiving channel, pipe or storm sewer system. For those sites where runoff is discharged into a pipe or pipe system, downstream stability analyses at the outfall of the pipe or pipe system shall be performed.

b. Adequacy of all channels and pipes shall be verified in the following manner:

(1) The applicant shall demonstrate that the total drainage area to the point of analysis within the channel is one hundred times greater than the contributing drainage area of the project in question; or

(2) (a) Natural channels shall be analyzed by the use of a two-year storm to verify that stormwater will not overtop channel banks nor cause erosion of channel bed or banks.

(b) All previously constructed man-made channels shall be analyzed by the use of a 10-year storm to verify that stormwater will not overtop its banks and by the use of a two-year storm to demonstrate that stormwater will not cause erosion of channel bed or banks; and

(c) Pipes and storm sewer systems shall be analyzed by the use of a 10-year storm to verify that stormwater will be contained within the pipe or system.

c. If existing natural receiving channels or previously constructed man-made channels or pipes are not adequate, the applicant shall:

(1) Improve the channels to a condition where a 10-year storm will not overtop the banks and a two-year storm will not cause erosion to the channel, the bed, or the banks;

(2) Improve the pipe or pipe system to a condition where the 10-year storm is contained within the appurtenances;

(3) Develop a site design that will not cause the pre-development peak runoff rate from a two-year storm to increase when runoff outfalls into a natural channel

or will not cause the pre-development peak runoff rate from a 10-year storm to increase when runoff outfalls into a man-made channel; or

(4) Provide a combination of channel improvement, stormwater detention or other measures which is satisfactory to the VESCP authority to prevent downstream erosion.

d. The applicant shall provide evidence of permission to make the improvements.

e. All hydrologic analyses shall be based on the existing watershed characteristics and the ultimate development condition of the subject project.

f. If the applicant chooses an option that includes stormwater detention, he shall obtain approval from the VESCP of a plan for maintenance of the detention facilities. The plan shall set forth the maintenance requirements of the facility and the person responsible for performing the maintenance.

g. Outfall from a detention facility shall be discharged to a receiving channel, and energy dissipators shall be placed at the outfall of all detention facilities as necessary to provide a stabilized transition from the facility to the receiving channel.

h. All on-site channels must be verified to be adequate.

i. Increased volumes of sheet flows that may cause erosion or sedimentation on adjacent property shall be diverted to a stable outlet, adequate channel, pipe or pipe system, or to a detention facility.

j. In applying these stormwater management criteria, individual lots or parcels in a residential, commercial or industrial development shall not be considered to be separate development projects. Instead, the development, as a whole, shall be considered to be a single development project. Hydrologic parameters that reflect the ultimate development condition shall be used in all engineering calculations.

k. All measures used to protect properties and waterways shall be employed in a manner which minimizes impacts on the physical, chemical and biological integrity of rivers, streams and other waters of the state.

l. Any plan approved prior to July 1, 2014, that provides for stormwater management that addresses any flow rate capacity and velocity requirements for natural or man-made channels shall satisfy the flow rate capacity and velocity requirements for natural or man-made channels if the practices are designed to (i) detain the water quality volume and to release it over 48 hours; (ii) detain and release over a 24-hour period the expected rainfall resulting from the one year, 24-hour storm; and (iii) reduce the allowable peak flow rate resulting from the 1.5, 2, and 10-year, 24-hour storms to a level that is less than or equal to the peak flow rate from the site assuming it was in a good forested condition, achieved through multiplication of the forested peak flow rate by a reduction factor that is equal to the runoff volume from the site when it was in a good forested condition divided by the runoff volume from the site in its proposed condition, and shall be exempt from any flow rate capacity and velocity requirements for natural or man-made channels as defined in any regulations promulgated pursuant to § 62.1-44.15:54 or 62.1-44.15:65 of the Act.

m. For plans approved on and after July 1, 2014, the flow rate capacity and velocity requirements of § 62.1-44.15:52 A of the Act and this subsection shall be satisfied by compliance with water quantity requirements in the Stormwater Management Act (§ 62.1-44.15:24 et seq. of the Code of Virginia) and attendant regulations, unless such land-disturbing activities are in accordance with 9VAC25-870-48 of the Virginia Stormwater Management Program (VSMP) Regulation or are exempt pursuant to subdivision C 7 of § 62.1-44.15:34 of the Act.

n. Compliance with the water quantity minimum standards set out in 9VAC25-870-66 of the Virginia Stormwater Management Program (VSMP) Regulation shall be deemed to satisfy the requirements of this subdivision 19.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-40, derived from VR625-02-00 § 4; eff September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013; amended, Virginia Register Volume 31, Issue 24, eff. August 26, 2015.

9VAC25-840-50. Variances.

The VESCP authority may waive or modify any of the requirements that are deemed inappropriate or too restrictive for site conditions, by granting a variance. A variance may be granted under these conditions:

1. At the time of plan submission, an applicant may request a variance to become part of the approved erosion and sediment control plan. The applicant shall explain the reasons for requesting variances in writing. Specific variances which are allowed by the VESCP authority shall be documented in the plan.

2. During construction, the person responsible for implementing the approved plan may request a variance in writing from the VESCP authority. The VESCP authority shall respond in writing either approving or disapproving such a request. If the VESCP authority does not approve a variance within 10 days of receipt of the request, the request shall be considered to be disapproved. Following disapproval, the applicant may resubmit a variance request with additional documentation.

3. The VESCP authority shall consider variance requests judiciously, keeping in mind both the need of the applicant to maximize cost effectiveness and the need to protect off-site properties and resources from damage.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-50, derived from VR625-02-00 § 5, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-60. Maintenance and inspections.

A. All erosion and sediment control structures and systems shall be maintained, inspected and repaired as needed to insure continued performance of their intended function. A statement describing the maintenance responsibilities of the permittee shall be included in the approved erosion and sediment control plan.

B. Periodic inspections are required on all projects by the VESCP authority. The VESCP authority shall either:

1. Provide for an inspection during or immediately following initial installation of erosion and sediment controls, at least once in every two-week period, within 48 hours following any runoff producing storm event, and at the completion of the project prior to the release of any performance bonds; or

2. Establish an alternative inspection program which ensures compliance with the approved erosion and sediment control plan. Any alternative inspection program shall be:

a. Approved by the board prior to implementation;

b. Established in writing;

c. Based on a system of priorities that, at a minimum, address the amount of disturbed project area, site conditions and stage of construction; and

d. Documented by inspection records.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-60, derived from VR625-02-00 § 6, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-65. Reporting.

Each VESCP authority shall report to the department, at least monthly, in a method such as an online reporting system and on a time schedule established by the department, a listing of each land-disturbing activity for which a plan has been approved by the VESCP authority under the Act and this chapter.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-65, derived from Virginia Register Volume 29, Issue 4, eff. November 21, 2012; renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013; amended, Virginia Register Volume 30, Issue 24, eff. July 1, 2014.

9VAC25-840-70. Developments.

A. An erosion and sediment control plan shall be filed for a development and the buildings constructed within, regardless of the phasing of construction.

B. If individual lots or sections in a residential development are being developed by different property owners, all land-disturbing activities related to the building construction shall be covered by an erosion and sediment control plan or an "Agreement in Lieu of a Plan" signed by the property owner.

C. Land-disturbing activity of less than 10,000 square feet on individual lots in a residential development shall not be considered exempt from the provisions of the Act and this chapter if the total land-disturbing activity in the development is equal to or greater than 10,000 square feet.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-70, derived from VR625-02-00 § 7, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-80. Criteria for determining status of land-disturbing activity.

A. The program administrator shall determine the validity of a claim of exempt status by a property owner who disturbs 10,000 square feet or more or 2,500 square feet or more in all areas of jurisdictions designated as subject to the Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC25-830). As soon as a nonexempt status is determined, the requirements of the Act shall be immediately enforced.

B. Should a land-disturbing activity not begin during the 180-day period following plan approval or cease for more than 180 days, the VESCP authority may evaluate the existing approved erosion and sediment control plan to determine whether the plan still satisfies local and state erosion and sediment control criteria and to verify that all design factors are still valid. If the VESCP authority finds the previously filed plan to be inadequate, a modified plan shall be submitted and approved prior to the resumption of land-disturbing activity.

C. Shore erosion control projects are not subject to this chapter. However, land-disturbing activity immediately outside the limits of the shore erosion project is subject to the Act and this chapter.

D. Whenever land-disturbing activity involves activity at a separate location (including but not limited to borrow and disposal areas), the VESCP authority may either:

1. Consider the off-site activity as being part of the proposed land-disturbing activity; or

2. If the off-site activity is already covered by an approved erosion and sediment control plan, the VESCP authority may require the applicant to provide proof of the approval and to certify that the plan will be implemented in accordance with a the Act and this chapter.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-80, derived from VR625-02-00 § 8, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-90. Review and evaluation of VESCPs: minimum program standards.

A. This section sets forth the criteria that will be used by the department to determine whether a VESCP operating under authority of the Act, satisfies minimum standards of effectiveness, as follows.

Each VESCP must contain an ordinance or other appropriate document or documents adopted by the VESCP authority. Such document or documents must be consistent with the Act and this chapter, including the following criteria:

1. The document or documents shall include or reference the definition of land-disturbing activity including exemptions, as well as any other significant terms, as necessary to produce an effective VESCP.

2. The document or documents shall identify the VESCP authority and any soil and water conservation district, adjacent locality, or other public or private entities that the VESCP authority entered into agreements or contracts with to assist with carrying out the provisions of the Act and this chapter, and must include the requirements and design standards to be used in the program.

3. The document or documents shall include procedures for submission and approval of plans, issuance of permits, monitoring and inspections of land-disturbing activities. The position, agency, department, or other party responsible for conducting inspections shall be identified. The VESCP authority shall maintain, either on-site or in VESCP files, a copy of the approved plan and a record of inspections for each active land-disturbing activity.

4. Each VESCP operated by a county, city, or town shall include provisions for the integration of the VESCP with Virginia stormwater management, flood insurance, flood plain management, and other programs requiring compliance prior to authorizing a land-disturbing activity in order to make the submission and approval of plans, issuance of permits, payment of fees, and coordination of inspection and enforcement activities more convenient and efficient both for the local governments and those responsible for compliance with the programs.

5. The VESCP authority must take appropriate enforcement actions, where authorized to do so, to achieve compliance with the program and maintain a record of enforcement actions for all active land-disturbing activities.

B. The department shall periodically conduct a comprehensive review and evaluation of local programs. The department will coordinate the review with its other program reviews for the same entity to avoid redundancy. The review and evaluation of a local program shall consist of the following: (i) consultation with the local program administrator or designee or designees; (ii) review of the local ordinance and other applicable documents; (iii) review of plans approved by the program; (iv) inspection of regulated activities; and (v) review of enforcement actions where authorized to do so. The department is also authorized to conduct a partial program compliance review.

C. Local programs shall be reviewed and evaluated for effectiveness in carrying out the Act and this chapter using the criteria in this section.

D. If deficiencies noted in the review will cause the erosion and sediment control program to be inconsistent with the state program and this chapter, the board shall provide the VESCP authority with a copy of its decision that specifies the deficiencies, action needed to be taken, and an approved corrective action plan and schedule required to attain the minimum standard of effectiveness. If the VESCP authority has not implemented the necessary compliance actions identified by the board within the corrective action schedule, or such additional period as is granted to complete the implementation of the corrective action, then the board shall have the authority to (i) issue a special order to any VESCP imposing a civil penalty set out in § 62.1-44.15:54 F of the Act or (ii) revoke its approval of the VESCP. The Administrative Process Act (§ 2.2-4000 et seq. of the Code of Virginia) shall govern the review activities and proceedings of the board and the judicial review thereof. In lieu of issuing a special order or revoking the program, the board is authorized to take legal action against a VESCP to ensure compliance.

E. Review and evaluation of VESCPs shall be conducted according to a schedule adopted by the department.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-90, derived from VR625-02-00 § 9, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-100. State agency projects.

A. All state agency land-disturbing activities that are not exempt and that have commenced without an approved erosion and sediment control plan shall immediately cease until the state agency has submitted annual standards and specifications for its conduct of land-disturbing activities which has been reviewed and approved by the department as being consistent with the Act and this chapter, or an erosion and sediment control plan has been submitted to and approved by the department. A formal

"Notice of Plan Requirement" will be sent to the state agency under whose purview the project lies since that agency is responsible for compliance with the Act and this chapter.

B. Where inspections by department personnel reveal deficiencies in carrying out an approved plan, the person responsible for carrying out the plan, as well as the state agency responsible, will be issued a notice to comply with specific actions and the deadlines that shall be met. Failure to meet the prescribed deadlines can result in the issuance of a stop work order for all land-disturbing activities on the project at the discretion of the department. The stop work order will be lifted once the required erosion and sediment control measures are in place and inspected by department staff.

C. Whenever the Commonwealth or any of its agencies fails to comply within the time provided in an appropriate final order, the director of the department may petition for compliance as follows: For violations in the Natural Resources Secretariat, to the Secretary of Natural Resources; for violations in other secretariats, to the appropriate Secretary; for violations in other state agencies, to the head of such agency. Where the petition does not achieve timely compliance, the director shall bring the matter to the Governor for resolution. The board or the department may also pursue enforcement as provided by § 62.1-44.15:63 of the Act.

D. Where compliance will require the appropriation of funds, the director shall cooperate with the appropriate agency head in seeking such an appropriation; where the director determines that an emergency exists, he shall petition the Governor for funds from the Civil Contingency Fund or other appropriate source.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Former 4VAC50-30-100, derived from VR625-02-00 § 10, eff. September 13, 1990; amended, Virginia Register Volume 11, Issue 11, eff. March 22, 1995; Volume 29, Issue 4, eff. November 21, 2012; amended and renumbered, Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

9VAC25-840-110. Delegation of Authority.

The director, or his designee, may perform any act of the board provided under this chapter, except as limited by § 62.1-44.14 of the Code of Virginia.

Statutory Authority

§ 62.1-44.15:52 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 30, Issue 2, eff. October 23, 2013.

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VIRGINIA UNIFORM CODING SYSTEM
for Erosion and Sediment Control Practices

★ Indicates normal applicability of a specific practice to one or more of the seven control categories

Virginia Erosion and SedimentControl Handbook

July 1992

RECOMMENDED PLAN SYMBOLS:

Existing Contour
Finished Contour
Drainage Divide
Limit of Grading
Storm Sewer
Boundary of a Control Measure

NO.	TITLE	KEY	SYMBOL	DESCRIPTION	A ACCESS PREVENTION	B PERIMETER CONTROL	C SLOPE PROTECTION	D SEDIMENT TRAPPING	E DRAINAGEWAY AND STREAM PROTECTION	F TEMPORARY STABILIZATION	G PERMANENT STABILIZATION
3.01	SAFETY FENCE	SAF		A protective barrier installed to prohibit undesirable use of an erosion control measure.	*						
3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE		A stone pad, located at points of vehicular ingress and egress on a construction site, to reduce the soil transported onto public roads and other paved areas.		*				*	
3.03	CONSTRUCTION ROAD STABILIZATION	CRS		Temporary stabilization with stone of access roads, subdivision streets, parking areas and other traffic areas immediately after grading to reduce erosion caused by vehicles during wet weather, and to prevent having to regrade permanent roadbeds between initial grading and final stabilization.						*	
3.04	STRAW BALE BARRIER	STB		A temporary sediment barrier composed of straw bales placed across or at the toe of a slope to intercept and detain sediment and decrease flow velocities from drainage areas of limited size; applicable where sheet and rill erosion may be a problem. Maximum effective life is 3 months.		*		*	*		
3.05	SILT FENCE	SF		A temporary sediment barrier constructed of posts, filter fabric and, in some cases, a wire support fence, placed across or at the toe of a slope or in a minor drainage way to intercept and detain sediment and decrease flow velocities from drainage areas of limited size; applicable where sheet and rill erosion or small concentrated flows may be a problem. Maximum effective life - 6 months.		*		*	*		
3.06	BRUSH BARRIER	BB		A temporary sediment barrier composed of limbs, weeds, vines, root mat, rock, and other cleared materials pushed together to form a berm; located across or at the toe of a slope to intercept and detain sediment and decrease flow velocities.		*		*			
3.07	STORM DRAIN INLET PROTECTION	IP		The installation of various kinds of sediment trapping measures around drop inlets or curb inlet structures prior to permanent stabilization of the disturbed area; limited to drainage areas not exceeding one acre, and not intended to control large, concentrated stormwater flows.				*			
3.08	CULVERT INLET PROTECTION	CIP		A sediment filter located at the inlet to storm sewer culverts which prevents sediment from entering, accumulating in and being transferred by the culvert. It also provides erosion control at culverts during the phase of a project where elevations and drainage patterns are changing, causing original control measures to be ineffective.				*			
3.09	TEMPORARY DIVERSION DIKE	DD		A ridge of compacted soil constructed at the top or base of a sloping disturbed area which diverts off-site runoff away from unprotected slopes and to a stabilized outlet, or to divert sediment-laden runoff to a sediment trapping structure. Maximum effective life is 18 months.		*	*				
3.10	TEMPORARY FILL DIVERSION	FD		A channel with a supporting ridge on the lower side, constructed along the top of an active earth fill constructed in order to divert runoff away from the unprotected fill slope to a stabilized outlet or sediment trapping structure; applicable where the area at the top of the fill drains toward the exposed slope and continuous fill operations make the use of a TEMPORARY DIVERSION DIKE infeasible; maximum effective life is one week.			*				
3.11	TEMPORARY RIGHT - OF - WAY DIVERSION	RWD		A ridge of compacted soil or loose gravel constructed across a disturbed right-of-way or similar sloping area to shorten the flow length within the disturbed strip and divert the runoff to a stabilized outlet. Earthen diversions are applicable where there will be little or no construction traffic within the right-of-way, and gravel structures are applicable where vehicular traffic must be accommodated.			*				
3.12	DIVERSION	DV		A permanent channel with a ridge on the lower side constructed across a slope to reduce slope length and intercept and divert stormwater runoff to a stabilized outlet at non-erosive velocities.			*				
3.13	TEMPORARY SEDIMENT TRAP	ST		A small ponding area, formed by constructing an earthen embankment with a stone outlet across a drainage swale, to detain sediment-laden runoff from small disturbed areas for enough time to allow most of the suspended solids to settle out. Maximum effective life is 18 months.		*		*			
3.14	TEMPORARY SEDIMENT BASIN	SB		A temporary barrier or dam with controlled stormwater release structure which is formed by constructing an embankment of compacted soil across a drainageway. It is used to detain sediment-laden runoff from drainage areas 3 acres or greater for enough time to allow most of the suspended solids to settle out. It can be constructed only where there is sufficient space and appropriate topography. Maximum effective life is 18 months unless designed as a permanent pond by a qualified professional.		*		*			
3.15	TEMPORARY SLOPE DRAIN	TSD		A flexible tubing or conduit, used before permanent drainage structures are installed, intended to conduct concentrated runoff safely from the top to the bottom of a disturbed slope without causing erosion on or below the slope.			*			*	
3.16	PAVED FLUME	PF		A permanent concrete-lined channel constructed to conduct concentrated runoff from the top to the bottom of a slope without causing erosion on or below the slope.			*				*
3.17	STORMWATER CONVEYANCE CHANNEL	SCC		A permanent channel designed to carry concentrated flows without erosion. Applicable to man-made channels, including roadside ditches, and natural channels that are modified to accommodate increased flows generated by land development; not generally applicable to major, continuous-flowing natural streams.					*		*
3.18	OUTLET PROTECTION	OP		The installation of riprap channel sections and/or stilling basins below storm drain outlets to reduce erosion and under-cutting from scouring at outlets and to reduce flow velocities before stormwater enters receiving channels below these outlets.					*		*
3.19	RIPRAP	RR		A permanent, erosion-resistant ground cover of large, loose, angular stone installed wherever soil conditions, water turbulence and velocity, expected vegetative cover, etc., are such that soil may erode under design flow conditions.			*		*	*	*
3.20	ROCK CHECK DAMS	CD		Small, temporary stone dams constructed across a drainage ditch to reduce the velocity of concentrated flows, reducing erosion of the swale or ditch. Limited to use in small open channels which drain 10 acres or less; should not be used in live streams.					*	*	
3.21	LEVEL SPREADER	LS		An outlet for dikes and diversions consisting of an excavated depression constructed at zero grade across a slope to convert concentrated, sediment-free runoff to sheet flow and release it onto areas of undisturbed soil which is stabilized by existing vegetation.		*				*	
3.22	VEGETATIVE STREAMBANK STABILIZATION	VSS		The establishment of appropriate vegetation on streambanks to protect the banks from erosion.					*		*
3.23	STRUCTURAL STREAMBANK STABILIZATION	SSS		Stabilizing the banks of live streams with permanent structural measures to protect them from erosion. Particularly applicable to watercourses which must pass increased flows due to upstream development, not applicable to tidal streams.					*		*
3.24	TEMPORARY VEHICULAR STREAM CROSSING	SC		A temporary structural span across a live stream to provide vehicular access to construction activity on either side of the stream while keeping sediment out of the stream and preventing damage to the channel bed and banks.					*		
3.25	UTILITY STREAM CROSSING	USC		A strategy for crossing small waterways when in-stream utility construction is involved. The strategy helps to prevent sediment from entering the affected watercourse and minimizes the amount of disturbance within the stream itself.					*		
3.26	DEWATERING STRUCTURE	DS		A temporary settling and filtering device for water which is discharged from dewatering activities				*	*		
3.27	TURBIDITY CURTAIN	TC		A floating geotextile material which minimizes sediment transport from a disturbed area adjacent to or within a body of water. It provides sedimentation protection for a watercourse from upslope land disturbance or from dredging or filling within the watercourse		*		*	*		
3.28	SUBSURFACE DRAIN	SD		A perforated conduit installed beneath the ground to intercept and convey groundwater. Prevents sloping soils from becoming excessively wet and subject to sloughing, and improves the quality of the vegetative growth medium in excessively wet areas by lowering the water table. Can also be used to drain detention structures.			*				*
3.29	SURFACE ROUGHENING	SR		Grading practices such as stair-stepping or grooving slopes or leaving slopes in a roughened condition by not fine-grading them. Reduces runoff velocity, provides sediment trapping and increases infiltration, all of which facilitate establishment of vegetation on exposed slopes. Applicable to all slopes steeper than 3:1 or that have received final grading but will not be stabilized immediately. Also recommended for other exposed slopes with flatter grades.			*			*	*
3.30	TOPSOILING	TO		Preserving and using topsoil to provide a suitable growth medium for vegetation used to stabilize disturbed areas. Applicable where preservation or importation of topsoil is most cost-effective method of providing a suitable growth medium; not recommended for slopes steeper than 2:1 unless other measures are taken to prevent erosion and sloughing.							*
3.31	TEMPORARY SEEDING	TS		Establishment of temporary vegetative cover on disturbed areas that will not be brought to final grade for periods of 30 days to one year by seeding with appropriate rapidly-growing plants.						*	
3.32	PERMANENT SEEDING	PS		Establishment of perennial vegetative cover by planting seed on rough-graded areas that will not be brought to final grade for a year or more or where permanent, long-lived vegetative cover is needed on fine-graded areas.							*
3.33	SODDING	SO		Stabilizing fine-graded areas by establishing permanent grass stands with sod. Provides immediate protection against erosion, and is especially effective in grassed swales and water-ways or in areas where an immediate aesthetic effect is desirable.				*			*
3.34	BERMUDAGRASS & ZOYSIAGRASS ESTABLISHMENT	BE / ZE	or	Establishment of vegetative cover with hybrid bermudagrass or zoysiagrass by planting sprigs, stolons or plugs to stabilize fine-graded areas where establishment by sod is not preferred.							*
3.35	MULCHING	MU		Application of plant residues or other suitable materials to disturbed surfaces to prevent erosion and reduce overland flow velocities. Fosters plant growth by increasing available moisture and providing insulation against extreme heat or cold. Should be applied to all seeding operations, other plant materials which do not provide adequate soil protection by themselves, and bare areas which cannot be seeded due to the season but which still need protection to prevent soil loss.						*	
3.36	SOIL STABILIZATION BLANKETS & MATTING	B/M	or	The installation of a protective blanket (Treatment 1) or a soil stabilization mat (Treatment 2) on a prepared planting of a steep slope, channel or shoreline.						*	*
3.37	TREES, SHRUBS, VINES AND GROUND COVERS	VEG		Stabilizing disturbed areas by planting trees, shrubs, vines and ground covers where turf is not preferred. These plant materials also provide food and shelter for wildlife as well as many other environmental benefits. Especially effective where ornamental plants are desirable and turf maintenance is difficult.							*
3.38	TREE PRESERVATION AND PROTECTION	TP		Protecting existing trees from mechanical and other injury during land-disturbing and construction activity to ensure the survival of desirable trees where they will be effective for erosion and sediment control and provide other environmental and aesthetic benefits.							*
3.39	DUST CONTROL	DC		Reducing surface and air movement of dust during land disturbance, demolition or construction activities in areas subject to dust problems in order to prevent soil loss and reduce the presence of potentially harmful airborne substance.							*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Virginia Department of Conservation & Recreation

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FREQUENTLY ASKED QUESTIONS (FAQ)
NATIVE VS. INVASIVE PLANT SPECIES FOR EROSION & SEDIMENT CONTROL

DCR's Natural Heritage Program and other conservation agencies and organizations recognize as "invasive non-natives" certain plant species referenced by DEQ in the *Virginia Erosion and Sediment Control Handbook*. This FAQ provides information regarding Virginia native and invasive non-native plant species and guidance for using natives in lieu of invasive Non-natives for vegetative stabilization of land-disturbing activities regulated by the Virginia Erosion and Sediment Control Law and Regulations. This document promotes sound ecological stewardship, while ensuring erosion control and compliance with the law and regulations. Visit DCR's website for further information about native and invasive plant species and for information about erosion and sediment control visit DEQ's website.

What is a Native Species?
Native species are those that naturally occur in the region in which they evolved. Plants evolve in specific habitats over extended periods of time in response to physical and biotic habitats processes that are characteristic of that place: the climate; the soils; the seasonal rainfall, drought, and frost; and interactions with other species occupying those habitats. Native species thus possess certain traits that enable them to thrive under local conditions.

What Are Invasive Non-Native Species and Why Are They of Concern?
Non-native plants, also known as exotic or non-native, are species that have been introduced intentionally or accidentally by human activity into a region in which they did not evolve. Many non-native species are well known and economically important in agriculture and horticulture, such as wheat, soybeans, and tulips. However, while some non-native plants are beneficial and have little capacity to spread in the natural environment, a few are *invasive* and pose serious threats to both natural communities and rare species. Because of a lack of natural controls like insect pests and competitors, some invasive non-native plants may escape cultivation, displace native plant species, reduce wildlife habitats, and alter ecosystem processes. The majority of invasive non-native plants are problematic due to their ability to easily and rapidly disperse across the landscape. Given this possibility of colonization, use of these species for erosion and sediment control should be avoided when possible.

How Many Invasive Non-Native Plant Species Have Been Identified in Virginia?
DCR's Natural Heritage Program and the Virginia Native Plant Society, in cooperation with land managers and agencies, nurserymen, landscape architects, horticulturalists, and other partners, have identified 90 (DCR 2014) invasive non-native plant species that threaten natural areas, forests, parks, and other conservation areas in Virginia. A complete list of invasive non-native plants for Virginia is available on DCR's website.

Why is Vegetative Stabilization of Land-Disturbing Activities Required?
Virginia Erosion and Sediment Control Law defines a land-disturbing activity as any land change of 10,000 sq. ft. or greater that involves clearing, grading, excavating, transporting, and filling of land. The Virginia Erosion and Sediment Control Regulations and local ordinances that implement the Law delineate strict requirements for timely temporary or permanent stabilization of land-disturbing activities, including denuded areas, soil stockpiles, earthen structures, cut and fill slopes, and watercourses, to prevent soil erosion from occurring in the first place. Planting vegetation, namely grasses or other herbaceous plants, is an effective and economic method for achieving expedient site stabilization. A copy of the Law and Regulations are available on DEQ's website.

Should Invasive Plants Referenced in the DCR Handbook Be Avoided?
Yes. DCR strongly discourages the use of the highly invasive **Common Reed** and **Chinese Lespedeza**. There are equally effective alternatives that are less problematic. It is especially important to avoid using these species in stormwater channels and on streambanks, as planting in these habitats may facilitate their wider distribution. Eight plant species considered invasive non-natives are referenced within the following sections of the *E&S Handbook*: Temporary Seeding (STD&SPEC 3.31), Permanent Seeding (STD&SPEC 3.32), Stormwater Conveyance Channels

(STD&SPEC 3.17), Vegetative Streambank Stabilization (STD&SPEC 3.22), and Sodding (STD&SPEC 3.33). However, DCR encourages using native plants whenever feasible as described in the remainder of this FAQ.

What Criteria Should Be Met For Native Species To Be Used for Stabilization?

The plant species chosen for stabilization must always be matched to the characteristics (climate, soils, etc.) of the site/region and must be commercially available in that region. Further, because interest in using native species for erosion and sediment control is relatively recent, alternative native species may not have been thoroughly field-tested to document their efficacy for erosion and sediment control. DCR recommends native plants for vegetative stabilization if the following criteria are met:

- Slopes < 15% slope gradient
- Soils with K factors < 0.36 (soils are not highly erodible)
- For use along roadways, species height must comply with Virginia Department of Transportation visibility requirements and not have characteristics that are highly attractive to birds and mammals
- For use on stormwater conveyance channels and streambanks, species must have proven effectiveness at the expected maximum stormwater flow volume and velocity

Generally, flat to gently sloping, open areas where there is little traffic are appropriate locales for planting most of the alternatives species suggested below. Utility easements or rights-of-way, park like areas, greenways, and other open tracks of land are excellent places to propagate native plants. However, natives may be considered even if one of these criteria is not met if there is sufficient evidence that the species is effective for erosion control.

What are Some Alternative Native Species to the Invasive Plants in the Handbook?

The table below provides a list of alternative Virginia native plants with similar attributes to the invasive non-native plants. These alternatives are offered as suggestions if the criteria listed above are met. Fact sheets for 30 invasive plant species and five brochures on using native plants for restoration and landscaping are available on DCR's website.

Invasive Non-Native Species	***Alternative Virginia Native***	
Common Name	*Common Name*	*Scientific Name*
Common Reed	Great bulrush	*Schoenoplectus tabernaemontani*
	Common Cattail	*Typha latifolia*
Chinese Lespedeza **Birdsfoot Trefoil** **Orchard Grass** **Redtop** **Weeping Lovegrass**	Roundheaded bushclover	*Lespedeza capitata*
	Patridge pea	*Chamaecrista fasciculata*
	Butterflyweed	*Asclepias tuberosa*
	Joe-pye weed	*Eutrochium dubium*
	Black-eyed Susan	*Rudbeckia fulgida*
	Big blue stem	*Andropogon gerardii*
	Indian grass	*Sorghastrum nutans*
	Side oats grama	*Bouteloua curtipendula*
Crownvetch	Roundheaded bushclover	*Lespedeza capitata*
	Patridge pea	*Chamaecrista fasciculata*
	Big blue stem	*Andropogon gerardii*
	Little blue stem	*Schizachyrium scoparium*
	Indian grass	*Sorghastrum nutans*
	Switchgrass	*Panicum virgatum*
Tall Fescue	Big blue stem	*Andropogon gerardii*
	Little blue stem	*Schizachyrium scoparium*
	Indian grass	*Sorghastrum nutans*
	Switchgrass	*Panicum virgatum*
	Broomsedge	*Andropogon virginicus*
	Deertongue	*Dichanthelium clandestinum*
	Side oats grama	*Bouteloua curtipendula*
	Canadian wildrye	*Elymus canadensis*
	Bottlebrush grass	*Elymus hystrix*
	Virginia wildrye	*Elymus virginicus*

Are There Other Considerations When Employing Alternative Native Plants? Yes. The following potential issues should also be considered when employing alternative native plants:

- Always using a native seed mix is desirable for two reasons:
  - Some natives take several seasons to fully establish, so a seed mix including some non-competing annual plant species is recommended
  - To prevent establishing a "monoculture" and encourage biodiversity, multiple natives species should be established on site when possible
- Some natives have new/unique maintenance requirements (weeding, mowing, herbicides, etc.)
- Adding compost to raise the organic content of the soil will greatly enhance the success of vegetation
- Always coordinate with and educate local government officials, property owners, and the citizenry about the benefits of natives – many natives don't produce lush green lawns, and are perceived as weeds

Who Must Approve Use of Alternative Native Plants?

Users should work with the local Native Plant Society chapter or equivalent and the erosion and sediment control program authority to select appropriate native plant species. Note that the selection of plant species for vegetative stabilization **must always** be approved by the program authority as a part of the erosion and sediment control plan.