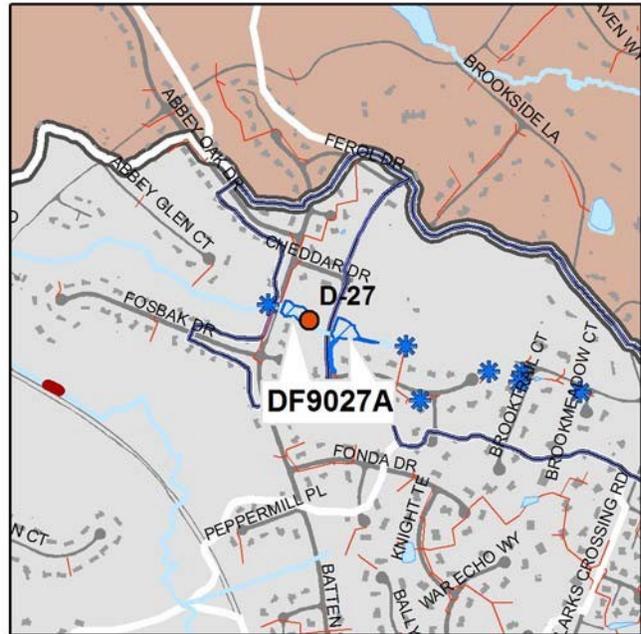


Project Number: DF9027A
Catchment Code: DFPB9501
Candidate Site: D-27

Project Type: Culvert Retrofit
Project Size: 0.5 acres
Treated Area: 104 acres

Project Location: This project would consist of two culvert retrofits at Batten Hollow and Brookhill Roads.

Project Description: This project would use two existing roadway embankments to create detention ponding areas. The primary goal of these retrofits will be to provide storage for channel protection. While water quality is not the primary goal, minor grading and landscaping features (e.g. forebays, micro-pools, vegetation improvements, etc.) would provide some treatment.



Potential Project Benefits:

Streamflow	Retrofits at these two sites would provide approximately 80% of the channel storage volume and help to reduce erosive flows downstream.
Water Quality	Improvements to water quality would be obtained through the reduction in scour forming discharges downstream with some sedimentation and vegetative uptake at the site.

Potential Project Constraints:

Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Forest and wetland impacts are anticipated during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access is very good from the roadway
Design / Construction	No significant design or construction issues were noted.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1,000
Excavation	970	CY	\$35.00	\$33,950
Impoundment Structure	2	LS	\$5,000.00	\$10,000
Landscaping	830	SY	\$2.50	\$2,075
Wetland Planting	280	SY	\$2.00	\$560
Base Construction Cost				\$47,585
Mobilization (5%)				\$2,379
Subtotal 1				\$49,964
Contingency (25%)				\$12,491
Subtotal 2				\$62,455
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$28,105
Estimated Project Cost				\$91,000

This project is part of the alternative project group for Regional Pond D-27. See Table 5-2 for the recommended disposition.

Concept Sketch

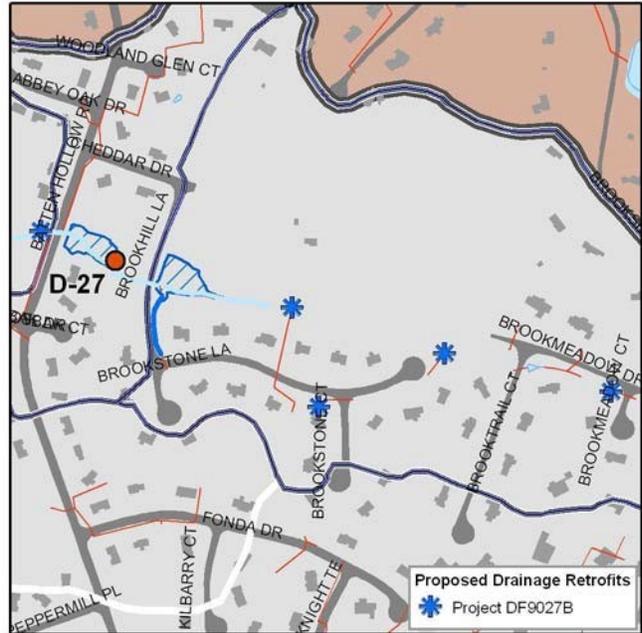


Project Number: DF9027B
Catchment Code: DFPB9501
Candidate Site: D-27

Project Type: Drainage Retrofit
Project Size: 233 feet of paved ditch; 5 Outfalls

Project Location: This project is located at various locations throughout the catchment.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream. Additionally, paved roadside ditches will be replaced with dry swale systems with an underdrain to provide water quality treatment.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and erosive potential immediately downstream. Swales will reduce both volume and velocity.
Water Quality	Replacing ditches with swales will provide treatment before stormwater reaches the stream system. Water quality will also benefit from the reduction of sediment loads associated from scour at the outfall locations.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified. Design should incorporate check dams or other features to ensure flow velocity is not erosive.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition (Haul Away)	233	LF	\$18.00	\$4,194
Dry Swale w/ Underdrain	233	LF	\$50.00	\$11,650
Outfall Protection	5	EA	\$8,000.00	\$40,000
Base Construction Cost				\$55,844
Mobilization (5%)				\$2,792
Subtotal 1				\$58,636
Contingency (25%)				\$14,659
Subtotal 2				\$73,295
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$32,983
Estimated Project Cost				\$106,000

This project is part of the alternative project group for Regional Pond D-27. See Table 5-2 for the recommended disposition.

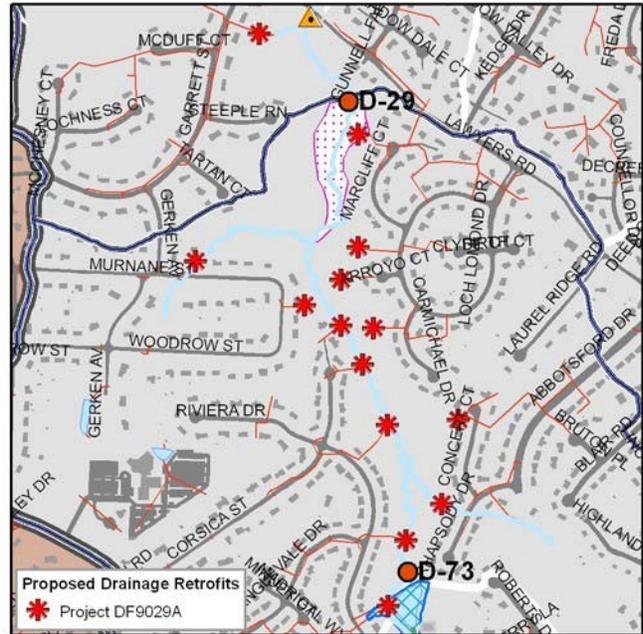
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Project Number: DF9029A
Catchment Code: DFPB9802
Candidate Site: D-29

Project Type: Drainage Retrofit
Project Size: 14 Outfalls

Project Location: This project is distributed throughout the catchment.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream. Alternatives may include drop structures, plunge pools, larger ditches with larger stone, or some combination.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	14	EA	\$8,000.00	\$112,000
Base Construction Cost				\$112,000
			Mobilization (5%)	\$5,600
			Subtotal 1	\$117,600
			Contingency (25%)	\$29,400
			Subtotal 2	\$147,000
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	\$66,150
			Estimated Project Cost	\$213,000

This project is part of the alternative project group for Regional Pond D-29. See Table 5-2 for the recommended disposition.

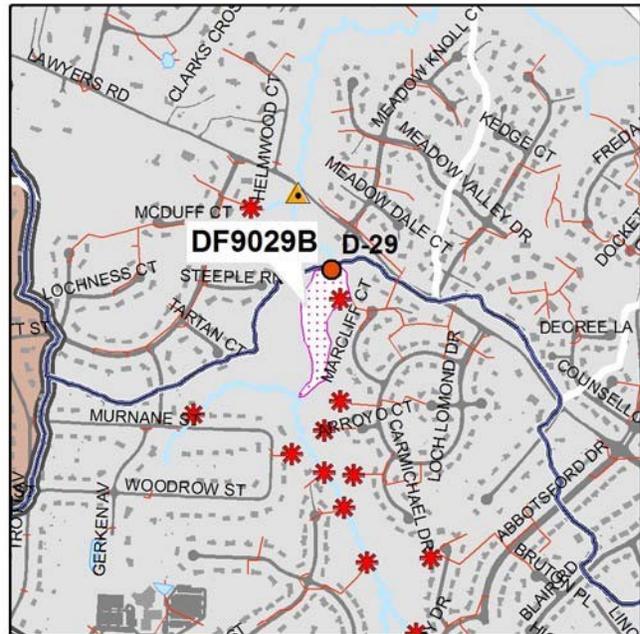
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Project Number: DF9029B
Catchment Code: DFPB9802
Candidate Site: D-29

Project Type: New Pond
Project Size: 3.8 acres
Treated Area: 321 acres

Project Location: This project is located on the upstream side of Lawyers Road.

Project Description: This project consists of constructing a new pond on the upstream side of Lawyers Road. This project is focused on the detention of storm flows to provide channel protection to reduce erosive flows downstream. Water quality features should be incorporated into this design to the greatest extent practicable.



Potential Project Benefits:

Streamflow	The project will provide 100% of the channel protection volume for this location.
Water Quality	Some reduction of pollutants will occur with increased settling and vegetative uptake associated with extended detention.

Potential Project Constraints:

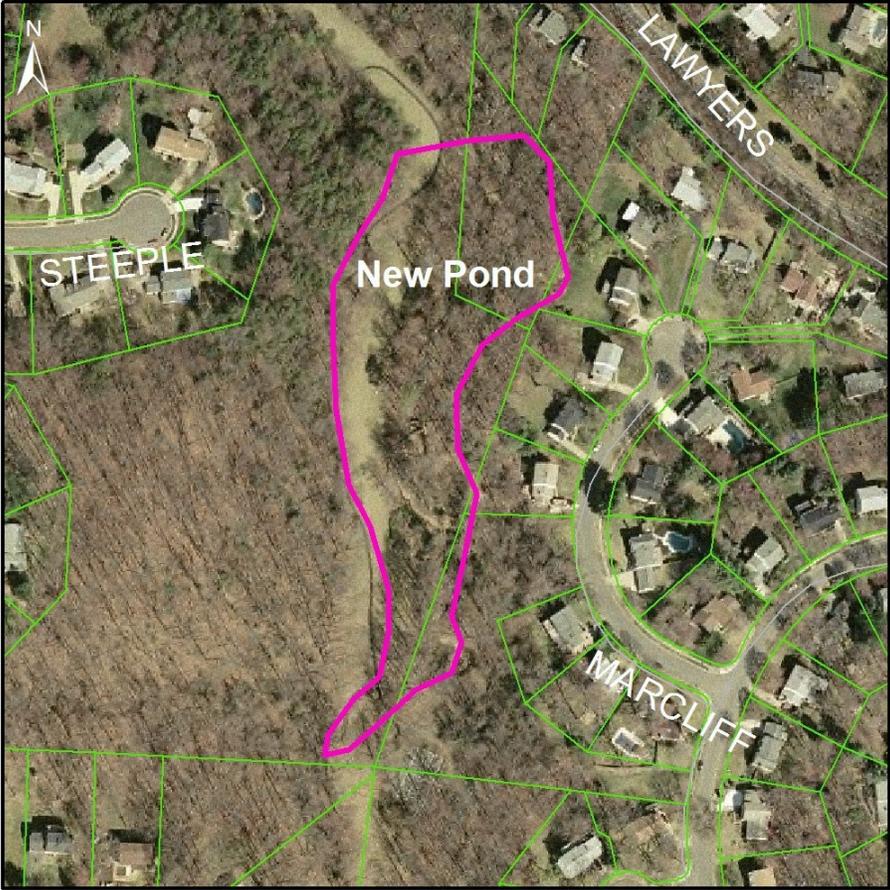
Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Forest and wetland impacts are anticipated during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access is more difficult than similar projects, however the site can be reached from Lawyers Road through the floodplain.
Design / Construction	No significant design or construction issues were noted.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	\$5,000.00	\$2,000
Embankment	4,090	CY	\$60.00	\$245,400
Riser Structure	1	LS	\$10,000.00	\$10,000
Landscaping	1,830	SY	\$2.50	\$4,575
Base Construction Cost				\$261,975
Mobilization (5%)				\$13,099
Subtotal 1				\$275,074
Contingency (25%)				\$68,768
Subtotal 2				\$343,842
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$154,729
Estimated Project Cost				\$499,000

This project is part of the alternative project group for Regional Pond D-29. See Table 5-2 for the recommended disposition.

Concept Sketch

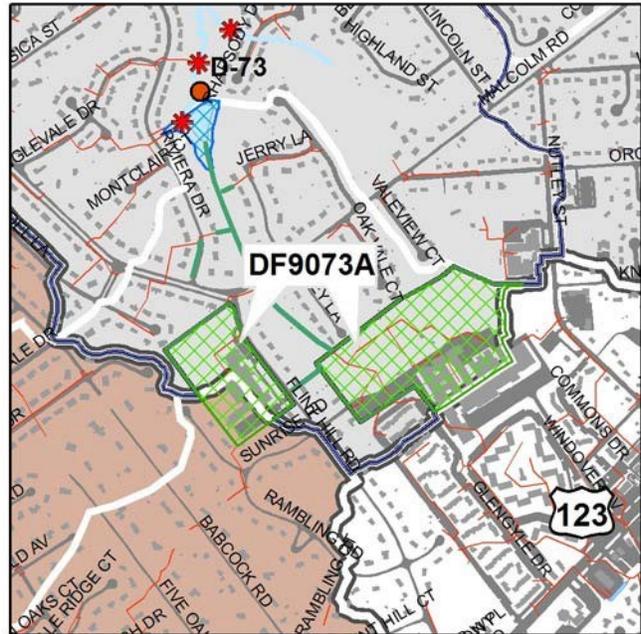


Project Number: DF9073A
Catchment Code: DFPB9801
Candidate Site: D-73

Project Type: LID Retrofit
Project Size: 0.2 acres
Treated Area: 30 acres

Project Location: Madison High School
 and Flint Hill Elementary School

Project Description: The project is a retrofit of LID site design and structures to improve the quality of the discharge from these two sites, which predate stormwater management facilities. A LID retrofit approach combining reduction of imperviousness, ponding, swales, and bioretention to mimic natural hydrology would reduce the runoff volume and improve water quality from these public properties.



The project could also serve as an excellent teaching tool for staff and students.

Potential Project Benefits:

Streamflow	While designed primarily for water quality, this project would reduce the amount of runoff through reduction of impervious area, infiltration and uptake by vegetation.
Water Quality	This project has been designed to treat 100% of the water quality volume for the site.

Potential Project Constraints:

Environmental	No environmental constraints or permitting issues are anticipated.
Facility Access	Access to the site is excellent by public roads and parking areas.
Design / Construction	A holistic LID approach, including disconnection of imperviousness and minimization of runoff, is recommended, rather than an approach relying on treatment systems, since space may be a limiting factor for structural solutions

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
LID Structural Control	961	SY	\$120.00	\$115,320
Interpretive Signs	1	LS	\$1,000.00	\$1,000
Base Construction Cost				\$116,320
Mobilization (5%)				\$5,816
Subtotal 1				\$122,136
Contingency (25%)				\$30,534
Subtotal 2				\$152,670
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$68,702
Estimated Project Cost				\$221,000

This project is part of the alternative project group for Regional Pond D-73. See Table 5-2 for the recommended disposition.

Concept Sketch

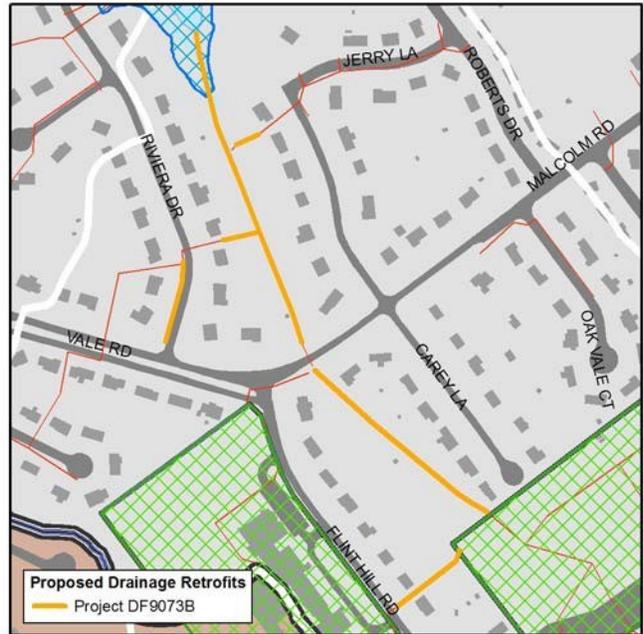


Project Number: DF9073B
Catchment Code: DFPB9801
Candidate Site: D-73

Project Type: Drainage Retrofit
Project Size: 1,389 LF of concrete ditch, 1,000 LF of armored stream channel

Project Location: Paved stream channel extending from Madison High School through Malcolm Road to a farm pond downstream.

Project Description: The upper end of this reach is a concrete trapezoidal channel. The lower reach is an artificially straightened stream armored with riprap that extends downstream from Malcolm Road to a point at which the streambed is rock. The project is intended to replace both of these drainage systems with more natural drainage. The upstream flume would be removed and replaced with a dry swale. The lower reach would be reconstructed as a natural stream channel with step pools to reduce flow velocity. Riparian buffer should be reestablished where deficient.



Potential Project Benefits:

Streamflow	The dry swale at the head of the reach would be expected to reduce runoff volume through infiltration. The naturalized stream reach would help to reduce velocity.
Water Quality	Water quality improvements would come from filtration from the dry swale and the reduction of sediment loads associated with erosion and scour.

Potential Project Constraints:

Environmental	Permitting and environmental constraints should be minimal for this retrofit. Projects in RPAs may require exceptions or waivers.
Facility Access	Access is very good from the ends of this project.
Design / Construction	The narrow channel constrains design options. Because the stream runs through private property and crosses Malcolm Road coordination with property owners and VDOT would most likely be extensive. Design should incorporate check dams or other features to ensure flow velocity is not erosive.

This project is part of the alternative project group for Regional Pond D-73. See Table 5-2 for the recommended disposition.

Difficult Run Watershed Management Plan
 Concept Plans
Piney Branch

Costs:

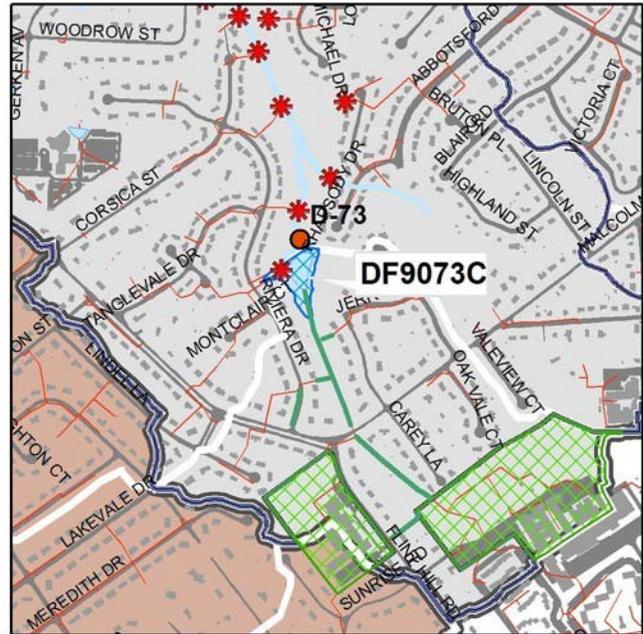
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition (Haul Away)	2389	LF	\$18.00	\$43,002
Dry Swale w/ Underdrain	1389	LF	\$50.00	\$69,450
Stream restoration -- step pools	1000	LF	\$225.00	\$225,000
Buffer restoration	included above	LF	\$25.00	\$0
Outfall Protection	2	EA	\$8,000.00	\$16,000
Base Construction Cost				\$353,452
Mobilization (5%)				\$17,673
Subtotal 1				\$371,125
Contingency (25%)				\$92,781
Subtotal 2				\$463,906
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$208,758
Estimated Project Cost				\$673,000

Project Number: DF9073C
Catchment Code: DFPB9801
Candidate Site: D-73

Project Type: Pond Retrofit
Project Size: 1.9 acres
Treated Area: 39.8 acres

Project Location: Existing farm pond near the intersection of Riviera Drive and Montclair Court.

Project Description: This project will include the retrofit and enhancement of an existing farm pond / marsh adjacent to the existing stream channel of this facility. The existing facility obtains flows from a diversion structure located in the main stem of the drainage for this catchment. The proposed retrofit would consist of reconstructing the diversion structure and providing a riser for outlet control to allow the pond to function as water quality treatment for the first flush.



Potential Project Benefits:

Streamflow	Minor improvements to streamflow are expected through diversion of the flow from smaller storms.
Water Quality	Detention and vegetative uptake of the first flush of stormwater is expected to improve water quality downstream. Approximately 30% of the water quality volume can be provided.

Potential Project Constraints:

Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Some wetland impacts are anticipated during construction and a permit from the Corps of Engineers and VDEQ will be required. Projects in RPAs may require exceptions or waivers.
Facility Access	A storm drain easement appears to provide direct access to the site.
Design / Construction	The existing facility is on private land and coordination with the property owner will be necessary. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000	\$1,000.00
Forebay (2 locations)	445	CY	\$45.00	\$20,025.00
Riser	1	LS	\$10,000.00	\$10,000.00
Rip Rap Stabilization	40	LF	\$50.00	\$2,000.00
Base Construction Cost				\$33,025
Mobilization (5%)				\$1,651
Subtotal 1				\$34,676
Contingency (25%)				\$8,669
Subtotal 2				\$43,345
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$19,505
Estimated Project Cost				\$63,000

This project is part of the alternative project group for Regional Pond D-73. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

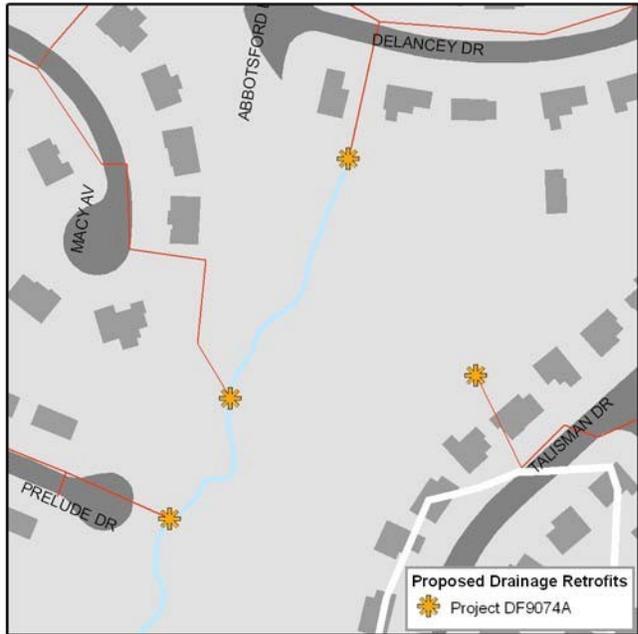


Project Number: DF9074A
Catchment Code: DFPB9901
Candidate Site: D-74

Project Type: Drainage Retrofit
Project Size: 4 Outfalls

Project Location: This project is distributed throughout the catchment.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	4	EA	\$8,000.00	\$32,000
Base Construction Cost				\$32,000
Mobilization (5%)				\$1,600
Subtotal 1				\$33,600
Contingency (25%)				\$8,400
Subtotal 2				\$42,000
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$18,900
Estimated Project Cost				\$61,000

This project is part of the alternative project group for Regional Pond D-74. See Table 5-2 for the recommended disposition.

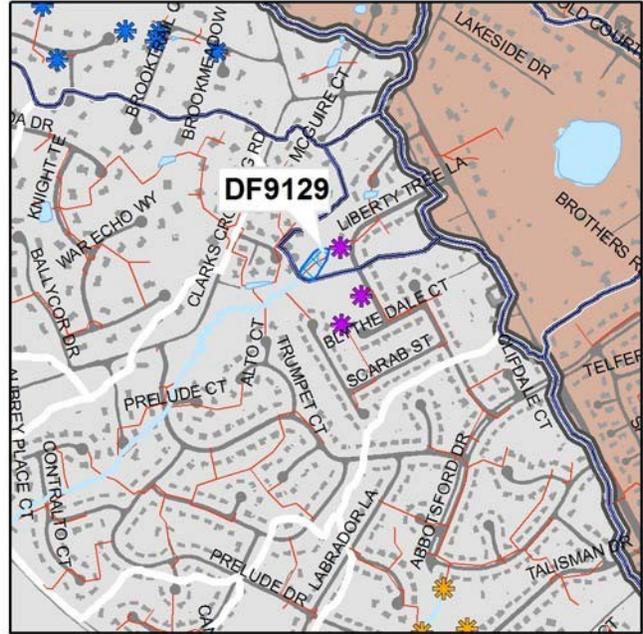
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Project Number: DF9129
Catchment Code: DFPB9701
Candidate Site: C29

Project Type: Pond Retrofit
Project Size: 0.6 acres
Treated Area: 16 acres

Project Location: Near Liberty Tree Lane

Project Description: The pond outfall shows signs of excessive flows and the spillway appears to have been inundated frequently. Once these issues have been addressed, installing a new, multi-stage riser and excavating to maximize the available storage space within the facility boundaries is recommended. Grading a flat area at the base of the riser will create a wet marsh that will promote vegetative uptake of nutrients and settling of sediment. Additional water quality components can be incorporated into any ditches or storm drain outfalls that flow into this facility.



Potential Project Benefits:

Streamflow	Approximately 90% of the channel protection volume can be obtained after the recommendations are implemented.
Water Quality	Excavation to create a wetland area will fulfill approximately 80% of the water quality volume. Reduction of erosive flows will also improve water quality downstream.

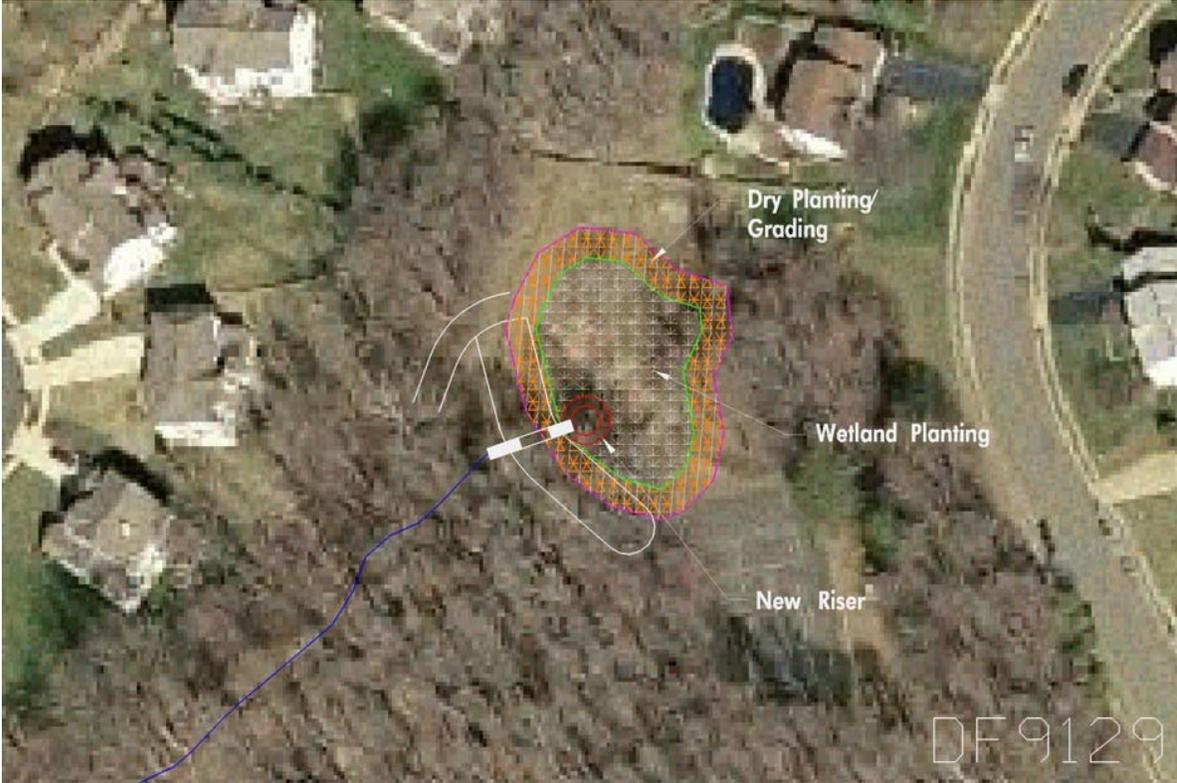
Potential Project Constraints:

Environmental	Permits may be required for in-stream work or wetland mitigation. If so, and a permit from the Corps of Engineers and VDEQ will be obtained. Projects in RPAs may require exceptions or waivers.
Facility Access	Access can be obtained from the roadway.
Design / Construction	Work on the existing embankment, outlet, and spillway and stabilization of the downstream channel is recommended. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	\$5,000	\$1,500.00
Grading and Excavation	1188	CY	\$30.00	\$35,640.00
Riser	1	LS	\$10,000.00	\$10,000.00
Wetland Planting	777	SY	\$2.00	\$1,554.00
Dry Landscaping	625	SY	\$2.50	\$1,562.50
Base Construction Cost				\$50,257
Mobilization (5%)				\$2,513
Subtotal 1				\$52,769
Contingency (25%)				\$13,192
Subtotal 2				\$65,962
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$29,683
Estimated Project Cost				\$96,000

Concept Sketch:

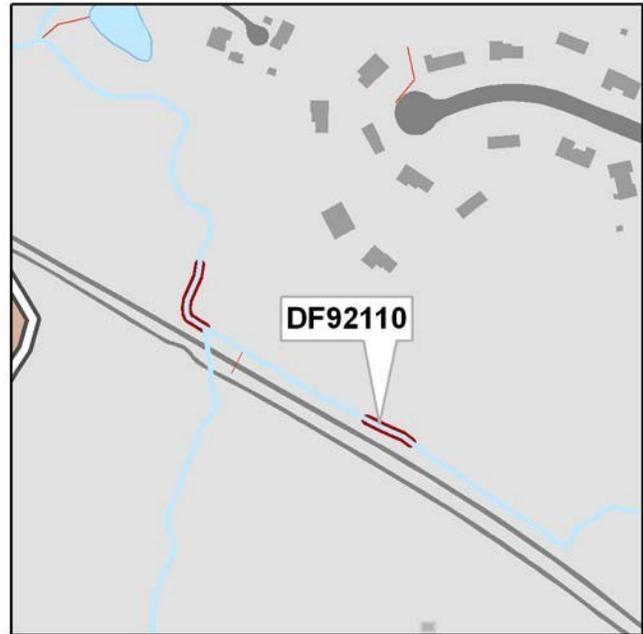


Project Number: DF92110
Catchment Code: DFPB0005
Candidate Site: S110

Project Type: Stream Restoration
Project Size: 242 feet

Project Location: This project is located south of Fosbak Drive adjacent to the W&OD Trail.

Project Description: The streambank has been artificially stabilized adjacent to the original railroad bed and is slightly incised. The proposed restoration would stabilize one reach with imbricated rip-rap to protect the trail, and reconstruct another to provide a pattern, dimension, and profile more consistent with a natural system.



Project Benefits:

Stream Stability	Stabilization with riprap and reconstruction to a more stable pattern will reduce future erosion.
Water Quality	Water quality will be improved by reducing sediment eroded from the streambanks.
Instream Habitat	Creating riffle pool sequences associated with a meandering stream will improve physical habitat conditions.

Project Constraints:

Environmental	The site will not require forest clearing. Impacts to jurisdictional wetlands will occur and a permit from the Corps of Engineers and VDEQ will be required. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will require improved access from the W & OD Trail
Design / Construction	Design efforts should be minimal. General constructability is good. The depth of a sanitary sewer line will have to be investigated to determine the feasibility of constructing the new channel alignment.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Reconstruct new pattern and profile	146	LF	\$250.00	\$36,500
Stabilize in place -- armoring	96	LF	\$225.00	\$21,600
Add'l cost, first 500 LF	242	LF	\$200.00	\$48,400
Base Construction Cost				\$106,500
Mobilization (5%)				\$5,325
Subtotal 1				\$111,825
Contingency (25%)				\$27,956
Subtotal 2				\$139,781
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$62,902
Estimated Project Cost				\$203,000

Concept Sketch

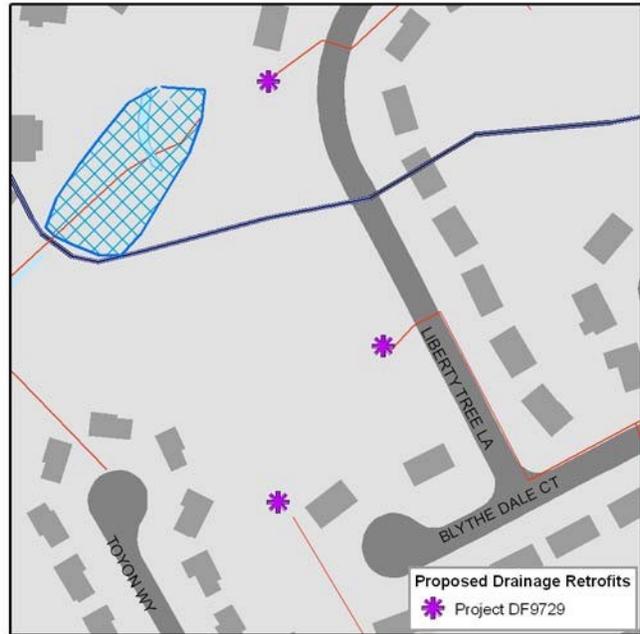


Project Number: DF9729
Catchment Code: DFPB9701
Candidate Site: C29

Project Type: Drainage Retrofit
Project Size: 3 Outfalls

Project Location: Projects are located at three outfalls from existing storm drains. The outfall below Chestnut Farm Drive and Liberty Tree Lane may need particular attention.

Project Description: This project consists of outfall treatments to increase energy dissipation and reduce velocities that are causing scour and erosion. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	3	EA	\$8,000.00	\$24,000
Base Construction Cost				\$24,000
Mobilization (5%)				\$1,200
Subtotal 1				\$25,200
Contingency (25%)				\$6,300
Subtotal 2				\$31,500
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$14,175
Estimated Project Cost				\$46,000

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Project Number: DF9730
Catchment Code: DFPB0001
Candidate Site: C30

Project Type: Drainage Retrofit
Project Size: 1 Outfall

Project Location: This project is located at the foot of Mill Street where the major outfall draining the catchment is located.

Project Description: This project consists of improving energy dissipation at the outfall to the storm drain system. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfall and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at this outfall location and within the downstream channel. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to the site is available from Mill Street.
Design / Construction	Because of size and complexity, the unit price for this project is higher than typical.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	1	EA	\$16,000.00	\$16,000
Base Construction Cost				\$16,000
Mobilization (5%)				\$400
Subtotal 1				\$8,400
Contingency (25%)				\$2,100
Subtotal 2				\$10,500
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$9,450
Estimated Project Cost				\$30,000

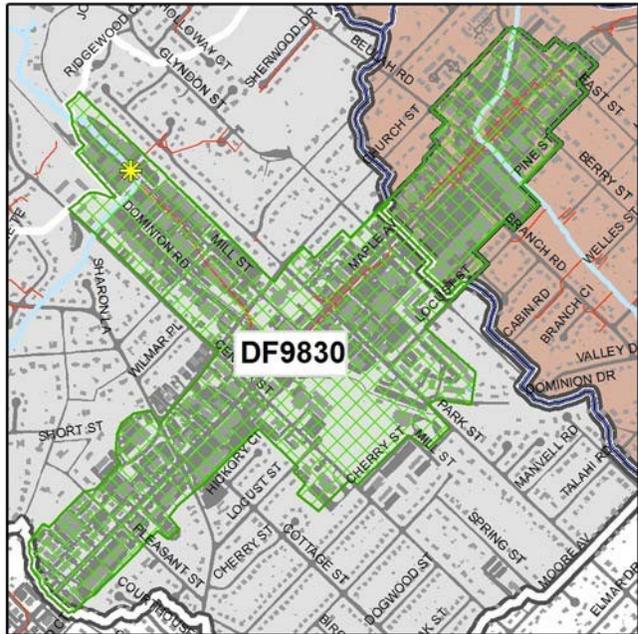
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Project Number: DF9830
Catchment Code: DFPB0001
Candidate Site: C30

Project Type: LID Retrofit
Project Size: 1.8 acres
Treated Area: 156.8 acres

Project Location: The area within 1 to 2 blocks on either side of Maple Street in Vienna and within 1 to 2 blocks of the W&OD Trail.

Project Description: This project requires a holistic LID approach to be retrofitted into two areas: the business corridor along Maple Street (Rte. 123), which is built out with commercial properties, and the more industrial area along the W&OD trail. The entire area is almost entirely impervious, and therefore results in high rates of runoff. The LID retrofit could include reduction of imperviousness, inlet filtration, bioretention, rooftop detention, or green roofs. Depending on the individual site characteristics, implementation could be phased via public projects or as redevelopment occurs.



Potential Project Benefits:

Streamflow	The LID approach is expected to reduce runoff volume through infiltration. Minor reductions in peak flow rates could be expected.
Water Quality	The project would treat 100% of the water quality volume, which would provide significant improvements for this drainage area.

Potential Project Constraints:

Environmental	No environmental permitting issues or impacts are anticipated for this project.
Facility Access	For the most part, access in this area is excellent from roads and parking lots.
Design / Construction	This project would require detailed survey and mapping of all utilities, drainage appurtenances and structures. Coordination with private property owners would be necessary in some of the areas.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
LID Structural Control	8,586.0	SY	\$120.00	\$1,030,320
Base Construction Cost				\$1,030,320
Mobilization (5%)				\$51,516
Subtotal 1				\$1,081,836
Contingency (25%)				\$270,459
Subtotal 2				\$1,352,295
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$608,533
Estimated Project Cost				\$1,961,000

Concept Sketch

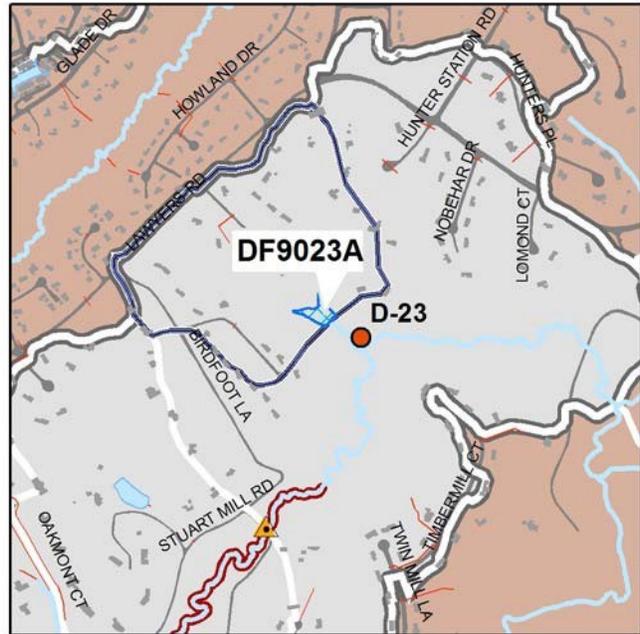


Project Number: DF9023A
Catchment Code: DFLD0008
Candidate Site: D-23

Project Type: Pond Retrofit
Project Size: 0.6 acres
Treated Area: 50.5 acres

Project Location: This project is located between Birdfoot Lane and Raccoon Ridge Court.

Project Description: This catchment drains the land south of Lawyers Road. There is an existing dry pond located on a tributary to Little Difficult Run near the outfall to this catchment. This project will improve the water quality performance of the facility with a multi-stage riser for extended detention.



Potential Project Benefits:

Streamflow	Minor improvements in peak flow reduction may occur for smaller storms.
Water Quality	Existing storage meets 100% of the water quality volume. Extended detention would provide more sedimentation.

Potential Project Constraints:

Environmental	Environmental permitting would be minimal within the footprint of the existing pond. Forest impacts would be incurred during construction and within the pond area. Projects in RPAs may require exceptions or waivers.
Facility Access	There is no construction or maintenance access from a nearby road, although it appears that no easements across private land would be required.
Design / Construction	Because of limited access to the site, construction would be more difficult than the typical retrofit. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Riser	1	LS	\$10,000.00	\$10,000
Base Construction Cost				\$10,500
Mobilization (5%)				\$525
Subtotal 1				\$11,025
Contingency (25%)				\$2,756
Subtotal 2				\$13,781
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$6,202
Estimated Project Cost				\$20,000

This project is part of the alternative project group for Regional Pond D-23. See Table 5-2 for the recommended disposition.

Concept Sketch:

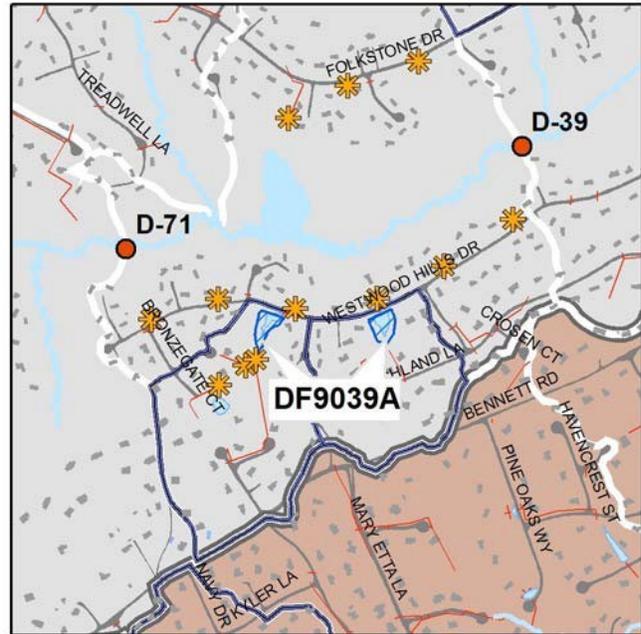


Project Number: DF9039A
Catchment Code: DFLD0002
Candidate Site: D-39

Project Type: Culvert Retrofit
Project Size: 0.7 acres (west)
 0.6 acres (east)
Treated Area: 58.1 acres

Project Location: This project is located on the south side of Westwood Hills Drive.

Project Description: This project consists of the construction of two culvert retrofits along Westwood Hills Drive. A redundant embankment and a riser structure would be constructed to provide discharge control. Landscaping, construction of a micropool, and wetland planting would provide some water quality benefits.



Potential Project Benefits:

Streamflow	This project would provide 100% of the channel protection volume for the drainage area, reducing erosive flows downstream.
Water Quality	Water quality features such as a micropool and wetland planting would be incorporated into these facilities to improve pollutant removal.

Potential Project Constraints:

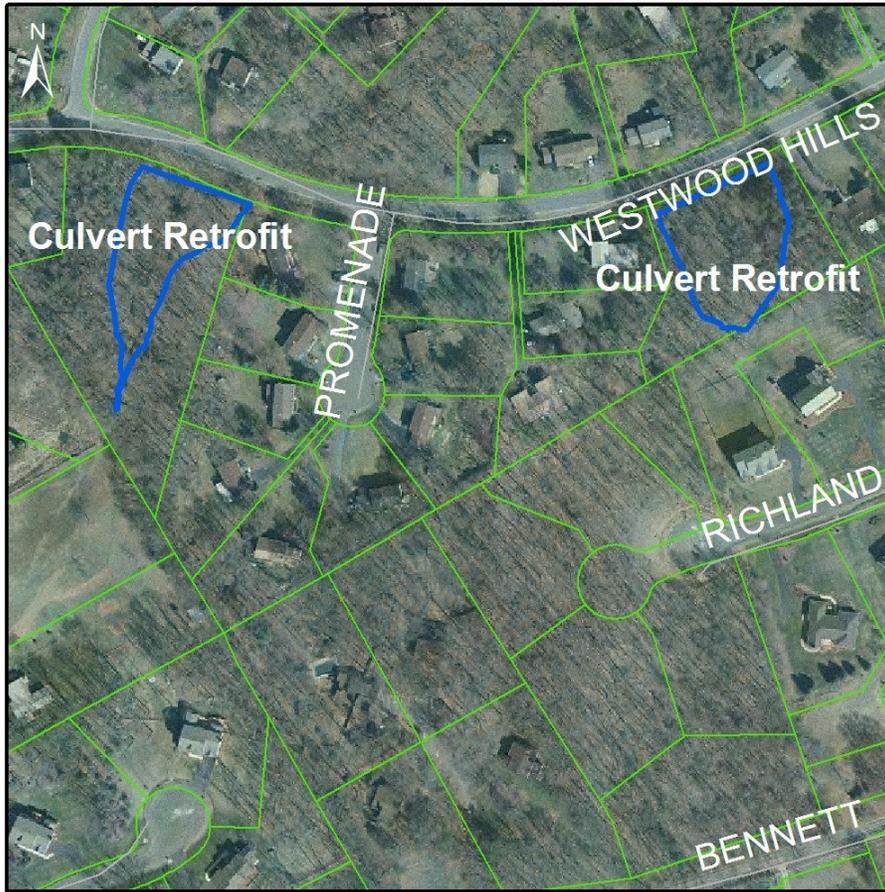
Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above these culverts. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this project is excellent from Westwood Hills Drive.
Design / Construction	No significant construction or design issues were noted.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	\$5,000.00	\$1,500
Excavation	1,330	CY	\$35.00	\$46,550
Impoundment Structure	2	LS	\$5,000.00	\$10,000
Landscaping	1,230	SY	\$2.50	\$3,075
Wetland Planting	410	SY	\$2.00	\$820
Base Construction Cost				\$61,945
Mobilization (5%)				\$3,097
Subtotal 1				\$65,042
Contingency (25%)				\$16,261
Subtotal 2				\$81,303
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$36,586
Estimated Project Cost				\$118,000

This project is part of the alternative project group for Regional Pond D-39. See Table 5-2 for the recommended disposition.

Concept Sketch

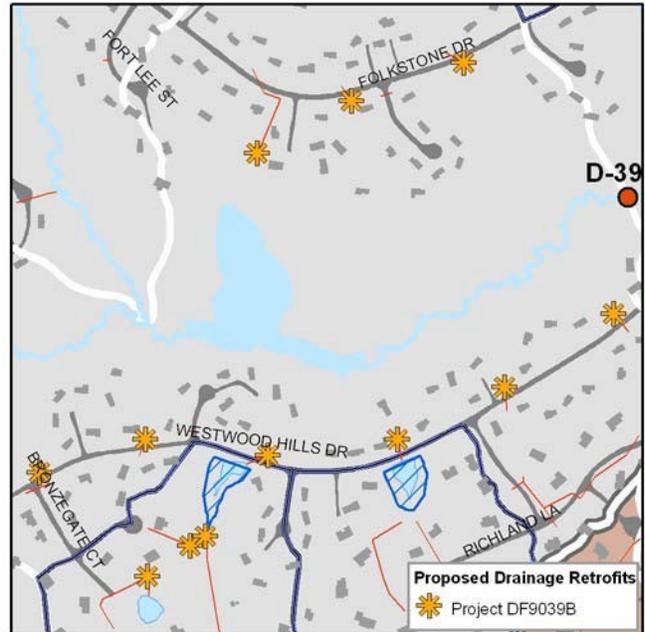


Project Number: DF9039B
Catchment Code: DFLD0002
Candidate Site: D-39

Project Type: Drainage Retrofit
Project Size: 12 Outfalls

Project Location: This project is distributed throughout the catchment where piped drainage systems discharge into natural channels.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	12	EA	\$8,000.00	\$96,000
Base Construction Cost				\$96,000
Mobilization (5%)				\$4,800
Subtotal 1				\$100,800
Contingency (25%)				\$25,200
Subtotal 2				\$126,000
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$56,700
Estimated Project Cost				\$183,000

This project is part of the alternative project group for Regional Pond D-39. See Table 5-2 for the recommended disposition.

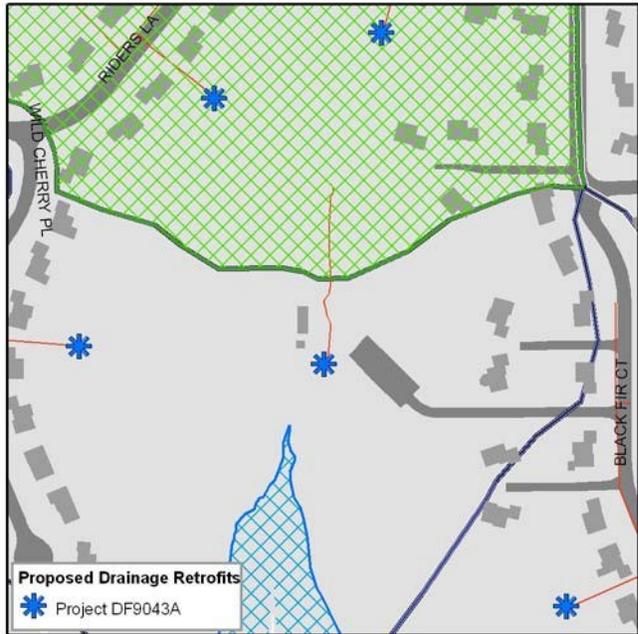
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Project Number: DF9043A
Catchment Code: DFLD9501
Candidate Site: D-43

Project Type: Drainage Retrofit
Project Size: 5 Outfalls

Project Location: This project is distributed throughout the catchment where piped drainage systems discharge into natural channels.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPA may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	5	EA	\$8,000.00	\$40,000
Base Construction Cost				\$40,000
Mobilization (5%)				\$2,000
Subtotal 1				\$42,000
Contingency (25%)				\$10,500
Subtotal 2				\$52,500
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$23,625
Estimated Project Cost				\$76,000

*This project is part of the alternative project group for Regional Pond D-43.
 See Table 5-2 for the recommended disposition.*

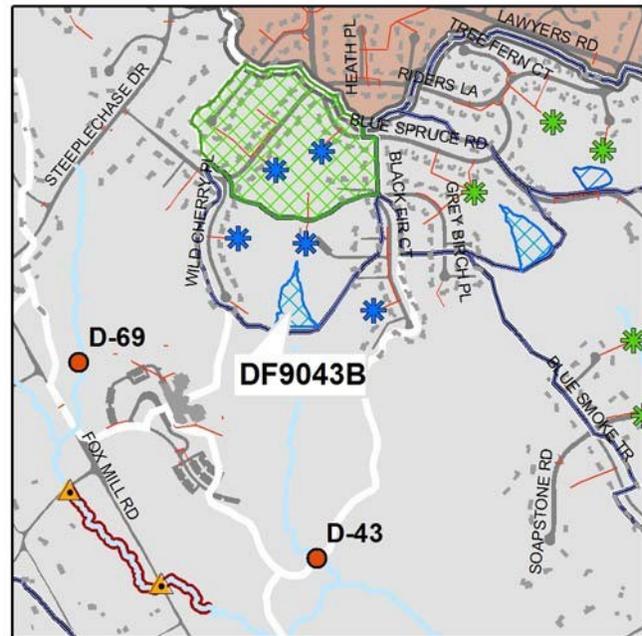
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Project Number: DF9043B
Catchment Code: DFLD9501
Candidate Site: D-43

Project Type: Pond Retrofit
Project Size: 1.5 acres
Treated Area: 22 acres

Project Location: This facility is located between Wild Cherry Place and Black Fir Court.

Project Description: Severe erosion on the backside of the embankment and failure of the downstream channel require stabilization. The mature woods within this facility are a constraint to excavation to create additional storage volume. Significant improvement in peak flow attenuation and water quality treatment can be achieved by installing a multi-stage riser over the existing standpipe. A water quality component at this location can be created by placing a plate over the existing orifice. Lastly, it is recommended to remove all woody vegetation from the embankment to prevent further seepage and potential future embankment failure



Potential Project Benefits:

Streamflow	100% of the channel protection volume can be met.
Water Quality	A wet marsh component will provide around 50% of the water quality volume.

Potential Project Constraints:

Environmental	Environmental permitting would be minimal because work would be confined to the footprint of the existing facility. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility is good from local roads.
Design / Construction	Stabilization of many elements within and surrounding this facility is required. No other issues were identified. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1000
Outlet Protection	1	EA	\$8,000.00	\$8,000
Riser	1	LS	\$10,000.00	\$10,000
Wetland Planting	1590	SY	\$2.00	\$3,180
Base Construction Cost				\$22,180
Mobilization (5%)				\$1,109
Subtotal 1				\$23,289
Contingency (25%)				\$5,822
Subtotal 2				\$29,111
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$13,100
Estimated Project Cost				\$42,000

This project is part of the alternative project group for Regional Pond D-43. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

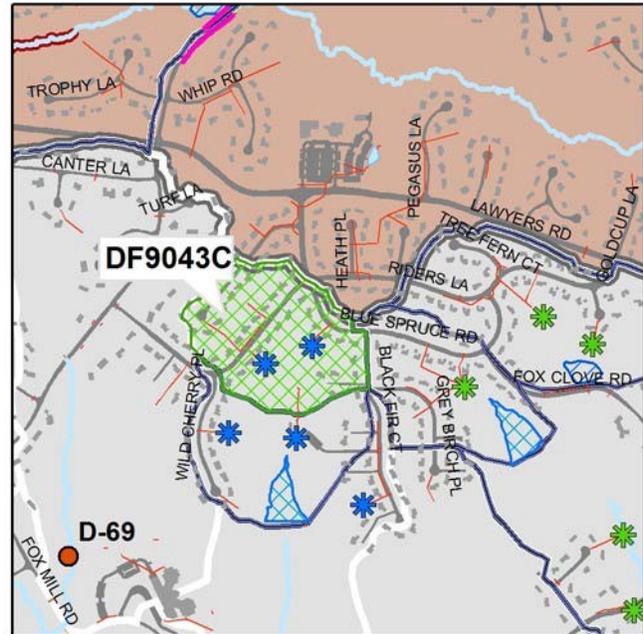


Project Number: DF9043C
Catchment Code: DFLD9501
Candidate Site: D-43

Project Type: LID Retrofit
Project Size: 0.1 acres
Treated Area: 23.4 acres

Project Location: Next to the parking lot of the Fox Mill Swim and Tennis Club.

Description: This project will involve obtaining permission and building a biofiltration swale adjacent to the parking lot at the Fox Mill Swim and Tennis Club. The existing swale has a small amount of active erosion and conveys drainage from off-site residential neighborhoods as well as from the Club property, whose lawn is managed.



Potential Project Benefits:

Streamflow	While this facility could only expect to treat a fraction of the catchment, there may be some reduction in both runoff peak and runoff volume.
Water Quality	Water quality would be improved by filtering residential and club runoff through a filtration media and using vegetative cover to remove nutrients and other contaminants.
Other	High Visibility. This facility could serve as a community education and outreach project.

Potential Project Constraints:

Environmental	No environmental constraints were found at this location.
Facility Access	Access to this site is very good.
Design / Construction	The location of this facility is on private property. Some negotiation may be necessary to allow construction activities; however, the end result could provide a desirable amenity. No other issues were noted.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
LID Structural Control	467.0	SY	\$120.00	\$56,040
Base Construction Cost				\$56,040
Mobilization (5%)				\$2,802
Subtotal 1				\$58,842
Contingency (25%)				\$14,711
Subtotal 2				\$73,553
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$33,099
Estimated Project Cost				\$107,000

This project is part of the alternative project group for Regional Pond D-43. See Table 5-2 for the recommended disposition.

Concept Sketch

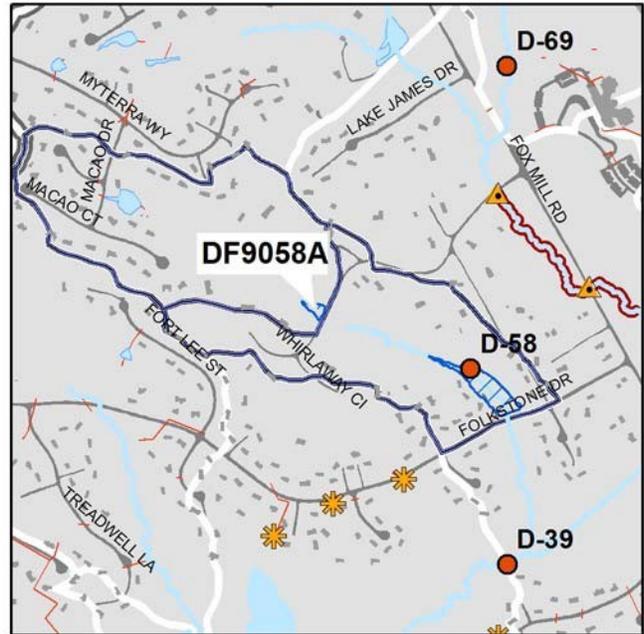


Project Number: DF9058A
Catchment Code: DFLD9801
Candidate Site: D-58

Project Type: Culvert Retrofit
Project Size: 0.2 acres
Treated Area: 47.6 acres

Project Location: This project is located upstream of Thoroughbred Road.

Project Description: Thoroughbred Road is currently a small gravel drive with access to several large residential lots and stables. The current roadway alignment does not allow much vertical rise in the water surface before overtopping occurs, so a redundant embankment is proposed.



Potential Project Benefits:

Streamflow	The project will provide approximately 45% of the channel protection volume.
Water Quality	Some reduction of pollutants will occur with increased settling associated with extended detention, along with vegetative uptake on the site.

Potential Project Constraints:

Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above this culvert. Some forest impacts would occur during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this project is very good from the roadway.
Design / Construction	No unusual design or construction issues were found.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Excavation	230	CY	\$35.00	\$8,050
Impoundment Structure	1	LS	\$5,000.00	\$5,000
Landscaping	210	SY	\$2.50	\$525
Wetland Planting	70	SY	\$2.00	\$140
Base Construction Cost				\$14,215
Mobilization (5%)				\$711
Subtotal 1				\$14,926
Contingency (25%)				\$3,731
Subtotal 2				\$18,657
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$8,396
Estimated Project Cost				\$27,000

*This project is part of the alternative project group for Regional Pond D-58
 See Table 5-2 for the recommended disposition.*

Concept Sketch

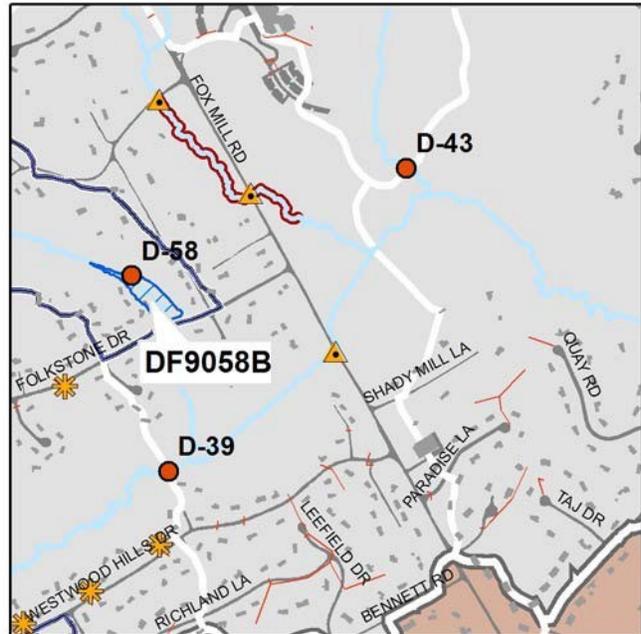


Project Number: DF9058B
Catchment Code: DFLD9801
Candidate Site: D-58

Project Type: Culvert Retrofit
Project Size: 1.6 acres
Treated Area: 39.6 acres

Project Location: This project is on the upstream side of Folkstone Drive.

Project Description: This project would consist of a culvert retrofit with a redundant embankment to detain peak flows. Benefits to this project would include the reduction of erosive discharge rates and velocities and the enhancement of the vegetative uptake for areas upstream of the impoundment.



Potential Project Benefits:

Streamflow	The project will provide 100% of the channel protection volume estimated for this location.
Water Quality	Some reduction of pollutants will occur with increased settling associated with extended detention, along with vegetative uptake on the site.

Potential Project Constraints:

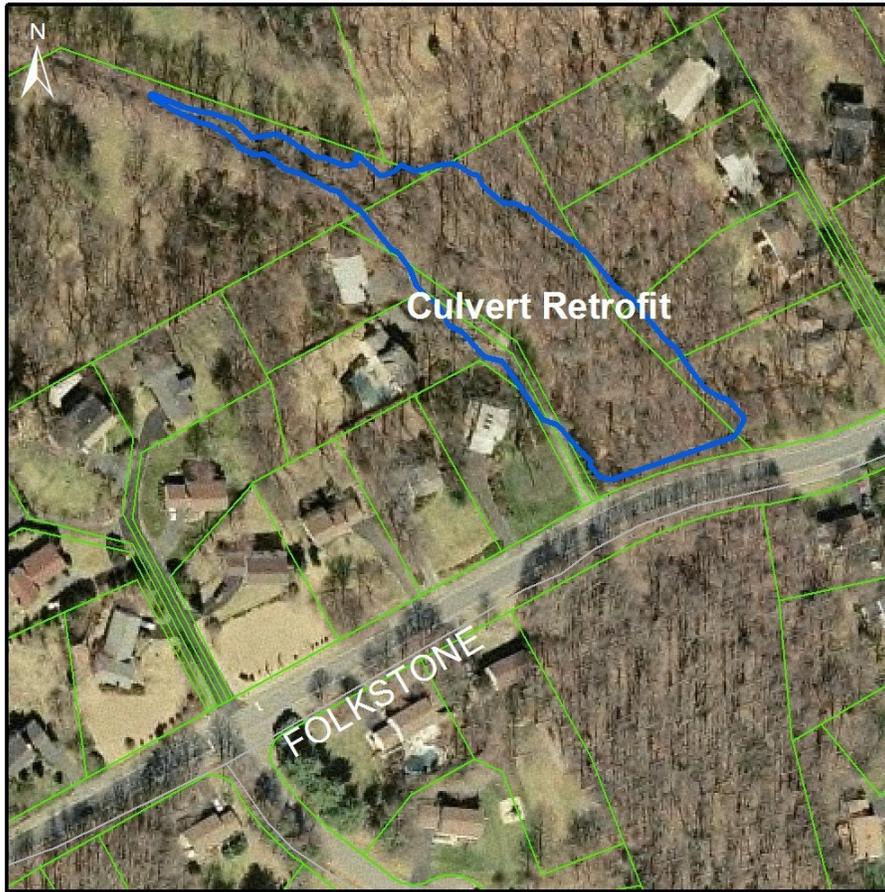
Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above this culvert. Some forest impacts would occur during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this project is very good from the roadway.
Design / Construction	No unusual design or construction issues were found.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Excavation	420	CY	\$35.00	\$14,700
Impoundment Structure	1	LS	\$5,000.00	\$5,000
Landscaping	450	SY	\$2.50	\$1,125
Wetland Planting	150	SY	\$2.00	\$300
Base Construction Cost				\$21,625
Mobilization (5%)				\$1,081
Subtotal 1				\$22,706
Contingency (25%)				\$5,677
Subtotal 2				\$28,383
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$12,772
Estimated Project Cost				\$41,000

This project is part of the alternative project group for Regional Pond D-58. See Table 5-2 for the recommended disposition.

Concept Sketch

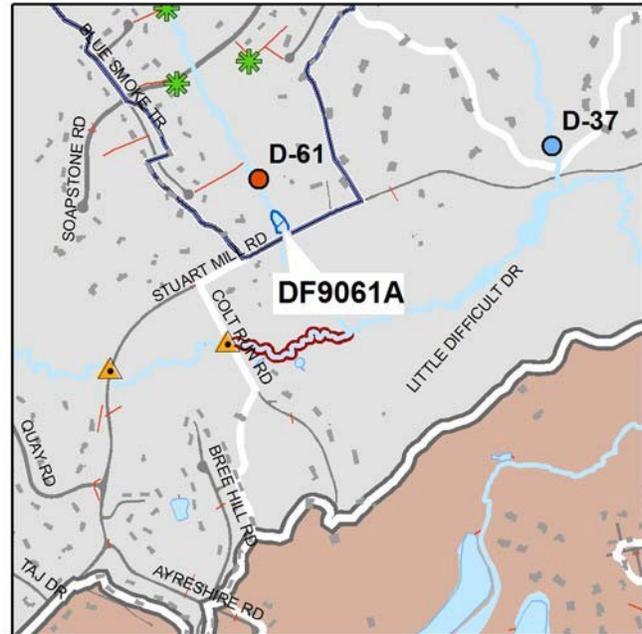


Project Number: DF9061A
Catchment Code: DFLD9401
Candidate Site: D-61

Project Type: Culvert Retrofit
Project Size: 0.3 acres
Treated Area: 99.7 acres

Project Location: This project is located at Stuart Mill Road.

Project Description: The culvert at this location is a low head crossing with a wide floodplain and an established wetland upstream. The project would be designed for water quality improvement and would consist of a redundant embankment which would store the water on the floodplain, but would not have a permanent pool. This facility would also settle out sediment and allow for vegetative uptake.



Potential Project Benefits:

Streamflow	The project is expected to result in minor reductions in peak flows; however, the water quality retention would provide some downstream channel protection.
Water Quality	The project has sufficient storage to treat 60% of the water quality volume. Sedimentation and nutrient uptake will also provide treatment.

Potential Project Constraints:

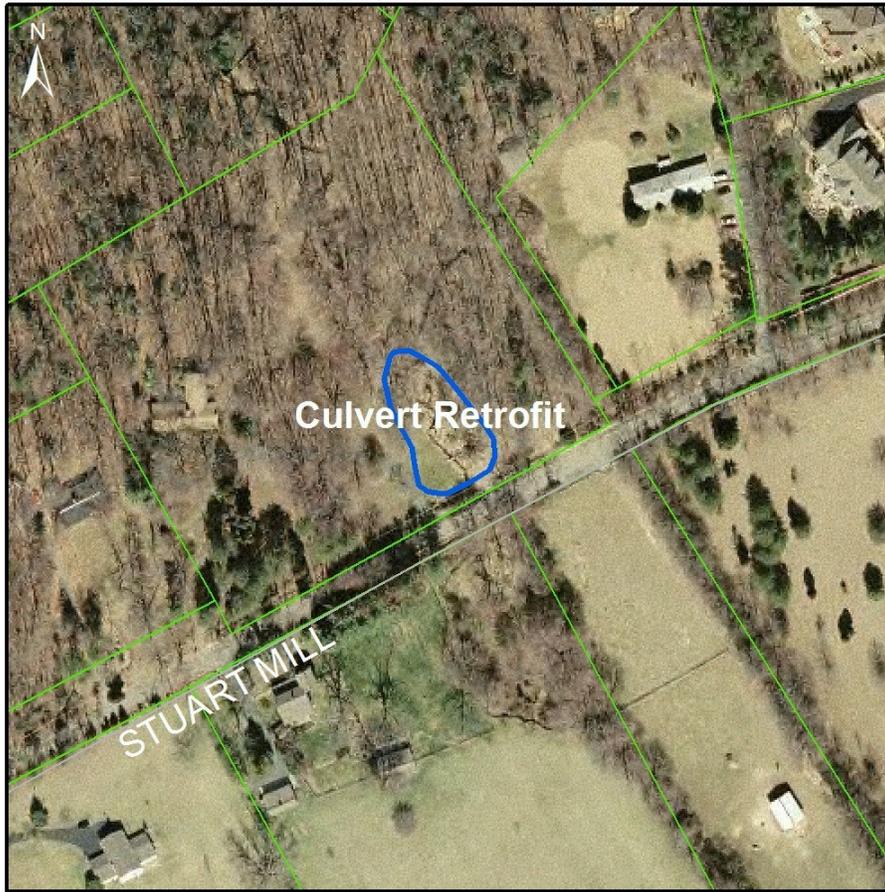
Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above this culvert. Some wetland impacts would occur during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this project is very good from Stuart Mill Road.
Design / Construction	No unusual design or construction issues were found.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Excavation	250	CY	\$35.00	\$8,750
Impoundment Structure	1	LS	\$5,000.00	\$5,000
Landscaping	410	SY	\$2.50	\$1,025
Wetland Planting	140	SY	\$2.00	\$280
Base Construction Cost				\$15,555
Mobilization (5%)				\$778
Subtotal 1				\$16,333
Contingency (25%)				\$4,083
Subtotal 2				\$20,416
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$9,187
Estimated Project Cost				\$30,000

This project is part of the alternative project group for Regional Pond D-61. See Table 5-2 for the recommended disposition.

Concept Sketch

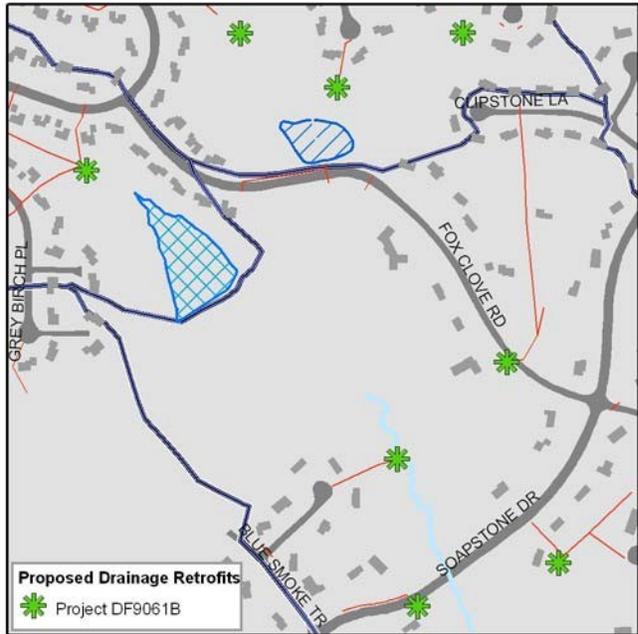


Project Number: DF9061B
Catchment Code: DFLD9401
Candidate Site: D-61

Project Type: Drainage Retrofit
Project Size: 8 Outfalls

Project Location: This project is distributed throughout the catchment where piped drainage systems discharge into natural channels.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	8	EA	\$8,000.00	\$64,000
Base Construction Cost				\$64,000
Mobilization (5%)				\$3,200
Subtotal 1				\$67,200
Contingency (25%)				\$16,800
Subtotal 2				\$84,000
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$37,800
Estimated Project Cost				\$122,000

This project is part of the alternative project group for Regional Pond D-61. See Table 5-2 for the recommended disposition.

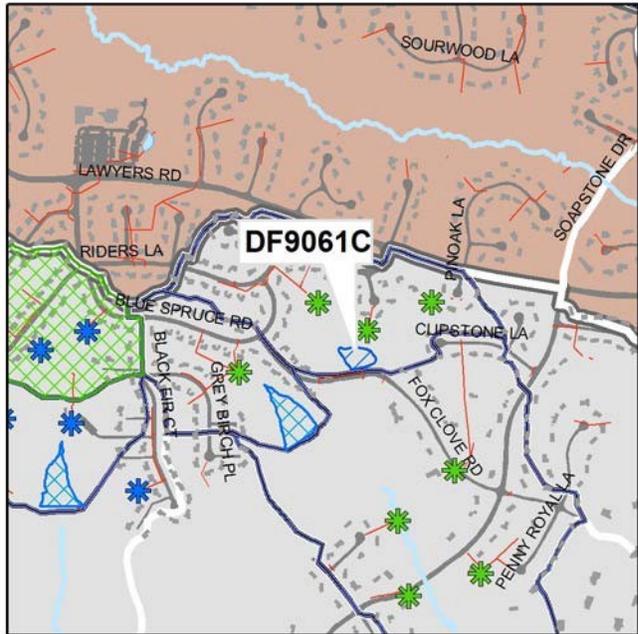
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Project Number: DF9061C
Catchment Code: DFLD9401
Candidate Site: D-61

Project Type: Culvert Retrofit
Project Size: 0.7 acres
Treated Area: 38 acres

Project Location: This project is located upstream of Foxclove Road.

Project Description: This culvert retrofit project would consist of a redundant embankment to create a backwater storage area at Foxclove Road, with the primary goal of reducing erosive flows downstream. The upstream area is forested so a dry detention facility is proposed.



Potential Project Benefits:

Streamflow	The project will provide 90% of the channel protection volume estimated for this location.
Water Quality	Some reduction of pollutants will occur with increased settling associated with extended detention, along with vegetative uptake on the site.

Potential Project Constraints:

Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above this culvert. Some forest impacts would occur during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this project is very good from the roadway.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1,000
Excavation	200	CY	\$35.00	\$7,000
Impoundment Structure	1	LS	\$5,000.00	\$5,000
Landscaping	630	SY	\$2.50	\$1,575
Wetland Planting	210	SY	\$2.00	\$420
Base Construction Cost				\$14,995
Mobilization (5%)				\$750
Subtotal 1				\$15,745
Contingency (25%)				\$3,936
Subtotal 2				\$19,681
Engineering, Survey, Land Acquisition Utility Relocations and Permits (45%)				\$8,856
Estimated Project Cost				\$29,000

This project is part of the alternative project group for Regional Pond D-61. See Table 5-2 for the recommended disposition.

Concept Sketch

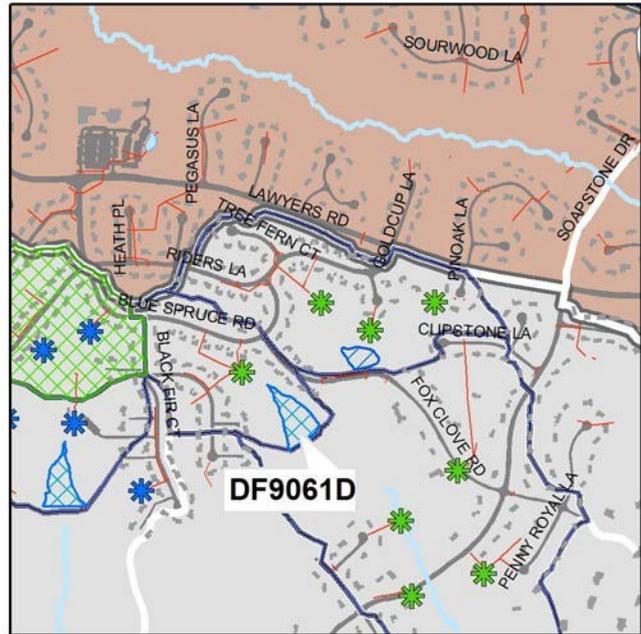


Project Number: DF9061D
Catchment Code: DFLD9401
Candidate Site: D-61

Project Type: Pond Retrofit
Project Size: 1.6 acres
Treated Area: 22.1 acres

Project Location: Existing partial embankment located in-stream along Foxclove Road

Project Description: This project consists of a retrofit to a dry pond facility where existing stormwater management elements need improvement. Reconstruction of the embankment, design and installation of a multistage control structure, barrel pipe, and emergency spillway using current design standards are required. During the restoration/redesign process, all mature wooded vegetation should be removed from the embankment to prevent seepage and risk of failure. No water quality features are recommended at this location because most runoff to the pond is filtered through the woods surrounding this facility.



Potential Project Benefits:

Streamflow	The addition of a multistage riser will provide full channel protection volume.
Water Quality	Reduction of sediment transport and scour will improve water quality.

Potential Project Constraints:

Environmental	Reconstruction of an existing facility should not involve difficult permitting issues. Forest impacts can be expected for construction access. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility is available from Foxclove Road, however, some clearing will be required.
Design / Construction	The facility has failed and a redesign of most stormwater management elements in this facility is required. Construction access is more difficult than typical pond retrofit projects. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	\$5,000.00	\$1,500
Remove Barrel Pipe	100	LF	\$77.00	\$7,700
Outlet Protection	1	EA	\$8,000.00	\$8,000
Reconstruct Embankment	3000	CY	\$60.00	\$180,000
Riser	1	LS	\$10,000.00	\$10,000
Outflow Pipe	100	LF	\$35.00	\$3,500
Base Construction Cost				\$210,700
Mobilization (5%)				\$10,535
Subtotal 1				\$221,235
Contingency (25%)				\$55,309
Subtotal 2				\$276,544
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$124,445
Estimated Project Cost				\$401,000

*This project is part of the alternative project group for Regional Pond D-61.
 See Table 5-2 for the recommended disposition.*

Site Photo:



Concept Sketch

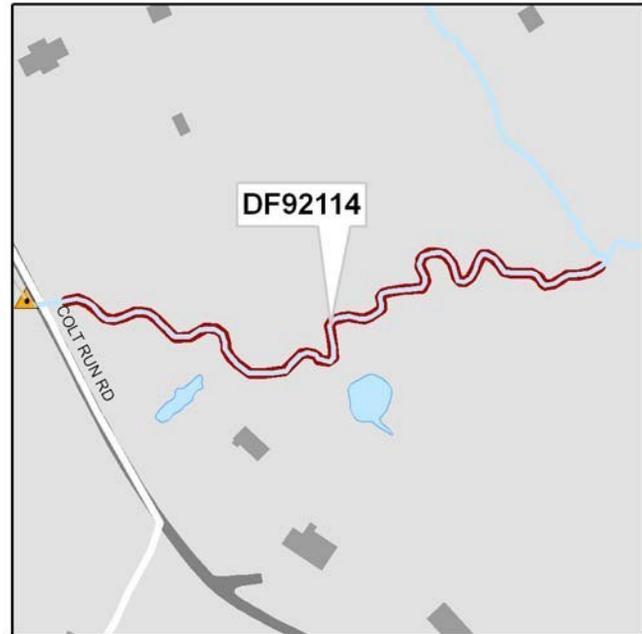


Project Number: DF92114
Catchment Code: DFLD0005
Candidate Site: S114

Project Type: Stream Restoration
Project Size: 1115 Linear Feet

Project Location: This project is located on the east of Colt Run Road just before the intersection with Stuart Mill Road.

Project Description: The stream is severely incised with raw, eroded streambanks. The riparian zone along both sides of the stream bank is in pasture. The stream will be reconstructed with a more stable pattern and profile, and a nested channel will be created. The banks and bench will be planted with native vegetation. A forested riparian buffer will be established on both sides of the stream.



Potential Project Benefits:

Stream Stability	Reconstruction to a more stable pattern with a nested channel and floodplain bench will reduce future erosion.
Water Quality	Water quality will be improved by a significant reduction in current and future bank and bed erosion.
Instream Habitat	Erosion reduction and establishing a riparian buffer will improve physical habitat conditions.

Potential Project Constraints:

Environmental	The site will not require forest clearing or impacts to jurisdictional wetlands. However, it will require a permit from both the U.S. Army Corps of Engineers and VDEQ. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will require an easement on private property but is open and unconstrained adjacent to the stream.
Design / Construction	Design efforts are moderate compared to other stream restoration projects. General constructability is good.

Difficult Run Watershed Management Plan
 Concept Plans
Little Difficult Run

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Reconstruct new pattern and profile	1115	LF	\$250.00	\$278,750
Add'l cost, first 500 LF	500	LF	\$200.00	\$100,000
Base Construction Cost				\$378,750
Mobilization (5%)				\$18,938
Subtotal 1				\$397,688
Contingency (25%)				\$99,422
Subtotal 2				\$497,109
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$223,699
Estimated Project Cost				\$721,000

Concept Sketch

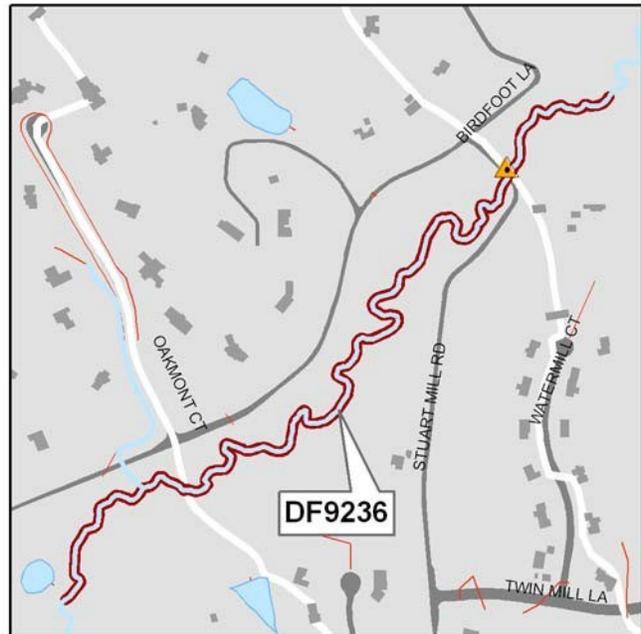


Project Number: DF9236
Catchment Code: DFLD0007
Candidate Site: S36

Project Type: Stream Restoration
Project Size: 4,095 Linear Feet

Project Location: This project is located south of Stuart Mill Road to the west of the intersection of Stuart Mill Road and Birdfoot Lane.

Project Description: This stream reach is moderately to slightly incised with moderate to severe streambank erosion. The bed lacks riffle pool morphology. The stream is located in a mix of open pasture and young forest on private property. For most of the reach, the proposed restoration would involve excavating a new floodplain and reestablish a meandering stream system to provide a pattern, dimension, and profile more consistent with a natural stream. This would prevent further mass erosion associated with channel widening and bank failure, improve instream habitat, and provide access to a functional floodplain. The new floodplain would be planted with native woody vegetation and grasses. A forested buffer would be established.



Potential Project Benefits:

Stream Stability	The pattern, dimension, and profile of the stream will be corrected and the floodplain connection will be improved.
Water Quality	Water quality will be improved by a significant reduction in current and future bank and bed erosion.
Instream Habitat	Erosion reduction, restored bed features, and establishing a riparian buffer will improve physical habitat conditions.

Potential Project Constraints:

Environmental	The site will require minimal forest clearing and some impacts to jurisdictional wetlands. It will require a permit from both the U.S. Army Corps of Engineers and the VDEQ. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will require an easement on private property but is open and unconstrained adjacent to the stream.
Design / Construction	Design efforts are significant compared to other stream restoration projects. General constructability is good. A utility pole located in the stream may need to be relocated.

Difficult Run Watershed Management Plan
 Concept Plans
Little Difficult Run

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Reconstruct new pattern and profile	2608	LF	\$250.00	\$652,000
Stabilize in place -- grading	1487	LF	\$175.00	\$260,225
Add'l cost, first 500 LF	500	LF	\$200.00	\$100,000
Base Construction Cost				\$1,012,225
Mobilization (5%)				\$50,611
Subtotal 1				\$1,062,836
Contingency (25%)				\$265,709
Subtotal 2				\$1,328,545
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$597,845
Estimated Project Cost				\$1,926,000

Concept Sketch

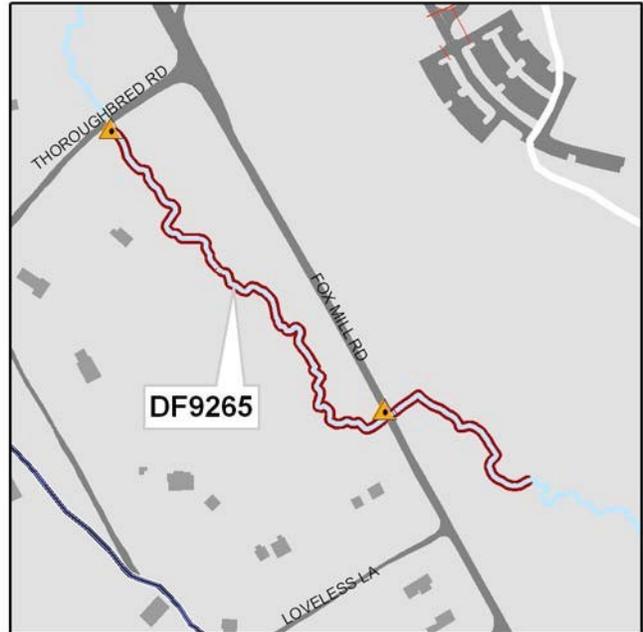


Project Number: DF9265
Catchment Code: DDF9203
Candidate Site: S65

Project Type: Stream Restoration
Project Size: 1655 Linear Feet

Project Location: This project is located west of Fox Mill Road and south of Thoroughbred Road.

Project Description: Stream stability has been impacted from the culverts on both ends of the reach. The stream is incised between 3 to 5 feet. The project will restore stability by minor regrading of the streambanks and restoration of the stream buffer.



Potential Project Benefits:

Stream Stability	Regrading the banks will reduce instability and erosion caused by failure of the vertical streambanks.
Water Quality	Water quality will be improved by a significant reduction in current and future streambank erosion.
Instream Habitat	Erosion reduction and establishing a riparian buffer will improve physical habitat conditions.

Potential Project Constraints:

Environmental	The site will require some tree removal and impacts to jurisdictional wetlands. It will require a permit from both the U.S. Army Corps of Engineers and VDEQ. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will require easements on private property.
Design / Construction	Design efforts are average compared to other stream restoration projects. General constructability is good.

Costs

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Stabilize in place -- grading	1655	LF	\$175.00	\$289,625
Add'l cost, first 500 LF	500	LF	\$200.00	\$100,000
Base Construction Cost				\$389,625
Mobilization (5%)				\$19,481
Subtotal 1				\$409,106
Contingency (25%)				\$102,277
Subtotal 2				\$511,383
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$230,122
Estimated Project Cost				\$742,000

Concept Sketch



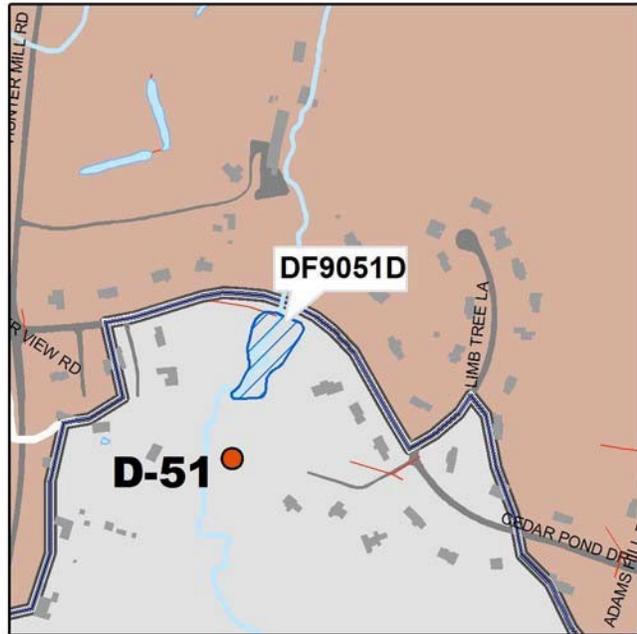
Project Number: DF9051D
Catchment Code: DFBA0003
Candidate Site: D-51

Project Type: Culvert Retrofit
Project Size: 1.2 acres

Project Location: This project is located upstream of Cedar Pond Road.

Project Description: This culvert has been altered by using boards to partially block the upstream face of the culvert. This configuration does not allow for in-stream sediment transport or fish passage, however.

The proposed project would provide a redundant embankment with a low-flow opening. Storage would be provided to a maximum depth of about 7 ft.



Potential Project Benefits:

Streamflow	This project would provide some peak flow reduction, with storage for approximately 16% of the channel protection volume.
Water Quality	Water quality features such as a micropool, wetland vegetation, or an aquatic bench will improve runoff quality.

Potential Project Constraints:

Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above this culvert. These would be subject to negotiation with permitting agencies. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this project is very good from Cedar Pond Road.
Design / Construction	There are no significant issues. The proposed project footprint would not affect adjacent properties.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1,000
Excavation	720	CY	\$35.00	\$25,200
Impoundment Structure	1	LS	\$5,000.00	\$5,000
Landscaping	850	SY	\$2.50	\$2,125
Wetland Planting	290	SY	\$2.00	\$580
Base Construction Cost				\$33,905
Mobilization (5%)				\$1,695
Subtotal 1				\$35,600
Contingency (25%)				\$8,900
Subtotal 2				\$44,500
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$20,025
Estimated Project Cost				\$65,000

This project is part of the alternative project group for Regional Pond D-51. See Table 5-2 for the recommended disposition.

Concept Sketch

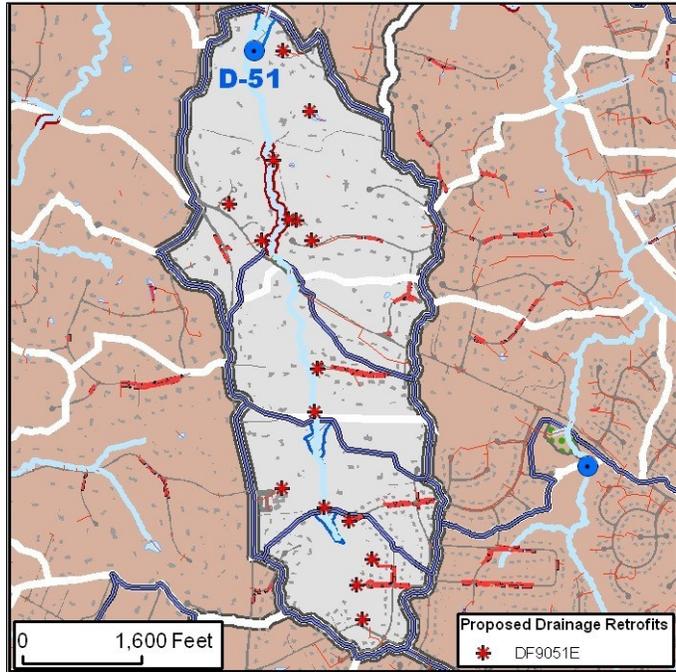


Project Number: DF9051E
Catchment Code: DFBA0003,
 DFBA0002, DFBA0001
Candidate Site: D-51

Project Type: Drainage Retrofit
Project Size: 16 Outfalls

Project Location:
 This project will be distributed throughout
 the catchment.

Project Description:
 Two processes have caused erosion
 problems at outfalls in this watershed. In
 the upstream area, stormwater flows have
 caused localized scour and erosion. In the
 downstream section, head cuts working
 upstream are undermining outfall
 structures. The proposed improvements
 will provide better energy dissipation at
 every interface from storm drains to
 natural channels. They will also provide a
 more stable outlet structure to prevent
 further damage.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfall and erosive potential immediately downstream.
Water Quality	The primary benefit to the water quality would come from the reduction of sediment loads associated with high velocity at the outfall locations. Reduction of sediment and velocity will also improve stream habitat.

Potential Project Constraints:

Environmental	No environmental constraints are anticipated. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to outfalls is generally available from the roadway or through drainage easements.
Design / Construction	There are no significant design or construction issues.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	16	EA	\$8,000	\$128,000
Base Construction Cost				\$128,000
Mobilization (5%)				\$6,400
Subtotal 1				\$134,400
Contingency (25%)				\$33,600
Subtotal 2				\$168,000
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$75,600
Estimated Project Cost				\$244,000

This project is part of the alternative project group for Regional Pond D-51.

See Table 5-2 for the recommended disposition.

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Project Number: DF92117
Catchment Code: DFBA0003
Candidate Site: S117

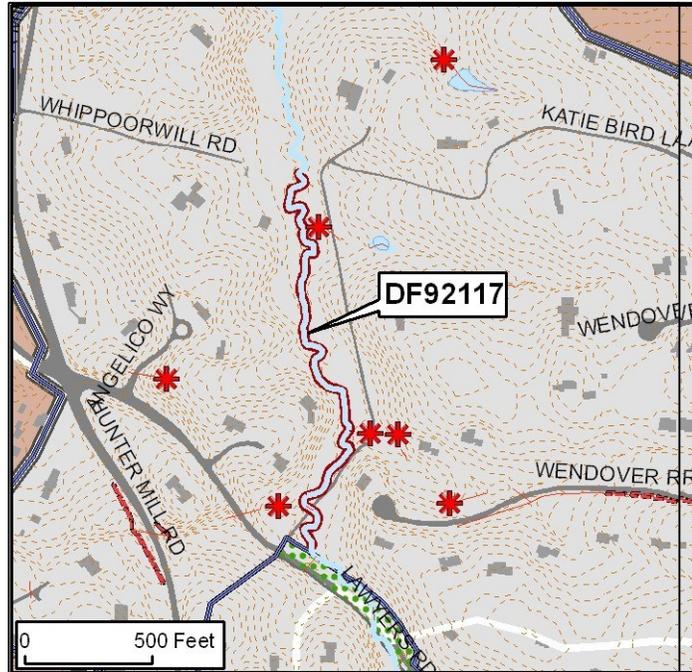
Project Type: Stream Restoration
Project Size: 2,754 linear feet

Project Location:

This project is located to the south of Whippoorwill Road and to the north of Lawyers Road. Hunter Mill Road is to the west of the project area.

Project Description:

This stream reach is severely incised with severe erosion against the valley walls in several locations. Bed features are poorly defined and inconsistent. The stream is located in a wooded valley between residential properties.



The proposed restoration would create a new pattern and profile for most of the existing channel, except for the most eroded area, where a new stream channel would be created in the floodplain. Spot stabilization measures would also be constructed. The stream buffer would be restored on all restoration reaches.

Potential Project Benefits:

Stream Stability	The pattern, dimension, and profile of the stream will be restored and a floodplain connection will be enhanced.
Water Quality	Water quality will be improved by a significant reduction in current and future bank and bed erosion.
Instream Habitat	Erosion reduction, and restored stable riffle pool morphology would significantly improve habitat

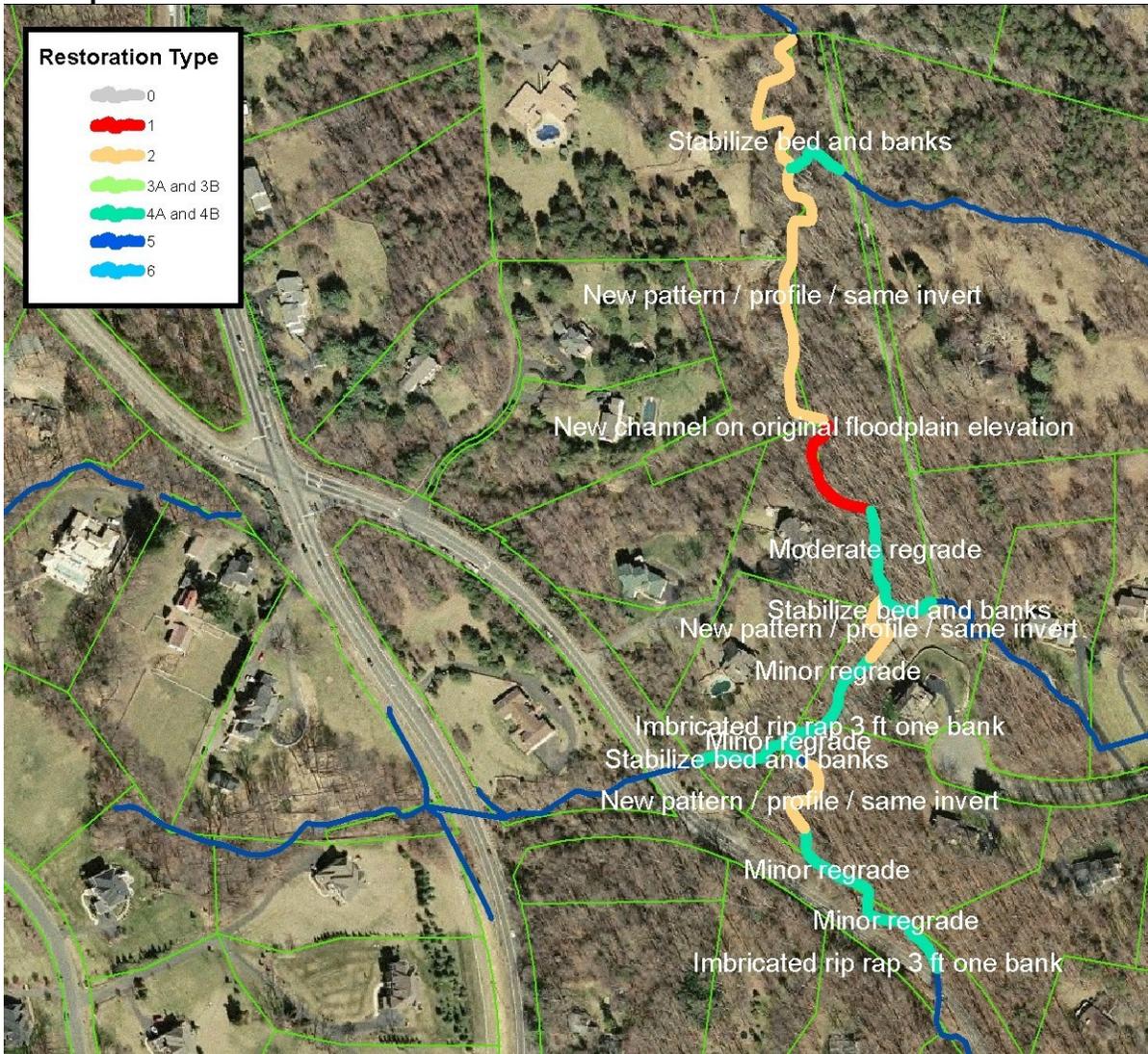
Potential Project Constraints:

Environmental	The project will require limited forest clearing or some impacts to jurisdictional wetlands. It will require a permit from both the U.S. Army Corps of Engineers and the Virginia DEQ. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will be from Whippoorwill Road and Lawyers Road and will require some construction impacts in the floodplain..
Design / Construction	Design efforts are moderate compared to other stream restoration projects. General constructability is good.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct new channel	248	LF	\$200.00	\$49,600.00
Reconstruct new pattern and profile	1267	LF	\$250.00	\$316,750.00
Stabilize in place -- grading	626	LF	\$175.00	\$109,550.00
Stabilize in place -- armoring	613	LF	\$225.00	\$137,925.00
Buffer restoration	Included	LF	\$25.00	\$0.00
Base Construction Cost				\$713,825
Mobilization (5%)				\$35,691
Subtotal 1				\$749,516
Contingency (25%)				\$187,379
Subtotal 2				\$936,895
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$421,603
Estimated Project Cost				\$1,358,000

Concept Sketch

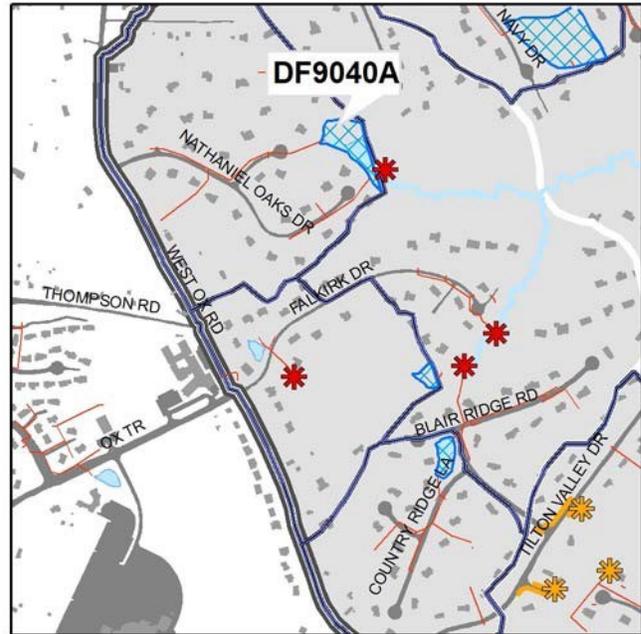


Project Number: DF9040A
Catchment Code: DFSF0001
Candidate Site: D-40

Project Type: Pond Retrofit
Project Size: 1.4 acres
Treated Area: 54.8 acres

Project Location: This project is located at the end of Nathaniel Oaks Drive.

Project Description: There are two concentrated inflow locations feeding runoff to this facility, which can be improved significantly by installing a new control structure and excavating the available space within the existing footprint to convert this dry pond to a wetland system. Installing a multistage riser will enable extended detention of the channel protection volume. In addition, removing or replacing the concrete pilot channels with meandering natural channels can optimize nutrient and sediment removal through reduction of stormwater runoff velocity. For public safety, a perimeter fence is recommended around the facility.



Potential Project Benefits:

Streamflow	100% of the channel protection volume can be stored.
Water Quality	The retrofit can treat 100% of the water quality volume. A forebay, micropool, and marsh can improve pollutant removal.

Potential Project Constraints:

Environmental	Permitting should not be an issue for a dry pond retrofit. Projects in RPAs may require exceptions or waivers.
Facility Access	Facility access currently exists from Nathaniel Oaks Drive.
Design / Construction	No significant design or construction issues have been noted. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.6	AC	\$5,000.00	\$3,000
Grading and Excavation	1860	CY	\$30.00	\$55,800
Riser	1	LS	\$10,000.00	\$10,000
Fencing	832	LF	\$20.00	\$16,640
Riprap Stabilization	50	LF	\$50.00	\$2,500
Wetland Planting	1590	SY	\$2.00	\$3,180
Dry Landscaping	1024	SY	\$2.50	\$2,560
Base Construction Cost				\$93,680
Mobilization (5%)				\$4,684
Subtotal 1				\$98,364
Contingency (25%)				\$24,591
Subtotal 2				\$122,955
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$55,330
Estimated Project Cost				\$178,000

This project is part of the alternative project group for Regional Pond D-40. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

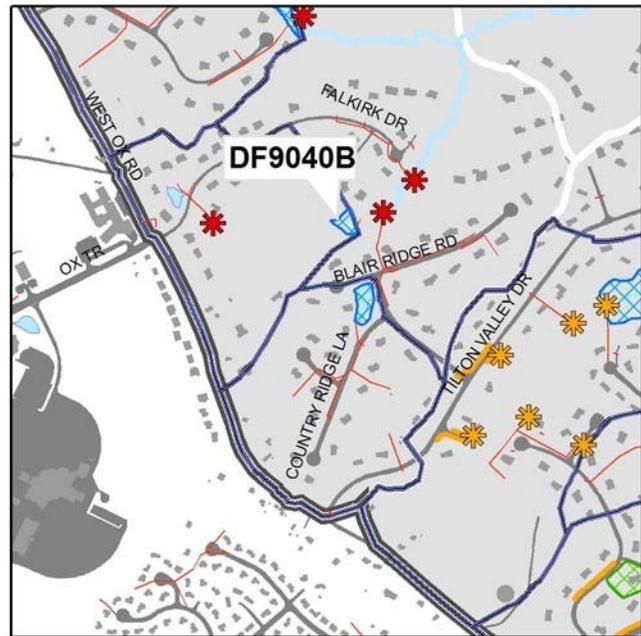


Project Number: DF9040B
Catchment Code: DFSF0001
Candidate Site: D-40

Project Type: Pond Retrofit
Project Size: 0.3 acres
Treated Area: 30.7 acres

Project Location: This project is between Falkirk Drive and Blair Ridge Road

Project Description: This retrofit project will focus on maximizing the performance of the facility within its existing footprint. Approximately half of the required channel protection volume can be achieved by replacing the riser with a multistage control structure. Water quality treatment can be improved by excavating the flat area within the pond and optimizing existing water quality components. A larger wetland area would incorporate both shallow and deeper micropools at the two inflow locations. However, this measure would disturb existing wetland features so the potential benefits of this improvement should be carefully considered.



Potential Project Benefits:

Streamflow	About 50% of the channel protection volume can be met.
Water Quality	Approximately 50% of the water quality volume can be treated. Wetlands and micropools could improve performance.

Potential Project Constraints:

Environmental	A permit may be required from both the U.S. Army Corps of Engineers and VDEQ. Projects in RPAs may require exceptions or waivers.
Facility Access	A paved maintenance road off of Falkirk Drive provides access to this facility.
Design / Construction	Analysis of the benefit tradeoff of excavating established wetlands to add additional water quality components must be carefully considered. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1,000
Grading and Excavation	429	CY	\$30.00	\$12,870
Riser	1	LS	\$10,000.00	\$10,000
Wetland Planting	385	SY	\$2.00	\$770
Dry Landscaping	260	SY	\$2.50	\$650
Base Construction Cost				\$25,290
Mobilization (5%)				\$1,265
Subtotal 1				\$26,555
Contingency (25%)				\$6,639
Subtotal 2				\$33,193
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$14,937
Estimated Project Cost				\$48,000

This project is part of the alternative project group for Regional Pond D-40. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

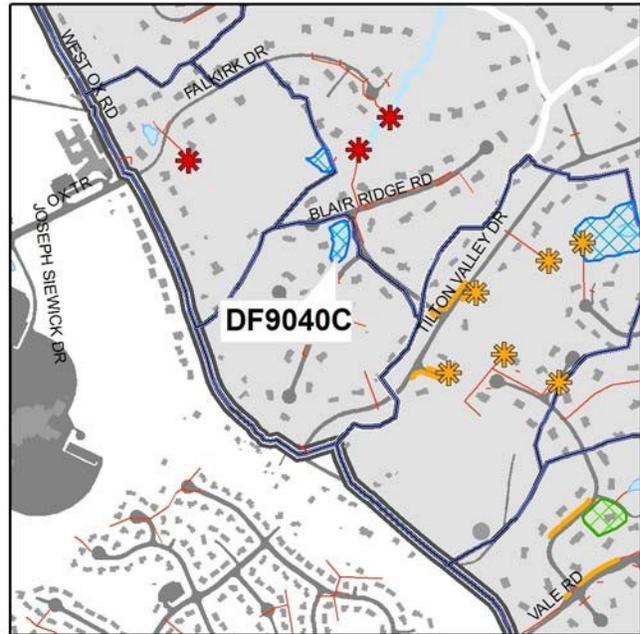


Project Number: DF9040C
Catchment Code: DFSF0001
Candidate Site: D-40

Project Type: Pond Retrofit
Project Size: 0.5 acres
Treated Area: 30.4 acres

Project Location: This project is located near Blair Ridge Road and Country Ridge Lane.

Project Description: Due to the location of this facility in a residential neighborhood, boundary constraints limit design improvements to the available space within the pond footprint. The channel protection volume for this facility can be met by excavation within the existing pond footprint and by modifying the existing riser structure. The concrete pilot channels would be removed and the pond bottom excavated to the invert of the existing channel. Water quality treatment for this facility would be met by further excavating the pond bottom to create shallow wetlands, incorporating a deeper micropool at the inflow point.



Potential Project Benefits:

Streamflow	100% of the channel protection volume for this facility can be met.
Water Quality	Wet marsh areas will meet 90% of the water quality volume.

Potential Project Constraints:

Environmental	Environmental permitting issues are not anticipated for this facility. Projects in RPAs may require exceptions or waivers.
Facility Access	Facility access currently exists from Birdsboro Drive and Blair Ridge Road.
Design / Construction	No significant design or construction issues have been noted. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1,000
Remove Pilot Channels	220	LF	\$6.00	\$1,320
Grading and Excavation	1206	CY	\$30.00	\$36,180
Riser	1	LS	\$10,000.00	\$10,000
Wetland Planting	694	SY	\$2.00	\$1,388
Dry Landscaping	155	SY	\$2.50	\$387
Base Construction Cost				\$50,276
Mobilization (5%)				\$2,514
Subtotal 1				\$52,789
Contingency (25%)				\$13,197
Subtotal 2				\$65,987
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$29,694
Estimated Project Cost				\$96,000

*This project is part of the alternative project group for Regional Pond D-40.
 See Table 5-2 for the recommended disposition.*

Site Photo:



Concept Sketch:

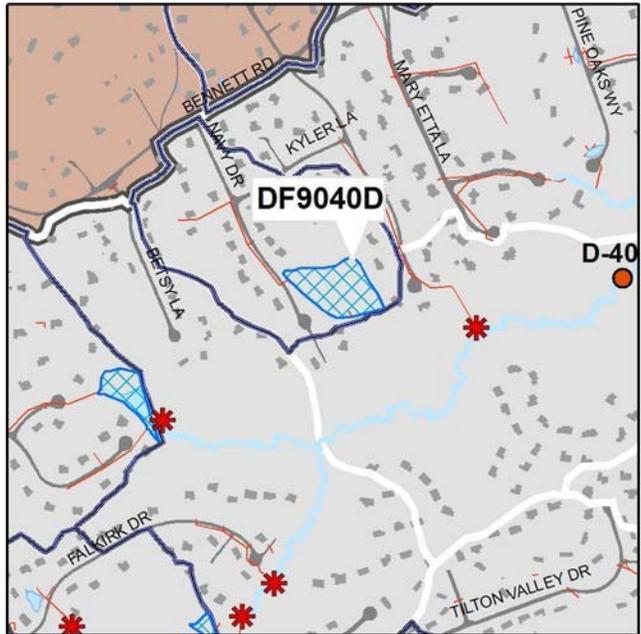


Project Number: DF9040D
Catchment Code: DFSF0002
Candidate Site: D-40

Project Type: Pond Retrofit
Project Size: 3.1 acres
Treated Area: 32.5 acres

Project Location: This project is located at the end of Navy Drive.

Project Description: This facility can be improved significantly by replacing the existing riser and excavating the available space to convert this dry pond to a wetland system. Excavating the pond bottom to create shallow wetlands would provide water quality treatment. Channel protection can be created by installing a multistage riser. Optimum removal of nutrients and sediment can take place by meandering flow channels through wetland areas.



Potential Project Benefits:

Streamflow	Approximately 90% of the channel protection volume can be achieved.
Water Quality	85% of the water quality volume can be met by excavating to convert this dry pond into a wetland.

Potential Project Constraints:

Environmental	Permitting issues should be minimal for this project. Projects in RPAs may require exceptions or waivers.
Facility Access	Facility access currently exists from Navy Drive.
Design / Construction	No significant design or construction issues have been noted. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	\$5,000.00	\$1,500
Grading and Excavation	988	CY	\$30.00	\$29,640
Riser	1	LS	\$10,000.00	\$10,000
Wetland Planting	959	SY	\$2.00	\$1,918
Dry Landscaping	260	SY	\$2.50	\$1,062
Base Construction Cost				\$44,121
Mobilization (5%)				\$2,206
Subtotal 1				\$46,327
Contingency (25%)				\$11,582
Subtotal 2				\$57,908
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$26,059
Estimated Project Cost				\$84,000

This project is part of the alternative project group for Regional Pond D-40. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

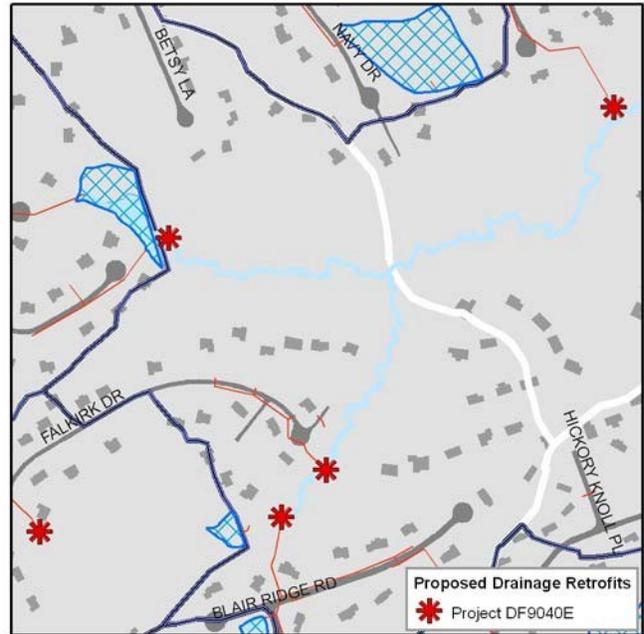


Project Number: DF9040E
Catchment Code: DFSF0002
Candidate Site: D-40

Project Type: Drainage Retrofit
Project Size: 5 Outfalls

Project Location: This project will be distributed throughout the catchment where piped drainage systems discharge into natural channels.

Project Description: This project is intended to reduce scour and erosion at outfalls where flows from the storm drain system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Generally, access can be obtained from adjacent roads.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	5	EA	\$8,000.00	\$40,000
Base Construction Cost				\$40,000
Mobilization (5%)				\$2,000
Subtotal 1				\$42,000
Contingency (25%)				\$10,500
Subtotal 2				\$52,500
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$23,625
Estimated Project Cost				\$76,000

This project is part of the alternative project group for Regional Pond D-40. See Table 5-2 for the recommended disposition.

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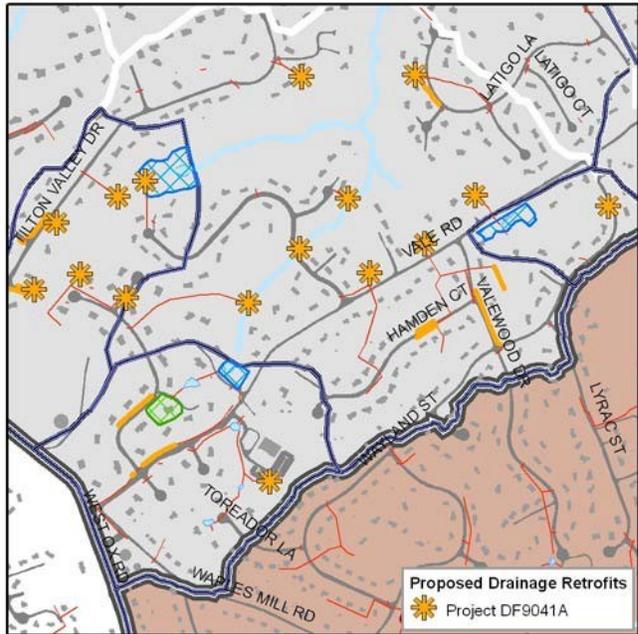
Project Number: DF9041A
Catchment Code: DFSF9902
Candidate Site: D-41

Project Type: Drainage Retrofit
Project Size: 18 Outfalls and 2390 ft of ditch removal

Project Location: This project will be distributed throughout the catchment at points where the storm drainage system discharges into natural channels, and at any location where stormwater is conveyed by paved ditches in the catchment.

Project Description: This project is intended to reduce scour and erosion at outfalls where flows from the storm drain system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.

Additionally, this project includes the removal of concrete lined ditches to be replaced with grass-covered dry swales using stone or check dams to control critical high velocity areas.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and erosive potential immediately downstream. Swales will reduce both volume and velocity.
Water Quality	Replacing ditches with swales will provide treatment before stormwater reaches the stream system. Water quality will also benefit from the reduction of sediment loads associated from scour at the outfall locations. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Generally, access can be obtained from adjacent roads or storm drain easements.
Design / Construction	No significant design or construction issues were identified for this project. Design should incorporate check dams or other features to ensure flow velocity is not erosive.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition (Haul Away)	2390	LF	\$18.00	\$43,020
Dry Swale w/ Underdrain	2390	LF	\$50.00	\$119,500
Outfall Protection	18	EA	\$8,000.00	\$144,000
Base Construction Cost				\$306,520
Mobilization (5%)				\$15,326
Subtotal 1				\$321,846
Contingency (25%)				\$80,462
Subtotal 2				\$402,308
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$181,038
Estimated Project Cost				\$583,000

This project is part of the alternative project group for Regional Pond D-41. See Table 5-2 for the recommended disposition.

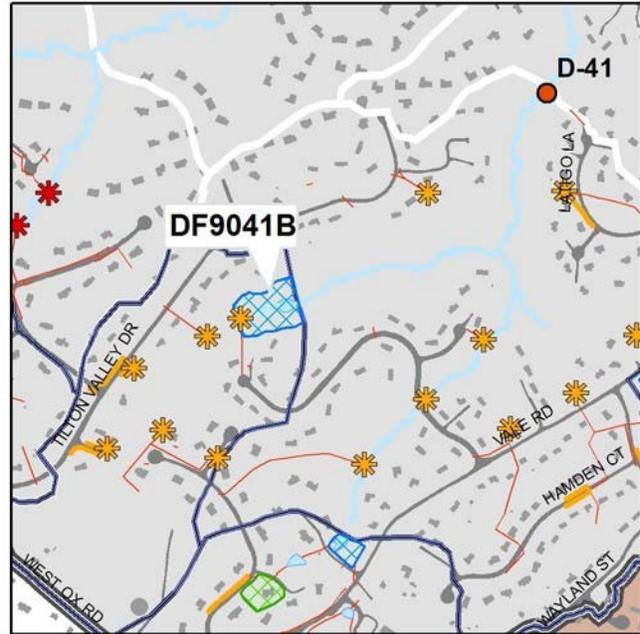
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Project Number: DF9041B
Catchment Code: DFSF9902
Candidate Site: D-41

Project Type: Pond Retrofit
Project Size: 2.4 acres
Treated Area: 58 acres

Project Location: This project is between Tilton Valley Drive and Hickory Hills Drive.

Project Description: Management of smaller storms can be improved by installing a multi-stage control structure. Although it is not recommended to interrupt the existing stream channel, there is available space to excavate between the stream channel and the wood line to create additional storage space. Excavation to create water quality volume is not recommended at this location because this is an in-stream pond.



Potential Project Benefits:

Peak Flow	Excavation and a new control structure will provide roughly 30% of the channel protection volume.
Water Quality	Indirect improvements to water quality are expected from reduction of high velocity flows and stream erosion downstream.

Potential Project Constraints:

Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Forest and wetland impacts are anticipated during construction. A permit may be required from both the U.S. Army Corps of Engineers and VDEQ. Projects in RPAs may require exceptions or waivers.
Facility Access	This facility has a paved maintenance access road to the embankment.
Design / Construction	Care should be taken to insure that the natural stream channel is minimally disturbed during construction. County staff will coordinate with the facility owner to implement the project.

Costs:

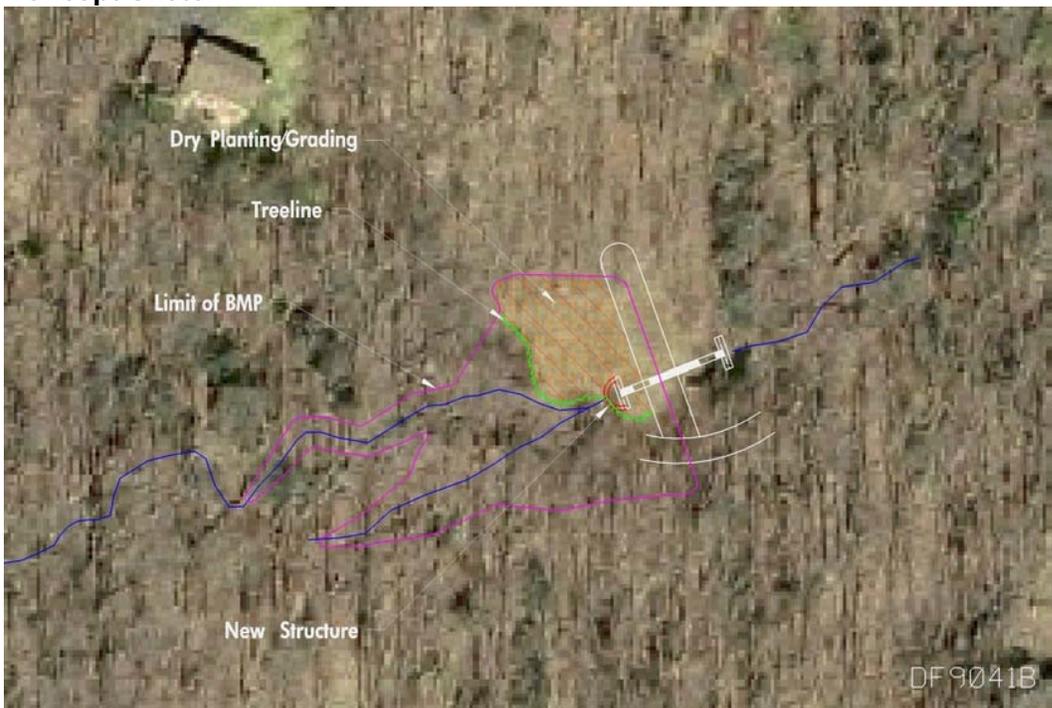
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Grading and Excavation	356	CY	\$30.00	\$10,680
Riser	1	LS	\$10,000.00	\$10,000
Dry Landscaping	528	SY	\$2.50	\$1,320
Base Construction Cost				\$22,500
Mobilization (5%)				\$1,125
Subtotal 1				\$23,625
Contingency (25%)				\$5,906
Subtotal 2				\$29,531
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$13,289
Estimated Project Cost				\$43,000

This project is part of the alternative project group for Regional Pond D-41. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

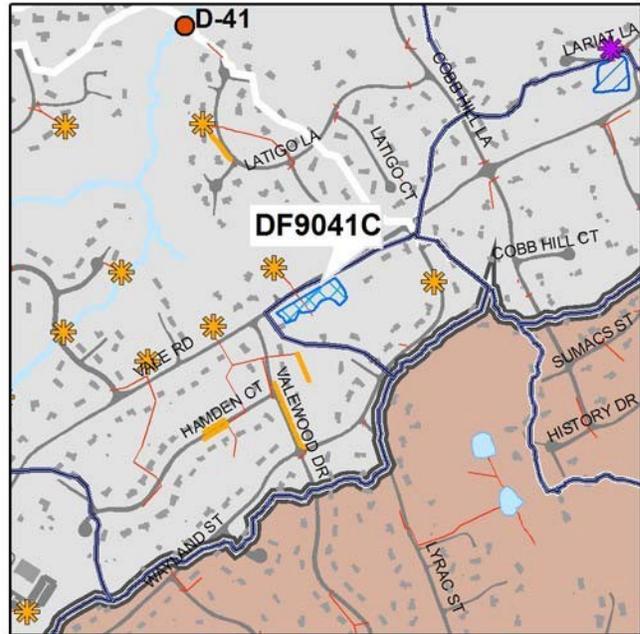


Project Number: DF9041C
Catchment Code: DFSF9902
Candidate Site: D-41

Project Type: Pond Retrofit
Project Size: 1.0 acres
Treated Area: 15 acres

Project Location: This project is located on the south side of Vale Road, east of Valewood Drive.

Project Description: Stabilization is required for erosion on the backside of the embankment and within the downstream channel. Maintenance to remove sediment accumulated in the culvert under Vale Road is also required. To reduce erosive velocities of smaller storms leaving this facility, a new multi-stage riser would create approximately one-third of the required channel protection volume for this drainage area. Excavation is not recommended due to impacts to adjacent woods.



Potential Project Benefits:

Streamflow	This facility is limited to approximately 30% of the calculated channel protection volume.
Water Quality	The existing facility already provides some retention and vegetative uptake. Improvements to water quality would be obtained through the reduction in scour forming discharges downstream

Potential Project Constraints:

Environmental	Environmental permitting would be minimal. Projects in RPAs may require exceptions or waivers.
Facility Access	This facility is near a public road where access is good.
Design / Construction	No significant design or construction issues have been noted. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Outlet Protection	1	EA	\$8,000.00	\$8,000
Riser	1	LS	\$10,000.00	\$10,000
Base Construction Cost				\$18,500
Mobilization (5%)				\$925
Subtotal 1				\$19,425
Contingency (25%)				\$4,856
Subtotal 2				\$24,281
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$10,927
Estimated Project Cost				\$35,000

This project is part of the alternative project group for Regional Pond D-41. See Table 5-2 for the recommended disposition.

Site Photo:



Concept Sketch:

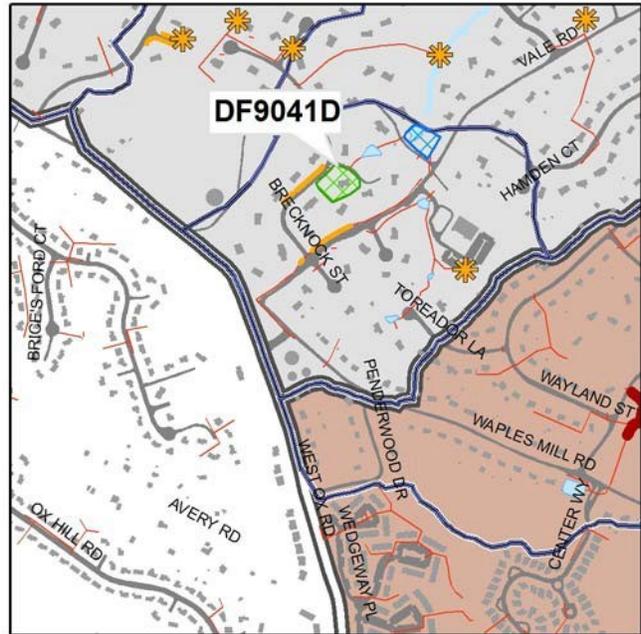


Project Number: DF9041D
Catchment Code: DFSF9902
Candidate Site: D-41

Project Type: LID Retrofit
Project Size: 9 SY
Treated Area: 0.9 acres

Project Location: This project is recommended at a private residence along Brecknock Street at the intersection with a pipestem driveway.

Project Description: This project would be a rain garden demonstration site placed in a residential setting to provide an example how these facilities can be incorporated into the landscape. This location was chosen because of ideal topography, but an additional advantage to this location is that it is in a community with managed lawns, and can demonstrate the nutrient removal potential of this application. If land rights cannot be acquired at the recommended site, then it is recommended that a nearby location be pursued.



Potential Project Benefits:

Streamflow	This project would provide some volume reduction through infiltration
Water Quality	This facility would be expected to provide water quality improvements though filtration and vegetative uptake.

Potential Project Constraints:

Environmental	Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility is excellent.
Design / Construction	No outstanding design or construction issues were identified. However, since the facility would be on private property, property owner coordination and agreement would be required

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
LID Structural Control	9.0	SY	\$120.00	\$1,080
Base Construction Cost				\$1,080
Mobilization (5%)				\$54
Subtotal 1				\$1,134
Contingency (25%)				\$284
Subtotal 2				\$1,418
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$638
Estimated Project Cost				\$2,000

This project is part of the alternative project group for Regional Pond D-41. See Table 5-2 for the recommended disposition.

Concept Sketch

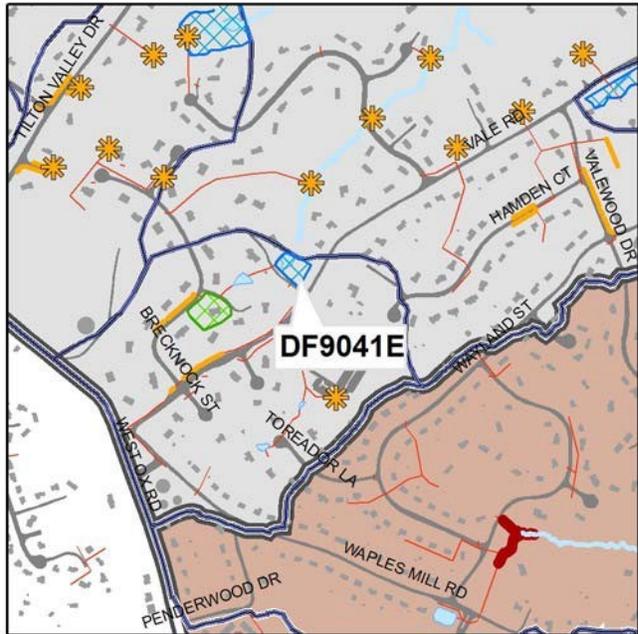


Project Number: DF9041E
Catchment Code: DFSF9902
Candidate Site: D-41

Project Type: Pond Retrofit
Project Size: 0.6 acres
Treated Area: 60.3 acres

Project Location: A private drive off Vale Road.

Project Description: The channel is extremely eroded upstream and downstream of the outfall of this facility. The full channel protection and water quality volumes cannot be met without completely redesigning the embankment and excavating private property. However, small improvements can be made to help handle smaller storms. If a new riser is installed along with outfall protection, the erosion potential of the outfall and the channel downstream will decrease significantly. Also, the woody vegetation on the embankment should be removed and the embankment stabilized.



Potential Project Benefits:

Streamflow	Installing a new riser into this facility would reduce peak discharges but is limited to less than 20% of the calculated channel protection volume.
Water Quality	Indirect improvements to water quality are expected from reduction of high velocity flows and stream erosion downstream.

Potential Project Constraints:

Environmental	Environmental impacts from this project would be minor. Projects in RPAs may require exceptions or waivers.
Facility Access	Access for this facility is excellent.
Design / Construction	To maximize benefits and avoid disturbance of private property, the design will be somewhat more complex than a typical pond retrofit. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.1	AC	\$5,000.00	\$500
Grading and Excavation	988	CY	\$30.00	\$29,640
Outlet Protection	1	EA	\$8,000.00	\$8,000
Reconstruct Embankment	120	CY	\$60.00	\$7,200
Riser	1	LS	\$10,000.00	\$10,000
Wetland Planting	411	SY	\$2.00	\$822
Base Construction Cost				\$56,162
Mobilization (5%)				\$2,808
Subtotal 1				\$58,970
Contingency (25%)				\$14,743
Subtotal 2				\$73,713
Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)				\$33,171
Estimated Project Cost				\$107,000

*This project is part of the alternative project group for Regional Pond D-41.
See Table 5-2 for the recommended disposition.*

Site Photo: :



Concept Sketch:

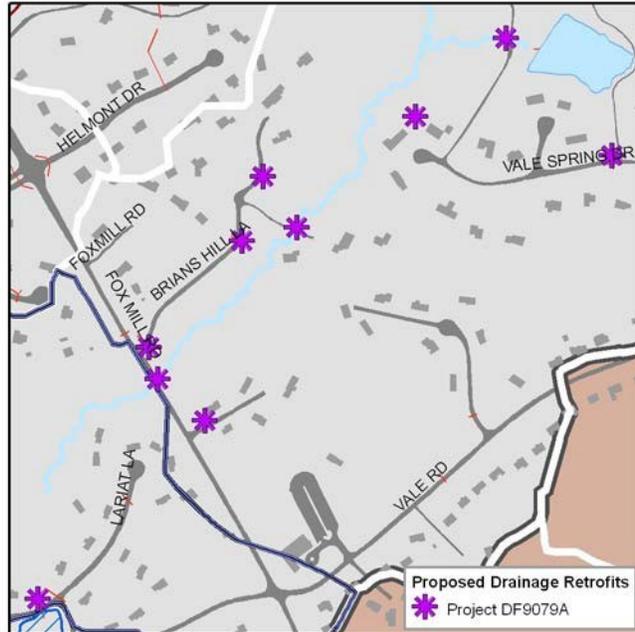


Project Number: DF9079A
Catchment Code: DFSF9802
Candidate Site: D-79

Project Type: Drainage Retrofit
Project Size: 10 Outfalls

Project Location: This project will be distributed throughout the catchment at points where the storm drainage system discharges into natural channels.

Project Description: This project is intended to reduce scour and erosion at outfalls where flows from the storm drain system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and erosive potential immediately downstream.
Water Quality	Water quality will benefit from the reduction of sediment loads associated from scour at the outfall locations. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Generally, access can be obtained from adjacent roads or storm drain easements.
Design / Construction	No significant design or construction issues were identified for this project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	10	EA	\$8,000.00	\$80,000
Base Construction Cost				\$80,000
Mobilization (5%)				\$4,000
Subtotal 1				\$84,000
Contingency (25%)				\$21,000
Subtotal 2				\$105,000
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$47,250
Estimated Project Cost				\$152,000

This project is part of the alternative project group for Regional Pond D-79. See Table 5-2 for the recommended disposition.

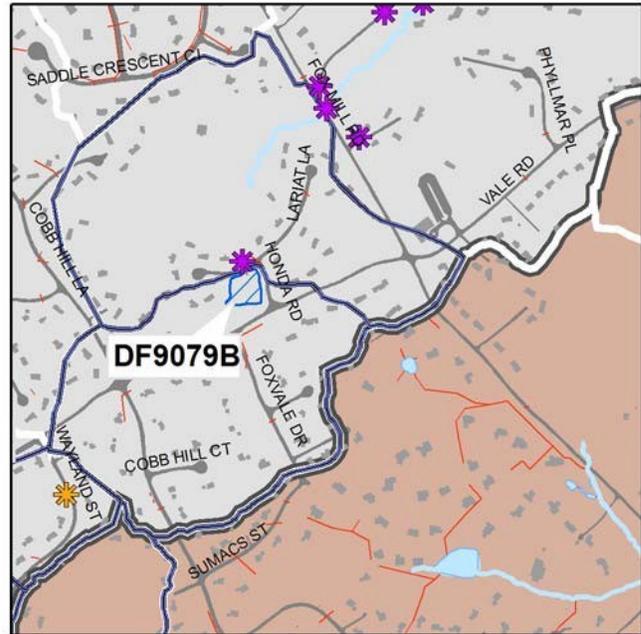
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Project Number: DF9079B
Catchment Code: DFSF9802
Candidate Site: D-79

Project Type: Culvert Retrofit
Project Size: 0.8 acres
Treated Area: 49.6 acres

Project Location: This project is located near the intersection of Honda Road and Lariat Lane.

Project Description: This project will consist of retrofitting an impoundment structure to the existing culvert to provide detention. Re-grading in this area will provide additional detention volume. Any detention at this location may help to reduce flooding impacts downstream at the Fox Mill crossing.



Potential Project Benefits:

Streamflow	This project can provide 100% of the channel protection storage.
Water Quality	There is sufficient storage to provide 100% of the water quality volume.

Potential Project Constraints:

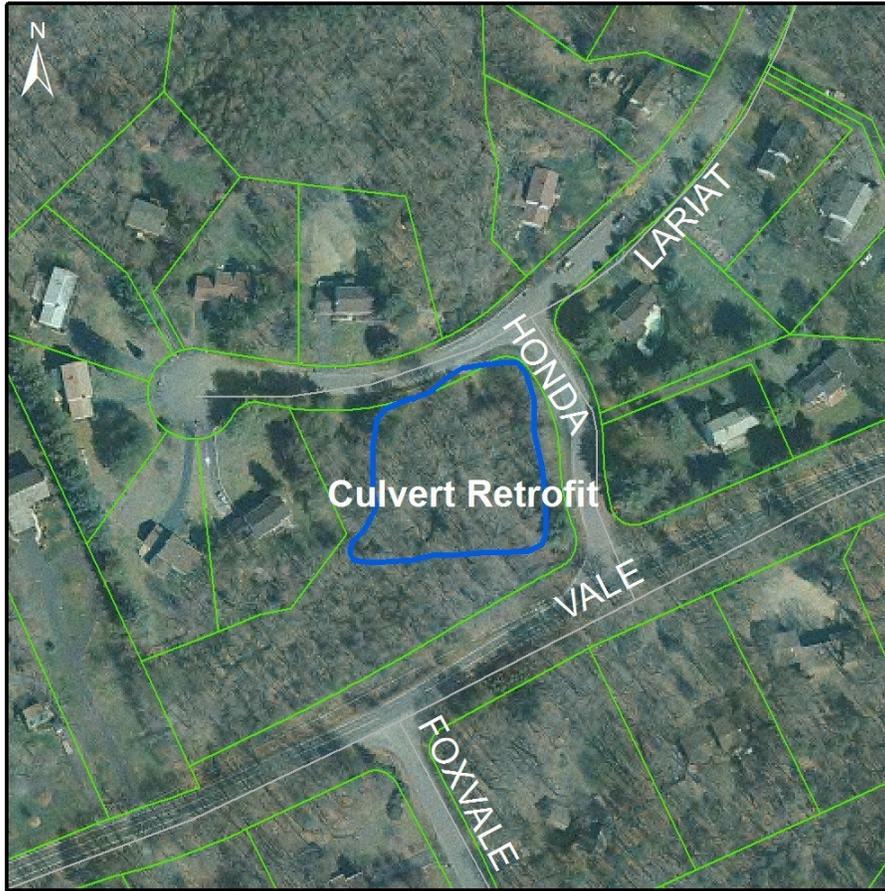
Environmental	There may be some permitting issues associated with the temporary impoundment of runoff in the floodplain above this culvert. Some forest impacts would occur during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access can be easily obtained from Honda Road and Lariat Lane.
Design / Construction	No significant design or construction issues were identified for this project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	\$5,000.00	\$1,000
Excavation	710	CY	\$35.00	\$24,850
Impoundment Structure	1	LS	\$5,000.00	\$5,000
Landscaping	770	SY	\$2.50	\$1,925
Wetland Planting	260	SY	\$2.00	\$520
Base Construction Cost				\$33,295
Mobilization (5%)				\$1,665
Subtotal 1				\$34,960
Contingency (25%)				\$8,740
Subtotal 2				\$43,700
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$19,665
Estimated Project Cost				\$63,000

This project is part of the alternative project group for Regional Pond D-79. See Table 5-2 for the recommended disposition.

Concept Sketch



Project Number: DF92120
Catchment Code: DFSF0005
Candidate Site: S120

Project Type: Stream Restoration
Project Size: 446 Linear Feet

Project Location: This project is located east of Fox Mill Road and north of Deerfield Drive.

Project Description: The stream has raw, vertical streambanks and moderate to severe incision. However, the bed morphology is relatively well defined. The riparian area on the left side of the stream is in pasture. The stream is located on private property. The proposed restoration would involve constructing a new plan and profile for about half the reach with a nested channel, and stabilizing the streambanks along the other half with moderate regrading. A forested buffer would be re-established in the pasture portion of the riparian zone.



Potential Project Benefits:

Stream Stability	Restoration of a more natural stream pattern, and stabilization of streambanks will reduce erosion.
Water Quality	Water quality will be improved by a significant reduction in current and future bank and bed erosion.
Instream Habitat	Erosion reduction, recreating an aquatic channel, and re-establishing a riparian buffer will improve physical habitat conditions.

Potential Project Constraints:

Environmental	The site will not require forest clearing or impacts to jurisdictional wetlands. It will require a permit from the U.S. Army Corps of Engineers. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will require an easement on private property but is open and unconstrained adjacent to the stream.
Design / Construction	Design efforts are minor compared to other stream restoration projects. General constructability is good.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Reconstruct new pattern and profile	484	LF	\$250.00	\$121,000
Stabilize in place -- grading	428	LF	\$175.00	\$74,900
Buffer restoration	included above	LF	\$25.00	\$0
Add'l cost, first 500 LF	500	LF	\$200.00	\$100,000
Base Construction Cost				\$295,900
Mobilization (5%)				\$14,795
Subtotal 1				\$310,695
Contingency (25%)				\$77,674
Subtotal 2				\$388,369
Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)				\$174,766
Estimated Project Cost				\$563,000

Concept Sketch:

