PROJECT CONCEPT

TOWN OF TIMBERVILLE

STATE ROUTE 211 STORMWATER CONCENTRATION POINT DRAINAGE IMPROVEMENTS

Location Description

38.63114, -78.77348

State Route 211 (New Market Road) at the culvert/drainage concentration point between Walmart and Tractor Supply and downstream flooding in Virginia Avenue and Maple Avenue neighborhoods.

Project Purpose

Manage stormwater from the ~512-acre drainage basin to reduce flooding in the Virginia Ave and Maple Ave residential neighborhoods.

Additional Information Needed

- Design information/H&H study from VDOT for culvert under State Route 211
- Possibly land acquisition and/or easements necessary
- Utility survey

Background

This is a two-part project: addressing current and future expansion of stormwater flowing to the State Route 211 culvert, and addressing the downstream outlet of stormwater as it is routed around the Tractor Supply building into the Virginia Avenue community, which has reported flooding along the drainage corridor.

An approximately 544-acre drainage area converges at State Route 211 in Timberville 950 feet east of the State Route 211/Main Street intersection (**Figure 1**). The box culvert under State Route 211 routes water to the north side of State Route 211 and into the Tractor Supply property (**Figure 2**, **Figure 3**), where flow is conveyed around the building in a large swale with periodic stone check dams. Near where flow leaves the property, it is routed through a four-barrel culvert crossing before exiting the Tractor Supply property into a much smaller and less defined channel running between two residences (196 and 220 Virginia Ave) (**Figure 4**, **Figure 5**). It appears that the channel between Tractor Supply and Virginia Avenue and the culverts under Virginia Avenue are no longer meeting their design capacity. The four-barrel culvert under Virginia Avenue is almost fully obscured and likely at least partially blocked on the upstream side by bushy vegetation visible in foreground of image at left.

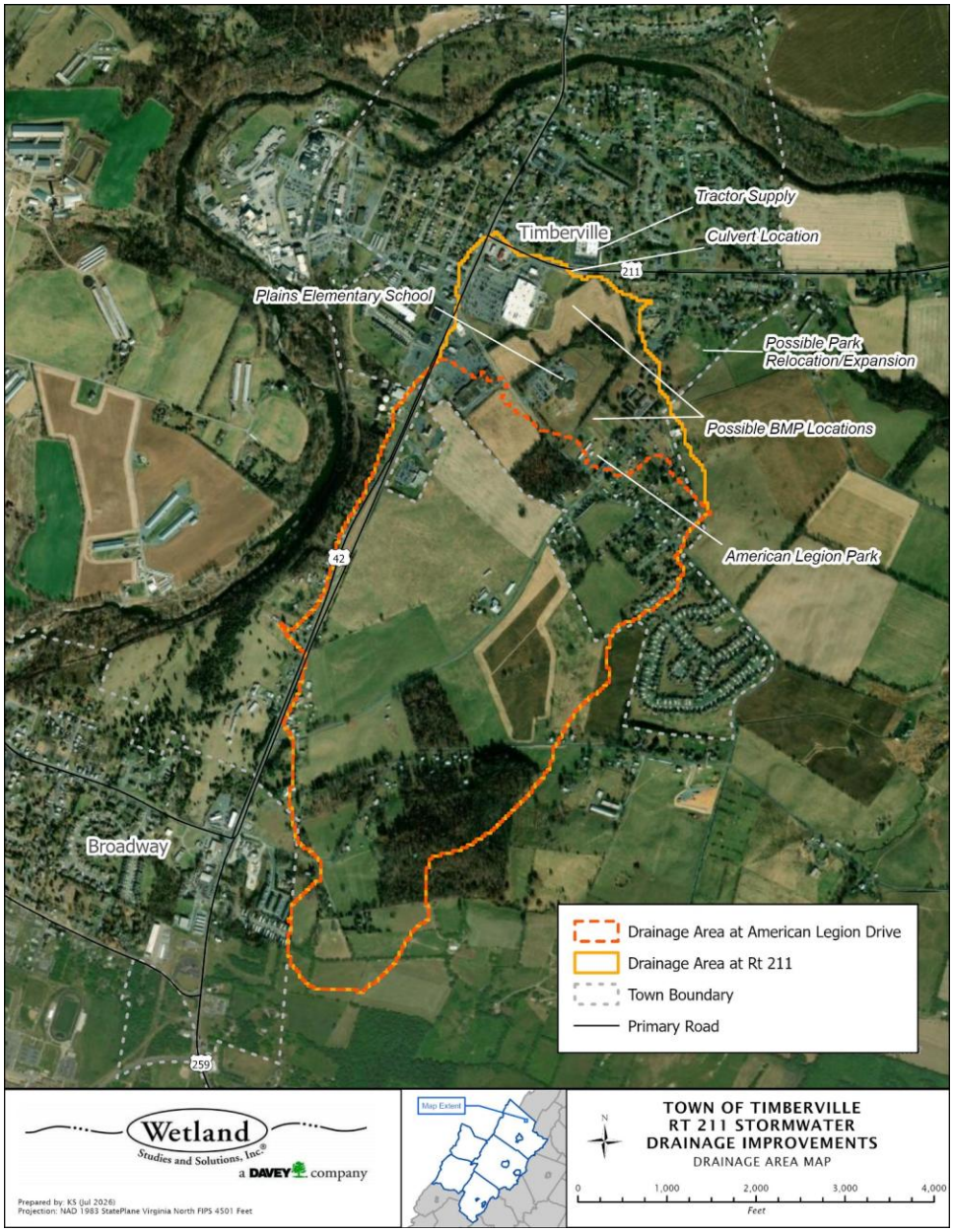

Figure 1. Map of drainage area to culvert conveying flow to north side of State Route 211 and potential BMP locations.



Figure 2. Map of current downstream routing of stormwater existing conveyance channel around Tractor Supply.



Figure 3. Culvert crossing State Route 211 viewed from upstream (left) showing potential location for regional BMP in the foreground and from downstream within Tractor Supply parking lot (right).



Figure 4. Four-barrel culvert crossing (left) in conveyance channel around Tractor Supply and immediate outfall (right) into grass lined channel between adjacent residential properties. Concrete visible in right image is the top of the culvert crossing shown in the left image.



Figure 5. Grassed channel immediately downstream of Tractor Supply outfall (left), facing west from Virginia Avenue and four-barrel culvert under Virginia Avenue (right, again facing west). Four-barrel culverts are almost fully obscured and likely at least partially blocked on the upstream side by bushy vegetation visible in foreground of image at left.

Conceptual Design and Planning-Level Cost Estimate

This is a two-part project: addressing current and future expansion of stormwater flowing to the State Route 211 culvert, and addressing the downstream outlet of stormwater as it is routed around the Tractor Supply building into the Virginia Avenue community. Given the interconnected nature of these issues, they should be considered together in assessing design.

While a full analysis of existing and needed flow capacity should be completed to ensure work won't need to be re-done, it is clear that the culverts under Virginia Avenue and the channel leading to and from them are at least partially blocked by vegetation and accumulated deposition. Clearing the obscuring vegetation and restoring the channel to dimensions matching the culvert array could be completed early in the process and potentially relieve some impacts of flooding while analysis and design is being completed.

The culvert crossings of State Route 211 are presumably designed to convey VDOT's minimum design standard of a 25-year storm event (4% annual risk) for primary roadways. VDOT's standard sizing for culverts under local streets is the 10-year storm event (10% annual risk). The interplay between these two standards as well as the design capacity and the effective capacity currently along the flow path north of State Route 211 needs to be evaluated. There is potentially space to expand the existing open ditch to Virginia Avenue and incorporate an improved grassed swale design to increase infiltration, but the installation of a buried storm drain should also be evaluated given the proximity of the houses, which may limit the ability to increase the capacity of the channel via grading alone. The ultimate design solution is likely a combination of grey and green practices.

Design of potential upgrades to conveyance under Virginia Avenue should be in tandem with evaluation of a potential regional/community-scale nature-based BMP (e.g. wet pond, constructed wetland, or regional bioretention basin), which would impact the flood flows reaching Virginia Avenue.

The TR-55 SCS Curve Number method was used to estimate the current runoff volume of the 0.8 square mile watershed for an array of different design storms. Another set of volumes were estimated simulating the entire 0.8 mi^2 watershed being developed as 1/3 acre residential throughout (not accounting for BMPs that would be implemented to meet state water quantity requirements for such planned developments, which would reduce these volumes). In the table below, these estimated runoff volumes are compared and an estimated increase of runoff in the simulated scenario can be calculated.

Table 1. Estimated runoff volumes for the watershed in existing and simulated scenarios.

NOAA Atlas 14 Event	Precipitation (inches)	V_{exist} (ac-ft) (CN 65.4)	V_{sim} (ac-ft) (CN 75)	V_{sim} - V_{exist} (ac-ft)
5 year 24 hour	3.36	31.7	54.6	22.9
10 year 24 hour	3.93	45.9	73.2	27.3
25 year 24 hour	4.77	69.5	102.6	33.2
50 year 24 hour	5.49	91.7	129.3	37.6

The estimated increase in runoff volume in the simulated scenario is conservative, as BMPs to meet state stormwater quantity requirements would lower these values. A basin with the capacity to detain 40 ac-ft of storm volume would account for the increase in the 50-year 24-hour storm event.

Further analysis will allow refinement of the design, but this concept is presented for a basin capacity of 32 ac-ft, which is an achievable volume and aligns with the 25-year 24-hour storm event which is a typical design storm for basin-style BMPs. An extended detention basin is proposed, with integrated constructed wetland features to enhance infiltration, pollutant removal, and ecological benefits (**Figure 6**). Internal berms will increase flow path length and retention time, further enhancing performance. Geotechnical studies will need to be performed in addition to standard survey and hydrologic analysis to assess any potential concerns with the depth of excavation and interactions with groundwater on the site.

Commented [KS1]: Check what height embankment estimated and discuss DCR dam safety regs

Options for methods to reduce the volume or cost of disposal of excavated material from basin construction should be explored in design, including construction of the internal berms and microtopography, re-use on nearby farms, etc.

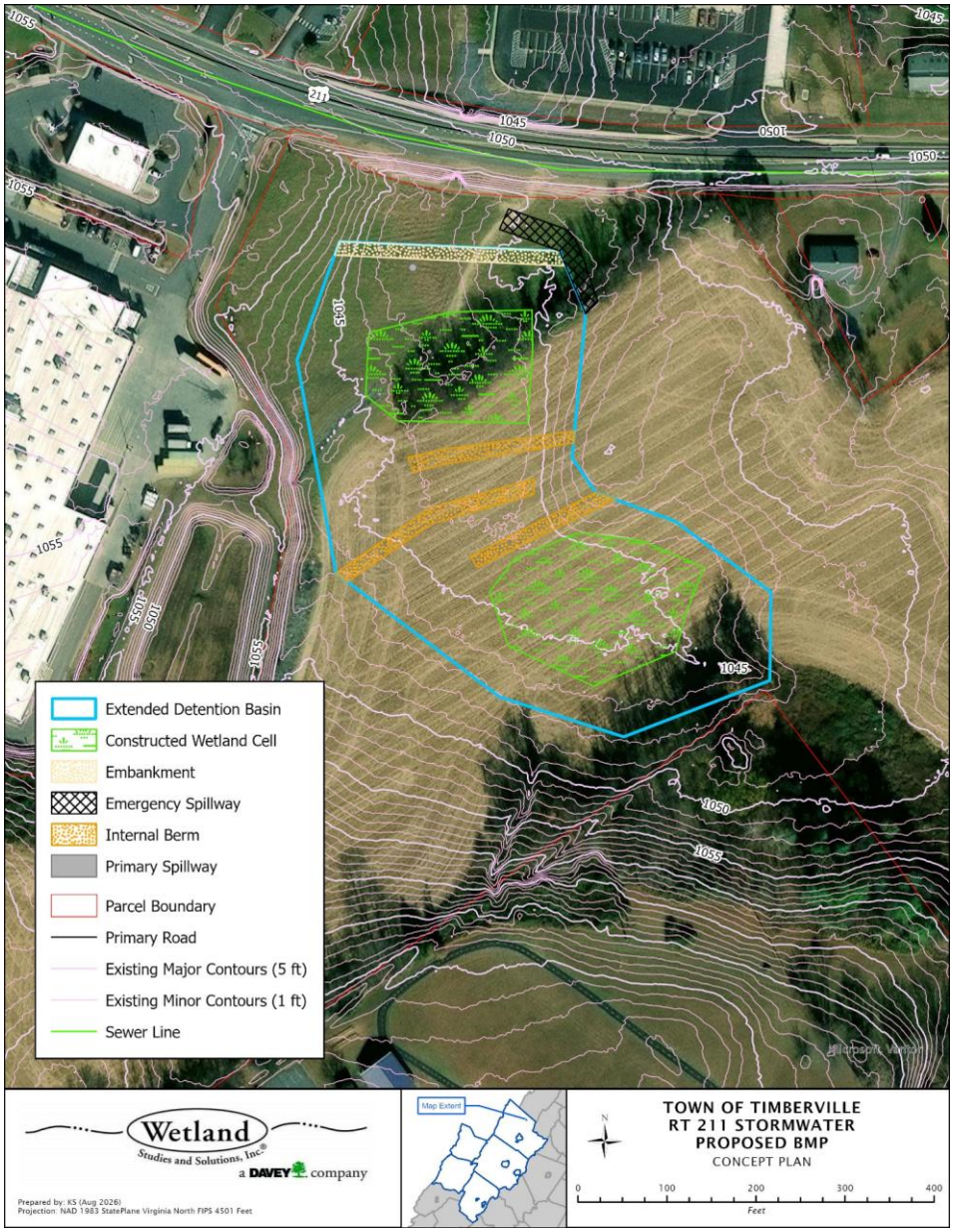

Figure 6. Conceptual map of proposed extended detention BMP.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Design and Survey					**$315,000**
Existing Conditions Survey	1	LS	$25,000.00	$25,000.00	
H&H Study and Virginia Avenue Conveyance Capacity Study	1	LS	$30,000.00	$30,000.00	
Geotechnical Study	1	LS	$60,000.00	$60,000.00	
Basin Design	1	LS	$175,000.00	$175,000.00	
Permitting	1	LS	$25,000.00	$25,000.00	
Construction Survey and Inspections					**$85,000**
Construction Oversight and Inspections	1	LS	$85,000.00	$85,000.00	
Access and Erosion/Sediment Control					**$154,500**
Temporary Construction Entrance	1	EA	$15,000.00	$15,000.00	
Super Silt Fence	3000	LF	$9.00	$27,000.00	
Diversion	2500	LF	$25.00	$62,500.00	
Deck Mats	500	LF	$100.00	$50,000.00	
Construction - Extended Detention Basin					**$2,300,373**
Stakeout	1	LS	$18,000.00	$18,000.00	
As-Built Survey	1	LS	$18,000.00	$18,000.00	
Mobilization	1	LS	$126,873.00	$126,873.00	
Clearing	1	AC	$25,000.00	$25,000.00	
Excavation and Hauling	40,000	CY	$45.00	$1,800,000.00	
Grading – rough	4	AC	$15,000.00	$60,000.00	
Grading – fine	3	AC	$20,000.00	$60,000.00	
Outlet Structure	1	EA	$30,000.00	$30,000.00	
Outlet Pipe	50	LF	$750.00	$37,500.00	
Riprap Forebay	1	LS	$75,000.00	$75,000.00	
Emergency Spillway	1	LS	$50,000.00	$50,000.00	
Vegetation Establishment					**$197,460**
Permanent Seeding and Straw/Matting	19,300	SY	$3.00	$57,900.00	
Erosion Control Mulch	9,500	SY	$2.00	$19,000.00	
Wetland Seed Mix	4,840	SY	$4.00	$19,360.00	
Woody Plantings	6,400	EA	$8.00	$51,200.00	
Tree Plantings	50	EA	$1,000.00	$50,000.00	
Construction – Virginia Ave. Conveyance					**$12,000**
Grassed Channel Re-establishment	400	LF	$30.00	$12,000.00	
Contingency (30%_					**$919,300**
TOTAL ESTIMATED BUDGET					**$3,983,632.90**

Assumptions

- Watershed (via StreamStats 6/12/2026) is 0.8 square miles (512 ac) south of State Route 211.
- Watershed (via StreamStats 7/22/2026) at Plains Elementary is 0.65 square miles (416 ac).
- Excavation volumes approximated at a 4 acre footprint and an average of 8 ft excavation depth. Calculations for design in further iterations will refine the volume estimates.
- Cost estimate does not include property acquisition.
- Flow path intercepted by proposed basin assumed not a perennial stream.

Presence of overhead power lines and 15" forced sewer line along southern side of State Route 211, in addition to substantial landowner easement coordination, assumed to preclude the alternative of installing buried 'bypass' to direct storm flow directly along the southern side of State Route 211, eliminating the loop to the north and its intersection with Virginia Avenue entirely. The costs associated with this design alternative could be evaluated in response to estimates presented here for BMP installation in the future.

Recommended Next Steps

Re-establish channel and clear culvert under Virginia Avenue. Evaluate pursuit of design for regional BMP.

References

USGS. StreamStats v4.33.0. Accessed online 1 June 2026.

VDOT Drainage Manual. 4/1/2002 rev. 7/8/2026 https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/technical-guidance-documents/drainage-manual/