Streets and Utilities Committee

MEETING AGENDA

Berryville-Clarke County Government Center

101 Chalmers Court, Second Floor

AB Meeting Room

Regular Session

April 25, 2023

3:00 PM

Item Page

1. **Call to Order**
2. **Approval of Agenda**
3. **Unfinished Business**

   Discussion: Truck Traffic on South Church Street

   Discussion: Drainage Improvement Projects in the Area of Dorsey, Treadwell, and Walnut Streets
4. **New Business**

   Discussion: Request from Owners of 214 East Main Street for Parking Restrictions East of Their Driveway Along North Side of East Main Street
5. **Other**
6. **Closed Session**
7. **Adjourn**

April 25, 2023
Discussion

Truck Traffic on South Church Street

History
The S&U Committee has discussed concerns about truck traffic on South Church Street (and adjoining streets – Josephine Street and Byrd Avenue) several times in the past. The Committee has discussed various restrictions that may be able to be adopted and most recently lead the effort to site signs on South Buckmarsh Street advising drivers that South Church Street is not suitable for tractor trailers. Dead End Street signs were also installed at the entrance of Josephine Street and Byrd Avenue.

Current request
S& U Committee Chair Harrison remains concerned about the level of tractor trailer traffic on South Church Street and wants the Committee to review the matter further to determine if there are other measures that can be employed to reduce tractor trailer traffic in the area.

Suggested action
Review the matter and forward any recommendation(s) that the Committee has on this matter to the Town Council.

April 25, 2023
Discussion

Drainage improvement projects in the area of Dorsey, Treadwell, and Walnut Streets

History
The Town Council authorized preliminary engineering studies to be completed for several areas of Town. The study reports are attached.

The Virginia Avenue project was approved for final engineering and included in a project offering that has been approved and is underway.

The other drainage improvements, for which some ARPA funding has been reserved, have not been approved for final engineering and bidding.

Current request
Review the attached evaluations and provide Town staff with direction as to how the Committee would like them to proceed with these proposed projects.

Suggested action
Review these projects and forward any recommendations that the Committee has on this matter to the Town Council.

Town of Berryville, Virginia

Northwest Quadrant Storm Study

Evaluation of Alternatives

June 20, 2019
Revised August 5, 2019

Prepared By:
Pennoni Associates, Inc.
Winchester VA

Table of Contents

Executive Summary

In 2018, from May through December, the Town of Berryville received 54.4 inches of rain. The average rainfall for this same period is 26.5 inches. So far in 2019, 27.5 inches have fallen in Berryville, the average January through July rainfall is 22.1 inches. Prompted by this record rainfall from May 2018 through June of 2019, the Town of Berryville has initiated a storm water management study in the northwest quadrant of the Town. Pennoni Engineering has reviewed five sites identified by citizens, Town elected officials and staff:

1. Ashby and Archer courts and impacts to Walnut Street (Area A);
2. Jackson Pond and downstream properties (Area C);
3. The intersection of Dorsey and Academy streets (Area B);
4. Properties along Dorsey and Treadwell streets (Area B); and,
5. Drainage swale 311 Treadwell to 304 West Main Street (Area C).

After reviewing several options for mitigation in each location, Pennoni recommends the following actions:

1. Ashby Court and Walnut– In order to avoid prolonged ponding and provide for positive drainage from the area, two improvements should be considered
   A. At the end of Ashby Ct, the west trap discharge weir should be relocated to drain to the east and a second trap which currently overflows to the south.
   B. Below that discharge, install an underdrain through three lots on Walnut Street and then along the shoulder on the north side Walnut Street. The new conveyance system will discharge directly to the existing storm inlet above and area impacted by a 100-year flood plain.
2. Jackson Pond – Since the current peak flow rates into and out of the Pond are currently far below the original condition two improvements that increase the discharge rate should be considered:
   A. The discharge structure should be replaced to provide a larger control orifice which will significantly reduce the detention time in the pond and only increase the discharge rate for a short period.
   B. A second discharge structure can be installed at a higher elevation, near West Main Street, to shift additional stormwater volume to the Town Run watershed.
3. Academy Street – To cure a ponding issue on the west side of Dorsey, north of Academy, a storm sewer system should be extended across that intersection discharging to the 12" culvert, 140 feet to the south.
4. Dorsey and Treadwell – Though two of the culverts that drain the area under Dorsey have been cleared, the runoff flow is hindered by roadside ditches and a downstream culvert which have been filled with sediment. The Town should consider replacement of the three culverts which drain the intersection and re-grading the Treadwell roadside ditches. To mitigate the flow now making it way south of Treadwell, a level spread should also be installed.

5. Drainage Swale B1 – in order to address the ponding within the swale which drains over 50 acres, the Town should consider installation of an underdrain and concrete ditch from below the discharge proposed below Treadwell in Item #4 above, to a 24" culvert under West Main Street. Installation of this improvement will smooth the contours at the ditch invert and provide a means to drain the flatter areas which currently cannot drain.

This document contains a detailed description of each of the mitigation options identified by Pennoni; maps of the respective locations; and detailed cost estimates. The Study scope did not include survey but relied on the available property line information from the Clarke County GIS. During your review it is important to remember that this is not a final design plan. We would recommend surveys be conducted to establish existing drainage facility elevations and right of way and easement locations. This will allow the design of the actual improvements to be completed. In all the locations studied, because of the limited difference in elevation across the site, a project that provides for conveyance of the two- or ten-year frequency storm event would include major storm sewer extensions and road reconstruction. The scope of our Study was to suggest improvements that would convey flows from the more frequent, nuisance, storm events. We would suggest therefore that the scope of the final design plan should be conditioned on no negative impact on existing residential lots and avoidance of road construction to allow larger culvert crossings.

Pennoni looks forward to meeting with the Town staff to discuss out findings and recommendations in more detail. In the meantime, please feel free to let us know if you have questions.

Introduction

The Town of Berryville has engaged Pennoni Associates to study the drainage situation at two areas in the northwest quadrant of Town. All of these are generally downstream of Battlefield Estates and the runoff conveyed originates in those relatively new areas. This area of Town is developed as mostly older single-family homes, though some new homes have been approved in the area. Generally, the issue which causes most of the problems is the lay of the land. The ditches that drain the area are flat and shallow and many of the roadside ditches and culverts have become silted in over time. This results in lower velocities, backwaters and ponding. The Town is interested to see if some of the main areas of concern can be addressed.

We were asked to prepare reports on conditions just south of the Ashby Court cul-de-sac and the Jackson Pond discharge routing, which crosses Dorsey and theoretically drains down to the 24" culvert at 304 West Main Street. We have attached a map showing these study areas, the attached Overall Area Plan. Additionally, as a part of the Jackson Pond evaluation, the drainage conditions at Dorsey and Treadwell was to be reviewed to see if a solution can be found to the ponding experienced at that intersection. Each of these areas is discussed here and exhibits provided as attachments to the report. In order to support our preliminary design and supplement the existing five-foot contour mapping available on the County GIS, we have obtained two-foot contour Lidar based mapping. Lidar is airborne laser mapping that creates a digital elevation model of the Earth's surface. This data is available to the public through the Virginia Geographic Information Network (VGIN).

Ashby Court Cul-de-sac

As a part of the Battlefield Estates project, Ashby Court was developed on the south side of Mosby Blvd. At the south end of the cul-de-sac, behind 300 and 301 Ashby Ct., two permanent sediment trap/level spreading devices were installed. The cul-de-sac to the west, Archer Ct, drains to the trap at the west end of 301 Ashby and the common drainage area between the rear yards on Archer and Ashby drains directly to the trap on the east end of 300 Ashby. Both are covered by the 30 ft drainage easement which runs along the rear property line. The drainage areas and trap locations are shown on Study Area Plan, Area A.

The west trap was designed and constructed to discharge to the rear yard of 308 Walnut Street. Based on a review of the available topographic mapping, that flow eventually would run across the rear yard of 306 Walnut, making its way through the side yards to Walnut Street. The eastern trap discharges directly to the rear yard of 306 Walnut Street, and then through the side yard to Walnut Street.

The owner of 308 Walnut (downstream of the west trap), placed fill in their rear yard a number of years ago which caused the western trap to back water and pond continuously. The Town asked that Pennoni recommend a solution to his issue.

We recommend utilizing the existing 30' drainage easement, located at the rear of 300 and 301 Ashby Ct, to relocate the overflow weir on the west trap, which now drains to the south, to drain to the east as shown on Study Area Plan, Area A. This would continue to take advantage of the peak flow mitigation provided by the west trap but direct the discharge across the drainage easement to the eastern trap. That eastern facility would continue to discharge to the south through 300 Walnut.

Since the discharge is to unimproved channels, the evaluation storm event would be that occurring every two years. During the two-year storm the peak discharge from the western trap to 308 Walnut is estimated at 6.0 cfs. The flow from the eastern trap to 306 Walnut is estimated at 5.7 cfs. With the suggested grading revision, the flow from the western trap would no longer discharge to 308 Walnut, but to the eastern trap and the total discharge from that corner would be 11.7 cfs. We have increased the time of concentration for that Archer Ct drainage area to try and account for the effect on travel time caused by needing to run through two trap devices instead of one. It is important to note that though the peak flow to 306 Walnut is increased at the east trap discharge, this is the same volume that makes it way to this point under the current condition. The flow quantity which drained to Walnut will be the same before and after this suggested diversion.

There are however two concerns with the discharge from Ashby Court. It appears that there is a depression in the existing swale that drains through 306 Walnut and thence to the north side of Walnut. A roadside inspection confirmed the presence of a mild depression in the rear yard of 300-306 Walnut. The nearest storm sewer is located to the east, approximately 800 feet from this low area. There is an estimated 18" deep grated inlet near the corner of 214 and 216 Walnut. We estimated the inlet rim at elevation 701 feet. The average slope of this "swale" is about 0.9%, though the upper reach slopes at about 0.6%. Additionally, we need to point out that over a majority of the road length there exists a paved/gravel shoulder to support parallel parking on the north side of Walnut. To install a storm sewer along this area would be very difficult due to the elevation of the downstream inlet, the flat ditch slope and the existing paved parking area. Because of the shallow and flat ditch, there is no room to provide cover on a new storm pipe. In order to avoid the standing water situation, we believe an underdrain would work best and not interfere with the off-street parking area. We have shown that drain on the Walnut Street profile, Sheet 3. It would be installed at the north edge of the parallel parking area. An easement is required. That underdrain detail is shown on Sheet 4.

We have estimated the cost of the diversion through 300 Ashby and 301 Ashby at $2,261. The underdrain from 306 Walnut to the 18" grate inlet is estimated to cost $51,316. The total cost of the construction project is estimated at $53,577. The estimate of the total cost is attached at the end of this report.

Dorsey and Treadwell

The intersection of Dorsey and Treadwell has recently been subject to ponding water on the roadway. This area is plagued by roadside ditches with almost no slope. Ditches on either side of Treadwell appear to have been silted in over the years causing the existing culverts to become non-effective. There is a significant drainage area to this point. Land that is north of Treadwell, both east and west of Dorsey drain to the intersection. The drainage areas are shown on Study Area Plan, Area B. Runoff arrives at the intersection from three points. A large area from the northwest, a smaller area from the northeast and basically the Treadwell right of way from the southwest. There are existing corrugated metal pipe (CMP) culverts under Dorsey, on both the north and south side of Treadwell. Though some flow may enter the culverts on the west, the ditch elevations on the east side prevent any quantifiable discharge to flow to a roadside ditch. From Dorsey the flow should be making its way east to the low point of Treadwell at the western (rear) property line of 106 Dorsey which is common to the western side property line of 311 Treadwell. The area from both the northwest and northeast should flow along the north side of Treadwell and cross to the south of Dorsey through an existing CMP. This culvert is silted in on the south side and we assume allows no flow to discharge.

We believe the issue is the ditch elevations along the south side of Treadwell between Dorsey and the Treadwell low point. There is in fact no ditch there. Though based on the installation depth of the existing culverts, there probably once was.

To correct the drainage situation along these roadways, we would recommend 12" RCP pipes be installed in place of the existing CMPs and the ditches between Dorsey and the Treadway low point, on both sides of Treadwell, be regraded to provide positive flow from the intersection to the east and south. The existing culvert elevations should be matched as closely as possible. We are recommending concrete pipe due to the limited cover available to distribute wheel loads.

The issue then is what to do with this stormwater which now arrives at the western, side property line, of 311 Treadwell. This is basically where the drainage runs now, but with very limited success. There is indication of some low areas and ditch flows along the side property line but not much flow control is provided. In theory a ditch should be graded along that side property line allowing this flow from Treadwell and Dorsey to run to the south,

eventually reaching the long flat, west to east, channel that drains Dorsey and Academy (and the Jackson Street Detention Pond discharge) to the east. This downstream channel is evaluated in the next "Jackson Pond" section of this report. The other issue is the development in the rear yard of 311 Treadwell. There are typical yard fixtures and an existing shed in the back that would make controlled routing of the flow through the yard difficult without impact to the yard. However, that is where the runoff goes now.

There is one alternative to running down the west side of 311 Treadwell. That would be to run this flow east along Treadwell, across the front of 311, and then turn down the eastern side property line, discharging at the back of the lot. Because of the cut required, we would recommend extension of a storm sewer around the lot. A ditch would need to be at least 3-4 ft deep at the northeast lot corner and that final grading would seriously impact the adjacent properties. This diversion, like any other solution evaluated, would end up concentrating flow at some point, where there is not currently concentrated discharge. Therefore, a level spreader would need to be installed at that outlet as well. These locations are shown on the Study Area Plan, Area B.

The cost estimate for this works is as follows.

To replace CMP culvert, required ditches and install level spreader	$50,111
To Divert the flow around the northeast corner of 311 Treadwell	$37,980
Total Cost	$88,091

We would recommend the least expensive option which is to replace the culverts and regrade the ditches as suggested above, bringing drainage area runoff to the south side of Treadwell at the west side of 311 Treadwell. At that point we would recommend a level spreader be provided to allow concentrated flow to dissipate and slow velocities prior to flowing to the south along the property line and working its way through the rear yard area. Easements would need to be acquired to allow the level spreader to be installed on 311 Treadwell. This location is shown on Study Area Plan, Area B. The cost estimate detail for this proposal is provided. The estimate breaks down the construction cost of the suggested improvement at $50,111. It also provides the detail on the diversion alternative and the Plan design fees.

In the following "Jackson Pond" section we address the conveyance of this flow, from the level spreader to West Main Street. The ditch through 311 Treadwell is at the upper reach of Swale B1. The slope of this section is 0.9%, which is generally able to support overload flow. Swale B1 is for the evaluated below.

Jackson Pond and conveyance to 304 West Main.

The Dorsey and Treadwell area, and the improvement recommended there, would drain directly to Swale B1. Below the upper reach described above, there is a broad 700 ft long swale that drains directly to West Main Street. At that point a 24" culvert conveys it across West Main Street to Town Run. This channel profile is shown on Sheet 3 and labelled Swale B1. The average slope of the lower 700 ft reach is 0.6%. A grass channel at this slope would have difficulty passing low flows.

The other areas which drain to this Swale extend from West Main to Dorsey and from the Battlefield Estates boundary in the west, to Smith Street. Most of this area, to the north and south, is direct runoff from the residential lots. This is basically sheet and shallow concentrated flow across areas with adequate slope. There is also a point source discharge from the Jackson Street Detention Pond which was originally constructed as a part of the Battlefield Estates subdivision. This pond discharges near the west end of Academy and then drains via a shallow ditch to Dorsey, then across the rear of a few lots to Swale B1. The shallow channel from Jackson Pond to Swale B1 has also been profiled and is labelled Swale B2. See Sheet 3.

The discharge from Jackson Pond has undergone changes since its installation. Originally configured as a sediment basin through construction, it actually retained that set up until just recently converted to its final design status in 2018. The flow to the pond never reached actual design capacity. The original plan called for about 109 acres of future Battlefield Estates development to drain to Jackson Pond. The ten-year peak inflow to the pond would be 130 cfs and using two 3" control orifices and riser provided in the original design, the pond would detain that flow releasing it at a rate of 82 cfs. The total volume of runoff passed through the pond for the two-year frequency storm would be 546,516 CF. Of course, the final sections of Battlefield Estates were never developed as intended and instead the new Clarke County High School was constructed on that land. That High School design included its own detention pond and instead of discharging to the Jackson Pond and our Swale B2 as originally planned, that discharge was taken to the south side of West Main and eventually flows directly to Town Run. Based on the available information, we estimate that 29 ac now drain to Jackson Pond. We have estimated that if the Jackson Pond conditions remains as it is now, the revised inflow to the pond for that same ten-year storm would be 80 cfs. The reduced discharge would be 1.2 cfs and the total volume through the pond would be 213,899 CF. The construction of the high school property has reduced the total volume of runoff to Swale B2 by about 61%.

Currently the lower reaches of Swale B1 are susceptible to water ponding largely due to the generally level, softly sloping terrain which characterizes this length of ditch. During 2018, there were observed longer periods of higher

flows and extended periods of ponding. Much of this can be attributed to twice the normal annual rainfall for that year, but the Town also wants to identify anything that can be done to reduce the flooding impacts to the area.

Pennoni first looked at the Jackson Pond. With the diversion of the runoff from the 80 acres west of Jackson Drive (High School Site) to Town Run as discussed above, the flow to the pond is significantly reduced. We originally considered installing a new outlet structure and providing only one 3" discharge orifice. Modeling this change showed basically no change in the ten-year discharge as the detained water surface elevation overflows the riser structure, which is typical for a ten-year storm design. Because the ten-year flow overtops the riser, the orifice size has little impact on discharge. The total volume discharged to the swale below would remain the same at 213,899 CF regardless of the outlet control provided. We also checked the time for the pond to completely drain. Typically, the drawdown period is kept around 48 hours. The current condition, with two 3" orifices, resulted in a draw down period of 4.1 days. If we go to only one 3" orifice, the draw down period would extend to 7.1 days. The longer water remains in the pond, the higher the risk of sinkholes forming or mosquito breeding. One option to reduce the detention time would be to increase the orifice size. With a 6" orifice, the detention time would be reduced to 2.5 days, but the tradeoff is that the discharge for the two-year storm would increase from 1.2 cfs to 1.66 cfs. The volume discharged would remain the same.

In order to try and reduce the total volume to Swale B2, we have also looked at diverting some portion of the flow to the south side of West Main and Town Run. The existing storm sewer which was installed in West Main with the School construction is higher than the pond bottom, but the elevations would allow some portion of the Jackson Pond discharge to be shifted south. We have estimated that a new outlet structure, with a 6" orifice at West Main about 109,402 CF of runoff could be shifted out of the Swale B2 drainage area over to Town Run. This by itself would slightly increase the ponding period to 4.8 days if the existing control outlet was to remain unchanged at 3". Under this scenario, the peak two-year discharge to B2 would be still be 1.2 cfs, since the riser would be overtopped. The volume of flow to B2 would be 104,497 CF, a reduction of 109,402 CF.

The Town should be careful with this transfer. The scope of this study did not include an analysis of Town Run's condition. We understand that there are portions of Town Run which are prone to flooding now. By adding new flow, to that previously diverted from the high school site, those Town Run conditions would probably not improve. But, the flow to be diverted is very small relative to the total Town Run watershed and may be able to be accommodated. This diverted discharge to B2 would eventually reach Town Run, but much lower in the channel, near the Smith Street intersection. The final design of any improvement should include an analysis of the downstream storm sewer. Going with this diversion, there is a slight increase to the detention time to 4.8 days, since the discharge would not crest the riser under this scenario.

After the Jackson Pond discharges to Swale B2, this ditch drains within an existing easement through the residential lots between West Main and Academy. The channel does come out of the easement just below the pond discharge and crosses over 411 Academy. Currently there is a 1% slope through the backyard. If the ditch is regraded to follow the alley and easement, the slope would be reduced in this area to about 0.8%. The Town should consider obtaining an easement to cover the existing flow path as it appears the existing ditch works well. Beyond 411 Academy, the ditch appears to stay within the easement until Dorsey. A 12" culvert does carry this flow across Dorsey. This culvert appears to operate satisfactorily. Below the pipe a "V" ditch does exist, centered on the property line. At the center of the ditch, a fence has been installed and dense vegetation has grown up through the fence on both sides. We believe that while the fence alone may not be a major restriction, the additional landscaping does impede flow through the backyards of 332 West Main and 12 Dorsey. We would recommend that the Town clean out the fence growth to allow the runoff to pass more easily. B2 then continues, following the easement to an intersection with B1. The slope of this swale is about 0.8%

There is also a drainage area which should drain to the Dorsey culvert from the north. At Academy, however, there is currently no way for this runoff to cross Academy and drain to the Dorsey culvert. To avoid major disturbance of yards, we would propose a small, 8" diameter HDPE pipe, to run from the north side of Academy all the way to the Dorsey culvert. This would avoid a need for a graded ditch across 11 Dorsey, and a major disturbance in the front yard 404 Academy. This new pipe could be installed within the existing right-of-way, although a temporary construction easement should be obtained.

Because of the flat slope of the Swale B1 below the intersection with B2, there is not enough depth from the invert of the culvert at West Main to the invert of the channel to install some sort of storm sewer system which could convey the storm flow underground. In order to have the peak flows pass as quickly as possible, we need to maintain whatever slope is available on the channel. One option to prevent ponding is to construct a concrete channel lining along the length of the swale. This type of improvement is sometimes installed within detention ponds with very flat bottom slopes. The concern we have is that the concrete channel slope can only be as steep as the existing grade, so portions of its length will be as flat as what exists now, and water will continue to pond in those areas as it does currently. The benefit is that it will eventually drain. It should be noted that, it is not unusual to have differential settlement of the yard areas outside of the concrete lining take place, preventing the yard runoff from flowing directly to the channel. We've provided a schematic detail of the concrete invert on Sheet 4.

We also looked at a berm system to contain the flows from upstream through the lower yard areas and confine any ponding between the berms. The challenge with this scenario is how to drain the yard areas as any break in the berm will allow the channel flow to back up into the yards. We detailed this option schematically on Sheet 4.

It does appear that there is some slope on the existing channel and that the higher peak flows can pass through to West Main. The primary issue is the ponding. We recommend that the Town consider an underdrain system which leaves the existing channel intact and would provide a subsurface drain that would allow ponding water to seep into the underdrain to be carried to West Main. The construction of the underdrain will also regrade the invert of the existing channel to remove any intermittent high spots and improve overall flow conditions.

We have estimated the costs of the various improvements as follows:

Jackson Pond

- Provide new outlet control structure to West Main storm sewer with a new outlet to B2 - $12,600

Swale B1

- Install underdrain and concrete ditch lining along channel invert - $53,066
- Academy Street Diversion - $12,040

Based on these costs we believe the most effective approach on swales B2 & B1 is to provide two new outlets at Jackson Pond, one to discharge to West Main, and one to discharge to B2 ($12,600); extend the HDPE along Dorsey ($12,040) and install the underdrain along the lower reach of B1, from the B2 connection to 304 West Main for a Total Cost Estimate of $77,706.

Pennoni Associates Inc.
Project: Town of Berryville - NW Stormwater Study
Ashby Court Sediment Trap Conversion
Walnut Street Drainage Improvements

EXHIBIT
Study Area A, Cost Estimate
Date 8/5/2019

EARTHWORKS				
REGULAR EXCAVATION	CY	20	$18	$360
UNSUITABLE MATERIAL DISPOSAL	CY	15	$17	$255
GRADING	SY	50	$8	$400
PERMANENT SEED	SY	50	$3	$150
EROSION AND SEDIMENT CONTROL				
SILT FENCE (EC-5, TYPE A)	LF	100	$3	$250
SOIL STABILIZATION BLANKET, (EC-2, TYPE 3)	SY	50	$4	$200
SUB TOTAL				$1,615
Ashby Trap Diversion Total with Mobilization And Contingency -			$2,261	
UNDERDRAIN				
VDOT #57 STONE	TN	85	$18	$1,530
UNSUITABLE MATERIAL DISPOSAL	CY	37	$12	$444
6" PERF. PVC	LF	945	$30	$28,350
CLEANOUTS	EA	4	$125	$500
FILTER FABRIC	SY	160	$3	$480
GRADING	SY	50	$12	$600
PERMANENT SEED	SY	50	$3	$150
STABILIZE POWER POLE/GUY	LS	1	$2,500	$2,500
CONNECTION TO EXISTING INLET	LS	1	$350	$350
INLET PROTECTION	LS	1	$250	$250
TREE TRIMMING	LS	1	$1,500	$1,500
SUB TOTAL				$36,654
MOBILIZATION @ 20%				$7,654
CONTINGENCIES @ 20%				$7,654
TOTAL COST ESTIMATE				$53,577
OTHER COSTS ASSOCIATED WITH THE PROJECT				
SURVEY				$8,000
DESIGN AND EASEMENTS				$12,000
BIDDING AND CONSTRUCTION ADMINISTARTION				$6,000
TOTAL				**$26,000**

Pennoni Associates Inc.
Project: Town of Berryville - Stormwater Study
Subject: Dorsey and Treadwell Renovation

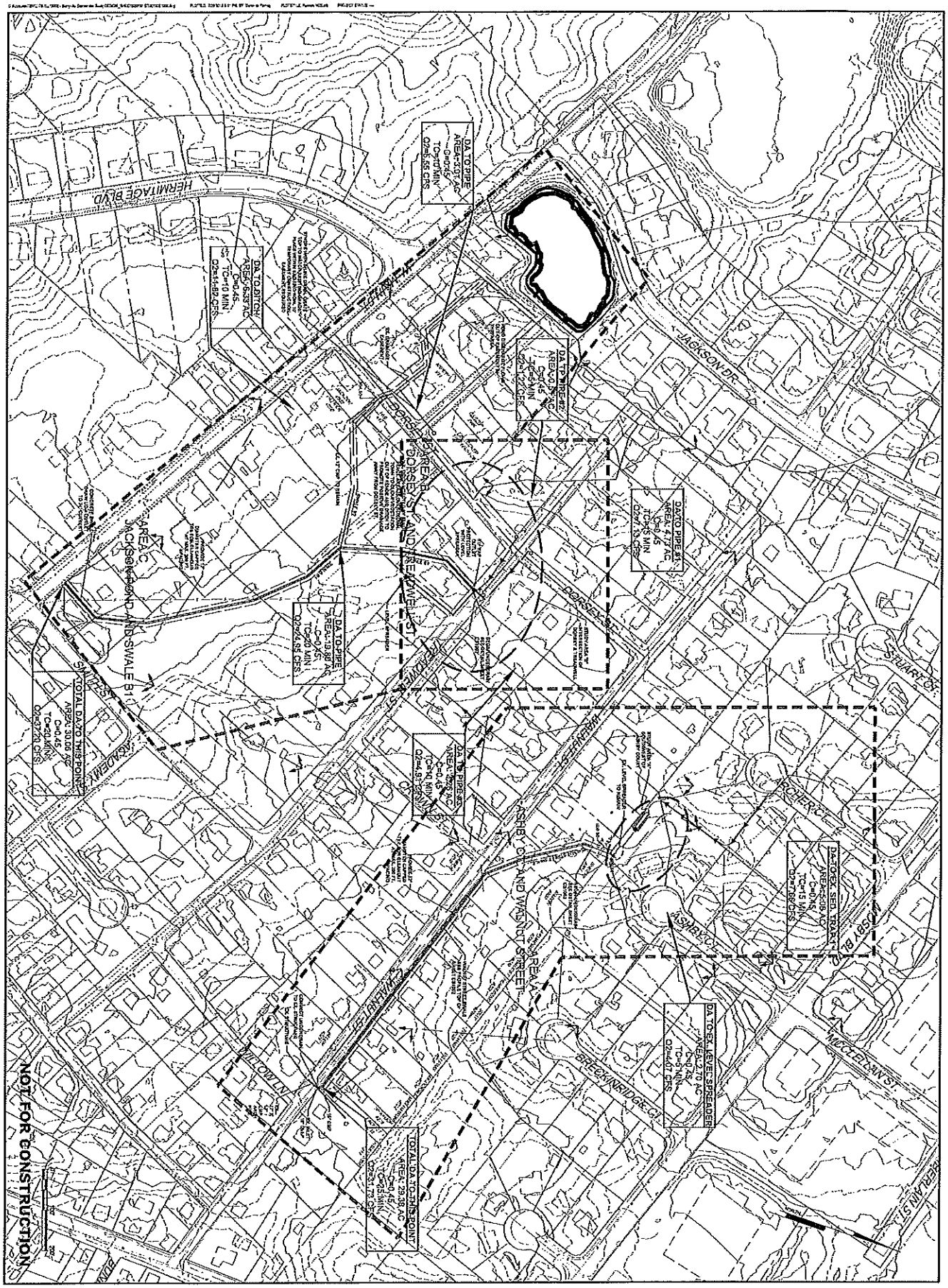
EXHIBIT
Study Area B, Cost Estimate
Date 8/5/2019

DEMOLITION	**UNIT**	**QTY**	**PRICE PER**	**PRICE TOTAL**
REMOVAL OF EXISTING DRAINAGE PIPE(3 CMP)	LF	66	$45	$2,970
PAVEMENT				
SURFACE COURSE - SM-9.5D	TON	9	$85	$765
INTERMEDIATE COURSE - IM-19.0D	TON	9	$100	$900
AGGREGATE BASE - NO.21B	TON	20	$18	$368
TACK COAT	GAL	3	$4	$11
EARTHWORKS				
REGULAR EXCAVATION	CY	50	$18	$900
UNSUITABLE MATERIAL DISPOSAL	CY	40	$17	$680
GRADING	SY	180	$8	$1,440
PERMANENT SEED	SY	180	$3	$540
TRAFFIC CONTROL				
LANE CLOSURE	LS	1	$4,500	$4,500
DRAINAGE				
STORM SEWER, CONC. PIPE, 12"	LF	66	$45	$2,970
VDOT STD ES-1, 12"	EA	6	$700	$4,200
EROSION AND SEDIMENT CONTROL				
SILT FENCE (EC-5, TYPE A)	LF	20	$3	$50
SOIL STABILIZATION BLANKET, (EC-2, TYPE 3)	SY	400	$4	$1,600
CULVERT INLET PROTECTION	EA	3	$300	$900
LEVEL SPREADER	EA	1	$5,000	$5,000
UTILITIES				
RELOCATE STABILIZE POWER POLE/GUY	LS	1	$5,000	$8,000
TOTAL BID AMOUNT				$35,794
CONTINGENCIES @ 20%				$7,159
CONTINGENCIES @ 20%				$7,159
SUB TOTAL				$50,111
ADDITIONAL COST TO EXTEND CULVERTS TO EAST AND SOUTH				
STORM SEWER, CONC. PIPE, 15"	LF	230	$115	$26,450
VDOT STD ES-1, 12"	EA	2	$850	$1,700
VDOT MH-1	EA	1	$3,500	$3,500
TOTAL BID AMOUNT				$31,650
CONTINGENCIES @ 20%				$6,330
SUB TOTAL				$37,980
TOTAL COST ESTIMATE				**$88,091**
OTHER COSTS ASSOCIATED WITH THE PROJECT				
SURVEY				$8,000
DESIGN AND EASEMENTS				$12,000
BIDDING AND CONSTRUCTION ADMINISTARTION				$5,000
TOTAL				**$25,000**

Pennoni Associates Inc.
Project: Town of Berryville - NW Stormwater Study
Jackson Pond, Swale B1

EXHIBIT
Study Area B, Cost Estimate
Date 8/5/2019

ACADEMY LANE CULVERT EXTENSION				
ROAD CROSSING				
SURFACE COURSE - SM-9.5D	TON	2	$150	$300
AGGREGATE BASE	TON	5	$22	$110
TACK COAT	GAL	2	$4	$7
EXCAVATION				
REGULAR EXCAVATION	CY	5	$18	$90
UNSUITABLE MATERIAL DISPOSAL	CY	3	$12	$36
GRADING	SY	12	$8	$96
PERMANENT SEED	SY	12	$3	$36
TRAFFIC CONTROL				
LANE CLOSURE	LS	1	$2,500	$2,500
RELOCATE STREET SIGN	LS	1	$350	$350
DRAINAGE				
8" HDPE	LF	135	$35	$4,725
INLINE TEE WITH GRATE	EA	1	$350	$350
SUB TOTAL				$8,600
Academy Street Total with Mobilization And Contingency -			$12,040	
DRAINAGE SWALE B1				
VDOT #57 STONE	TN	88	$18	$1,584
UNSUITABLE MATERIAL DISPOSAL	CY	50	$12	$600
6" PERF. PVC	LF	1,010	$30	$30,300
CLEANOUTS	EA	5	$125	$625
FILTER FABRIC	SY	170	$3	$510
GRADING	SY	75	$12	$900
PERMANENT SEED	SY	75	$3	$225
CONCRETE INVERT	SY	6	$60	$360
VEGETATION REMOVAL	LS	1	$750	$750
EROSION AND SEDIMENT CONTROL				
ROCK FILL CHECK DAMS	EA	5	$250	$1,250
SOIL STABILIZATION BLANKET, (EC-2, TYPE 3)	SY	100	$4	$400
CULVERT INLET PROTECTION	EA	1	$400	$400
SUB TOTAL				$37,904
SUB TOTAL				$46,504
MOBILIZATION @ 20%				$9,301
CONTINGENCIES @ 20%				$9,301
TOTAL COST ESTIMATE				**$65,106**
ADD ALTERNATE FOR REDUCED VOLUME				
JACKSON POND				
4 FT DIA. MH	EA	1	$3,500	$3,500
TRASH RACK AND DEBRIS CAGE	EA	1	$650	$650
GROUT EX. CULVERT	CY	4	$300	$1,050
STABILIZATION	LS	1	$350	$350
DIVERSION TO WEST MAIN				
4 FT DIA. MH	EA	1	$3,500	$3,500
TRASH RACK AND DEBRIS CAGE	EA	1	$650	$650
12" PVC CULVERT	LF	80	$50	$4,000
CONNECTION TO EXISTING STRUCTURE	EA	1	$500	$500
STABILIZATION	LS	1	$350	$350
SUB TOTAL				$9,000
CONTINGENCIES @ 20%				$1,800
MOBILIZATION @ 20%				$1,800
TOTAL COST ESTIMATE				**$12,600**
TOTAL COST ESTIMATE WITH ALTERNATE				**$77,706**
OTHER COSTS ASSOCIATED WITH THE PROJECT				
SURVEY				$10,000
DESIGN AND EASEMENTS				$18,000
BIDDING AND CONSTRUCTION ADMINISTARTION				$6,000
TOTAL				**$34,000**



CS1000

SHEET 1 OF 5

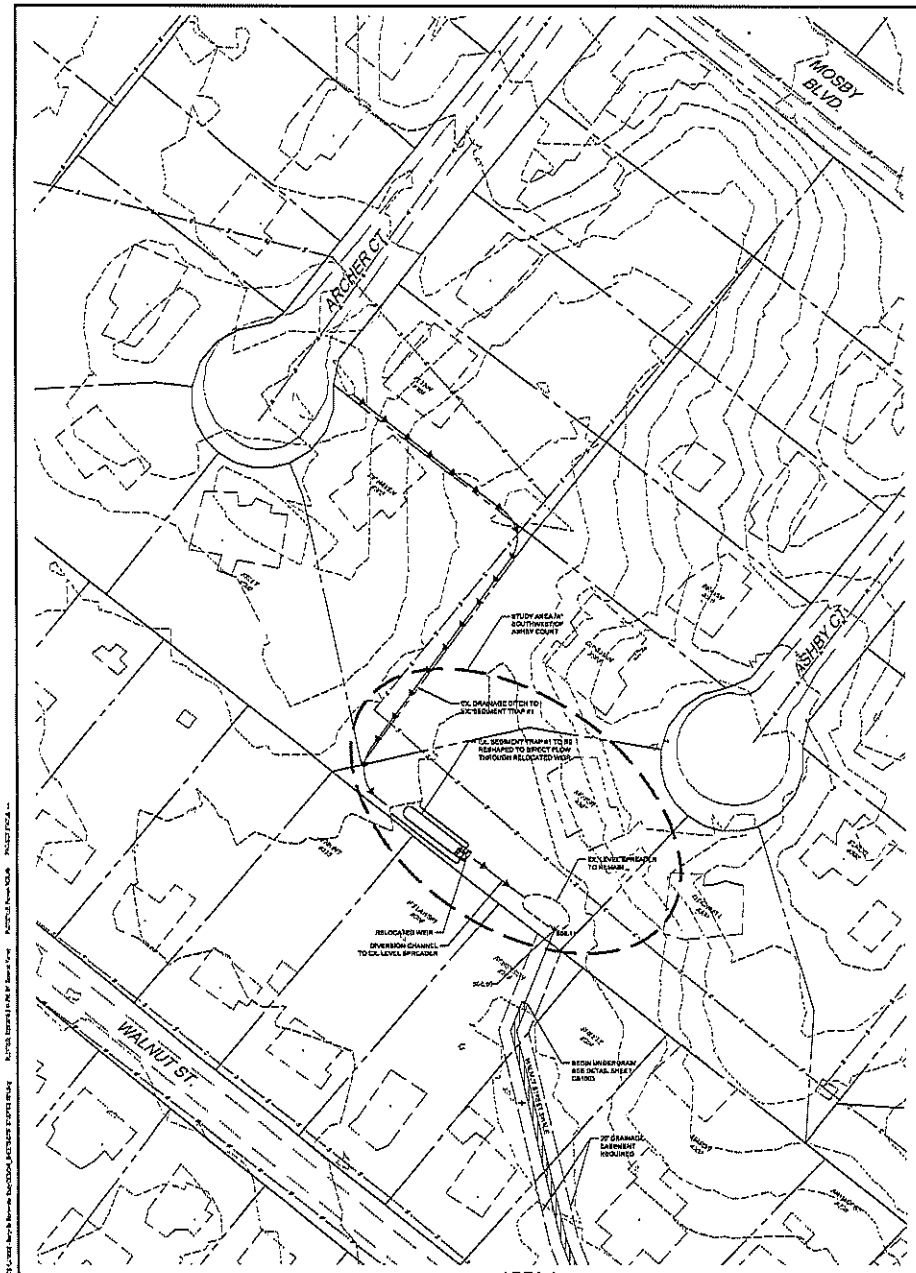
TOWN OF BERRYVILLE, VIRGINIA
NORTHWEST QUADRANT STORM STUDY

OVERALL AREA PLAN

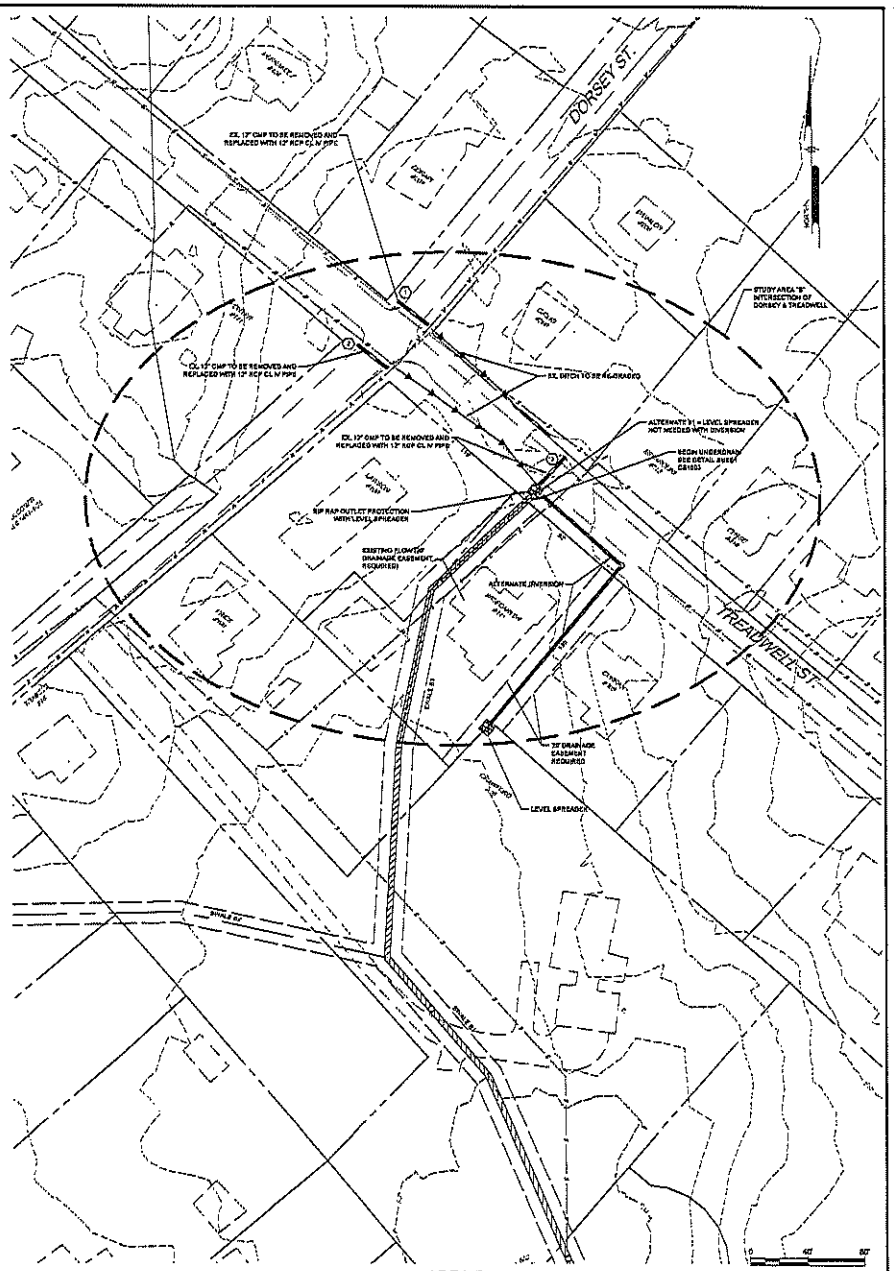
ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

Pennoni

PENNONI ASSOCIATES INC.
117 East Piccadilly Street
Winchester, VA 22601
T 540.667.2139 F 540.665.0493



AREA A
SOUTH OF ASHBY CT.



AREA B
DORSEY ST. AND TREADWELL ST.

NOT FOR CONSTRUCTION

Pennoni

PENNONI ASSOCIATES INC.
117 East Piccadilly Street
Winchester, VA 22601
T 540.667.2139 F 540.665.6493

ALL DIVERSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

TOWN OF BERRYVILLE, VIRGINIA
NORTHWEST QUADRANT STORM STUDY

STUDY AREA PLAN

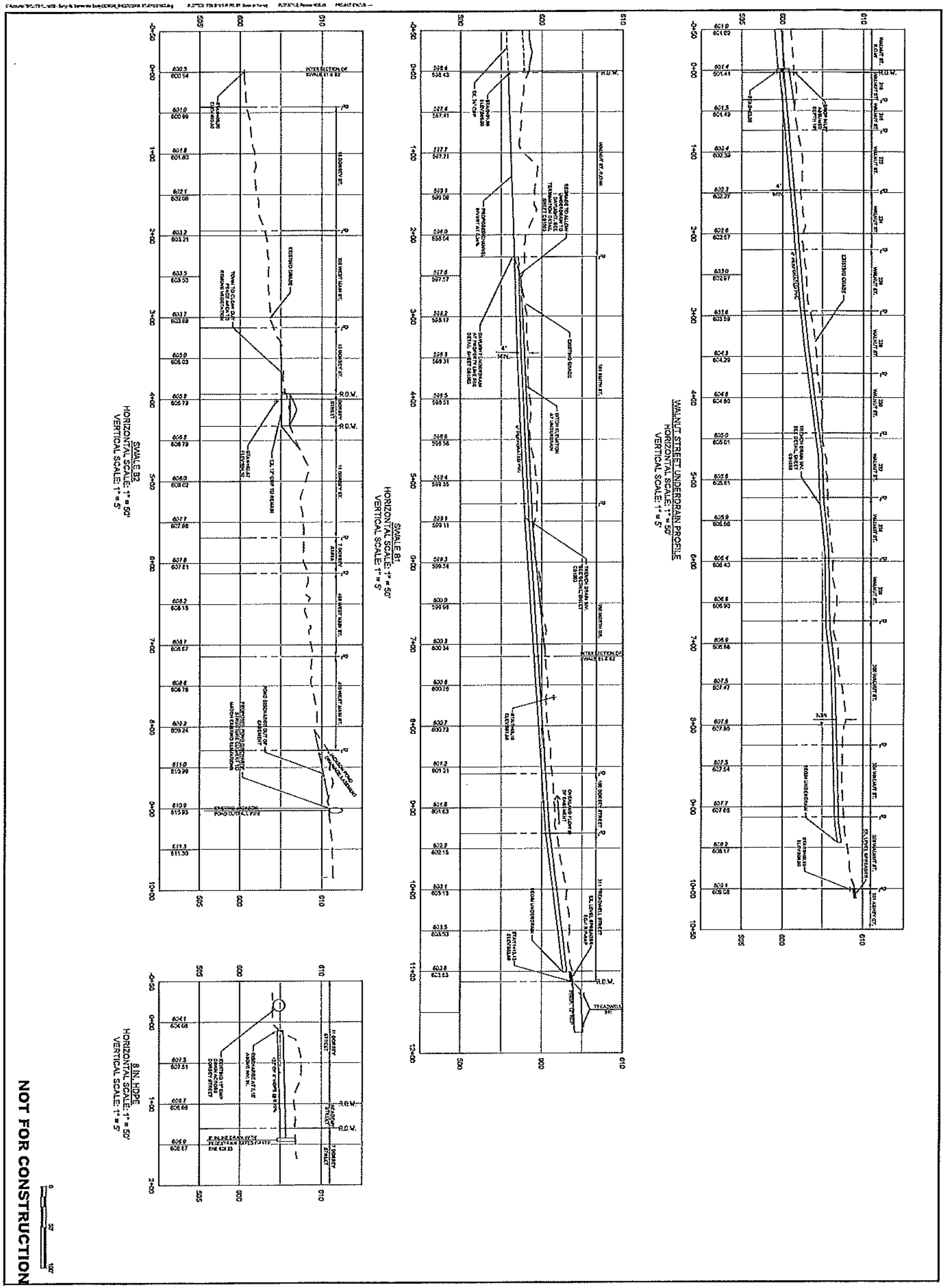
NO.	REVISIONS	BY	DATE

ALL DRAWINGS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT TO THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES. OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES INCLUDING ATTORNEYS' FEES ARISING OUT OF OR RESULTING THEREFROM.

PROJECT	TBVLL19002
DATE	2019-06-20
DRAWING SCALE	AS SHOWN
DRAWN BY	YLM
APPROVED BY	RAM

CS1001

SHEET 2 OF 5



TOWN OF BERRYVILLE, VIRGINIA
NORTHWEST QUADRANT STORM STUDY

SWALE PROFILES

ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

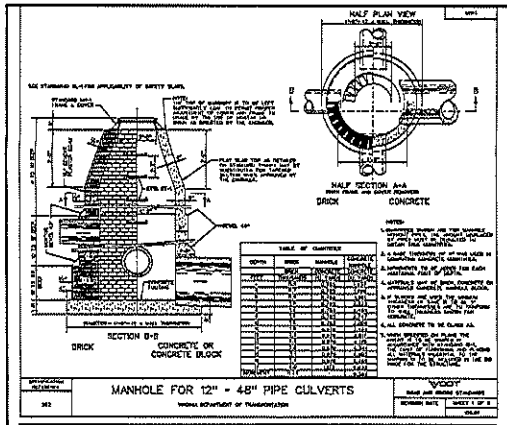
DATE	NO.	REVISIONS	BY

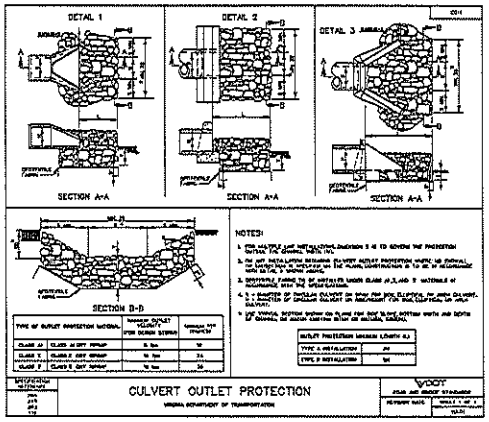
PROJECT: TBVLL19002
DATE: 2019-06-30
DRAWING SCALE: AS SHOWN
DRAWN BY: KLM
APPROVED BY: RAM

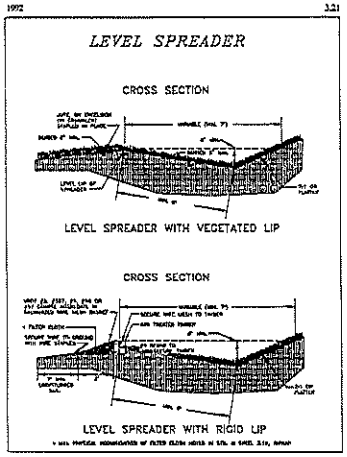
CS1002
SHEET 3 OF 5

Pennoni

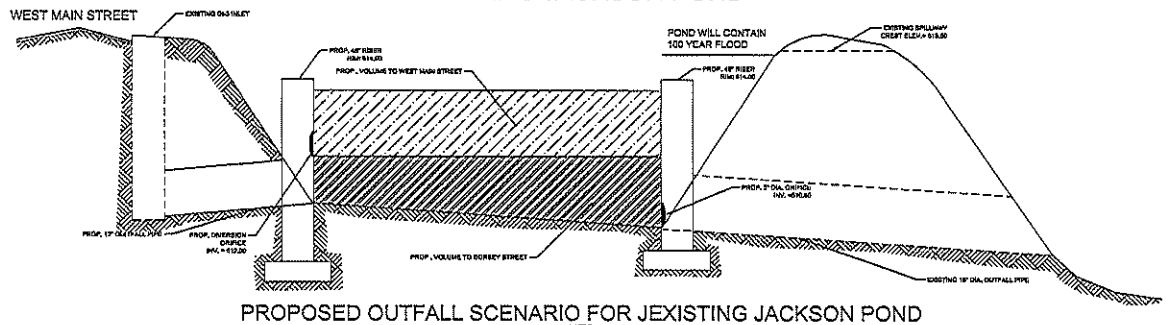
PENNONI ASSOCIATES INC.
117 East Piccadilly Street
Winchester, VA 22601
T 540.667.2139 F 540.665.0493



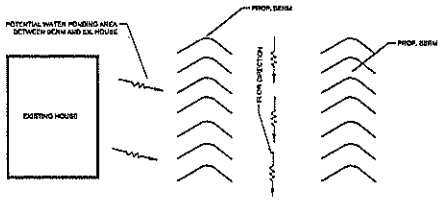




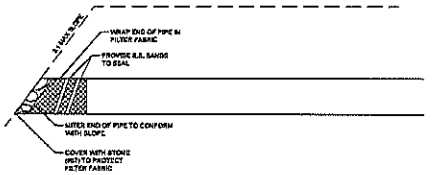
EXISTING JACKSON POND



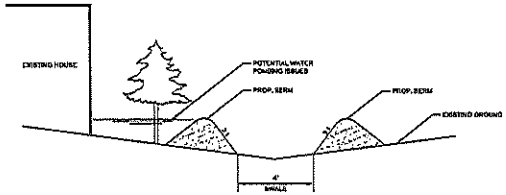
PROPOSED OUTFALL SCENARIO FOR JEXISTING JACKSON POND
NTS



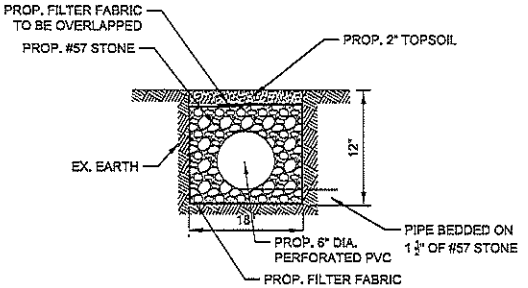
PLAN VIEW
BERM DIVERSION OPTION



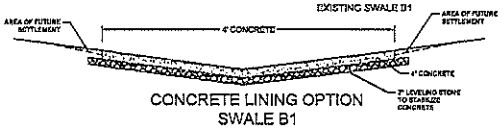
UNDERDRAIN OUTLET DETAIL
NTS



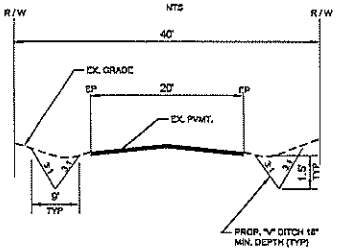
SECTION VIEW
BERM DIVERSION OPTION
NTS



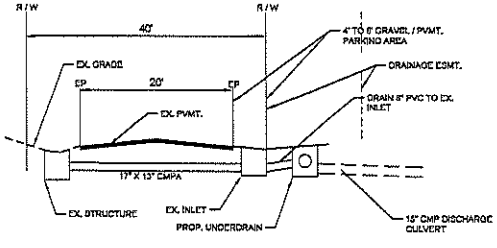
UNDERDRAIN DETAIL
NTS



CONCRETE LINING OPTION
SWALE B1
NTS



TYPICAL SECTION TREADWELL STREET
NTS



TYPICAL SECTION WALNUT STREET
NTS

NOT FOR CONSTRUCTION

Pennoni
PENNONI ASSOCIATES INC.
117 East Piccadilly Street
Winchester, VA 22601
T 540.667.2139 F 540.665.0493

ALL OVERSIGHTS MUST BE VERIFIED BY CONTRACTOR AND APPROVED BY ENGINEER PRIOR TO ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

TOWN OF BERRYVILLE, VIRGINIA
NORTHWEST QUADRANT STORM STUDY

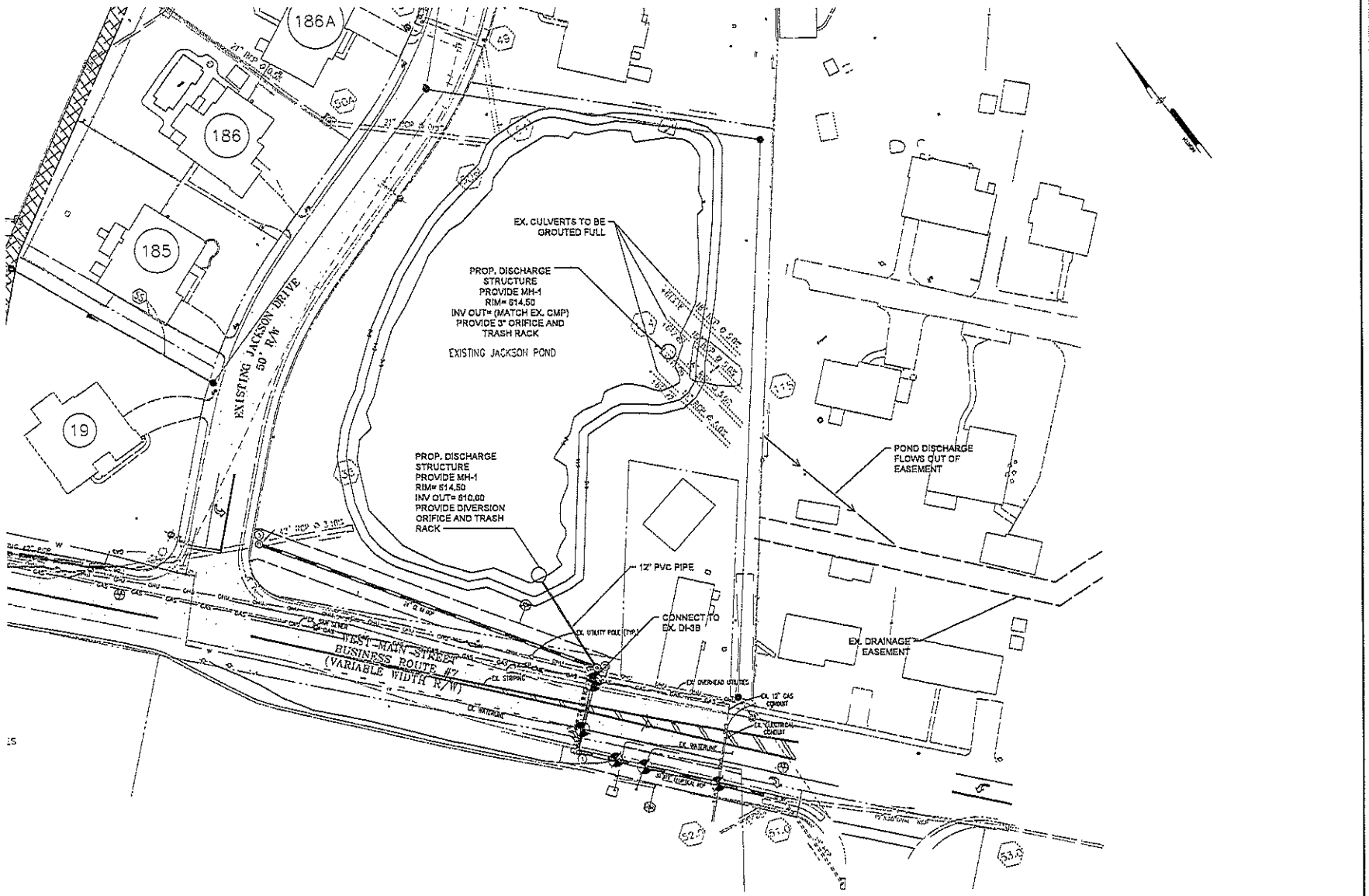
SWALE DETAILS

NO.	DATE	REVISIONS	BY

PROJECT	TBVLL19002
DATE	2019-06-20
DRAWING SCALE	AS SHOWN
DRAWN BY	KLM
APPROVED BY	RAM

CS1003

SHEET 4 OF 5



NOT FOR CONSTRUCTION

Pennoni

PENNONI ASSOCIATES INC.
117 East Piccadilly Street
Winchester, VA 22601
P 540.667.2139 F 540.665.0493

ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK.

TOWN OF BERRYVILLE, VIRGINIA
NORTHWEST QUADRANT STORM STUDY

SWM POND

NO	DATE	REVISIONS	BY

PROJECT	TBVLL19002
DATE	2019-06-29
DRAWING SCALE	AS SHOWN
DRAWN BY	KLM
APPROVED BY	RAM

CS1004

SHEET 5 OF 5

Town of Berryville, Virginia

Main Street Storm Sewer Study and Town Run Drainage Improvements

November 13, 2020

Prepared By:
Pennoni Associates, Inc.
Winchester VA

Table of Contents

Executive Summary

Pennoni has been tasked to analyze the storm sewer structures connecting the area northwest of Smith Street to the Main Street drainage system and the main channel at Lincoln Avenue. Also, an additional analysis of the storm sewer structures connecting Sub-System E , as outlined in the Dewberry Storm Report, to the Main Street drainage system and then to Town Run has been prepared. This analysis will determine the impact of the additional flow assumptions on the existing storm sewer systems that outfall into Town Run at the noted locations. A detailed description of the findings and site improvement recommendations have been provided below and throughout this report.

After performing a site investigation of the existing storm sewer system in these areas, and reviewing the previously approved Stormwater Management Report prepared by Dewberry and the Clarke County High School Plan prepared by Urban, Pennoni noted the following items:

1. West Main Street and Smith Street/Lincoln Avenue Analysis:

    - There is an existing end-section on the north side of West Main Street. It is noted as **86A** in the Stormwater Management Plan prepared by Dewberry.
    - A 24" RCP flows from **86A** to **86** then through another 24" RCP under West Main Street from **86A** to **87**.
    - From **87** the flow continues through an existing 30" x 48" storm sewer system, **87** to **84A** and **84A** to **97**. This system outfalls into an existing concrete channel adjacent to 12 Lincoln Avenue, which then outfalls into Town Run.
    - The above storm sewer pipes and concrete channel carry flow draining from the north and west of the noted Main Street intersection. The areas investigated and reviewed from previously submitted plans and reports include; Clarke County High School pond outfall, Jackson Pond outfall, Hermitage Pond Discharge, and overland flow from the Dorsey and Treadwell areas.

Pennoni has prepared a conceptual layout and supporting computations for the existing storm sewer system and for a proposed system to upgrade existing pipes that have been noted as inadequate in this area. It was determined, and is our recommendation that the existing 24" RCP under West Main Street be upgraded to a 24" x 38" elliptical pipe to adequately convey the additional 1-year and 2-year flow assumptions from the drainage areas northwest of Smith Street noted in the Dorsey-Treadwell study previously prepared by Pennoni. An elliptical pipe was proposed to eliminate the need for any extensive road improvements. A cost estimate has been provided later in the report for the installation of the proposed pipe.

Also, it was a finding during our analysis of the existing concrete channel at the Lincoln Avenue outfall, that no improvements will be required at this location since the calculated

depths of flow in the channel were determined to be adequate. Supporting computations have been provided for this channel in this report.

2. Sub-System E:

- There is an existing curb inlet on the north side of East Main Street. It is noted as **9** in the Stormwater Management Plan prepared by Dewberry, and has a total drainage area of 6.83 acres.
- A 15" CMP crosses under East Main Street from **9** to **10**.
- The structure noted as **10** is a grate inlet located in the flow line directly south on East Main Street, and has a total drainage area of 0.43 acres.
- It was noted during our site investigation that there is not a direct connection from **10** to Town Run, and there appears to be no discharge from this structure. The approved plan prepared by Dewberry specifies that the drainage from 10 flows to **R (Town Run)**.

Pennoni has prepared a conceptual layout and supporting computations for the existing storm sewer system and for proposed ALT A and proposed ALT B in this area. It was determined, and is our recommendation that the existing 15" CMP under East Main Street be upgraded to a 14" x 23" elliptical pipe to adequately convey the 1-year and 2-year flow assumptions from the drainage areas noted in the Dewberry study. This improvement was proposed with both ALT A and ALT B. An elliptical pipe was proposed to eliminate the need for any extensive road improvements. In addition, there appears to be no direct connection to Town Run to allow the flow from structure 10 to outfall. ALT A and ALT B were proposed as possible options to provide an outfall to Town Run. ALT A proposed a new storm sewer system from a new inlet that would replace existing structure 10 on the south side of East Main Street to outfall just upstream of the existing (5) 24" HP culverts. ALT B proposed a new storm sewer pipe from a new inlet that would replace existing structure 10 and outfall at the existing 5' W x 2' H concrete channel at Town Run. ALT A is recommended since it will have minimal impact to the surrounding buildings. A cost estimate and additional design information has been provided later in the report for the installation of the proposed pipes and structures.

Also, it was a finding during our analysis of the existing (5) 24" HP culverts under Chalmers Court that no improvements will be required at this location since the calculated flows to these culverts, including the addition of Sub-System E, are adequately conveyed during the 1-year and 2-year storm event. Supporting computations have been provided in this report.

3. Jackson Pond Outfall to West Main Street Storm Sewer:
   - Using the CCHS plan it was determined that the estimated amount of additional flow from Jackson Pond that can be added to the existing storm sewer system pipes on the south side of West Main Street is 4 cfs without any proposed upgrades.

- Currently the pond outfalls to the west across Dorsey Street as previously discussed in a report prepared by Pennoni. The existing and proposed alternative was outlined in detail when discussing the diversion options.

It was noted during the previously prepared report by Pennoni, that in order to reduce the total volume to the swale downstream of the Jackson Pond outfall (Swale B2), a portion of the flow would need to be diverted through the existing storm sewer system on the south side of West Main Street, which ultimately outfalls into Town Run at the Lincoln Avenue outfall. This alternative could possibly eliminate a portion of flow that would drain across Dorsey Street down to the previously mentioned existing storm sewer system under West Main Street just west of Smith Street. It is our finding that this diversion would slightly change the 2-year flow to the swale downstream of the Jackson Pond outfall (Swale B2) if the noted upgrades were made to the existing orifice in Jackson Pond. Per our analysis of the existing storm sewer systems, this improvement option would cause portions of the existing storm sewer along West Main Street to be upgraded at both locations and not just at the intersection of West Main Street and Smith Street if any more than 4 cfs is diverted into the existing storm sewer system south of the Jackson Pond. Upgrading the existing pond outfall structure and drainage swales as noted in the Dorsey Treadwell study downstream of the existing Jackson Pond outfall and areas upstream of the existing storm sewer system at the Smith Street intersection is believed to be a cost effective approach. In addition, upgrading the storm sewer system at the Smith Street intersection is recommended as noted later in this report.

This document contains plan exhibits that show the proposed site improvement options as well, and detailed cost estimates for each location. During your review it is important to remember that this is a preliminary design, and not the final design plan. The scope of our analysis was to analyze the existing storm sewer system at the intersection of West Main Street and Smith Street/Lincoln Avenue, the existing storm sewer system in Sub-System E, and suggest improvements if needed that would adequately convey flows from these areas to Town Run. We would suggest therefore that the scope of the final design plan should be conditioned to have the least amount of impact to East and West Main Street and the surrounding areas.

Also, preparation of field run topo and an additional site investigation could be required to prepare a final design. The final design prepared for the Town will propose site improvements to convey the 1-year flow and 2-year flow into the section of Town Run north of 12 Lincoln Avenue. In addition, final designs will propose site improvements to better identify the exact location the 1-year and 2-year flow will outfall into Town Run near the intersection of East Main Street and Chalmers Court.

Pennoni looks forward to continued coordination with the Town of Berryville staff to discuss findings and recommendations in more detail. If you have any questions, please do not hesitate to contact us.

Introduction

The Town of Berryville had engaged Pennoni Associates to analyze the existing drainage situation in the area of Dorsey Street and Treadwell Street. That study made recommendations that would increase flow to Town Run. Now the Town has asked Pennoni to check if making those improvements and if adding that flow will require upgrades to the Town Run channel. In addition, the Town asked if the addition of Sub-System E would pose any problems. This Dorsey-Treadwell area is upstream of an existing storm sewer system under West Main Street, which extends from Lincoln Avenue to Clarke County High School. The Dorsey-Treadwell report planned to increase flow at two locations. One near the inlet at the intersection of Hermitage Boulevard and the other at the Smith Street intersection. The intersection with Smith Street/Lincoln Avenue is developed as mostly older single-family homes along West Main Street, Smith Street, and Lincoln Avenue. Generally, the existing drainage in this area flows from the north and west.

Sub-System E is upstream of an existing 15" CMP storm sewer pipe under East Main Street, west of Chalmers Court. This particular area of Town is developed as mostly businesses along East Main Street. Generally, the existing drainage in this area flows from the north and west.

Pennoni has analyzed the existing storm sewer systems in these areas to determine if design improvements are necessary to adequately convey the flows from the Sub-System areas to Town Run. The Dorsey Treadwell study recommendations were based on the 2-year discharge when analyzing the possible flow reductions to the noted swale locations and ultimately the existing storm sewer systems under West Main Street. These same conditions exist for the conveyance of runoff from the subject areas to Town Run. Since it is not feasible to lower Town Run, the existing storm sewer systems need to be analyzed and upgraded under that same constraint.

We have attached plan view exhibits showing the areas analyzed. In order to support our design, we have used 2 ft. county topo based mapping to study the total drainage area, and to check that the approved areas and flows from the storm drainage system report prepared by Dewberry are still correct.

West Main Street and Smith Street/Lincoln Avenue Analysis

This sub area is to the north and west of West Main Street, Smith Street, and Lincoln Avenue. The drainage flows from the north and west to existing **86A** and continues through the existing system under West Main Street. The estimated 1-year and 2-year flow through this system is Q1=53.65 cfs and Q2=60.58 cfs, respectively. These flows have been estimated using previously submitted plans and reports. These available documents have suggested drainage improvements to the swales and existing culverts located in the contributing upstream areas so that there are minimal flow restrictions. It should be noted that per the computations attached that the existing

24" RCP storm sewer pipe under West Main Street is over capacity and is currently not adequate to convey the 1-year flow and 2-year flow calculated from available records. Below is a proposed recommendation to adequately convey the flow from to Town Run.

We recommend proposing the following storm sewer system upgrade: a 24" x 38" RCP under West Main Street from Ex. 86 to Ex. 87. In order to convey the 1-year flow and 2-year flow and install with minimal impact and concern to existing site features we recommend this solution. Also, upgrading using an elliptical RCP will not change the cover over the proposed pipe. If an additional storm event needs to be conveyed, this would require further analysis and changes to the proposed improvements noted above and in the cost estimate.

Cost Estimate

The cost estimate for the proposed site improvements is as follows:

ITEM	UNIT	UNIT COST	QUANTITY	EXTENSION
24" X 38" RCP	LF	$350.00	40	$14,000.00
CURB AND GUTTER REPLACEMENT	LF	$35.00	100	$3,500.00
PIPE TIE IN TO EX. STR.	EA	$500.00	2	$1,000.00
OPEN CUT AND REPAVING	LS	$14,600.00	1	$14,600.00
SUBTOTAL IMPROVEMENTS				**$33,100**
+ 25% CONTINGENCIES				$8,275.00
+ 20% EROSION CONTROL				$6,620.00
+ 15% MOBILIZATION				$4,965.00
GRAND TOTAL IMPROVEMENTS				**$52,960.00**

These are budget cost estimate based on a conceptual design. It should be used only for estimation referral. Contractor bid results will depend on market conditions for labor and materials.

Trapezoidal Concrete Ditch Analysis

The existing trapezoidal concrete ditch, with a field measured bottom width equal to 3', has been analyzed as well. This concrete ditch section is located at the storm sewer outfall under Lincoln Avenue. The total calculated 1-year flow to this location is 69.24 cfs and the 2-year flow is 84.62 cfs. The calculated depths for the 1-year and 2-year storm event is 1.16' and 1.27'. During our site investigation we were able to talk with the homeowner of the lot (12 Lincoln Avenue)

adjacent to the concrete channel. They indicated that there is currently not a drainage issue at this particular location, and that any proposed improvements will hopefully not change that. We have taken into account the homeowners concerns and estimated a 10-year flow of 140.88 cfs to this study point using available records. The calculated 10-year depth of 1.62' in our opinion should not have any impact to the surrounding lots at this particular location. Additional field run topography would be necessary to provide an accurate evaluation of the upstream areas and the concrete ditch that outfalls into Town Run.

Sub-System E Analysis

This sub area is to the north of East Main Street and south of Liberty Street. The drainage flows from the north and west to existing system (**9 to 10**) under East Main Street. The estimated 1-year and 2-year flow through this system is Q1=9.88 cfs and Q2=11.84 cfs, respectively. It should be noted that per the computations attached that the existing 15" CMP storm sewer pipe is over capacity and is not adequate to convey either the 1-year flow or 2-year flow. Below are two recommendations to adequately convey both the 1-year and 2-year flow from Sub-System E to Town Run.

ALTA A:

We recommend proposing the following storm sewer system as ALT A to control the 1-year and 2-year storm events to Town Run: a 14" X 23" RCP under East Main Street from Ex. 9 to a new curb inlet that will replace Ex. 10, a 21" RCP on the south side of East Main Street from a new curb inlet that will replace Ex. 10 to a new curb inlet at the intersection of East Main Street and Chalmers Court, and a 21" RCP from the new inlet at the intersection to an outfall section upstream of the existing 5-24" HP pipes located in the main flow line of Town Run under Chalmers Court. This option will upgrade the existing storm sewer under East Main Street and provide an adequate outfall location.

ALTA B:

We recommend proposing the following storm sewer system as ALT B to control the 1-year and 2-year storm events to Town Run: a 14" X 23" RCP under East Main Street from Ex. 9 to a new curb inlet that will replace Ex. 10, a 21" RCP from a new curb inlet that will replace Ex. 10 to an outfall that will match the invert at the existing 5' W x 2' H concrete channel at Town Run. This option will upgrade the existing storm sewer under East Main Street and provide an adequate outfall location as well. It should be noted that the outfall connection at Town Run is in close proximity to the rear of an existing building.

The capacity of the existing 15" CMP does not convey the analyzed storm events. Our recommendations of ALT A and ALT B will both be a better option to convey the 1-year flow as well as the 2-year flow directly to Town Run.

In order to convey the 1-year and 2-year flow and install with minimal impact and concern to existing site features we recommend ALT A. Also, upgrading to concrete pipe from corrugated metal pipe will provide greater pipe strength and less maintenance over the life of the product. If an additional storm event needs to be conveyed, this would require further analysis and changes to the proposed improvements noted above and in the cost estimate.

Cost Estimates

The cost estimate for ALT A site improvements is as follows:

ITEM	UNIT	UNIT COST	QUANTITY	EXTENSION
14" X 23" RCP	LF	$150.00	62	$9,300.00
21" RCP	LF	$90.00	258	$23,220.00
GRATE INLET	EA	$5,000.00	1	$5,000.00
CURB INLET	EA	$6,500.00	1	$6,500.00
CURB AND GUTTER REPLACEMENT	LF	$35.00	200	$7,000.00
21" END SECTION	EA	$900.00	1	$745.00
PIPE TIE IN TO EX. STR.	EA	$500.00	1	$500.00
OPEN CUT AND REPAVING	LS	$22,500.00	1	$22,500.00
SUBTOTAL IMPROVEMENTS				**$74,765**
+ 25% CONTINGENCIES				$18,691.25
+ 20% EROSION CONTROL				$14,953.00
+ 15% MOBILIZATION				$11,214.75
GRAND TOTAL IMPROVEMENTS				**$119,624.00**

The cost estimate for ALT B site improvements is as follows:

ITEM	UNIT	UNIT COST	QUANTITY	EXTENSION
14" X 23" RCP	LF	$150.00	62	$9,300.00
21" RCP	LF	$90.00	131	$11,790.00
GRATE INLET	EA	$5,000.00	1	$5,000.00
PIPE TIE IN TO EX. STR.	EA	$500.00	2	$1,000.00
OPEN CUT AND REPAVING	LS	$34,700.00	1	$34,700.00

SUBTOTAL IMPROVEMENTS				**$61,790**
+ 25% CONTINGENCIES				$15,447.50
+ 20% EROSION CONTROL				$12,358.00
+ 15% MOBILIZATION				$9,268.50
GRAND TOTAL IMPROVEMENTS				**$98,864.00**

These are budget cost estimate based on a conceptual design. It should be used only for estimation referral. Contractor bid results will depend on market conditions for labor and materials.

5-24" HP Analysis

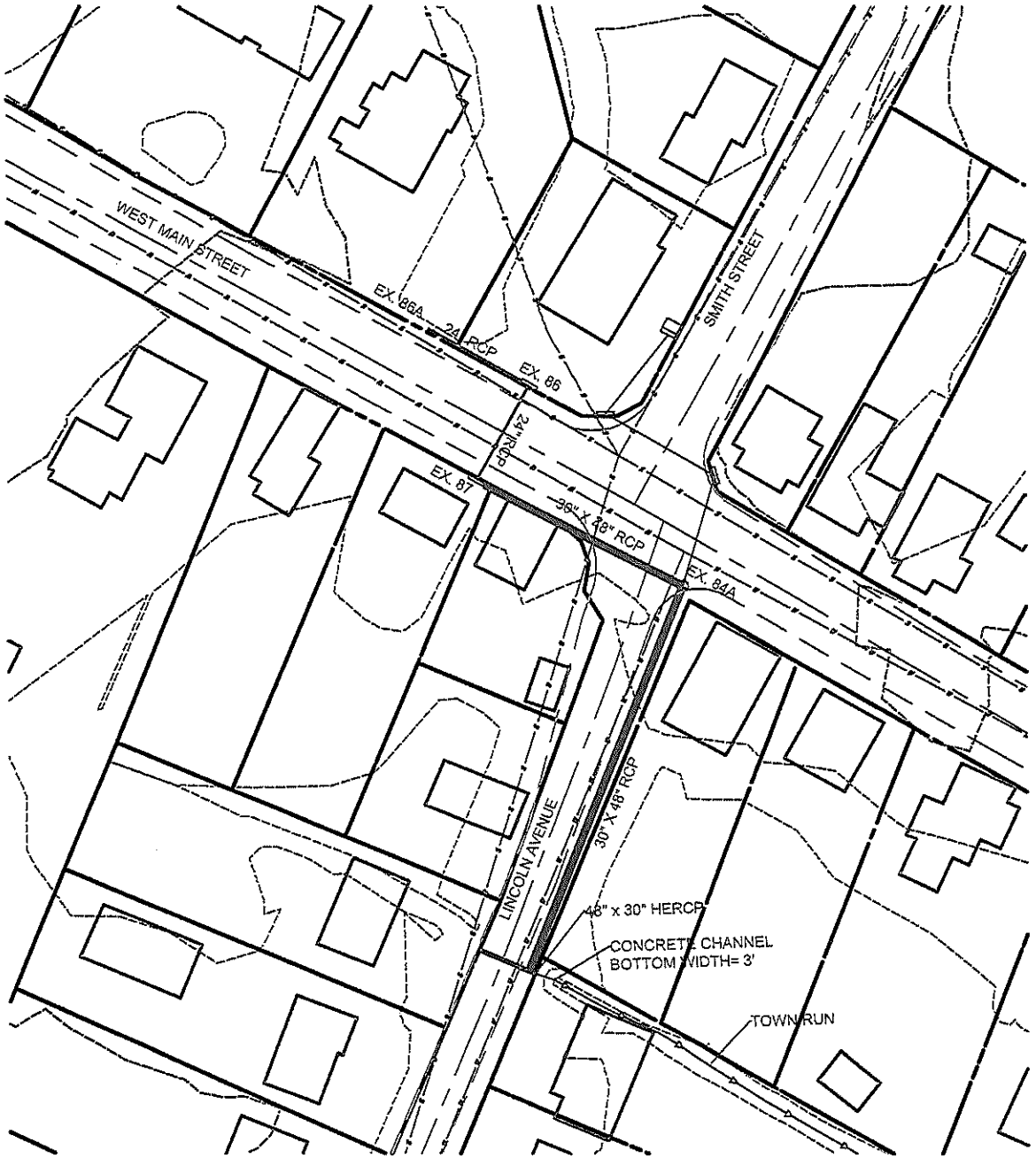
The existing 5-24" HP culverts under Chalmers Court have been analyzed as well. There is an estimated 1-year flow of 65.04 cfs and 2-year flow of 78.54 cfs to this study point using available records. We assumed 90% KARST topography for the contributing drainage areas to this location of Town Run, using a factor of 0.34 to calculate the 1-year flow and 2-year flow. The existing culverts per our calculations adequately convey the 1-year and 2-year storm events, assuming the roadway elevation of Chalmers Court at this location is 573.50. Invert elevations have also been assumed using 2 ft. county topo based mapping. The total flows used have included the flows from Sub-System E. Additional field run topography would be recommended to provide a more accurate evaluation of the 5-24" HP culverts.

Jackson Pond Outfall to West Main Street Storm Sewer

Jackson Pond currently outfalls and drains to an area west of the existing pond. We have used previously prepared plans and reports to identify the additional flow from Jackson Pond that can be added into the existing storm sewer along West Main Street. This alternative could possibly eliminate a portion of flow that would drain through the Dorsey Street and Treadwell Street area. An estimated flow of 4 cfs can be added without any changes to the existing storm sewer pipes on the south side of West Main Street. It was discussed in a previous report prepared by Pennoni to improve the existing drainage situation downstream of the existing pond outfall and direct the flow to the existing storm sewer system at the Smith Street intersection. This existing storm sewer system has been analyzed as noted in this report under the West Main Street and Smith Street/Lincoln Avenue Analysis. It is recommended that this option is preferred since it was

noted during previous meetings with the Town that the existing storm sewer pipe under Main Street at the Smith Street intersection could be upgraded prior to repaving.

It was observed during our site investigation of Town Run that sections of the existing channel could be cleaned up by simply regrading to provide positive flow with no obstructions. These areas would be dependent on the wants and needs of the homeowners, business owners, and the Town of Berryville. These areas can be analyzed in more detail if deemed necessary.



EXISTING CONDITION
SCALE: 1" = 50'

PROPOSED CONDITION
SCALE: 1" = 50'

SMITH STREET

11/4/2020
8:50 AM

STORM SEWER DESIGN COMPUTATIONS-Q1

From Struct. #	To Struct. #	Structure Type	Drainage Area (acres)	Runoff C Factor	C * A		tc To Pipe (min.)	Intensity "I" (in./hr.)	Flow		Design				Profile				Top Elev.
					Increm. C * A	Accum. C * A			Q Increm. (c.f.s.)	Q Accum. (c.f.s.)	Pipe Diameter (inches)	Slope (%)	Mannings "n" Factor	Maximum Q (c.f.s.)	Flow Full Velocity (f.p.s.)	Length (ft.)	Fall (ft.)	Upper Invert	Lower Invert	
EXISTING STM. SEW.																			
EX. 86A	EX. 86	END-SECTION	30.06	0.45	13.53	13.53	20.00	2.25	30.44	34.13	24"	4.90	0.013	50.08	15.94	60.00	2.94	598.70	595.76	601.00
EX. 86	EX. 87	CURB INLET	0.16	0.90	0.14	13.67	20.00	2.25	0.32	34.45	24"	1.37	0.013	26.53	8.44	40.00	0.55	595.76	595.21	600.70
EX. 87	EX. 84A	CURB INLET	0.20	0.90	0.18	13.85	20.00	2.25	0.41	48.64	30" X 48"	0.38	0.013	61.84	6.43	90.00	0.34	595.21	594.87	600.70
EX. 84A	EX. 97	MANHOLE	0.00	0.00	0.00	13.85	20.00	2.25	0.00	53.65	30" X 48"	0.46	0.013	68.08	7.08	190.00	0.87	594.87	594.00	600.00
PROPOSED STM. SEW.																				
EX. 86A	EX. 86	END-SECTION	30.06	0.45	13.53	13.53	20.00	2.25	30.44	34.13	24"	4.90	0.013	50.08	15.94	60.00	2.94	598.70	595.76	601.00
EX. 86	EX. 87	CURB INLET	0.16	0.90	0.14	13.67	20.00	2.25	0.32	34.45	24" X 38"	1.37	0.013	48.10	9.80	40.00	0.55	595.76	595.21	600.70
EX. 87	EX. 84A	CURB INLET	0.20	0.90	0.18	13.85	20.00	2.25	0.41	48.64	30" X 48"	0.38	0.013	61.84	6.43	90.00	0.34	595.21	594.87	600.70
EX. 84A	EX. 97	MANHOLE	0.00	0.00	0.00	13.85	20.00	2.25	0.00	53.65	30" X 48"	0.46	0.013	68.08	7.08	190.00	0.87	594.87	594.00	600.00
Note: Pipe Lengths, Inverts, and Top Elevations are taken from Dewberry Study																				

SMITH STREET

STORM SEWER DESIGN COMPUTATIONS-Q2

From Struct. #	To Struct. #	Structure Type	Drainage Area (acres)	Runoff C Factor	C * A		Flow				Design				Profile				Top Elev.
					Increm. C * A	Accum. C * A	tc To Pipe (min.)	Intensity "I" (in./hr.)	Q Increm. (c.f.s.)	Q Accum. (c.f.s.)	Pipe Diameter (inches)	Slope (%)	Mannings "n" Factor	Maximum Q (c.f.s.)	Flow Full Velocity (f.p.s.)	Length (ft.)	Fall (ft.)	Upper Invert	Lower Invert	
EXISTING CONDITION																			
EX. 86A	EX. 86	END-SECTION	30.06	0.45	13.53	13.53	20.00	2.75	37.20	40.89	24"	4.90	0.013	50.08	15.94	60.00	2.94	598.70	595.76	601.00
EX. 86	EX. 87	CURB INLET	0.16	0.90	0.14	13.67	20.00	2.75	0.40	41.29	24"	1.37	0.013	26.53	8.44	40.00	0.55	595.76	595.21	600.70
EX. 87	EX. 84A	CURB INLET	0.20	0.90	0.18	13.85	20.00	2.75	0.50	55.57	30" X 48"	0.38	0.013	61.84	6.43	90.00	0.34	595.21	594.87	600.70
EX. 84A	EX. 97	MANHOLE	0.00	0.00	0.00	13.85	20.00	2.75	0.00	60.58	30" X 48"	0.46	0.013	68.08	7.08	190.00	0.87	594.87	594.00	600.00
PROPOSED CONDITION																			
EX. 86A	EX. 86	END-SECTION	30.06	0.45	13.53	13.53	20.00	2.75	37.20	40.89	24"	4.90	0.013	50.08	15.94	60.00	2.94	598.70	595.76	601.00
EX. 86	EX. 87	CURB INLET	0.16	0.90	0.14	13.67	20.00	2.75	0.40	41.29	24" X 38"	1.37	0.013	48.10	9.80	40.00	0.55	595.76	595.21	600.70
EX. 87	EX. 84A	CURB INLET	0.20	0.90	0.18	13.85	20.00	2.75	0.50	55.57	30" X 48"	0.38	0.013	61.84	6.43	90.00	0.34	595.21	594.87	600.70
EX. 84A	EX. 97	MANHOLE	0.00	0.00	0.00	13.85	20.00	2.75	0.00	60.58	30" X 48"	0.46	0.013	68.08	7.08	190.00	0.87	594.87	594.00	600.00
Note: Pipe Lengths, Inverts, and Top Elevations are taken from Dewberry Study																				

Q1-Trapezoidal Concrete Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	69.24	ft^3/s

Results

Normal Depth	1.16	ft
Flow Area	7.50	ft^2
Wetted Perimeter	10.32	ft
Hydraulic Radius	0.73	ft
Top Width	9.95	ft
Critical Depth	1.59	ft
Critical Slope	0.00261	ft/ft
Velocity	9.24	ft/s
Velocity Head	1.33	ft
Specific Energy	2.48	ft
Froude Number	1.88	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.16	ft
Critical Depth	1.59	ft
Channel Slope	0.01000	ft/ft

Q1-Trapezoidal Concrete Channel

GVF Output Data

Critical Slope	0.00261	ft/ft

Q2-Trapezoidal Concrete Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	84.62	ft^3/s

Results

Normal Depth	1.27	ft
Flow Area	8.69	ft^2
Wetted Perimeter	11.06	ft
Hydraulic Radius	0.79	ft
Top Width	10.64	ft
Critical Depth	1.75	ft
Critical Slope	0.00254	ft/ft
Velocity	9.74	ft/s
Velocity Head	1.47	ft
Specific Energy	2.75	ft
Froude Number	1.90	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.27	ft
Critical Depth	1.75	ft
Channel Slope	0.01000	ft/ft

Q2-Trapezoidal Concrete Channel

GVF Output Data

Critical Slope	0.00254	ft/ft

Q10-Trapezoidal Concrete Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	140.88	ft^3/s

Results

Normal Depth	1.62	ft
Flow Area	12.67	ft^2
Wetted Perimeter	13.22	ft
Hydraulic Radius	0.96	ft
Top Width	12.69	ft
Critical Depth	2.23	ft
Critical Slope	0.00238	ft/ft
Velocity	11.12	ft/s
Velocity Head	1.92	ft
Specific Energy	3.54	ft
Froude Number	1.96	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.62	ft
Critical Depth	2.23	ft
Channel Slope	0.01000	ft/ft

Q10-Trapezoidal Concrete Channel

GVF Output Data

Critical Slope	0.00238	ft/ft

EXISTING CONDITION
SCALE: 1" = 50'

PROPOSED CONDITION
SCALE: 1" = 50'

CHALMERS COURT

11/4/2020
9:47 AM

STORM SEWER DESIGN COMPUTATIONS-Q1

From Struct. #	To Struct. #	Structure Type	Drainage Area (acres)	Runoff C Factor	C * A		tc To Pipe (min.)	Intensity "I" (in./hr.)	Flow		Design					Profile				Top Elev.
					Increm. C * A	Accum. C * A			Q Increm. (c.f.s.)	Q Accum. (c.f.s.)	Pipe Diameter (inches)	Slope (%)	Mannings "n" Factor	Maximum Q (c.f.s.)	Flow Full Velocity (f.p.s.)	Length (ft.)	Fall (ft.)	Upper Invert	Lower Invert	
EXISTING STM. SEW.																				
EX. 9	EX.10	CURB INLET	6.83	0.40	2.73	2.73	10.00	3.11	8.50	8.50	15"	2.62	0.024	5.66	4.62	50.00	1.31	574.50	573.19	577.01
EX. 10	OUTFALL ?	GRATE INLET	0.43	0.90	0.39	3.12	10.28	3.08	1.19	9.61	15"		0.024			160.00				577.01
PROPOSED STM. SEW. (ALT A)																				
EX. 9	NEW INTELT	CURB INLET	6.83	0.40	2.73	2.73	10.00	3.11	8.50	8.50	14" X 23"	2.11	0.013	15.27	8.64	62.00	1.31	574.50	573.19	577.01
NEW INTELT	10AA	GRATE INLET	0.43	0.90	0.39	3.12	10.28	3.08	1.19	9.61	21"	0.85	0.013	14.56	6.06	200.00	1.69	572.69	571.00	577.01
10AA	10A	CURB INLET	0.10	0.90	0.09	3.21	10.28	3.08	0.28	9.88	21"	0.95	0.013	15.43	6.41	58.00	0.55	570.75	570.20	575.50
PROPOSED STM. SEW. (ALT B)																				
EX. 9	NEW INLET	CURB INLET	6.83	0.40	2.73	2.73	10.00	3.11	8.50	8.50	14" X 23"	2.11	0.013	15.27	8.64	62.00	1.31	574.50	573.19	577.01
NEW INLET	10B	GRATE INLET	0.43	0.90	0.39	3.12	10.28	3.08	1.19	9.61	21"	0.92	0.013	15.22	6.33	129.00	1.19	572.69	571.50	577.01
Note: Pipe Lengths, Inverts, and Top Elevations are taken from Dewberry Study																				

CHALMERS COURT

STORM SEWER DESIGN COMPUTATIONS-Q2

From Struct. #	To Struct. #	Structure Type	Drainage Area (acres)	Runoff C Factor	C * A		tc To Pipe (min.)	Intensity "I" (in./hr.)	Flow		Design					Profile				Top Elev.
					Increm. C * A	Accum. C * A			Q Increm. (c.f.s.)	Q Accum. (c.f.s.)	Pipe Diameter (inches)	Slope (%)	Mannings "n" Factor	Maximum Q (c.f.s.)	Flow Full Velocity (f.p.s.)	Length (ft.)	Fall (ft.)	Upper Invert	Lower Invert	
EXISTING STM. SEW.																				
EX. 9	EX.10	CURB INLET	6.83	0.40	2.73	2.73	10.00	3.73	10.19	10.19	15"	2.62	0.024	5.66	4.62	50.00	1.31	574.50	573.19	577.01
EX. 10	OUTFALL ?	GRATE INLET	0.43	0.90	0.39	3.12	10.28	3.69	1.43	11.51	15"		0.024			160.00				577.01
PROPOSED STM. SEW. (ALT A)																				
EX. 9	NEW INTELT	CURB INLET	6.83	0.40	2.73	2.73	10.00	3.73	10.19	10.19	14"X23"	2.11	0.013	15.27	8.64	62.00	1.31	574.50	573.19	577.01
NEW INTELT	10AA	GRATE INLET	0.43	0.90	0.39	3.12	10.28	3.69	1.43	11.51	21"	0.85	0.013	14.56	6.06	200.00	1.69	572.69	571.00	577.01
10AA	10A	CURB INLET	0.10	0.90	0.09	3.21	10.28	3.69	0.33	11.84	21"	0.95	0.013	15.43	6.41	58.00	0.55	570.75	570.20	575.50
PROPOSED STM. SEW. (ALT B)																				
EX. 9	NEW INLET	CURB INLET	6.83	0.40	2.73	2.73	10.00	3.73	10.19	10.19	14"X23"	2.11	0.013	15.27	8.64	62.00	1.31	574.50	573.19	577.01
NEW INLET	10B	GRATE INLET	0.43	0.90	0.39	3.12	10.28	3.69	1.43	11.51	21"	0.92	0.013	15.22	6.33	129.00	1.19	572.69	571.50	577.01
Note: Pipe Lengths, Inverts, and Top Elevations are taken from Dewberry Study																				

Culvert Calculator Report
Q1-(5) 24" ADS

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	573.50	ft	Headwater Depth/Height	1.05	
Computed Headwater Elev	571.09	ft	Discharge	65.04	cfs
Inlet Control HW Elev.	570.89	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	571.09	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	569.00	ft	Downstream Invert	568.78	ft
Length	44.50	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	1.30	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.30	ft
Velocity Downstream	6.03	ft/s	Critical Slope	0.013747	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.020	
Section Type	CPE Smooth Interior		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	5				

Corrugated HDPE Material (Corrugated Interior)

Outlet Control Properties					
Outlet Control HW Elev.	571.09	ft	Upstream Velocity Head	0.32	ft
Ke	0.20		Entrance Loss	0.06	ft

Inlet Control Properties					
Inlet Control HW Elev.	570.89	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	15.7	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Q2-(5) 24" ADS

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	573.50	ft	Headwater Depth/Height	1.21	
Computed Headwater Elev	571.42	ft	Discharge	78.54	cfs
Inlet Control HW Elev.	571.14	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	571.42	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	569.00	ft	Downstream Invert	568.78	ft
Length	44.50	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	1.43	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.43	ft
Velocity Downstream	6.54	ft/s	Critical Slope	0.015443	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.020	
Section Material	24 inch (Corrugated Interior)		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	5				

Corrugated HDPE Material

Outlet Control Properties					
Outlet Control HW Elev.	571.42	ft	Upstream Velocity Head	0.39	ft
Ke	0.20		Entrance Loss	0.08	ft

Inlet Control Properties					
Inlet Control HW Elev.	571.14	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	15.7	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

PRE DEVELOPMENT DRAINAGE DIVIDES
1" = 500'

POST DEVELOPMENT DRAINAGE DIVIDES

1" = 500'

Town of Berryville, Virginia

Virginia Avenue Drainage Improvements

February 19, 2021

Prepared By:
Pennoni Associates, Inc.
Winchester VA

Table of Contents

Executive Summary

After meeting and reviewing our design solution with the Town of Berryville, Pennoni recommends the following actions:

- In order to avoid prolonged ponding and provide for positive drainage from the area, the following improvements should be considered:
    - Approximately 152 LF of curb and gutter is proposed along Virginia Avenue.
    - A CG-9B, Standard Entrance Gutter, will be provided to allow the owners of 16 Virginia Avenue to park and access their garage.
    - A 4' wide concrete vee ditch, approximately 116 LF @ 0.50%, will begin at the end of the proposed curb and gutter, and will end where the proposed 18" x 11" HERCP begins.
    - The HERCP system will then convey the flow and outfall into the existing concrete channel (Town Run).
    - An 18" ADS inline drain is proposed directly south of an existing driveway entrance along Virginia Avenue.
    - A 3' wide gravel shoulder is proposed between the concrete vee ditch and the existing edge of pavement along Virginia Avenue.

This document contains plan and profile exhibits that show the proposed site improvements, and a detailed cost estimate. During your review it is important to remember that this is a preliminary design, and not the final design plan. The scope of our analysis was to suggest improvements that would convey flows from the more frequent, nuisance, storm events. We would suggest therefore that the scope of the final design plan should be conditioned on no negative impact on existing residential lots and avoiding any road construction along Virginia Avenue.

Pennoni looks forward to continued coordination with the Town of Berryville staff to discuss findings and recommendations in more detail. If you have any questions, please do not hesitate to contact us.

Introduction

The Town of Berryville has engaged Pennoni Associates to analyze the existing drainage situation along Virginia Avenue. This subject area is upstream of an existing concrete channel, Town Run, at the intersection of East Main Street and Virginia Avenue. This particular area of Town is developed as mostly older single-family homes. Generally, the issue which causes most of the problems is the existing lay of the land. The road grades and ditches along Virginia Avenue are relatively flat. Also, during the preparation of the field run topo and a site investigation, it was determined that a low point along Virginia Avenue is causing a significant amount of ponding. The Town is interested to see if some of the main areas of concern can be addressed.

We were asked to prepare a design to improve the existing drainage along Virginia Avenue. Attached are plan view exhibits showing the area of concern. In order to support our design, and supplement the field run topography, we have used Lidar based mapping to study the total drainage to the area of concern.

Virginia Avenue

The longitudinal slope along the analyzed area of Virginia Avenue ranges from 0%-2%. With the flattest areas being along the portion of road adjacent to 16 Virginia Avenue. The low point along the curve is where the excessive ponding occurs. This area is shown on the site plan exhibit. The total proposed flow from the south end of Virginia Avenue and the surrounding single-family lots to the concrete ditch, at the subject low point, was calculated to be 6.91 cfs for the 1-year storm event and 8.14 cfs for the 2-year storm event. The accumulated flow to the 18" x 11" HERCP system was calculated to be 7.21 cfs for the 1-year storm event and 8.49 cfs for the 2-year storm event.

We recommend proposing a 4' concrete vee ditch, 18" x 11" HERCP system, and 18" ADS inline drain to improve the existing conditions. This option will have the least amount of disturbance to the existing site conditions.

The capacity of the 18" x 11" HERCP will not convey either the 1-year or 2-year storm event. To allow for some cover over the proposed pipe at the upstream invert, and to match the existing invert at Town Run, this pipe size would work with the existing site conditions with minimal disturbance to the roadway and surrounding lots.

In order to convey the 1-year and 2-year storm event a 30" x 19" HERCP would be required. If we match the invert at Town Run, the top of the proposed pipe would be 4" above the adjacent existing edge of pavement elevation.

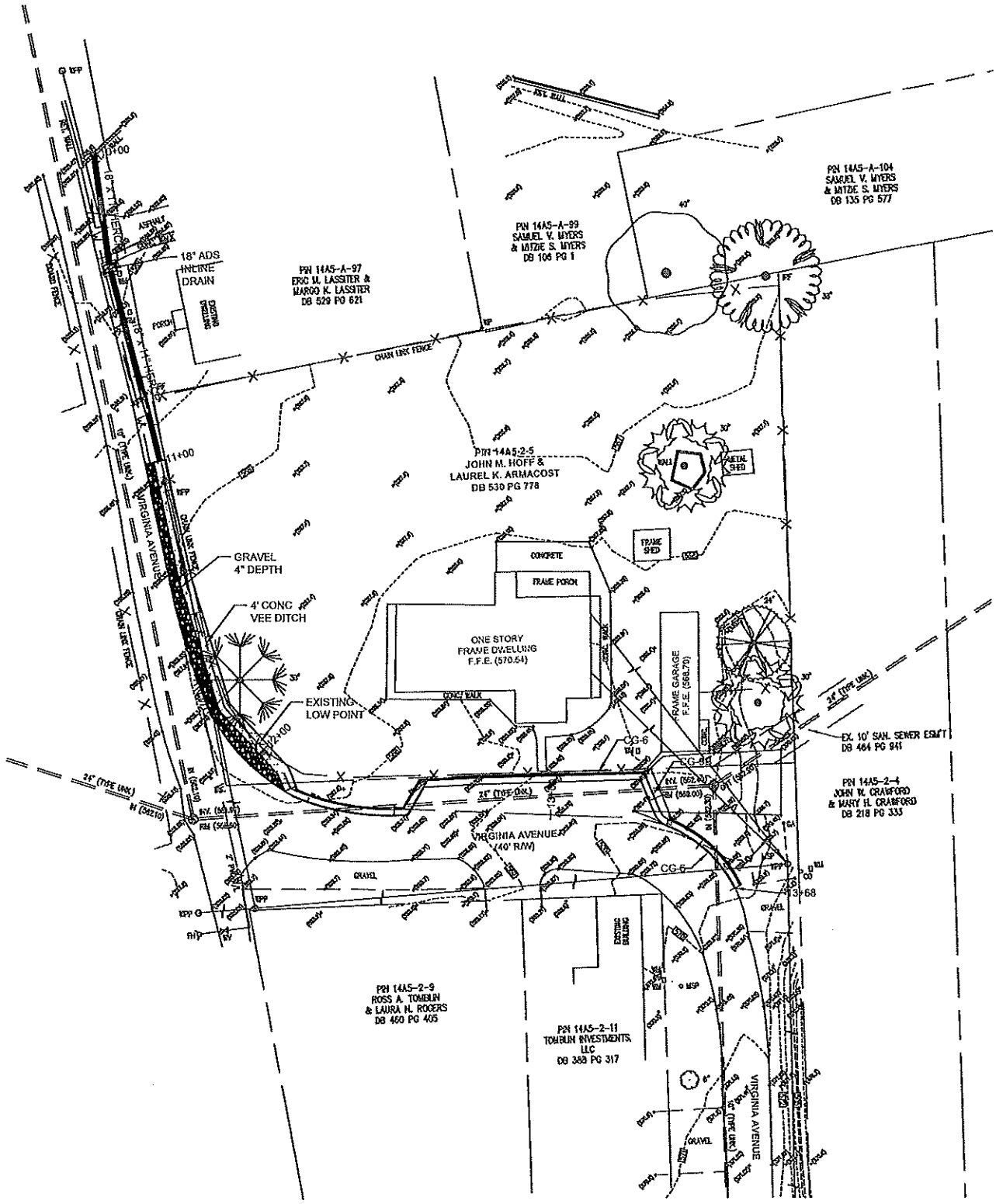
Cost Estimate

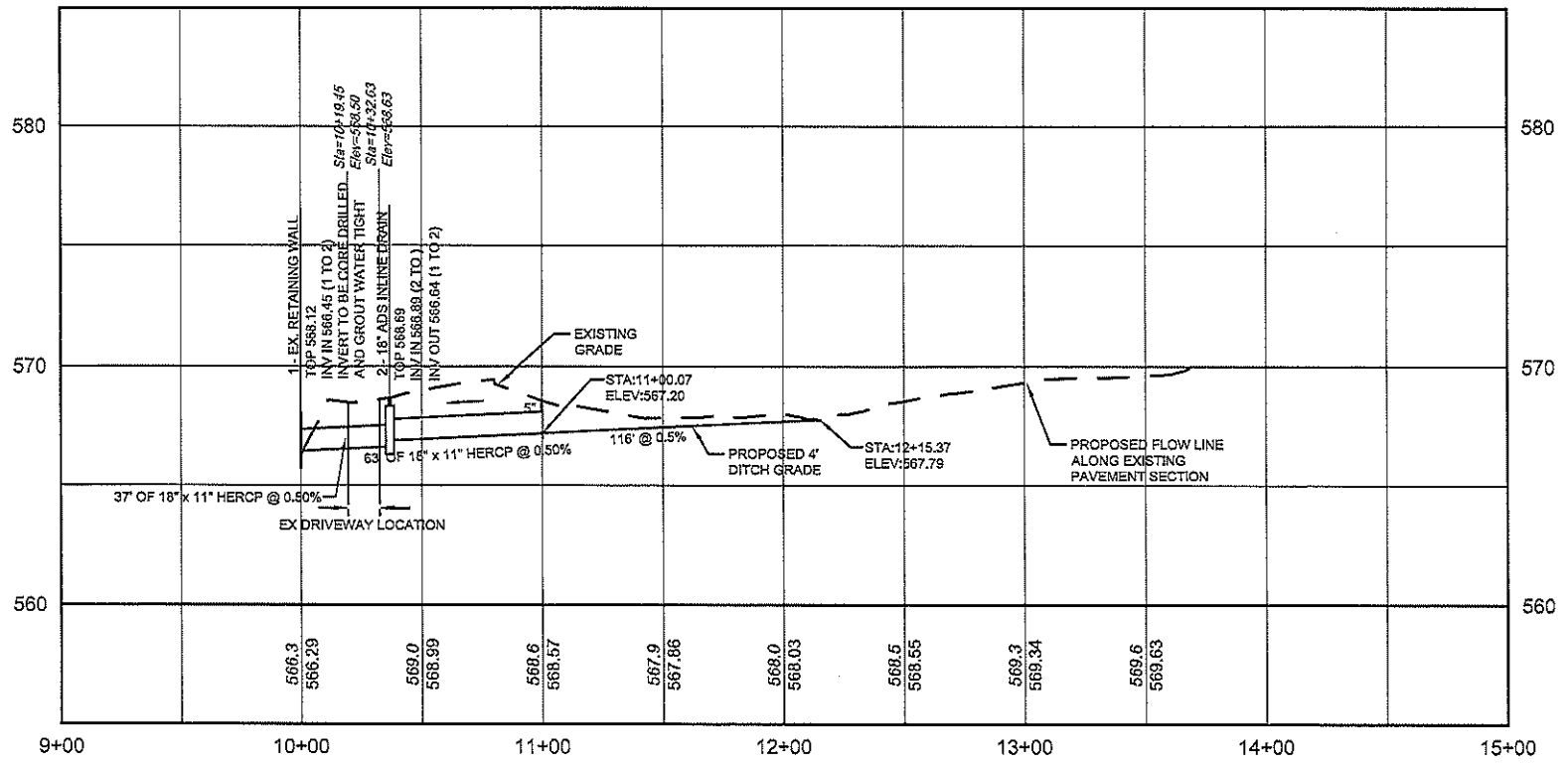
The cost estimate for the site improvements is as follows:

ITEM	UNIT	UNIT COST	QUANTITY	EXTENSION
18" X 11" HERCP	LF	$75.00	100	$7,500
18" ADS INLINE DRAIN	EA	$1,800.00	1	$1,800
4' WIDE CONCRETE VEE DITCH	SY	$121.00	52	$6,345.24
3' WIDE GRAVEL SHOULDER, 4"	SY	$11.50	39	$452.30
CG-6 CURB & GUTTER	LF	$35.00	152	$5,305.65
CG-9B STANDARD ENTRANCE GUTTER	EA	$3,500.00	1	$3,500.00
TRANSITION FROM CONCRETE VEE DITCH TO 18" X 11" HERCP CONNECTION	LS	$850.00	1	$850.00
EASEMENT AND R/W ACQUISITION AND RECORDATION	LS	$5,000.00	1	$5,000.00

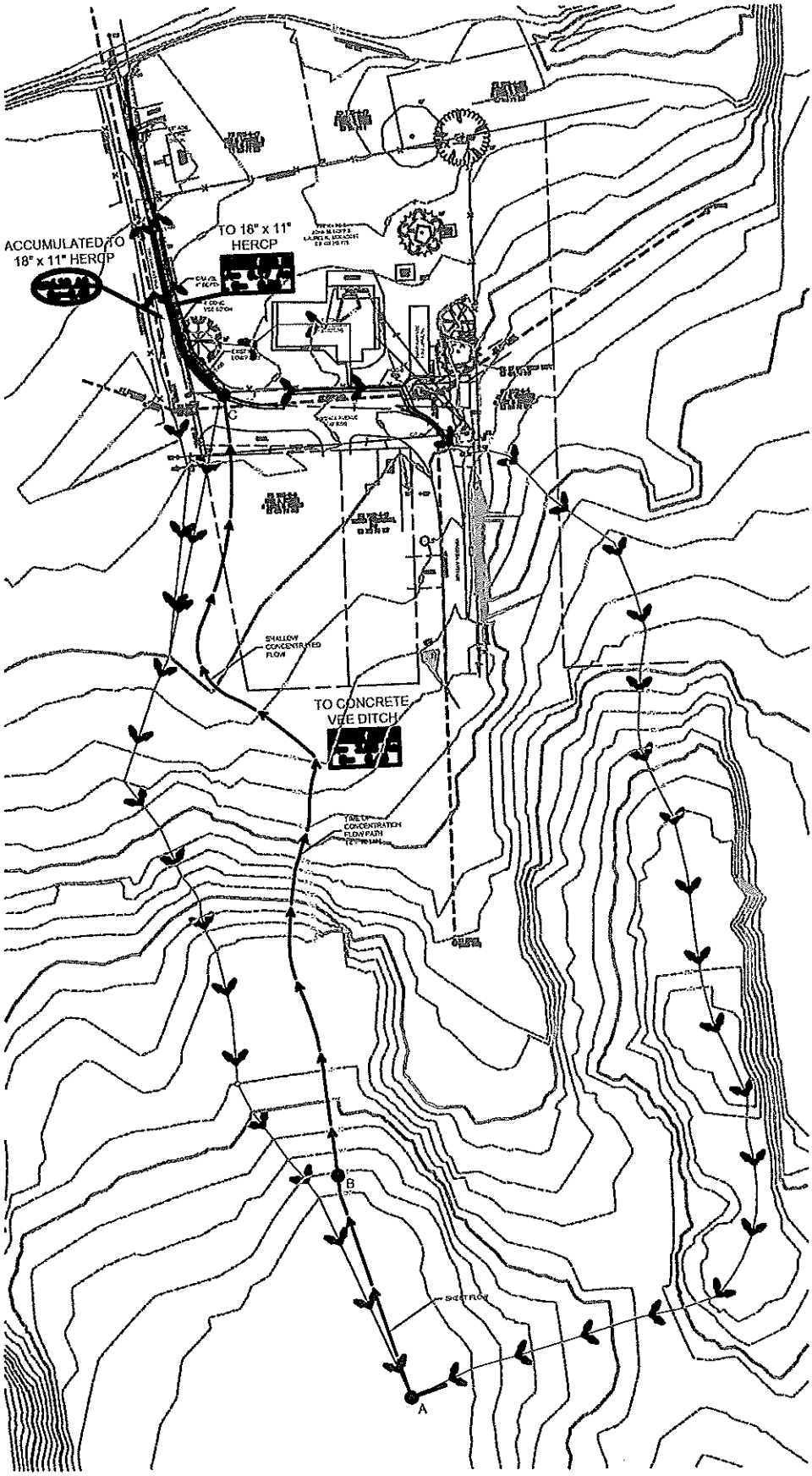
SUBTOTAL IMPROVEMENTS				**$25,753**
+ 25% CONTINGENCIES				$6,438.30
+ 20% EROSION CONTROL				$5,150.64
+ 15% MOBILIZATION				$3,862.98
GRAND TOTAL IMPROVEMENTS				**$41,205.10**

This is a budget cost estimate based on a conceptual design. It should be used only for estimation referral. Contractor bid results will depend on market conditions for labor and materials.


PIN 14A5-A-104
SAMUEL V. MYERS
& MITZIE S. MYERS
DB 135 PG 577
PIN 14A5-A-99
SAMUEL V. MYERS
& MITZIE S. MYERS
DB 106 PG 1
PIN 14A5-A-97
ERIC M. LASSITER &
MARGO K. LASSITER
DB 529 PG 621
18" ADS
INCline
DRAIN
CHAIN LINK FENCE
PIN 14A5-2-5
JOHN M. HOFF &
LAUREL K. ARMACOST
DB 530 PG 778
METAL SHED
FRAME SHED
CONCRETE
FRAME PORCH
ONE STORY
FRAME DWELLING
F.F.E. (570.54)
FRAME GARAGE
F.F.E. (568.79)
GRAVEL
4" DEPTH
4' CONC
VEE DITCH
EXISTING
LOW POINT
VIRGINIA AVENUE
(40' R/W)
11+00
12+00
CG-6
EX. 10' SAN. SEWER ESMT
DB 464 PG 941
PIN 14A5-2-4
JOHN W. CRAWFORD
& MARY H. CRAWFORD
DB 218 PG 335
PIN 14A5-2-9
ROSS A. TOMBLIN
& LAURA N. ROGERS
DB 460 PG 405
PIN 14A5-2-11
TOMBLIN INVESTMENTS,
LLC
DB 388 PG 317
EXISTING BUILDING
GRAVEL



DITCH
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'


ACCUMULATED TO 18" x 11" HERCP
TO 16" x 11" HERCP
TO CONCRETE VEE DITCH
SHALLOW CONCENTRATED FLOW
SHEET FLOW
A
B
C
D

Worksheet for Q1-Concrete Triangular Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	6.91	ft^3/s

Results

Normal Depth	0.75	ft
Flow Area	1.70	ft^2
Wetted Perimeter	4.76	ft
Hydraulic Radius	0.36	ft
Top Width	4.51	ft
Critical Depth	0.80	ft
Critical Slope	0.00358	ft/ft
Velocity	4.07	ft/s
Velocity Head	0.26	ft
Specific Energy	1.01	ft
Froude Number	1.17	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.80	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00358	ft/ft

Worksheet for Q2-Concrete Triangular Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	8.14	ft^3/s

Results

Normal Depth	0.80	ft
Flow Area	1.92	ft^2
Wetted Perimeter	5.06	ft
Hydraulic Radius	0.38	ft
Top Width	4.80	ft
Critical Depth	0.86	ft
Critical Slope	0.00351	ft/ft
Velocity	4.24	ft/s
Velocity Head	0.28	ft
Specific Energy	1.08	ft
Froude Number	1.18	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.80	ft
Critical Depth	0.86	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00351	ft/ft

Culvert Calculator Report
Q1-HERCP (15" Equivalent)

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	568.46	ft	Headwater Depth/Height	1.83	
Computed Headwater Elev	569.48	ft	Discharge	7.21	cfs
Inlet Control HW Elev.	569.13	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	569.48	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	567.20	ft	Downstream Invert	566.89	ft
Length	63.25	ft	Constructed Slope	0.004980	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	1.07	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.07	ft
Velocity Downstream	6.43	ft/s	Critical Slope	0.011569	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.25	ft
Section Size	15 inch		Rise	1.25	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	569.48	ft	Upstream Velocity Head	0.54	ft
Ke	0.20		Entrance Loss	0.11	ft

Inlet Control Properties					
Inlet Control HW Elev.	569.13	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Q2-HERCP (15" Equivalent)

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	568.46	ft	Headwater Depth/Height	2.30	
Computed Headwater Elev	570.07	ft	Discharge	8.49	cfs
Inlet Control HW Elev.	569.52	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	570.07	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	567.20	ft	Downstream Invert	566.89	ft
Length	63.25	ft	Constructed Slope	0.004980	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	1.14	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.14	ft
Velocity Downstream	7.24	ft/s	Critical Slope	0.015092	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.25	ft
Section Size	15 inch		Rise	1.25	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	570.07	ft	Upstream Velocity Head	0.74	ft
Ke	0.20		Entrance Loss	0.15	ft

Inlet Control Properties					
Inlet Control HW Elev.	569.52	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Q1-HERCP (24" Equivalent)

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	568.46	ft	Headwater Depth/Height	0.74	
Computed Headwater Elev	568.39	ft	Discharge	7.21	cfs
Inlet Control HW Elev.	568.33	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	568.39	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	567.20	ft	Downstream Invert	566.89	ft
Length	63.25	ft	Constructed Slope	0.004980	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.76	ft
Slope Type	Steep		Normal Depth	0.76	ft
Flow Regime	Supercritical		Critical Depth	0.80	ft
Velocity Downstream	4.83	ft/s	Critical Slope	0.004165	ft/ft

Section					
Section Shape	Horizontal Ellipse		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.52	ft
Section Size	19x30 inch		Rise	1.60	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	568.39	ft	Upstream Velocity Head	0.32	ft
Ke	0.20		Entrance Loss	0.06	ft

Inlet Control Properties					
Inlet Control HW Elev.	568.33	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end with headwall (horizontal ellipse)		Area Full	3.3	ft²
K	0.00180		HDS 5 Chart	29	
M	2.50000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Q2-HERCP (24" Equivalent)

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	568.46	ft	Headwater Depth/Height	0.78	
Computed Headwater Elev	568.45	ft	Discharge	8.49	cfs
Inlet Control HW Elev.	568.40	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	568.45	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	567.20	ft	Downstream Invert	566.89	ft
Length	63.25	ft	Constructed Slope	0.004980	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.80	ft
Slope Type	Steep		Normal Depth	0.80	ft
Flow Regime	Supercritical		Critical Depth	0.83	ft
Velocity Downstream	4.95	ft/s	Critical Slope	0.004000	ft/ft

Section					
Section Shape	Horizontal Ellipse		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.52	ft
Section Size	19x30 inch		Rise	1.60	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	568.45	ft	Upstream Velocity Head	0.35	ft
Ke	0.20		Entrance Loss	0.07	ft

Inlet Control Properties					
Inlet Control HW Elev.	568.40	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end with headwall (horizontal ellipse)		Area Full	3.3	ft²
K	0.00180		HDS 5 Chart	29	
M	2.50000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

April 25, 2023
Discussion

Request from owners of 214 East Main Street for parking restrictions east of their driveway along the north side of East Main Street

History
The owner of 214 East Main Street contacted VDOT and the Town and requested that parking be restricted east of their driveway. This request was made because the owner is concerned about sight distance (to the east) as he and his family exit their driveway.

Chief White met with the property owner and examined conditions in the area. The Town Manager and the Chief of Police met on site and examined conditions in the area.

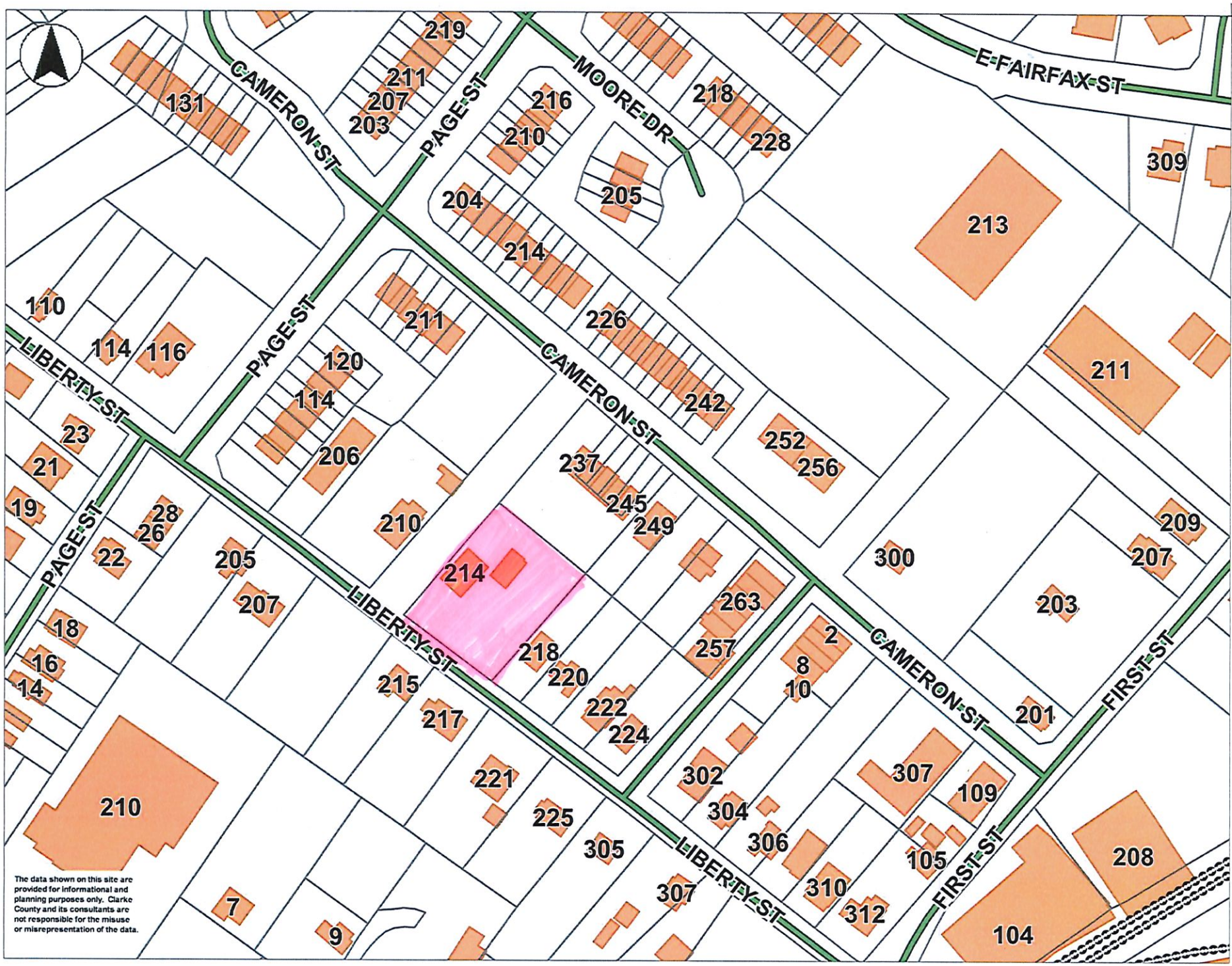
The Town Manager denied the property owner's request because, in his opinion the sight distance conditions at 214 East Main Street are consistent with the conditions found at other driveways in the area.

Current request
The property owner requested that the Town Council review his request for parking restrictions.

The Town Manager contacted S&U Committee Chair Harrison and requested that his matter be placed on the April 25 agenda. Mrs. Harrison agreed to have the matter added to the agenda.

Attachments
- Vicinity map
- Correspondence

Suggested action
Review the matter and forward a recommendation on this request to the Town Council.



Printed on 04/21/2023 at 01:18 PM

Clarke County MapsOnline

Keith Dalton

From: Michael Lee [redacted]
Sent: Friday, April 14, 2023 12:01 PM
To: Keith Dalton
Subject: Re: Follow up

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Good afternoon Keith,

Thank you so much for your quick reply.
Yes we would like to elevate this to the Town Counsel via the street and utilities committee.
Thank you again for your attention to this matter as there have been many near collisions entering and exiting our residence and one just yesterday.
Please keep us apprised of the status and we will be in attendance of the up coming town meetings.

v/r
Michael Lee

> On Apr 14, 2023, at 11:05 AM, Keith Dalton <townmanager@berryvilleva.gov> wrote:
>
> Mr. Lee:
>
> Thank you emailing me about this matter.
>
> Chief White and I have discussed this matter. As a part of this discussion, he and I visited the area in question.
>
> As I understand it, you are requesting that the Town restrict parking east of your driveway entrance to provide improved sight distance for those exiting your driveway.
>
> While such parking restrictions along approaches of streets or commercial/institutional uses may be advisable because of the volume of traffic utilizing those entrances, no parking zones for individual driveways would only be considered if conditions at the subject driveway are not shared by similarly situated properties. I am of the opinion that the sight distance conditions at your driveway are not unique along Main Street.
>
> Accordingly, I hereby deny the request for a no parking zoning east of your driveway.
>
> While the Berryville Code provides a general grant of authority to my position to regulate parking within Berryville, the Town Council has the authority to make determinations in this regard. If you would like to elevate this matter to them, then I suggest that you let me know that you would like the Town Council to review the matter. If you would like to pursue that path, then I suspect that the Council would delegate initial review of the request to its Streets and Utilities Committee. If the Council chose that course of action, then the Streets and Utilities Committee would review your request and provide an recommendation to the Council and the Council would then make a determination in the matter.

Please let me know if you would like to elevate this mater to the Town Council. I will be more than glad to shepherd such a request through their review process.

Take care,

Keith

Keith R. Dalton, Town Manager
Town of Berryville, VA
101 Chalmers Court, Suite A
Berryville, VA 22611

Office Phone: 540.955.1099

From: Michael Lee <[redacted]
Sent: Wednesday, April 12, 2023 7:43 AM
To: Keith Dalton <townmanager@berryvilleva.gov>
Cc: Michele Lee <[redacted]
Subject: Follow up

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Good morning Mr.s Dalton,

I wanted to follow up with you regarding a meeting that I had with Chief White a couple weeks ago. My wife and I live at 214 East Main Street in Berryville and we requested yellow stripping be installed adjacent to the entrance to our driveway due to multiple near collisions while exiting our property. Chief White met me at our home and agreed that this was a viable concern and was writing a report or recommendation to you for review. We just wanted to close the loop to determine the status of this request.
My wife and I are working from home this week and will be available should you want to meet to discuss.

v/r
Michael Lee
[redacted]

Keith Dalton

From: Michael Lee [redacted]
Sent: Thursday, March 16, 2023 7:37 AM
To: Arthur Boyce
Cc: Christy Dunkle; Funkhouser, Rhonda (VDOT); Johnson, Joseph; Keith Dalton
Subject: Re: Berryville- Rte7 Bus- Restricted parking areas

Good morning all,

Thank you Mr. Boyce,
I welcome replies from the town.

v/r
Michael Lee

On Thu, Mar 16, 2023 at 7:23 AM Arthur Boyce <bobby.boyce@vdot.virginia.gov> wrote:

> Hey Michael,
>
> Thanks for the inquiry and we are doing well. I hope the same is true for you and yours.
>
> I'm going to defer you to the Town of Berryville on this parking issue. VDOT permits the Town to install and maintain all the on-street parking on Rte 7 Business. We only get involved with commercial entrances and major street intersections not private entrances.
>
> If you have any questions, please give me a call.
>
> Sincerely,
>
> *Bobby Boyce*
>
> VDOT- Land Development Engineer
> Shenandoah, Frederick, Clarke, & Warren Counties
> 14031 Old Valley Pike
> Edinburg, VA 22824
> (540) 534-3211

From: Michael Lee <[redacted]
Sent: Tuesday, March 14, 2023 10:06 AM
To: Arthur Boyce <bobby.boyce@vdot.virginia.gov>
Subject: Restricted parking areas

Good morning Mr. Boyce,

It's been a while since our last conversation and I hope all is well with you and your family.

I am writing to find out the requirements for "no parking areas" adjacent to driveways and street intersections.

My wife and I have almost been hit 6-7 times when exiting our driveway onto East Main street in Berryville. Seems that our neighbors park their vehicles up to the place where the sidewalk meets our driveway and blocks our line of sight when merging into traffic.

Thank you for your time and consideration,

v/r

Michael Lee

214 E Main Street

Berryville, VA 22611