HRG
Herbert, Rowland & Grubic, Inc.
Engineering & Related Services
AN EMPLOYEE-OWNED COMPANY

LOWER CONNOQUENESSING STORMWATER PLANNING STUDY

Submitted to:
BUTLER COUNTY
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Date:
April 28, 2021

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PROJECT OVERVIEW

1. PROJECT OVERVIEW

The Connoquenessing Creek watershed has a history of stormwater impacts and flooding. The residences and businesses that are located in the municipalities located in the watershed have been negatively impacted during significant rainfall events and during periods of intense rainfall. In the recent years that contained record breaking historical rainfall, these events began to feel like routine, causing each municipality to focus on identifying solutions to help mitigate these solutions.

Addressing these issues previously has been challenging for reasons that include historical development in the floodway and floodplain, recent development and lack of cooperation across political boundaries. With the help of Butler County, an effort was undertaken to generate a regionalized approach to address these issues from a watershed basis with the goal of overcoming obstacles related to lack of communication and cooperation caused by political boundaries. In late 2019, a group of ten (10) municipalities, along with Butler County agreed to invest in an effort to study opportunities in the Lower Connoquenessing Creek watershed to address these long-standing problems. The goal of the study would have two specific focuses, the first being to research if release rates for future development could help mitigate some of the historical and future impacts from development. The second focus would be identifying specific problem areas that each municipality is experiencing from a watershed view and provide recommendations to address these problems. The above-mentioned approach is a smaller effort than the study completed in the previously completed Act 167 Plan undertaken by DEP and Butler County in 2010.

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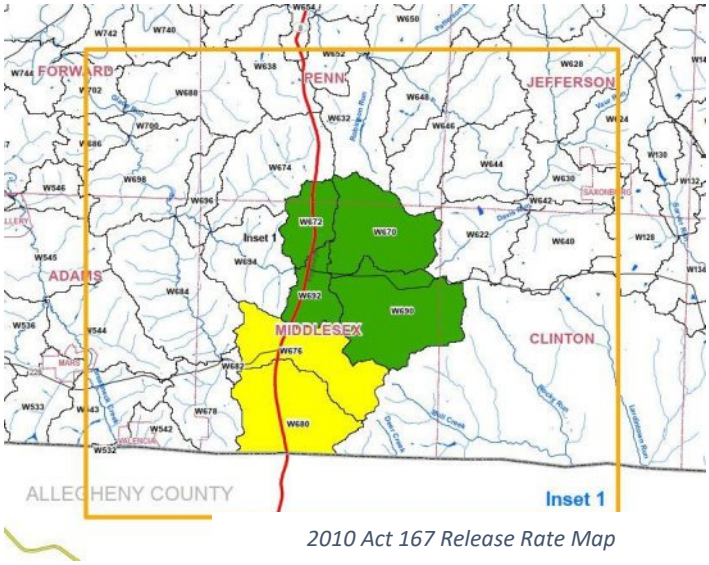
RATE CONTROLS

2. RELEASE RATE ANALYSIS

2.1 Executive Summary



2010 Act 167 Release Rate Map

As requested, Herbert, Rowland & Grubic, Inc. (HRG) has completed stormwater planning for the Lower Connoquenessing Creek watershed. The goal of the study was to investigate the possibility of implementing revised stormwater regulations consistent with Butler County's approved Act 167 Stormwater plan with the goal of decreasing future nuisance flood occurrences within the local watershed of Connoquenessing Creek.

Based on HRG's discussions with the County and multiple municipalities located within the Lower Connoquenessing Creek watershed, there is an interest in re-evaluating the stormwater modeling of the previous Butler County Act 167 Stormwater plan with the goal of positively impacting future stormwater impacts to the watershed. The goal of the project was to evaluate if more stringent release rates in the watershed would have a meaningful impact to the watershed as it relates to stormwater nuisance flooding. In order to complete the analysis, the 2010 Act 167 HEC-HMS Models were updated for approximate 2020 conditions, future conditions were considered on a watershed basis, and release rates were analyzed using the updated HEC-HMS models.

2.2 Existing Condition Analysis

The 2010 Act 167 HEC-HMS Models were updated by re-calculating curve numbers, lag times, and subsequent calibrations. Updated curve numbers for each subbasin were determined by analyzing existing land cover data and soils data in ArcGIS. Land cover data was obtained from the recently published 2016 National Land Cover Dataset (NLCD) and was then converted to land cover designations that correspond to the National Resources Conservation Service (NRCS) curve number tables. Soils data was obtained from the NRCS Web Soil Survey and was utilized to determine hydrologic soil group ratings (A/B/C/D). An ArcGIS spatial analysis of these two datasets, along with the previously created subbasin shapefiles, ultimately determined curve numbers for each subbasin. The updated curve numbers are based on an antecedent runoff condition of two (ARC=2), similar to the previous 2010 Act 167 curve number calculations, and were utilized to determine updated lag times and updated calibrated curve numbers for multiple runoff events. All updated values in tabular form can be found in the Appendix.

The updated model parameters and subsequent results are relatively synonymous with the 2010 models. Apart from the Breakneck Creek and Upper Connoquenessing Creek models, curve number values per subbasin generally increased by an average of 1%. These modest changes are relatively negligible considering the size of the model. It is important to note that the 2010 models utilized 2001 NLCD data and the updated models utilized 2016 NLCD data. The 15-year gap in data and subsequent accuracy differences may explain some of the changes in calculated values. This data is summarized in the table below.

Updated HEC-HMS Models vs. 2010 Act 167 HEC-HMS Models Average Percent Change							
HEC-HMS Model	Per Subbasin		Per Node (Flows)				
	CN	Lag	2-year	10-year	25-year	50-year	100-year
Breakneck	-2.0%	+4.3%	-19.5%	-15.2%	-14.4%	-14.2%	-14.0%
Lower Conny	+1.1%	-1.8%	-0.6%	-0.8%	-0.8%	-0.7%	-0.6%
Upper Conny	0.0%	+0.5%	-9.7%	-7.6%	-6.9%	-6.6%	-6.2%
Lower Slippery	+0.8%	-1.6%	+4.0%	+2.9%	+2.6%	+2.4%	+2.4%
Upper Slippery	+0.9%	-1.7%	+6.5%	+4.7%	+4.2%	+3.9%	+3.8%
Wolf	+0.7%	-1.4%	+3.8%	+2.7%	+2.4%	+2.2%	+2.0%

The 2010 Act 167 HEC-HMS models were mostly calibrated utilizing regression equations, which are based on empirical equations, not actual flows. This was due to a lack of quality stream gauges that could be used for calibration. Only two stream gauges were used for calibration in the previous models: USGS Station 03106000 along Connoquenessing Creek (upstream of Brush Creek) and USGS Station 03106500 along Slippery Rock Creek (upstream of Connoquenessing Creek). Both stream gauges provide ample amounts of data for determining peak flows based on different events, and since the updated models are within 5% of the previously calculated flows at both USGS stations, the updated models are considered valid.

Updated HEC-HMS Models vs. 2010 Act 167 HEC-HMS Models Percent Change						
USGS Station	Stream	Per Event (Flows)				
		2-year	10-year	25-year	50-year	100-year
03106000	Connoquenessing	-3.00%	-2.26%	-2.37%	-2.44%	-2.49%
03106500	Slippery Rock	+5.10%	+3.55%	+3.17%	+2.90%	+2.78%

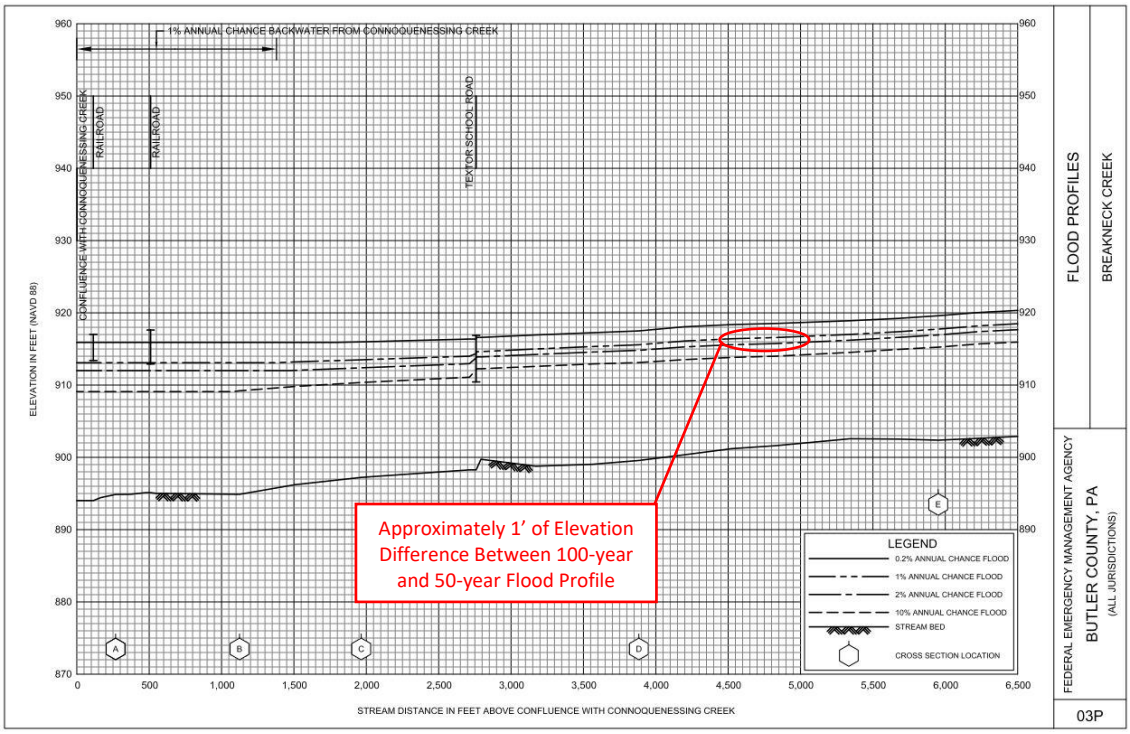
2.3 Future Condition Analysis

The 2010 Act 167 Plan utilized assumptions regarding future development over a span of ten years in order to determine future condition flows. The future condition flows were then compared to existing condition flows in order to determine if release rates were necessary to offset increased stream flows downstream of future developments as a result of increased runoff volume from development. While this methodology has been used historically for many different Act 167 plans, this method of determining release rates is greatly subjective to the model itself, future condition assumptions, and the timespan between existing and future conditions. Rather than assuming future conditions per subbasin over a span of ten years in order to determine release rates, future conditions were assumed on a watershed basis in order to prioritize release rates throughout the study area.

The Connoquenessing Creek watershed in Butler County is expected to experience the most development over time compared to the other major watersheds within the County. The watershed intersects with the I-79, SR 228, and SR 8 corridors which are all expected to experience future development. Overall, the southwestern portion of Butler County is currently the most developed area of the county and is expected to see even more development, including re-development, in the future.

2.4 Peak Flow Analysis

In order to reduce stream flow peaks through more stringent release rates, the release rates must be applied throughout the entire watershed and must be based on target flows. For the sake of this report, HRG investigated what steps would be necessary to reduce the 100-year stream flow peaks to the 50-year stream flow peaks during the 100-year event for Breakneck Creek. In other words, release rates were utilized to investigate the possibility of reducing water surface elevations by approximately one foot near the downstream portions of Breakneck Creek during the 100-year event in order to decrease flooding occurrences.



Breakneck Creek FEMA FIS Profile

Breakneck Creek 2020 Existing Condition Peak Flows (Per Node)				
Discharge Point	Cumulative Area (mi^2)	100-year (cfs)	50-year (cfs)	Percent Difference
1	5.46	1127	1010	-10.4%
2	3.34	700	616	-11.9%
3	2.28	541	464	-14.3%
4	3.83	565	486	-14.1%
5	8.68	1147	1047	-8.7%
6	19.09	3202	2874	-10.2%
7	22.77	3449	3085	-10.6%
8	29.56	3993	3555	-11.0%
9	32.94	3911	3482	-11.0%
10	35.90	4055	3606	-11.1%
11	39.53	4160	3693	-11.2%
12	41.75	4220	3747	-11.2%

While the results from the existing condition models indicate that the 50-year stream flow peaks are approximately 90% of the 100-year stream flow peaks, a release rate of 90% would not result in the 100-year stream flow peaks decreasing to the 50-year stream flow peaks during the 100-year event. This is due to drainage area size, runoff volume, and timing factors which ultimately dictate the release rate required to achieve the necessary results.

The Breakneck Creek HEC-HMS Model was utilized to investigate the release rate required to decrease the 100-year stream flow peaks to the 50-year stream flow peaks during the 100-year event. In order to do so, the model was designed to reduce peak flows from each subbasin to approximately 67% of existing flows while maintaining the amount of runoff volume from each subbasin during the 100-year event. In doing so, the model essentially mimicked the installation of rate control dams along the downstream portions of each subbasin within the Breakneck Creek watershed (19 total).

Breakneck Creek Peak Flows (per Subbasin) Subbasin Peak Flows Reduced to 67% of 100-year Peak Flows							
Subbasin	Drainage Area (mi^2)	Existing 100-year (cfs)	Existing 50-year (cfs)	Percent Diff.	Existing 100-year (cfs)	Reduced 100-year (cfs)	Percent Diff.
W532	1.37	171	144	-15.6%	171	116	-32.1%
W533	2.14	520	469	-9.9%	520	357	-31.4%
W534	1.75	459	412	-10.3%	459	309	-32.8%
W535	3.71	679	608	-10.4%	679	460	-32.2%
W536	1.78	503	444	-11.8%	503	338	-32.9%
W537	3.34	700	616	-11.9%	700	473	-32.3%
W538	2.3	504	441	-12.6%	504	340	-32.6%
W539	1.43	399	347	-12.9%	399	263	-34.0%
W540	2.28	541	464	-14.3%	541	366	-32.4%
W541	1.34	352	310	-11.9%	352	238	-32.5%
W542	2.46	402	348	-13.5%	402	274	-31.9%
W543	2.71	628	579	-7.8%	628	432	-31.1%
W544	3.17	707	629	-11.0%	707	474	-32.9%
W545	3.68	794	707	-11.0%	794	534	-32.8%
W546	1.15	319	282	-11.6%	319	215	-32.6%
W547	3.38	742	676	-8.9%	742	509	-31.4%
W548	1.53	513	430	-16.3%	513	339	-33.9%
W549	0.01	6	7	16.4%	6	4	-36.1%
W550	2.22	608	548	-9.8%	608	416	-31.6%

The results indicate that the most downstream segments of Breakneck Creek would be greater than or equal to the 50-year stream flow peaks during the 100-year event and that the most upstream segments would be less than the 50-year stream flow peaks during the 100-year event. Therefore, implementing release rates that would reduce 100-year peak flows by approximately 33% at the downstream portions of each subbasin within the Breakneck Creek would essentially reduce 100-year flood elevations near the confluence of Likens Run by approximately one foot over the course of time. However, these findings do not imply that implementing a 67% release rate throughout the Breakneck Creek watershed would achieve these desired results. The release rate would need to be proportional to the average drainage area of stormwater facilities.

Breakneck Creek Peak Flows (per Node) Subbasin Peak Flows Reduced to 67% of 100-year Peak Flows							
Discharge Point	Cumulative Area (mi^2)	Existing 100-year (cfs)	Reduced 100-year (cfs)	Percent Diff.	Existing 50-year (cfs)	Reduced 100-year (cfs)	Percent Diff.
1	5.46	1127	762	-32.4%	1010	762	-24.5%
2	3.34	700	473	-32.3%	616	473	-23.2%
3	2.28	541	366	-32.4%	464	366	-21.1%
4	3.83	565	386	-31.7%	486	386	-20.5%
5	8.68	1147	951	-17.0%	1047	951	-9.1%
6	19.09	3202	2413	-24.6%	2874	2413	-16.0%
7	22.77	3449	2762	-19.9%	3085	2762	-10.5%
8	29.56	3993	3354	-16.0%	3555	3354	-5.7%
9	32.94	3911	3437	-12.1%	3482	3437	-1.3%
10	35.90	4055	3591	-11.4%	3606	3591	-0.4%
11	39.53	4160	3723	-10.5%	3693	3723	+0.8%
12	41.75	4220	3803	-9.9%	3747	3803	+1.5%

In order to achieve 33% rate reduction at the downstream portions of each subbasin, which in turn would reduce stream flow peaks 10% at the downstream portions of Breakneck Creek, and hence reduce water surface elevations approximately one foot during the 100-year event, a release rate much less than 67% would be needed for stormwater facilities. This is due to the relationship between drainage area and release rates. The larger the drainage area, the smaller the impact release rates have on stream flows, which was determined through the Breakneck Creek model. The reasoning for this is due to runoff volume. Release rates are designed to hold back additional runoff volume in order to reduce peak runoff rates. However, the runoff volume is still released during the runoff event and ultimately becomes cumulative as the drainage area increases, hence providing negligible benefits to the most downstream portions of watersheds.

In addition to a very low release rate throughout the entire Breakneck Creek watershed, every acre would need to be tributary to a stormwater facility designed for the release rate. Assuming an average drainage area of 15 acres per stormwater facility, the installation of over 1,500 stormwater facilities designed for the release rate would be necessary throughout the Breakneck Creek watershed. Assuming a similar scope for the Connoquenessing Creek watershed, with the western boundary line of Butler County being the point of interest, and a drainage area of 321.28 square miles – or nearly eight times greater than the total drainage area for Breakneck Creek, the installation of over 12,000 stormwater facilities designed for an even smaller release rate than that of Breakneck Creek would be necessary throughout the Connoquenessing Creek watershed.

While the model results indicate that release rates can be used to decrease stream flow peaks, and hence reduce water surface elevations, the model results also provide insight into the relationship between drainage area, runoff volume, stream flows, and release rates. Generally, larger drainage areas produce larger amounts of runoff volume, higher stream flows, and require more stringent release rates in order to reduce stream flows. Ultimately, implementing stringent release rates in order to reduce stream flows do not provide equal benefits throughout a watershed. The release rates will generally benefit smaller drainage areas more than larger ones. Additionally, the effect of release rates is greatly dependent on how quickly the release rates are adopted by municipalities, how much development is expected to occur within the watershed, and how quickly the development occurs within the watershed.

2.5 Release Rate Analysis

The analysis presented in the previous section demonstrates that release rates alone will not substantially benefit areas that are experiencing flooding by larger streams. However, adopting release rates will generally provide benefits to storm sewer systems and small streams as a result of reduced peak flows. To demonstrate these benefits, the HEC-HMS model for Breakneck Creek was analyzed by making assumptions regarding future conditions. The assumptions were then utilized to update curve numbers and lag times within each subbasin to replicate a realistic development scenario. Generally, the newly developed acres calculated for each subbasin were used to replace woods land cover with residential land cover.

Breakneck Creek Watershed Future Condition Assumptions								
Municipality	Sites per Year	Acres per Site	Acres per Year	Years	Acres	Subbasin	Newly Developed Acres	Percent of Subbasin Developed
Forward	2	50	100	10	1000	W547	1000	46%
Jackson	3	50	150	10	1500	W539	375	41%
						W540	375	26%
						W541	375	44%
						W550	375	26%
Adams	4	50	200	10	2000	W533	250	18%
						W534	250	22%
						W535	250	11%
						W536	250	22%
						W538	250	17%
						W543	250	14%
						W544	250	12%
						W545	250	11%

The release rates analyzed for this model can be defined as differences between design storms. Historically, a 100% release rate indicates that the 100/50/25/10/2-year post-construction peak flows will be less than or equal to the 100/50/25/10/2-year pre-construction flow. For this model, release rates were determined by offsetting the difference between post- and pre-construction peak flows by one design storm. In other words, the 100/50/25/10/5/2-year post-construction peak flows would be less than or equal to the 50/25/10/5/2/1-year pre-construction flow. While these potential release rates would not reduce stream flow peaks to lower tier design storms at lower portions in the watershed, as determined in the previous section, the potential release rates would eventually reduce peak flows to lower tier design storms for storm sewers systems and small streams over the course of time.

Potential Release Rates
2-year Post-Construction Peak Flow Rate </= 1-year Pre-Construction Peak Flow Rate
5-year Post-Construction Peak Flow Rate </= 2-year Pre-Construction Peak Flow Rate
10-year Post-Construction Peak Flow Rate </= 5-year Pre-Construction Peak Flow Rate
25-year Post-Construction Peak Flow Rate </= 10-year Pre-Construction Peak Flow Rate
50-year Post-Construction Peak Flow Rate </= 25-year Pre-Construction Peak Flow Rate
100-year Post-Construction Peak Flow Rate </= 50-year Pre-Construction Peak Flow Rate

The results from the Breakneck Creek HEC-HMS model are presented below. The model analyzed the 100-year peak flows under updated existing conditions, future condition assumptions with no stormwater management, future condition assumptions with current stormwater management standards, and future condition assumptions with the release rates defined above as the new standard. The results indicate that more stringent release rates generally reduce peak flows more than the current 100% release rate. However, there are a few locations where peak flows slightly increase (Discharge Point 5, 11, and 12). The increase in peak flows at #5 is due to timing factors from subbasins with no anticipated development and subbasins with anticipated development. These timing factors are also due to model calibration and modeling assumptions. On the other hand, the increases in peak flows for #11 and #12 are very small and are generally within the percent error of the model. Overall, the results indicate that discharge points with smaller cumulative areas (Discharge Point 1 & 3) will benefit more from stringent release rates than discharge points with larger drainage areas (Discharge Point 11 & 12).

Breakneck Creek Peak Flows (per Node) **Future Condition Results**								
Discharge Point	Cumulative Area (mi^2)	Existing 100-yr (cfs)	Future 100-yr w/ No SWM (cfs)	% Diff. from Existing	Future 100-yr w/ Current RR (cfs)	% Diff. from Existing	Future 100-yr w/ New RR (cfs)	% Diff. from Existing
1	5.46	1127	1321	17.2%	1229	9.0%	1123	-0.3%
2	3.34	700	700	0.0%	700	0.0%	700	0.0%
3	2.28	541	674	24.5%	591	9.2%	483	-10.8%
4	3.83	565	565	0.0%	565	0.0%	565	0.0%
5	8.68	1147	1257	9.6%	1264	10.2%	1316	14.8%
6	19.09	3202	3609	12.7%	3482	8.8%	3388	5.8%
7	22.77	3449	3805	10.3%	3732	8.2%	3646	5.7%
8	29.56	3993	4372	9.5%	4264	6.8%	4148	3.9%
9	32.94	3911	4234	8.3%	4235	8.3%	4199	7.4%
10	35.90	4055	4387	8.2%	4399	8.5%	4373	7.8%
11	39.53	4160	4504	8.3%	4543	9.2%	4545	9.3%
12	41.75	4220	4567	8.2%	4615	9.3%	4625	9.6%

While the potential release rates are defined in terms of design storms, the release rates can also be simplified as a percentage – similar to current release rates. Generally, this percentage varies by subbasin, watershed, design storm tiers (e.g. 100 to 50 vs. 50 to 25), and other factors. However, the release rates can be approximated as a 90% release rate. This approximation was determined by analyzing percent differences in peak flows between design storms from the existing conditions model. The 90% release rate approximation can also be used to coincide with existing stormwater management ordinances.

2.6 Release Rate Recommendation

The 2010 Act 167 Plan proposed stormwater rate/volume controls, along with release rates in specified subbasins, in order to maintain stream flow peaks after development. However, due to an abundance of flooding and erosion issues throughout Butler County, more stringent release rates are recommended in order to reduce flow peaks in storm sewer systems and streams with

small drainage areas. While implementing more stringent release rates would provide negligible impacts to stream flow peaks with large drainage areas, the effects of more stringent release rates will be evident throughout the upper reaches of the watershed where future development is anticipated.

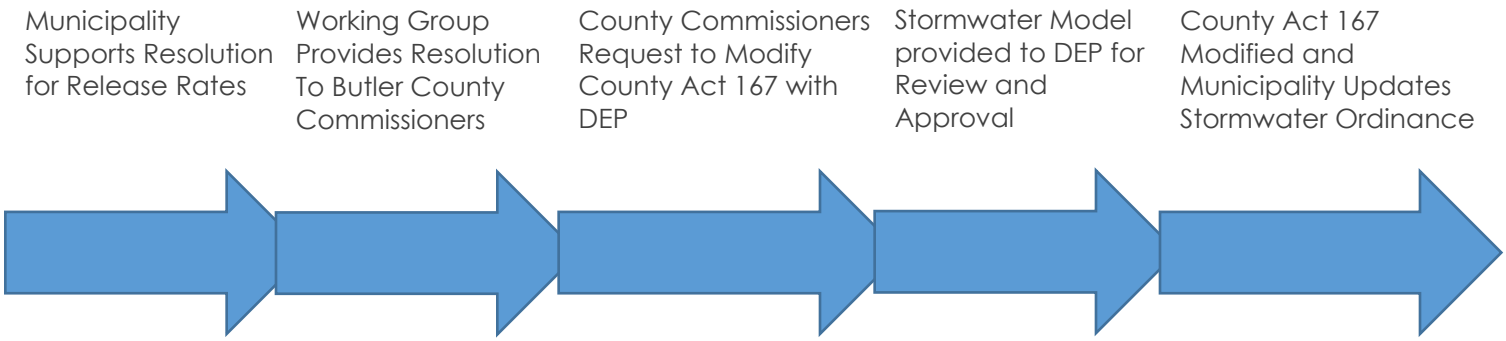
Based on a 90% release rate, and assuming traditional stormwater management practices, stormwater facilities are expected to increase in size. While this increase may impact future developments, developers may seek out alternatives to reduce post-construction runoff rates in order to minimize the required footprint for stormwater facilities. The rate controls defined in the previous section may also provide a metric for existing stormwater facilities to be retrofitted in order to meet the new release rate.

In order to have an equitable impact, the 90% release rate should be adopted by municipalities that anticipate development within the Connoquenessing watershed. Therefore, most of the municipalities that participated in this study should consider adopting the release rate. For municipalities that already have adopted release rates, it is recommended that they maintain rates that are more conservative than 90% and reduce rates that are higher than 90%. This approach will mainly impact Cranberry Township and only in the sub watershed that drains to Breakneck Creek.

Overall, effective stormwater management will continue to be a critical component of Butler County's infrastructure needs. Hundreds of years of land clearing and development without proper stormwater management, along with the increased duration and frequency of runoff events, have certainly caused an increase in stream flow peaks and erosion, higher water surface elevations, and subsequently more flooding. In order to account for a lack of stormwater management prior to current standards, increases in precipitation, and future developments, more stringent release rates controls are necessary in order to prevent detrimental impacts to Butler County's streams and storm sewer infrastructure.

2.7 Release Rate Implementation

Proper implementation of the proposed release rates will require the County to update the current Act 167 Stormwater plan. This requires proposed release rates to be reviewed by PADEP. Upon approval from DEP to modify the existing Act 167 Plan, each municipality will need to revise their current stormwater management ordinance to finish the implementation of the proposed release rates. Based on discussions with the working group, it was discussed that each participating municipality pass a resolution supporting the implementation of release rates in their municipality and requesting that Butler County amend the current Act 167 plan. A summary of the implementation process is located below.



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PROBLEM AREAS

3. PROBLEM AREA ANALYSIS

3.1 Executive Summary

The second portion of this study is focused on evaluating known stormwater impacts in each community with the goal of preparing a planning solution and planning level cost estimate to be used to generate a plan of addressing these concerns. Each municipality submitted three (3) stormwater problem areas that impact their community. The municipalities were encouraged to focus on problem areas that could be addressed with infrastructure improvements, assist in operational aspects of the community, and/or problems that a larger regional focus could be utilized to leverage support.

The projects that received from each community varied, but generally consisted of areas located within 100-year floodplains, flooding by adjacent tributaries and streams, enclosed streams, failing roadway culverts, storm sewer upgrades, dam modifications, and BMP improvements. It was also observed that multiple projects crossed municipal boundaries or had benefits to multiple municipalities. In total, Butler County and ten (10) municipalities participated in the study and thirty-three (33) problem areas were identified. The relevant watersheds for the participating governmental bodies are listed below.

No.	Participant	Watersheds of Identified Problem Areas
1	Adams Township	Breakneck Creek
2	Butler County	Connoquenessing Creek
3	Cranberry Township	Brush Creek & Wolfe Run
4	Evans City Borough	Breakneck Creek
5	Forward Township	Connoquenessing Creek & Glade Run
6	Harmony Borough	Connoquenessing Creek & Unnamed Tributary to Conn. Creek
7	Jackson Township	Connoquenessing Creek & Glade Run
8	Lancaster Township	Little Connoquenessing Creek, Little Yellow Creek, & Scholars Run
9	Penn Township	Connoquenessing Creek & Thorn Creek
10	Seven Fields Borough	Kaufman Run
11	Zelienople Borough	Glade Run & Unnamed Tributary to Connoquenessing Creek

Desktop assessments and field investigations for each site were conducted in order to gather additional information and confirm the data provided. This information was then utilized to generate conceptual level solutions and cost estimates. A summary identifying the proposed areas submitted, the information obtained from the field view, and recommendations for mitigation was performed for each municipality.

The proposed projects within the Connoquenessing Creek watershed generally include: floodplain improvements along tributaries and streams, roadway improvements, storm sewer improvements, improvements to enclosed streams, modification of existing stormwater detention facilities, and the implementation of the Federal Emergency Management Agency's Hazard Mitigation Assistance (FEMA HMA) programs for various communities. Planning level cost estimates were prepared for each project, as well as anticipated permitting efforts. It should be noted that the cost estimates are planning level and did not include costs associated with land or right-of-way acquisition, permit fees, and unforeseen costs that could be identified during engineering design. A table summarizing the projects with costs are identified below.

Location	Proposed Project	Cost Estimate
Adams Township	Mars Valencia Road Flooding	$2M to $4M
	Clay Avenue Flooding	$50K to $100K
	Clarks Lane Flooding	$25K to $300K
Butler County	Connect Watershed Groups with Municipalities	$10K to $30K
	Identify Opportunities to Do Floodplain Restoration/Mitigation in The Watershed	$15K to $45K
	Girls Scout Camp Amphitheater	$150K to $350K
Cranberry Township	Fox Run Neighborhood Stormwater Improvements	$30K to $200K
	Pinehurst Neighborhood Culvert Improvements	$150K to $450K
	St. Leonard Woods Detention Basin Modification	$15K to $90K
Evans City Borough	Benefit/Cost Analysis for Capital Improvement/Maintenance	$20K to $150K
	Stormwater Conveyance System Improvements	$25K to $150K
Forward Township	Nursey Road Culvert	$100K to $200K
	Nursery Road and Rader School Road Culverts	$150K to $300K
	Johns School Road Bridge	$600K to $900K
Harmony Borough	Old Little Creek Road	$200K to $500K
	Spring Street Flooding	$50K to $500K
Jackson Township	Tollgate School Road Corridor	$50K to $250K
	Evergreen Mill Road Corridor	$900K to $1.2M
	Textor School Road	$65K to $90K
	German Street Flooding	$25K to $45K
Lancaster Township	West Lancaster Road Flooding	$150K to $200K
	Little Yellow Creek Road	$2M to $4M
	Little Creek Road	$35K to $150K
Penn Township	Dodds Road near Rockdale Road	$30K to $250K
	Dutchtown Road near Woodland/Crisswell Road	$500K to $800K
	East Main Street in Renfrew	$2.6M to $4M
Seven Fields Borough	Castle Creek Drive Pond Modification	$10K to $30K
	High Pointe Drive Dam Modification	$15K to $25K
	Cumberland Drive Regional Stormwater Detention	$40K to $60K
Zelienople Borough	Fairlawn Area Stormwater Management	$350K to $1.5M
	Borough Park Flooding	$10K to $150K
	Glade Run Watershed Stormwater Management	$100K to $500K

4

ADAMS TOWNSHIP

4. ADAMS TOWNSHIP

4.1 Overview

Adams Township is generally comprised of two (2) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Breakneck Creek and Glade Run. While smaller watersheds exist within Adams Township, the watersheds encompass the entirety of the municipality's drainage area for this study.

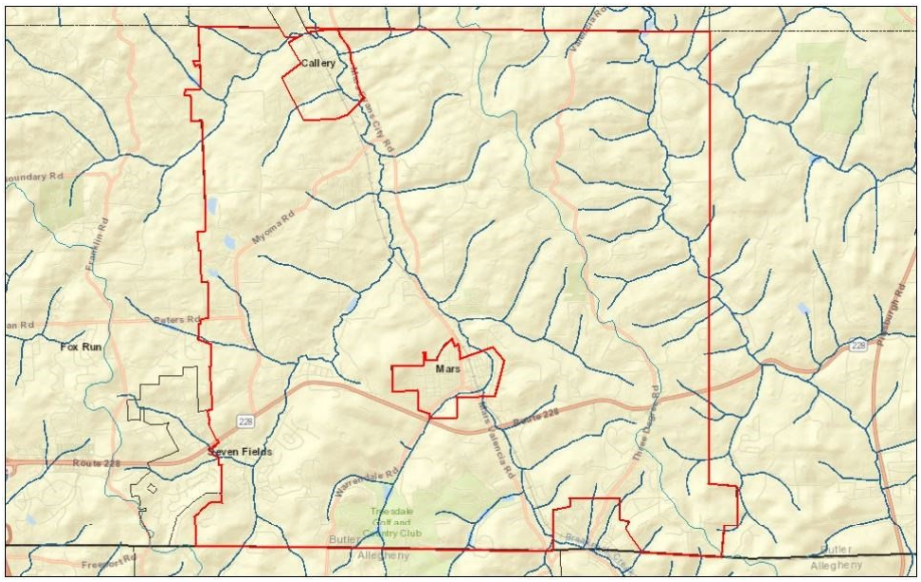


Figure 1A: Adams Township (PADEP EMAP)

4.2 Identified Problem Areas

Adams Township provided three (3) projects for consideration. All three (3) projects are within the Breakneck Creek watershed and negatively impact residential properties, local businesses, and local transportation networks. The specific areas that were identified by the municipality include the following:

- Mars Valencia Road flooding along Breakneck Creek near Brickyard Road and Jimmy's Strip District Grill.
- Clay Avenue flooding along Breakneck Creek near Empire Specialty Company.
- Clarks Lane flooding from small tributary running from Seaton Crest Plan to Mars Borough.

4.3 Project Overview

Mars Valencia Road Flooding

Mars Valencia Road and adjacent structures are subject to flooding due to their location within the 100-year floodplain of Breakneck Creek. Site specific challenges for this area include the historical presence of development in the floodplain, that is adjacent to the stream, and the stream location being situated between a main transportation route into Mars Borough (SR 3015) and the Buffalo & Pittsburgh Railroad.

Figure 1B: Site Photo

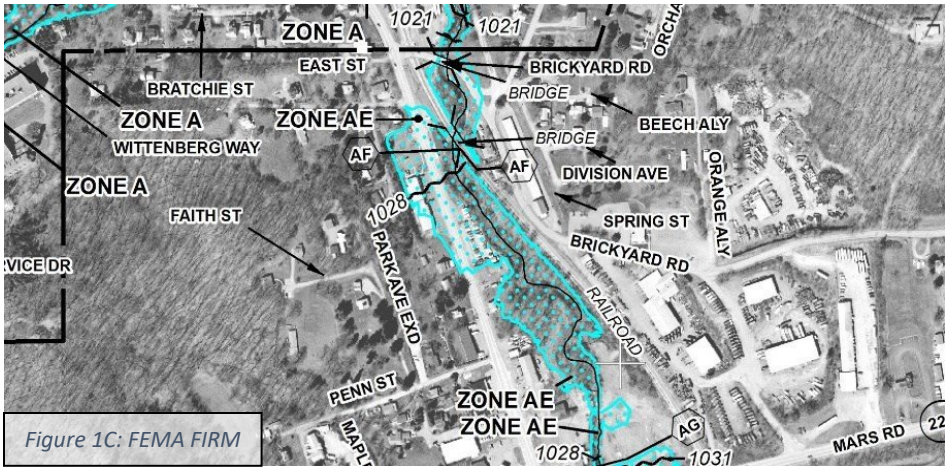


Figure 1C: FEMA FIRM

Based on HRG's review of the current FEMA flood mapping, it appears that multiple road and railroad crossings may be contributing to increased flood elevations in this area. These obstructions appear to be acting as a significant obstruction to the waterway and may be impacting the upstream flood elevation as much as seven (7) feet. A potential solution to help alleviate the impact of flooding would be to increase the flow capacity of the downstream bridges/culverts to help decrease the height of the upstream flood elevations, while making sure that there are no negative repercussions from increases to downstream elevations resulting from increased flows. Additional detailed modeling of this stream corridor will need to be completed due to the proximity of each of the structures.

Costs to address these obstructions will vary greatly based on permitting, property ownership, and coordination with the railroad. For planning purposes, it was assumed that the project costs could range from $2,000,000 to $4,000,000 to replace one or both structures.

Clay Avenue Flooding

Clay Avenue is subject to flooding due to its proximity to Breakneck Creek. The stream is located along the northeast side of Clay Avenue and eventually enters the storm sewer system near Dobson Road. The stream is mostly enclosed in the downstream portion and mostly exposed in the upstream portions; however, the stream channel alignment appears to have been significantly altered from historical development.

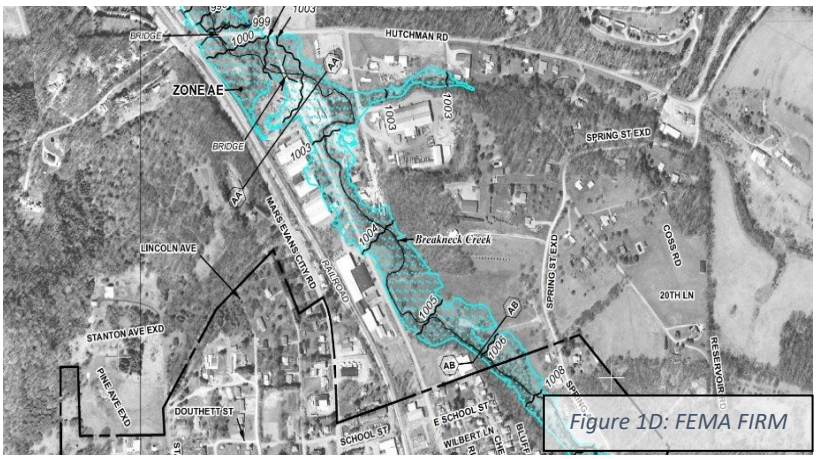


Figure 1D: FEMA FIRM

Based on discussions with the Township, this section of stream frequently floods, and under large flooding events, impacts the ability of adjoining business to operate. It is apparent that past development has significantly encroached on the floodway and it is assumed that the historical conveyance system was installed without detailed engineering study. The Township has attempted to perform some work in the area to stabilize the streambank, however, this portion of the stream requires routine maintenance to ensure that debris does not cause additional obstructions to the current conveyance system.

Addressing flooding in this area will be challenging due to the amount of historical development that is located within the floodplain and the presence of the existing stream enclosure. The Township should investigate opportunities to work with the adjacent business owners to better the property when opportunities present themselves. Examples of this could be requiring streambank restoration during redevelopment and working with the property owners to upsize the existing conveyance system when it is due to be maintained or replaced. The Township should also routinely inspect the stream to ensure that debris, loose vegetation, and refuse is not present in the channel that could cause additional obstruction to the existing pipe system. By implementing routine channel maintenance, the risk of major flooding from smaller storm events could be minimized.

Figure 1E: Site Photo

The Township should also work with the affected businesses to implement flood proofing measures for the structures on the property to mitigate flood damage to the businesses. There may also be some opportunities to install flap gates on the discharge pipes to prevent back flooding on smaller storm events. The planning level cost estimate for this area is $50,000 to $100,000.

Clarks Lane Flooding

Clarks Lane is subject to flooding due to its proximity to an Unnamed Tributary to Breakneck Creek. The stream is located along the southern edge of Clarks Lane and eventually enters the storm sewer system near Spring Street before it discharges to Breakneck Creek. The Unnamed Tributary to Breakneck Creek travels the entirety of Clarks Lane in Adams Township from east to west. The stream is mostly enclosed in the downstream portion, mostly exposed in the upstream portions, and periodically enclosed by driveway crossings. The full extents of the stream generally start at the Seaton Crest Plan and ends at Breakneck Creek.

Figure 1F: Site Photo

Based on observations during our site visit, it appears that the existing stormwater channels and piping are not adequately sized to handle storm events. It also appears that the stream channel/swale portion of the system is experiencing significant erosion and once the system is beyond capacity, runoff directly impacts downstream residential properties. It is recommended that the existing stream channel be modified through a natural streambank restoration project to enlarge the channel to increase capacity, slow the velocity of the water in the channel to decrease erosive forces, and adequately size the downstream pipe network to have capacity to handle desired storm events. There may also be an opportunity to protect some the downstream residents from runoff impacts by adjusting the roadway crown or cross slope to keep water from crossing the centerline of the road and discharging on the properties.

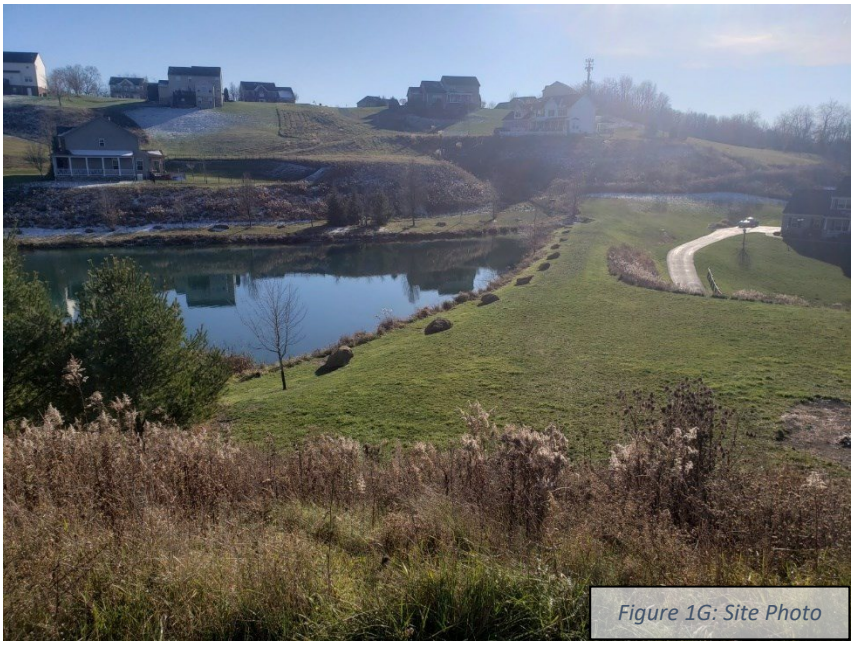


Figure 1G: Site Photo

A larger opportunity to decrease the rate of runoff to the area could be modifying the discharge structure of an upstream retention pond to discharge less flow during smaller rainfall events. This effort will require additional engineering study and may require additional DEP permitting efforts since the basin appears to meet the criteria of a dam. It should also be noted that given the way it appears that the plan was recorded, the basin is located within multiple private properties and not in common or green space. The Township would need to obtain permission to access one or multiple properties to complete this work. The planning level cost estimate for this area is $25,000 to $300,000.

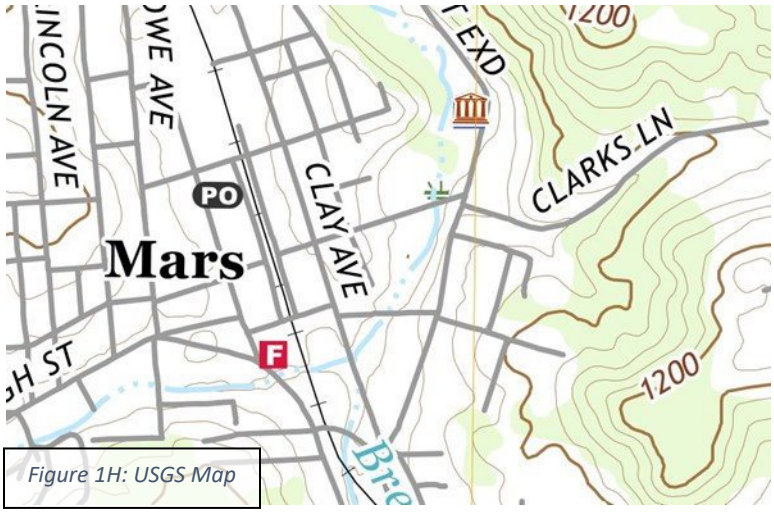


Figure 1H: USGS Map

5

BUTLER COUNTY

5. BUTLER COUNTY

5.1 Overview

Butler County is generally comprised of one (1) watershed that is tributary to the Connoquenessing Creek at the western border of Butler County: Connoquenessing Creek. While other watersheds exist within Butler County, the aforementioned watershed encompasses the entirety of the county's drainage area for this study.

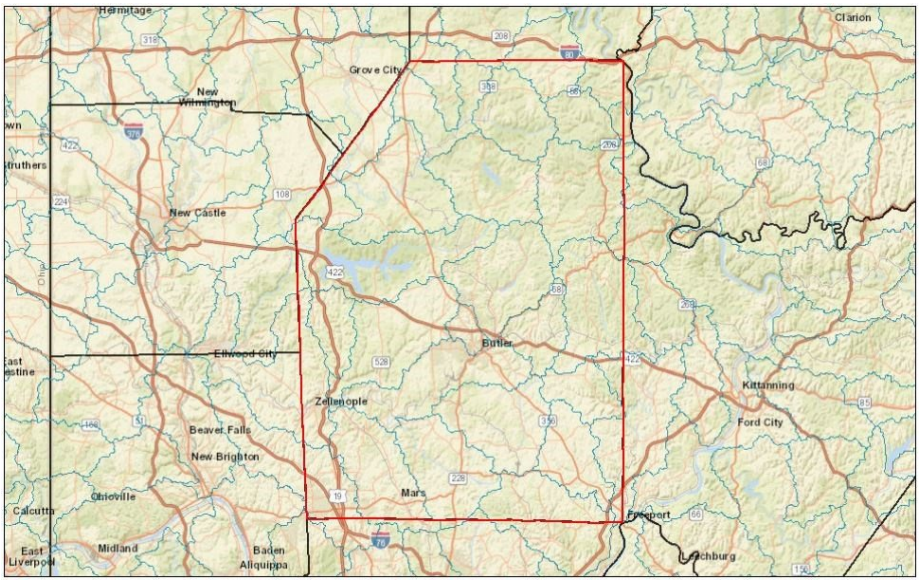


Figure 2A: Butler County (PADEP EMAP)

5.2 Identified Problem Areas

Butler County provided three (3) projects for consideration. All three (3) projects are within the Connoquenessing Creek watershed.

- Connect watershed groups with municipalities.
- Identify properties/opportunities to do floodplain restoration/mitigation in the watershed.
- Girls Scout Camp Amphitheater options for flood mitigation.

5.3 Project Overview

Connect Watershed Groups with Municipalities

Connecting watershed groups with municipalities could benefit both the municipalities and watershed groups. Cooperation with volunteer groups could assist in providing labor, funding, and awareness to the issues caused by stormwater and flooding. Watershed group cooperation could allow communities to leverage funding that may not be available to local governments and can help gather public support of stormwater initiatives. Obvious opportunities for this cooperation could be annual cleanup days to remove debris from streambanks or volunteer labor to install riparian buffer plantings, both of which provide improvement to the waterway for minimal investment. Another major contribution that these groups can provide is public education to help municipalities gain support for a project and when needed, help overcome the voices in the room that do not believe in stormwater improvement investment. Groups that the County could continue to focus on would be The Connoquenessing Watershed Alliance, Allegheny Aquatic Alliance, the Seneca Valley High School Environmental Club, the Pittsburgh Kayakers, the Butler Outdoor Club, local sportsman's clubs, and the Boy Scouts and Girl Scout Troops.

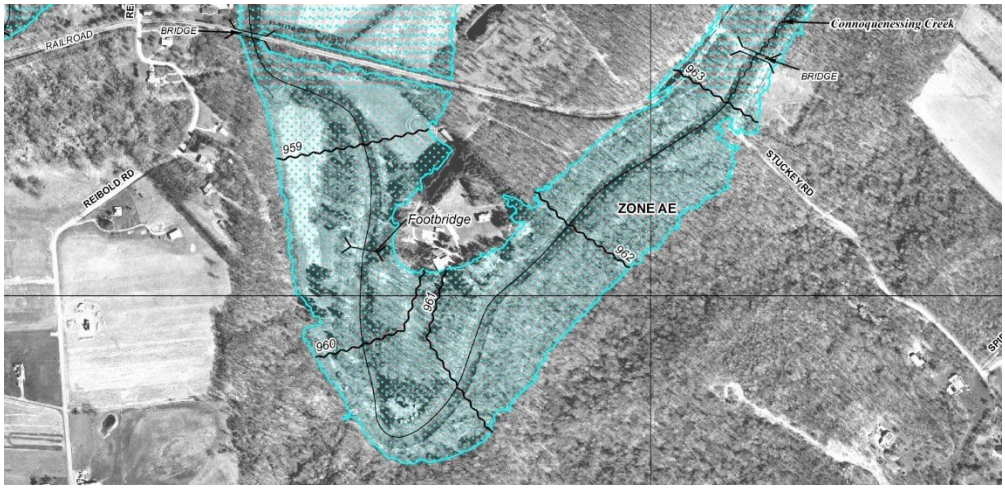
Identify Opportunities to Do Floodplain Restoration/Mitigation in The Watershed

An abundance of properties/opportunities are available for floodplain restoration/mitigation throughout the Connoquenessing Creek watershed. Most notably, the upstream tributaries and reaches of the Connoquenessing Creek watershed are ideal for floodplain restoration/mitigation due to their relatively low flows and smaller cross sections. There are multiple opportunities to identify these areas including, protecting floodplain from future development, obtain access to preform streambank stabilization and/or restoring floodplain that has been previously developed. These efforts could help provide additional runoff volume and decrease streamflow velocity should help prevent erosion resulting in the formation of downstream gravel bars.

Girls Scout Camp Amphitheater

The Girls Scout Camp Amphitheater is located at Camp Redwing off of Rader School Road in Forward Township near the Connoquenessing Creek. The amphitheater is subject to flooding due to its location within the 100-year floodplain of Connoquenessing Creek. It is our understanding that the structure has recently been impacted by flooding from the Connoquenessing Creek.

Being that the facility is located within the 100-year floodplain and is within close proximity of the creek, there are two (2) approaches to help mitigate the issue. The most viable option for this area is to relocate or reconstruct the amphitheater out of the floodplain. Another option would be to raise the existing structure and its utilities that could be damaged by a flood above the 100-year flood elevation.



Amphitheater (FEMA FIRM 42019C0411D)

6

CRANBERRY TOWNSHIP

6. CRANBERRY TOWNSHIP

6.1 Overview

Cranberry Township is generally comprised of two (2) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Kaufman Run and Wolfe Run. In addition, the vast majority of Cranberry Township is tributary to Brush Creek, which discharges to the Connoquenessing Creek in North Sewickley Township, Beaver County. While other watersheds exist within Cranberry Township, the aforementioned watersheds encompass the majority of the municipality's drainage area for this study.

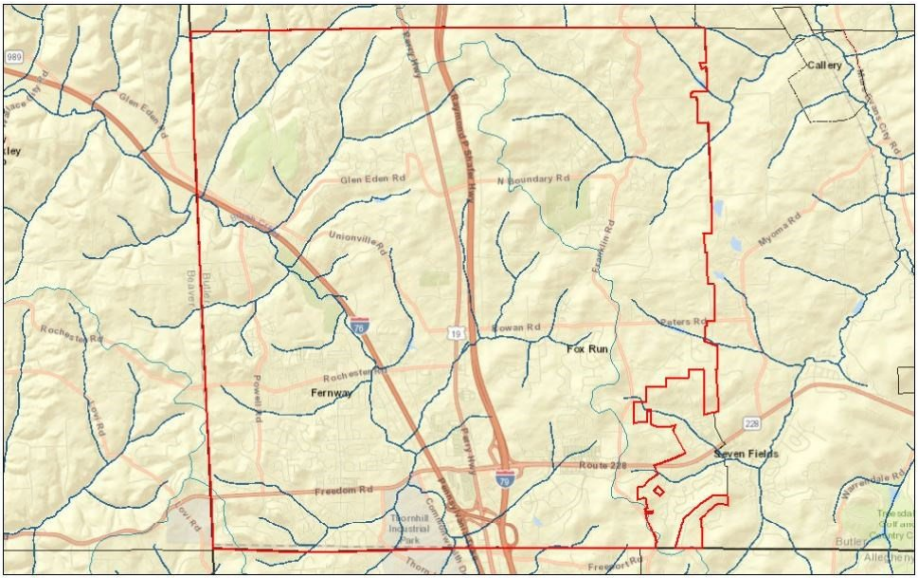


Figure 3A: Cranberry Township (PADEP EMAP)

6.2 Identified Problem Areas

Cranberry Township provided three (3) projects for consideration. The projects selected are not directly impacting businesses or property owners, however, appear to be an opportunity to provide better stormwater management to the community. The projects include the following:

- Fox Run Neighborhood – Early subdivision with no stormwater detention. There may be an opportunity to provide additional stormwater management as part of a recreational improvement project.
- Pinehurst Neighborhood – Existing large culvert is experiencing deterioration consistent with nearing the end of its design life.
- Detention Basin Modification – Investigate the possibility to complete detention basin modifications for two (2) basins in the St. Leonard Woods Development.

6.3 Project Overview

Fox Run Neighborhood Stormwater Improvements

The Fox Run Neighborhood appears to have been developed with minimal stormwater detention facilities, however, stormwater conveyance infrastructure is present and functioning. Multiple parcels within the development's boundaries are owned and maintained by Cranberry Township and are currently being used for recreation/open space purposes. The site can be described as

Figure 3B: Site Photo

elevated and generally flat with a stream/channel bordering the site to the south and west. The stormwater conveyance system appears to consist of a small piped stream that is day lighted around the property, and since the existing parcel is graded higher than the surrounding residential properties, overflows discharge into the residential yards.

Based on HRG's review of the site, it appears that this location would be suitable for a grading modification that would provide additional capacity for stormwater runoff in the channel to limit the impacts to residential property. With proper modeling, there may be an opportunity to provide limited detention during small storm events for the development. This detention could be provided with the installation of a small rain garden on the northern portion of the site and natural stream design within the channel. This work could be combined as part of an overall recreational type improvement, as the existing recreational facility is due for replacement. If streambank restoration methodologies are incorporated in this effort, it would open the Township up to additional funding and could help the Township in meeting MS4 requirements for both their PRP and public education requirements.

It should be noted that the improvements within the Fox Run neighborhood area is not tributary to the Connoquenessing Creek at the western border of Butler County. The Fox Run Neighborhood discharges to Brush Creek, which eventually discharges to the Connoquenessing Creek in North Sewickley Township, Beaver County.

Figure 3C: Aerial

Costs to complete the project could range from $30,000 to construct just a rain garden, to $200,000 in order to complete significant grading, rain garden construction, and stream restoration. Permitting for the project would vary based on the scope of the project, but may require NPDES stormwater permitting, and Water Obstruction and Encroachment Permitting. Costs for this project could be combined with recreational funding sources to open the Township up to non-traditional funding streams.

Figure 3D: Site Photo

Pinehurst Neighborhood Culvert Improvements

Located under Pinehurst Drive is a large corrugated metal culvert that is experiencing deterioration and failure of the upstream gabion basket headwall. The culvert is the main connection point between the northeast and southwest portions of the development and located under significant fill. It is our understanding that there is most likely multiple underground utilities located between the top of the culvert and the road surface, making traditional replacement challenging. The stream channel is off alignment from the culvert causing erosion scouring of the existing headwall. Compounding this erosion, the bottom of the metal culvert is starting to erode, potentially impacting the structural capacity of the culvert crossing.

Based on our observations during the site visit, this culvert should be rehabilitated in place before more significant damage occurs. The culvert location is conducive to relining with a smaller culvert or shotcrete the existing culvert. In addition, the headwall should be repaired or replaced. Given the amount of embankment over the culvert, capacity of the culvert should not be an issue with the proposed repair. The Township should also investigate completing a streambank restoration project to realign the stream channel with the existing culvert opening in the attempt to prevent future scour of the headwall.

The proposed work will most likely require a Water Obstruction and Encroachment General Permit – GP-11 from DEP prior to completing the work. The costs to complete the project will vary based on the approach and materials selected, as well as the total scoping of the project. Budgetary cost estimates for the work could range between $150,000 to $450,000.

Figure 3E: Site Photo

Figure 3F: Aerial

St. Leonard Woods Detention Basin Modification

The St. Leonard Woods Development located between Peters Road and Franklin Road was constructed with stormwater conveyance and detention facilities. The basin that was observed appears to be functioning well and is well maintained.

The basin is fully vegetated, fenced, with a concrete outlet structure. The outlet structure consists of three (3) orifices: one at grade with a trash rack, a secondary circular orifice partway up the vertical face of the structure, and a third orifice consisting of a horizontal Type M inlet grate. The basin also has an emergency spillway graded into the basin embankment.

The basin appears to be a good candidate to convert from its existing use of providing rate control, to a basin that can provide both rate and volume control/water quality. It is proposed that the basin calculations be re-evaluated to modify the outlet structure orifices in a manner to allow installation of bioretention material and an underdrain to filter a determined volume of stormwater during storm events. The Township may also be able to over detain minor storm events resulting in a decreased rate of runoff discharge than the current design. The installation of bioretention material will also assist the Township with meeting nutrient and sedimentation removal requirements of their MS4 PRP Requirements.

Costs to complete the proposed modifications will vary based on the amount and type of modification chosen, however, planning estimates for the proposed modifications will range between $15,000 to $90,000. The proposed work may not require any permitting if the disturbance can be limited to less than one acre or can be classified as maintenance.

Figure 3G: Site Photo

7

EVANS CITY BOROUGH

7. EVANS CITY BOROUGH

7.1 Overview

Evans City Borough is generally comprised of one (1) watershed that is tributary to the Connoquenessing Creek at the western border of Butler County: Breakneck Creek. While smaller watersheds exist within Evans City Borough, the aforementioned watershed encompasses the entirety of the municipality's drainage area for this study.

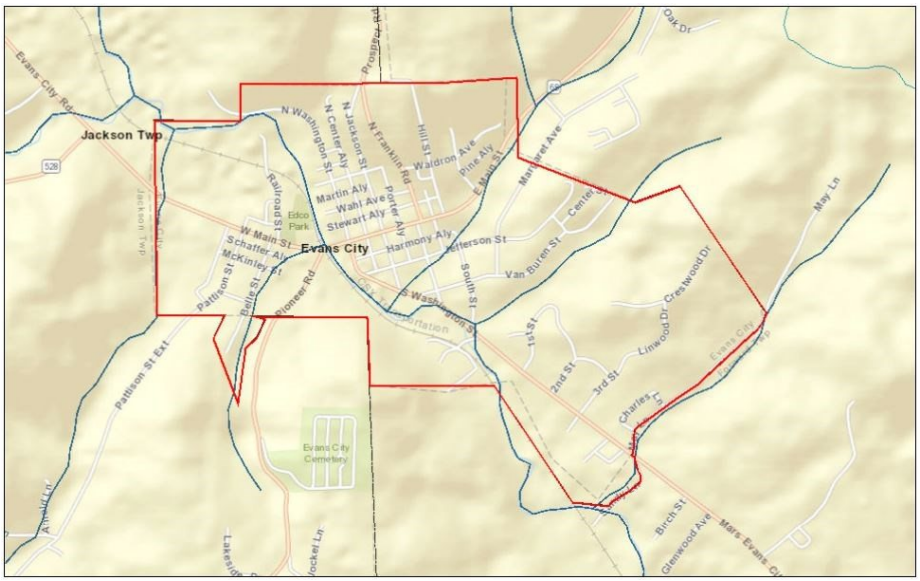


Figure 4A: Evans City Borough (PADEP EMAP)

7.2 Identified Problem Areas

Evans City Borough provided three (3) projects for consideration. All three (3) projects are within the Breakneck Creek watershed.

- Investigate the benefits and costs to develop a Capital Improvement/Maintenance Plan for the Borough's stormwater system. The goal for the plan would be more efficient use of resources and capital to address nuisance stormwater issues that impact the Borough.
- Evaluate the costs to upgrade an existing stormwater conveyance system in the Borough. HRG to work with and assist the Borough in finalizing the locations after site visit and map review with the Borough. Study area most likely in the northeast portion of the Borough.
- Evaluate upstream opportunities along Breakneck Creek to construct flood control measures that may benefit the Borough.

7.3 Project Overview

Benefit/Cost Analysis for Capital Improvement/Maintenance Plan

The Borough's stormwater system consists of a combination of storm sewers and their typical appurtenances, along with open channels and swales along some roadways. The system is ultimately tributary to Breakneck Creek, which flows primarily from southeast to northwest through the center of the Borough. The Borough allocates a portion of their annual budget to the operation and maintenance of the system, with the primary activities being repair, cleaning, or replacement of facilities in response to resident complaints or facility failure. There are numerous locations of frequent and localized flooding during rainfall events.

Figure 4B: Site Photo

Based upon HRG's field investigations and coordination with Borough officials, a primary recommendation would be for the Borough to undertake a comprehensive condition assessment of its stormwater management system, to include the identification of flooding problem areas and the identification and mapping of the Borough's stormwater assets. The results of this assessment would form the basis of an up-to-date Operation and Maintenance/Capital Improvement Plan for the system.

The intent of the Plan would be to allow the Borough to properly plan for the work and funding of not only the required annual cleaning and maintenance activities, but for the identification, prioritization, and scheduling of recommended capital improvements and flooding mitigation projects.

The Plan could be developed in phases, to even include "simple" solutions to immediate flooding issues such as the cleaning of pipes or the installation of flap gates or backflow preventers. It would also be complimentary to the other efforts described in this report, as it should include the development of funding strategies for the implementation of conveyance system improvements and longer-term projects.

Figure 4C: Site Photo

Costs for the O&M/CIP Planning Effort would range from approximately $20,000 for an initial assessment to $100,000 - $150,000 for a Plan that should include mapping, project planning, conceptual design, and funding alternatives.

Stormwater Conveyance System Improvements

The northeast portion of the Borough has very few adequate stormwater management facilities, which include storm sewers, swales, and curbed roadways. In conjunction with the overall O&M/CIP Planning efforts, the Borough should study both the extent of the existing facilities as well as the potential for the installation of new facilities. A phased approach to their design and installation could allow for appropriate funding considerations.

Figure 4D: Site Photo

The study should include surveying, mapping, determination of any required permitting, identification of grants or other funding opportunities, and levels of service that are desired.

Costs of such a study would range from $25,000 for localized areas to approximately $150,000 to cover the entire quadrant of the Borough.

Regional Flood Control Measures

Flood control measures along Breakneck Creek are not recommended at this time since a dam certification, hazard mitigation analysis, and/or a large encroachment would most likely be needed. Most importantly, a dam within the Breakneck Creek watershed would move flooding from one place to another, thus creating a new problem along Breakneck Creek upstream of Evans City Borough. However, improvements within the Breakneck Creek watershed are proposed within this study for multiple municipalities upstream of Evans City Borough.

8

FORWARD TOWNSHIP

8. FORWARD TOWNSHIP

8.1 Overview

Forward Township is generally comprised of three (3) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Breakneck Creek, Connoquenessing Creek, and Glade Run. While smaller watersheds exist within Forward Township, the aforementioned watersheds encompass the entirety of the municipality's drainage area for this study.

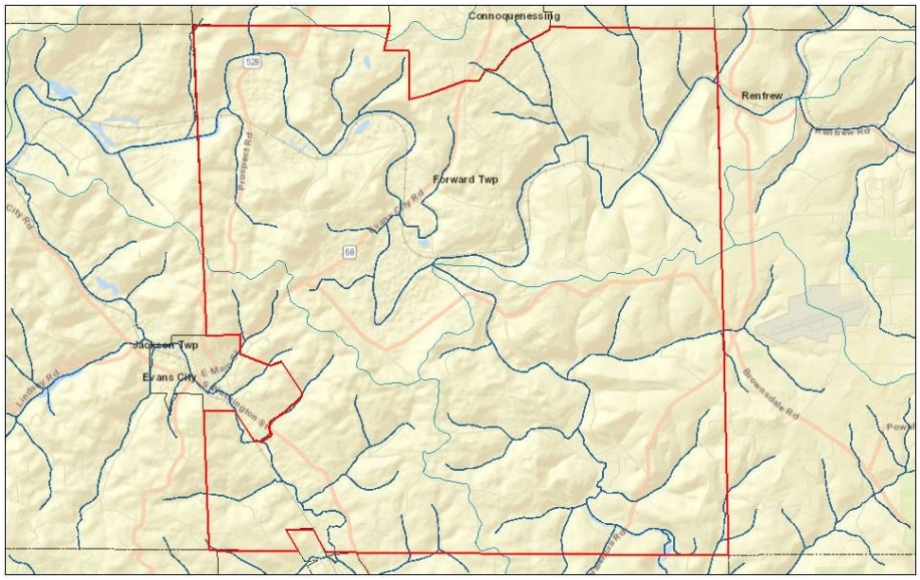


Figure 5A: Forward Township (PADEP EMAP)

8.2 Identified Problem Areas

Forward Township provided three (3) projects for consideration. Two (2) of the projects consist of localized flooding at culvert road crossings and the other project consists of stream flooding that is impacting residential properties adjacent to a stream. The specific projects identified by Forward Township are as follows:

- Nursery Road Culvert.
- Nursery Road and Rader School Road Culverts.
- Johns School Road Bridge.

8.3 Project Overview

Nursey Road Culvert

The culvert located under Nursey Road consists of an undersized culvert that routinely floods during routine storm events. Based on discussions during our site visit, it is believed that the flooding has become worse as a result of upstream development. It was observed that the culvert location also contains multiple utilities, mainly underground gas mains. Based on observations of

Figure 5B: Site Photo

Figure 5C: Site Photo

the site, it appears that the site contains both small diameter gas service lines and larger gas transmission mains within proximity of the culvert location. Any work in this area will need to coordinate with these utility owners to ensure that improvements do not impact the operation during construction, and to provide erosion protection after construction.

Solutions to mitigate the routine flooding in this area would be to design the culvert opening of sufficient size to handle the 50- or 100-year storm event. The roadway may also be adjusted to allow for further capacity of the culvert by allowing additional freeboard before overtopping. The Township may want to evaluate the possibility of completing a minor realignment of the stream channel and culvert location to move the culvert away from the large gas transmission main.

Permitting requirements will vary based on the final scope of the project and the amount of stream realignment proposed, but at a minimum will require the completion of a Water Obstruction and Encroachment General Permit GP-11. The project costs should generally range between $100,000 to $200,000 depending on the impacts of the existing utilities during construction.

Nursery Road and Rader School Road Culverts

The Township's second problem area is another culvert location on Nursey Road, similar to the previous problem area. This crossing consists of an undersized culvert that routinely floods during routine storm events. Based on our field observations, the existing crossing is a 36-inch corrugated HDPE Pipe with a minor amount of cover over the pipe.

Figure 5D: Site Photo

During discussions with the Township, they expressed concerns that increasing capacity of the Nursey Road Culvert will have a negative impact on the downstream Rader School Road Culvert. Our observations of the Rader School crossing show multiple culverts of various sizes and materials, but again with minimal cover. This location is also subject to flooding and there was a significant grade change between the two crossing locations. It appears that the pipe sizes for the crossings were not sized for a storm event, but for constructability.

Figure 5E: Site Photo

Given the proximity of the two crossings, it is recommended that they both be done at the same time or that the downstream culvert (Rader School Road) is completed prior to Nursery School Road. The Township should investigate the opportunity to obtain floodplain/drainage easements where possible from adjoining property owners prior to the land being proposed for development. This will prevent potential impacts to the floodplain if these properties are developed.

The planning level costs to complete these culverts would range from $75,000 to $150,000 for each site.

However, a cost savings may be possible if the culverts are bundled together. Permitting requirements most likely will require the completion of a Water Obstruction and Encroachment General Permit GP-11 for both crossings.

Johns School Road Bridge

Figure 5F: FIRM Aerial

The Township's third problem area consists of five (5) residential properties that are located within the floodplain, which routinely flood during large flood events causing significant damage to the residential properties. Based on discussions with the Township, the flooding can also be compounded in the winter and spring by ice jams that block the streamflow at the downstream bridge.

Given the proximity of the residential structures to the stream, the most effective approach to mitigate the flood damage is to relocate the residents of these properties to structures outside of the floodplain. Typically, floodplain relocation projects are completed utilizing FEMA/PEMA hazard mitigation programs that allow the property owners to receive fair market value for their properties. The cost of the property will need to be appraised, however, for planning purposes, it is assumed that each property averages $150,000 each, which would total approximately $750,000 to obtain the effected properties.

Figure 5G: Site Photo

9

HARMONY BOROUGH

9. HARMONY BOROUGH

9.1 Overview

Harmony Borough is generally comprised of two (2) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Connoquenessing Creek and an Unnamed Tributary to Connoquenessing Creek. While other watersheds exist within Harmony Borough, the aforementioned watersheds encompass the majority of the municipality's drainage area for this study. The Borough has experienced historical flooding from the Connoquenessing Creek and localized flooding inside the Borough limits.

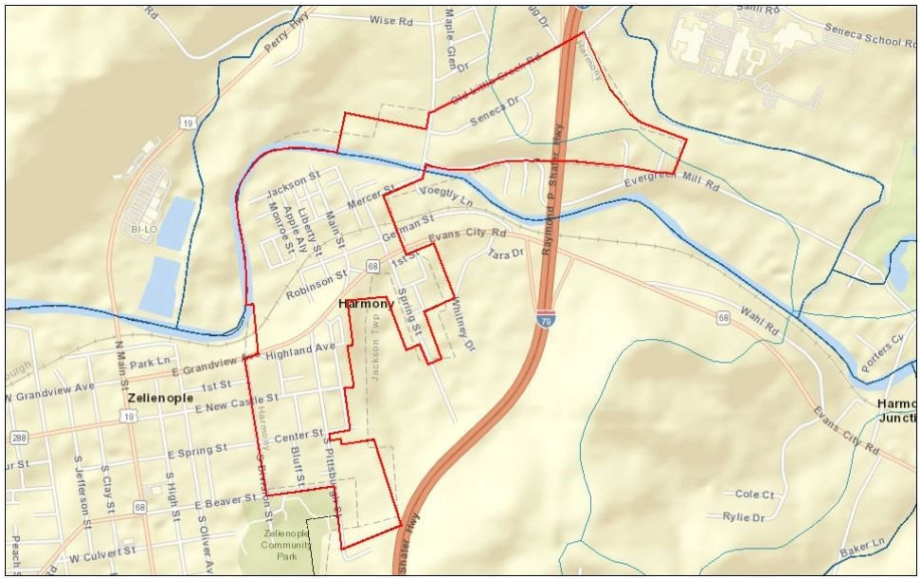


Figure 6A: Harmony Borough (PADEP EMAP)

9.2 Identified Problem Areas

Harmony Borough provided two (2) projects for consideration. One project is within the Connoquenessing Creek watershed and the other project is located within the Unnamed Tributary to Connoquenessing Creek watershed. Both projects have a significant footprint in Jackson Township and will require joint cooperation to successfully execute.

- Old Little Creek Road – Evaluate stormwater drainage improvements along Old Little Creek Road.
- Spring Street Runoff – The Borough is experiencing stormwater runoff issues along Spring Street impacting other portions of the Borough.

9.3 Project Overview

Old Little Creek Road

Flooding along Little Creek Road has been an ongoing issue for the Borough. The roadway corridor has a limited amount of stormwater infrastructure to convey runoff from the pavement and surrounding residential areas. Compounding this issue is the runoff from a significant portion of Interstate 79 being conveyed under the highway to a channel near Old Little Creek Road.

Old Little Creek Road stormwater drainage improvements is recommended due to flooding caused by a lack of properly sized stormwater conveyance infrastructure in the area. Old Little Creek Road is located between Mercer Road and Gregg Drive and has a grade break with a

mild longitudinal slope located approximately at the midpoint. The existing roadway generally lacks adequate curbing, roadside ditches, and storm sewer inlets/piping along its entire length.

The Borough should investigate the existing drainage channel to ensure it is properly functioning for the stormwater that is being captured by the Interstate conveyance system. Given the age of the system, the required capacity most likely has been affected by vegetation and sediment accumulation. The Borough most likely could use support from the County in this effort since these facilities are part of the federal highway system.

The Borough should also properly design a stormwater conveyance system consisting of properly sized swales, curbing, pipe and inlet, or a combination of both. Construction of this system will most likely require utility relocations and property easements to construct the project. The planning level cost estimate for the project is $200,00 to $500,000, not including property costs.

Permitting for this project would most likely require an NPDES Stormwater Permit for the construction of the system. If modifications to the Interstate stormwater system is proposed, coordination with Federal Highway Association and PennDOT will be required.

Spring Street Flooding

Spring Street and the surrounding areas are subject to flooding due to their location within the 100-year floodplain of Connoquenessing Creek, and their proximity to an Unnamed Tributary to Connoquenessing Creek. Additionally, the roadway experiences nuisance flooding caused by an inadequate stormwater conveyance system that meanders through the Borough with a mixture of swales, pipes, and culverts. This system is located within the roadway, on private property, and under multiple businesses. In addition, the conveyance system changes types, materials, condition, and capacity as it eventually discharges to the Creek.

Figure 6B: Site Photo

Figure 6C: Site Photo

In addition to conveyance issues experienced in the Borough, the watershed contains un-detained runoff from Interstate 79 that is conveyed through the area locally known as Swampoodle. The current land use in this area consists of woodlands, agricultural lands, and a large marsh area. This area, to the west of Spring Street (located in Jackson Township), would be a prime location to construct a stormwater detention, wetland enhancement, or a combination of the two, in order to help mitigate the impacts of the Interstate runoff. Detaining this water higher in the watershed could also provide relief to

the existing undersized stormwater system in the Borough. The Borough, with the help of the County and Jackson Township, should investigate the opportunity to obtain a drainage easement or wetland protection easement for this drainageway to ensure that if this parcel develops, the area would be preserved. Obtaining rights to this area would allow it to be preserved for future stormwater uses even if the parcel develops before this work can be completed.

Figure 6D: Site Photo

During our field work on this site, we also observed that the existing stormwater management facilities for the industrial park located along Whitney Drive may not be functioning to its fullest potential. The existing basin contained dense vegetation – mainly cattails – and the outlet structure could not be located or inspected. It appears that the property is still owned by the Community Development Corporation of Butler County, however, this information should be verified. Given the age and condition of this basin, retrofitting the basin could provide an opportunity to obtain additional detention for the area at a relatively low investment.

Opportunities to help alleviate localized flooding that is not associated with the Connoquenessing Creek overtopping its banks, are available within the Borough as well. The Borough should look at a phased approach to replace the existing stormwater conveyance system to a system that is of proper capacity and in a location that it can function effectively. Any proposed drainage improvements should be located in the Borough right-of-way, when possible, or easement when located on private property. The most logical approach is to work from downstream to upstream to ensure that as the system is improved, there is enough downstream capacity. The Borough should also look at installing flap gates or Tideflex valves at the discharge points of their pipes that discharge to the creek, in order to prevent back flooding when the stream elevation rises, and to help mitigate sediment from accumulating in the pipe. The Borough should also prioritize areas where stormwater is located underneath structures or business lots. These facilities need to be relocated to allow for maintenance and to prevent further property damage. There are also opportunities to provide additional stormwater capacity during smaller storm events by performing grading improvements to multiple properties located between Mercer Road, Spring Street, and German Street. These improvements will have little impact during smaller flood events, however, should help slow the rate of runoff and possibly direct runoff away from residential structures.

Figure 6E: Site Photo

The Borough will most likely need to obtain easements in order to construct these improvements and should investigate every possibility to do so, including condemnation. Permitting for these projects will greatly depend on the scope and location of the project. Work within the floodplain and wetlands will require a DEP Water Obstruction and Encroachment Permit. Other permits that could be required include PennDOT Highway Occupancy Permits and DEP NPDES stormwater permits.

Figure 6F: Site Photo

Costs for each of these projects will also greatly vary per scope and location, however, planning estimates for the Swampoodle area improvements would be estimated at $60,000 to $120,000, costs to rehabilitate the industrial park stormwater basin would be estimated at $60,000, and relocating the pipe under the Wonder Bar Coffee shop would be estimated at $200,000. All of these costs do not include land acquisition costs.

10

JACKSON TOWNSHIP

10. JACKSON TOWNSHIP

10.1 Overview

Jackson Township is generally comprised of six (6) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Breakneck Creek, Connoquenessing Creek, Glade Run, Likens Run, Little Connoquenessing Creek, and Scholars Run. While other watersheds exist within Jackson Township, the aforementioned watersheds encompass the majority of the municipality's drainage area for this study.

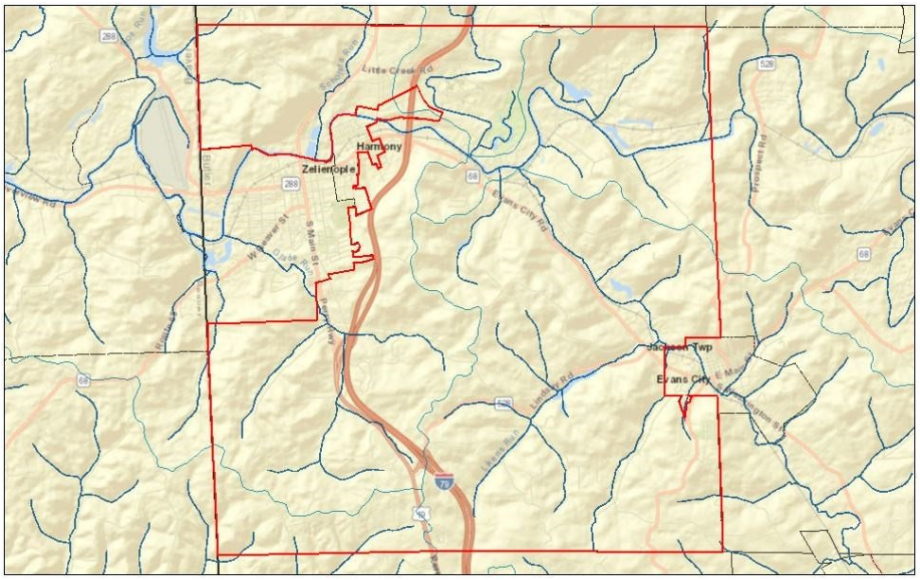


Figure 7A: Jackson Township (PADEP EMAP)

10.2 Identified Problem Areas

Jackson Township provided three (3) projects for consideration. One (1) project is within the Glade Run watershed and the other two(2) projects are within the Connoquenessing Creek watershed. The stormwater impacts for each problem area differs with impacts to the community due to flooding being the major focus. The problem areas submitted are as follow:

- Tollgate School Road Corridor – Watershed based stormwater runoff control utilizing existing stormwater detention basins in the watershed.
- Evergreen Mill Road Corridor: The project will evaluate improvements to either end of Evergreen Mill Road that may provide for flood relief at more frequent storm events. The project will also examine reciprocal access of the Seneca Valley campus to the Evergreen Mill Road corridor and nursing home located on Evergreen Mill Road via a bridge as a means of hazard mitigation and safety.
- Textor Hill Road: Using, in part, a storm water easement granted to the Township on Parcel 180-4F52-4H that may be used for stormwater detention and infiltration, the project will examine mitigation of flooding in the area of the railroad crossing to the driveway serving the Double Gas Well pad.

10.3 Project Overview

Tollgate School Road Corridor

The Tollgate Road corridor has seen steady residential development over the last decade and is the headwaters to the Glade Run watershed. The Glad Run flows to the northwest through the Borough of Zelienople, ultimately discharging into Connoquenessing Creek at Front Street.

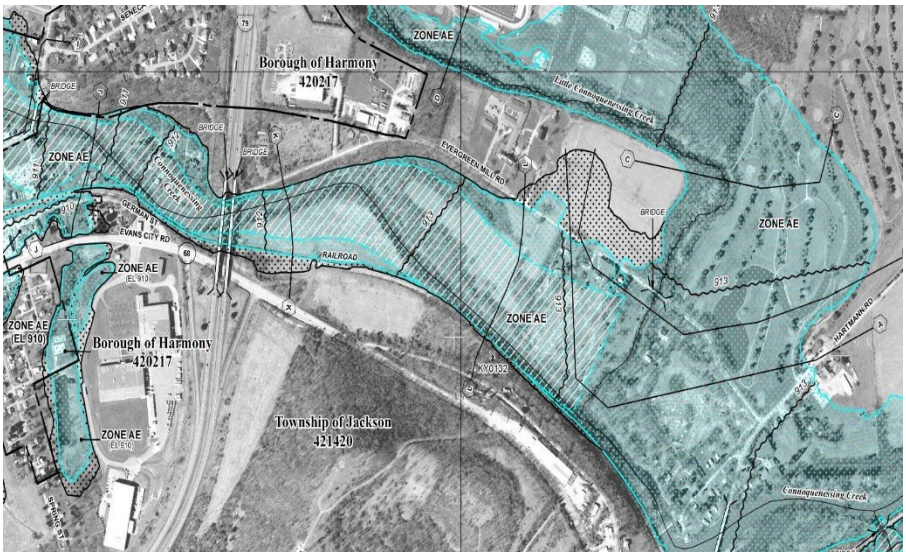
Given the historical flooding of cased by Glade Run, the Township is looking for opportunities to better manage the stormwater rate and volume higher in the watershed with the hopes of helping to mitigate downstream impacts. The project would include modifying the exiting stormwater facility's outlet structure to detain additional stormwater runoff within the basins. Opportunities to complete these modifications are present in the Jackson Crossings, Spring Valley, Brookview Farms, Old Hickory Highlands, and Dutch Creek Developments. Currently the basins are owned and maintained by each of the development's homeowners' associations with the Township having easement access to the basins. To complete this work, the Township should reach agreements with each homeowner's association to analyze potential improvements and complete construction.

Costs to complete these improvements will vary from site to site and largely depend on scope of rehabilitation. Simple outlet structure modification could cost only a few hundred dollars to a full basin retrofit costing upwards of $100,000 per basin, if grading is required. Permitting for this effort should be minimal assuming that this work is being completed as basin maintenance. The Township may want to investigate a stormwater fee program to assist in funding these improvements and the long-term maintenance of the facilities, resulting in alleviating these responsibilities from the homeowner's associations.

The Township should also investigate the opportunity to complete similar retrofits or incorporate additional detention for developments along the growing Gudekunst Road corridor. This type of work could be beneficial in meeting DEP MS4 PRP requirements for Jackson Township when they are required to have a permit. These corridors may also provide opportunities for neighboring communities to meet their requirements as well.

Evergreen Mill Road Corridor

Evergreen Mill Road is subject to flooding on two sides of the roadway subject to flooding due to their location within the 100-year floodplain of Connoquenessing Creek. When there is a flood event on this corridor, multiple properties are stranded from high water. Some of these properties include multiple manufacturing businesses, residential properties, and a senior care facility. While maintaining access to all these facilities is important, providing access to a care facility is critical to the public health and safety of the community.



One option would include providing access across the Little Connoquenessing Creek from Maybrook Evergreen property to the Seneca Valley School District property. To minimize costs, the crossing could consist of a smaller pedestrian type bridge that could act as part of a municipal trail network to allow the project at access additional opportunities for funding.

Another option could be investigating the opportunity to obtain an access easement through the properties that access Precision Drive and Meadow Brook Lane.

A major consideration for both options includes obtaining property easement to access the properties either for a trail or for emergency access. Permitting requirements for the pedestrian bridge would include a DEP Water Obstruction and Encroachment Joint Permit.

Costs for the pedestrian bridge for planning purposes are estimated to cost $900,000 to $1.2M without property costs.

Textor School Road Corridor

Textor School Road is a Township roadway with a steep grade and limited stormwater management. During intense rainfall events, large amounts of stormwater is conveyed along the roadway and the edge of the roadway, causing excessive maintenance and negatively impacting private property.

The Township should install proper stormwater facilities consisting of roadside swales, piping, and inlets to capture the runoff and convey the runoff as not to cause damage to the surrounding area.

Permits required to complete this project would most likely require the Township to obtain a DEP Water Obstruction and Encroachment General Permit GP-3 for any outfalls in the stream. Planning level costs to complete this project are estimated at $65,000 to $90,000, however could be lower if the work could be performed by Township forces.

German Street Flooding

German Street routinely experiences flooding during significant rainfall events, making the roadway impassable. This closure requires the public works for Harmony Borough and Jackson Township to barricade the roadway. During our site visit, we walked the drainage channel from upstream of State Route 68 to the railroad tracks to the north of German Street. It was observed that the stormwater is conveyed under a large, approximately 6x6 foot concrete box culvert. At the end of this culvert, the runoff is forced to then be conveyed through a smaller 18-inch corrugated metal pipe of poor condition. We believe that this abrupt downsizing of this culvert is contributing the flooding as the runoff cannot get into the stormwater system that crosses German Street, resulting in ponding behind the railroad embankment.

During our field work on this site, we also observed that the existing stormwater management facilities for the industrial park located along Whitney Drive may not be functioning to its fullest potential. The existing basin contained dense vegetation – mainly cattails – and the outlet structure could not be located or inspected. It appears that the property is still owned by the Community Development Corporation of Butler County, however, this information should be verified. Given the age and condition of this basin, retrofitting the basin could provide an opportunity to obtain additional detention for the area at a relatively low investment.

The proposed project for this site is removing the undersize pipe obstruction located between State Route 68 and German Street and replace it with a stabilized vegetated channel. This channel will allow the runoff to be better conveyed under German Street and the railroad tracks. This channel would also act as a small overflow and detention area during small rain events.

Permitting for this project may require a DEP Water Obstruction and Encroachment General permit and possibly a PennDOT Highway Occupancy permit for work in the State right-of-way. Planning level estimates for the project would be approximately $25,000 to $45K dollars, not including property costs.

11

LANCASTER TOWNSHIP

11. LANCASTER TOWNSHIP

11.1 Overview

Lancaster Township is generally comprised of five (5) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Crab Run, Little Connoquenessing Creek, Little Yellow Creek, Scholars Run and Yellow Creek. While other watersheds exist within Lancaster Township, the aforementioned watersheds encompass the majority of the municipality's drainage area for this study.

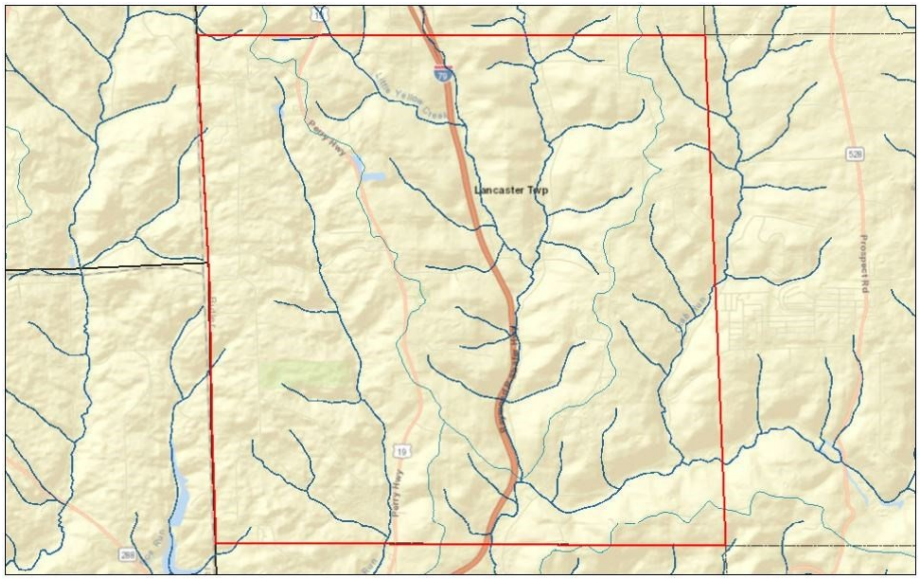


Figure 8A: Lancaster Township (PADEP EMAP)

11.2 Identified Problem Areas

Lancaster Township provided three (3) projects for consideration. The projects are located in the Little Connoquenessing Creek, Little Yellow Creek, and Scholars Run watersheds.

- West Lancaster Road – A culvert crossing West Lancaster Road, east of Rose Lane, is most likely undersized and nearing the end of its useful life, with resultant flooding in the areas adjacent to the roadway. (Scholars Run)
- Little Yellow Creek Road – A portion of Little Yellow Creek Road to the east of Interstate 79 experiences flooding due to the combined impacts of an undersized culvert and the roadway elevation being within the 100-year floodplain. (Little Yellow Creek)
- Little Creek Road – An area of Little Creek Road east of Whitestown Road experiences flooding due to a deteriorating, multi-pipe culvert. Exacerbating this situation is the proximity of an existing natural gas line on the upstream side of Little Creek Road. (Trib 34956 of Little Connoquenessing Creek)

11.3 Project Overview

West Lancaster Road Flooding

Scholars Run crosses West Lancaster Road east of Rose Lane and adjacent to House #1081. There is a single barrel pipe crossing under the roadway, with no headwalls, endwalls or bank protection, and there is minimal elevation difference between the pipe invert and the road surface. The area

Figure 8B: Site Photo

floods during significant rainfall, impacting not only the roadway, guiderail, and adjacent residential parcels, but causing erosion and bank deterioration.

Based upon HRG's review of the site, it appears that a multi-faceted project of culvert replacement and roadway/streambank stabilization would be appropriate for this area. This would not only reduce the frequency of flooding along the roadway, it would provide long-term protection for the roadway facilities and adjacent residential properties. An appropriate level of modeling should be completed to determine the most cost-effective size, number, and types of pipe for the culvert replacement as well as estimate the upstream and downstream impacts. In addition, the installation should include appropriate culvert entrance and exit protection to preclude further deterioration of the roadway berms and embankments. The project will also require a PADEP GP-11 General Permit for Water Obstructions and Encroachments.

Costs for this project could range from approximately $65,000 to $150,000, depending upon the amount/type of stream channel stabilization completed and if the work can be done by Township forces.

Little Yellow Creek Road

Little Yellow Creek Road parallels Interstate 79 through Lancaster Township. Little Yellow Creek runs along the roadway and a single corrugated plastic pipe carries drainage under the roadway.

Figure 8C: Site Photo

Figure 8D: Site Photo

Flooding occurs in this area due to the lack of capacity in this pipe, and due to the small elevation difference between the stream channel and roadway. There is also very little slope along the stream and on either side of the roadway in this area, due to the area being within a floodplain. While this area is not heavily populated or developed, this section of Little Yellow Creek Road is the only access for the existing residents along the northern extents of the road, as well as access for emergency services.

Based upon HRG's assessment of the site conditions, the primary long-term improvements in this area most likely consist of raising the impacted portions of the roadway,

along with the installation and/or replacement of culverts and other drainage facilities serving the road. This will require a combination of modeling, permit acquisition, and site design. The modeling will allow for the evaluation of the balance between design-storm levels of service to the area and the costs and impacts to achieve that level of service. This project could impact between 1,500 and 2,000 feet of roadway and adjacent streambed. Overall project costs in this area would be expected to range between $2,000,000 and $4,000,000, depending upon the length of roadway impacted and number and sizing of drainage facilities that would be required.

Figure 8E: Site Photo

Little Creek Road

An area of Little Creek Road east of Whitestown Road experiences flooding due to a deteriorating, multi-barrel culvert. This culvert is constructed of two (2), 24-inch diameter corrugated plastic pipes that were installed under the roadway with no upstream or downstream facilities and/or roadway/streambank protection. There is less than two (2) feet of elevation difference between the pipe crown and the roadway surface, limiting the ability of any improvements to be installed at greater depths. There is also an existing natural gas line on the upstream side of Little Creek Road, in immediate proximity of the pipe installation. In addition, there are residential and other structures downstream of the crossing, and the stream channel in this area is deteriorating.

Figure 8F: Site Photo

Given the site limitations, the primary options for improving the flooding conditions in this area involve replacing the culvert, installing appropriate culvert entrance and exit facilities, and stream channel improvement/stabilization. The existing gas line and any other adjacent utilities must, at the very least, be protected during this work and may require relocation.

The project will require modeling to evaluate the appropriate pipe capacities and configurations, as well as the streambank stabilization techniques necessary to handle the resultant flows.

The project will require at least the application for and the acquisition of a PADEP GP-11 Water Obstruction Permit and may require additional permitting depending upon the ultimate project extents. Planning level cost estimates for this work, including the permitting activities, would range between approximately $75,000 and $150,000.

Figure 8G: Site Photo

12

PENN TOWNSHIP

12. PENN TOWNSHIP

12.1 Overview

Penn Township is generally comprised of five (5) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Connoquenessing Creek, Glade Run, Patterson Run, Robinson Run, and Thorn Creek. While smaller watersheds exist within Penn Township, the aforementioned watersheds encompass the entirety of the municipality's drainage area for this study.

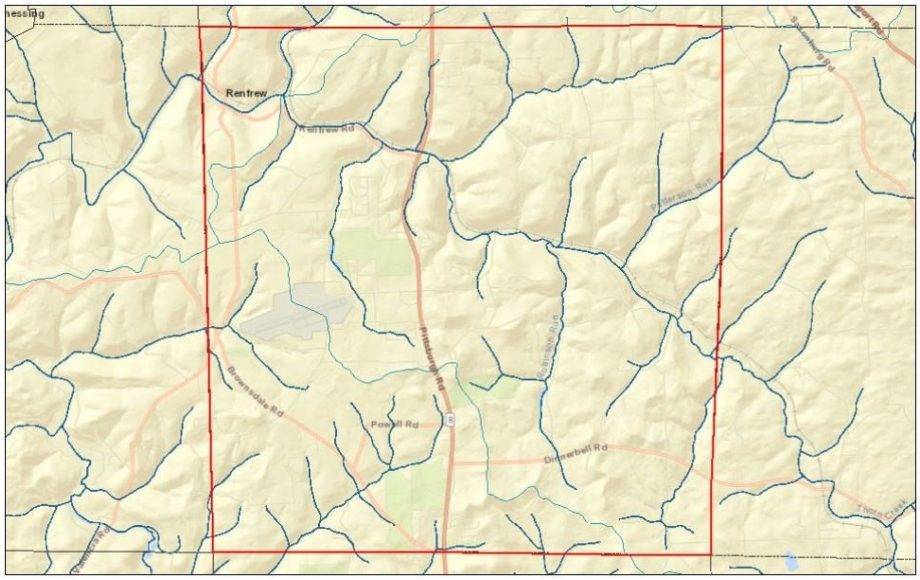


Figure 9A: Penn Township (PADEP EMAP)

12.2 Identified Problem Areas

Penn Township provided three (3) projects for consideration. One project is located within the Connoquenessing Creek watershed and the other two projects are located within the Thorn Creek watershed.

- Dodds Road near Rockdale Road.
- Dutchtown Road near Woodland/Crisswell Road.
- East Main Street in Renfrew.

12.3 Project Overview

Dodds Road near Rockdale Road

Dodds Road near Rockdale Road is located within the 100-year floodplain of Thorn Creek. The roadway elevation decreases along Dodds Road as it travels to the west of Rockdale Road, and the roadway and adjacent residential property experience flooding during significant rainfall. A gravel bar has built up in the stream channel, further exacerbating the flow conditions.

Figure 9B: Site Photo

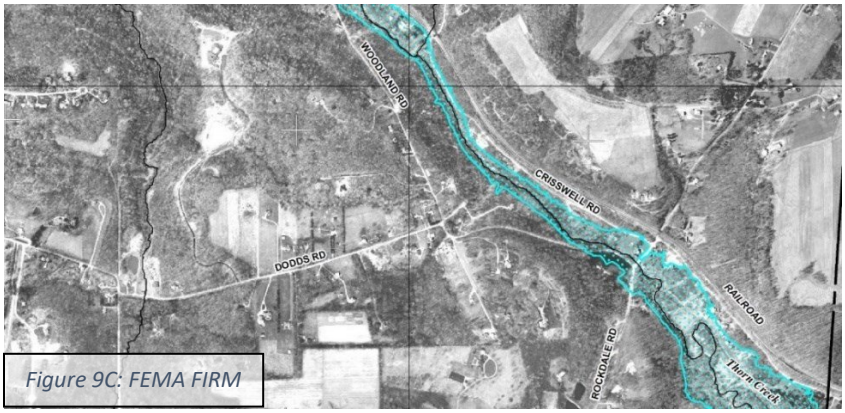


Figure 9C: FEMA FIRM

Since the roadway and the adjacent residence were constructed in the floodplain, options for remediation are limited. The Township could explore raising the roadway above the elevation of the 100-year floodplain, but hydraulic and hydrologic modeling would be necessary to determine the upstream and downstream impacts of such improvements on the floodplain elevation, as well as the residence. Estimated costs of the modeling and conceptual roadway layout range from approximately $30,000 to $50,000.

It is our understanding that Thorn Creek is a stocked trout stream. The Township could also investigate the possibility of installing streambank restoration/fish habitat with the goal of focusing the mainstream flow toward the center of the stream channel. This would help prevent gravel bar formation as currently observed and prevent further erosion of the Township right-of-way and add to the habitat of the stream.

Figure 9D: Site Photo

The owner of the adjacent private residence could explore alternatives that include raising the structure above the 100-year floodplain elevation and/or modifying the structure to include floodproofing features. Raising the structure would require modeling/calculations to determine the impacts on the floodplain elevation. Since this is private property, this would not become a Township project.

Given the proximity of the residential structure to the stream, another effective approach to mitigate the flood damage is to relocate the residents of this property to structures outside of the floodplain. Typically, floodplain relocation projects are completed utilizing FEMA/PEMA hazard mitigation programs that allow the property owners to receive fair market value for their properties. The cost of the property will need to be appraised, however for planning purposes, it is assumed that similar properties in this area average $200,000 to $250,000 each.

Dutchtown Road near Woodland/Crisswell Road

Similar to the previous area, Dutchtown Road near Woodland/Crisswell Road is also located within the 100-year floodplain of Thorn Creek. This area is just downstream of the Dodds Road problem area.

Figure 9E: FEMA FIRM

Figure 9F: Site Photo

Crisswell Road travels beneath the adjacent railroad line at this location, and the elevated railroad creates an additional barrier for floodwaters to abate. The residential properties located between Thorn Creek and the railroad, as well as Dutchtown Road, flood during significant rainfall.

Like the previous problem area, the options to mitigate the flooding on these properties are to raise/floodproof them or acquire them through FEMA/PEMA hazard mitigation programs. Costs per property could be expected to average between $200,000 and $250,000.

East Main Street in Renfrew

East Main Street in Renfrew is located within the 100-year floodplain of Connoquenessing Creek.

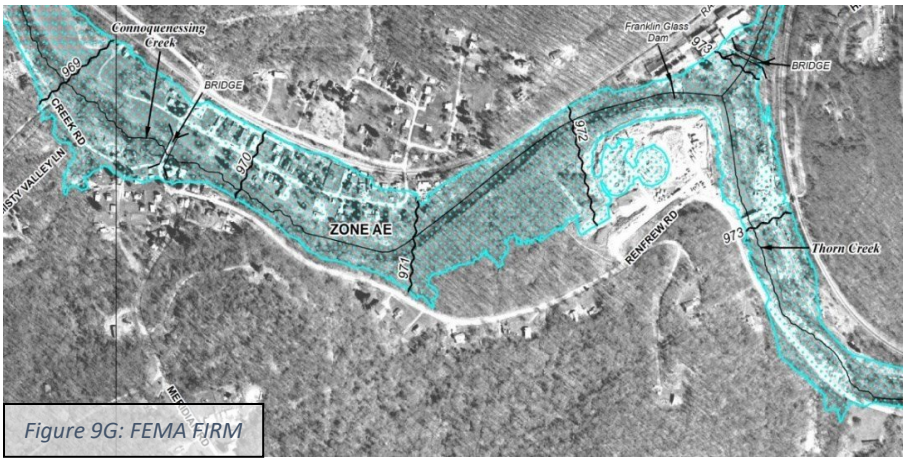


Figure 9G: FEMA FIRM

This area includes numerous properties that experience flooding during significant rainfall. This involves between 15 and 20 different properties. The options for mitigation are limited since the area is adjacent to the stream and there is little elevation change northward to Railroad Street. The most viable options include property acquisition utilizing the FEMA/PEMA hazard mitigation programs, as discussed previously, and floodproofing to attempt to minimize damage. Properties in this area could be expected to be worth between $130,000 and $200,000 to acquire, making this option's cost ultimately between $2,600,000 and $4,000,000.

13

SEVEN FIELDS BOROUGH

13. SEVEN FIELDS BOROUGH

13.1 Overview

Seven Fields Borough is generally comprised of one (1) watershed that is tributary to the Connoquenessing Creek at the western border of Butler County: Kaufman Run. While smaller watersheds exist within Seven Fields Borough, the aforementioned watershed encompasses the entirety of the municipality's drainage area for this study.

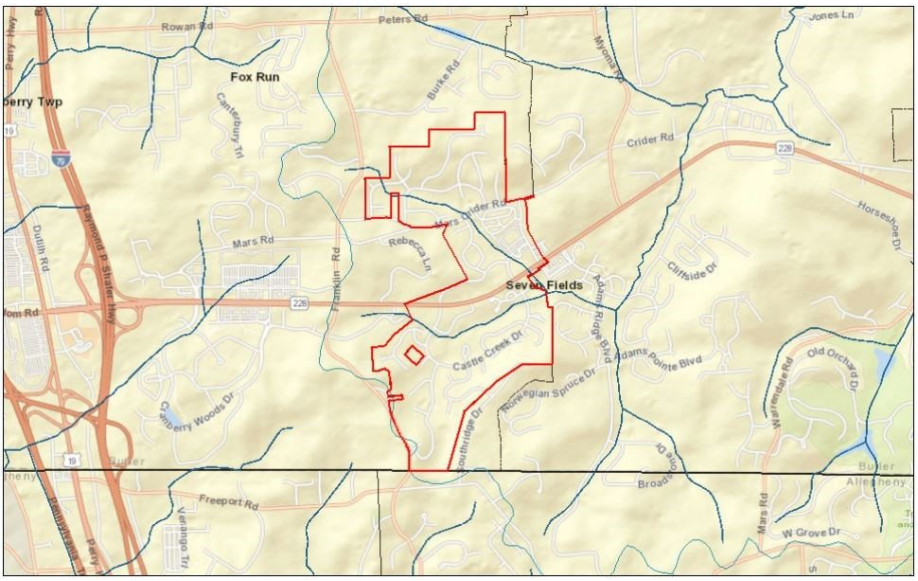


Figure 13A: Seven Fields Borough (PADEP EMAP)

13.2 Identified Problem Areas

Seven Fields Borough provided three (3) projects for consideration. Compared to other municipalities in the study area, the Borough is fortunate that most of its stormwater infrastructure is relatively new and was designed to modern standards. The three (3) projects identified are within the Kaufman Run watershed and are as follows:

- Castle Creek Drive Pond Modification for additional stormwater detention.
- High Pointe Drive Dam Modification – Investigate opportunities to provide further stormwater detention.
- Cumberland Drive Regional Stormwater Detention – Investigate the opportunity for additional stormwater management.

13.3 Project Overview

Castle Creek Drive Pond Modification

The Castle Creek Drive Stormwater Management Pond detains nearly all runoff from the southwest portion of the Borough. Castle Creek Drive acts as the basin embankment to the east with natural grading to the north and south of the outlet

Figure 10B: FEMA Aerial

Figure 13C: Site Photo

structure, serving as the impoundment areas. The stormwater management facility is located within Seven Fields Borough's property.

Based on discussions with the Borough, this area is scheduled to be utilized as the Borough's MS4 Permit's PRP project as a streambank restoration project. This area appears to be a good location to perform such a project. In addition, there may be some opportunities to provide additional rate control by modifying the outlet structures of the facility. However, a detailed study should be completed prior to modification – especially considering the substantial drainage area to the stormwater facility. It is recommended that this type of work be completed as part of the MS4 project, or during maintenance to the facility. Costs to complete any modifications would vary depending on the scope of the modification and if the work is done with Borough forces or is contracted out. Budgetary estimates would range between $10,000 to $30,000.

High Pointe Drive Dam Modification

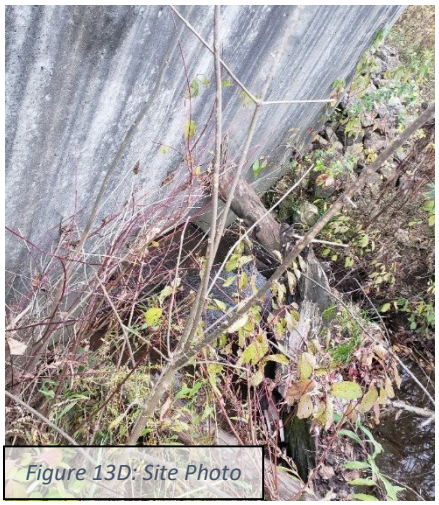


Figure 13D: Site Photo

The stormwater management facility located along High Point Drive manages stormwater from the northern portion of the Borough. The facility is located on an Unnamed Tributary to Kaufman Run, is permitted as a dam, and flow rates are controlled by a concrete outlet structure.

During our field observation of the site, we identified significant vegetation and some debris located within the facility. It is suggested the Borough actively inspect and manage this material to ensure that it doesn't negatively impact the operation of the facility. Opportunities to modify the facility to better manage runoff may exist, however a detailed study would be required to verify the impacts. It is suggested that the Borough institute an active inspection and maintenance program to ensure that this large facility operates correctly.

The Borough may want to perform a topographic survey to ensure that the facility still has the intended design capacity and has not been filled with sediment since construction. Costs to complete this investigation would be budgeted at $15,000 to $25,000.

Figure 13D: Site Photo

Cumberland Drive Regional Stormwater Detention

Figure 13E: Site Photo

Seven Fields Borough owns a parcel of approximately 0.25 acres in size along Cumberland Drive that is currently a low-lying area between two residential properties. The property contains significant vegetation and may have been used as an ice-skating rink in the past. The Borough has received feedback multiple times about the property being utilized for some other purpose other than its current condition.

This property may be converted into a small detention or water quality BMP to better manage stormwater in the development. Assuming that this site is not determined to be a wetland, it would be a good candidate for a wetland enhancement project or a small bioretention/rain garden project. This area could possibly assist the Township in meeting future DEP MS4 permit requirements for public education and pollution reduction.

Figure 13F: Site Photo

Permitting for a project will greatly depend on the scope of the project and the presence or absence of wetlands. A DEP Water Obstruction and Encroachment Permit will be needed if wetlands are present. Costs to complete the project will greatly vary based on the scope of the project, however a budgetary cost of $40,000 to $60,000 could be budgeted for a wetland mitigation project.

General Observation

Seven Fields Borough is very fortunate to have been master planned with relatively modern stormwater management facilities and their infrastructure is in good condition. This has allowed the Borough to not experience some of the same infrastructure issues as some of the other municipalities that are participating in this study. During our time looking at the Borough's facilities, it was noticed that a significant portion of the Borough's stormwater is managed in two (2) centralized facilities. It is suggested that the Borough invest in a robust inspection and maintenance program for its stormwater facilities to ensure that they remain in good operational condition. This approach would have two benefits to the Borough: (1) maintenance costs of existing infrastructure costs less than replacement costs, and (2) if this infrastructure were not to operate properly, the impact to the community, its budget, and its downstream neighbors, could be severe.

14

ZELIENOPLE BOROUGH

14. ZELIENOPLE BOROUGH

14.1 Overview

Zelienople Borough is generally comprised of two (2) watersheds that are tributary to the Connoquenessing Creek at the western border of Butler County: Glade Run and an Unnamed Tributary to Connoquenessing Creek. While other watersheds exist within Zelienople Borough, the aforementioned watersheds encompass the majority of the municipality's drainage area for this study.

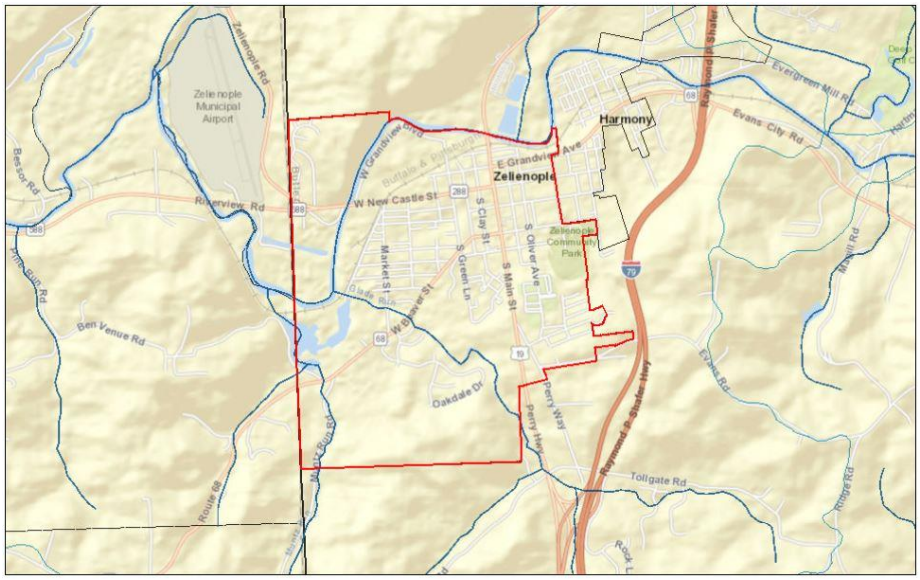


Figure 13A: Zelienople Borough (PADEP EMAP)

14.2 Identified Problem Areas

Zelienople Borough provided three (3) projects for consideration. The first two projects are within the Glade Run watershed and the third project is within the watershed for the Unnamed Tributary to Connoquenessing Creek.

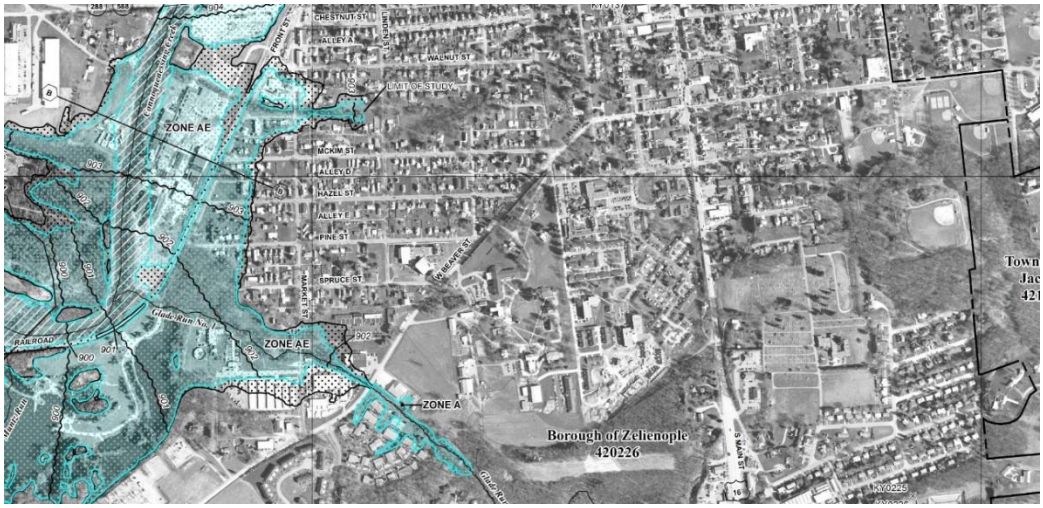
- Glade Run Watershed Stormwater Management – Investigate opportunities to slow stormwater in the upper watershed to help mitigate issues in the lower watershed.
- Fairlawn Area Stormwater Detention - Investigate opportunities to construct additional stormwater detention in the upper watershed to help mitigate issues in the lower watershed.
- Borough Park Flooding - Investigate opportunities to construct additional stormwater detention in the upper watershed to help mitigate issues in the lower watershed.

14.3 Project Overview

Glade Run Watershed Stormwater Management

During heavy rain events, Glade Run raises rather quickly and is often muddy. Glade Run flows to the northwest through the Borough and discharges downstream A retention facility on Glade Run between Gudekunst Road and the Timberbrook development could help slow down the potential flooding near the Sportsman's Club, which overflows into the Pine Street area. Flooding in this area is highly dependent on the Connoquenessing Creek stream elevation. During periods of high

water, runoff from Glade Run is prevented from discharging to the creek at the confluence of the two water bodies.



The Borough could cooperate with Jackson Township to evaluate the possibility of modifying the existing stormwater detention basin in the Tollgate Road corridor to detain additional stormwater in the headwaters of this watershed to reduce peak flows experienced by the Borough.

The Borough should also investigate the possibility of completing streambank stabilization projects along Glade Run and its tributaries to minimize soil erosion that will deposit lower in the Borough's system even further limiting capacity of the conveyance system.

Costs to complete these improvements will vary from site to site and largely depend on scope of rehabilitation. Simple outlet structure modification could cost only a few hundred dollars to a full basin retrofit costing upwards of $100,000 per basin if grading is required. Permitting for this effort should be minimal assuming that this work is being completed as basin maintenance. Streambank stabilization work would most likely require a DEP Water Obstruction and Encroachment Joint or General Permit.

Fairlawn Area Stormwater Management

Similar to the Glade Run watershed, the Fairlawn Area of Zelienople also experiences flooding during significant rainfall events. Development in this area appears to have been completed prior to stormwater regulations requiring detention. The roadway appears to have a stormwater conveyance system consisting of curb and inlet, however visually it appears there are not sufficient inlets for the amount and grade of roadway. It is also observed that in multiple instances the roadway grade is significantly higher than the adjacent houses and drives.

The Borough should investigate opportunities to install stormwater detention in this problem area to better detain runoff, however it appears there are limited opportunities to do so without impacting developed property. There could be an opportunity higher in the watershed on property owned by the Borough, however this area is smaller in relationship to what is discharging to the study area.

The Borough should also investigate the opportunity to install a sufficient stormwater conveyance system to better capture and convey runoff along Fairlawn Boulevard and Hillside Drive. It is suspected that the lack of stormwater inlets is causing significant bypass compounding as it travels

further down the watershed/roadway. This compounding effect could be causing significant runoff along lower Fairlawn Boulevard.

Costs to complete this project would vary based on the option chosen and the scope of the project. For planning purposes, it could be assumed that a medium detention facility would be estimated at $50,000 depending on the location. The cost to complete a stormwater conveyance system would vary but could be estimated at $350,000 to $1.5 million dollars to complete the corridor. Costs could escalate if the project requires crossing State Route 19 with large piping. Permitting for this work will vary based on the scope of the project but would most likely require a DEP NPDES Stormwater permit and a DEP Water Obstruction and Encroachment General or Joint permit if discharging to a stream.

Borough Park Flooding

Similar to the Glade Run watershed, the area between Community Park and areas west that follow this course to the Connoquenessing Creek also experience flooding during significant rainfall events. The runoff begins on the east side of Interstate 79 and flows northwest under the highway. During heavy rain events, the unnamed tributary raises rather quickly and is often muddy. This unnamed tributary flows to the northwest through the Borough and discharges to the Connoquenessing Creek, traveling through the Community Park, through residential areas and along South Main Street. The upper watershed can be described as vegetated woodland with an area of newly developed residential development. The lower watershed generally is densely developed residential and urban land use.

It is our understanding that the Borough has recently completed some small retention type structures that detain stormwater during smaller storm events that have been effective. During larger storm events, the Borough still experiences impacts in this area. It is suggested that the Borough work with Jackson Township to investigate the possibility of implementing additional stormwater mitigation in the upper watershed to help further detain peak flow runoff. The newly constructed Foxwood Development may allow for further detention with its existing basins or may allow opportunity to further detain runoff upstream of Interstate 79.

The Borough should also investigate the possibility of completing streambank stabilization projects along the watershed to minimize soil erosion that will deposit Borough's existing system to prevent sedimentation from limiting storage capacity of the newly constructed detention facilities.

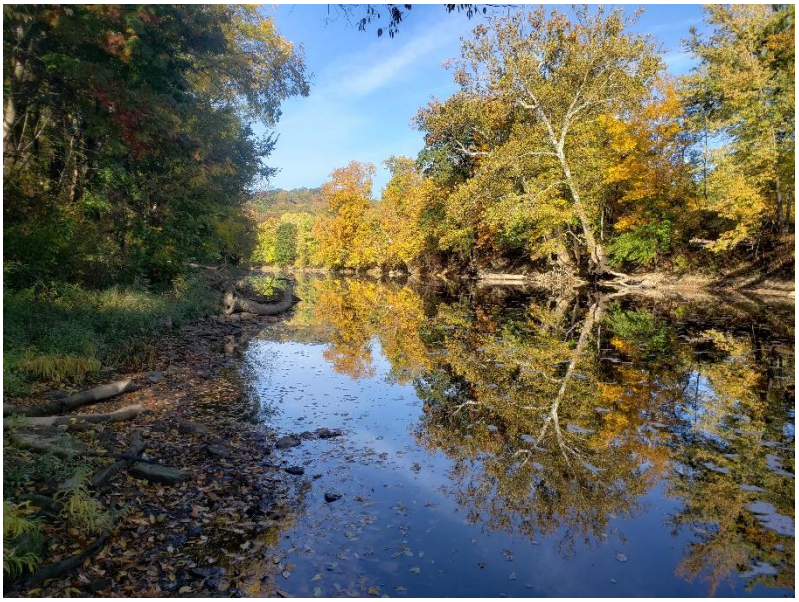
Permitting for this work will vary based on the scope of the project and the drainage area to the improvement, however a DEP Water Obstruction and Encroachment General or Joint permit may be required to complete the work. Costs to complete the work will also vary dependent on the scope, however, are expected to range from $10,000 for a minor outfall change to $150,000 to construct additional detention.

15

CONCLUSIONS

15. CONCLUSIONS/RECOMMENDATIONS

15.1 Conclusion



The flooding impacts that the Lower Connoquenessing has historically experienced are complex and without one single solution. The regionalized approach to addressing these issues is the only way to continue positive momentum in ensuring future efforts are implemented with the goal of mitigating stormwater impacts. The continued cooperation and focus of the municipalities that contributed to this effort, along with Butler County should be commended for crossing political boundaries for a common goal.

Upon completion of this project, a couple objectives are clear. The partnering municipalities are interested in implementing additional stormwater regulations with the goal of providing additional stormwater rate control on future development. There is also interest in utilizing this approach to modify existing stormwater basins in certain locations with the hopes of lower peak flows and stream velocity in localized watersheds.

Another clear objective is that the participating municipalities are interested in continuing to work together in some manner to work towards solving stormwater issues in the watershed. In analyzing the problem area portion of this report, it is clear that there are multiple opportunities to implement a regional approach to address a problem area that is located in one community, but the cumulative benefit will be felt by many.

15.2 Recommendations

In finalizing this study, HRG has some recommendations for the group to implement the positive finding of this report. The first recommendation is that the group together implement the release rate proposed in Section 02 of this report. The proper way to implement the rate controls would be to request an amendment to Butler County's approved Act 167 Plan. This would require that the request be sent to PA DEP, assuming with the County's approval, to amend the current Act 167 Plan. Upon approval from DEP, each community will need to amend their current Stormwater Management Ordinance to reflect the new release rates.

A second recommendation is implementing some projects in the watershed that would show immediate response to this planning effort. These projects could be large or small but will help continue the cooperation effort from the group and show action to those living in the watershed. Some projects that HRG recommends are as follows:

Butler County	Connect Watershed Groups	N/A
Butler County/ Evans City	Identify Properties for Restoration and Mitigation	N/A
Harmony Borough, Jackson Township, Zelienople Borough	Spring Street Flooding/Swamp Poodle/ Industrial Park Detention	$50K to $500K
Zelienople Borough, Jackson Township	Glade Run Watershed Stormwater Management	$50K-$250K
Harmony Borough, Jackson Township	German Street Improvements	$35K
Multiple	Regionalized Approach to Flood Hazard Mitigation Program	Based on Scope

These projects vary in scope and cost, however, focus on both localized flooding and floodplain impacts. Implementing these projects would show progress to residents in the watershed and will continue to build momentum for the other projects.

This study also identifies multiple projects that require significant investment to design, permit, and construct. Viable project funding sources are usually the biggest challenge in getting a project from just a plan to completion. This group should investigate opportunities to generate funding to implement the projects identified in the report. Opportunities could include regional grant applications, leveraging development opportunities, utilize the Butler County Infrastructure Bank program, and forming a stormwater utility to secure stormwater specific funding. These approaches would be most beneficial to be undertaken as a regional approach, however, could be done as an individual municipality or small regional effort.

Lastly the groups should identify the best avenue to continue this regional focus and cooperation that has been generated from this study. At this point, it is unclear as to what type of arrangement will work best for everyone, but some suggestions would be a working group, consortium, or council of governments. The key aspect of whatever is chosen is that this group continues to meet and communicate the challenges that each are experiencing and maintain a regional focus when generating solutions.

15.3 Funding Opportunities

Traditional funding opportunities are available for the problem areas identified in this study. Various programs administered by FEMA/PEMA, DCED, Butler County and the corresponding grant requirements have been included in the appendix of this report.

The group should also discuss the potential of forming a regional, sub-regional, or individual stormwater fee to raise funding specifically to complete stormwater projects. Fees are typically generated based on imperious area and apply to properties that are tax exempt. Opportunities for individual properties to reduce or eliminate their fee can be available if they are proactive in addressing stormwater on-site with BMP's. A regionalized approach could be beneficial to the group by spreading the cost across a larger population resulting a smaller monthly fee for individual residential property owners.