Piney Run Watershed Study
Piney Run Dam

Maryland Dam No. 139 (NID ID: MD00139)

Hydrologic and Hydraulic Report

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1. Introduction and Purpose

1.1 Project Setting and History

Piney Run Dam is located on Piney Run in Carroll County, Maryland, approximately one mile north of Sykesville, Maryland. The purpose of the dam was originally intended to be three-fold:

- To provide flood control for areas downstream of the dam along Piney Run
- To provide recreational opportunities for the patrons of Piney Run Park which surrounds the reservoir
- To store raw water for water supply to southern Carroll County

At present, only the first two uses of the dam are realized. From left to right (and upstream to downstream), the dam is comprised of the main embankment dam, principal spillway riser, principal spillway conduit, impact basin, water intake tower, water intake conduit, water intake rate control structure and conduits, and a vegetated earth-cut auxiliary spillway.

The reservoir has a surface area of approximately 290 acres at the normal pool elevation of 523.0 feet as surveyed in the North American Vertical Datum of 1988 (NAVD88). The reservoir's gross storage volume is 12,400 acre-feet measured to the dam crest elevation of 540.5 (NAVD88). This includes a normal pool volume of 5,560 acre-feet and a flood storage volume of 6,840 acre-feet. The drainage area to the project is approximately 10.6 square miles. Reservoir base flows pass through the principal spillway structure while excess flows pass through a combination of the principal and auxiliary spillways. The auxiliary spillway has a crest elevation of approximately 531.2 (NAVD88) and a control section width of 245 feet. The principal spillway riser has a lake-drain conduit and gate that is operated from the top of the riser using a rising stem and hand-cranked operator. The water intake tower has six gates operated using rising stem and hand-wheel operators located at the top of the tower. The gates are located at different elevations in the reservoir to withdraw raw water. In addition, there are two isolation gates located in internal walls inside of the tower to release water from the tower into the water intake conduit. As it is not in operation, the water intake conduit is currently plugged and water in the conduit discharges via a field connection to a rate control system of twin conduits that are controlled with butterfly valves and discharge to the principal spillway impact basin. As it is currently not used for raw water supply, the water intake tower is used to provide base flow bypass in the event that the principal spillway must be dewatered or if the reservoir level drops below the riser weir crest. A summary of specific data for the dam is presented in Table 1.

The dam and reservoir were designed and constructed under authority of the United States Department of Agriculture, Natural Resource Conservation Service (NRCS) and the Watershed Protection and Flood Prevention Act (Public Law or PL-566) between 1968 and 1974. As such, the dam is regulated by two authorities. The Maryland Department of the Environment, Dam Safety Division (MDE) is the regulator of dams in the state of Maryland. In addition, as a PL-566 dam, the dam is also regulated by the NRCS.

Table 1. Dam and Reservoir Data

Description	Value
General Data	
Year Designed	1972
Year of Completed Construction	1974
Purpose	Flood Control / Recreation / Water Supply(1)
Original Hazard Classification	High
Current Hazard Classification	High
Drainage Area	10.6 square miles (2)
Dam Height (Overall)	73 Feet (3)(5)
Embankment Length	600 Feet (3)
Embankment Top Width	22 Feet (3)
Embankment Upstream Slope	2.7H:1V to 3H:1V (3)
Embankment Downstream Slope	2.8H:1V (3)
Critical Elevations (NAVD 88)	
Principal Spillway Crest/Normal Pool	523.0 Feet (3)
Auxiliary Spillway Crest	531.2 Feet (3)
Dam Crest	540.5 Feet (3)
Storage Capacities	
Normal Pool	5,560 Acre-Feet (4)
Auxiliary Spillway Crest	8,090 Acre-Feet (4)
Top of Dam	12,120 Acre-Feet (4)
Pool Surface Areas	
Normal Pool	290 Acres (4)
Auxiliary Spillway Crest	377 Acres (4)
Top of Dam	492 Acres (4)
Other Features	
Principal Spillway Weir Crest Length	18 Feet (3)
Auxiliary Spillway Control Section Width	249 Feet (3)

(1) Reservoir is not currently used for water supply although it was designed and constructed with that intent.
(2) Data derived from 2020 Hydrologic and Hydraulic Analysis described in this report.
(3) Data obtained from 2019 Field-Run and Aerial Photogrammetric Surveys by AECOM.
(4) Data obtained from 2019 Bathymetric Survey by AECOM and 2016 LiDAR Data from the Maryland Geographic Information Office.
(5) Overall height is defined by NRCS TR-60 as the difference in elevation between the lowest point in the dam crest and the lowest point of the downstream toe.

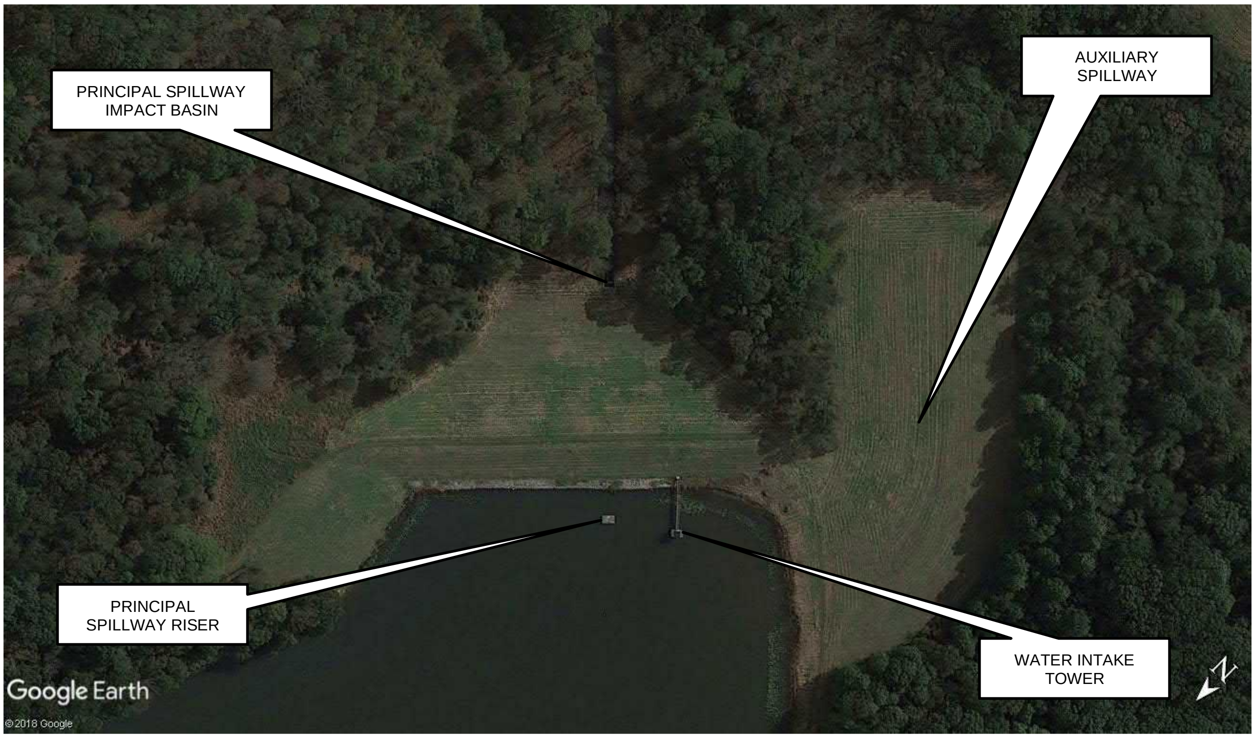


Figure 1. Aerial view of Piney Run Dam.

1.2 Report Purpose and Scope

This report presents hydrologic and hydraulic modeling for Piney Run Dam in Carroll County, Maryland and includes documentation of methods, data sources, technical references, findings, and recommendations.

The scope of the report includes:

- Hydrologic Analysis of the contributing watershed to Piney Run Dam and estimates of inflow hydrographs.
- Hydraulic Analysis of the outlet works of Piney Run Dam and estimates of outflow hydrographs as well as peak discharges and reservoir water surface elevations.
- Hydraulic Analysis of breach scenarios for Piney Run Dam including estimates of peak breach discharge and downstream flood inundation limits.
- Modeling and analysis of auxiliary spillway integrity under stability design hydrograph and freeboard hydrograph/spillway design flood conditions.
- Recommendations associated with hydrologic and hydraulic aspects of Piney Run Dam pertaining to hydraulic capacity and the integrity of the auxiliary spillway.

This work has been carried out in accordance with reasonable and accepted engineering practices and standard of care. No warranty or guarantee, either written or implied, is applicable to this work.

2. Hydrologic Analysis

According to the MDE, Piney Run Dam is currently classified as a high hazard (Category I) dam. The Code of Maryland Regulations (COMAR) section 26.17.04.05 defines a Category I dam as one in which failure would result in the potential for probable loss of life (population-at-risk or PAR is greater than six) and/or a potential for serious damage to residential, industrial, or commercial buildings, important public utilities, public roads, or railroads. The Spillway Design Flood (SDF) of a dam is the flood that a spillway must be able to safely pass based upon regulations and hazard potential. The SDF for a high hazard dam is determined through an analysis that considers the incremental damage caused by the failure of the dam that is beyond the damage that would have been experienced had the dam not failed. Under COMAR, the maximum possible SDF for a high hazard dam is the Probable Maximum Flood (PMF).

Similarly, as a PL-566 dam, the dam is classified under NRCS guidelines as a Class 'C' dam which is also a designation of a high hazard dam. As a Class 'C' dam, the dam is subject to the guidance of the NRCS' publication, Technical Release 210-60: Earth Dams and Reservoirs (TR-60). This guidance requires that the freeboard hydrograph (FBH), which is analogous to the SDF, be the flood generated from the Probable Maximum Precipitation (PMP).

The PMP is the theoretically greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographic location at a certain time of year (American Meteorological Society, 1959). The PMF is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the drainage basin under study (FEMA, 2013). Precipitation depths and the spatial and temporal rainfall distribution for such precipitation are derived from PMP estimates. A hydrologic model is used to simulate the PMP over the study watershed and transform the excess precipitation into the surface runoff that represents the PMF. The following sub-sections detail the parameters and tools used to analyze the current spillway capacity of the Piney Run Dam. Consequences of dam failure for Piney Run Dam are discussed in Section 3.

In addition, this study examines several additional precipitation events due to the purpose and regulatory nature of the dam. They include:

- Frequency Events for the 10% (10-year), 2% (50-year), 1% (100-year), and 0.2% (500-year) annual exceedance probabilities (24-hour event duration)
- Principal Spillway Hydrograph (PSH) for the 1% (100-year) annual exceedance probability (10-day event duration)
- Auxiliary Spillway Stability Design Hydrograph (SDH) as defined in TR-60 for a Class 'C' dam

2.1 Watershed Analysis

Using Geographic Information System (GIS) ArcMap version 10.6 software, a hydrologic database was created to support the watershed analysis. The GIS hydrologic database contains input data used to define and characterize the watershed, such as hydrologic soil types, land use types, runoff curve number and time of concentration. A gridded terrain surface was obtained in the form of a Hydro Flattened Digital Elevation Model (DEM) with a 10-foot cell size resolution. The DEM was derived from Light Detection and Ranging (LiDAR) data published by the state of Maryland Geographic Information Office's (GIO) iMAP Program in 2016.

The NRCS' Water Resources Site Analysis Computer Program, SITES version 2005.1.8 was used to create a hydrologic model of the Piney Run Dam watershed. This model was used to estimate the inflow hydrographs to Piney Run Dam and route the storms through the reservoir as required by MDE and NRCS guidance. Since the watershed is less than 50 square miles, in accordance with NRCS guidance, the basin was modeled as a single sub-basin as shown in Figure 4. The watershed was delineated using ArcGIS hydrology tools and manually verified. The watershed area is estimated to be 6,760 acres (10.6 square miles).

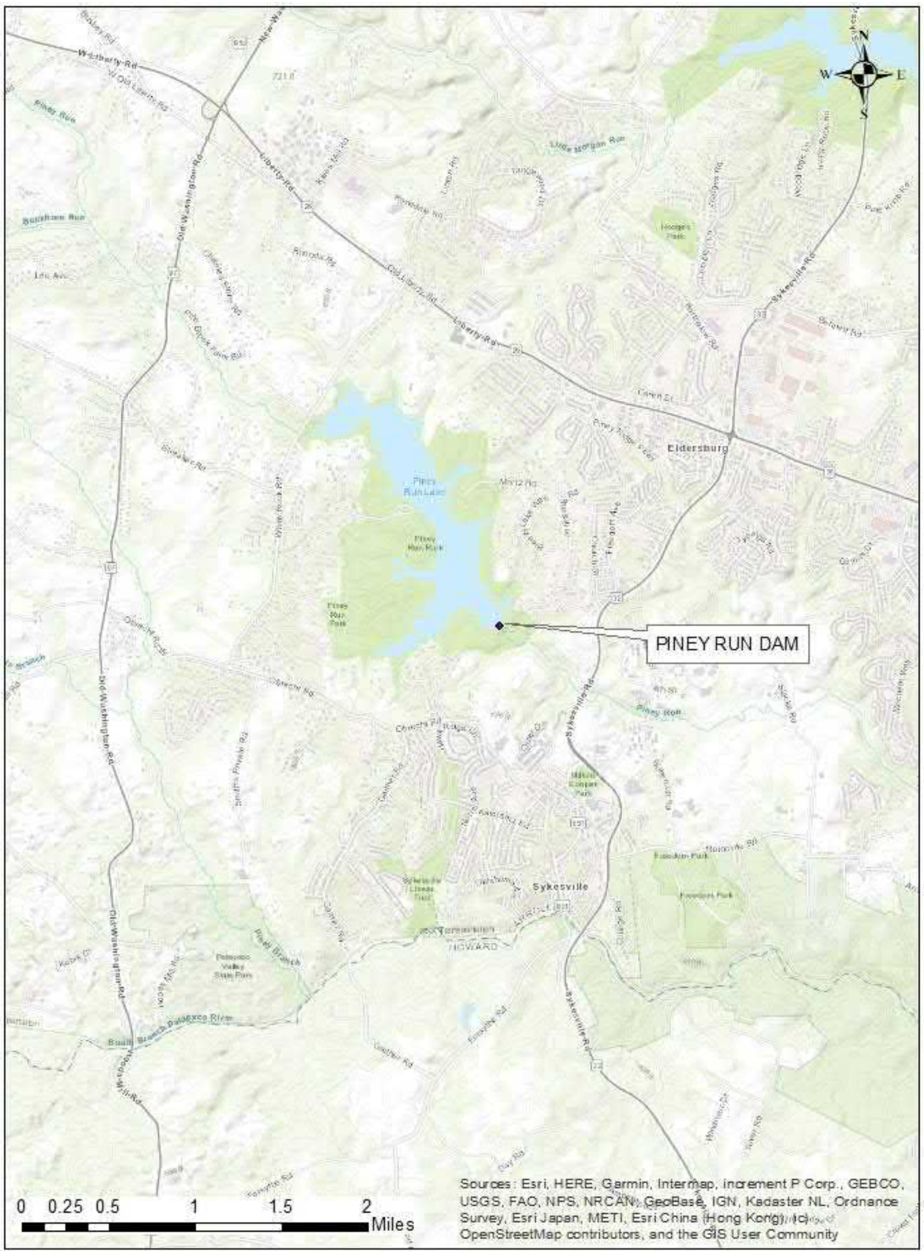


Figure 2. Piney Run Dam location map.

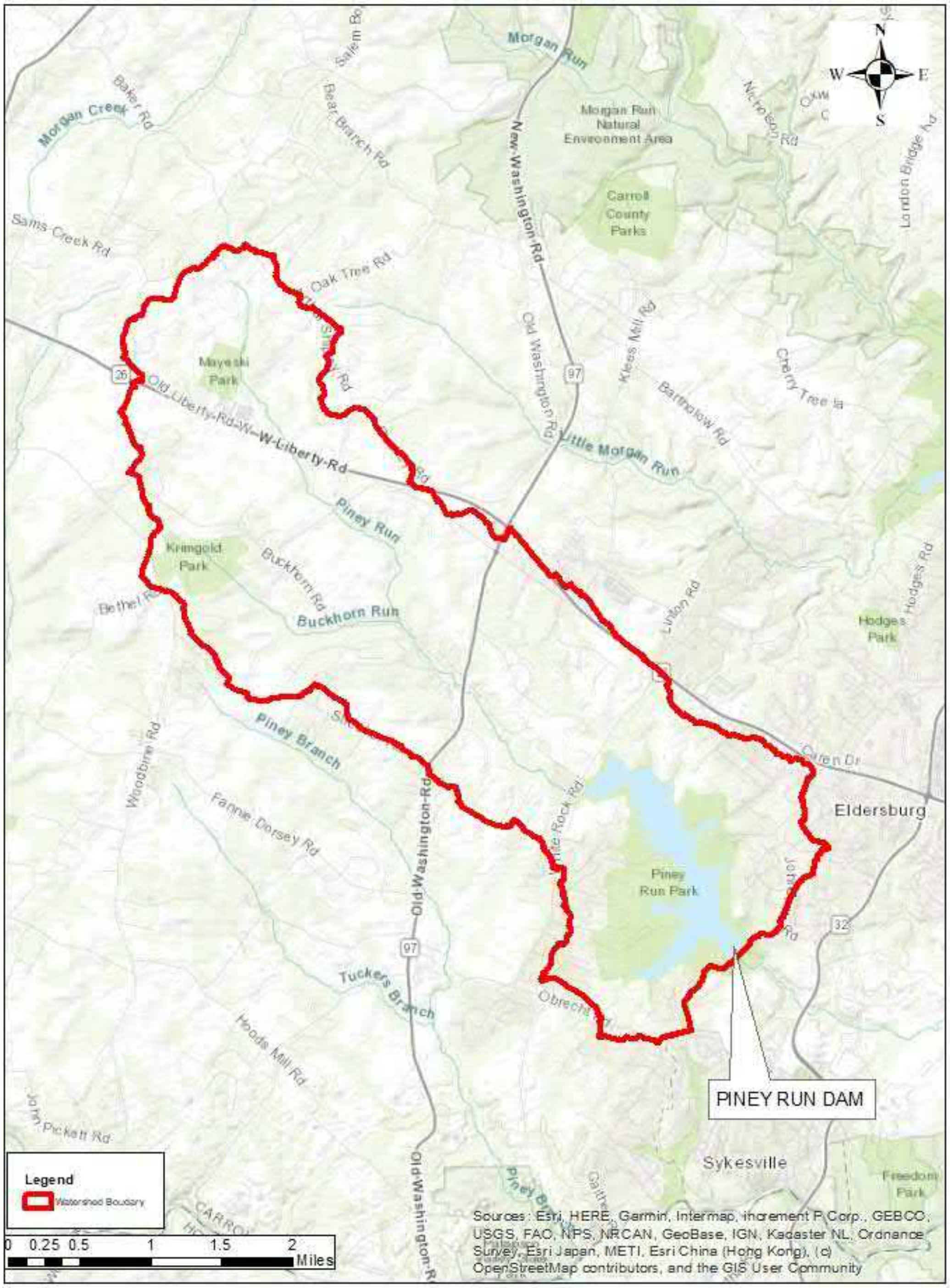


Figure 3. Piney Run Dam watershed map.

2.2 Precipitation Losses (Existing Conditions)

For the Piney Run Dam hydrologic model, rainfall losses were computed using NRCS' Runoff Curve Number method. The Runoff Curve Number (CN) is an empirical parameter that provides an indication of storm runoff potential over an area based on land cover, underlying soil type, and hydrologic condition. Higher CN values indicate a quicker watershed response time and an increase in runoff. These values were determined using ArcMap and the following methodology:

1. Land use was manually determined using aerial imagery obtained from the Maryland GIO. Land use was classified based on NRCS guidance. Due to the large residential lots ranging from ¼ acre to eight acres found in the watershed, several composite curve numbers were developed using similar methods used to develop residential development curve numbers in NRCS guidance (Formula 1).

$$CN_{CR} = CN_P(1-I) + CN_I(I) \qquad (1)$$

where: CN_{CR} = Composite residential curve number

CN_P = Pervious area curve number (open space in good condition land use)

I = Fraction of Impervious Area on the Lot (the fraction of impervious area was determined by extrapolating the relationship between lot size and percent impervious given in NRCS guidance)

CN_I = Curve number for impervious area (98)

In a few cases, residential lots examined were entirely forested except for the footprints of the house and outbuildings. Therefore, curve numbers for Woods in Good condition were used for the pervious curve number in Formula 1. Table 2 contains a summary of the land use data for the watershed and Figure 4 depicts the land uses in the watershed.

Table 2. Piney Run Dam Watershed Existing Conditions Land Use

Land Use	Area	% of Watershed Area
1 acre Residential	638.3	9%
1/2 acre Residential	187.5	3%
1/4 acre Residential	0.8	0%
2 acre Residential	268.8	4%
3 acre Residential	808.8	12%
3 acre Residential - Wooded	87.6	1%
4 acre Residential	260.5	4%
5 acre Residential	90.3	1%
6 acre Residential - Wooded	52.6	1%
7 acre Residential	26.2	0%
8 acre Residential	7.1	0%
Brush Mix - Good	4.5	0%
Commercial	28.6	0%
Farmstead	164.9	2%
Institutional	59.1	1%
Meadow - Good	45.1	1%
Open Section Road	86.7	1%
Open Space - Good	334.7	5%
Open Water	297.1	4%
Pasture - Good	85.9	1%
Row - Contoured - Good	44.4	1%
Row - Straight - Good	1516.5	22%
Woods - Good	1581.2	23%
Woods - Grass - Mix - Good	83.1	1%
Grand Total	**6760**	**100%**

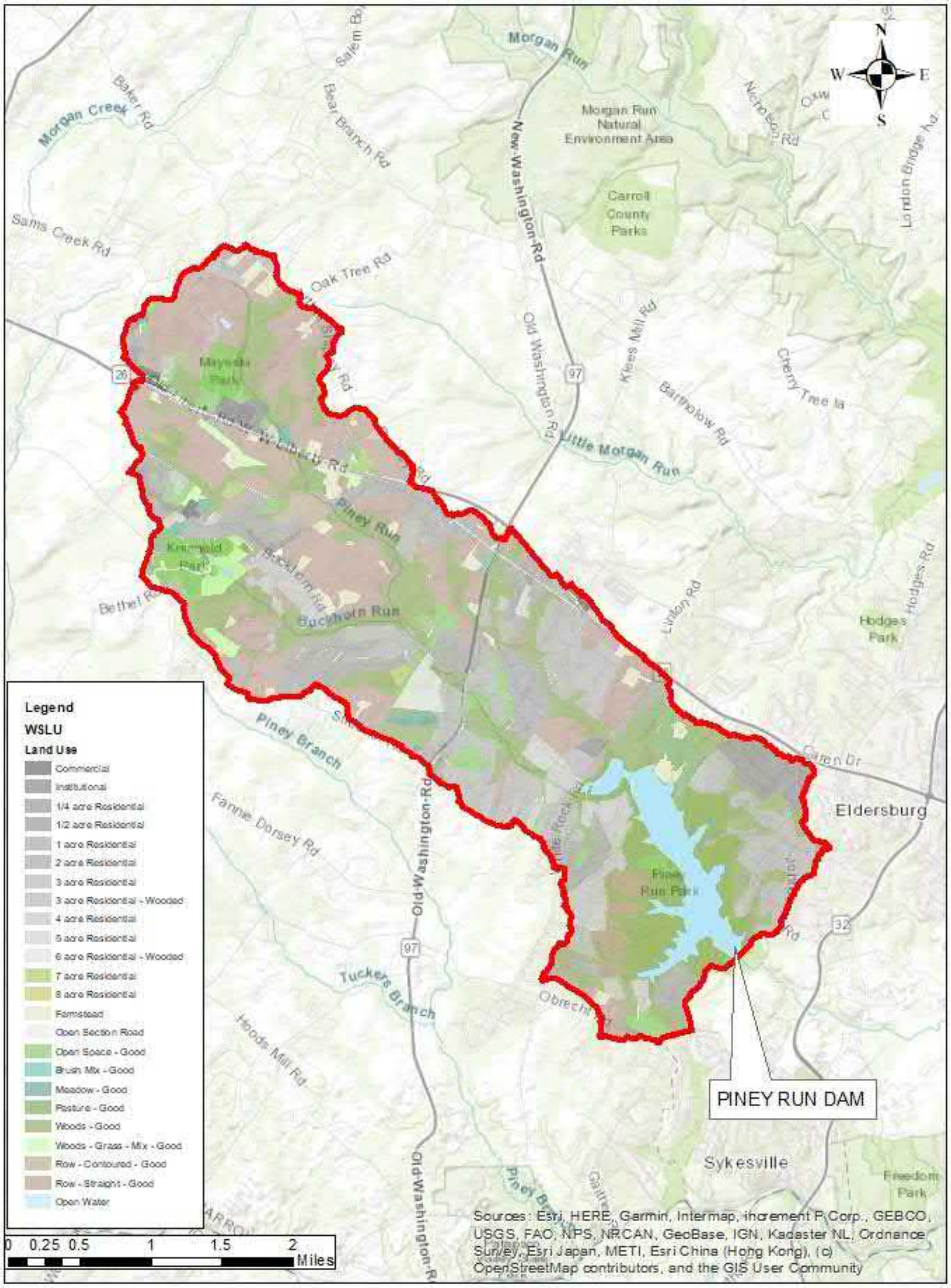


Figure 4. Piney Run Dam watershed existing conditions land use map.

2. Soils data were obtained from the NRCS Soil Survey Geographic Database (SSURGO) and the Hydrologic Soil Group (HSG) for each soil type was extracted from the dataset. Table 3 contains a summary of the soils data for the watershed and Figure 5 depicts the HSG values within the watershed.

Table 3. Piney Run Dam Watershed Soils

Hydrologic Soil Group	Total	
	Area	% of Total
A	0.0	0%
B	4,327.4	64%
C	1,185.6	18%
D*	1,247.6	18%
Total	6,760.6	100%

**Soils denoted as hybrid (two) hydrologic soil groups (e.g. B/D) were assumed to have the characteristics of the more conservative soil group (e.g. the soil group with the least amount of infiltration capability).*

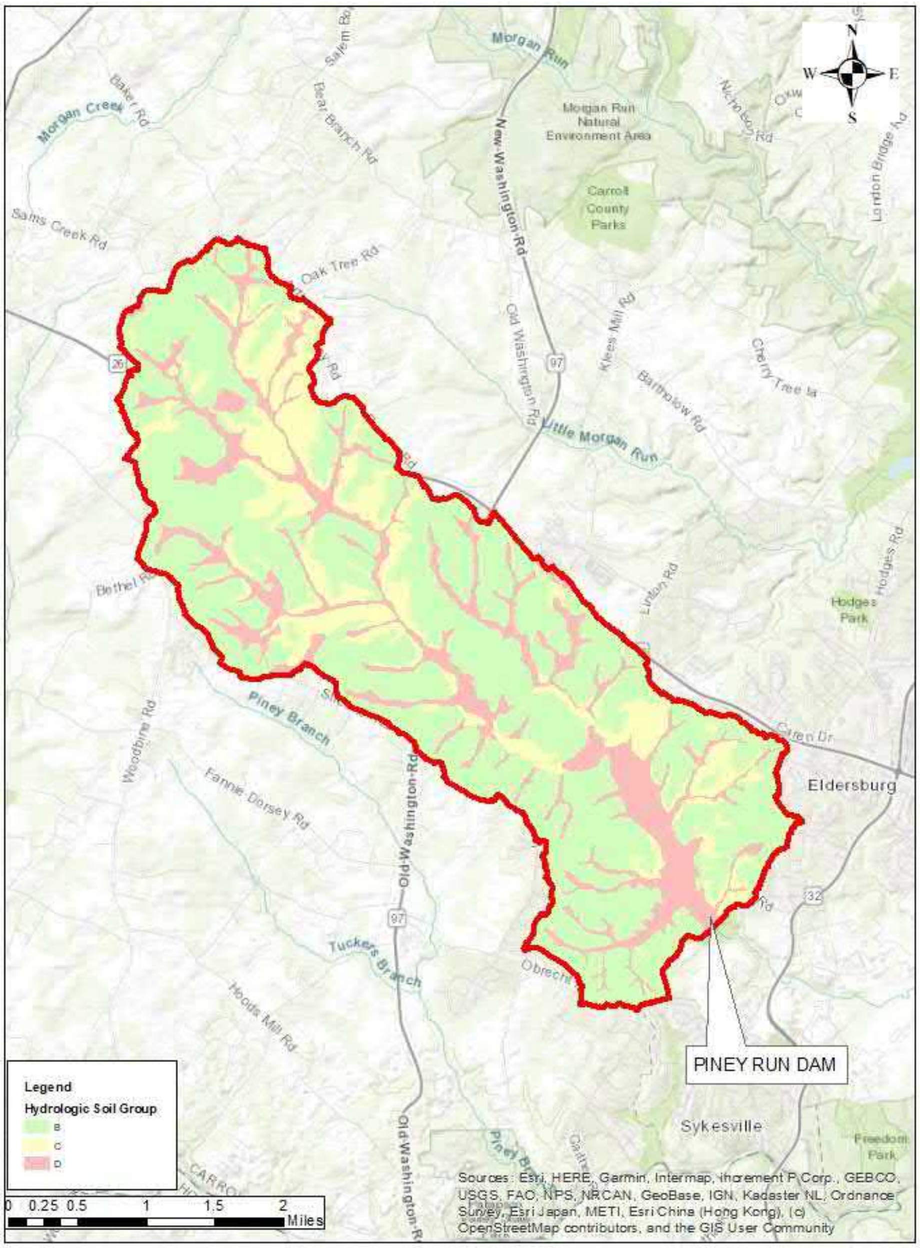


Figure 5. Piney Run Dam watershed soils map.

3. The soil and land use data were combined within ArcGIS and the resulting dataset was clipped to the watershed.
4. A custom CN lookup table was developed by determining a relationship between the land use data and the HSG using values published by the NRCS to assign curve number values. This table can be found in Appendix B.
5. An area-weighted curve number was calculated for the watershed by cross-referencing the soil and land use data with the lookup table values.

As a cross-check of the curve number development using methods described above, additional curve number estimates were prepared using alternative land use and land cover sources. These alternative sources included:

- 2016 National Land Cover Dataset (NLCD)
- 2006 Chesapeake Bay Program (CBP) Land Cover dataset
- 2014 Chesapeake Bay Land Cover dataset

The resultant curve number estimates ranged from 70 for the NLCD 2016 dataset to 73 for the CBP 2006 dataset. When incorporated into the model, the resultant discharge variations between the low and high CN bounds were approximately two percent or less for peak discharge inflow to the reservoir. Therefore, the model is not determined to be sensitive to small variations in CN and the manually determined CN of 72 was selected as the CN to be used in the model.

In addition to the CN, the Runoff Curve Number method uses an initial abstraction (Ia) value to represent the total rainfall lost before runoff initiates, including losses from interception, initial infiltration, surface depression storage, and evapotranspiration. The Ia was calculated using Formula 2 found in NRCS methodology:

$$I_a = 0.2\left(\frac{1000}{CN} - 10\right) \qquad (2)$$

The composite runoff curve number estimated for the entire Piney Run Dam watershed is 72. Computations related to the CN values can be found in Appendix B.

2.3 Hydrograph Transform (Existing Conditions)

To convert excess precipitation into surface runoff, the Soil Conservation Service (SCS) Unit Hydrograph Transform Method was employed within the watershed model. The inputs for this method include graph type and a time of concentration. The Standard graph type with peak rate factor of 484 was selected for this analysis as recommended by Maryland Hydrology Panel for the Piedmont and Blue Ridge physiographic regions which encompass the Piney Run Dam watershed (Maryland Hydrology Panel, 2016). Time of concentration (Tc) is the “time required for runoff to travel from the hydraulically most distant point in the watershed to the outlet”. Time of concentration can also be defined as the “time from the end of excess rainfall to the point on the falling limb of the dimensionless unit hydrograph (point of inflection) where the recession curve begins” (NRCS, 2010).

The Tc for the watershed was calculated using the Velocity Method which is a segmental approach involving defining travel times for three different flow types along the longest flow path: sheet flow, shallow concentrated flow, and open channel flow. Sheet flow is described as shallow, steady uniform flow with depths not exceeding 0.1 feet and occurs at the head of the flow path. Sheet flow is calculated based on slope for a maximum flow length of typically 100 feet (NRCS, 2010). Where sheet flow ends, shallow concentrated flow begins. Shallow concentrated flow is described as flow that is not in a well-defined channel and consisting of flow depths between 0.1 and 0.5 feet. For this analysis, the transition to open channel flow was determined by analyzing the LiDAR-based DEM for channel-like depressions. Manning's open channel flow equation was used to compute the channel velocities and travel time for the open channel flow segments. Cross section hydraulic characteristics were determined by plotting the cross section using the DEM and directly measuring the area and wetted perimeter of the cross section. Wave celerity (wave velocity) travel time was also included in the time of concentration calculation to account for the travel time of the inflow hydrograph wave through the reservoir to the dam. Time of concentration for the entire flow path was determined by summing the travel times of each of the flow segment types.

The estimated time of concentration of the Piney Run Dam watershed is 2.87 hours. A map showing the selected Tc flow path is depicted in Figure 6. The computations related to the Tc value determination can be found in Appendix B.

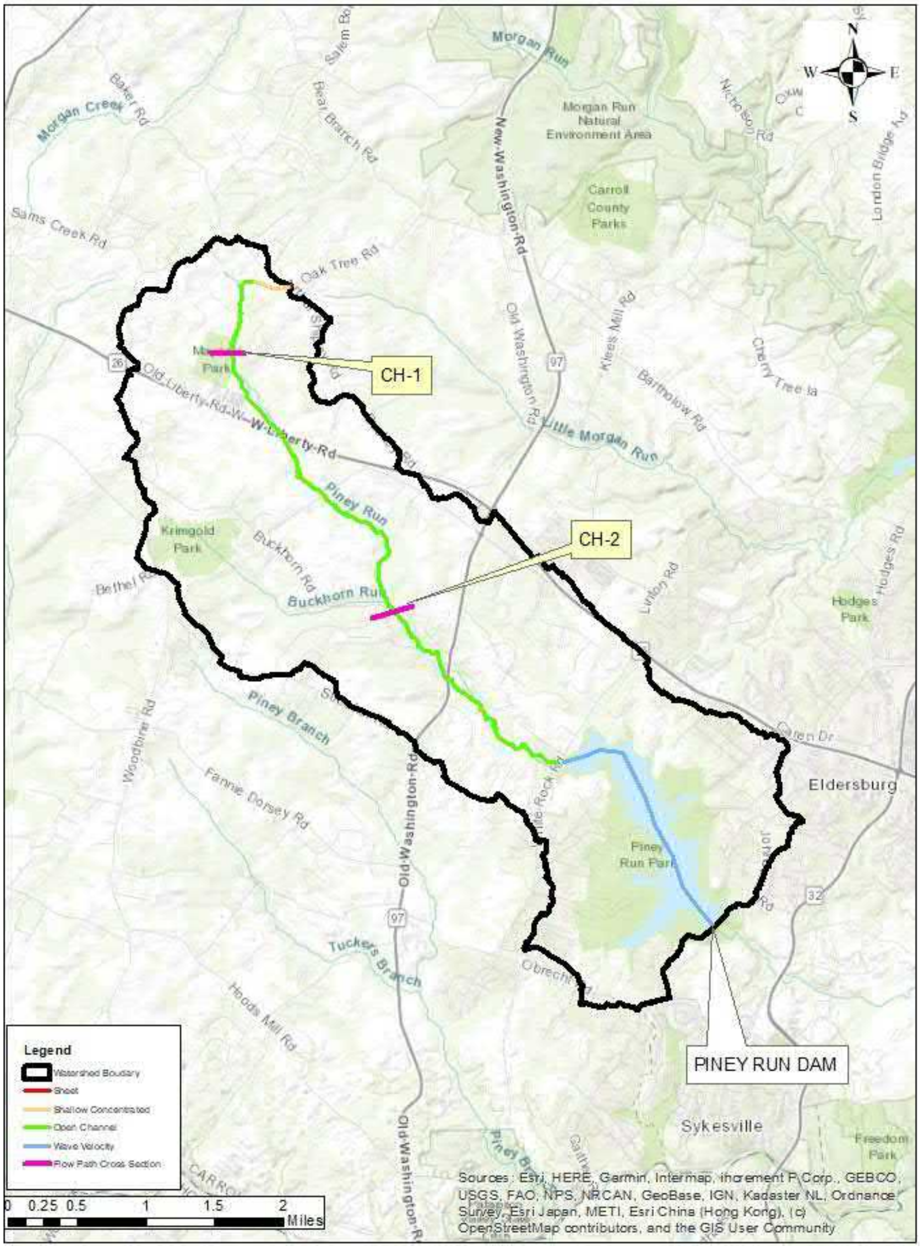


Figure 6. Piney Run Dam watershed flow path.

2.4 Precipitation Losses and Hydrograph Transform (Ultimate Conditions)

To account for future development, ultimate land use conditions based on Carroll County zoning were used to develop CN and time of concentration values for the watershed. The CN was calculated using the same method discussed in Section 2.1.1 except instead of manually assessing land use, the land use was determined using a shapefile of zoning for Carroll County. Each zone was assigned a corresponding NRCS land use based on the descriptions of the zone in the Carroll County zoning code:

- R-10000: ¼ Acre Residential
- R-20000: ½ Acre Residential
- R-40000: 1 Acre Residential

- B-NR/BG: Commercial
- IR: Industrial
- Conservation: Open Space – Good Condition
- AG: Row Crops – Straight – Good Condition

In addition, Piney Run reservoir was designated as Open Water and assigned a CN of 100 similar to the existing conditions scenario.

Computations related to the ultimate conditions CN value can be found in Appendix B

To calculate the ultimate condition time of concentration, it was assumed that open channel segment flow lengths and velocities would remain the same as existing conditions. Sheet flow and shallow concentrated flow segments were updated to reflect ultimate conditions if the surface land use changed for those areas. In this case, the surface land use changed from natural conditions (dense grass and woods) to a projected agricultural land use based on the zoning data overlaying this portion of the watershed. Therefore, the sheet flow and shallow concentrated surfaces were modified to reflect cultivated land use. It should be noted that this change would have applied to any of the other potential longest flow paths analyzed for the watershed, so the flow path is assumed to remain the same since the surface change would have been applied to the others as well.

For ultimate conditions, the estimated CN value is 75 and the estimated time of concentration value is 2.49 hours. Ultimate conditions land use is documented in Figure 7. Computations related to the ultimate conditions time of concentration values can be found in Appendix B.

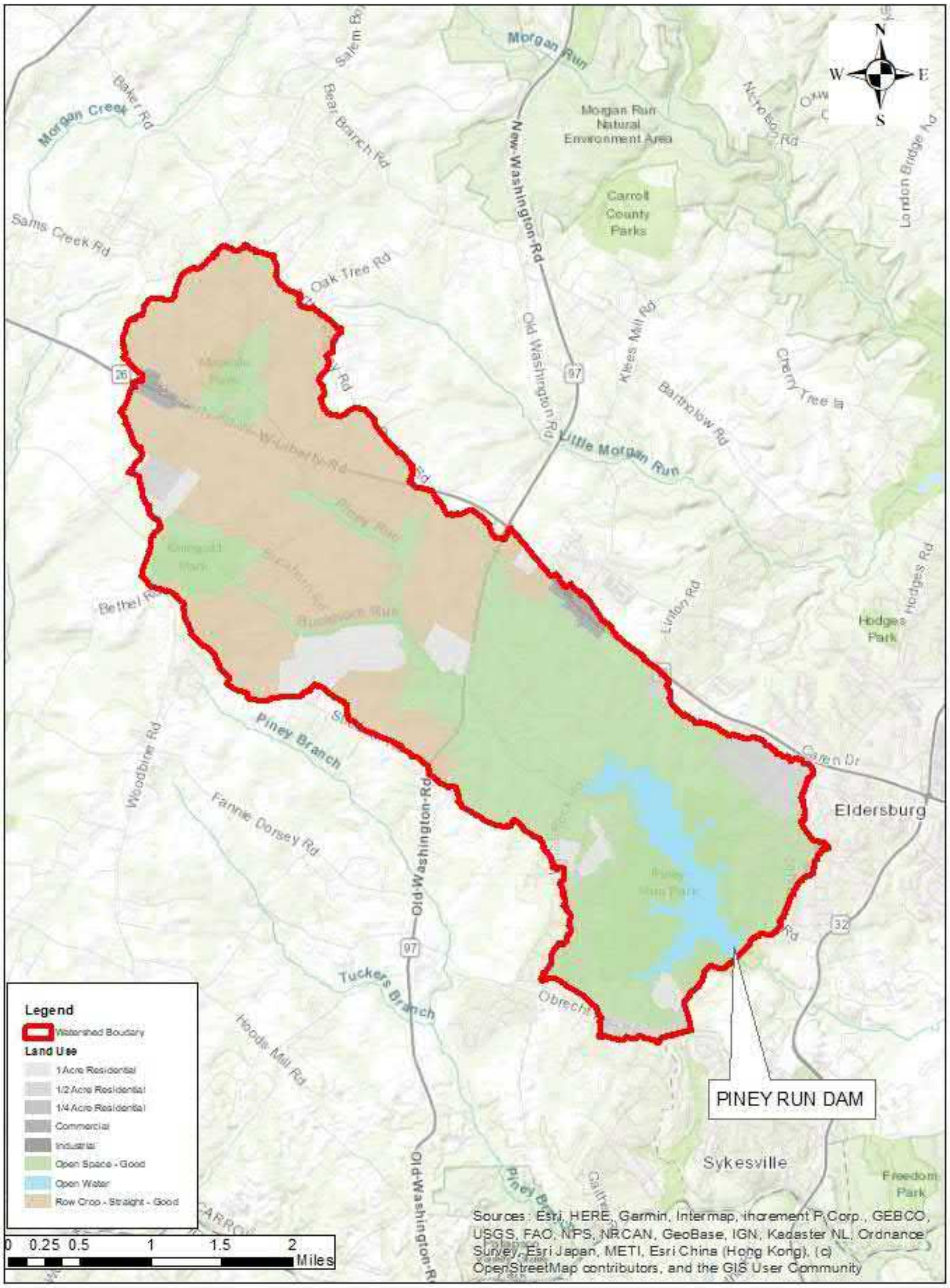


Figure 7. Piney Run Dam watershed ultimate conditions land use map.

2.5 Precipitation Data Analysis

This study covers analysis of several hydrometeorological events as required by the scope of work and regulatory agencies. These events include the following:

- Frequency Events for the 10% (10-year), 2% (50-year), 1% (100-year), and 0.2% (500-year) annual exceedance probabilities (24-hour event duration)
- PSH for the 1% (100-year) annual exceedance probability (10-day event duration)

- Auxiliary Spillway SDH as defined in TR-60 for a Class 'C' dam
- FBH / SDF as defined by COMAR and by NRCS in TR-60 for a high hazard or Category 'I' (MDE) or Class 'C' (NRCS) dam.

2.5.1 Frequency Events

Frequency events for the 24-hour duration were analyzed for 10%, 2%, 1%, and 0.2% annual exceedance probabilities. The precipitation data was obtained from the National Oceanic and Atmospheric Administration's Atlas 14, Volume 2, Version 3 (NOAA, 2019). The estimates are the mean estimates assuming a center of storm over a location slightly south of the intersection of Old Washington Road (MD 97) and Sykesville Road (MD 26) which is located upstream of the dam near the centroid of the watershed. A summary of precipitation depths used in the model is provided in Table 4.

Table 4. Frequency Event 24-hour Precipitation Values

Annual Exceedance (%)	Return Interval (years)	Depth (inches)
10	10	4.81
2	50	7.09
1	100	8.30
0.2	500	11.80

The temporal precipitation distribution used to model each of these events is the NOAA Type 'C' distribution (Merkel, et al., 2015). This distribution was manually input into the SITES program.

2.5.2 Principal Spillway Hydrograph Event

In accordance with TR-60 guidance for flood retarding structures, the principal spillway was analyzed for a 1% annual exceedance, 10-day duration event using methods described in the National Engineering Handbook (NEH), Part 630, Chapter 21, Design Hydrographs (NRCS, 2019). The PSH was developed internally in the SITES program using the following input parameters captured in Table 5.

Table 5. Principal Spillway Hydrograph SITES Parameters

Description	Value	Units	Source
1% A.E. Precipitation (1-Day)	8.3	inches	NOAA Atlas-14
1% A.E. Precipitation (10-Day)	12.2	inches	NOAA Atlas-14
Quick Return Flow	6	CFS/mi^2	NEH Part 630, Chapter 21
Climatic Index	1.47	---	SITES Program

The temporal distribution of the PSH is created in the SITES model by critically stacking the resulting runoff values and accumulating the results as defined in NEH, Part 630, Chapter 21.

2.5.3 Auxiliary Spillway Stability Design Hydrograph Event

In accordance with TR-60 guidance, the auxiliary spillway must be analyzed for discharge capacity, stability (erosion potential), and integrity (breach potential). This analysis is performed by examining spillway performance under both six- and 24-hour duration events and using the most critical results when evaluating the spillway. As a high hazard dam, the required precipitation depth for the auxiliary spillway SDH is determined by Formula 3:

$$P_{SDH} = P_{100} + 0.26\left(PMP - P_{100}\right) \qquad (3)$$

where:

P_{SDH} = Precipitation Depth for the SDH (inches)

P_{100} = Precipitation Depth for the 1% Annual Exceedance (100-year) Event (inches)

PMP = Probable Maximum Precipitation Depth (inches)

Precipitation depths for the 1% annual exceedance event (P_{100}) for both six and 24-hour durations were obtained as described in section 2.5.1 for six- and 24-hour durations respectively. PMP estimates for the Piney Run Dam watershed were obtained from the NOAA's Hydrometeorological Report No. 51: "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian" (NOAA, 1978). PMP values obtained from HMR-51 and used in this analysis are summarized in Table 6.

Table 6. PMP Data

Isohyet Area (mi^2)	Duration (hours)				
	6	**12**	**24**	**48**	**72**
10	27.3	31.8	35.2	38.9	40.5
200	18.9	22.5	26.4	29.9	31.1
1000	13.7	17.3	21.1	24.0	25.0
5000	8.3	11.6	14.5	17.9	19.1
10000	6.4	9.5	12.0	15.0	16.2
20000	4.5	7.5	9.9	13.1	14.0

The PMP depths obtained as described in this section were used in this analysis. The United States Army Corps of Engineers Hydrologic Engineering Center developed the Meteorological Visualization Utility Engine, version 3.0 (HEC-MetVue) to facilitate viewing and manipulating meteorological datasets as well as performing a variety of computations and analyses, including temporal and spatial aggregation of datasets and areal average computations. HEC-MetVue was used to develop the PMP events for the Piney Run Dam watershed. HEC-MetVue utilizes methodologies of NOAA's HMR-52 to adjust the precipitation depth and extents for the size, shape, and orientation of the watershed and to temporally distribute precipitation. The orientation of the storm calculated within HEC-MetVue is 124.05 degrees (measured clockwise from north) and the centroid of the storm is approximately 77.01 degrees North latitude and 39.42 degrees West longitude. Figure 8 depicts the storm orientation and location over the watershed.

HEC-MetVue gives a 72-hour output hyetograph for the watershed. Unit hyetographs for six- and 24-hour duration storms were extracted from the 72-hour hyetograph using the method in the NEH Part 630, Chapter 4, Storm Rainfall Depth and Distribution (NRCS, 2015). A graph showing the resulting hyetographs used in this analysis is provided in Appendix B. These unit hyetographs were input into the SITES program for the six- and 24-hour duration SDH events to create temporal distributions of the SDH precipitation depths as determined in Formula 3.

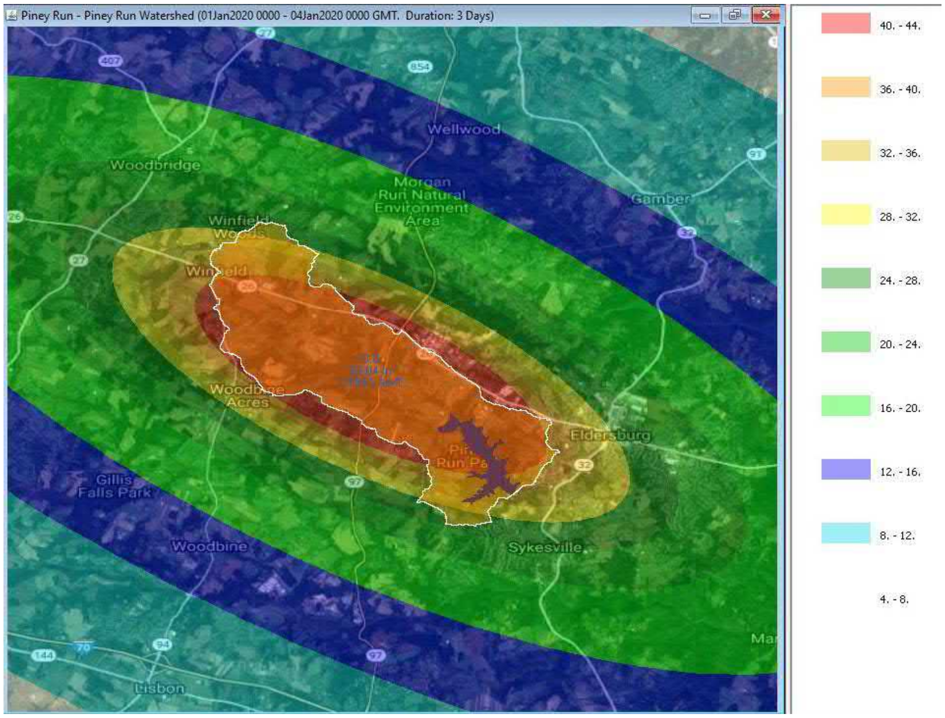


Figure 8. PMP storm orientation relative to watershed (precipitation depth in inches legend at right).

2.5.4 Freeboard Hydrograph/Spillway Design Flood Event

In accordance with TR-60 guidance and COMAR, the dam must be analyzed for capacity and sufficient freeboard using FBH or SDF event. This analysis is performed by examining the dam's hydraulic performance under both six- and 24-hour duration events for TR-60 and for the six, 24-, and 72-hour events based MDE guidance and using the most critical results when evaluating discharge capacity and freeboard. As a high hazard dam, the required precipitation depth for the FBH/SDF is the PMP.

The PMP depths were obtained as described in Section 2.5.3. As previously discussed, HEC-MetVue gives a 72-hour output hyetograph for the watershed. This hyetograph was used to model the 72-hour event in SITES while six- and 24-hour hyetographs were extracted using the method in the NEH Part 630, Chapter 4, Storm Rainfall Depth and Distribution (NRCS, 2015). The total PMP event precipitation depths for the six-, 24- and 72-hour events are shown in Table 7. The hyetographs for these events were input directly into the SITES program.

Table 7. Piney Run Dam Watershed PMP Depths (inches)

Duration (hours)		
6	**24**	**72**
26.3	33.9	39.1

2.6 Model Calibration

To validate the parameters developed for the model, a calibration of the model was performed in accordance with methods described in Application of Hydrologic Methods in Maryland, 4th Edition (Maryland Hydrology Panel, 2016). The SITES model was used to determine peak discharges for the 10%(10-year), 2% (50-year), 1% (100-year), 0.5% (200-year), and 0.2% (500-

year) annual exceedance events and were compared with estimates of peak discharge for the same annual exceedance probabilities determined using regression equations for the Blue Ridge and Piedmont physiographic regions. These estimates were determined using a regression estimating computer program ("Tasker") developed by the Maryland Hydrology Panel. The Tasker program does include an option to weight the regression discharge estimates based on adjacent stream gage data and a stream gage on Piney Run was located which had a period of record from 1932 to 1974 (Gage No. 1588000). However, this gage was determined to not be appropriate to use as the estimated imperviousness of its watershed during its period of operation (less than 6%) was not similar to the current watershed's imperviousness (greater than 10%).

Per the hydrology panel report, a model is generally considered to be acceptably calibrated when the estimate peak discharge for the range of events analyzed fall within the regression-estimated mean and the mean plus one Standard Error (SE). Table 8 provides a summary of the peak discharges calculated by regression equations, estimated by the model, and the mean plus one standard error upper limit. Figure 9 provides a graphical representation of the data in Table 8. The calculated peak flow in SITES generally falls within the acceptable range as defined in this section, and this the model was considered calibrated without any modifications. The output from the "Tasker" program used to generate the regression estimates can be found in Appendix B.

Table 8. Model Calibration Data

Annual Exceedance Probability Event	Regression-Estimated Discharge (cfs)	SITES Model-Estimated Discharge (cfs)	Regression-Estimated Discharge + 1 SE (cfs)
10.0%	2680	3309	3590
2.0%	5360	6434	7190
1.0%	6970	8189	9520
0.5%	8650	10249	12300
0.2%	11900	13435	17800

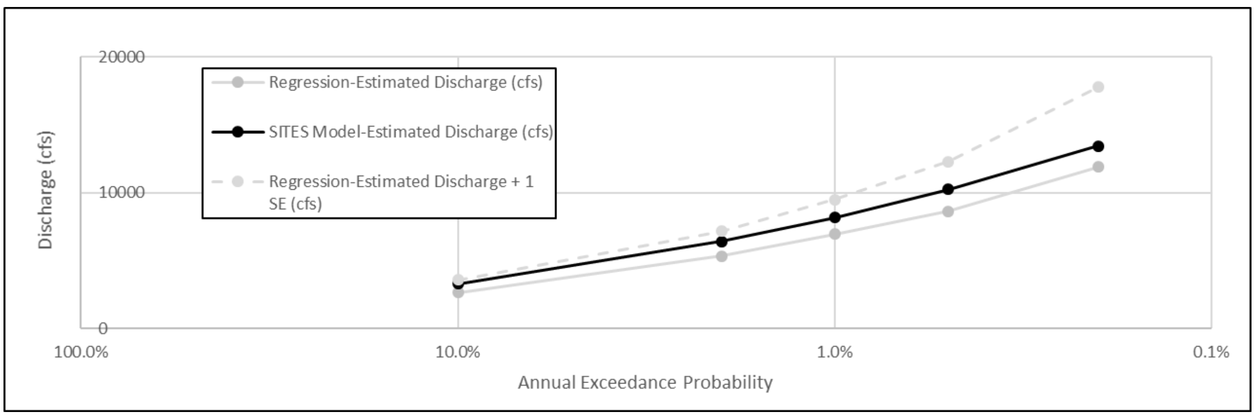


Figure 9. Graphical depiction of model calibration results.

3. Reservoir Routing

3.1 Overview and Stage-Storage Rating

Reservoir routing through Piney Run Reservoir and Dam was performed within the SITES watershed model. The stage-storage relationship of Piney Run Reservoir was developed using a combination of bathymetric survey data below elevation 523.0 (NAVD88) which was performed in 2019 one-meter LiDAR data obtained from the Maryland GIO above elevation 523.0 (NAVD88). Storage volume calculations were prepared to elevation 546.0 (NAVD88) (approximately 5.5 feet above the dam crest elevation). The resulting stage-storage relationship of Piney Run Reservoir is summarized in Figure 10. Tabular calculations for the stage-storage relationship are presented in Appendix C.

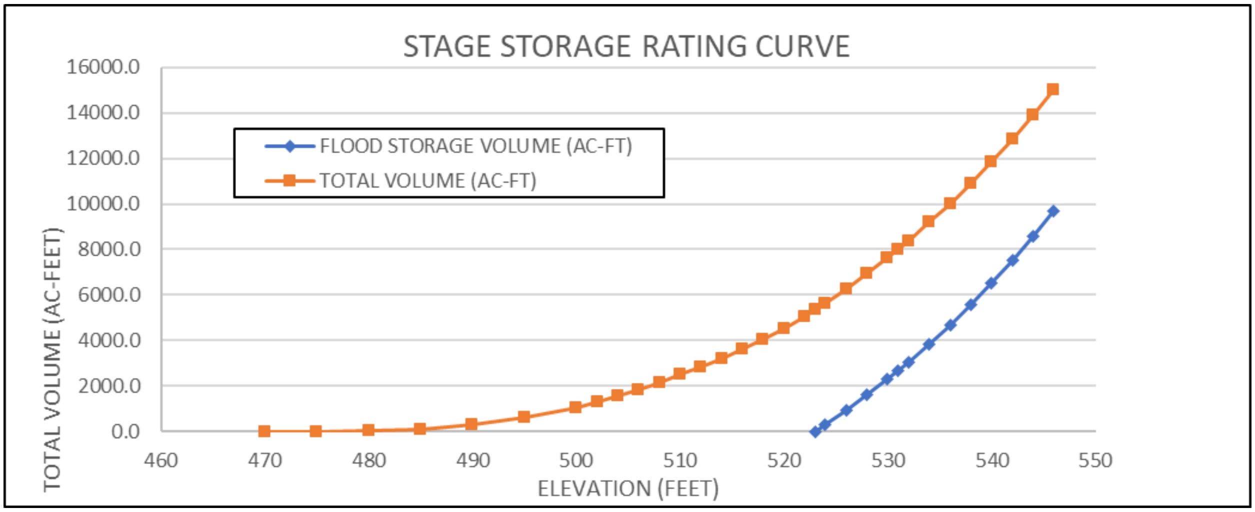


Figure 10. Stage-storage rating curve for Piney Run Reservoir.

3.2 Principal Spillway Stage-Discharge Rating

The principal spillway stage-discharge rating was developed internally in the SITES model using geometric input data derived from the survey and as-built plans. While most elevations of the principal spillway were not directly surveyed, the existing monuments located on the dam's appurtenant structures were surveyed and compared with the as-built surveyed elevations to determine an appropriate adjustment factor to apply to the reported pertinent elevations on the as-built plans. A summary of the benchmark survey data is provided in Table 9.

Table 9. Benchmark Survey Summary

Description	Surveyed BM Elevations		Difference
	As-Built	**2019 Survey**	
BM - Disk on Flow Meter Cabinet	477.34	476.31	-1.03
BM - Disk on Impact Basin Sill	468.16	467.16	-1.00
BM - Riser Hatch	526.16	525.18	-0.98
BM Top Concrete Step of Catwalk to Water Intake Tower	531.47	530.43	-1.04
Mean Adjustment			**-1.013**
Standard Deviation			**0.0275**
Lower Limit Adjustment Estimate (95% Confidence - Student's T)			**-1.045**
Upper Limit Adjustment Estimate (95% Confidence - Student's T)			**-0.980**

A total of six benchmarks were recovered and surveyed. However, two of the benchmarks were iron pipes located on the abutments of the dam that were discarded from the datum adjustment analysis since they were subject to more potential disturbance and settlement than the benchmarks located on hard surfaces such as concrete or steel. The benchmark located inside of the water intake tower was not accessible at the time of survey and therefore was not surveyed. Of the remaining four benchmarks that were surveyed, the mean difference between the as-built elevation and the surveyed elevation was -1.013 feet with a standard deviation of 0.0275 feet (5/16 inches). When applied to a Student's T distribution with three degrees of freedom, the 95% confidence interval on which the appropriate datum adjustment can be made is between -1.045 feet and -0.980 feet which represents a variation from the mean of approximately plus or minus 3/8 inches (3% of the mean). Given this small variance, a datum adjustment -1.01 feet was applied to as-built elevations for the principal spillway.

The parameters used to create the rating curve in the SITES model were determined predominately using geometric data from the as-built plans. The tailwater elevation for the conduit was determined by creating a hydraulic model of the conduit using the Federal Highway Administration (FHWA) HY-8, version 7.5 program. The hydraulic model included a typical cross section of Piney Run taken immediately downstream of the impact basin using one-meter resolution DEM data obtained from the Maryland GIO and used to determine the tailwater elevation for a range of discharges and headwater elevations ranging from the principal spillway weir crest to the highest ordinate in the rating curve (elevation 544.0 (NAVD88)). The maximum tailwater elevation was used as an input to the SITES model. A summary of the principal spillway parameters is provided in Table 10.

Table 10. Principal Spillway Rating SITES Parameters

Description	Value	Units	Source
Crest Elevation	523.0	feet (NAVD88)	As-Built Plans/Datum Adjustment
Weir Length	18	feet	As-Built Plans
Entrance Loss Coefficient	0.7	---	SITES Documentation
Number of Conduits	1	---	As-Built Plans
Length of Conduit	303.0	feet	As-Built Plans
Diameter of Conduit	36	inches	As-Built Plans
Manning's 'n' Value	0.013	---	SITES Documentation
Elevation, HGL at Outlet	471.3	feet (NAVD88)	HY-8 Model Output

3.3 Auxiliary Spillway Stage-Discharge Rating

The auxiliary spillway stage-discharge rating was developed internally in the SITES model using geometric input data derived from the 2019 topographic survey. A summary of the geometric parameters for the auxiliary spillway is provided in Table 11 and a profile of the auxiliary spillway in Figure 11.

Table 11. Auxiliary Spillway Rating SITES Parameters

Description	Value	Units	Source
Crest Elevation	531.2	feet (NAVD88)	Topographic Survey
Crest Width	249	feet	Topographic Survey
Control Section Length	32	feet	Topographic Survey
Average Side Slopes	2.8H:1V	---	Topographic Survey
Inlet Channel Length	284	feet	Topographic Survey
Exit Channel Length	330.0	feet	Topographic Survey
Manning's 'n' Value	0.04	---	Visual Inspection

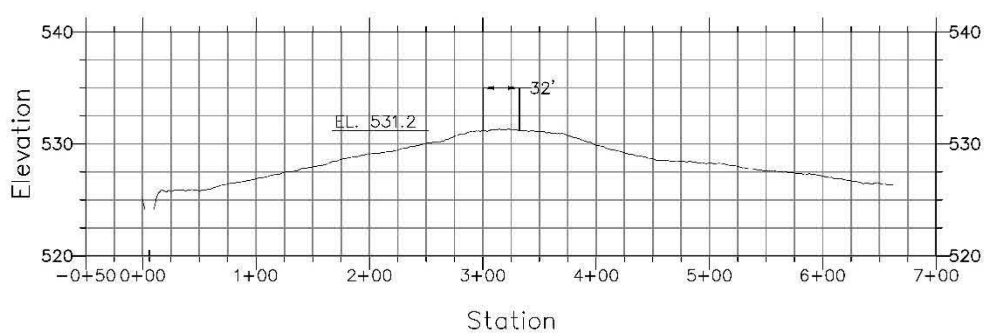


Figure 11. Profile of auxiliary spillway.

As part of the auxiliary spillway analysis and due to the varying length of the turfgrass cover in the spillway during the course of the year, a sensitivity analysis of the spillway discharge rating was completed. The Manning's 'n' value, which is reflective of the length of the turfgrass (and thus the roughness of the spillway lining), was evaluated from 0.02 to 0.05 in increments of 0.005 with 0.04 representing the base value. The results of the sensitivity analysis depicted in Figure 12 showed that for depths of flow greater than approximately three feet, the discharge rating is not significantly sensitive to variations in the roughness of the spillway lining. Therefore, it was determined that a 'n' value of 0.04 was appropriate for the spillway.

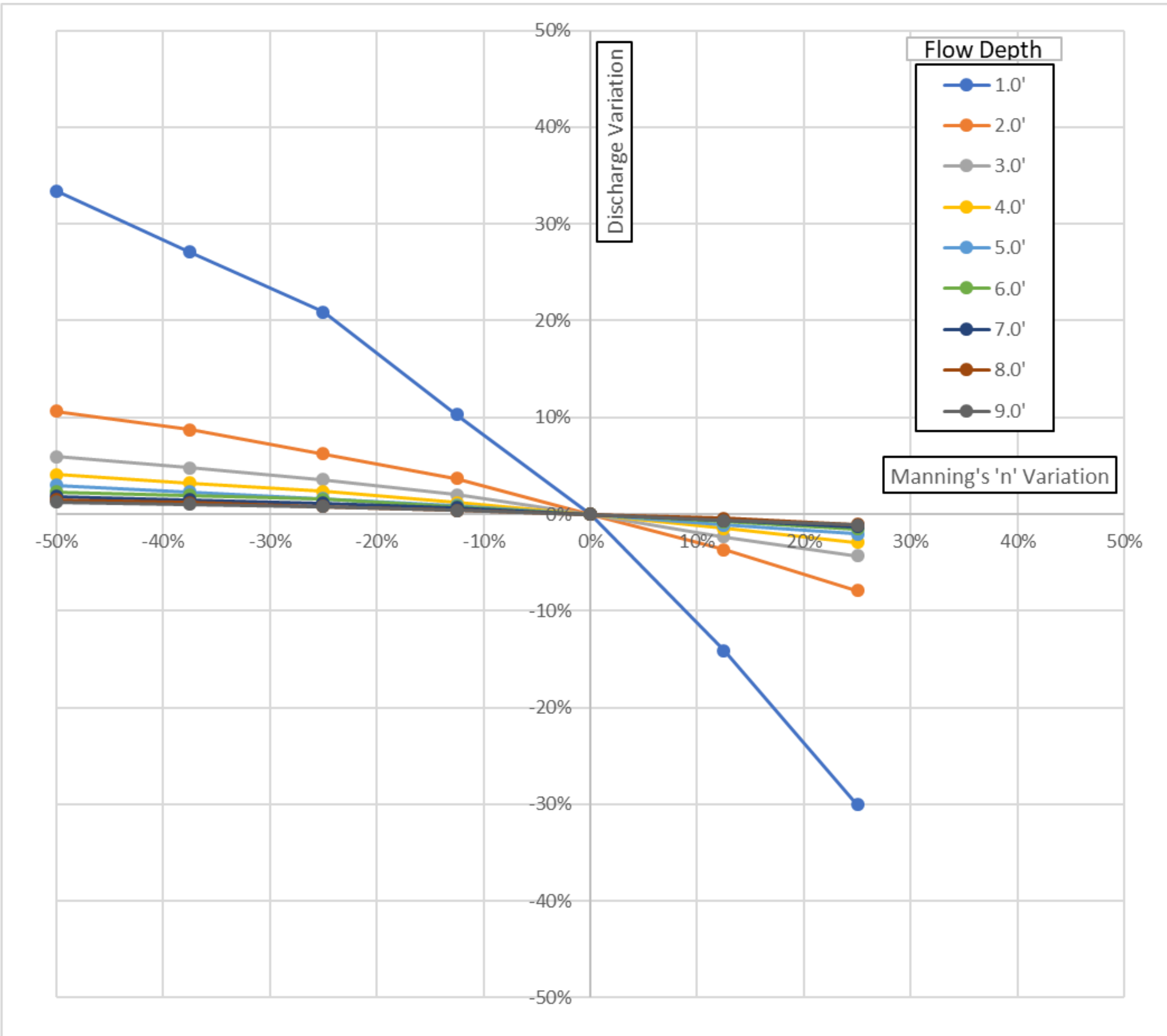


Figure 12. Discharge capacity sensitivity to spillway lining roughness.

3.4 Dam Stage-Discharge Rating

The principal and auxiliary spillway stage-discharge rating curves were developed internally in the SITES program and used in the model to route the inflow hydrographs through the dam. The rating curves are shown in Figure 13. Tabular ratings are found in Appendix C.

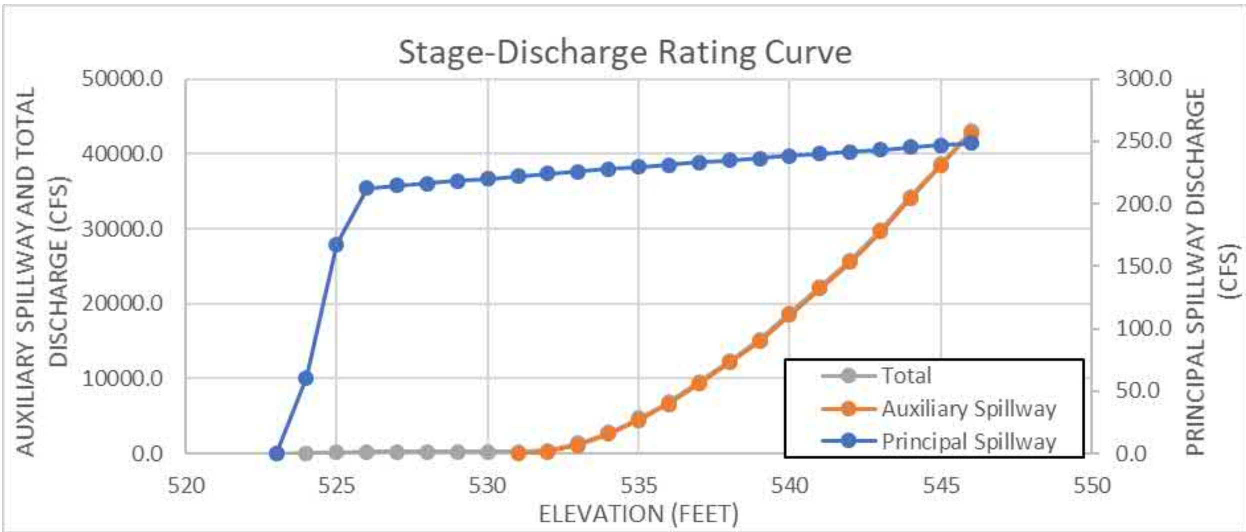


Figure 13. Stage-discharge rating curves for Piney Run Dam.

4. Reservoir Hydraulic Modeling Results

SITES model runs were completed to evaluate the hydraulic performance of Piney Run Dam during the flood events described in this report. The SITES model runs were evaluated for both the existing condition CN and time of concentration values as well as ultimate conditions values. Tables 12 and 13 summarize the reservoir routing results for existing and ultimate conditions respectively. SITES Model reports are provided in Appendix D.

Table 12. SITES Model Results – Existing Conditions

Flood Event[1]	Duration (hours)	Precipitation Depth (inches)	Peak Inflow Discharge (cfs)	Max Reservoir Elevation (feet - NAVD88)[2]	Peak Outflow Discharge (cfs)	Freeboard (feet)[3]
10% A.E.	24	4.8	3,309	526.3	213	14.2
2% A.E.	24	7.1	6,434	529.2	219	11.3
1% A.E.	24	8.3	8,189	530.8	222	9.7
0.2% A.E.	24	11.8	13,435	533.2	1,829	7.3
1% PSH[4,5]	10-days	12.2	11,056	531.2	223	9.3
SDH	6	10.8	14,882	533.9	2,677	6.6
SDH	24	15.0	19,076	535.8	6,690	4.7
FBH	6	26.3	44,971	541.4	24,240	-0.9
FBH	24	33.9	48,208	543.1	31,075	-2.6
FBH	72	39.1	48,730	543.5	33,084	-3.0

Table 13. SITES Model Results – Ultimate Conditions

Flood Event[1]	Duration (hours)	Precipitation Depth (inches)	Peak Inflow Discharge (cfs)	Max Reservoir Elevation (feet, (NAVD88)) [2]	Peak Outflow Discharge (cfs)	Freeboard (feet)[3]
10% A.E.	24	4.8	4,141	526.7	214	13.8
2% A.E.	24	7.1	7,712	529.8	220	10.7
1% A.E.	24	8.3	9,705	531.4	223	9.1
0.2% A.E.	24	11.8	15,560	533.5	2,189	7.0
1% PSH[4,5]	10-days	12.2	12,830	531.8	224	8.7
SDH	6	10.8	17,236	534.3	3,422	6.2
SDH	24	15.0	21,546	536.2	7,577	4.3
FBH	6	26.3	50,306	541.9	26,041	-1.4
FBH	24	33.9	53,145	543.6	33,249	-3.1
FBH	72	39.1	53,558	544.0	35,217	-3.5

1) *A.E. denotes Annual Exceedance Probability.*
2) *Does not include dam overtopping flows in reservoir routing calculations.*
3) *Freeboard measurements are taken from the dam crest low point elevation of 540.5 feet (NAVD88).*
4) *PSH precipitation depths used in analysis are: 1-Day = 8.3 inches, 10-day = 12.18 inches.*
5) *Auxiliary spillway crest elevation is 531.2 Feet (NAVD88)*

The SDH event was evaluated for both six- and 24-hour durations per TR-60 to determine the critical SDH flood event. The 24-hour duration resulted in a higher maximum water surface elevation and higher auxiliary spillway channel shear stresses, and therefore, it is the critical storm duration for the SDH event. The FBH event was evaluated for six-, 24-, and 72-hour durations per guidance from TR-60 and MDE to determine the critical FBH flood event. The 72-hour duration resulted in a higher maximum water surface elevation, and therefore, it is the critical storm duration for the FBH event.

5. Comparative Analysis of Models

Previous hydrologic and hydraulic models and/or modeling results were obtained from MDE and Carroll County, Maryland and evaluated for comparative purposes. This information included the following:

- 1972 Design Report by Rummel, Klepper, and Kahl (RK&K)
- 1988 HEC-1 Model by MDE (Harrington)
- 2012 HEC-1 Model by MDE (Harrington)
- 2016 Revised Dam Breach Analysis Report by Charles P. Johnson & Associates (CPJ)

Using the PMF as the event of comparison, Table 14 summarizes major aspects of each model as well as the modeling presented in this report.

Table 14. Comparative Analysis of Current and Previous Models

Author	RK&K	MDE (Harrington)	MDE (Harrington)	CPJ (Revised)	AECOM
Year	1972	1988	2012	2016	2020
Model	Unknown	HEC-1	HEC-1	HEC-1	SITES
PMP Precipitation Depth	26.5	26.8	34.0	39.4	39.1
Duration	6	6	24	72	72
Distribution	Unknown	NRCS	NOAA C	HMR-52	HMR-52
Watershed Area (Square Miles)	10.43	10.43	10.43	10.70	10.56
CN	Unknown	75	75	70	72
Tc (hours)	Unknown	3.5	4.1	2.8	2.9
Calibrated?	Unknown	Unknown	Yes	Yes	Yes
Peak Inflow Discharge (cfs)	Unknown	38,239	38,391	52,731	48,730
Peak Outflow Discharge (cfs)	Unknown	30,812	32,708	50,528	33,084
Max Reservoir Elevation (feet (NAVD88))	"Overtop"	542.6	542.9	543.6	543.5
Dam Crest Elevation (feet)	541.5[1]	541.5[1]	541.5[1]	540.0[2]	540.5[2]
Freeboard (feet)	Unknown	-1.1	-1.4	-3.6	3.0
Dam Overtopping Flows included in Outlet Routing?	Unknown	Yes	Yes	Yes	No

1. Project datum as reported on the as-built plans

2. North American Vertical Datum of 1988

The RK&K design report, while informative regarding the intent of hydrologic design, does not include any modeling, inflow or outflow estimates or hydrologic parameters beyond the estimated watershed area. However, it does indicate that the designers did not intend for the dam to safely pass the PMF (which was then referred to the as the Maximum Probable Storm or MPS) which they assumed to consist of a six-hour precipitation depth of 26.5 inches. However, it does appear that a six-hour event of approximately one-half of the MPS (13.7 inches) was expected to pass through the dam at a peak water surface elevation of 540 (539.0 feet, NAVD88).

In addition, the 1988 and 2012 models developed by MDE relied on the dimensionless design storm hydrograph from NRCS for temporally distributing the PMP. The 2016 CPJ analysis relied on using HMR-52 to develop both the PMP depth estimate and the temporal distribution. The CPJ analysis only modeled the 72-hour PMP event which is the longest event that the HMR-52 model develops. NRCS guidance requires that hydrologic models use HMR guidance for temporal distributions when available. Only when such guidance is not available can the dimensionless design storm hydrograph be used in PMP modeling. In the case of the United States east of the 105th meridian which includes the Piney Run watershed, methods for temporally distributing the PMP are provided in HMR-52.

In addition, both the 1988 and 2012 models only model a six-hour duration PMP event. While the COMAR Section 26.17.04.05 which governs dams in Maryland does not specifically define the PMF, both NRCS and other industry practice require evaluation of PMP events of various durations and orientations to determine the critical event for the dam that produces the largest flood. NRCS guidance specifically requires that evaluation and determination of the FBH event include both six- and 24-hour duration events for the PMP. However, MDE guidance generally is consistent with industry practice which is to analyze events up to and including the 72-hour duration event. This analysis shows that the 72-hour duration event yields a higher peak inflow discharge to the reservoir and thus a more conservative hydraulic loading. Therefore, while the 24-hour duration PMP event is considered the PMF or the FBH in the context of NRCS guidance, the 72-hour event would be considered the PMF or SDF in the context of MDE guidance.

6. Auxiliary Spillway Integrity Analysis

An auxiliary spillway integrity analysis was performed using the SITES model. Subsurface information obtained from the original geologic investigation report (RK&K, 1971) and from a geologic and geotechnical investigation made during this study were used to develop representative geologic profiles through the auxiliary spillway with conservative (i.e. most erodible) input parameters. Headcut erodibility index (Kh) and other soil and rock parameters were estimated based on available subsurface data. Based on survey data of the existing topography of the ground surface, the auxiliary spillway is approximately 249-feet wide with 2.8H:1V side slopes. Three different profiles through the auxiliary spillway were evaluated. These were along the inside edge of the spillway (closest to the dam, left side), through the centerline of the spillway and along the outside edge of the spillway (furthest from the dam, right side).

Twelve borings were drilled in the auxiliary spillway to determine subsurface profiles and to collect samples for estimation of soil and rock erodibility parameters for auxiliary spillway integrity analysis (see Figure 14). Laboratory testing of soil samples collected during the subsurface exploration program made as part of this study was performed for use in the spillway integrity analysis. All testing was performed in accordance with applicable ASTM test standards. Laboratory test results are included in Appendix E. Calculations were performed to estimate soil and rock erodibility parameters for use in an auxiliary spillway integrity analysis using the SITES program. The headcut erodibility index for each stratum was estimated using procedures in the NEH, Part 628, Chapter 52, Field Procedures Guide for the Headcut Erodibility Index (NRCS, 2001).

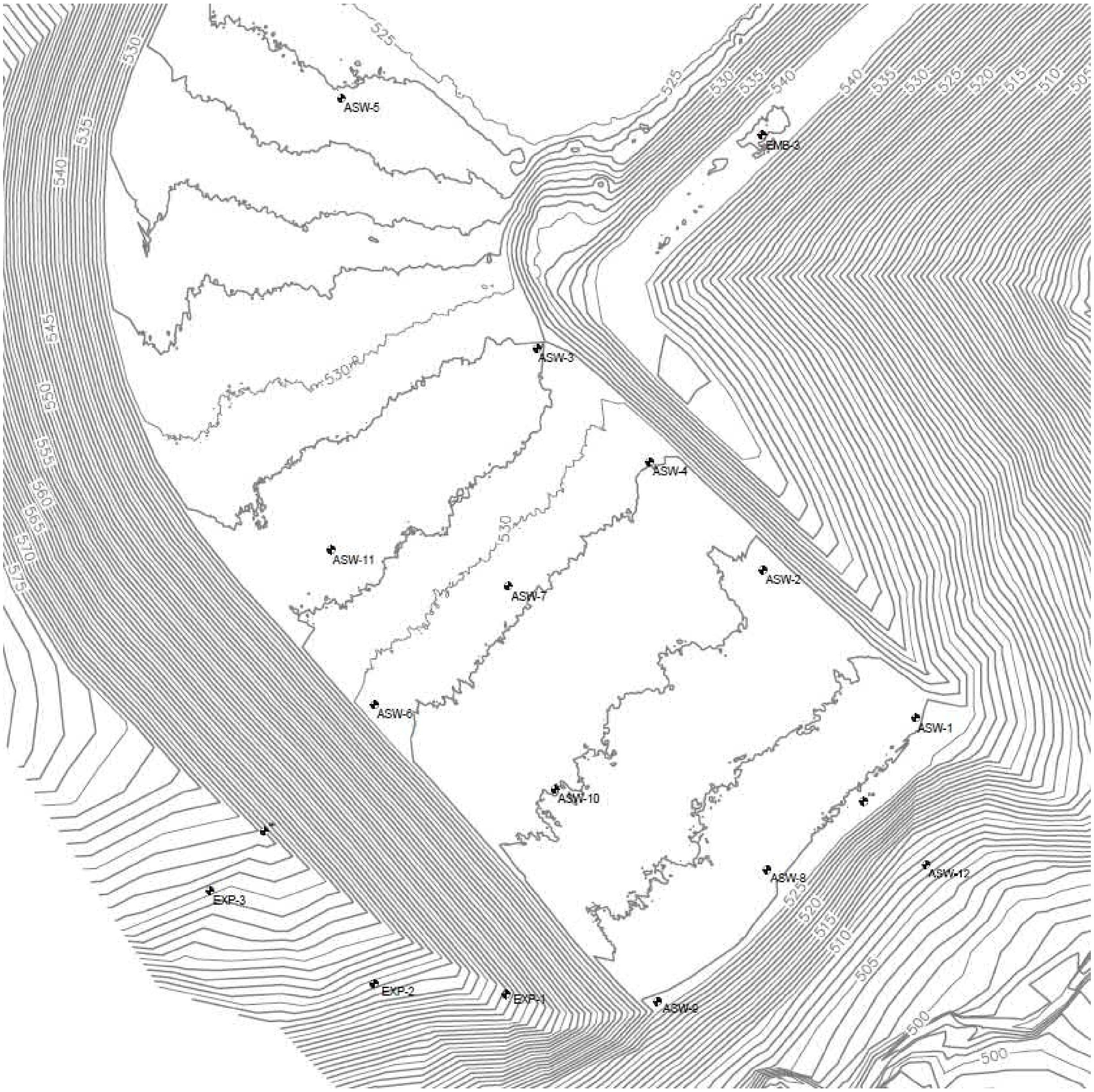
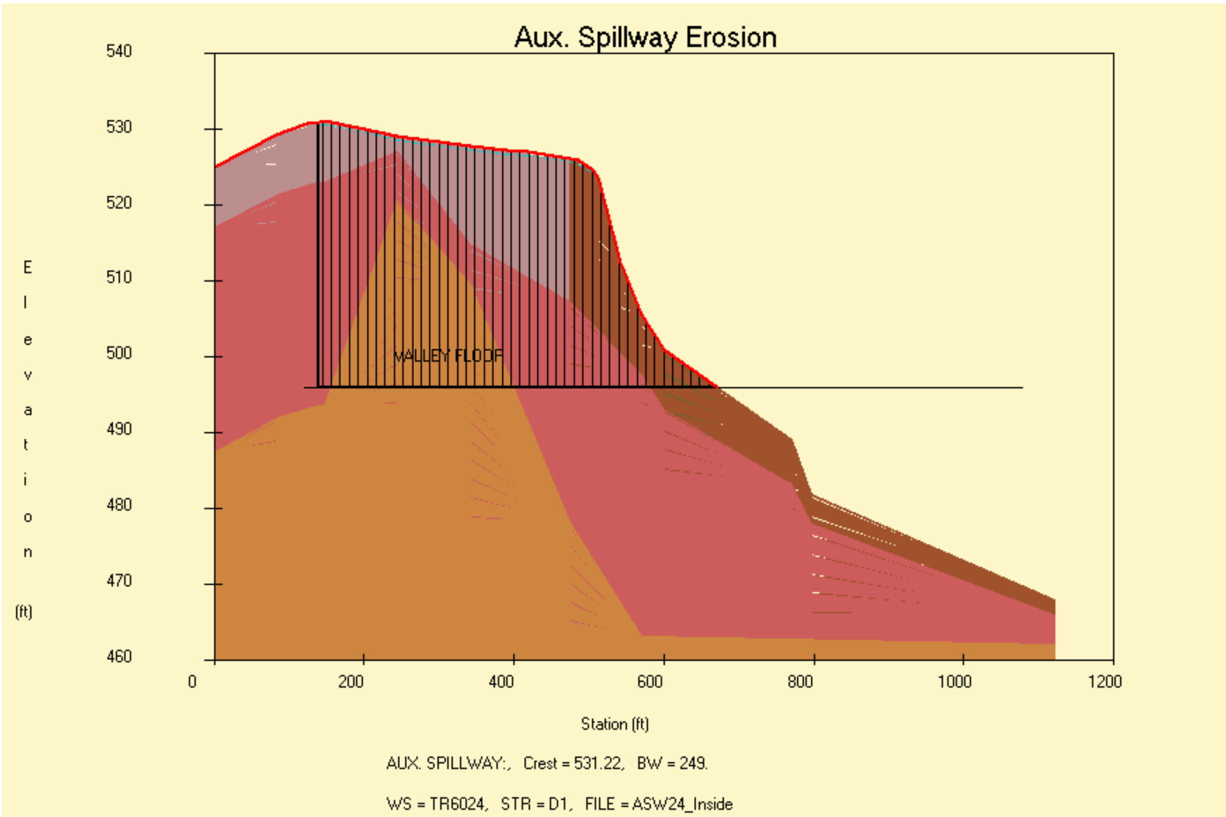


Figure 14. Auxiliary spillway borehole location plan.

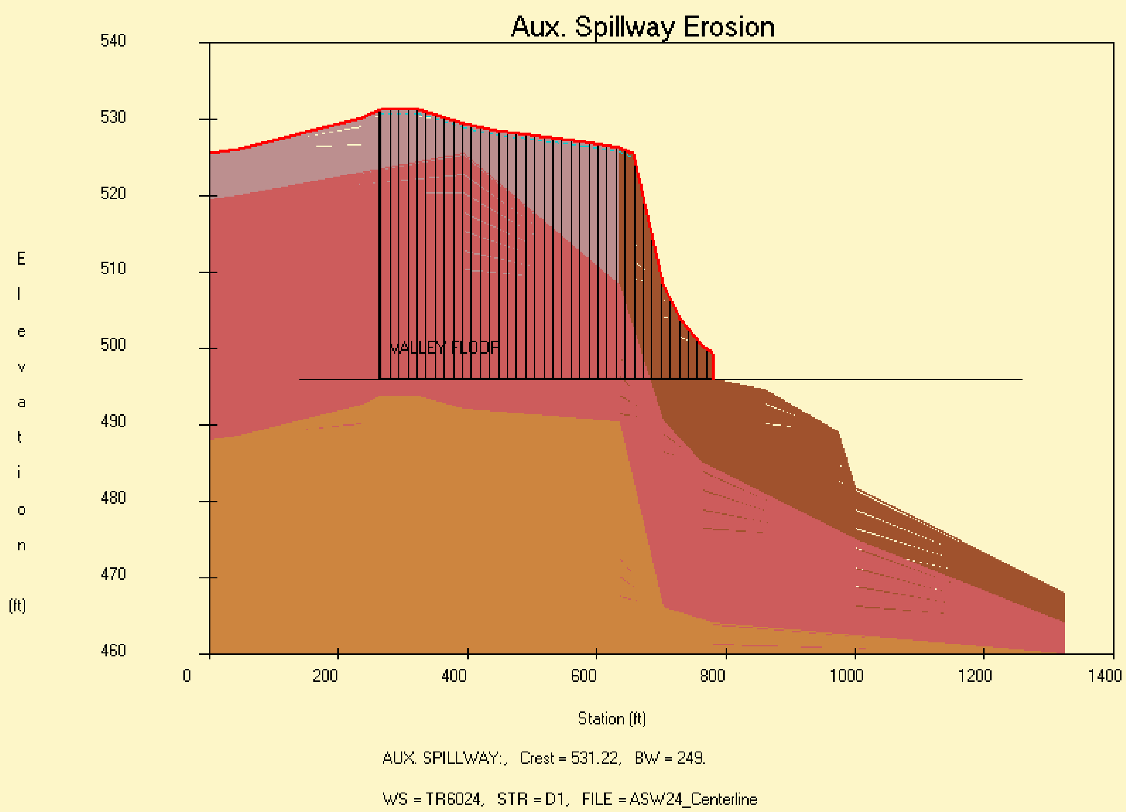
The auxiliary spillway surface condition parameters were estimated based on the conditions observed during a visual inspection made in November 2019. The Vegetal Retardance Curve Index is approximated by the Manning's roughness value of the cover through the auxiliary spillway. A Manning's roughness value of 0.04 was used for the constructed portion of the auxiliary spillway while a value of 0.10 was used for the wooded area downstream of the constructed portion of the spillway. The vegetal cover factor ranges from zero for non-vegetated surfaces to 0.87 for typical turf grass sod covers. The area downstream of the constructed portion of the auxiliary spillway was assumed to have a vegetal cover factor of 0.5 which corresponds to typical bunch grasses. The maintenance code describes the overall uniformity of the cover in the channel. A maintenance code of 1 was used for the constructed portion of the spillway profile which represents uniform cover. A maintenance code of 2 was used for the wooded area downstream of the constructed portion of the spillway which represents minor discontinuities present in the cover. The potential rooting depth is the depth to which roots could reasonably penetrate under good growing conditions. A potential rooting depth of 1.0 foot was used for the constructed portion of the spillway and a depth of 5.0 feet was used for the wooded area downstream of the constructed portion of the spillway. The valley floor is defined as the elevation below which the spillway will not erode because of downstream control. The valley floor was defined as elevation 496.0 feet for all of the profiles modeled in SITES which is the elevation where the inside edge profile meets the stream channel approximately 150 feet downstream of the constructed portion of the auxiliary spillway.

Schematic profiles of the inside edge, centerline and outside edge of the auxiliary spillway from the SITES model output are presented in Figure 15, Figure 16, and Figure 17, respectively. Soil and rock material properties are also presented in each figure.



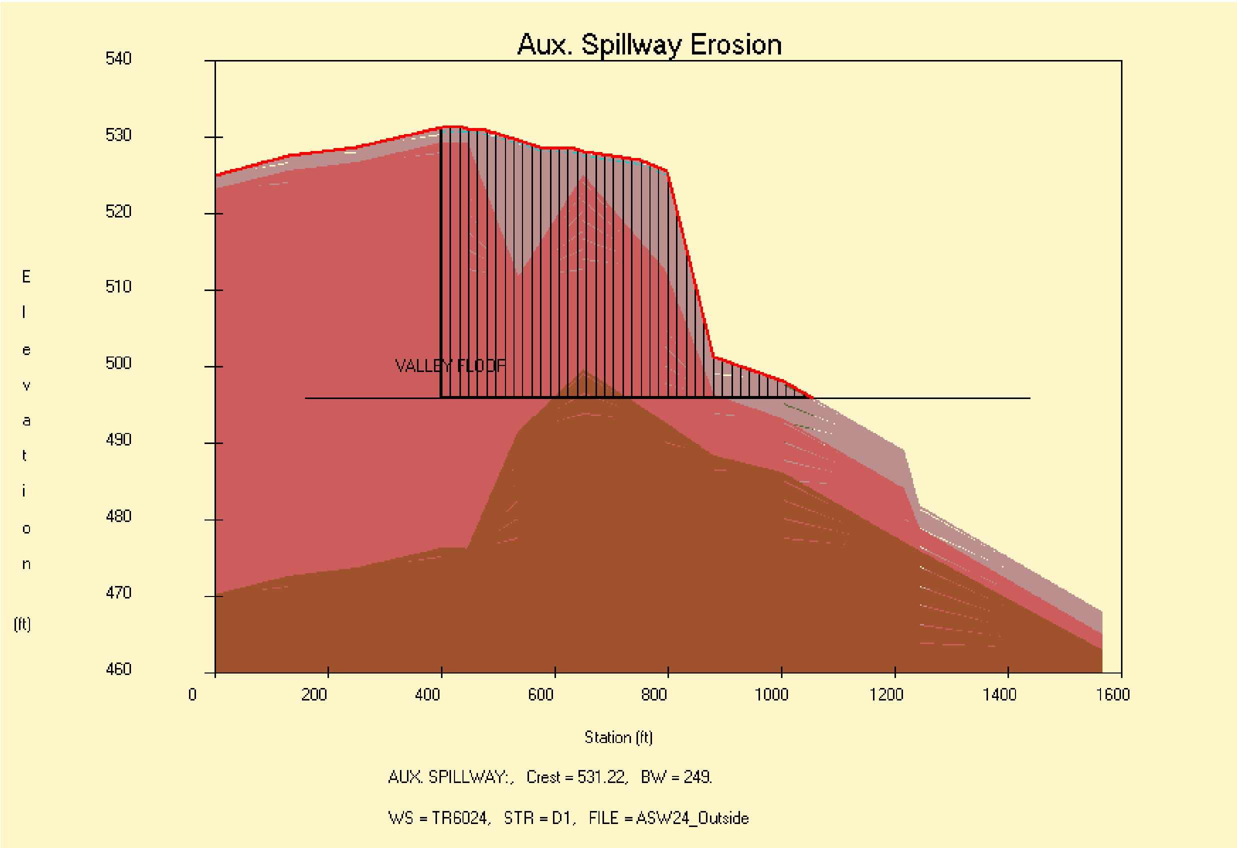
Material Description	Detach. Rate (ft/h)/(lb/sq ft)	Dry Density (lbs/cu ft)	Headcut Index (Kh)	Percent Clay	Plasticity Index	Rep. Diameter (in)
ML	--	100.	0.06	3.0	0.	0.01000
SM	--	105.	0.16	1.0	0.	0.14000
GM	--	110.	0.12	11.0	12.	0.26000
MICASCHIST	--	178.	10.00	0.0	0.	12.00000

Figure 15. Plot of auxiliary spillway inside edge profile and extent of erosion from integrity analysis for existing conditions 24-hour PMF obtained from SITES model output.



Material Description	Detach. Rate (ft/h)/(lb/sq ft)	Dry Density (lbs/cu ft)	Headcut Index (Kh)	Percent Clay	Plasticity Index	Rep. Diameter (in)
SM-1	--	107.	0.06	1.0	0.	0.09000
SM-2	--	110.	0.16	2.0	0.	0.10000
GM	--	110.	0.12	11.0	12.	0.26000
MICASCHIST	--	178.	50.00	0.0	0.	36.00000

Figure 16. Plot of auxiliary spillway centerline profile and extent of erosion from integrity analysis for existing conditions 24-hour PMF obtained from SITES model output.

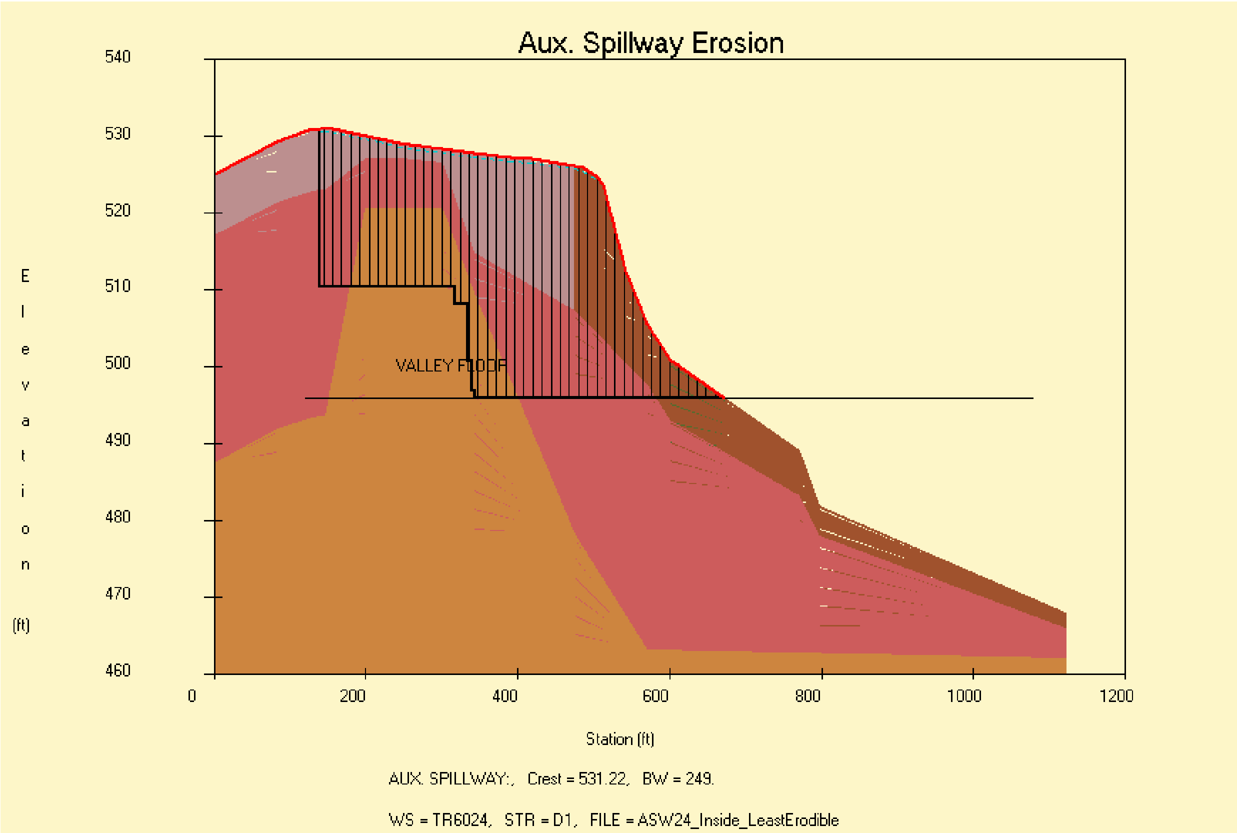


Material Description	Detach. Rate (ft/h)/(lb/sq ft)	Dry Density (lbs/cu ft)	Headcut Index (Kh)	Percent Clay	Plasticity Index	Rep. Diameter (in)
SM-1	--	93.	0.06	1.0	0.	0.10000
SM-2	--	110.	0.16	2.0	0.	0.09000
MICASCHIST	--	170.	20.00	0.0	0.	24.00000

Figure 17. Plot of auxiliary spillway outside edge profile and extent of erosion from integrity analysis for existing conditions 24-hour PMF obtained from SITES model output.

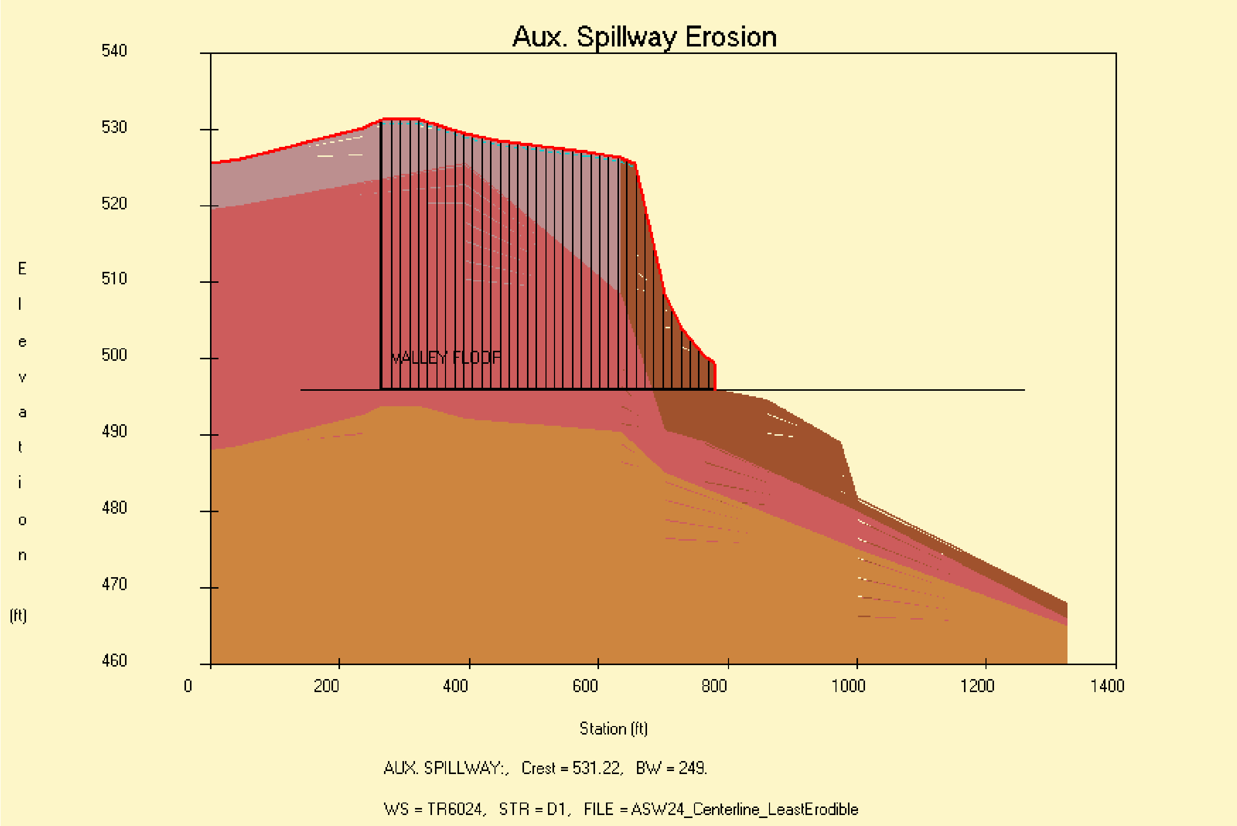
The SITES model-based auxiliary spillway integrity analysis for the inside edge profile, centerline profile, and outside edge profile all show erosion of the soil overburden of the auxiliary spillway and a breach of the spillway crest during passage of the 6- and 24-hour PMF events. The SITES model shows that the 24-hour PMF scenario is the worst-case scenario for the integrity of the spillway. During the 24-hour PMF event, the model estimates a maximum final headcut depth of approximately 35 feet for the inside edge, centerline, and outside edge profiles.

A sensitivity analysis was performed where the soil and rock parameters were evaluated for a range of values to determine if altering the subsurface profile and material properties would change the results of the model. The sensitivity analysis showed that the spillway would still breach during a 24-hour PMF event even if the material properties were changed to the least possible erodible material properties based on the possible range of material properties as determined by the soil borings and lab testing results. The sensitivity analysis was performed on the inside edge profile, centerline profile, and outside edge profile with the results and the material properties used shown in Figure 18, Figure 19, and Figure 20, respectively. All three profiles showed that a breach would likely occur. The results of the sensitivity analysis support the original material properties used because even when the least erodible material properties within the range of possible material properties are used, the model still shows a breach of the spillway.



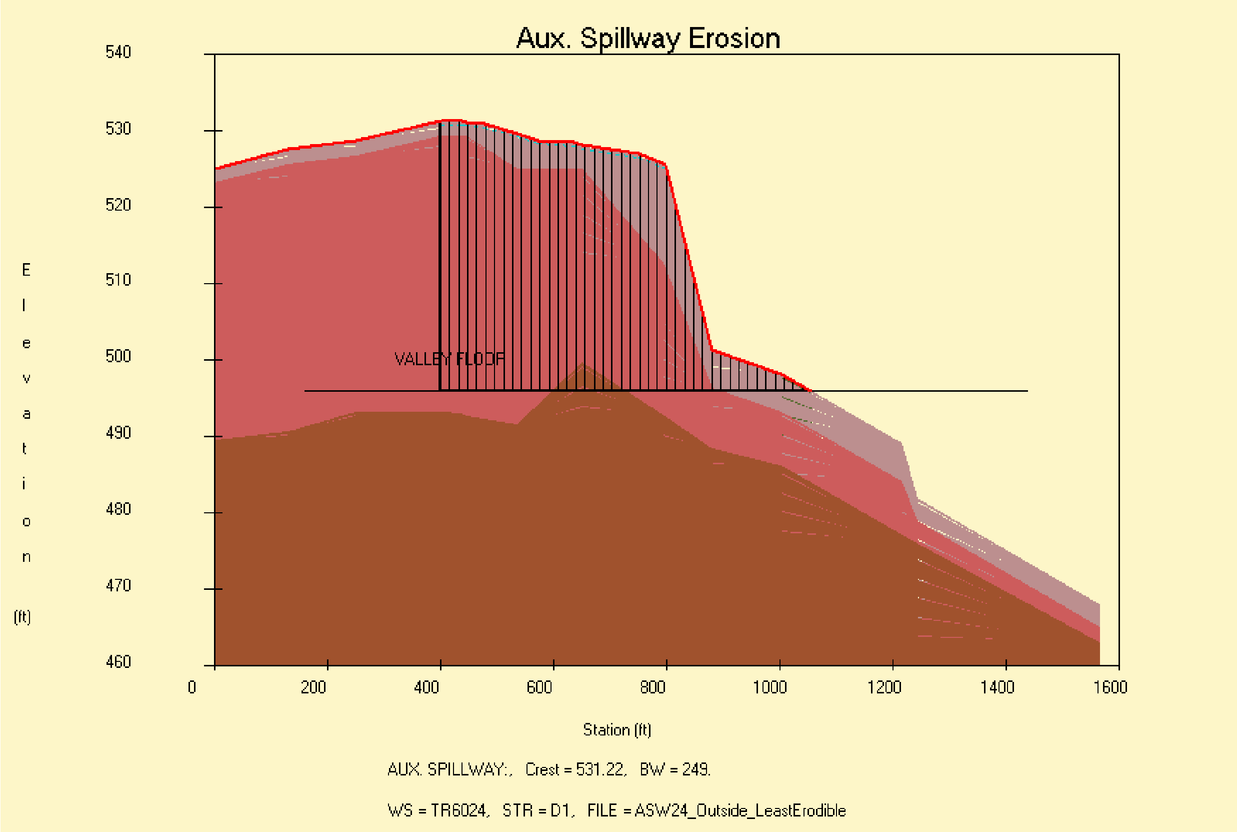
Material Description	Detach. Rate (ft/h)/(lb/sq ft)	Dry Density (lbs/cu ft)	Headcut Index (Kh)	Percent Clay	Plasticity Index	Rep. Diameter (in)
ML	--	110.	0.20	5.0	5.	0.10000
SM	--	115.	0.50	5.0	5.	0.60000
GM	--	110.	0.20	20.0	20.	0.35000
MICASCHIST	--	185.	2000.00	0.0	0.	48.00000

Figure 18. Extent of erosion from the integrity sensitivity analysis along the spillway inside edge profile for the existing conditions 24-hour PMF obtained from SITES model output.



Material Description	Detach. Rate (ft/h)/(lb/sq ft)	Dry Density (lbs/cu ft)	Headcut Index (Kh)	Percent Clay	Plasticity Index	Rep. Diameter (in)
SM-1	--	115.	0.20	5.0	5.	0.20000
SM-2	--	115.	0.50	5.0	5.	0.20000
GM	--	120.	0.30	20.0	20.	0.35000
MICASCHIST	--	185.	2000.00	0.0	0.	60.00000

Figure 19. Extent of erosion from the integrity sensitivity analysis along the spillway centerline profile for the existing conditions 24-hour PMF obtained from SITES model output.



Material Description	Detach. Rate (ft/h)/(lb/sq ft)	Dry Density (lbs/cu ft)	Headcut Index (Kh)	Percent Clay	Plasticity Index	Rep. Diameter (in)
SM-1	--	115.	0.20	5.0	5.	0.30000
SM-2	--	115.	0.50	5.0	5.	0.30000
MICASCHIST	--	185.	2000.00	0.0	0.	60.00000

Figure 20. Extent of erosion from the integrity sensitivity analysis along the spillway outside edge profile for the existing conditions 24-hour PMF obtained from SITES model output.

Based on the results of the SITES model and the sensitivity analysis, it is likely that a breach of the auxiliary spillway would occur during passage of the 24-hour PMF. A breach of the spillway could endanger the main dam embankment or result in an uncontrolled released of the reservoir. The SITES input and output summaries for the inside edge profile, centerline profile, and outside edge profile model runs and sensitivity analysis during a 24-hour PMF event are presented in Appendix E.

7. Downstream Hydraulic Model

The discharge hydrographs developed through the hydrologic analysis and reservoir routing were used as inputs for downstream hydraulic modeling to determine the extent of flooding for a variety of events. The downstream hydraulic model is a two-dimensional unsteady flow model developed using the U.S. Army Corps of Engineers'(USACE) HEC-RAS Version 5.0.7 computer program to determine the inundation limits downstream of the dam. The model covers the entire downstream inundation area and was used to determine the flow path of water, particularly in flat areas where the water will tend to spread out in multiple directions rather than travel linearly in the direction of the channel. Two-meter resolution, 2016 LiDAR data was utilized to develop the terrain used in calculating the two-dimensional mesh of cells. Within the two-dimensional flow area, Manning's roughness values were assigned to the terrain based on land cover data from the 2016 Chesapeake Bay High-Resolution Land Cover Dataset and the correlation of values presented in Table 15.

Table 15. Two-Dimensional Area Manning's n Values (derived from Chesapeake Bay High-Resolution Land Cover Dataset, 2016)

Chesapeake Conservancy High Resolution Land Cover Description	Manning's n value
1. Open Water	0.03
2. Wetlands	0.08
3. Tree Canopy	0.12
4. Shrubland	0.06
5. Low Vegetation	0.06
6. Barren	0.045
7. Structures	1.0
8. Impervious Surfaces	0.015
9. Impervious Road	0.015
10. Tree Canopy over Structures	1.0
11. Tree Canopy over Impervious Surfaces	0.015
12. Tree Canopy over Impervious Roads	0.015

For all hydrologic loading scenarios where the dam was assumed to exist, the reservoir was modeled as a storage area and the dam as well as the principal and auxiliary spillway were modeled as storage area/2D area connections. Inflows routed through the reservoir were included as lateral inflow hydrographs that were input directly from the output of the SITES model.

For the flood frequency event modeling, the two-dimensional flow area was given a calculation grid size of 50 feet by 50 feet. The resulting mesh contained a grid of 36,745 cells covering an area of approximately 2,164 acres. The grid extended approximately 6.7 miles downstream of the dam to just beyond the confluence of Piney Run with the South Branch of the Patapsco River. The downstream boundary condition was defined as normal depth with a slope of 1.0 percent.

For the flood modeling of the static and seismic breach events, the two-dimensional flow area was given a calculation grid size of 50 feet by 50 feet. The resulting mesh contained a grid of 129,859 cells covering an area of approximately 7,565 acres. The grid extended approximately 18.1 miles downstream of the dam to beyond where the breach flood limits converge to within the limits of the 100-year floodplain of the Patapsco River approximately one mile downstream of the Baltimore-National Pike (US 40). In addition, the breach model also extended approximately 3.2 miles upstream on the North Branch of the Patapsco River to Liberty Dam and approximately 5.7 miles upstream on the South Branch of the Patapsco River. The downstream boundary condition was defined as normal depth with a slope of one percent.

For the flood modeling of the hydrologic breach event, the model was divided into two separate two-dimensional flow areas to reduce the computation time. The upstream two-dimensional flow area included the dam and downstream area to a location immediately downstream of the confluence of the North and South Branches of the Patapsco River. The upstream two-dimensional flow area was given a calculation grid size of 100 feet by 100 feet. The resulting mesh contained a grid of 18,868 cells covering an area of approximately 4,374 acres. The grid extended approximately 6.9 miles downstream of the dam. In addition, the breach model also extended approximately 3.2 miles upstream on the North Branch of the Patapsco River to Liberty Dam and approximately 5.7 miles upstream on the South Branch of the Patapsco River. The downstream boundary condition was defined as normal depth with a slope of 0.135 percent.

The downstream two-dimensional flow area extended from the downstream terminus of the upstream two-dimensional flow area to the mouth of the Patapsco River at the Baltimore Harbor. The downstream two-dimensional flow area was given a calculation grid size of 100 feet by 100 feet. The resulting mesh contained a grid of 48,263 cells covering an area of approximately 11,079 acres. The grid extended approximately 24.6 miles downstream of the dam. The downstream boundary condition was defined as normal depth with a slope of 0.01 percent.

The HEC-RAS program calculates detailed elevation versus area, wetted perimeter, and roughness curves for each face of each cell enabling two-dimensional hydraulic calculations across the entire grid while preserving sub-grid terrain information. This allows for accurate depictions of inundated area regardless of grid size. The two-dimensional area was calculated using full momentum equations.

Bridge and culvert crossings were included in the development of the model. Six transportation crossings were included in the model predominately to determine relative flood effects from the flood frequency events modeled. Because a two-dimensional model was utilized, each of these crossings was modeled as a culvert as current HEC-RAS modeling capabilities do not allow for bridge modeling in a two-dimensional environment. Crossing locations can be seen on the inundation maps found in Appendices F and G. The modeled culvert geometry was determined using data obtained from the Federal Emergency Management Agency (FEMA) Flood Insurance Study model obtained from MDE and corroborated by bridge inventory data also obtained from MDE. Table 16 provides a summary of the transportation crossings that were included in the model.

Table 16. Transportation Crossings Included in Model

Crossing	Approximate Distance Downstream of Dam (Feet)
Sykesville Road (MD 32)	3,300
Buttercup Road	5,600
Slacks Road	10,300
Brangles Road	15,800
Arrington Road	24,800
Marriottsville Road	34,500

Other impacted road crossings included:

- Woodstock Road (MD 125)
- Old Frederick Road (MD 99)
- Main Street/Frederick Road (MD 144)
- Ilchester Road
- Washington Boulevard (US 1)

These roads were not modeled as their culverts and bridge openings provided insignificant capacity (overtopping by five or more feet) relative to the discharge and depth of flooding during a hydrologic breach event. Five other roads, I-70, Baltimore-National Pike (US 40), I-95, I-895, and I-195 were not modeled because their bridge deck elevations were sufficiently higher than the peak breach water surface elevation. The bridge abutments were captured in the terrain model, so the model accounted for effects of each bridge opening.

8. Flood Frequency Routing and Mapping

Downstream modeling of certain frequency events was performed using the model described in Section 7. For each of the flood frequency events, two scenarios were modeled: the existing condition and a scenario where the dam is removed (the dam decommissioned scenario). For these events, the model extended to a point where the flood control benefits of the dam became insignificant which generally occurred just upstream of the confluence of Piney Run with the South Branch of the Patapsco River.

8.1 Hydrologic Loadings

Hydrologic loadings were provided at eight locations in the model. An inflow hydrograph obtained from the SITES modeling was provided to the storage area (Piney Run Reservoir) to be routed through the reservoir and dam and then downstream through the model.

Additional hydrologic loadings were provided at seven other locations in the model. The purpose of including these hydrologic loadings is to simulate wet weather conditions throughout the watershed. These additional hydrologic loadings were provided immediately downstream of each of the six transportation crossings as well as along the South Branch of the Patapsco River immediately upstream of the confluence with Piney Run.

Each hydrologic loading was modeled as a constant discharge hydrograph developed using the following methodology:

1. The peak discharge to the first hydrologic loading location downstream of the dam was estimated using regression equations in *Application of Hydrologic Methods in Maryland, Fourth Edition* (July 2016). Inputs for the regression equations were based on the physiographic region in which Piney Run is located (Piedmont) and obtained from the United States Geologic Survey (USGS) *StreamStats* website. For the study area, the following inputs were obtained:
    a. Drainage area (square miles)
    b. Portion of the drainage area that is forested (%)
    c. Portion of the drainage area that has limestone formations (%)
    d. Portion of the drainage area that is impervious (%)
2. The peak discharge to the dam estimated during the hydrologic model calibration was subtracted from the peak discharge determined in Step 1 to determine the additional discharge added to the model from the additional drainage area.
3. This was repeated for the next downstream hydrologic loading location. For this step, instead of subtracting the peak discharge from the dam, the peak discharge estimate for the watershed to the upstream hydrologic loading location was subtracted.
4. In cases where a peak discharge estimate for a hydrologic loading location was lower than the estimate of the upstream hydrologic loading location, no additional discharge was assumed for that location.

The hydrologic loadings modeled are summarized in Table 17. The outputs from the "Tasker" program developed by the Maryland Hydrology Panel and used to generate the regression estimates for each tributary can be found in Appendix F.

Table 17. Downstream Hydrologic Loadings

ID	SA Name	Estimated Peak Discharge (cfs)	Annual Exceedance Probability			
			10%	2%	1%	0.2%
SA1	Piney Run Dam	Total	2,690	5,370	6,980	11,900
		Incremental	**2,690**	**5,370**	**6,980**	**11,900**
SA2	Sykesville Road (MD 32)	Total	2,770	5,540	7,200	12,200
		Incremental	**80**	**170**	**220**	**300**
SA3	Buttercup Road	Total	2,860	5,710	7,410	12,500
		Incremental	**90**	**170**	**210**	**300**
SA4	Slacks Road	Total	3,010	5,960	7,720	13,000
		Incremental	**150**	**250**	**310**	**500**
SA5	Brangles Road	Total	3,600	7,030	9,050	14,800
		Incremental	**590**	**1,070**	**1,330**	**1,800**
SA6	Arrington Road	Total	3,750	7,350	9,480	15,600
		Incremental	**150**	**320**	**430**	**800**
SA7	Marriottsville Road	Total	3,750	7,420	9,600	15,800
		Incremental	**0**	**70**	**120**	**200**
SA8	S. Branch Patapsco	Total	9,210	17,400	22,200	35,700
		Incremental	**5,460**	**9,980**	**12,600**	**19,900**

8.2 Model Runs

Frequency flood events for the 10%, 2%, 1%, and 0.2% annual exceedance (AE) probabilities for 24-hour duration were modeled considering both dam-in-place and no-dam-in-place scenarios to determine the effect of the dam on flood flows in Piney Run downstream of the dam. Each model was run from the time initiation of the inflow hydrograph into the Piney Run reservoir beyond the peak of the hydrograph at the downstream terminus of the model. For all runs this resulted in a model simulation time of 30 hours. The models were run on one second calculation time steps with output generation time steps of one minute. The one second time step was selected to achieve model stability and to minimize noise in the output hydrographs.

Initial conditions were specified as a water surface elevation of 523.1 feet for the Piney Run reservoir to simulate a normal pool condition and dry conditions in the two-dimensional modeling area.

8.3 Model Results

The model extends approximately six miles downstream of the dam to a location approximately 0.25 miles downstream of the confluence of Piney Run and the South Branch of the Patapsco River. The mapping also includes upstream tributaries to a sufficient distance for which the entire flood wave is modeled.

Impacts to existing structures and transportation facilities were determined from elevations obtained from LiDAR data sets used in the analysis. For existing structures, building footprints obtained from GIS datasets from Carroll, Howard, and Baltimore Counties for buildings located within the inundated areas were overlaid on the LiDAR data and an elevation profile around the structure extracted. The lowest floor elevation, either the first floor or in some cases, the basement elevation was determined using this data and visual observation of the structure either using web-based aerial and street-side imagery services (such as Google Maps/Street View) or by direct visual observation from a public right-of-way. The lowest floor elevation was used to support determination of whether or not a structure was impacted by a given flood scenario. For existing transportation facilities, impacts were determined by plotting profiles of the facility in the *RAS Mapper* module in HEC-RAS using the LiDAR data and flood depth mapping results to determine inundation depths along the subject facility.

For the dam-in-place flood frequency routing scenarios, up to 11 structures and seven transportation links (roads and railroads) are estimated to be inundated with impacts varying depending on the hydrologic event modeled. Up to two structures (park structures located in Piney Run Park) and one road (White Rock Road) may be inundated upstream of the dam due to reservoir rise. Up to two additional structures including the water pumping station located at 7235 Brangles Road and three additional roads (Slacks Road, Brangles Road, and Arrington Road) are estimated to be inundated along Piney Run upstream of the Marriottsville Road area. At Marriottsville Road, up to seven structures on five properties as well as portions of Henryton Road and Marriottsville Road as well as the CSX railroad tracks are estimated to be impacted. Impacts in the area of Marriottsville Road appear to be a result of the confluence of flood flows from Piney Run and the South Branch of the Patapsco River.

For the decommissioned dam flood frequency routing scenarios, up to 21 structures and seven transportation links are estimated to be inundated with impacts varying depending on the hydrologic event modeled. Up to 14 structures and four roads (Sykesville Road/MD 32, Slacks Road, Brangles Road, and Arrington Road) are estimated to be inundated along Piney Run upstream of the Marriottsville Road area. At Marriottsville Road, up to seven structures as well as portions of Henryton Road and Marriottsville Road as well as the CSX railroad tracks are estimated to be impacted. Similar to the dam-in-place scenario, impacts in the area of Marriottsville Road appear to be a result of the confluence of flood flows from Piney Run and the South Branch of the Patapsco River.

Table 18 provides a summary of impacts by flood frequency event. Flood inundation maps are provided in Appendix F. A complete list of impacts is provided in Appendix G.

Table 18. Flood Frequency Routing – Downstream Impacts

Hydrologic Event	Scenario and Impact Type			
	Dam-in-Place		Dam Decommissioned	
	Structures	Transportation	Structures	Transportation
10% AE	0	3	2	5
2% AE	5	3	12	6
1% AE	6	3	16	6
0.2% AE	11	7	21	7

9. Breach Analysis and Inundation Mapping

Downstream modeling of certain breach events was performed using the model described in Section 7. The three breach events modeled are required per TR-60 guidance and included:

- Hydrologic Breach Event – a breach event was simulated to occur at the peak water surface elevation in the reservoir during the PMF event. This is also the dam's spillway design flood event;
- Seismic Breach Event – a breach event was simulated to occur during normal pool conditions with no inflow hydrograph. This event is considered the dry weather or Sunny Day breach event by MDE;
- Static Breach Event – a breach event was simulated to occur during a condition where the pool was at the auxiliary spillway crest elevation with no inflow hydrograph.

Modeling and assumptions for these breach events is described in more detail in this section.

9.1 Downstream Hydrologic Loadings

For the seismic and static breach events, no hydrologic loadings were modeled as the breaches were assumed to occur during dry weather.

For the hydrologic breach event, the PMF inflow hydrograph obtained from the SITES modeling was provided to the storage area (Piney Run Reservoir) to be routed through the reservoir and dam and then downstream through the model. Hydrologic loadings for the PMF were provided at 16 other locations in the model downstream of the dam. Flood magnitudes for each downstream hydrologic loading were determined by overlaying the PMP event determined for the Piney Run Dam watershed as described in Section 2.5 on the downstream watersheds using HEC-MetVUE. Because the PMP storm is centered geographically on the centroid of the Piney Run Dam watershed and oriented to maximize moisture on that watershed, downstream watersheds would receive far less, albeit significant rainfall (see Figure 21).

The PMP depth (72-hour duration) was evaluated against precipitation frequency depth ranges using NOAA Atlas 14. For sub watersheds where the PMP depth fell within a defined 72-hour duration precipitation frequency, the equivalent flood frequency discharge was calculated and incorporated into the downstream hydraulic model using methods described in Section 8.1.

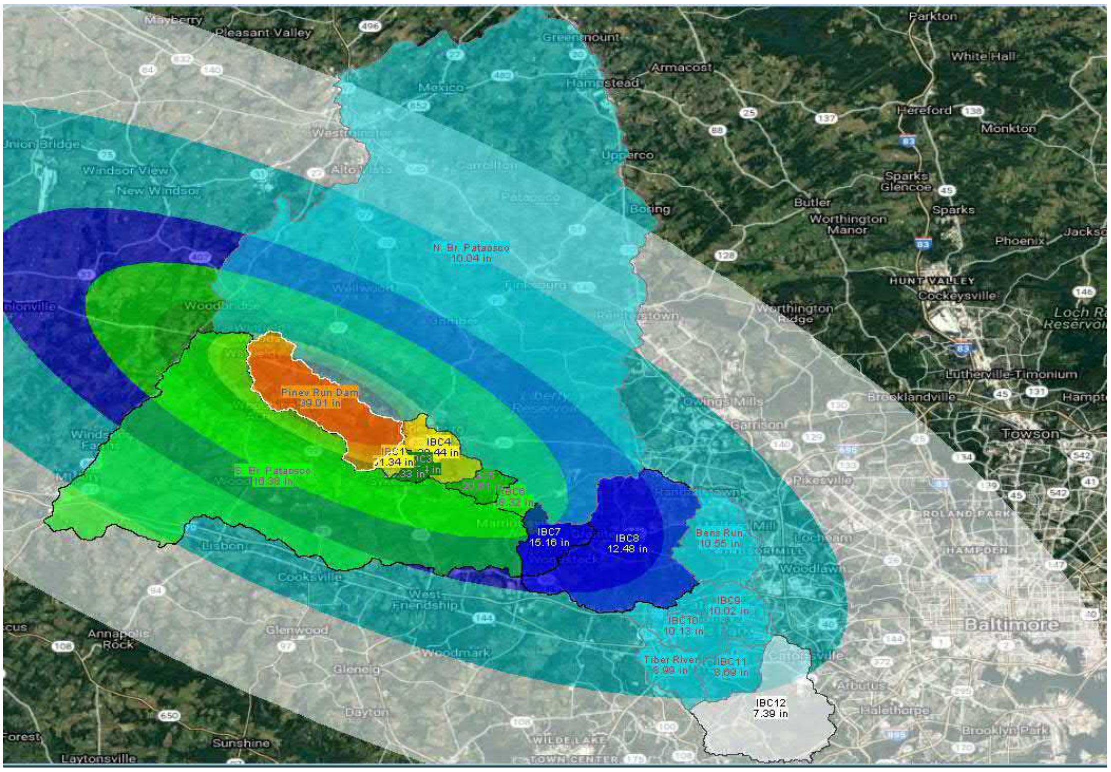


Figure 21. PMP storm overlaid on drainage areas to and downstream of Piney Run Dam.

Where PMP depths exceeded the 0.2% annual exceedance probability, the discharge hydrographs were developed using hydrologic modeling. In these instances, the hydrologic characteristics, watershed area, CN, and time of concentration were determined for each sub watershed.. CN values were determined using 2016 National Land Cover Dataset and SSURGO soils data. The time of concentration was determined via the NRCS lag equation (Equation 3) and converting to an equivalent time of concentration value (NRCS, 2010).

$$t_C = \frac{l^{0.8}(S+1)^{0.7}}{1{,}140Y^{0.5}} \quad (3)$$

where: l = flow length (feet)

Y = average watershed slope (%)

S = maximum potential retention (inches) = $\left(\frac{1000}{CN} - 10\right)$

Inputs for the lag equation were derived using ArcGIS. The exception to this was for the sub watershed covering the South Branch of the Patapsco River which exceeds the limits for use of the lag equation. For this sub watershed, the time of concentration was determined using the segmental velocity method. Discharge hydrographs for each of the hydrologically-modeled sub watersheds were developed using the 72-hour PMP hyetographs developed in HEC-MetVUE and the aforementioned hydrologic parameters in the SITES model. The hydrographs where then entered into the downstream hydraulic model manually. A summary of the downstream hydrologic parameters is provided in Table 19.

Table 19. Summary of Downstream Hydrologic Inputs

HEC RAS Hydrograph ID	Description	PMP Precip. Depth (inches)[1]	Approx. Precip. Freq. Equivalent[2]	Area (sq. miles)	CN	Tc (hours)	Peak Q (cfs)
IBC1	Sykesville Road	31.4	> 0.2%	0.8	67	0.33	3,090
IBC2	Buttercup Road	26.3	> 0.2%	0.3	69	0.27	762
IBC3	Slacks Road	28.0	> 0.2%	0.6	70	0.38	1,770
IBC4	Brangles Road	29.4	> 0.2%	3.5	70	1.32	10,878
IBC5	Arrington Road	20.6	> 0.2%	1.6	64	0.51	2,754
IBC6	Marriotsville Road	18.3	> 0.2%	0.9	64	0.48	1,282
S. Branch	S. Br. Patapsco	16.4	> 0.2%	66.8	67	6.64[4]	56,948
N. Branch	N. Br. Patapsco	10.0	1.0%	---	---	---	28,300[3]
IBC7	MD 125	15.2	> 0.2%	3.7	56	2.36	3,564
IBC8	Patapsco to Bens Run	12.5	0.5%	---	---	---	11,400[3]
Bens	Bens Run	10.6	1.0%	---	---	---	5,640[3]
IBC9	US 40	10.0	1.0%	---	---	---	3,980[3]
IBC10	MD 144	10.1	1.0%	---	---	---	3,780[3]
Tiber	Tiber River	9.0	1.0%	---	---	---	4,310[3]
IBC11	Ilchester Road	8.7	2.0%	---	---	---	1,700[3]
IBC12	I-95	7.4	4.0%	---	---	---	3,260[3]

(1) Determined using HEC-MetVUE
(2) As defined in NOAA Atlas 14
(3) Computed using Piedmont Regional Regression Equations (Maryland Hydrology Panel, 2016)
(4) Computed using the segmental velocity method (NRCS, 2010)

9.2 Breach Parameters

Breach parameters describe the size, location, and the time it takes the breach of the dam to develop. The dam breach parameters, including the breach formation time, breach bottom width, and side slopes were estimated using MDE's Dam Breach Worksheet for Earthen Dams 2018. The bottom elevation was defined as elevation 468.0 feet for each scenario. Although the floodplain elevation on either side of the outlet channel is higher than the defined elevation, the elevation was selected to a) yield a conservative estimate of breach height and b) because the floodplain is assumed to be eroded by the breach discharge during the breach event yielding a lower invert elevation across the floodplain. The water surface elevation at the time of the breach was based on the maximum water surface elevation calculated within HEC-RAS during the non-breach scenario for the hydrologic scenario, the normal pool elevation of 523.1 feet for the seismic breach, and the auxiliary spillway crest elevation of 531.2 feet for the static breach. For the hydrologic breach scenario, the dam overtops and therefore, an overtopping breach scenario was assumed. For the seismic and static breach scenarios, the water surface elevation was below the top of dam elevation and therefore, a piping failure mode was assumed with a piping coefficient of 0.5. The piping coefficient is an orifice coefficient; a value of 0.5 was selected to represent the energy losses occurring during a breach. A breach weir coefficient of 2.6 was used, which is the default value for earthen dams.

The Froehlich method (Froehlich, 2008) was used to estimate breach parameters for each scenario. Table 20 provides a summary of breach parameters for the scenarios modeled.

Table 20. Breach Parameters

Failure Event	Water Surface Elevation at time of Breach (Feet)	Bottom Width (Feet)(1)	Bottom Elevation (Feet)	Side Slopes (H:1V)(1)	Breach Formation Time (Hours)(1)
Seismic	523.1	100.0	468	0.7	0.87
Static	531.2	122.4	468	0.7	0.92
PMF	543.5(2)	195.5	468	1.0	1.00

(1) Computed using the Froehlich method (Froehlich, 2008).
(2) Maximum water surface elevation calculated within HEC-RAS during the PMF non-breach scenario.

9.3 Model Runs

Breach simulations and the downstream flood wave propagation were modeled in HEC-RAS. The seismic and static breach scenarios were initiated at the start of the model run and the model run extended to a time beyond the peak of the hydrograph at the downstream terminus of the model. The hydrologic breach scenario was run from the time of initiation of the inflow hydrograph into the Piney Run reservoir beyond the peak of the hydrograph at the downstream terminus of the model. Model durations were selected to capture the peak of the breach hydrograph at the downstream terminus of the model and varied from six hours for the seismic and static breaches to 84 hours for the hydrologic breach. Time steps were selected to adequately account for breach dynamics and to minimize noise in the flood hydrographs. Time steps for the seismic and static breach models were 10 seconds and for the hydrologic breach was one second. Output was generated at a one-minute interval for all models.

Initial conditions for the hydrologic and seismic breach scenarios were specified as a water surface elevation of 523.1 feet for the Piney Run reservoir to simulate a normal pool condition and dry conditions in the two-dimensional modeling area. Initial conditions for the static breach scenario were specified as changing the water surface elevation of 531.2 feet for the Piney Run reservoir to a pool condition at the auxiliary spillway and dry conditions in the two-dimensional modeling area.

9.4 Model Results

The model for the seismic and static breaches extends approximately 18 miles downstream of the dam to a location approximately one mile downstream of the Baltimore-National Pike (US 40) crossing of the Patapsco River. The mapping also includes upstream tributaries to a sufficient distance for which the entire flood wave is modeled. The model was terminated at the approximate location of each breach hydrograph's convergence with the FEMA 100-year floodplain of the Patapsco River which occurs for breach hydrographs upstream of this location.

The model for the hydrologic breach extends approximately 32 miles downstream of the dam to the location where the Patapsco River enters the Baltimore Harbor just downstream of the Potee Street (MD 2) bridges over the river. The mapping also includes upstream tributaries to a sufficient distance for which the entire flood wave is modeled. The breach and non-breach flood depths converge to within one foot of each other just downstream of the I-195 crossing of the Patapsco River (approximately 27 miles downstream of the dam).

Impacts to existing structures and transportation facilities were determined in the same manner as described in Section 8.3.

During a dam failure, multiple bridges and structures may be impacted. A breach of the dam during the PMF event may impact up to 242 structures including an electrical substation, water treatment plant, two water pumping stations, 48 surface roads, and one railroad. In addition, it should be noted that there are a number of proposed structures not able to be included in the impact assessment as they are not yet constructed. These structures are located in the Parkside at Warfield development on Springfield Avenue in Sykesville, Maryland which at the time of this report had only been approximately 10% constructed so specific impacts to proposed buildings could not be estimated at this time. This development should be assessed for flood impacts once they are constructed. Based on this and the criteria of COMAR Section 26.17.04.05, Piney Run Dam is classified as a high hazard (Category I) dam based on the impacts calculated during a dam failure event. A summary of impacts for each breach event is provided in Table 21. A complete list of impacts is provided in Appendix G.

Table 21. Breach Routing – Downstream Impacts

Breach Event	Impact Type	
	Structures	Transportation
Seismic	36	14
Static	40	19
Hydrologic	242	49

*The hydrologic breach event magnitude is the PMF.

9.5 Breach Flood Inundation Mapping

Inundation zones were determined for each of the analyzed events and maps were prepared for the seismic, static, and hydrologic breach scenarios. These maps can be found in Appendix G. A breach of the dam during the PMF event may produce a flood wave of up to approximately 60 feet in height. The mapping extents are similar to that of the model convergence for each breach scenario as described in Section 9.4. The inundation limits for the dam failure were mapped using the *RAS Mapper* application within HEC-RAS. The hydraulic model and the extent of the inundation areas were delineated using the surface created from the two-meter-resolution terrain data.

On the maps, flood wave data is provided at each transportation crossing to be used as reference points to indicate the approximate timing and intensity of the breach flood wave as it moves downstream. Specific data provided includes:

1. Road name;
2. Distance of the crossing downstream from the dam where the breach is located;
3. Breach flood wave arrival time, which is the time it takes for the flood wave to travel from the dam to the crossing and is measured from the start of the breach formation at the dam to the time of the peak water surface elevation at the crossing;

4. Maximum depth of overtopping, which is the maximum height of water over the transportation surface at the crossing.

The breach inundation maps provide an estimation of areas that would be flooded if the dam were to fail. Mapped limits of flooded areas are approximate and are subject to certain assumptions and generalizations that are necessary for and intrinsic to the breach flood wave modeling and mapping process. Modifications to floodplain features and localized floodplain conditions such as debris, vegetation, and maintenance condition can significantly alter the inundation limits, and the extent of inundation resulting from an actual breach event may differ substantially from the information presented on the maps. It is prudent to assume that peripheral areas located outside of the demarcated inundation limits could also be subject to flood inundation.

10. Conclusions and Recommendations

Based on the hydrologic and hydraulic modeling completed in SITES for this study, under existing conditions, Piney Run Dam is capable of passing the 1% annual exceedance probability event for a 24-hour duration without activating the auxiliary spillway which satisfies MDE requirements. It is also capable of passing the 10-day PSH without activating the auxiliary spillway which meets NRCS requirements for dams that are subject to the requirements of TR-60. Under ultimate development conditions, the dam does not pass the 1% annual exceedance probability event for a 24-hour duration or the 10-day PSH without activating the auxiliary spillway although flow depths in the spillway are less than one foot for each event. This does not meet the requirements of MDE or NRCS which also apply to ultimate development conditions.

The FBH or the PMF per TR-60 requirements for the dam is determined to be the flood from the 24-hour PMP. However, per MDE guidance the SDF is determined to be the 72-hour PMP. In either case, the dam is not capable of safely passing this event with the minimum freeboard required by TR-60 (zero feet) or MDE (one foot) under existing or ultimate development conditions. The dam would need to be raised by approximately 3.0 feet under existing conditions and 3.5 feet under ultimate development conditions in order to pass the FBH/SDF without overtopping based on the existing configuration and capacity of the principal and auxiliary spillways. In order to satisfy the MDE freeboard requirement, the dam would need to be raised by approximately 4.0 feet under existing conditions and 4.5 feet under ultimate development conditions.

Based on the spillway integrity analysis completed using the SITES model which was based on material testing results from soil and rock samples taken from the spillway, the spillway would likely not be able to withstand the flows resulting from the 24-PMF event which is the event required to be modeled by TR-60. The consequence of this condition is a failure through the spillway which may either endanger the integrity of the adjacent embankment and/or result in an uncontrolled release of a significant part of the reservoir.

A comparative analysis of the flood impacts of frequency events for 10%, 2%, 1% and 0.2% annual exceedance probabilities demonstrates the flood control capability of Piney Run Dam. Along Piney Run, the flooding is reduced for all events and most significantly for events with annual exceedance probabilities greater than or equal to 1%. Downstream of Piney Run in the Patapsco River, the influence of Piney Run Dam for flood control is insignificant due to the much larger flood discharges from the watershed of the South Branch of the Patapsco River.

A breach of the dam under any of the described conditions (seismic, static, or hydrologic) will result in significant impacts downstream including flooding of both roads and structures including inhabited structures. Under the hydrologic breach scenario, a breach during the PMF event, up to 48 surface roads and one railroad may be impacted with some impacted in multiple locations. In addition, impacts to up to 242 structures are possible.

Recommendations for Piney Run Dam resulting from this study are:

1. Make modifications to the dam to increase spillway capacity to meet the required freeboard requirements for the FBH/SDF.

2. Make modifications to the dam to improve spillway integrity to resist the erosive effects of the spillway discharge during the FBH/SDF.
3. Review the Emergency Action Plan for the dam and revise to reflect the breach inundation impacts of the worst-case breach scenario modeled and documented in this report: the hydrologic breach event (PMF).
4. Once completed, the final topography of the Parkside at Warfield development should be incorporated into the breach inundation model and each property assessed for flood impacts to associated structures. At the time of this study, there was insufficient data concerning building locations to determine what buildings would be impacted by flooding.

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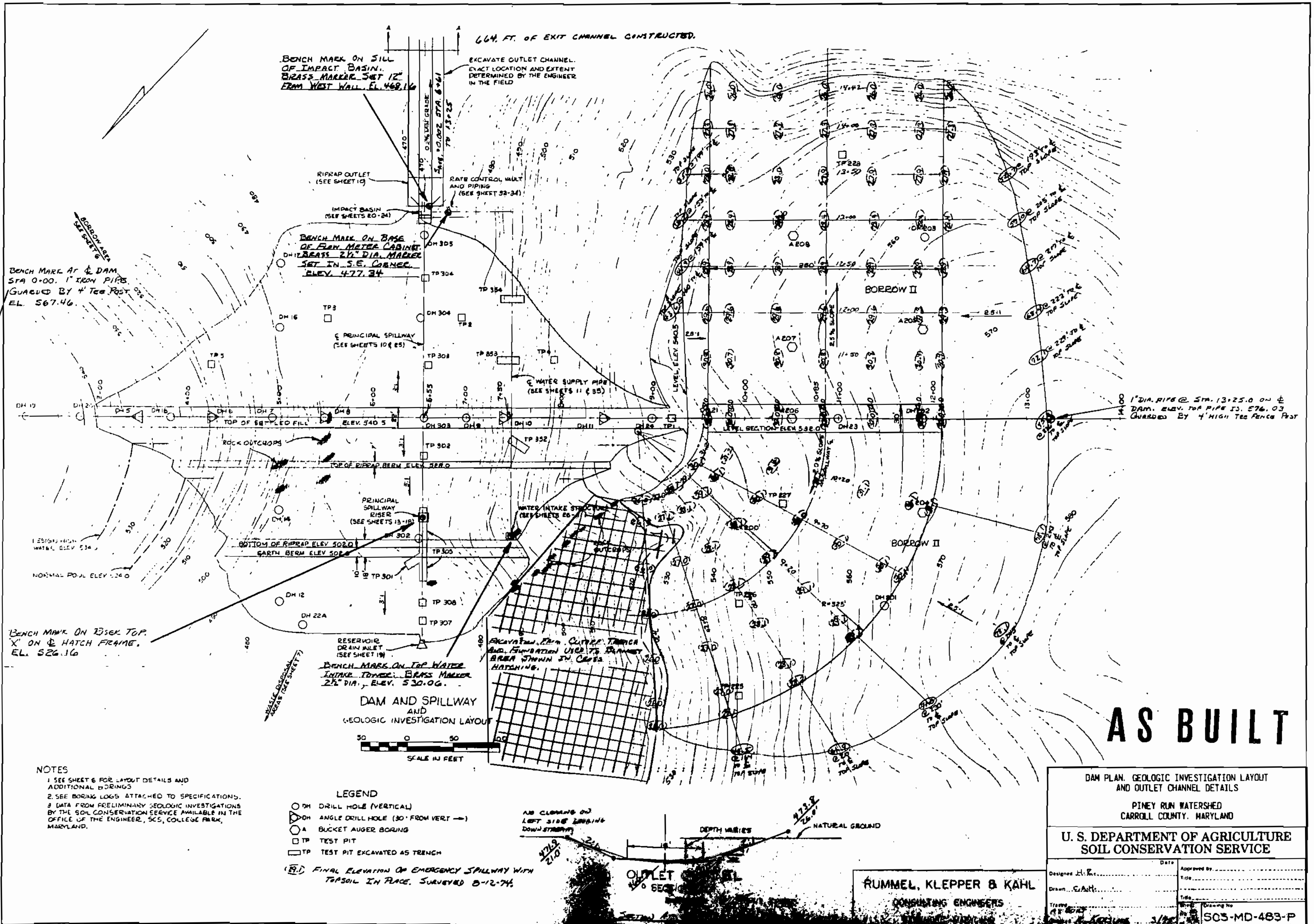
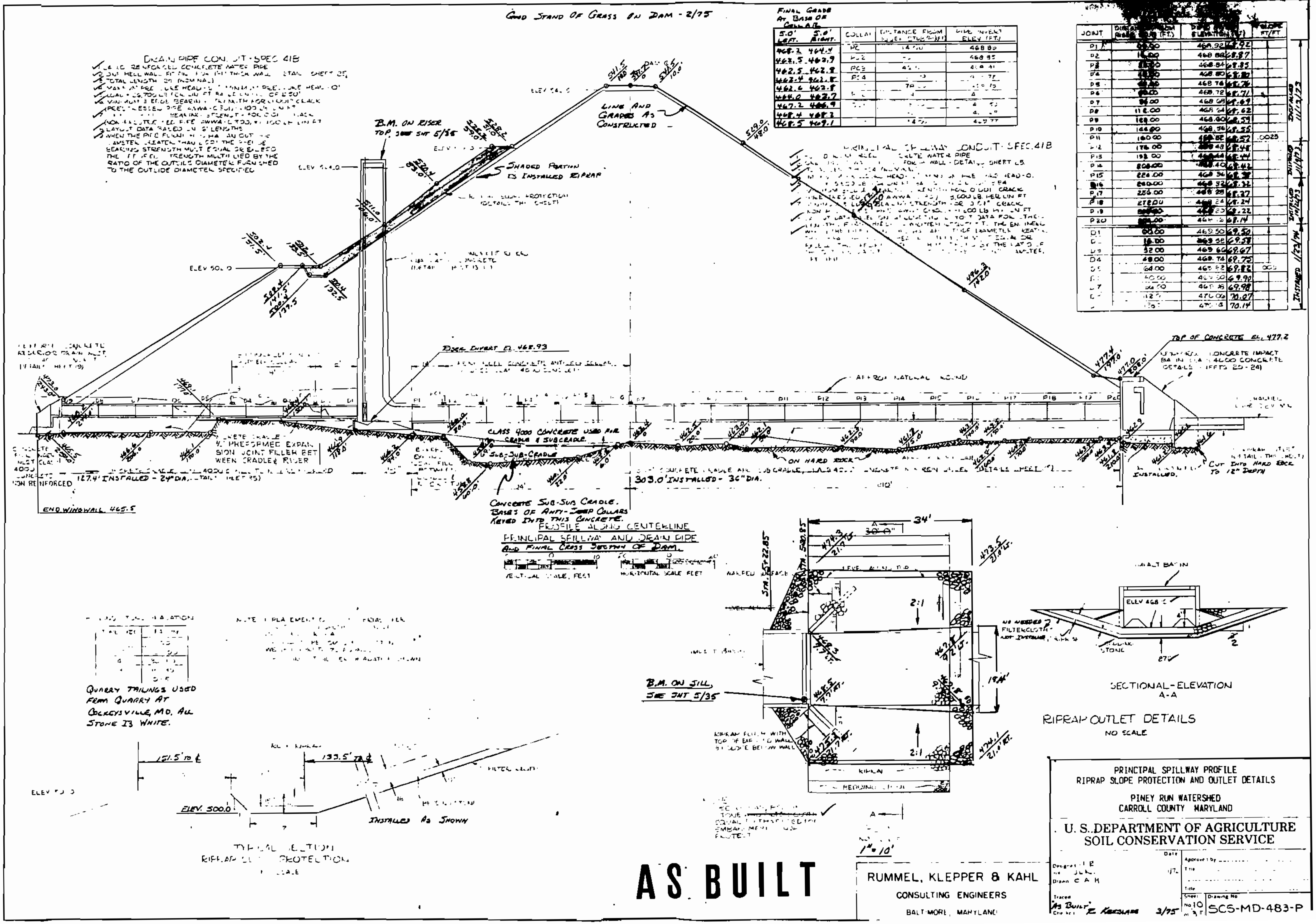
Appendix A – Selected As-Built Plans


664 FT. OF EXIT CHANNEL CONSTRUCTED.
BENCH MARK ON SILL OF IMPACT BASIN. BRASS MARKER SET 12" FROM WEST WALL. EL. 468.16
EXCAVATE OUTLET CHANNEL. EXACT LOCATION AND EXTENT DETERMINED BY THE ENGINEER IN THE FIELD
RIPRAP OUTLET (SEE SHEET 19)
RATE CONTROL VAULT AND PIPING (SEE SHEET 32-34)
IMPACT BASIN (SEE SHEETS 20-24)
BENCH MARK ON BASE OF FLOW METER CABINET. BRASS 2½" DIA. MARKER SET IN S.E. CORNER. ELEV. 477.34
BENCH MARK AT ℄ DAM STA 0+00. 1" IRON PIPE. GUARDED BY 4' TEE POST EL. 567.46.
BORROW AREA SEE SHEET 6
℄ PRINCIPAL SPILLWAY (SEE SHEETS 10 & 25)
℄ WATER SUPPLY PIPE (SEE SHEETS 11 & 35)
BORROW II
TOP OF SETTLED FILL ELEV. 540.5
LEVEL SECTION ELEV. 538.0
LEVEL, ELEV. 540.5
ROCK OUTCROPS
TOP OF RIPRAP BERM ELEV. 528.0
PRINCIPAL SPILLWAY RISER (SEE SHEETS 13-18)
WATER INTAKE STRUCTURE (SEE SHEETS 26-...)
BOTTOM OF RIPRAP ELEV 502.0
EARTH BERM ELEV 502.0
DESIGN HIGH WATER ELEV 534
NORMAL POOL ELEV 524.0
1" DIA. PIPE @ STA. 13+25.0 ON ℄ DAM. ELEV. TOP PIPE IS 576.03 GUARDED BY 4' HIGH TEE FENCE POST
BENCH MARK ON RISER TOP. 'X' ON ℄ HATCH FRAME. EL. 526.16
RESERVOIR DRAIN INLET (SEE SHEET 19)
BENCH MARK ON TOP WATER INTAKE TOWER. BRASS MARKER 2½" DIA., ELEV. 530.06.
EXCAVATION FROM CUTOFF TRENCH AND FOUNDATION USED TO BACKFILL AREA SHOWN IN CROSS HATCHING.
WASTE DISPOSAL AREAS (SEE SHEET 7)
DAM AND SPILLWAY AND GEOLOGIC INVESTIGATION LAYOUT
SCALE IN FEET
AS BUILT
NOTES
1. SEE SHEET 6 FOR LAYOUT DETAILS AND ADDITIONAL BORINGS
2. SEE BORING LOGS ATTACHED TO SPECIFICATIONS.
3. DATA FROM PRELIMINARY GEOLOGIC INVESTIGATIONS BY THE SOIL CONSERVATION SERVICE AVAILABLE IN THE OFFICE OF THE ENGINEER, SCS, COLLEGE PARK, MARYLAND.
LEGEND
DH DRILL HOLE (VERTICAL)
DH ANGLE DRILL HOLE (30° FROM VERT →)
A BUCKET AUGER BORING
TP TEST PIT
TP TEST PIT EXCAVATED AS TRENCH
FINAL ELEVATION OF EMERGENCY SPILLWAY WITH TOPSOIL IN PLACE. SURVEYED 8-12-74.
NO CLEARING ON LEFT SIDE LOOKING DOWNSTREAM
DEPTH VARIES
NATURAL GROUND
OUTLET CHANNEL SECTION
DAM PLAN, GEOLOGIC INVESTIGATION LAYOUT AND OUTLET CHANNEL DETAILS
PINEY RUN WATERSHED
CARROLL COUNTY, MARYLAND
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
SCS-MD-483-P



Final Grade At Base Of Collar

5.0' Left.	5.0' Right.	Collar	Distance From Riser Stub (ft)	Pipe Invert Elev (ft)
468.2	464.4	PC	14.00	468.85
462.5	462.9	PC2	[illegible]	468.95
462.5	462.9	PC3	[illegible]	[illegible]
462.4	462.8	PC4	[illegible]	[illegible]
462.6	462.8	[illegible]	78 [illegible]	[illegible]
464.0	462.7	[illegible]	[illegible]	[illegible]
467.2	466.9	[illegible]	[illegible]	[illegible]
468.4	468.3		[illegible]	[illegible]
468.5	469.1	[illegible]	[illegible]	[illegible]

Joint	Distance From Riser (ft.)	Pipe Invert Elevation (ft.)		Slope ft/ft
P1	[illegible]	468.92	68.92	
P2	16.00	468.88	68.87	
P3	[illegible]	468.84	68.85	
P4	[illegible]	468.80	68.80	
P5	[illegible]	468.76	68.76	
P6	[illegible]	468.72	68.71	
P7	96.00	468.69	68.69	
P8	112.00	468.64	68.62	
P9	128.00	468.60	68.59	
P10	144.00	468.56	68.55	
P11	160.00	468.52	68.52	.0025
P12	176.00	[illegible] 48	68.48	
P13	192.00	[illegible]	68.44	
P14	208.00	[illegible].40	68.42	
P15	224.00	468.36	68.37	
P16	240.00	468.32	68.32	
P17	256.00	468.28	68.27	
P18	272.00	468.24	68.24	
P19	[illegible]	468.20	68.22	
P20	[illegible]	468.16	68.14	
D1	00.00	469.50	69.50	
D2	16.00	469.58	69.58	
D3	32.00	469.66	69.67	
D4	48.00	469.74	69.75	
D5	64.00	469.82	69.82	.005
D6	80.00	469.90	69.90	
D7	96.00	469.98	69.98	
D8	112.00	470.06	70.07	
[illegible]	128.00	470.14	70.14	

INSTALLED 11/13/73 · INSTALLED 11/9/73 · INSTALLED 10/24/73 · INSTALLED 11/23/74

PRINCIPAL SPILLWAY PROFILE
RIPRAP SLOPE PROTECTION AND OUTLET DETAILS

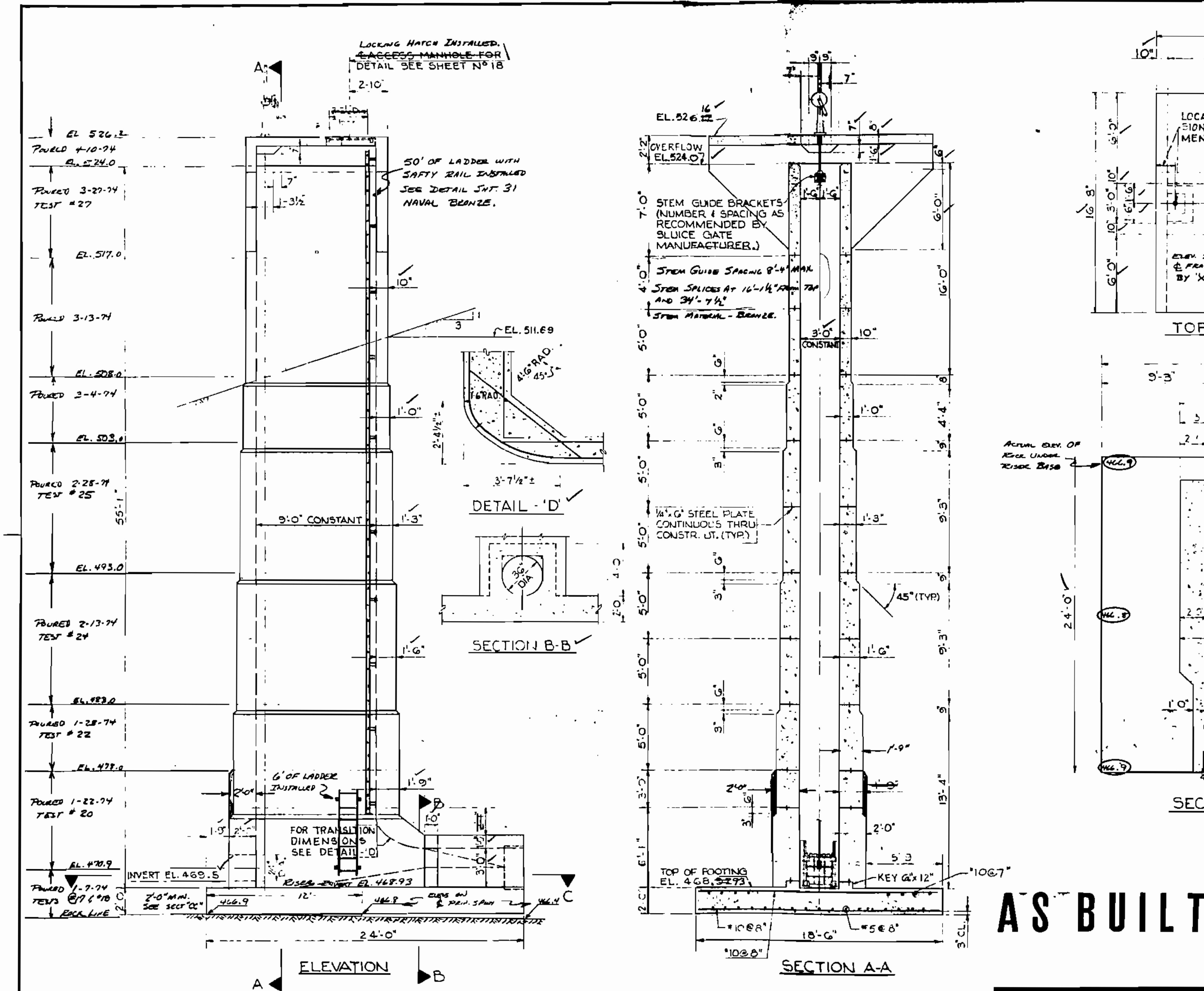
PINEY RUN WATERSHED
CARROLL COUNTY MARYLAND

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AS BUILT

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

Drawn C. A. K.
Traced "As Built" E. Kerslake 3/75
Sheet No. 10 of 35
Drawing No. SCS-MD-483-P



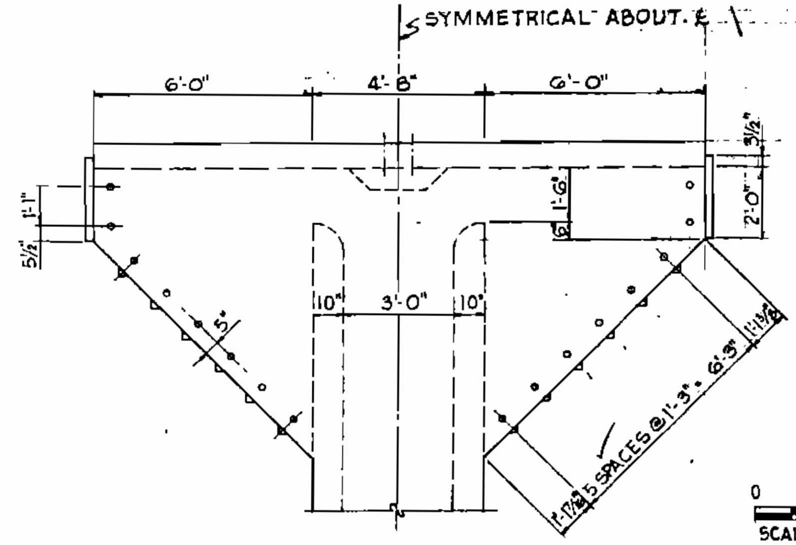
AS BUILT

RISER STRUCTURE
PLAN, ELEVATION AND SECTIONS

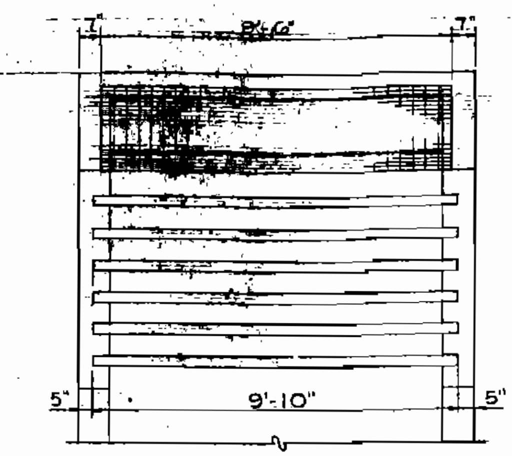
PINEY RUN WATERSHED
CARROLL COUNTY, MARYLAND

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed C.H.M.
Drawn C.R.B.
As Built Z. Kerslake 3-75
Sheet No. 16 of 33

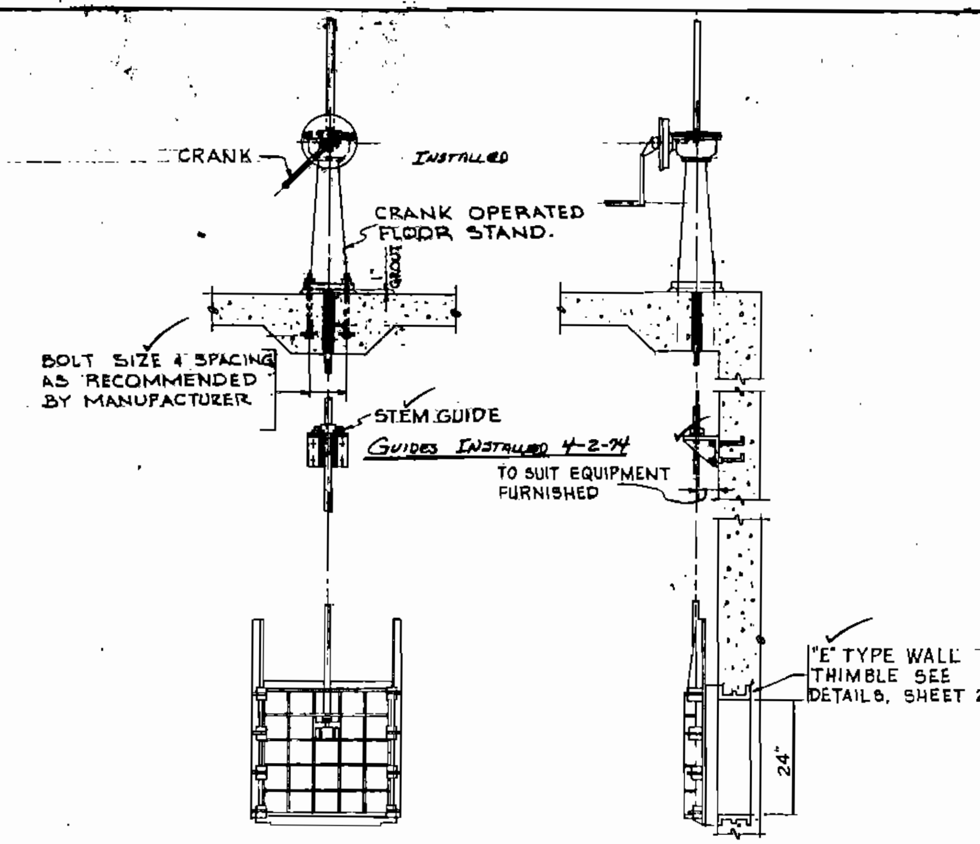


FRONT ELEVATION VIEW



SIDE ELEVATION VIEW

0 2 4
SCALE IN FEET

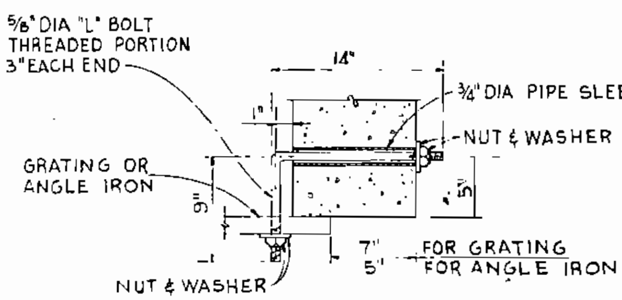


ELEVATION VIEW

SECTION VIEW

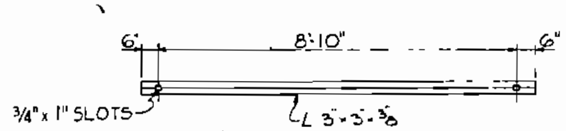
TYPICAL SLIDE GATE DETAIL

NOT TO SCALE



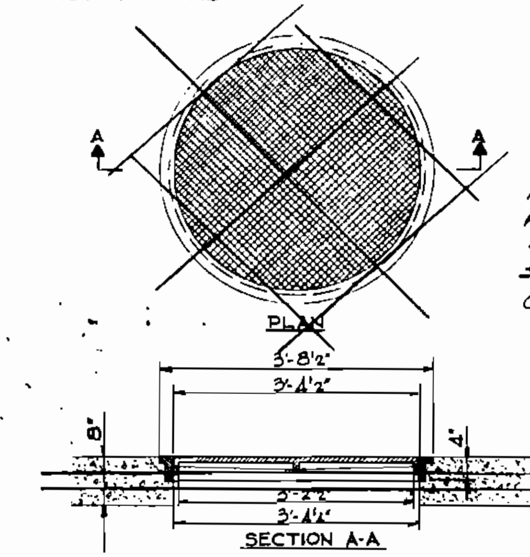
"L" BOLT DETAIL

NOT TO SCALE



ANGLE IRON DETAIL

NOT TO SCALE



SECTION A-A

LOCKING HATCH AND FRAME INSTALLED 4-10-74 WITH TOP SLAB CONCRETE POUR ON RISER.

~~MANHOLE FRAME DETAIL~~

NO SCALE

MANHOLE DELETED IN FAVOR OF HINGED LOCKING HATCH

TRASH RACK DETAILS

TRASH RACK INSTALLED 4-22-74

¼" x 6" STEEL PLATE, CONTINUOUS THRU CONSTR. JT. SPLICES SHALL BE EITHER:
1. BUTT WELDED.
2. LAPPED 3" AND BOLTED.
3. LAPPED 3" AND FILLET WELDED

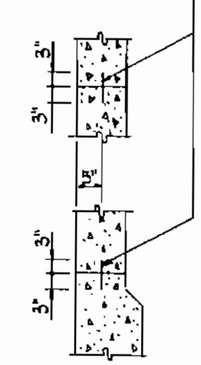


PLATE CONSTR. JOINT

BILL OF MATERIAL

LOCATION	ITEM	SIZE	LENGTH	QUANTITY
TRASH	ANGLE IRON	3"x3"x3/8"	9'-10"	12
RACK &	"L" BOLT W/TYPE 2 NUTS & WASHERS	5/8" DIA.	9"x14"	32
TOP OF	GALV. PIPE SLEEVE	¾" DIA.	10"	32
RISER	GRATING *	8	27⅛"x9'-6"	2

* BORDEN TYPE W/B OR EQUIVALENT

NOTE: BEARING BARS OF GRATING ARE PARALLEL TO LONGITUDINAL AXIS.
ENTIRE TRASH RACK AND TOP GRATE TO BE GALVANIZED IN ACCORDANCE WITH SPEC. 119.
MATERIAL IN TRASH RACK SHALL CONFORM TO SPEC. 117.

AS BUILT

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

RISER STRUCTURE
TRASH RACK AND SLIDE GATE DETAILS

PINEY RUN WATERSHED
CARROLL COUNTY, MARYLAND

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed		Approved by
Drawn J.F.P.		Title
As Built Traced E. Keeslake	3-75	Title
Checked JGS		Sheet No. 18 of 35 · Drawing No. SCS-MD.-483-P

Appendix B – Hydrologic Computations

NOAA Atlas 14, Volume 2, Version 3
Location name: Sykesville, Maryland, USA*
Latitude: 39.4177°, Longitude: -77.0102°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.341 (0.309-0.375)	0.407 (0.369-0.449)	0.482 (0.436-0.531)	0.537 (0.484-0.591)	0.606 (0.543-0.667)	0.660 (0.589-0.726)	0.710 (0.632-0.783)	0.759 (0.671-0.839)	0.821 (0.720-0.910)	0.870 (0.757-0.966)
10-min	0.544 (0.492-0.598)	0.650 (0.589-0.717)	0.772 (0.699-0.851)	0.859 (0.775-0.946)	0.967 (0.867-1.06)	1.05 (0.936-1.15)	1.13 (1.00-1.24)	1.20 (1.06-1.33)	1.30 (1.14-1.44)	1.37 (1.19-1.52)
15-min	0.679 (0.615-0.748)	0.817 (0.740-0.901)	0.974 (0.882-1.07)	1.08 (0.978-1.19)	1.22 (1.10-1.34)	1.32 (1.18-1.46)	1.42 (1.26-1.57)	1.51 (1.34-1.67)	1.63 (1.43-1.80)	1.71 (1.49-1.90)
30-min	0.931 (0.843-1.02)	1.13 (1.02-1.24)	1.38 (1.25-1.52)	1.57 (1.42-1.73)	1.81 (1.62-1.99)	1.99 (1.78-2.19)	2.17 (1.93-2.39)	2.35 (2.08-2.59)	2.58 (2.26-2.86)	2.76 (2.40-3.07)
60-min	1.16 (1.05-1.28)	1.41 (1.28-1.56)	1.77 (1.60-1.95)	2.04 (1.84-2.25)	2.40 (2.16-2.65)	2.69 (2.40-2.96)	2.98 (2.66-3.29)	3.29 (2.91-3.63)	3.70 (3.24-4.10)	4.03 (3.51-4.47)
2-hr	1.37 (1.24-1.52)	1.67 (1.51-1.85)	2.11 (1.90-2.34)	2.46 (2.21-2.72)	2.96 (2.64-3.26)	3.37 (2.99-3.72)	3.81 (3.36-4.21)	4.29 (3.75-4.74)	4.98 (4.31-5.52)	5.55 (4.76-6.17)
3-hr	1.48 (1.33-1.65)	1.80 (1.62-2.00)	2.28 (2.05-2.53)	2.66 (2.38-2.95)	3.20 (2.85-3.55)	3.66 (3.24-4.06)	4.15 (3.64-4.60)	4.68 (4.07-5.19)	5.44 (4.68-6.06)	6.09 (5.17-6.80)
6-hr	1.83 (1.65-2.05)	2.22 (2.00-2.48)	2.80 (2.52-3.13)	3.28 (2.94-3.67)	4.00 (3.55-4.46)	4.62 (4.06-5.14)	5.29 (4.61-5.89)	6.04 (5.21-6.72)	7.15 (6.07-7.99)	8.10 (6.80-9.09)
12-hr	2.24 (2.00-2.55)	2.71 (2.42-3.08)	3.43 (3.06-3.90)	4.06 (3.59-4.61)	5.02 (4.39-5.67)	5.87 (5.10-6.63)	6.82 (5.85-7.70)	7.89 (6.69-8.92)	9.55 (7.92-10.8)	11.0 (8.97-12.5)
24-hr	2.59 (2.36-2.89)	3.13 (2.86-3.49)	4.02 (3.66-4.48)	4.81 (4.36-5.34)	6.01 (5.40-6.65)	7.09 (6.32-7.80)	8.30 (7.33-9.11)	9.69 (8.45-10.6)	11.8 (10.1-12.9)	13.7 (11.6-14.9)
2-day	3.01 (2.73-3.36)	3.63 (3.29-4.06)	4.65 (4.21-5.20)	5.53 (4.99-6.18)	6.85 (6.14-7.63)	8.00 (7.13-8.91)	9.29 (8.20-10.3)	10.7 (9.38-11.9)	12.9 (11.1-14.3)	14.8 (12.5-16.4)
3-day	3.18 (2.88-3.55)	3.84 (3.48-4.29)	4.91 (4.44-5.48)	5.83 (5.26-6.50)	7.21 (6.46-8.03)	8.42 (7.50-9.36)	9.77 (8.61-10.8)	11.3 (9.84-12.5)	13.5 (11.6-15.0)	15.5 (13.2-17.2)
4-day	3.35 (3.03-3.73)	4.05 (3.67-4.51)	5.16 (4.67-5.76)	6.13 (5.52-6.83)	7.58 (6.79-8.42)	8.84 (7.86-9.81)	10.2 (9.03-11.4)	11.8 (10.3-13.1)	14.2 (12.2-15.7)	16.2 (13.8-18.0)
7-day	3.89 (3.55-4.31)	4.69 (4.28-5.19)	5.92 (5.40-6.55)	6.98 (6.34-7.71)	8.57 (7.73-9.44)	9.93 (8.90-10.9)	11.4 (10.2-12.6)	13.1 (11.6-14.4)	15.6 (13.6-17.2)	17.8 (15.3-19.6)
10-day	4.45 (4.08-4.89)	5.34 (4.90-5.87)	6.67 (6.10-7.33)	7.78 (7.10-8.54)	9.40 (8.53-10.3)	10.8 (9.71-11.8)	12.2 (11.0-13.4)	13.8 (12.3-15.1)	16.1 (14.2-17.7)	18.1 (15.7-19.8)
20-day	6.03 (5.60-6.52)	7.17 (6.66-7.76)	8.66 (8.04-9.37)	9.87 (9.15-10.7)	11.6 (10.7-12.5)	12.9 (11.9-14.0)	14.4 (13.2-15.5)	15.8 (14.4-17.1)	17.9 (16.2-19.4)	19.5 (17.5-21.2)
30-day	7.44 (6.97-8.00)	8.80 (8.24-9.46)	10.5 (9.78-11.2)	11.8 (11.0-12.7)	13.7 (12.7-14.6)	15.1 (14.0-16.2)	16.6 (15.4-17.8)	18.2 (16.7-19.5)	20.3 (18.5-21.8)	22.0 (19.9-23.6)
45-day	9.37 (8.82-9.98)	11.0 (10.4-11.8)	12.9 (12.1-13.7)	14.3 (13.5-15.3)	16.2 (15.2-17.3)	17.7 (16.5-18.8)	19.1 (17.8-20.3)	20.5 (19.1-21.8)	22.3 (20.7-23.8)	23.6 (21.8-25.3)
60-day	11.2 (10.5-11.9)	13.1 (12.4-13.9)	15.2 (14.3-16.1)	16.7 (15.8-17.7)	18.7 (17.6-19.8)	20.2 (19.0-21.4)	21.6 (20.3-22.9)	23.0 (21.5-24.4)	24.8 (23.0-26.3)	26.0 (24.1-27.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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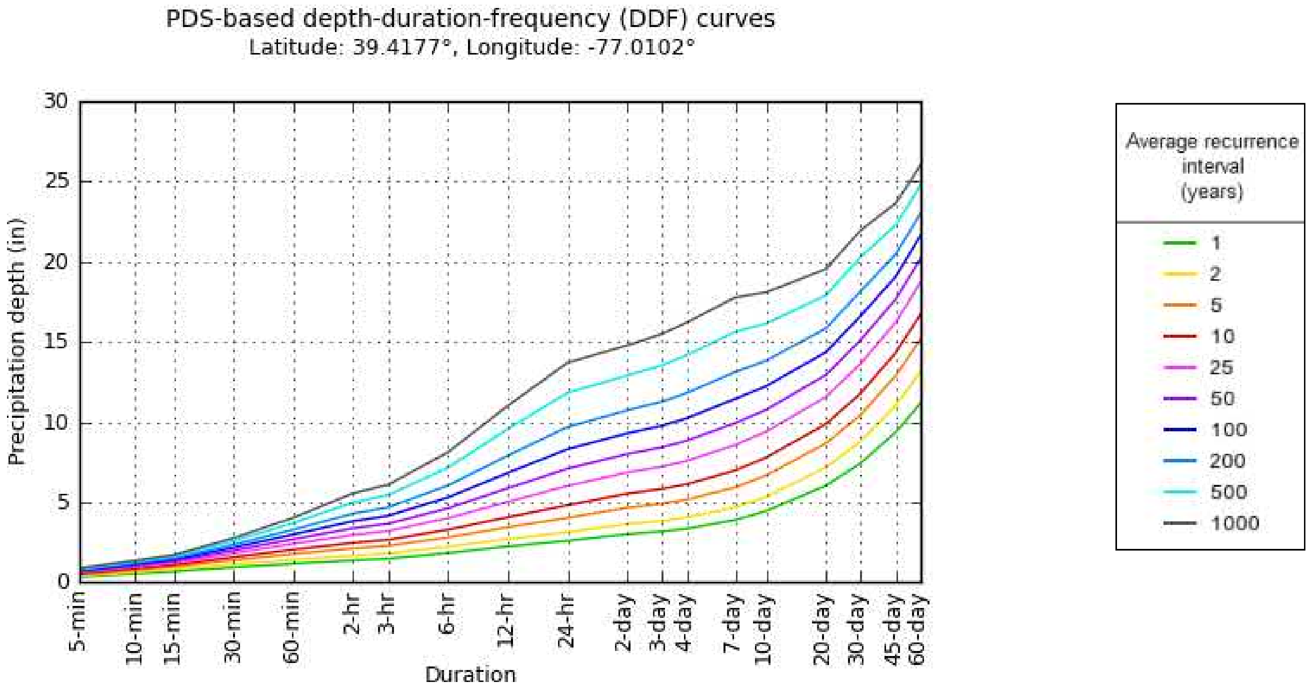
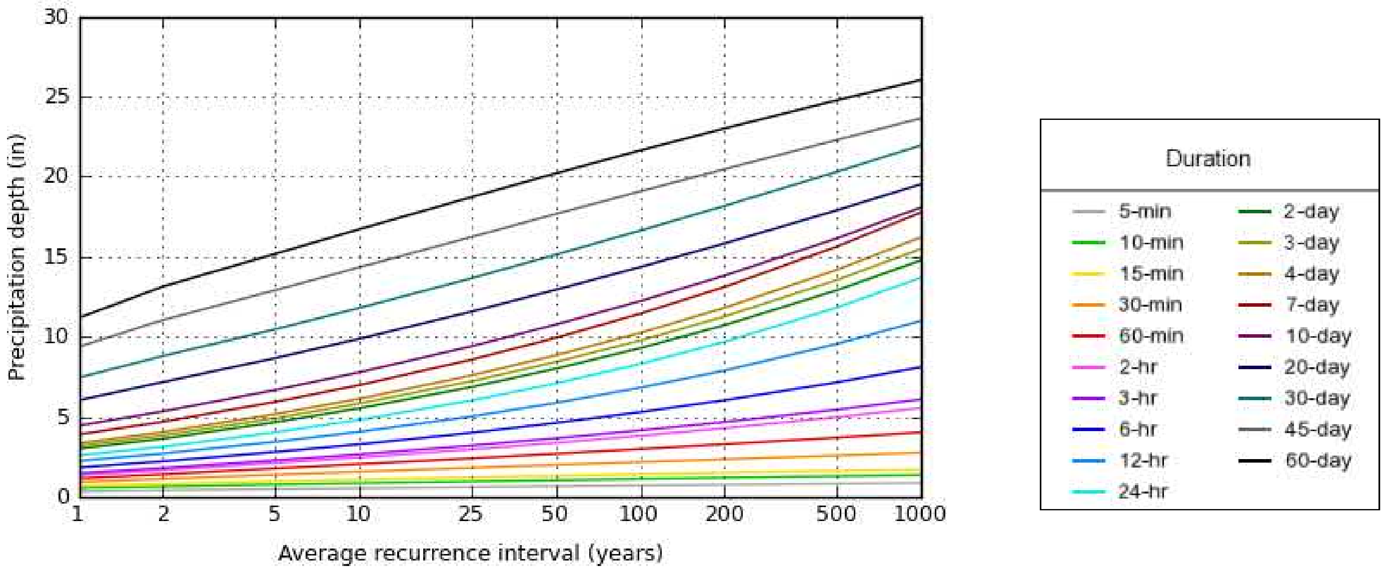
PF graphical





NOAA Atlas 14, Volume 2, Version 3 Created (GMT): Fri Oct 25 01:05:58 2019

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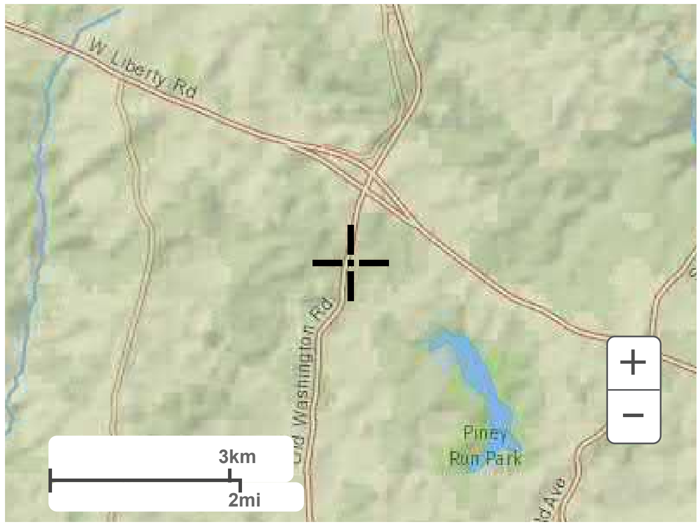
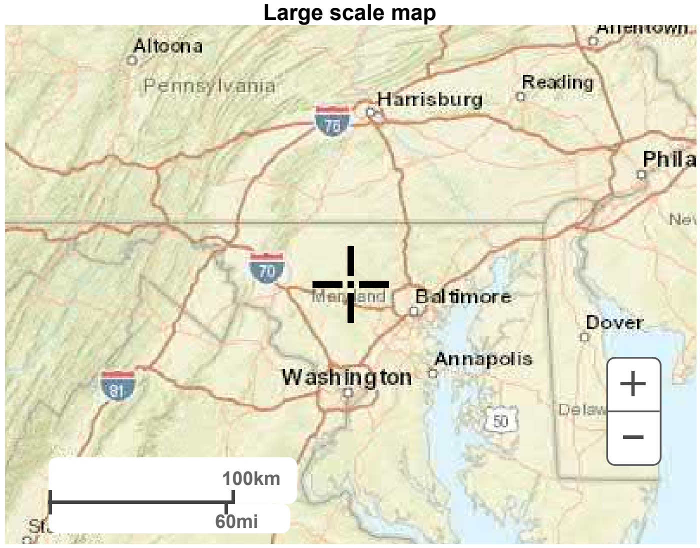
Maps & aerials

Small scale terrain

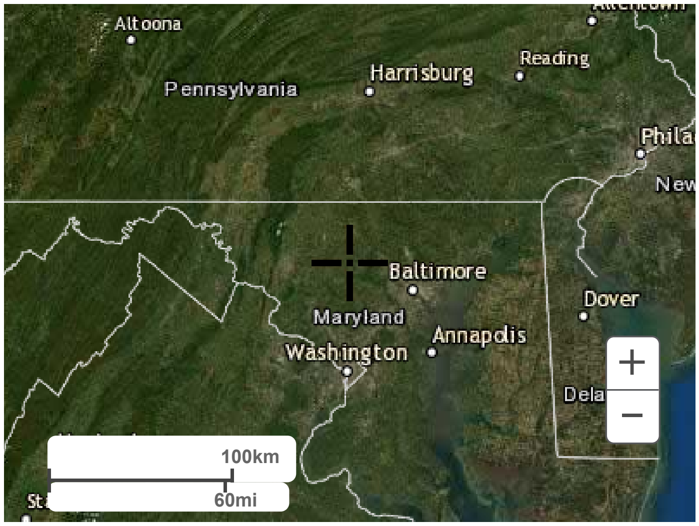


Large scale terrain

Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Type 'C' Distribution							
Time (hours)	Unit Depth (in/in)	Time (hours)	Unit Depth (in/in)	Time (hours)	Unit Depth (in/in)	Time (hours)	Unit Depth (in/in)
0.0	0.0000	6.1	0.0809	12.2	0.6338	18.3	0.9256
0.1	0.0013	6.2	0.0826	12.3	0.6630	18.4	0.9271
0.2	0.0023	6.3	0.0843	12.4	0.6843	18.5	0.9287
0.3	0.0034	6.4	0.0861	12.5	0.7045	18.6	0.9303
0.4	0.0044	6.5	0.0879	12.6	0.7176	18.7	0.9318
0.5	0.0055	6.6	0.0898	12.7	0.7298	18.8	0.9334
0.6	0.0065	6.7	0.0916	12.8	0.7409	18.9	0.9349
0.7	0.0076	6.8	0.0936	12.9	0.7510	19.0	0.9364
0.8	0.0087	6.9	0.0955	13.0	0.7600	19.1	0.9379
0.9	0.0098	7.0	0.0975	13.1	0.7679	19.2	0.9394
1.0	0.0109	7.1	0.0996	13.2	0.7753	19.3	0.9409
1.1	0.0121	7.2	0.1017	13.3	0.7821	19.4	0.9424
1.2	0.0132	7.3	0.1038	13.4	0.7883	19.5	0.9439
1.3	0.0143	7.4	0.1060	13.5	0.7939	19.6	0.9453
1.4	0.0155	7.5	0.1082	13.6	0.7990	19.7	0.9468
1.5	0.0167	7.6	0.1104	13.7	0.8039	19.8	0.9482
1.6	0.0178	7.7	0.1127	13.8	0.8086	19.9	0.9496
1.7	0.0190	7.8	0.1150	13.9	0.8132	20.0	0.9511
1.8	0.0202	7.9	0.1174	14.0	0.8177	20.1	0.9525
1.9	0.0214	8.0	0.1198	14.1	0.8220	20.2	0.9539
2.0	0.0226	8.1	0.1223	14.2	0.8261	20.3	0.9553
2.1	0.0238	8.2	0.1247	14.3	0.8301	20.4	0.9566
2.2	0.0251	8.3	0.1273	14.4	0.8340	20.5	0.9580
2.3	0.0263	8.4	0.1298	14.5	0.8377	20.6	0.9594
2.4	0.0276	8.5	0.1324	14.6	0.8412	20.7	0.9607
2.5	0.0288	8.6	0.1351	14.7	0.8446	20.8	0.9621
2.6	0.0301	8.7	0.1378	14.8	0.8479	20.9	0.9634
2.7	0.0314	8.8	0.1405	14.9	0.8510	21.0	0.9647
2.8	0.0327	8.9	0.1432	15.0	0.8540	21.1	0.9660
2.9	0.0340	9.0	0.1461	15.1	0.8568	21.2	0.9673
3.0	0.0353	9.1	0.1490	15.2	0.8595	21.3	0.9686
3.1	0.0366	9.2	0.1521	15.3	0.8622	21.4	0.9699
3.2	0.0379	9.3	0.1554	15.4	0.8649	21.5	0.9712
3.3	0.0393	9.4	0.1588	15.5	0.8676	21.6	0.9724
3.4	0.0406	9.5	0.1623	15.6	0.8702	21.7	0.9737
3.5	0.0420	9.6	0.1660	15.7	0.8727	21.8	0.9749
3.6	0.0434	9.7	0.1699	15.8	0.8753	21.9	0.9762
3.7	0.0447	9.8	0.1739	15.9	0.8778	22.0	0.9774
3.8	0.0461	9.9	0.1780	16.0	0.8802	22.1	0.9786
3.9	0.0475	10.0	0.1823	16.1	0.8826	22.2	0.9798
4.0	0.0489	10.1	0.1868	16.2	0.8850	22.3	0.9810
4.1	0.0504	10.2	0.1914	16.3	0.8873	22.4	0.9822
4.2	0.0518	10.3	0.1961	16.4	0.8896	22.5	0.9834
4.3	0.0532	10.4	0.2010	16.5	0.8918	22.6	0.9845
4.4	0.0547	10.5	0.2061	16.6	0.8940	22.7	0.9857
4.5	0.0562	10.6	0.2117	16.7	0.8962	22.8	0.9868
4.6	0.0576	10.7	0.2179	16.8	0.8983	22.9	0.9879
4.7	0.0591	10.8	0.2247	16.9	0.9004	23.0	0.9891
4.8	0.0606	10.9	0.2321	17.0	0.9025	23.1	0.9902
4.9	0.0621	11.0	0.2400	17.1	0.9045	23.2	0.9913
5.0	0.0636	11.1	0.2490	17.2	0.9064	23.3	0.9924
5.1	0.0651	11.2	0.2591	17.3	0.9084	23.4	0.9935
5.2	0.0667	11.3	0.2702	17.4	0.9103	23.5	0.9945
5.3	0.0682	11.4	0.2825	17.5	0.9121	23.6	0.9956
5.4	0.0697	11.5	0.2955	17.6	0.9139	23.7	0.9967
5.5	0.0713	11.6	0.3157	17.7	0.9157	23.8	0.9977
5.6	0.0729	11.7	0.3370	17.8	0.9174	23.9	0.9987
5.7	0.0745	11.8	0.3662	17.9	0.9191	24.0	1.0000
5.8	0.0760	11.9	0.4067	18.0	0.9208		
5.9	0.0776	12.0	0.4766	18.1	0.9224		
6.0	0.0793	12.1	0.5933	18.2	0.9240		

HEC-MetVUE v3.0: HMR52 Output
==

Shapefile in use: C:\Users\jeff.blass\Desktop\Report\GIS\Hydrology\WSDAM1.shp
Area : 10.57 sq. miles
Centroid : Lon: -77.01Lat: 39.42
Rotational alignment to minimum inertial axis: 124.05 degrees CW from north.

Location to use for Depth-Area-Duration curves, optimal storm angle, and 1:6-hour hyetograph ratio: Lon: -77.01 Lat: 39.42

Storm center for this computation: Lon: -77.01 Lat: 39.42

1:6-hour hyetograph ratio: 0.2970

Optimal storm angle for this location: 205.0 degrees (measured CW from north)

Angle for this computation: 124.1 degrees (measured CW from north)

Hyetograph ordinal order to be applied: HMR52 standard. Values: [12, 10, 8, 6, 4, 2, 1, 3, 5, 7, 9, 11]

PMP DEPTHS FROM HMR 51

AREA			DURATION		
(SQ. MI.)	6-HR	12-HR	24-HR	48-HR	72-HR
10	27.29	31.84	35.17	38.95	40.54
200	18.94	22.51	26.36	29.93	31.13
1000	13.66	17.27	21.06	23.97	24.97
5000	8.27	11.55	14.49	17.85	19.05
10000	6.36	9.47	12.03	15.04	16.23
20000	4.51	7.5	9.87	13.05	13.97

ISOHYETAL STORM TOTAL PRECIP FOR STORM SIZE WITH ROTATION AND NOMOGRAPH ADJUSTMENTS FOR WSDAM1
ORIENTATION = 124.05, PREFERRED ORIENTATION = 205.00 DEGREES CW FROM NORTH
STORM CENTER COORDINATES LON: -77.01 LAT: 39.42

STORM SIZE (SQ MI)	ANGLE REDUCTION COEFF	TOTAL VOLUME (AC-FT)	ISOHYETAL STORM TOTAL PRECIP FOR STORM SIZE WITH ROTATION AND NOMOGRAPH ADJUSTMENTS																		
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
*10	1	18974	35.17	22.54	16.88	13.44	10.55	8.44	6.76	4.92	3.52	2.17	0.78	0	0	0	0	0	0	0	0
17	1	18595	33.97	26.56	19.79	15.8	12.67	10.27	8.33	6.52	4.85	3.27	1.85	0.36	0	0	0	0	0	0	0
25	1	18424	33.13	31.14	22.24	17.48	14.37	11.46	9.49	7.49	5.81	4.22	2.58	1.13	0	0	0	0	0	0	0
35	1	18158	32.64	30.73	24.77	19.24	15.64	12.77	10.56	8.35	6.45	4.86	3.23	1.8	0.31	0	0	0	0	0	0

PROBABLE MAXIMUM STORM FOR WSDAM1
STORM AREA = 10 SQ. MI., ORIENTATION = 124.05, PREFERRED ORIENTATION = 205.00
STORM CENTER COORDINATES LON: -77.01 LAT: 39.42

DEPTHS (INCHES) FOR 6-HOUR INCREMENTS OF PMS

	ISOHYET AREA (SQ.MI.)	1	2	3	4	5	6	7	8	9	10	11	12
A	10	27.29	4.55	2.04	1.29	1.11	1.01	0.89	0.76	0.58	0.43	0.32	0.26
B	25	17.47	2.91	1.32	0.84	0.72	0.65	0.58	0.49	0.38	0.28	0.21	0.17
C	50	13.1	2.19	0.98	0.62	0.53	0.48	0.43	0.37	0.28	0.21	0.15	0.12
D	100	10.37	1.78	0.79	0.5	0.43	0.39	0.35	0.3	0.23	0.17	0.12	0.1
E	175	8.19	1.37	0.61	0.39	0.33	0.3	0.27	0.23	0.18	0.13	0.1	0.08
F	300	6.55	1.09	0.49	0.31	0.27	0.24	0.21	0.18	0.14	0.1	0.08	0.06
G	450	5.19	0.91	0.41	0.26	0.22	0.2	0.18	0.15	0.12	0.09	0.06	0.05
H	700	3.82	0.64	0.28	0.18	0.16	0.14	0.13	0.11	0.08	0.06	0.04	0.04
I	1000	2.73	0.46	0.2	0.13	0.11	0.1	0.09	0.08	0.06	0.04	0.03	0.03
J	1500	1.64	0.32	0.13	0.08	0.07	0.07	0.06	0.05	0.04	0.03	0.02	0.02
K	2150	0.55	0.14	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01
L	3000	0	0	0	0	0	0	0	0	0	0	0	0
M	4500	0	0	0	0	0	0	0	0	0	0	0	0
N	6500	0	0	0	0	0	0	0	0	0	0	0	0
O	10000	0	0	0	0	0	0	0	0	0	0	0	0
P	15000	0	0	0	0	0	0	0	0	0	0	0	0
Q	25000	0	0	0	0	0	0	0	0	0	0	0	0
R	40000	0	0	0	0	0	0	0	0	0	0	0	0
S	60000	0	0	0	0	0	0	0	0	0	0	0	0

TIME INTERVAL = 15 MINUTESS
1-HR TO 6-HR RATIO FOR ISOHYET A AT 20000 SQ. MI. = 0.297

DEPTH VS. DURATION

ISOHYET	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	6HR	12HR	18HR	1DAY	30HR	36HR	42HR	2DAY	54HR	60HR	66HR	3DAY
A	1.64	3.28	4.91	9.45	15.08	18.85	21.85	27.29	31.84	33.88	35.17	36.28	37.29	38.18	38.95	39.53	39.97	40.28	40.54
B	0.32	0.63	0.95	1.9	3.8	7.51	10.93	17.47	20.38	21.7	22.54	23.27	23.92	24.5	25	25.38	25.66	25.87	26.03
C	0.24	0.48	0.71	1.43	2.85	5.63	8.2	13.1	15.29	16.26	16.88	17.42	17.9	18.33	18.69	18.97	19.18	19.34	19.46
D	0.19	0.38	0.56	1.13	2.25	4.45	6.48	10.37	12.15	12.94	13.44	13.88	14.27	14.62	14.92	15.14	15.31	15.44	15.54
E	0.15	0.3	0.45	0.89	1.78	3.52	5.13	8.19	9.55	10.16	10.55	10.89	11.19	11.46	11.68	11.86	11.99	12.09	12.16
F	0.12	0.24	0.36	0.71	1.42	2.82	4.1	6.55	7.64	8.13	8.44	8.71	8.95	9.16	9.35	9.49	9.59	9.67	9.73
G	0.09	0.19	0.28	0.56	1.12	2.22	3.24	5.19	6.1	6.5	6.76	6.98	7.19	7.36	7.52	7.63	7.72	7.78	7.84
H	0.07	0.14	0.21	0.42	0.83	1.64	2.39	3.82	4.46	4.74	4.92	5.08	5.22	5.35	5.45	5.53	5.6	5.64	5.68
I	0.05	0.1	0.15	0.3	0.59	1.17	1.71	2.73	3.18	3.39	3.52	3.63	3.73	3.82	3.89	3.95	4	4.03	4.05
J	0.03	0.06	0.09	0.18	0.35	0.7	1.02	1.64	1.96	2.09	2.17	2.24	2.31	2.37	2.42	2.46	2.48	2.5	2.52
K	0.01	0.02	0.03	0.06	0.12	0.23	0.33	0.55	0.68	0.74	0.78	0.82	0.85	0.87	0.9	0.91	0.93	0.94	0.94
L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

HYETOGRAPHS

31-Dec-19	1900	-	1915	0.01	1-Jan-20	1900	-	1915	0.04	2-Jan-20	1900	-	1915	0.04
31-Dec-19	1915	-	1930	0.01	1-Jan-20	1915	-	1930	0.04	2-Jan-20	1915	-	1930	0.04
31-Dec-19	1930	-	1945	0.01	1-Jan-20	1930	-	1945	0.04	2-Jan-20	1930	-	1945	0.04
31-Dec-19	1945	-	2000	0.01	1-Jan-20	1945	-	2000	0.05	2-Jan-20	1945	-	2000	0.04
31-Dec-19	2000	-	2015	0.01	1-Jan-20	2000	-	2015	0.05	2-Jan-20	2000	-	2015	0.04
31-Dec-19	2015	-	2030	0.01	1-Jan-20	2015	-	2030	0.05	2-Jan-20	2015	-	2030	0.04
31-Dec-19	2030	-	2045	0.01	1-Jan-20	2030	-	2045	0.05	2-Jan-20	2030	-	2045	0.04
31-Dec-19	2045	-	2100	0.01	1-Jan-20	2045	-	2100	0.05	2-Jan-20	2045	-	2100	0.04
31-Dec-19	2100	-	2115	0.01	1-Jan-20	2100	-	2115	0.05	2-Jan-20	2100	-	2115	0.04
31-Dec-19	2115	-	2130	0.01	1-Jan-20	2115	-	2130	0.05	2-Jan-20	2115	-	2130	0.04
31-Dec-19	2130	-	2145	0.01	1-Jan-20	2130	-	2145	0.05	2-Jan-20	2130	-	2145	0.04
31-Dec-19	2145	-	2200	0.01	1-Jan-20	2145	-	2200	0.05	2-Jan-20	2145	-	2200	0.04
31-Dec-19	2200	-	2215	0.01	1-Jan-20	2200	-	2215	0.05	2-Jan-20	2200	-	2215	0.04
31-Dec-19	2215	-	2230	0.01	1-Jan-20	2215	-	2230	0.05	2-Jan-20	2215	-	2230	0.04
31-Dec-19	2230	-	2245	0.01	1-Jan-20	2230	-	2245	0.05	2-Jan-20	2230	-	2245	0.04
31-Dec-19	2245	-	2300	0.01	1-Jan-20	2245	-	2300	0.05	2-Jan-20	2245	-	2300	0.04
31-Dec-19	2300	-	2315	0.01	1-Jan-20	2300	-	2315	0.05	2-Jan-20	2300	-	2315	0.04
31-Dec-19	2315	-	2330	0.01	1-Jan-20	2315	-	2330	0.06	2-Jan-20	2315	-	2330	0.04
31-Dec-19	2330	-	2345	0.01	1-Jan-20	2330	-	2345	0.06	2-Jan-20	2330	-	2345	0.04
31-Dec-19	2345	-	2400	0.01	1-Jan-20	2345	-	2400	0.06	2-Jan-20	2345	-	2400	0.04
1-Jan-20	0	-	2415	0.01	2-Jan-20	0	-	2415	0.06	3-Jan-20	0	-	2415	0.04
1-Jan-20	15	-	2430	0.01	2-Jan-20	15	-	2430	0.06	3-Jan-20	15	-	2430	0.04
1-Jan-20	30	-	2445	0.01	2-Jan-20	30	-	2445	0.06	3-Jan-20	30	-	2445	0.04
1-Jan-20	45	-	100	0.01	2-Jan-20	45	-	100	0.06	3-Jan-20	45	-	100	0.04
1-Jan-20	100	-	115	0.02	2-Jan-20	100	-	115	0.11	3-Jan-20	100	-	115	0.04
1-Jan-20	115	-	130	0.02	2-Jan-20	115	-	130	0.12	3-Jan-20	115	-	130	0.04
1-Jan-20	130	-	145	0.02	2-Jan-20	130	-	145	0.12	3-Jan-20	130	-	145	0.04
1-Jan-20	145	-	200	0.02	2-Jan-20	145	-	200	0.13	3-Jan-20	145	-	200	0.04
1-Jan-20	200	-	215	0.02	2-Jan-20	200	-	215	0.13	3-Jan-20	200	-	215	0.04
1-Jan-20	215	-	230	0.02	2-Jan-20	215	-	230	0.14	3-Jan-20	215	-	230	0.04
1-Jan-20	230	-	245	0.02	2-Jan-20	230	-	245	0.14	3-Jan-20	230	-	245	0.04
1-Jan-20	245	-	300	0.02	2-Jan-20	245	-	300	0.15	3-Jan-20	245	-	300	0.04
1-Jan-20	300	-	315	0.02	2-Jan-20	300	-	315	0.15	3-Jan-20	300	-	315	0.04
1-Jan-20	315	-	330	0.02	2-Jan-20	315	-	330	0.16	3-Jan-20	315	-	330	0.04
1-Jan-20	330	-	345	0.02	2-Jan-20	330	-	345	0.17	3-Jan-20	330	-	345	0.04
1-Jan-20	345	-	400	0.02	2-Jan-20	345	-	400	0.17	3-Jan-20	345	-	400	0.04
1-Jan-20	400	-	415	0.02	2-Jan-20	400	-	415	0.18	3-Jan-20	400	-	415	0.04
1-Jan-20	415	-	430	0.02	2-Jan-20	415	-	430	0.19	3-Jan-20	415	-	430	0.04
1-Jan-20	430	-	445	0.02	2-Jan-20	430	-	445	0.19	3-Jan-20	430	-	445	0.04
1-Jan-20	445	-	500	0.02	2-Jan-20	445	-	500	0.2	3-Jan-20	445	-	500	0.04
1-Jan-20	500	-	515	0.02	2-Jan-20	500	-	515	0.21	3-Jan-20	500	-	515	0.04
1-Jan-20	515	-	530	0.02	2-Jan-20	515	-	530	0.22	3-Jan-20	515	-	530	0.04
1-Jan-20	530	-	545	0.02	2-Jan-20	530	-	545	0.23	3-Jan-20	530	-	545	0.04
1-Jan-20	545	-	600	0.02	2-Jan-20	545	-	600	0.24	3-Jan-20	545	-	600	0.04
1-Jan-20	600	-	615	0.02	2-Jan-20	600	-	615	0.25	3-Jan-20	600	-	615	0.04
1-Jan-20	615	-	630	0.02	2-Jan-20	615	-	630	0.26	3-Jan-20	615	-	630	0.04
1-Jan-20	630	-	645	0.02	2-Jan-20	630	-	645	0.27	3-Jan-20	630	-	645	0.04
1-Jan-20	645	-	700	0.02	2-Jan-20	645	-	700	0.28	3-Jan-20	645	-	700	0.04
1-Jan-20	700	-	715	0.03	2-Jan-20	700	-	715	0.29	3-Jan-20	700	-	715	0.02
1-Jan-20	715	-	730	0.03	2-Jan-20	715	-	730	0.35	3-Jan-20	715	-	730	0.02
1-Jan-20	730	-	745	0.03	2-Jan-20	730	-	745	0.41	3-Jan-20	730	-	745	0.02
1-Jan-20	745	-	800	0.03	2-Jan-20	745	-	800	0.47	3-Jan-20	745	-	800	0.02

1-Jan-20	800	-	815	0.03	2-Jan-20	800	-	815	0.54	3-Jan-20	800	-	815	0.02
1-Jan-20	815	-	830	0.03	2-Jan-20	815	-	830	0.62	3-Jan-20	815	-	830	0.02
1-Jan-20	830	-	845	0.03	2-Jan-20	830	-	845	0.7	3-Jan-20	830	-	845	0.02
1-Jan-20	845	-	900	0.03	2-Jan-20	845	-	900	0.78	3-Jan-20	845	-	900	0.02
1-Jan-20	900	-	915	0.03	2-Jan-20	900	-	915	0.87	3-Jan-20	900	-	915	0.02
1-Jan-20	915	-	930	0.03	2-Jan-20	915	-	930	0.97	3-Jan-20	915	-	930	0.02
1-Jan-20	930	-	945	0.03	2-Jan-20	930	-	945	1.92	3-Jan-20	930	-	945	0.02
1-Jan-20	945	-	1000	0.03	2-Jan-20	945	-	1000	4.18	3-Jan-20	945	-	1000	0.02
1-Jan-20	1000	-	1015	0.03	2-Jan-20	1000	-	1015	4.5	3-Jan-20	1000	-	1015	0.02
1-Jan-20	1015	-	1030	0.03	2-Jan-20	1015	-	1030	3.32	3-Jan-20	1015	-	1030	0.02
1-Jan-20	1030	-	1045	0.03	2-Jan-20	1030	-	1045	1.01	3-Jan-20	1030	-	1045	0.02
1-Jan-20	1045	-	1100	0.03	2-Jan-20	1045	-	1100	0.92	3-Jan-20	1045	-	1100	0.02
1-Jan-20	1100	-	1115	0.03	2-Jan-20	1100	-	1115	0.83	3-Jan-20	1100	-	1115	0.02
1-Jan-20	1115	-	1130	0.03	2-Jan-20	1115	-	1130	0.74	3-Jan-20	1115	-	1130	0.02
1-Jan-20	1130	-	1145	0.03	2-Jan-20	1130	-	1145	0.65	3-Jan-20	1130	-	1145	0.02
1-Jan-20	1145	-	1200	0.03	2-Jan-20	1145	-	1200	0.58	3-Jan-20	1145	-	1200	0.02
1-Jan-20	1200	-	1215	0.03	2-Jan-20	1200	-	1215	0.51	3-Jan-20	1200	-	1215	0.02
1-Jan-20	1215	-	1230	0.03	2-Jan-20	1215	-	1230	0.44	3-Jan-20	1215	-	1230	0.02
1-Jan-20	1230	-	1245	0.03	2-Jan-20	1230	-	1245	0.38	3-Jan-20	1230	-	1245	0.02
1-Jan-20	1245	-	1300	0.03	2-Jan-20	1245	-	1300	0.32	3-Jan-20	1245	-	1300	0.02
1-Jan-20	1300	-	1315	0.04	2-Jan-20	1300	-	1315	0.11	3-Jan-20	1300	-	1315	0.01
1-Jan-20	1315	-	1330	0.04	2-Jan-20	1315	-	1330	0.11	3-Jan-20	1315	-	1330	0.01
1-Jan-20	1330	-	1345	0.04	2-Jan-20	1330	-	1345	0.1	3-Jan-20	1330	-	1345	0.01
1-Jan-20	1345	-	1400	0.04	2-Jan-20	1345	-	1400	0.1	3-Jan-20	1345	-	1400	0.01
1-Jan-20	1400	-	1415	0.04	2-Jan-20	1400	-	1415	0.1	3-Jan-20	1400	-	1415	0.01
1-Jan-20	1415	-	1430	0.04	2-Jan-20	1415	-	1430	0.09	3-Jan-20	1415	-	1430	0.01
1-Jan-20	1430	-	1445	0.04	2-Jan-20	1430	-	1445	0.09	3-Jan-20	1430	-	1445	0.01
1-Jan-20	1445	-	1500	0.04	2-Jan-20	1445	-	1500	0.09	3-Jan-20	1445	-	1500	0.01
1-Jan-20	1500	-	1515	0.04	2-Jan-20	1500	-	1515	0.09	3-Jan-20	1500	-	1515	0.01
1-Jan-20	1515	-	1530	0.04	2-Jan-20	1515	-	1530	0.08	3-Jan-20	1515	-	1530	0.01
1-Jan-20	1530	-	1545	0.04	2-Jan-20	1530	-	1545	0.08	3-Jan-20	1530	-	1545	0.01
1-Jan-20	1545	-	1600	0.04	2-Jan-20	1545	-	1600	0.08	3-Jan-20	1545	-	1600	0.01
1-Jan-20	1600	-	1615	0.04	2-Jan-20	1600	-	1615	0.08	3-Jan-20	1600	-	1615	0.01
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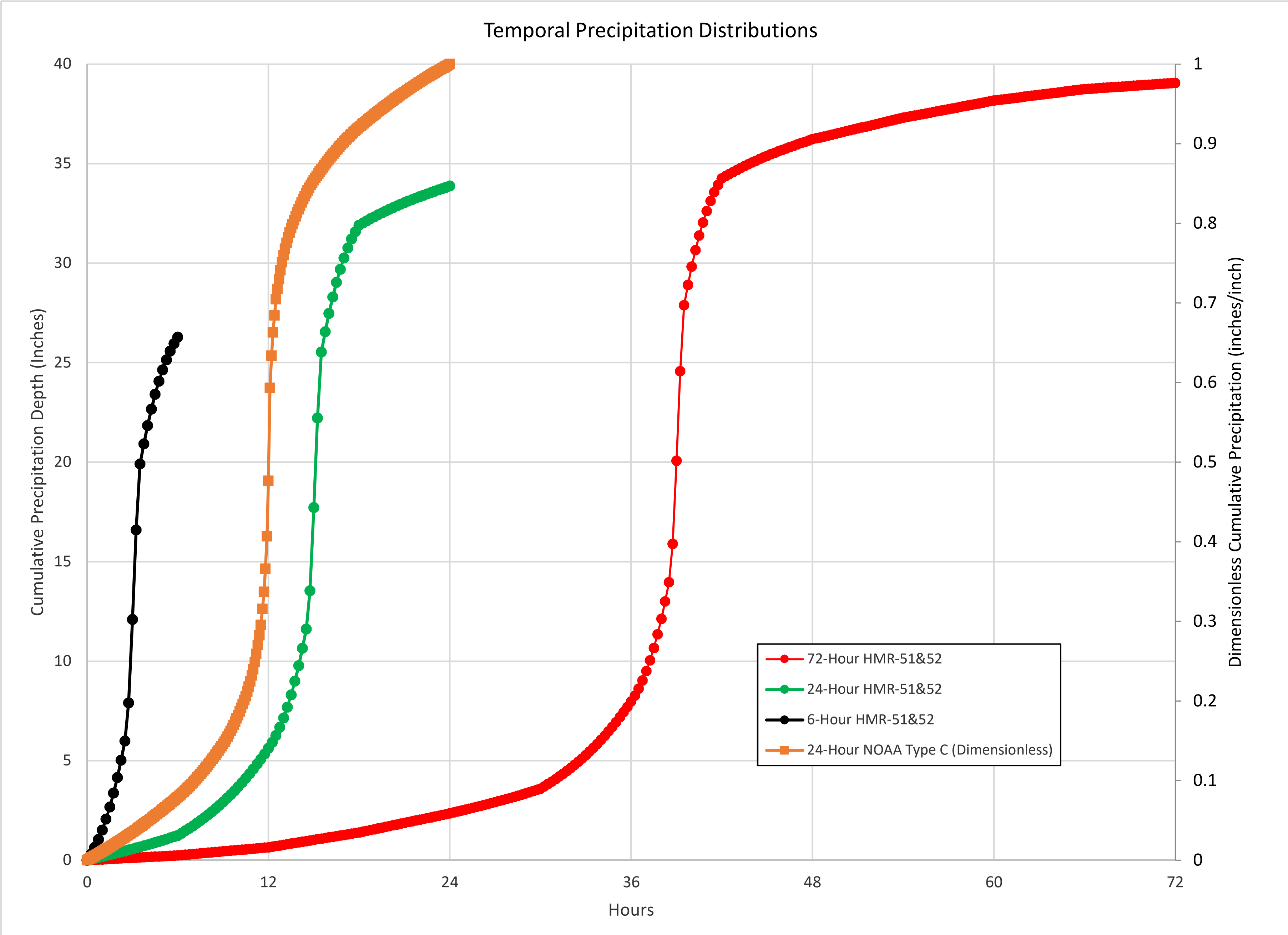
1-Jan-20	1630	-	1645	0.04	2-Jan-20	1630	-	1645	0.07	3-Jan-20	1630	-	1645	0.01
1-Jan-20	1645	-	1700	0.04	2-Jan-20	1645	-	1700	0.07	3-Jan-20	1645	-	1700	0.01
1-Jan-20	1700	-	1715	0.04	2-Jan-20	1700	-	1715	0.07	3-Jan-20	1700	-	1715	0.01
1-Jan-20	1715	-	1730	0.04	2-Jan-20	1715	-	1730	0.07	3-Jan-20	1715	-	1730	0.01
1-Jan-20	1730	-	1745	0.04	2-Jan-20	1730	-	1745	0.07	3-Jan-20	1730	-	1745	0.01
1-Jan-20	1745	-	1800	0.04	2-Jan-20	1745	-	1800	0.07	3-Jan-20	1745	-	1800	0.01
1-Jan-20	1800	-	1815	0.04	2-Jan-20	1800	-	1815	0.07	3-Jan-20	1800	-	1815	0.01
1-Jan-20	1815	-	1830	0.04	2-Jan-20	1815	-	1830	0.06	3-Jan-20	1815	-	1830	0.01
1-Jan-20	1830	-	1845	0.04	2-Jan-20	1830	-	1845	0.06	3-Jan-20	1830	-	1845	0.01
1-Jan-20	1845	-	1900	0.04	2-Jan-20	1845	-	1900	0.06	3-Jan-20	1845	-	1900	0.01



Temporal Precipitation Distributions
Cumulative Precipitation Depth (Inches)
Dimensionless Cumulative Precipitation (inches/inch)
Hours
0
12
24
36
48
60
72
0
5
10
15
20
25
30
35
40
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
72-Hour HMR-51&52
24-Hour HMR-51&52
6-Hour HMR-51&52
24-Hour NOAA Type C (Dimensionless)

United States Department of Agriculture

NRCS

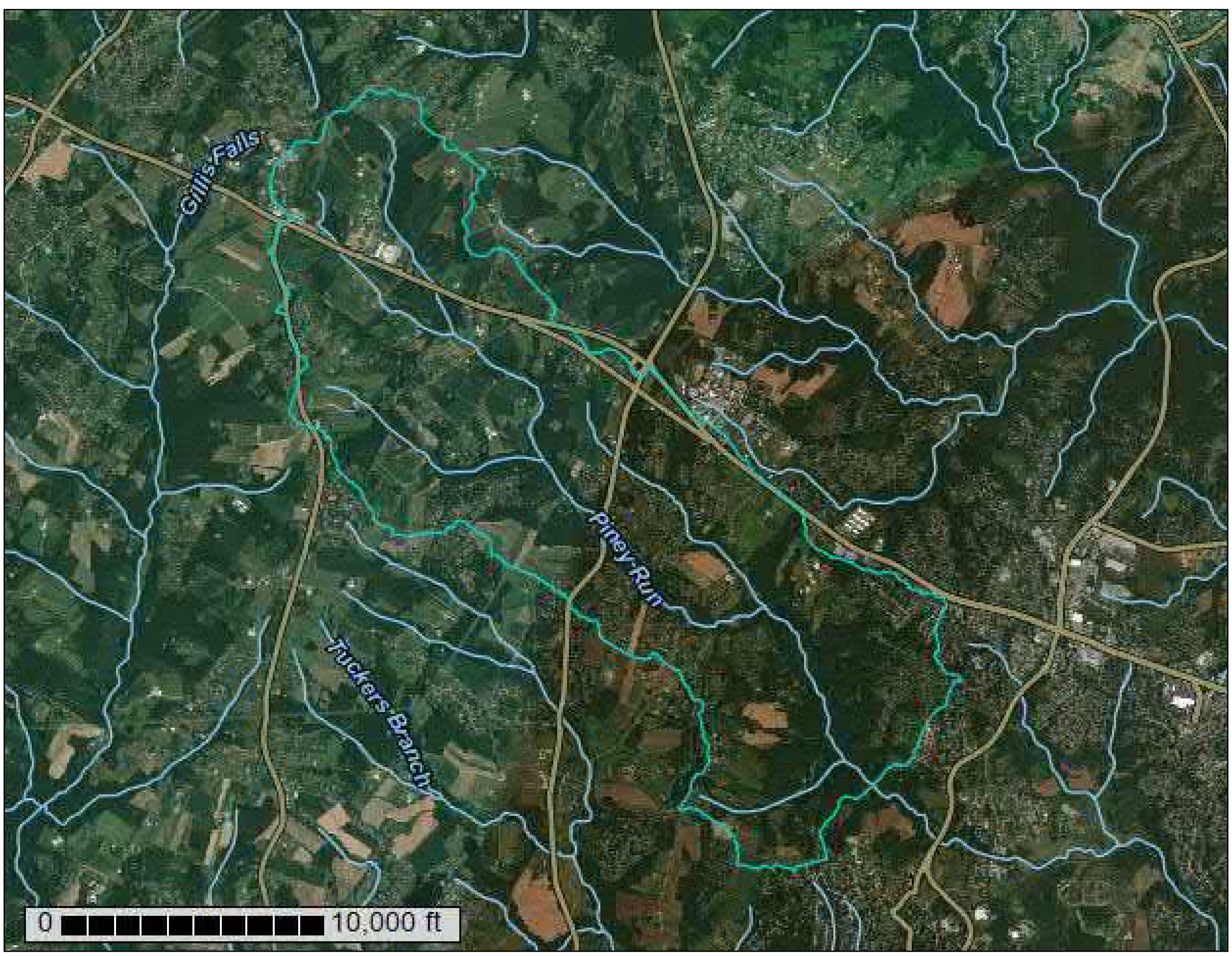
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Carroll County, Maryland

Piney Run Dam Watershed



January 10, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

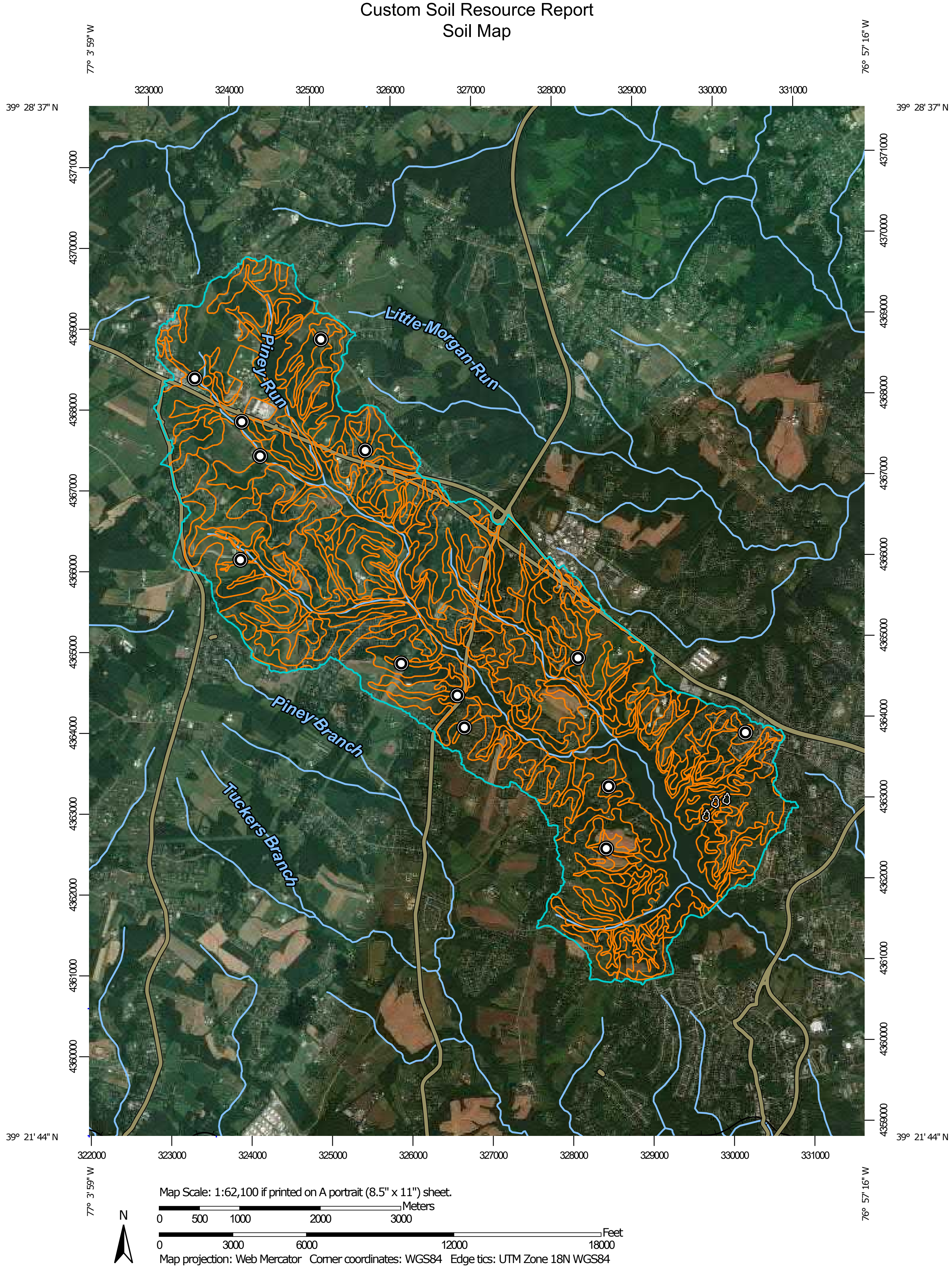
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


77° 3' 59" W
76° 57' 16" W
39° 28' 37" N
39° 21' 44" N
323000
324000
325000
326000
327000
328000
329000
330000
331000
322000
4371000
4370000
4369000
4368000
4367000
4366000
4365000
4364000
4363000
4362000
4361000
4360000
4359000
Little Morgan Run
Piney Run
Piney Branch
Tuckers Branch
Map Scale: 1:62,100 if printed on A portrait (8.5" x 11") sheet.
Meters
0
500
1000
2000
3000
Feet
0
3000
6000
12000
18000
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Carroll County, Maryland
Survey Area Data: Version 17, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 23, 2013—Jul 25, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BaA	Baile silt loam, 0 to 3 percent slopes	77.7	1.1%
BaB	Baile silt loam, 3 to 8 percent slopes	154.9	2.3%
BrB	Brinklow channery loam, 3 to 8 percent slopes	128.3	1.9%
BrC	Brinklow channery loam, 8 to 15 percent slopes	405.2	6.0%
BrD	Brinklow channery loam, 15 to 25 percent slopes	452.0	6.7%
BrE	Brinklow channery loam, 25 to 45 percent slopes	88.3	1.3%
CdA	Codorus silt loam, 0 to 3 percent slopes	49.5	0.7%
DAM	Dams, concrete	2.0	0.0%
DeB	Delanco silt loam, 3 to 8 percent slopes	3.0	0.0%
EsB	Elsinboro silt loam, 3 to 8 percent slopes	4.7	0.1%
GaC	Gaila loam, 8 to 15 percent slopes	40.9	0.6%
GaD	Gaila loam, 15 to 25 percent slopes	3.5	0.1%
GbC	Gaila channery loam, 8 to 15 percent slopes	90.9	1.3%
GdA	Glenelg loam, 0 to 3 percent slopes	11.2	0.2%
GdB	Glenelg loam, 3 to 8 percent slopes	1,343.7	19.9%
GdC	Glenelg loam, 8 to 15 percent slopes	514.4	7.6%
GeB	Glenelg channery loam, 3 to 8 percent slopes	739.9	10.9%
GeC	Glenelg channery loam, 8 to 15 percent slopes	306.4	4.5%
GfB	Glenelg-Urban land complex, 0 to 8 percent slopes	130.0	1.9%
GfC	Glenelg-Urban land complex, 8 to 15 percent slopes	30.0	0.4%
GhA	Glenville silt loam, 0 to 3 percent slopes	3.9	0.1%
GhB	Glenville silt loam, 3 to 8 percent slopes	440.4	6.5%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GhC	Glenville silt loam, 8 to 15 percent slopes	39.6	0.6%
GkB	Glenville-Urban land-Udorthents complex, 0 to 8 percent slopes	15.8	0.2%
HaA	Hatboro silt loam, 0 to 3 percent slopes	226.8	3.4%
MaB	Manor loam, 3 to 8 percent slopes	110.5	1.6%
MaC	Manor loam, 8 to 15 percent slopes	750.1	11.1%
MaD	Manor loam, 15 to 25 percent slopes	135.6	2.0%
MaF	Manor loam, 25 to 65 percent slopes	20.6	0.3%
UrB	Urban land-Udorthents complex, 0 to 8 percent slopes	35.8	0.5%
W	Water	312.1	4.6%
WhB	Wheaton-Glenelg complex, 0 to 8 percent slopes	85.5	1.3%
WhC	Wheaton-Glenelg complex, 8 to 15 percent slopes	9.3	0.1%
Totals for Area of Interest		**6,762.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Carroll County, Maryland

BaA—Baile silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2pqrv
Elevation: 250 to 980 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 120 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Baile and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baile

Setting

Landform: Depressions, hillslopes, drainageways, swales
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave, linear

Typical profile

A - 0 to 9 inches: silt loam
Btg - 9 to 32 inches: silty clay loam
Cg - 32 to 65 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 15 percent
Landform: Drainageways, swales
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear

Hydric soil rating: No

BaB—Baile silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2pqrw
Elevation: 250 to 980 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 120 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Baile and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baile

Setting

Landform: Depressions, swales, drainageways, hillslopes
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave, linear

Typical profile

A - 0 to 9 inches: silt loam
Btg - 9 to 32 inches: silty clay loam
Cg - 32 to 65 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 15 percent
Landform: Drainageways, swales
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

BrB—Brinklow channery loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v7h6
Elevation: 410 to 800 feet
Mean annual precipitation: 40 to 53 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 170 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Brinklow and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brinklow

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from schist and/or phyllite

Typical profile

Ap - 0 to 10 inches: channery loam
Bt - 10 to 19 inches: channery silt loam
BC - 19 to 25 inches: channery loam
Cr - 25 to 35 inches: bedrock
R - 35 to 80 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 30 inches to paralithic bedrock; 30 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Glenelg
Percent of map unit: 15 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

BrC—Brinklow channery loam, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2v7gg
Elevation: 30 to 1,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Brinklow and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brinklow

Setting
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly residuum weathered from phyllite and/or gravelly residuum weathered from schist

Typical profile
Ap - 0 to 10 inches: channery loam
Bt - 10 to 19 inches: channery silt loam
BC - 19 to 25 inches: channery loam

Cr - 25 to 35 inches: weathered bedrock
R - 35 to 45 inches: bedrock

Properties and qualities
Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 36 inches to paralithic bedrock; 28 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Glenelg
Percent of map unit: 15 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear
Across-slope shape: Concave, convex, linear
Hydric soil rating: No

BrD—Brinklow channery loam, 15 to 25 percent slopes

Map Unit Setting
National map unit symbol: 2v7gf
Elevation: 250 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: Not prime farmland

Map Unit Composition
Brinklow and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brinklow

Setting
Landform: Hillslopes

Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly residuum weathered from phyllite and/or gravelly residuum weathered from schist

Typical profile
Ap - 0 to 10 inches: channery loam
Bt - 10 to 19 inches: channery silt loam
BC - 19 to 25 inches: channery loam
Cr - 25 to 35 inches: bedrock
R - 35 to 45 inches: bedrock

Properties and qualities
Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 36 inches to paralithic bedrock; 28 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Glenelg
Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Blocktown
Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

BrE—Brinklow channery loam, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 2v7h7
Elevation: 410 to 800 feet
Mean annual precipitation: 40 to 53 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 170 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Brinklow and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brinklow

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly residuum weathered from phyllite and/or gravelly residuum weathered from schist

Typical profile

Ap - 0 to 10 inches: channery loam
Bt - 10 to 19 inches: channery silt loam
BC - 19 to 25 inches: channery loam
Cr - 25 to 35 inches: bedrock
R - 35 to 80 inches: bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 20 to 30 inches to paralithic bedrock; 30 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Manor

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

CdA—Codorus silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2ptj9
Elevation: 200 to 600 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Codorus and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Codorus

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from phyllite, schist, diabase and/or greenstone

Typical profile

Ap - 0 to 11 inches: silt loam
Bw1 - 11 to 18 inches: silt loam
Bw2 - 18 to 40 inches: gravelly silt loam
2C - 40 to 60 inches: stratified sand to very gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Hatboro

Percent of map unit: 15 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

DAM—Dams, concrete

Map Unit Setting

National map unit symbol: 2ptjh
Elevation: 160 to 300 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Dams, : 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dams,

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D

Hydric soil rating: No

DeB—Delanco silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2ptjk
Elevation: 0 to 1,050 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 48 to 61 degrees F
Frost-free period: 110 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Delanco and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Delanco

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, concave
Across-slope shape: Convex, linear
Parent material: Loamy alluvium derived from igneous and metamorphic rock

Typical profile

Ap - 0 to 13 inches: silt loam
BE - 13 to 26 inches: silt loam
Bt1 - 26 to 33 inches: silty clay loam
Bt2 - 33 to 43 inches: silt loam
2BC - 43 to 72 inches: stratified loamy sand to sandy clay loam
2C - 72 to 79 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.13 to 0.71 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Elsinboro

Percent of map unit: 15 percent
Landform: Terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Hydric soil rating: No

EsB—Elsinboro silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2ptjp
Elevation: 0 to 1,050 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 48 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Elsinboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elsinboro

Setting

Landform: Terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Parent material: Loamy alluvium derived from phyllite and/or loamy alluvium derived from mica schist and/or loamy alluvium derived from quartzite

Typical profile

Ap - 0 to 9 inches: silt loam
Bt, BC - 9 to 37 inches: silt loam
C1-2 - 37 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Delanco

Percent of map unit: 10 percent
Landform: Stream terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, concave
Across-slope shape: Convex, linear

Glenelg

Percent of map unit: 5 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GaC—Gaila loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2ptjw
Elevation: 250 to 1,050 feet
Mean annual precipitation: 37 to 46 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 145 to 255 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gaila and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gaila

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from quartz muscovite schist

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 17 inches: loam
BC - 17 to 20 inches: sandy loam
C - 20 to 76 inches: sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Manor

Percent of map unit: 15 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GaD—Gaila loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2ptjx
Elevation: 250 to 1,050 feet
Mean annual precipitation: 37 to 46 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 145 to 255 days
Farmland classification: Not prime farmland

Map Unit Composition

Gaila and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gaila

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from quartz muscovite schist

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 17 inches: loam
BC - 17 to 20 inches: sandy loam
C - 20 to 76 inches: sandy loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Manor

Percent of map unit: 15 percent
Landform: Ridges, hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GbC—Gaila channery loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2ptjt
Elevation: 250 to 1,050 feet

Mean annual precipitation: 37 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 110 to 255 days
Farmland classification: Not prime farmland

Map Unit Composition

Gaila and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gaila

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from quartz muscovite schist

Typical profile

Ap - 0 to 8 inches: channery loam
Bt - 8 to 17 inches: loam
BC - 17 to 20 inches: sandy loam
C - 20 to 76 inches: sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Glenelg

Percent of map unit: 10 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Manor

Percent of map unit: 5 percent

Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GdA—Glenelg loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2w062
Elevation: 30 to 1,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenelg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex, linear, concave
Parent material: Residuum weathered from mica schist

Typical profile

Ap1 - 0 to 6 inches: loam
Ap2 - 6 to 10 inches: clay loam
Bt1 - 10 to 18 inches: clay loam
Bt2 - 18 to 25 inches: clay loam
Bt3 - 25 to 30 inches: clay loam
BCt - 30 to 42 inches: loam
CBt - 42 to 54 inches: loam
C - 54 to 76 inches: very channery fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, interfluve
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

GdB—Glenelg loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v7gp
Elevation: 30 to 1,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenelg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope

Down-slope shape: Linear
Across-slope shape: Convex, linear, concave
Parent material: Residuum weathered from mica schist

Typical profile

Ap1 - 0 to 6 inches: loam
Ap2 - 6 to 10 inches: clay loam
Bt1 - 10 to 18 inches: clay loam
Bt2 - 18 to 25 inches: clay loam
Bt3 - 25 to 30 inches: clay loam
BCt - 30 to 42 inches: loam
CBt - 42 to 54 inches: loam
C - 54 to 76 inches: channery fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gaila

Percent of map unit: 10 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

GdC—Glenelg loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2v7gq
Elevation: 30 to 1,050 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Glenelg and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear, convex, concave
Parent material: Residuum weathered from mica schist

Typical profile

Ap1 - 0 to 6 inches: loam
Ap2 - 6 to 10 inches: clay loam
Bt1 - 10 to 18 inches: clay loam
Bt2 - 18 to 25 inches: clay loam
Bt3 - 25 to 30 inches: clay loam
BCt - 30 to 42 inches: loam
CBt - 42 to 54 inches: loam
C - 54 to 76 inches: channery fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 10 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

GeB—Glenelg channery loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tt7v
Elevation: 20 to 1,260 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenelg and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear, concave, convex
Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 10 inches: channery loam
Bt1 - 10 to 25 inches: loam
Bt2 - 25 to 30 inches: loam
BCt - 30 to 54 inches: channery loam
C - 54 to 76 inches: very channery sandy loam
Cr - 76 to 94 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 56 to 98 inches to paralithic bedrock
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gladstone

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear, concave, convex
Hydric soil rating: No

Brinklow

Percent of map unit: 5 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Swales, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

GeC—Glenelg channery loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2ptk2
Elevation: 250 to 1,050 feet
Mean annual precipitation: 37 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 110 to 255 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Glenelg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 10 inches: channery loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gaila

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Manor

Percent of map unit: 5 percent
Landform: Hillslopes, ridges, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GfB—Glenelg-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2ptk6
Elevation: 250 to 1,050 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Glenelg and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 10 inches: loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam

C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Udorthents

Percent of map unit: 15 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, nose slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

GfC—Glenelg-Urban land complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2ptk7
Elevation: 250 to 1,050 feet
Mean annual precipitation: 37 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Glenelg and similar soils: 45 percent
Urban land: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Typical profile

Ap - 0 to 10 inches: loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Udorthents

Percent of map unit: 15 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, nose slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Manor

Percent of map unit: 10 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GhA—Glenville silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2ptk8
Elevation: 250 to 1,050 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 110 to 235 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenville

Setting

Landform: Drainageways, swales
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy colluvium derived from phyllite and/or loamy colluvium derived from schist

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1, Bt2 - 8 to 30 inches: silt loam
Btx - 30 to 40 inches: loam
C1, C2 - 40 to 70 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 24 to 39 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Baile

Percent of map unit: 10 percent
Landform: Hillslopes, swales, depressions, drainageways
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Glenelg

Percent of map unit: 5 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GhB—Glenville silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tmch
Elevation: 20 to 1,090 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenville and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenville

Setting

Landform: Drainageways, swales
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Parent material: Colluvium derived from metamorphic rock over schist, gneiss or phyllite residuum

Typical profile

Ap - 0 to 11 inches: silt loam
Bt1 - 11 to 20 inches: channery silt loam
Bt2 - 20 to 30 inches: silt loam
Btx - 30 to 40 inches: silt loam
C1 - 40 to 59 inches: loam
C2 - 59 to 82 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 29 to 31 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.03 to 0.11 in/hr)
Depth to water table: About 18 to 22 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D

Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 15 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Baile

Percent of map unit: 10 percent
Landform: Drainageways, swales
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: Yes

GhC—Glenville silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2ptkb
Elevation: 250 to 1,050 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Glenville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenville

Setting

Landform: Drainageways, swales
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy colluvium derived from phyllite and/or loamy colluvium derived from schist

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1, Bt2 - 8 to 30 inches: silt loam
Btx - 30 to 40 inches: loam

C1, C2 - 40 to 70 inches: loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 24 to 39 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Glenelg

Percent of map unit: 15 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GkB—Glenville-Urban land-Udorthents complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2ptkc
Elevation: 250 to 1,050 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Glenville and similar soils: 45 percent
Urban land: 35 percent
Udorthents and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenville

Setting

Landform: Drainageways, swales

Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear

Typical profile
Ap - 0 to 8 inches: silt loam
Bt1, Bt2 - 8 to 30 inches: silt loam
Btx - 30 to 40 inches: loam
C1, C2 - 40 to 70 inches: loam

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: 24 to 39 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Urban Land

Setting
Parent material: Human transported material

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Udorthents

Setting
Landform: Ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, nose slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Graded areas of schist and/or gneiss

Typical profile
A - 0 to 3 inches: silt loam
C - 3 to 40 inches: gravelly silt loam
2C - 40 to 65 inches: gravelly silt loam
R - 65 to 80 inches: bedrock

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: 40 to 72 inches to paralithic bedrock

Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

HaA—Hatboro silt loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2ptkd
Elevation: 200 to 600 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Hatboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hatboro

Setting
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy alluvium derived from greenstone, quartzite, phyllite, schist and/or diabase

Typical profile
A - 0 to 11 inches: silt loam
Bg1,Bg2,BCg - 11 to 44 inches: silt loam
Cg1 - 44 to 55 inches: silty clay loam
Cg2 - 55 to 60 inches: sandy loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.4 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Codorus
Percent of map unit: 15 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

MaB—Manor loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2ptmp
Elevation: 250 to 1,050 feet
Mean annual precipitation: 37 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 255 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Manor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Setting
Landform: Interfluves, hillslopes, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum derived from phyllite and/or loamy residuum derived from schist

Typical profile
A1, A2 - 0 to 6 inches: loam
Bw1, Bw2 - 6 to 22 inches: sandy loam

C1,C2,C3,C4 - 22 to 72 inches: channery loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gaila

Percent of map unit: 10 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Glenelg

Percent of map unit: 5 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

MaC—Manor loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2tkpw
Elevation: 50 to 1,080 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Manor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mica schist

Typical profile

A1 - 0 to 2 inches: loam
A2 - 2 to 6 inches: sandy loam
Bw1 - 6 to 13 inches: fine sandy loam
Bw2 - 13 to 22 inches: fine sandy loam
C1 - 22 to 30 inches: fine sandy loam
C2 - 30 to 44 inches: channery coarse sand
C3 - 44 to 53 inches: loamy sand
C4 - 53 to 83 inches: channery loamy sand
Cr - 83 to 108 inches: bedrock
R - 108 to 138 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: 59 to 100 inches to paralithic bedrock; 100 to 128 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.07 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Mt. airy

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Swales, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope, interfluve, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

MaD—Manor loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2tmcg
Elevation: 250 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: Not prime farmland

Map Unit Composition

Manor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mica schist

Typical profile

A1 - 0 to 2 inches: loam
A2 - 2 to 6 inches: sandy loam
Bw1 - 6 to 13 inches: fine sandy loam
Bw2 - 13 to 22 inches: fine sandy loam
C1 - 22 to 30 inches: fine sandy loam
C2 - 30 to 44 inches: channery coarse sand

C3 - 44 to 53 inches: loamy sand
C4 - 53 to 83 inches: channery loamy sand
Cr - 83 to 108 inches: bedrock
R - 108 to 138 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: 59 to 100 inches to paralithic bedrock; 100 to 128 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.07 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Mt. airy

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Swales, drainageways
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

MaF—Manor loam, 25 to 65 percent slopes

Map Unit Setting

National map unit symbol: 2ptms
Elevation: 250 to 1,050 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 145 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Manor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum derived from phyllite and/or loamy residuum derived from schist

Typical profile

A1, A2 - 0 to 6 inches: loam
Bw1, Bw2 - 6 to 22 inches: sandy loam
C1,C2,C3,C4 - 22 to 72 inches: channery loamy sand

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 15 percent
Landform: Hillslopes, hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Free face, side slope
Hydric soil rating: No

UrB—Urban land-Udorthents complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2pv67
Elevation: 250 to 1,050 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Udorthents and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Udorthents

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, nose slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Graded areas of schist and/or gneiss

Typical profile

A - 0 to 3 inches: silt loam
C - 3 to 40 inches: gravelly silt loam
2C - 40 to 65 inches: gravelly silt loam
R - 65 to 80 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 40 to 72 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WhB—Wheaton-Glenelg complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2pv69
Elevation: 250 to 2,000 feet
Mean annual precipitation: 37 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wheaton and similar soils: 60 percent
Glenelg and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheaton

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 6 inches: loam
C1,C2,C3,C4 - 6 to 68 inches: loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Glenelg

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 10 inches: loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

WhC—Wheaton-Glenelg complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2pqs8
Elevation: 300 to 2,000 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheaton and similar soils: 60 percent
Glenelg and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheaton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 6 inches: silt loam
C1,C2,C3,C4 - 6 to 68 inches: channery loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Glenelg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 10 inches: loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

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AECOM

Exsiting Conditions CN Composite Summary

Project: Piney Run Dam - Watershed By: JBB Date: 1/2/2020

Location: Carroll County, Maryland Checked: WCH Date: 1/14/2020

Drainage Area = **6761** acres = **10.56** mi^2

Hydrologic Soil Group	Land Cover Description	Curve Number	Area (acres)	% of Area	CN x Area
B	Open Space Good	61	258.7	3.8%	15,781
C	Open Space Good	74	27.1	0.4%	2,005
D	Open Space Good	80	48.9	0.7%	3,912
B/C/D	Open Water	100	297.1	4.4%	29,710
B	Roads - Open Section	89	61.0	0.9%	5,429
C	Roads - Open Section	92	15.2	0.2%	1,398
D	Roads - Open Section	93	10.6	0.2%	986
B	Commercial	92	21.2	0.3%	1,950
D	Commercial	95	7.5	0.1%	713
B	Industrial	88	32.8	0.5%	2,886
C	Industrial	91	4.8	0.1%	437
D	Industrial	93	23.9	0.4%	2,223
B	1/4 Acre Residential	75	0.8	0.0%	60
B	1/2 Acre Residential	70	143.1	2.1%	10,017
C	1/2 Acre Residential	80	34.6	0.5%	2,768
D	1/2 Acre Residential	85	9.9	0.1%	842
B	1 Acre Residential	68	497.6	7.4%	33,837
C	1 Acre Residential	79	92.0	1.4%	7,268
D	1 Acre Residential	84	48.7	0.7%	4,091
B	2 Acre Residential	65	220.8	3.3%	14,352
C	2 Acre Residential	77	28.6	0.4%	2,202
D	2 Acre Residential	82	19.4	0.3%	1,591
B	3 Acre Residential	65	687.6	10.2%	44,694
C	3 Acre Residential	76	51.8	0.8%	3,937
D	3 Acre Residential	82	69.4	1.0%	5,691
B	3 Acre Residential - Wooded	59	9.5	0.1%	561
C	3 Acre Residential - Wooded	73	66.0	1.0%	4,818
D	3 Acre Residential - Wooded	79	12.2	0.2%	964
B	4 Acre Residential	64	229.5	3.4%	14,688
C	4 Acre Residential	76	12.9	0.2%	980
D	4 Acre Residential	81	18.1	0.3%	1,466
B	5 Acre Residential	64	62.1	0.9%	3,974
C	5 Acre Residential	76	20.2	0.3%	1,535
D	5 Acre Residential	81	8.0	0.1%	648
B	6 Acre Residential - Wooded	58	38.9	0.6%	2,256
C	6 Acre Residential - Wooded	72	6.2	0.1%	446
D	6 Acre Residential - Wooded	78	7.4	0.1%	577
B	7 Acre Residential	63	11.5	0.2%	725
C	7 Acre Residential	75	6.3	0.1%	473
D	7 Acre Residential	81	8.4	0.1%	680
B	8 Acre Residential	63	6.9	0.1%	435
D	8 Acre Residential	81	0.3	0.0%	24
B	Row (SR) - Good	78	1075.3	15.9%	83,873
C	Row (SR) - Good	85	269.9	4.0%	22,942
D	Row (SR) - Good	89	171.3	2.5%	15,246
B	Row (Contoured) - Good	75	0.9	0.0%	68
C	Row (Contoured) - Good	82	30.1	0.4%	2,468

D	Row (Contoured) - Good	86	13.3	0.2%	1,144
B	Farmstead	74	103.4	1.5%	7,652
C	Farmstead	82	41.0	0.6%	3,362
D	Farmstead	86	20.6	0.3%	1,772
B	Pasture - Good	61	42.7	0.6%	2,605
C	Pasture - Good	74	38.9	0.6%	2,879
D	Pasture - Good	80	4.3	0.1%	344
B	Meadow - Good	58	32.8	0.5%	1,902
C	Meadow - Good	71	2.4	0.0%	170
D	Meadow - Good	78	7.5	0.1%	585
B	Brush Mix - Good	48	2.4	0.0%	115
D	Brush Mix - Good	73	2.0	0.0%	146
B	Woods/Grass Mix - Good	58	36.8	0.5%	2,134
C	Woods/Grass Mix - Good	72	11.1	0.2%	799
D	Woods/Grass Mix - Good	79	35.1	0.5%	2,773
B	Woods - Good	55	746.5	11.0%	41,058
C	Woods - Good	70	423.1	6.3%	29,617
D	Woods - Good	77	411.7	6.1%	31,701
		Totals	6,760.6	100.0%	489,383
		Composite CN	**72**		

AECOM

Ultimate Conditions CN Composite Summary

Project: Piney Run Dam - Watershed — By: JBB — Date: 1/2/2020

Location: Carroll County, Maryland — Checked: WCH — Date: 1/14/2020

Drainage Area = **6761** acres = **10.56** mi^2

Hydrologic Soil Group	Land Cover Description	Curve Number	Area (acres)	% of Area	CN x Area
B	Open Space Good	61	2105.1	31.1%	128,411
C	Open Space Good	74	417.5	6.2%	30,895
D	Open Space Good	80	492.0	7.3%	39,360
B/C/D	Open Water	100	297.1	4.4%	29,710
B	Commercial	92	54.8	0.8%	5,042
C	Commercial	94	5.8	0.1%	545
D	Commercial	95	9.0	0.1%	855
B	Industrial	88	0.9	0.0%	79
D	Industrial	93	3.9	0.1%	363
B	1/4 Acre Residential	75	9.0	0.1%	675
B	1/2 Acre Residential	70	218.3	3.2%	15,281
C	1/2 Acre Residential	80	31.0	0.5%	2,480
D	1/2 Acre Residential	85	13.2	0.2%	1,122
B	1 Acre Residential	68	219.8	3.3%	14,946
C	1 Acre Residential	79	106.1	1.6%	8,382
D	1 Acre Residential	84	43.6	0.6%	3,662
B	Row (SR) - Good	78	1717.6	25.4%	133,973
C	Row (SR) - Good	85	624.2	9.2%	53,057
D	Row (SR) - Good	89	391.7	5.8%	34,861
	Totals		6,760.6	100.0%	503,700
	Composite CN		**75**		

Existing Conditions Time of Concentration Summary

Project:	Piney Run Dam	By: JBB	Date: 1/2/2020
		Checked: WCH	Date: 1/14/2020
Location:	Carroll County, Maryland		

Sheet Flow Properties

Segment ID		SH-1
1. Surface description		Dense Grasses
2. Manning's roughness coefficient, n (NRCS NEH,Table 15-1)		0.240
3. Flow length, L (ft)		100
4. Two-year 24-hour rainfall, P2 (in) (NOAA HDSC PFDS)		3.20
5. Land slope, s (ft/ft)		0.01600
$T_t = \frac{0.007\,(nL)^{0.8}}{(P2)^{0.5}(s)^{0.4}}$	$T_t =$	0.26 hours

Shallow Concentrated Flow Properties

	SC-1	SC-2
Segment ID	SC-1	SC-2
6. Surface description (NRCS NEH, Table 15-3)	Forest with heavy ground litter and hay meadows	Cultivated straight row crops
7. Flow length, L (ft)	638	736
8. Watercourse slope, s (ft/ft)	0.05800	0.03400
9. Average velocity, V (NRCS NEH, Table 15-3)	0.606	1.616
	V=2.516(s)^0.5	V=8.762(s)^0.5
$T_t = \frac{L}{3600V}$ $T_t =$	0.29 hours	0.13 hours

Open Channel Flow Properties

	CH-1	CH-2
Segment ID	CH-1	CH-2
10. Cross sectional area, A (sq ft)	90.0	150.0
11. Wetted perimeter, P (ft)	110.0	105.0
12. Hydraulic radius, r = A/P (ft)	0.82	1.43
13. Channel slope, s (ft/ft)	0.0135	0.0071
14. Manning's roughness coefficient, n	0.040	0.040
15. Velocity, V (ft/sec)	3.79	3.98
$V = \frac{1.49(r^{2/3})(s^{1/2})}{n}$		
16. Flow length, L (ft)	7150	22320
$T_t = \frac{L}{3600V}$ Tt =	0.52 hours	1.56 hours

Wave Velocity of Reservoir

Surface Area (ac)			290	
Volume (ac-ft)			5560	
Average Depth (ft)			19.2	
Reservoir Length (ft)			9919	
Wave Velocity (ft/s)	Vw =	$(gD)^{1/2}$	24.85	
		Tt =	0.11	hours

Results

Total Flowpath Length =	**40,863**	**feet**			
Time of Concentration =	**2.87**	**hours**	**=**	**172.3**	**minutes**
Lag Time (0.6*Tc) =	**1.72**	**hours**	**=**	**103.4**	**minutes**

AECOM

Ultimate Conditions Time of Concentration Summary

Project:	Piney Run Dam	By:	JBB	Date:	1/9/2020
		Checked:	WCH	Date:	1/14/2020
Location:	Carroll County, Maryland				

Sheet Flow Properties

	Segment ID	SH-1
1. Surface description		Cultivated Soils (residue cover < 20%)
2. Manning's roughness coefficient, n (NRCS NEH,Table 15-1)		0.060
3. Flow length, L (ft)		100
4. Two-year 24-hour rainfall, P2 (in) (NOAA HDSC PFDS)		3.20
5. Land slope, s (ft/ft)		0.01600

$$T_t = \frac{0.007\,(nL)^{0.8}}{(P2)^{0.5}(s)^{0.4}}$$

T_t = 0.09 hours

Shallow Concentrated Flow Properties

	Segment ID	SC-1	SC-2
6. Surface description (NRCS NEH, Table 15-3)		Cultivated straight row crops	Cultivated straight row crops
7. Flow length, L (ft)		638	736
8. Watercourse slope, s (ft/ft)		0.05800	0.03400
9. Average velocity, V (NRCS NEH, Table 15-3)		2.110	1.616
		V=8.762(s)^0.5	V=8.762(s)^0.5
$T_t = \frac{L}{3600V}$	T_t =	0.08 hours	0.13 hours

Open Channel Flow Properties

	Segment ID	CH-1	CH-2
10. Cross sectional area, A (sq ft)		90.0	150.0
11. Wetted perimeter, P (ft)		110.0	105.0
12. Hydraulic radius, r = A/P (ft)		0.82	1.43
13. Channel slope, s (ft/ft)		0.0135	0.0071
14. Manning's roughness coefficient, n		0.040	0.040
15. Velocity, V (ft/sec)		3.79	3.98

$$V = \frac{1.49(r^{2/3})(s^{1/2})}{n}$$

16. Flow length, L (ft)		7150	22320
$T_t = \frac{L}{3600V}$	Tt =	0.52 hours	1.56 hours

Wave Velocity of Reservoir				
Surface Area (ac)			290	
Volume (ac-ft)			5560	
Average Depth (ft)			19.2	
Reservoir Length (ft)			9919	
Wave Velocity (ft/s)	Vw =	$(gD)^{1/2}$	24.85	
		Tt =	0.11	hours

Results					
Total Flowpath Length =	**40,863**	**feet**			
Time of Concentration =	**2.49**	**hours**	**=**	**149.3**	**minutes**
Lag Time (0.6*Tc) =	**1.49**	**hours**	**=**	**89.6**	**minutes**

Piney Run No Gage

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
Piney Run
REGION: Blue Ridge & Piedmont
area= 10.56:lime = 0.00:forest = 23.50 :Impervious Area= 10.40 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	593.	44.6	2.66	0.1851
1.50	760.	41.2	2.74	0.1720
2.00	1010.	37.8	3.42	0.1588
5.00	1870.	32.1	8.55	0.1360
10.00	2680.	29.8	14.78	0.1267
25.00	4050.	28.8	24.00	0.1226
50.00	5360.	30.0	28.65	0.1275
100.00	6970.	32.0	31.43	0.1357
200.00	8650.	36.0	32.16	0.1514
500.00	11900.	42.3	29.59	0.1761

P R E D I C T I O N   I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	446.	789.	387.	908.	295.	1190.	257.	1370.
1.50	583.	991.	511.	1130.	397.	1450.	350.	1650.
2.00	788.	1290.	698.	1450.	553.	1830.	492.	2060.
5.00	1510.	2300.	1370.	2560.	1120.	3120.	1010.	3450.
10.00	2200.	3260.	2000.	3590.	1660.	4320.	1510.	4750.
25.00	3350.	4900.	3060.	5370.	2550.	6440.	2330.	7050.
50.00	4410.	6530.	4000.	7190.	3310.	8680.	3020.	9530.
100.00	5650.	8590.	5100.	9520.	4170.	11600.	3780.	12900.
200.00	6850.	10900.	6110.	12300.	4890.	15300.	4370.	17100.
500.00	9050.	15600.	7920.	17800.	6110.	23100.	5370.	26300.

Appendix C – Reservoir Routing Computations

AECOM

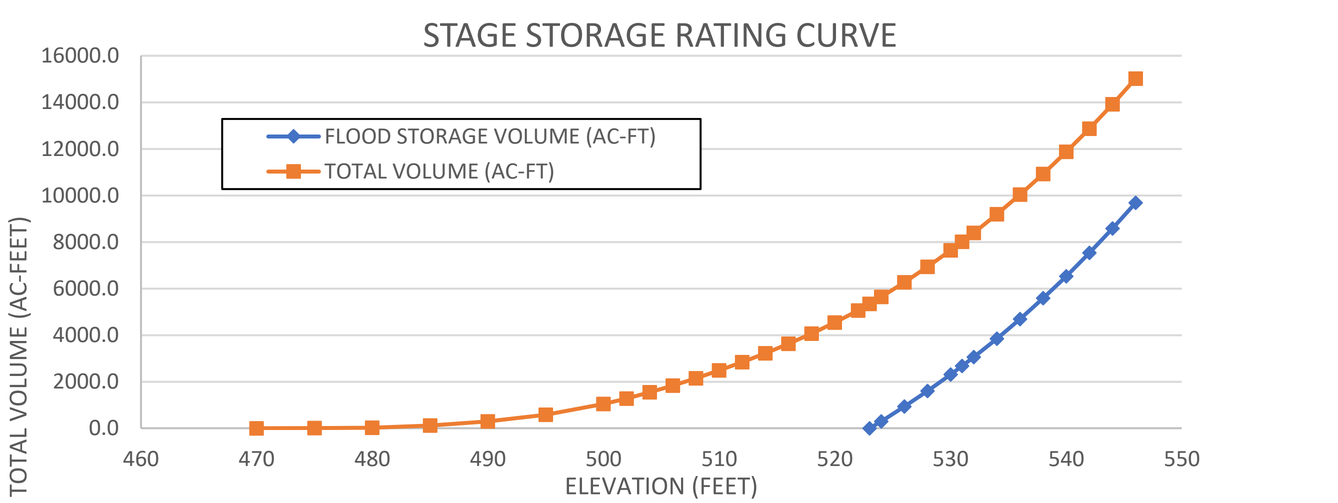
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
Tel: 301.820.3000

DESIGN JBB DATE 26-Dec-2019
CHECK WCH DATE 15-Jan-2020
PROJECT: Piney Run Dam

STAGE-STORAGE RATING TABLE CALCULATIONS

RATING ELEVATIONS		
	START	470.00'
	END	546.00'
	POOL	523.00'

ELEVATION (FEET)	AREA (SF)	AVERAGE AREA (SF)	INCREMENTAL DEPTH (FEET)	INCREMENTAL VOLUME (CF)	TOTAL VOLUME (CF)	TOTAL VOLUME (AC-FT)	FLOOD STORAGE VOLUME (AC-FT)
470.00	0	0	0.00	0	0	0.0	
475.00	23,427	11,714	5.00	58,568	58,568	1.3	
480.00	359,714	191,571	5.00	957,853	1,016,420	23.3	
485.00	1,137,010	748,362	5.00	3,741,810	4,758,230	109.2	
490.00	2,046,816	1,591,913	5.00	7,959,565	12,717,795	292.0	
495.00	3,066,700	2,556,758	5.00	12,783,790	25,501,585	585.4	
500.00	4,846,628	3,956,664	5.00	19,783,320	45,284,905	1039.6	
502.00	5,463,383	5,155,006	2.00	10,310,011	55,594,916	1276.3	
504.00	6,050,343	5,756,863	2.00	11,513,726	67,108,642	1540.6	
506.00	6,612,899	6,331,621	2.00	12,663,242	79,771,884	1831.3	
508.00	7,139,010	6,875,955	2.00	13,751,909	93,523,793	2147.0	
510.00	7,599,201	7,369,106	2.00	14,738,211	108,262,004	2485.4	
512.00	8,004,706	7,801,954	2.00	15,603,907	123,865,911	2843.6	
514.00	8,477,001	8,240,854	2.00	16,481,707	140,347,618	3221.9	
516.00	9,091,112	8,784,057	2.00	17,568,113	157,915,731	3625.2	
518.00	9,843,204	9,467,158	2.00	18,934,316	176,850,047	4059.9	
520.00	10,794,527	10,318,866	2.00	20,637,731	197,487,778	4533.7	
522.00	11,983,079	11,388,803	2.00	22,777,606	220,265,384	5056.6	
523.00	12,630,777	12,306,928	1.00	12,306,928	232,572,312	5339.1	0.0
524.00	13,310,043	12,970,410	1.00	12,970,410	245,542,722	5636.9	297.8
526.00	14,133,119	13,721,581	2.00	27,443,162	272,985,884	6266.9	927.8
528.00	14,968,970	14,551,045	2.00	29,102,089	302,087,973	6935.0	1595.9
530.00	15,857,826	15,413,398	2.00	30,826,796	332,914,769	7642.7	2303.5
531.00	16,329,030	16,093,428	1.00	16,093,428	349,008,197	8012.1	2673.0
532.00	16,827,970	16,578,500	1.00	16,578,500	365,586,697	8392.7	3053.6
534.00	17,835,285	17,331,628	2.00	34,663,255	400,249,952	9188.5	3849.3
536.00	18,881,610	18,358,448	2.00	36,716,895	436,966,847	10031.4	4692.3
538.00	19,996,816	19,439,213	2.00	38,878,426	475,845,273	10923.9	5584.8
540.00	21,133,208	20,565,012	2.00	41,130,024	516,975,297	11868.1	6529.0
542.00	22,354,622	21,743,915	2.00	43,487,830	560,463,127	12866.5	7527.3
544.00	23,554,388	22,954,505	2.00	45,909,010	606,372,137	13920.4	8581.3
546.00	24,236,385	23,895,387	2.00	47,790,773	654,162,910	15017.5	9678.4



AECOM

PROJECT: Piney Run Dam

DESIGN: JBB DATE: 8-Jan-2020

CHECK: WCH DATE: 14-Jan-2020

Stage Discharge and Storage Rating Table				
Elevation (feet MSL)	**Principal Spillway Discharge (cfs)(1)**	**Auxiliary Spillway Discharge (cfs)(2)**	**Total Discharge (cfs)**	**Flood Storage Volume (acre-feet)(3)**
523	0.0	0.0	0.0	0
524	57.3	0.0	57.3	300
525	159.2	0.0	159.2	613
526	212.6	0.0	212.6	932
527	214.5	0.0	214.5	1261
528	216.5	0.0	216.5	1599
529	218.4	0.0	218.4	1951
530	220.2	0.0	220.2	2307
531	222.1	0.0	222.1	2672
532	224.0	239.9	463.9	3056
533	225.8	1173.5	1399.3	3452
534	227.6	2480.0	2707.6	3858
535	229.4	4443.0	4672.4	4272
536	231.2	6674.7	6905.9	4693
537	233.0	9380.5	9613.5	5146
538	234.8	12086.3	12321.1	5600
539	236.5	15098.8	15335.3	6059
540	238.2	18590.8	18829.1	6553
541	240.0	22082.9	22322.9	7047
542	241.7	25575.0	25816.7	7541
543	243.4	29680.2	29923.6	8061
544	245.1	34048.1	34293.2	8600
545	246.8	38416.1	38662.8	9139
546	248.5	42784.0	43032.5	9678

(1) Determined using the NRCS SITES Model.

(2) Determined using the NRCS SITES Model.

(3) Determined as shown in Appendix B

Appendix D – SITES Model Output Reports

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:33:00

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD10     Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         10% Annual Exceedance Probability Event (24-hour duration)
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.15              212.9     0         979.4
                    526.88              214.3     0         1220.9
                    527.60              215.7     0         1462.5
                    528.32              217.1     0         1710.4
                    529.05              218.5     0         1966.4
                    529.77              219.8     0         2222.4
                    530.49              221.2     0         2485.7
                    531.22              222.5     0         2755.1
                    531.95              223.9     229.1     3036.7
                    532.69              225.2     846.6     3329.8
                    534.02              227.7     2669.2    3859.3
                    535.65              230.6     6025.1    4544.8
                    538.61              235.8     14278.9   5871.8
                    542.30              242.2     27502.0   7687.1
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     72        10.56     2.87
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
```

```
                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
ENDTABLE
POOLDATA  ELEV                523       523.0
GRAPHICS  I
GO,STORM  QLC       NOAAC     4.81                          523.0
SAVMOV    2    101  1                   D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
       VER 2005.1.8                 Piney Run Dam                 WSID = PRD10


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 10% Annual Exceedance Probability Event (24-hour duration)

 Existing Conditions

 AECOM 20 January 2020


1SITES -------------------------------------------------------------------------
 XEQ 01/20/2020               Piney Run Dam                          WSID= PRD10
 VER 2005.1.8                   Piney Run Dam                          SUBW= 01
 TIME 10:33:00            SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 CLIMATE AREA - NOT DEFINED                        DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
              4.81         24.00          NOAAC

 WSDATA -       CN         DA-SM          TC/L            -/H           QRF
             72.00         10.56          2.87           0.00          0.00

 SITEDATA- PERM POOL     CREST PS        FP SED       VALLEY FL        378?
              0.00        523.00        523.00           0.00           NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00         SIMULATION

 PSDATA -  NO. COND        COND L         DIA/W            -/H
              0.00          0.00          0.00           0.00

              PS N            KE         WEIR L          TW EL
             0.000          0.00          0.00           0.00
```

```
          2ND STG         ORF H          ORF L      START AUX.
             0.00          0.00           0.00         523.00

 ASCRESTS -  AUX.1         AUX.2          AUX.3          AUX.4          AUX.5
             0.00          0.00           0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                0          0.00           0.00              0

 AUX.Data - INLET N     SIDE SLOPE      EXIT N      EXIT SLOPE     ACTUAL AUX?
            0.000          0.00          0.000          0.000             NO

 BTM WIDTH -    BW1           BW2            BW3            BW4            BW5
             0.00          0.00           0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
    RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
   U/S  D/S       ft              ft          ft         U/S   D/S     U/S   D/S
  2.50 2.50      10.0             0.0        0.00       0.00  0.00    0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.007	0.008	0.009	0.010
0.011	0.012	0.013	0.014	0.015
0.017	0.018	0.019	0.020	0.021
0.023	0.024	0.025	0.026	0.028
0.029	0.030	0.031	0.033	0.034
0.035	0.037	0.038	0.039	0.041
0.042	0.043	0.045	0.046	0.048
0.049	0.050	0.052	0.053	0.055
0.056	0.058	0.059	0.061	0.062
0.064	0.065	0.067	0.068	0.070
0.071	0.073	0.074	0.076	0.078
0.079	0.081	0.083	0.084	0.086
0.088	0.090	0.092	0.094	0.096
0.098	0.100	0.102	0.104	0.106
0.108	0.110	0.113	0.115	0.117
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.140	0.143
0.146	0.149	0.152	0.155	0.159
0.162	0.166	0.170	0.174	0.178
0.182	0.187	0.191	0.196	0.201
0.206	0.212	0.218	0.225	0.232
0.240	0.249	0.259	0.270	0.282
0.296	0.316	0.337	0.366	0.407
0.477	0.593	0.634	0.663	0.684
0.705	0.718	0.730	0.741	0.751
0.760	0.768	0.775	0.782	0.788
0.794	0.799	0.804	0.809	0.813
0.818	0.822	0.826	0.830	0.834
0.838	0.841	0.845	0.848	0.851
0.854	0.857	0.860	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.883	0.885	0.887	0.890
0.892	0.894	0.896	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.916	0.917	0.919
0.921	0.922	0.924	0.926	0.927
0.929	0.930	0.932	0.933	0.935
0.936	0.938	0.939	0.941	0.942
0.944	0.945	0.947	0.948	0.950
0.951	0.952	0.954	0.955	0.957
0.958	0.959	0.961	0.962	0.963
0.965	0.966	0.967	0.969	0.970
0.971	0.972	0.974	0.975	0.976
0.977	0.979	0.980	0.981	0.982
0.983	0.985	0.986	0.987	0.988
0.989	0.990	0.991	0.992	0.993
0.995	0.996	0.997	0.998	0.999
1.000				

CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.4 ACFT	0.00 AC	10.6 CFS
AUX. CREST	531.22 FT	2755.1 ACFT	0.00 AC	222.5 CFS

PS STORAGE   2755.1 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS

```
STORM HYD     D=  24.00 HR    P=  4.81 IN     Q=  2.05 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=   1156.0 ACFT

     PEAK =      3309.0 CFS, AT   14.0 HRS.


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1    :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.


RATING TABLE NUMBER  2
       ELEV.   Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET      CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.40     26.40      0.00    181.10      0.00
  3   524.22     74.80     74.80      0.00    365.90      0.00
  4   524.82    137.40    137.40      0.00    557.30      0.00
  5   525.43    211.50    211.50      0.00    748.70      0.00
  6   526.15    212.90    212.90      0.00    979.40      0.00
  7   526.88    214.30    214.30      0.00   1220.90      0.00
  8   527.60    215.70    215.70      0.00   1462.50      0.00
  9   528.32    217.10    217.10      0.00   1710.40      0.00
 10   529.05    218.50    218.50      0.00   1966.40      0.00
 11   529.77    219.80    219.80      0.00   2222.40      0.00
 12   530.49    221.20    221.20      0.00   2485.70      0.00
 13   531.22    222.50    222.50      0.00   2755.10      0.00
 14   531.95    453.00    223.90    229.10   3036.70      0.00
 15   532.69   1071.80    225.20    846.60   3329.80      0.00
 16   534.02   2896.90    227.70   2669.20   3859.30      0.00
 17   535.65   6255.70    230.60   6025.10   4544.80      0.00
 18   538.61  14514.70    235.80  14278.90   5871.80      0.00
 19   542.30  27744.20    242.20  27502.00   7687.10      0.00
 20   546.00  44281.00    248.50  44032.50   9678.00      0.00

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
STORM HYD         0.0    526.28    1021.7       0.0      0.00       0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     213.1       0.0     213.1
-------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        213.15 CFS  at   25.41 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

PRD10         Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************


SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
```

---------------- DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
PRD10	01/20/2020	10:33:00

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	72.	2.87	10.56	TR60	S	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	531.2	0.0	-4.9	526.3	0.	0.	0.0	STORM HYD

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
PRD10 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\10.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\10.OUT
DATED 01/20/2020 10:33:00

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\10.DRG DATED 01/20/2020 10:33:00

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\10.DHY DATED 01/20/2020 10:33:00

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\10.DEM DATED 01/20/2020 10:33:00

```
*******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:33:07

************************** 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD50     Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         2% Annual Exceedance Probability Event (24-hour duration)
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.15              212.9     0         979.4
                    526.88              214.3     0         1220.9
                    527.60              215.7     0         1462.5
                    528.32              217.1     0         1710.4
                    529.05              218.5     0         1966.4
                    529.77              219.8     0         2222.4
                    530.49              221.2     0         2485.7
                    531.22              222.5     0         2755.1
                    531.95              223.9     229.1     3036.7
                    532.69              225.2     846.6     3329.8
                    534.02              227.7     2669.2    3859.3
                    535.65              230.6     6025.1    4544.8
                    538.61              235.8     14278.9   5871.8
                    542.30              242.2     27502.0   7687.1
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     72        10.56     2.87
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
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                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
 ENDTABLE
 POOLDATA  ELEV               523       523.0
 GRAPHICS  I
 GO,STORM  QLC       NOAAC    7.09                          523.0
 SAVMOV    2    101  1                  D1
 ENDJOB

 ********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE -------------------------------
       VER 2005.1.8                 Piney Run Dam                WSID = PRD50


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 2% Annual Exceedance Probability Event (24-hour duration)

 Existing Conditions

 AECOM 3 January 2020


1SITES --------------------------------------------------------------------------------
 XEQ 01/20/2020                Piney Run Dam                        WSID= PRD50
 VER 2005.1.8                    Piney Run Dam                        SUBW= 01
 TIME 10:33:07             SITE = D1                PASS=    1      PART=   1


 ****************************    BASIC Data    *********************************
 CLIMATE AREA - NOT DEFINED                         DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
              7.09         24.00           NOAAC

 WSDATA -        CN         DA-SM          TC/L           -/H           QRF
              72.00        10.56          2.87          0.00          0.00

 SITEDATA- PERM POOL     CREST PS       FP SED        VALLEY FL        378?
              0.00       523.00        523.00          0.00            NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00         0.00          0.00        SIMULATION

 PSDATA -  NO. COND        COND L         DIA/W           -/H
              0.00         0.00          0.00          0.00

              PS N           KE          WEIR L         TW EL
             0.000         0.00          0.00          0.00
```

```
          2ND STG          ORF H           ORF L      START AUX.
            0.00            0.00            0.00        523.00

 ASCRESTS -  AUX.1          AUX.2          AUX.3          AUX.4          AUX.5
            0.00            0.00            0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                 0          0.00            0.00             0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
           0.000           0.00          0.000          0.000            NO

 BTM WIDTH -    BW1           BW2            BW3            BW4            BW5
            0.00            0.00            0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft             ft          ft         U/S   D/S    U/S   D/S
 2.50 2.50      10.0            0.0        0.00       0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

```
 NOAA Type 'C' 24-Hour Distribution
 IDENTIFICATION NAME IS NOAAC  GIVEN DURATION =  24.0 HRS

       0.000      0.001      0.002      0.003      0.004
       0.005      0.007      0.008      0.009      0.010
       0.011      0.012      0.013      0.014      0.015
       0.017      0.018      0.019      0.020      0.021
       0.023      0.024      0.025      0.026      0.028
       0.029      0.030      0.031      0.033      0.034
       0.035      0.037      0.038      0.039      0.041
       0.042      0.043      0.045      0.046      0.048
       0.049      0.050      0.052      0.053      0.055
       0.056      0.058      0.059      0.061      0.062
       0.064      0.065      0.067      0.068      0.070
       0.071      0.073      0.074      0.076      0.078
       0.079      0.081      0.083      0.084      0.086
       0.088      0.090      0.092      0.094      0.096
       0.098      0.100      0.102      0.104      0.106
       0.108      0.110      0.113      0.115      0.117
       0.120      0.122      0.125      0.127      0.130
       0.132      0.135      0.138      0.140      0.143
       0.146      0.149      0.152      0.155      0.159
       0.162      0.166      0.170      0.174      0.178
       0.182      0.187      0.191      0.196      0.201
       0.206      0.212      0.218      0.225      0.232
       0.240      0.249      0.259      0.270      0.282
       0.296      0.316      0.337      0.366      0.407
       0.477      0.593      0.634      0.663      0.684
       0.705      0.718      0.730      0.741      0.751
       0.760      0.768      0.775      0.782      0.788
       0.794      0.799      0.804      0.809      0.813
       0.818      0.822      0.826      0.830      0.834
       0.838      0.841      0.845      0.848      0.851
       0.854      0.857      0.860      0.862      0.865
       0.868      0.870      0.873      0.875      0.878
       0.880      0.883      0.885      0.887      0.890
       0.892      0.894      0.896      0.898      0.900
       0.902      0.904      0.906      0.908      0.910
       0.912      0.914      0.916      0.917      0.919
       0.921      0.922      0.924      0.926      0.927
       0.929      0.930      0.932      0.933      0.935
       0.936      0.938      0.939      0.941      0.942
       0.944      0.945      0.947      0.948      0.950
       0.951      0.952      0.954      0.955      0.957
       0.958      0.959      0.961      0.962      0.963
       0.965      0.966      0.967      0.969      0.970
       0.971      0.972      0.974      0.975      0.976
       0.977      0.979      0.980      0.981      0.982
       0.983      0.985      0.986      0.987      0.988
       0.989      0.990      0.991      0.992      0.993
       0.995      0.996      0.997      0.998      0.999
       1.000

1SITES ---------------------------------------------------------------------------
 XEQ 01/20/2020                 Piney Run Dam                           WSID= PRD50
 VER 2005.1.8                     Piney Run Dam                           SUBW= 01
 TIME 10:33:07            SITE = D1                PASS=    1     PART=   2


 CREST PS         523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 SED ACCUM        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 BASEFLOW         523.24 FT      72.4 ACFT      0.00 AC      10.6 CFS

 AUX. CREST       531.22 FT    2755.1 ACFT      0.00 AC     222.5 CFS

      PS STORAGE   2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS
```

```
STORM HYD     D=  24.00 HR    P=  7.09 IN     Q=  3.91 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=   2199.8 ACFT

     PEAK =      6434.0 CFS, AT   13.9 HRS.


****************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.


RATING TABLE NUMBER  2
```

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.40	26.40	0.00	181.10	0.00
3	524.22	74.80	74.80	0.00	365.90	0.00
4	524.82	137.40	137.40	0.00	557.30	0.00
5	525.43	211.50	211.50	0.00	748.70	0.00
6	526.15	212.90	212.90	0.00	979.40	0.00
7	526.88	214.30	214.30	0.00	1220.90	0.00
8	527.60	215.70	215.70	0.00	1462.50	0.00
9	528.32	217.10	217.10	0.00	1710.40	0.00
10	529.05	218.50	218.50	0.00	1966.40	0.00
11	529.77	219.80	219.80	0.00	2222.40	0.00
12	530.49	221.20	221.20	0.00	2485.70	0.00
13	531.22	222.50	222.50	0.00	2755.10	0.00
14	531.95	453.00	223.90	229.10	3036.70	0.00
15	532.69	1071.80	225.20	846.60	3329.80	0.00
16	534.02	2896.90	227.70	2669.20	3859.30	0.00
17	535.65	6255.70	230.60	6025.10	4544.80	0.00
18	538.61	14514.70	235.80	14278.90	5871.80	0.00
19	542.30	27744.20	242.20	27502.00	7687.10	0.00
20	546.00	44281.00	248.50	44032.50	9678.00	0.00

```
ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
STORM HYD         0.0    529.24    2034.1       0.0      0.00       0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     218.8       0.0     218.8
----------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        218.84 CFS  at   26.03 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
----------------------------------------------------------------------------

PRD50         Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

****************************************************************************



SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
```

---------------- DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
PRD50	01/20/2020	10:33:07

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	72.	2.87	10.56	TR60	S	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	531.2	0.0	-2.0	529.2	0.	0.	0.0	STORM HYD

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
PRD50 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\50.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\50.OUT
DATED 01/20/2020 10:33:07

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\50.DRG DATED
01/20/2020 10:33:07

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\50.DHY DATED
01/20/2020 10:33:07

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\50.DEM DATED
01/20/2020 10:33:07

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:33:02

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD100    Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         1% Annual Exceedance Probability Event (24-hour duration)
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.15              212.9     0         979.4
                    526.88              214.3     0         1220.9
                    527.60              215.7     0         1462.5
                    528.32              217.1     0         1710.4
                    529.05              218.5     0         1966.4
                    529.77              219.8     0         2222.4
                    530.49              221.2     0         2485.7
                    531.22              222.5     0         2755.1
                    531.95              223.9     229.1     3036.7
                    532.69              225.2     846.6     3329.8
                    534.02              227.7     2669.2    3859.3
                    535.65              230.6     6025.1    4544.8
                    538.61              235.8     14278.9   5871.8
                    542.30              242.2     27502.0   7687.1
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     72        10.56     2.87
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
```

```
                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
 ENDTABLE
 POOLDATA  ELEV               523       523.0
 GRAPHICS  I
 GO,STORM  QLC        NOAAC     8.30                          523.0
 SAVMOV    2    101  1                   D1
 ENDJOB

 ********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE -------------------------------
       VER 2005.1.8                 Piney Run Dam                 WSID = PRD100


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 1% Annual Exceedance Probability Event (24-hour duration)

 Existing Conditions

 AECOM 3 January 2020


1SITES --------------------------------------------------------------------------
 XEQ 01/20/2020                  Piney Run Dam                        WSID= PRD100
 VER 2005.1.8                      Piney Run Dam                        SUBW= 01
 TIME 10:33:02            SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 CLIMATE AREA - NOT DEFINED                         DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
              8.30         24.00           NOAAC

 WSDATA -       CN         DA-SM          TC/L            -/H           QRF
             72.00         10.56          2.87           0.00          0.00

 SITEDATA- PERM POOL     CREST PS        FP SED       VALLEY FL        378?
              0.00        523.00        523.00           0.00           NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00        SIMULATION

 PSDATA -  NO. COND        COND L         DIA/W            -/H
              0.00          0.00          0.00           0.00

              PS N            KE        WEIR L         TW EL
             0.000          0.00          0.00           0.00
```

```
          2ND STG          ORF H          ORF L       START AUX.
             0.00           0.00           0.00         523.00

 ASCRESTS -   AUX.1          AUX.2          AUX.3          AUX.4          AUX.5
             0.00           0.00           0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                0           0.00           0.00              0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
            0.000           0.00          0.000          0.000            NO

 BTM WIDTH -    BW1            BW2            BW3            BW4            BW5
             0.00           0.00           0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS       WIDTH       U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft              ft          ft          U/S  D/S    U/S  D/S
 2.50 2.50      10.0            0.0        0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.007	0.008	0.009	0.010
0.011	0.012	0.013	0.014	0.015
0.017	0.018	0.019	0.020	0.021
0.023	0.024	0.025	0.026	0.028
0.029	0.030	0.031	0.033	0.034
0.035	0.037	0.038	0.039	0.041
0.042	0.043	0.045	0.046	0.048
0.049	0.050	0.052	0.053	0.055
0.056	0.058	0.059	0.061	0.062
0.064	0.065	0.067	0.068	0.070
0.071	0.073	0.074	0.076	0.078
0.079	0.081	0.083	0.084	0.086
0.088	0.090	0.092	0.094	0.096
0.098	0.100	0.102	0.104	0.106
0.108	0.110	0.113	0.115	0.117
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.140	0.143
0.146	0.149	0.152	0.155	0.159
0.162	0.166	0.170	0.174	0.178
0.182	0.187	0.191	0.196	0.201
0.206	0.212	0.218	0.225	0.232
0.240	0.249	0.259	0.270	0.282
0.296	0.316	0.337	0.366	0.407
0.477	0.593	0.634	0.663	0.684
0.705	0.718	0.730	0.741	0.751
0.760	0.768	0.775	0.782	0.788
0.794	0.799	0.804	0.809	0.813
0.818	0.822	0.826	0.830	0.834
0.838	0.841	0.845	0.848	0.851
0.854	0.857	0.860	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.883	0.885	0.887	0.890
0.892	0.894	0.896	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.916	0.917	0.919
0.921	0.922	0.924	0.926	0.927
0.929	0.930	0.932	0.933	0.935
0.936	0.938	0.939	0.941	0.942
0.944	0.945	0.947	0.948	0.950
0.951	0.952	0.954	0.955	0.957
0.958	0.959	0.961	0.962	0.963
0.965	0.966	0.967	0.969	0.970
0.971	0.972	0.974	0.975	0.976
0.977	0.979	0.980	0.981	0.982
0.983	0.985	0.986	0.987	0.988
0.989	0.990	0.991	0.992	0.993
0.995	0.996	0.997	0.998	0.999
1.000				

```
1SITES ---------------------------------------------------------------------------
 XEQ 01/20/2020              Piney Run Dam                      WSID= PRD100
 VER 2005.1.8                  Piney Run Dam                      SUBW= 01
 TIME 10:33:02           SITE = D1               PASS=    1     PART=   2


 CREST PS        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 SED ACCUM       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 BASEFLOW        523.24 FT      72.4 ACFT      0.00 AC      10.6 CFS

 AUX. CREST      531.22 FT    2755.1 ACFT      0.00 AC     222.5 CFS

      PS STORAGE   2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV      523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS
```

```
STORM HYD     D=  24.00 HR    P=  8.30 IN     Q=  4.96 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=   2792.7 ACFT

     PEAK =      8189.0 CFS, AT   13.9 HRS.


********************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.


RATING TABLE NUMBER  2
       ELEV.   Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET      CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00     0.00      0.00      0.00      0.00
  2   523.61     26.40    26.40      0.00    181.10      0.00
  3   524.22     74.80    74.80      0.00    365.90      0.00
  4   524.82    137.40   137.40      0.00    557.30      0.00
  5   525.43    211.50   211.50      0.00    748.70      0.00
  6   526.15    212.90   212.90      0.00    979.40      0.00
  7   526.88    214.30   214.30      0.00   1220.90      0.00
  8   527.60    215.70   215.70      0.00   1462.50      0.00
  9   528.32    217.10   217.10      0.00   1710.40      0.00
 10   529.05    218.50   218.50      0.00   1966.40      0.00
 11   529.77    219.80   219.80      0.00   2222.40      0.00
 12   530.49    221.20   221.20      0.00   2485.70      0.00
 13   531.22    222.50   222.50      0.00   2755.10      0.00
 14   531.95    453.00   223.90    229.10   3036.70      0.00
 15   532.69   1071.80   225.20    846.60   3329.80      0.00
 16   534.02   2896.90   227.70   2669.20   3859.30      0.00
 17   535.65   6255.70   230.60   6025.10   4544.80      0.00
 18   538.61  14514.70   235.80  14278.90   5871.80      0.00
 19   542.30  27744.20   242.20  27502.00   7687.10      0.00
 20   546.00  44281.00   248.50  44032.50   9678.00      0.00

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
STORM HYD         0.0    530.84    2615.9       0.0      0.00       0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     221.8       0.0     221.8
--------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        221.83 CFS  at   26.17 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
--------------------------------------------------------------------------------

PRD100        Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

********************************************************************************



SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
```

```
                                ----------------           DATED 01/01/2005

 WATERSHED ID                         RUN DATE                            RUN TIME
 ------------                         --------                            --------
 PRD100                             01/20/2020                            10:33:02

 >>>    SITE   SUBWS   SUBWS DA   CURVE     TC   TOTAL DA   TYPE    STRUC    <<<
         ID     ID     (SQ MI)     NO.    (HRS)  (SQ MI)  DESIGN   CLASS
        -----   ----   --------   -----   ----   -------   -----   -----
        D1      01       10.56     72.    2.87     10.56    TR60     S

 PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
  NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
      (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
 ----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
    1    0.0    531.2     0.0  -0.4    530.8       0.     0.     0.0  STORM HYD


 *  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
    HYDROGRAPH SHOWN UNDER TYPE HYD.



 SITES.......SUMMARY TABLE 1 COMPLETED.


                   NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                            PRD100   FILES

INPUT  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\100.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\100.OUT
         DATED 01/20/2020 10:33:02

                         GRAPHICS FILES GENERATED

OPTION "L"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\100.DRG
DATED 01/20/2020 10:33:02

OPTION "P"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\100.DHY
DATED 01/20/2020 10:33:02

OPTION "E"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\100.DEM
DATED 01/20/2020 10:33:02
```

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:33:09

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD500    Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         0.2% Annual Exceedance Probability Event (24-hour duration)
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.15              212.9     0         979.4
                    526.88              214.3     0         1220.9
                    527.60              215.7     0         1462.5
                    528.32              217.1     0         1710.4
                    529.05              218.5     0         1966.4
                    529.77              219.8     0         2222.4
                    530.49              221.2     0         2485.7
                    531.22              222.5     0         2755.1
                    531.95              223.9     229.1     3036.7
                    532.69              225.2     846.6     3329.8
                    534.02              227.7     2669.2    3859.3
                    535.65              230.6     6025.1    4544.8
                    538.61              235.8     14278.9   5871.8
                    542.30              242.2     27502.0   7687.1
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     72        10.56     2.87
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
```

```
                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
ENDTABLE
POOLDATA  ELEV             523       523.0
GRAPHICS  I
GO,STORM  QLC       NOAAC     11.8                          523.0
SAVMOV    2    101  1                  D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE -------------------------------
       VER 2005.1.8                 Piney Run Dam                 WSID = PRD500


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 0.2% Annual Exceedance Probability Event (24-hour duration)

 Existing Conditions

 AECOM 3 January 2020


1SITES --------------------------------------------------------------------------
 XEQ 01/20/2020               Piney Run Dam                           WSID= PRD500
 VER 2005.1.8                   Piney Run Dam                           SUBW= 01
 TIME 10:33:09            SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 CLIMATE AREA - NOT DEFINED                        DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
             11.80         24.00          NOAAC

 WSDATA -       CN          DA-SM          TC/L           -/H          QRF
             72.00         10.56           2.87           0.00          0.00

 SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL        378?
              0.00        523.00         523.00           0.00           NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00           0.00       SIMULATION

 PSDATA -  NO. COND        COND L          DIA/W           -/H
              0.00          0.00           0.00           0.00

              PS N            KE         WEIR L         TW EL
             0.000          0.00           0.00           0.00
```

```
          2ND STG          ORF H           ORF L      START AUX.
            0.00            0.00            0.00        523.00

ASCRESTS -  AUX.1          AUX.2          AUX.3          AUX.4          AUX.5
            0.00            0.00            0.00          0.00           0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
               0           0.00            0.00               0

AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
           0.000            0.00          0.000          0.000             NO

BTM WIDTH -    BW1            BW2            BW3            BW4            BW5
            0.00            0.00            0.00          0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft              ft          ft        U/S   D/S    U/S   D/S
 2.50 2.50      10.0             0.0        0.00       0.00  0.00   0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

     0.0000     0.0300     0.1000     0.1900     0.3100
     0.4700     0.6600     0.8200     0.9300     0.9900
     1.0000     0.9900     0.9300     0.8600     0.7800
     0.6800     0.5600     0.4600     0.3900     0.3300
     0.2800     0.2410     0.2070     0.1740     0.1470
     0.1260     0.1070     0.0910     0.0770     0.0660
     0.0550     0.0470     0.0400     0.0340     0.0290
     0.0250     0.0210     0.0180     0.0150     0.0130
     0.0110     0.0090     0.0080     0.0070     0.0060
     0.0050     0.0040     0.0030     0.0020     0.0010
     0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

      0.000      0.008      0.016      0.025      0.033
      0.043      0.052      0.063      0.074      0.086
      0.099      0.112      0.126      0.142      0.160
      0.180      0.205      0.255      0.345      0.437
      0.530      0.603      0.633      0.660      0.684
      0.705      0.724      0.742      0.759      0.775
      0.790      0.804      0.818      0.831      0.844
      0.856      0.868      0.879      0.890      0.900
      0.910      0.920      0.930      0.939      0.948
      0.957      0.966      0.975      0.983      0.992
      1.000
```

NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.007	0.008	0.009	0.010
0.011	0.012	0.013	0.014	0.015
0.017	0.018	0.019	0.020	0.021
0.023	0.024	0.025	0.026	0.028
0.029	0.030	0.031	0.033	0.034
0.035	0.037	0.038	0.039	0.041
0.042	0.043	0.045	0.046	0.048
0.049	0.050	0.052	0.053	0.055
0.056	0.058	0.059	0.061	0.062
0.064	0.065	0.067	0.068	0.070
0.071	0.073	0.074	0.076	0.078
0.079	0.081	0.083	0.084	0.086
0.088	0.090	0.092	0.094	0.096
0.098	0.100	0.102	0.104	0.106
0.108	0.110	0.113	0.115	0.117
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.140	0.143
0.146	0.149	0.152	0.155	0.159
0.162	0.166	0.170	0.174	0.178
0.182	0.187	0.191	0.196	0.201
0.206	0.212	0.218	0.225	0.232
0.240	0.249	0.259	0.270	0.282
0.296	0.316	0.337	0.366	0.407
0.477	0.593	0.634	0.663	0.684
0.705	0.718	0.730	0.741	0.751
0.760	0.768	0.775	0.782	0.788
0.794	0.799	0.804	0.809	0.813
0.818	0.822	0.826	0.830	0.834
0.838	0.841	0.845	0.848	0.851
0.854	0.857	0.860	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.883	0.885	0.887	0.890
0.892	0.894	0.896	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.916	0.917	0.919
0.921	0.922	0.924	0.926	0.927
0.929	0.930	0.932	0.933	0.935
0.936	0.938	0.939	0.941	0.942
0.944	0.945	0.947	0.948	0.950
0.951	0.952	0.954	0.955	0.957
0.958	0.959	0.961	0.962	0.963
0.965	0.966	0.967	0.969	0.970
0.971	0.972	0.974	0.975	0.976
0.977	0.979	0.980	0.981	0.982
0.983	0.985	0.986	0.987	0.988
0.989	0.990	0.991	0.992	0.993
0.995	0.996	0.997	0.998	0.999
1.000				

CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.4 ACFT	0.00 AC	10.6 CFS
AUX. CREST	531.22 FT	2755.1 ACFT	0.00 AC	222.5 CFS

PS STORAGE 2755.1 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS

```
STORM HYD     D=  24.00 HR    P= 11.80 IN     Q=  8.15 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00    VOL=   4588.7 ACFT

     PEAK =     13434.9 CFS, AT   13.8 HRS.


********************************************************************************
RATING TABLE DEVELOPED, SITE = D1    :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.
```

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.40	26.40	0.00	181.10	0.00
3	524.22	74.80	74.80	0.00	365.90	0.00
4	524.82	137.40	137.40	0.00	557.30	0.00
5	525.43	211.50	211.50	0.00	748.70	0.00
6	526.15	212.90	212.90	0.00	979.40	0.00
7	526.88	214.30	214.30	0.00	1220.90	0.00
8	527.60	215.70	215.70	0.00	1462.50	0.00
9	528.32	217.10	217.10	0.00	1710.40	0.00
10	529.05	218.50	218.50	0.00	1966.40	0.00
11	529.77	219.80	219.80	0.00	2222.40	0.00
12	530.49	221.20	221.20	0.00	2485.70	0.00
13	531.22	222.50	222.50	0.00	2755.10	0.00
14	531.95	453.00	223.90	229.10	3036.70	0.00
15	532.69	1071.80	225.20	846.60	3329.80	0.00
16	534.02	2896.90	227.70	2669.20	3859.30	0.00
17	535.65	6255.70	230.60	6025.10	4544.80	0.00
18	538.61	14514.70	235.80	14278.90	5871.80	0.00
19	542.30	27744.20	242.20	27502.00	7687.10	0.00
20	546.00	44281.00	248.50	44032.50	9678.00	0.00

```
ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED        BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS           FT        FT        ACFT      AC         FT       ACFT
STORM HYD          0.0    533.24    3549.5       0.0      2.02      794.4

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      226.     1603.     1829.
--------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =       1829.17 CFS  at   18.73 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
 --------------------------------------------------------------------------------

 PRD500        Piney Run Dam

       0 SUBWATERSHED(S) ANALYZED.

       1 STRUCTURE(S) ANALYZED.

       1 HYDROGRAPHS ROUTED AT LOWEST SITE.

       0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 ********************************************************************************


 SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1          SITES VERSION 2005.1.8
```

---------------- DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
PRD500	01/20/2020	10:33:09

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	72.	2.87	10.56	TR60	S	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	531.2	0.0	2.0	533.2	0.	0.	0.0	STORM HYD

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
PRD500 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\500.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\500.OUT
DATED 01/20/2020 10:33:09

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\500.DRG
DATED 01/20/2020 10:33:09

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\500.DHY
DATED 01/20/2020 10:33:09

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\500.DEM
DATED 01/20/2020 10:33:09

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:48:49

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005TR606     Piney Run Dam                10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                                    1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph (FBH) Event
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                                     0
                    524                                     298
                    526                                     928
                    528                                     1596
                    530                                     2304
                    531                                     2673
                    532                                     3054
                    534                                     3849
                    536                                     4692
                    538                                     5585
                    540                                     6529
                    542                                     7527
                    544                                     8581
                    546                                     9678
ENDTABLE
WSDATA    2C 01     72        10.56     2.87                6.05
BASEFLOW            1
RAINTABLE HMR6      6         6-Hour Duration Distribution (HMR-52)
                    0.000     0.011     0.024     0.040     0.058
                    0.078     0.102     0.128     0.158     0.191
                    0.228     0.301     0.460     0.631     0.758
                    0.796     0.831     0.863     0.891     0.916
                    0.938     0.957     0.973     0.988     1.000
ENDTABLE
PDIRECT   1.47      8.3       12.2      10.80     26.30
POOLDATA  ELEV      523.0     523.0     523.0     540.5     468       SC
PSINLET             0.7       18
PSDATA    1         303       36                  0.013     471.3
ASSPRFL   41                            Auxiliary
          0         525.8     34        525.8     284       531.2
          316       531.2     438       528.5     646       526.3
          665       525.2     710       508.6     787       499.5
ENDTABLE
ASSURFACE 41        665       0.1
          0         646       0.04      0.87      1         0.5
          646       787       0.10      0.87      2         2
ENDTABLE
ASDATA    41                            2.8                           2
BTMWIDTH  FEET      249
GRAPHICS  I
GO,DESIGN HLC       HMR6      6
SAVMOV    2    101  1                   D1
ENDJOB

******************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
      VER 2005.1.8                 Piney Run Dam                 WSID = TR606


Piney Run Watershed Study

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

Existing Conditions

AECOM 20 January 2020

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO   531.20
                FROM THE ASSPRFL RECORDS.


1SITES -----------------------------------------------------------------------
```

```
XEQ 01/20/2020               Piney Run Dam                      WSID= TR606
VER 2005.1.8                   Piney Run Dam                      SUBW= 01
TIME 10:48:49           SITE = D1              PASS=    1     PART=   1

****************************    BASIC Data    ********************************
HUMID- SUBHUMID CLIMATE AREA                      DESIGN CLASS  C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -6-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY    P-PS,10-DAY       P-SD           P-FB
              8.30          12.20         10.80          26.30

WSDATA -       CN          DA-SM          TC/L            -/H          QRF
            72.00          10.56          2.87           0.00         6.05

SITEDATA- PERM POOL     CREST PS        FP SED       VALLEY FL        378?
           523.00         523.00        523.00         468.00           NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00         DESIGN

PSDATA -  NO. COND        COND L         DIA/W            -/H
              1.00        303.00         36.00           0.00

              PS N            KE        WEIR L          TW EL
             0.013          0.70         18.00         471.30

           2ND STG         ORF H         ORF L     START AUX.
              0.00          0.00          0.00           0.00

ASCRESTS -   AUX.1         AUX.2         AUX.3          AUX.4         AUX.5
           531.20          0.00          0.00           0.00          0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
               41          0.00        316.00              0

AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE    ACTUAL AUX?
             0.040          2.80         0.040          0.022           NO

BTM WIDTH -    BW1           BW2           BW3            BW4           BW5
  ft        249.00          0.00          0.00           0.00          0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************      DETAILED LIST OF BASIC Data      *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH      U&D/S WIDTHS   DELTA H      WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft            ft          ft          U/S   D/S    U/S   D/S
 2.50 2.50      10.0           0.0        0.00        0.00  0.00   0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

     0.0000     0.0300     0.1000     0.1900     0.3100
     0.4700     0.6600     0.8200     0.9300     0.9900
     1.0000     0.9900     0.9300     0.8600     0.7800
     0.6800     0.5600     0.4600     0.3900     0.3300
     0.2800     0.2410     0.2070     0.1740     0.1470
```

0.1260	0.1070	0.0910	0.0770	0.0660
0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

6-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR6 GIVEN DURATION = 6.0 HRS

0.000	0.011	0.024	0.040	0.058
0.078	0.102	0.128	0.158	0.191
0.228	0.301	0.460	0.631	0.758
0.796	0.831	0.863	0.891	0.916
0.938	0.957	0.973	0.988	1.000

1SITES --

```
XEQ 01/20/2020              Piney Run Dam                     WSID= TR606
VER 2005.1.8                  Piney Run Dam                     SUBW= 01
TIME 10:48:49           SITE = D1                PASS=    1     PART=   2
```

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935
221.	0.9938	0.9942	0.9945	0.9949	0.9952	0.9956	0.9959	0.9962	0.9966	0.9969
231.	0.9972	0.9975	0.9978	0.9982	0.9985	0.9988	0.9991	0.9994	0.9997	1.0000

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS

```
CREST PS        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

SED ACCUM       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

BASEFLOW        523.24 FT      72.3 ACFT      0.00 AC      10.6 CFS

START ELEV      523.24 FT      72.3 ACFT      0.00 AC      10.6 CFS


NRCS-PSH  RAINFALL   1-DAY =   8.23 IN    10-DAY =  12.18 IN    DA =  10.56 SM
          RUNOFF     1-DAY =   4.90 IN    10-DAY =   5.78 IN

     CLIMATIC INDEX = 1.47    CN 10-DAY = 54.    CN 1-DAY =  72.


     AREAL CORRECTION 1 DAY =0.9915     AREAL CORRECTION 10 DAY =0.9987
     QRF  =     63.89 CFS      524.08 FEET,    GIVEN Value.

     PEAK =     11056.2 CFS, AT  121.3 HRS.


ROUTED RESULT - HYD TYPE      EMAX         VOL-MAX        AMAX         QMAX
                NRCS-PSH    531.22 FT    2755.1 ACFT      0.00 AC    222.5 CFS

     PS STORAGE    2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST        524.56 FT     474.7 ACFT    110.37 CFS
     CONTROL IS 0.150 DETENTION STORAGE

     TIME TO DDT TEST DISCHARGE IS   8.41 DAYS - DRAWDOWN CONTINUING.

     TIME LIMIT =  10.00 DAYS;  FLOW WAS    80.34 CFS,  ELEV =   524.27 FT


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  1
       ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET       CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.44     26.44      0.00    181.10      0.00
  3   524.22     74.77     74.77      0.00    365.87      0.00
  4   524.82    137.37    137.37      0.00    557.30      0.00
                                          FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43    211.49    211.49      0.00    748.74      0.00
  6   528.00    216.46    216.46      0.00   1596.73      0.00
  7   530.57    221.31    221.31      0.00   2515.53      0.00
  8   533.14    226.06    226.06      0.00   3508.90      0.00
  9   535.72    230.72    230.72      0.00   4572.12      0.00
 10   538.29    235.27    235.27      0.00   5720.34      0.00
 11   540.86    239.75    239.75      0.00   6957.10      0.00
 12   543.43    244.14    244.14      0.00   8280.12      0.00
 13   546.00    248.45    248.45      0.00   9678.13      0.00


1SITES ------------------------------------------------------------------------
XEQ 01/20/2020                 Piney Run Dam                      WSID= TR606
VER 2005.1.8                    Piney Run Dam                       SUBW= 01
TIME 10:48:49             SITE = D1                PASS=    1     PART=   3


AUX. CREST      531.22 FT    2755.1 ACFT      0.00 AC     222.5 CFS

     PS STORAGE   2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV      524.27 FT     382.9 ACFT      0.00 AC      80.3 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH      D=   6.00 HR    P= 10.76 IN     Q=  7.19 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=   4046.7 ACFT

     PEAK =     14882.0 CFS, AT    5.0 HRS.

NRCS-FBH      D=   6.00 HR    P= 26.21 IN     Q= 22.06 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=  12422.0 ACFT

     PEAK =     44971.2 CFS, AT    4.9 HRS.
              AUX. AREAL CORRECTION USED =0.9965
```

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.20) AND AUXILIARY CREST (531.22) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****

RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
					FULL CONDUIT FLOW, ELEV = 525.43 FT	
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.15	212.90	212.90	0.00	979.43	0.00
7	526.88	214.30	214.30	0.00	1220.94	0.00
8	527.60	215.69	215.69	0.00	1462.45	0.00
9	528.32	217.07	217.07	0.00	1710.43	0.00
10	529.05	218.45	218.45	0.00	1966.40	0.00
11	529.77	219.81	219.81	0.00	2222.37	0.00
12	530.49	221.16	221.16	0.00	2485.73	0.00
13	531.22	222.51	222.51	0.00	2755.13	0.00
14	531.95	452.98	223.88	229.10	3036.72	0.00
15	532.69	1071.83	225.24	846.59	3329.80	0.00
16	534.02	2896.81	227.67	2669.15	3859.32	0.00
17	535.65	6255.66	230.60	6025.06	4544.79	0.00
18	538.61	14514.76	235.84	14278.92	5871.82	0.00
19	542.30	27744.23	242.23	27502.00	7687.12	0.00
20	546.00	44280.93	248.45	44032.47	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	34.	0.0	0.040	**	**	**	INLET
2	34.	284.	-2.2	0.040	**	**	**	INLET
3	284.	316.	0.0	0.040	**	**	**	CREST
4	316.	438.	2.2	0.040	0.87	1	0.5	EXIT !
5	438.	646.	1.1	0.040	0.87	1	0.5	EXIT
6	646.	665.	5.8	0.100	0.87	2	2.0	EXIT
7	665.	710.	36.9	0.100	0.87	2	2.0	exit
8	710.	787.	11.8	0.100	0.87	2	2.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 4 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	533.87	3795.5	0.0	2.65	1040.3

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	227.	2449.	2677.

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	1.44	6.74	0.021	0.028

AUXILIARY SPILLWAY DURATION FLOW = 23.0 HOURS

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 6.9 FT/SEC
EXIT SLOPE = 0.022 FT/FT
FLOW DEPTH = 1.4 FT

****

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
Aux. Spillway Discharge = 2449. cfs; Bottom Width = 249. ft

TOTAL EFFECTIVE

```
          REACH   FROM    TO    SLOPE  MANNING`S  VELOCITY  STRESS  STRESS
           NO.    STA     STA     %        n        ft/s    lb/ft^2 lb/ft^2
            4     316.    438.  2.21   0.040       6.87      1.95   0.048
            5     438.    646.  1.06   0.040       5.49      1.16   0.029
            6     646.    665.  5.79   0.100       5.27      6.61   0.201   max.
         *******************************************************************

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-FBH        249.0    541.36    7206.2       0.0     10.14    4451.1

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      241.    23999.    24240.

                        CRITICAL  CRITICAL   CRITICAL  25% OF Q
                          DEPTH   VELOCITY   SLOPE-Sc     Sc
          AUXILIARY        FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---    6.45     13.94      0.013     0.017

          AUXILIARY SPILLWAY DURATION FLOW =       28.2 HOURS
                             ATTACK, OE/B =       38.2 ACFT/FT

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  16.5 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   5.5 FT
-------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        222.46 CFS  at  127.97 hrs.,  Location Point

Inflow Hyd 1 SDH-Peak =       2676.70 CFS  at    8.06 hrs.,  Location Point

Inflow Hyd 1 FBH-Peak =      24239.67 CFS  at    6.38 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

TR606         Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      3 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************



SITES.....COMPUTATIONS COMPLETE


                             SUMMARY TABLE  1         SITES VERSION 2005.1.8
                            ----------------               DATED 01/01/2005


WATERSHED ID                                 RUN DATE                    RUN TIME
------------                                 --------                    --------
TR606                                      01/20/2020                    10:48:49

>>>   SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
       ID     ID     (SQ MI)     NO.    (HRS)  (SQ MI)  DESIGN   CLASS
      -----  ----   --------   -----   ----   -------   -----   -----
      D1      01      10.56      72.   2.87     10.56    TR60      C

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH  HP     ELEV    VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1   36.0    531.2   249.0  10.1    541.4       0.     0.    16.5  NRCS-FBH


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.



SITES.......SUMMARY TABLE 1 COMPLETED.
```

```
                    NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                             TR606    FILES

INPUT  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology
and Hydraulics\Computations\SITES\Piney Run Existing\ASW6.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology
and Hydraulics\Computations\SITES\Piney Run Existing\ASW6.OUT
         DATED 01/20/2020 10:48:49

                         GRAPHICS FILES GENERATED

OPTION "L"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434
_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW6.DRG DATED 01/20/2020 10:48:49

OPTION "P"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434
_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW6.DHY DATED 01/20/2020 10:48:49

OPTION "E"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434
_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW6.DEM DATED 01/20/2020 10:48:49
```

```
********************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:48:40

************************** 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005TR6024    Piney Run Dam                 10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph (FBH) Event
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                                     0
                    524                                     298
                    526                                     928
                    528                                     1596
                    530                                     2304
                    531                                     2673
                    532                                     3054
                    534                                     3849
                    536                                     4692
                    538                                     5585
                    540                                     6529
                    542                                     7527
                    544                                     8581
                    546                                     9678
ENDTABLE
WSDATA    2C 01     72        10.56     2.87                6.05
BASEFLOW            1
RAINTABLE HMR24     24        24-Hour Duration Distribution (HMR-52)
                    0.000     0.001     0.003     0.004     0.005
                    0.007     0.008     0.009     0.011     0.012
                    0.014     0.015     0.017     0.018     0.020
                    0.021     0.023     0.025     0.026     0.028
                    0.030     0.031     0.033     0.035     0.037
                    0.040     0.044     0.047     0.051     0.055
                    0.059     0.063     0.067     0.072     0.077
                    0.081     0.087     0.092     0.097     0.103
                    0.109     0.115     0.122     0.128     0.135
                    0.143     0.150     0.158     0.166     0.175
                    0.185     0.197     0.211     0.227     0.245
                    0.266     0.289     0.314     0.343     0.400
                    0.523     0.656     0.754     0.784     0.811
                    0.835     0.857     0.876     0.894     0.908
                    0.921     0.933     0.942     0.945     0.948
                    0.952     0.955     0.957     0.960     0.963
                    0.966     0.968     0.971     0.973     0.975
                    0.978     0.980     0.982     0.984     0.986
                    0.988     0.990     0.992     0.994     0.996
                    0.998     1.000
ENDTABLE
PDIRECT   1.47      8.3       12.2      15.00     33.90
POOLDATA  ELEV      523.0     523.0     523.0     540.5     468       SC
PSINLET             0.7       18
PSDATA    1         303       36                  0.013     471.3
ASSPRFL   41                            Auxiliary
          0         525.8     34        525.8     284       531.2
          316       531.2     438       528.5     646       526.3
          665       525.2     710       508.6     787       499.5
ENDTABLE
ASSURFACE 41        665       0.1
          0         646       0.04      0.87      1         0.5
          646       787       0.10      0.87      2         2
ENDTABLE
ASDATA    41                            2.8                           2
BTMWIDTH  FEET      249
GRAPHICS  I
GO,DESIGN HLC       HMR24     24
```

```
SAVMOV    2    101  1                   D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
      VER 2005.1.8                  Piney Run Dam                  WSID = TR6024


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

 Existing Conditions

 AECOM 20 January 2020

 ***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO   531.20
                 FROM THE ASSPRFL RECORDS.


1SITES -----------------------------------------------------------------------
 XEQ 01/20/2020               Piney Run Dam                       WSID= TR6024
 VER 2005.1.8                   Piney Run Dam                       SUBW= 01
 TIME 10:48:40             SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 HUMID- SUBHUMID CLIMATE AREA                        DESIGN CLASS  C

 STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

 STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

 PRECIP. - P-PS,1-DAY    P-PS,10-DAY       P-SD          P-FB
              8.30          12.20         15.00         33.90

 WSDATA -       CN          DA-SM          TC/L            -/H           QRF
             72.00          10.56          2.87           0.00          6.05

 SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL        378?
            523.00        523.00         523.00         468.00           NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00         DESIGN

 PSDATA -  NO. COND        COND L         DIA/W            -/H
              1.00        303.00         36.00           0.00

              PS N            KE         WEIR L          TW EL
             0.013          0.70          18.00         471.30

           2ND STG         ORF H          ORF L      START AUX.
              0.00          0.00           0.00           0.00

 ASCRESTS -   AUX.1        AUX.2          AUX.3          AUX.4         AUX.5
            531.20          0.00           0.00           0.00          0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                41          0.00         316.00              0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE    ACTUAL AUX?
             0.040          2.80          0.040          0.022            NO

 BTM WIDTH -    BW1           BW2            BW3            BW4           BW5
   ft        249.00          0.00           0.00           0.00          0.00

 AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.
```

```
1*********************     DETAILED LIST OF BASIC Data     *********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS       WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft             ft          ft         U/S   D/S    U/S   D/S
  2.50 2.50     10.0            0.0        0.00       0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000


 24-Hour Duration Distribution (HMR-52)
 IDENTIFICATION NAME IS HMR24  GIVEN DURATION =  24.0 HRS

       0.000      0.001      0.003      0.004      0.005
       0.007      0.008      0.009      0.011      0.012
       0.014      0.015      0.017      0.018      0.020
       0.021      0.023      0.025      0.026      0.028
       0.030      0.031      0.033      0.035      0.037
       0.040      0.044      0.047      0.051      0.055
       0.059      0.063      0.067      0.072      0.077
       0.081      0.087      0.092      0.097      0.103
       0.109      0.115      0.122      0.128      0.135
       0.143      0.150      0.158      0.166      0.175
```

0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948
0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975
0.978	0.980	0.982	0.984	0.986
0.988	0.990	0.992	0.994	0.996
0.998	1.000			

1SITES ---

XEQ 01/20/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 10:48:40 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935
221.	0.9938	0.9942	0.9945	0.9949	0.9952	0.9956	0.9959	0.9962	0.9966	0.9969
231.	0.9972	0.9975	0.9978	0.9982	0.9985	0.9988	0.9991	0.9994	0.9997	1.0000

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM

```
     RUNOFF     1-DAY =   4.90 IN    10-DAY =   5.78 IN

  CLIMATIC INDEX = 1.47    CN 10-DAY = 54.    CN 1-DAY =  72.


  AREAL CORRECTION 1 DAY =0.9915     AREAL CORRECTION 10 DAY =0.9987
  QRF  =     63.89 CFS      524.08 FEET,    GIVEN Value.

  PEAK =     11056.2 CFS, AT  121.3 HRS.


ROUTED RESULT - HYD TYPE      EMAX        VOL-MAX        AMAX        QMAX
                NRCS-PSH    531.22 FT    2755.1 ACFT     0.00 AC    222.5 CFS

  PS STORAGE    2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST        524.56 FT     474.7 ACFT    110.37 CFS
  CONTROL IS 0.150 DETENTION STORAGE

  TIME TO DDT TEST DISCHARGE IS   8.41 DAYS - DRAWDOWN CONTINUING.

  TIME LIMIT =  10.00 DAYS;  FLOW WAS    80.34 CFS,  ELEV =   524.27 FT


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  1
       ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET       CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.44     26.44      0.00    181.10      0.00
  3   524.22     74.77     74.77      0.00    365.87      0.00
  4   524.82    137.37    137.37      0.00    557.30      0.00
                                           FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43    211.49    211.49      0.00    748.74      0.00
  6   528.00    216.46    216.46      0.00   1596.73      0.00
  7   530.57    221.31    221.31      0.00   2515.53      0.00
  8   533.14    226.06    226.06      0.00   3508.90      0.00
  9   535.72    230.72    230.72      0.00   4572.12      0.00
 10   538.29    235.27    235.27      0.00   5720.34      0.00
 11   540.86    239.75    239.75      0.00   6957.10      0.00
 12   543.43    244.14    244.14      0.00   8280.12      0.00
 13   546.00    248.45    248.45      0.00   9678.13      0.00


1SITES ------------------------------------------------------------------------
 XEQ 01/20/2020                Piney Run Dam                        WSID= TR6024
 VER 2005.1.8                   Piney Run Dam                         SUBW= 01
 TIME 10:48:40            SITE = D1                PASS=    1     PART=   3


AUX. CREST      531.22 FT    2755.1 ACFT      0.00 AC     222.5 CFS

  PS STORAGE   2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV      524.27 FT     382.9 ACFT      0.00 AC      80.3 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH      D=  24.00 HR    P= 14.95 IN     Q= 11.12 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=   6261.5 ACFT

  PEAK =     19076.4 CFS, AT   16.8 HRS.

NRCS-FBH      D=  24.00 HR    P= 33.78 IN     Q= 29.52 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=  16627.6 ACFT

  PEAK =     48208.4 CFS, AT   16.9 HRS.
              AUX. AREAL CORRECTION USED =0.9965
```

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.20) AND AUXILIARY CREST (531.22) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****

RATING TABLE DEVELOPED, SITE = D1   :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
					FULL CONDUIT FLOW, ELEV = 525.43 FT	
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.15	212.90	212.90	0.00	979.43	0.00
7	526.88	214.30	214.30	0.00	1220.94	0.00
8	527.60	215.69	215.69	0.00	1462.45	0.00
9	528.32	217.07	217.07	0.00	1710.43	0.00
10	529.05	218.45	218.45	0.00	1966.40	0.00
11	529.77	219.81	219.81	0.00	2222.37	0.00
12	530.49	221.16	221.16	0.00	2485.73	0.00
13	531.22	222.51	222.51	0.00	2755.13	0.00
14	531.95	452.98	223.88	229.10	3036.72	0.00
15	532.69	1071.83	225.24	846.59	3329.80	0.00
16	534.02	2896.81	227.67	2669.15	3859.32	0.00
17	535.65	6255.66	230.60	6025.06	4544.79	0.00
18	538.61	14514.76	235.84	14278.92	5871.82	0.00
19	542.30	27744.23	242.23	27502.00	7687.12	0.00
20	546.00	44280.93	248.45	44032.47	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	34.	0.0	0.040	**	**	**	INLET
2	34.	284.	-2.2	0.040	**	**	**	INLET
3	284.	316.	0.0	0.040	**	**	**	CREST
4	316.	438.	2.2	0.040	0.87	1	0.5	EXIT !
5	438.	646.	1.1	0.040	0.87	1	0.5	EXIT
6	646.	665.	5.8	0.100	0.87	2	2.0	EXIT
7	665.	710.	36.9	0.100	0.87	2	2.0	exit
8	710.	787.	11.8	0.100	0.87	2	2.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach   4 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	535.82	4614.6	0.0	4.60	1859.5

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	231.	6460.	6690.

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	2.73	9.23	0.017	0.023

```
          AUXILIARY SPILLWAY DURATION FLOW =       27.3 HOURS

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  10.0 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   2.5 FT
         *******************************************************************

         EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
         (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
           Aux. Spillway Discharge =    6460. cfs;   Bottom Width =   249. ft

                                                              TOTAL  EFFECTIVE
           REACH   FROM    TO    SLOPE  MANNING`S  VELOCITY  STRESS  STRESS
            NO.    STA     STA     %        n        ft/s    lb/ft^2 lb/ft^2
             4     316.    438.   2.21   0.040      10.02      3.48   0.086
             5     438.    646.   1.06   0.040       7.99      2.07   0.051
             6     646.    665.   5.79   0.100       7.67     11.80   0.238   max.
         *******************************************************************

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-FBH        249.0    543.06    8088.1       0.0     11.85    5333.0

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      244.    30832.    31075.

                        CRITICAL  CRITICAL   CRITICAL  25% OF Q
                          DEPTH   VELOCITY   SLOPE-Sc     Sc
          AUXILIARY        FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---    7.58     15.05      0.012     0.016

          AUXILIARY SPILLWAY DURATION FLOW =       31.3 HOURS
                             ATTACK, OE/B =      54.5 ACFT/FT

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  18.1 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   6.4 FT
-------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        222.46 CFS  at  127.97 hrs.,  Location Point

Inflow Hyd 1 SDH-Peak =       6690.42 CFS  at   19.19 hrs.,  Location Point

Inflow Hyd 1 FBH-Peak =      31075.04 CFS  at   17.94 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

TR6024        Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      3 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************


SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
                             ----------------               DATED 01/01/2005


WATERSHED ID                           RUN DATE                          RUN TIME
------------                           --------                          --------
```

TR6024 01/20/2020 10:48:40

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	72.	2.87	10.56	TR60	C	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	36.0	531.2	249.0	11.9	543.1	0.	0.	18.1	NRCS-FBH

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
TR6024 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW24.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW24.OUT
DATED 01/20/2020 10:48:40

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW24.DRG
DATED 01/20/2020 10:48:40

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW24.DHY
DATED 01/20/2020 10:48:40

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW24.DEM
DATED 01/20/2020 10:48:40

```
*******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 10:48:57

************************** 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005TR6072    Piney Run Dam                 10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph (FBH) Event
*         Existing Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                                     0
                    524                                     298
                    526                                     928
                    528                                     1596
                    530                                     2304
                    531                                     2673
                    532                                     3054
                    534                                     3849
                    536                                     4692
                    538                                     5585
                    540                                     6529
                    542                                     7527
                    544                                     8581
                    546                                     9678
ENDTABLE
WSDATA    2C 01     72        10.56     2.87                6.05
BASEFLOW            1
RAINTABLE HMR24     72        72-Hour Duration Distribution (HMR-52)
                    0.000     0.0003    0.0005    0.0008    0.0010
                    0.0013    0.0015    0.0018    0.0020    0.0023
                    0.0026    0.0028    0.0031    0.0033    0.0036
                    0.0038    0.0041    0.0044    0.0046    0.0049
                    0.0051    0.0054    0.0056    0.0059    0.0061
                    0.0066    0.0070    0.0075    0.0079    0.0083
                    0.0088    0.0092    0.0096    0.0101    0.0105
                    0.0109    0.0114    0.0118    0.0122    0.0127
                    0.0131    0.0135    0.0140    0.0144    0.0149
                    0.0153    0.0157    0.0162    0.0166    0.0174
                    0.0182    0.0190    0.0198    0.0206    0.0214
                    0.0221    0.0229    0.0237    0.0245    0.0253
                    0.0261    0.0269    0.0277    0.0285    0.0293
                    0.0301    0.0309    0.0317    0.0325    0.0333
                    0.0341    0.0349    0.0356    0.0367    0.0377
                    0.0387    0.0397    0.0408    0.0418    0.0428
                    0.0438    0.0449    0.0459    0.0469    0.0479
                    0.0490    0.0500    0.0510    0.0520    0.0531
                    0.0541    0.0551    0.0561    0.0572    0.0582
                    0.0592    0.0602    0.0614    0.0625    0.0637
                    0.0648    0.0660    0.0672    0.0684    0.0696
                    0.0709    0.0721    0.0734    0.0747    0.0760
                    0.0773    0.0787    0.0801    0.0815    0.0829
                    0.0844    0.0859    0.0874    0.0889    0.0905
                    0.0921    0.0951    0.0981    0.1012    0.1045
                    0.1078    0.1113    0.1149    0.1187    0.1226
                    0.1267    0.1309    0.1353    0.1399    0.1446
                    0.1496    0.1548    0.1601    0.1658    0.1716
                    0.1776    0.1839    0.1905    0.1972    0.2043
                    0.2118    0.2208    0.2312    0.2571    0.2729
                    0.2907    0.3107    0.3330    0.3577    0.4069
                    0.5139    0.6291    0.7141    0.7401    0.7636
                    0.7847    0.8036    0.8204    0.8352    0.8481
                    0.8594    0.8690    0.8772    0.8801    0.8828
                    0.8855    0.8881    0.8906    0.8930    0.8954
                    0.8976    0.8999    0.9020    0.9041    0.9062
                    0.9082    0.9101    0.9120    0.9139    0.9157
                    0.9174    0.9192    0.9209    0.9226    0.9243
```

```
                    0.9259    0.9275    0.9287    0.9298    0.9310
                    0.9321    0.9333    0.9344    0.9356    0.9368
                    0.9379    0.9391    0.9402    0.9414    0.9425
                    0.9437    0.9448    0.9460    0.9471    0.9483
                    0.9494    0.9506    0.9517    0.9529    0.9540
                    0.9551    0.9561    0.9570    0.9579    0.9588
                    0.9597    0.9607    0.9616    0.9625    0.9634
                    0.9644    0.9653    0.9662    0.9671    0.9680
                    0.9690    0.9699    0.9708    0.9717    0.9727
                    0.9736    0.9745    0.9754    0.9763    0.9773
                    0.9779    0.9785    0.9791    0.9797    0.9803
                    0.9809    0.9816    0.9822    0.9828    0.9834
                    0.9840    0.9846    0.9853    0.9859    0.9865
                    0.9871    0.9883    0.9889    0.9896    0.9902
                    0.9908    0.9914    0.9920    0.9923    0.9927
                    0.9930    0.9933    0.9937    0.9940    0.9943
                    0.9947    0.9950    0.9953    0.9957    0.9960
                    0.9963    0.9967    0.9970    0.9973    0.9977
                    0.9980    0.9983    0.9987    0.9990    0.9993
                    0.9997    1.0000
ENDTABLE
PDIRECT   1.47      8.3       12.2      17.38     39.05
POOLDATA  ELEV      523.0     523.0     523.0     540.5     468       SC
PSINLET             0.7       18
PSDATA    1         303       36                  0.013     471.3
ASSPRFL   41                            Auxiliary
          0         525.8     34        525.8     284       531.2
          316       531.2     438       528.5     646       526.3
          665       525.2     710       508.6     787       499.5
ENDTABLE
ASSURFACE 41        665       0.1
          0         646       0.04      0.87      1         0.5
          646       787       0.10      0.87      2         2
ENDTABLE
ASDATA    41                            2.8                           2
BTMWIDTH  FEET      249
GRAPHICS  I
GO,DESIGN HLC       HMR24     72
SAVMOV    2    101  1                   D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
       VER 2005.1.8                 Piney Run Dam                 WSID = TR6072


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

 Existing Conditions

 AECOM 20 January 2020

 ***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO   531.20
                FROM THE ASSPRFL RECORDS.


1SITES ------------------------------------------------------------------------
 XEQ 01/20/2020               Piney Run Dam                        WSID= TR6072
 VER 2005.1.8                   Piney Run Dam                        SUBW= 01
 TIME 10:48:57            SITE = D1                PASS=    1     PART=   1


 ****************************     BASIC Data    *********************************
 HUMID- SUBHUMID CLIMATE AREA                     DESIGN CLASS  C

 STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).
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STORM DISTRIBUTION AUX. -72-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY    P-PS,10-DAY       P-SD           P-FB
              8.30         12.20         17.38          39.05

WSDATA -       CN          DA-SM          TC/L             -/H           QRF
             72.00         10.56          2.87            0.00          6.05

SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL         378?
            523.00        523.00        523.00          468.00            NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00          DESIGN

PSDATA -  NO. COND        COND L         DIA/W             -/H
              1.00        303.00         36.00            0.00

              PS N            KE         WEIR L          TW EL
             0.013          0.70         18.00          471.30

           2ND STG         ORF H          ORF L      START AUX.
              0.00          0.00          0.00            0.00

ASCRESTS -   AUX.1         AUX.2          AUX.3           AUX.4         AUX.5
            531.20          0.00          0.00            0.00          0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                41          0.00        316.00               0

AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
             0.040          2.80         0.040           0.022            NO

BTM WIDTH -    BW1           BW2           BW3             BW4           BW5
  ft        249.00          0.00          0.00            0.00          0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************     DETAILED LIST OF BASIC Data     *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft             ft          ft         U/S   D/S    U/S   D/S
 2.50 2.50      10.0            0.0        0.00       0.00  0.00   0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

     0.0000     0.0300     0.1000     0.1900     0.3100
     0.4700     0.6600     0.8200     0.9300     0.9900
     1.0000     0.9900     0.9300     0.8600     0.7800
```

0.6800	0.5600	0.4600	0.3900	0.3300
0.2800	0.2410	0.2070	0.1740	0.1470
0.1260	0.1070	0.0910	0.0770	0.0660
0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

72-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 72.0 HRS

0.000	0.000	0.001	0.001	0.001
0.001	0.002	0.002	0.002	0.002
0.003	0.003	0.003	0.003	0.004
0.004	0.004	0.004	0.005	0.005
0.005	0.005	0.006	0.006	0.006
0.007	0.007	0.008	0.008	0.008
0.009	0.009	0.010	0.010	0.011
0.011	0.011	0.012	0.012	0.013
0.013	0.014	0.014	0.014	0.015
0.015	0.016	0.016	0.017	0.017
0.018	0.019	0.020	0.021	0.021
0.022	0.023	0.024	0.025	0.025
0.026	0.027	0.028	0.029	0.029
0.030	0.031	0.032	0.033	0.033
0.034	0.035	0.036	0.037	0.038
0.039	0.040	0.041	0.042	0.043
0.044	0.045	0.046	0.047	0.048
0.049	0.050	0.051	0.052	0.053
0.054	0.055	0.056	0.057	0.058
0.059	0.060	0.061	0.063	0.064
0.065	0.066	0.067	0.068	0.070
0.071	0.072	0.073	0.075	0.076
0.077	0.079	0.080	0.082	0.083
0.084	0.086	0.087	0.089	0.091
0.092	0.095	0.098	0.101	0.105
0.108	0.111	0.115	0.119	0.123
0.127	0.131	0.135	0.140	0.145
0.150	0.155	0.160	0.166	0.172
0.178	0.184	0.191	0.197	0.204
0.212	0.221	0.231	0.257	0.273
0.291	0.311	0.333	0.358	0.407
0.514	0.629	0.714	0.740	0.764
0.785	0.804	0.820	0.835	0.848
0.859	0.869	0.877	0.880	0.883
0.886	0.888	0.891	0.893	0.895
0.898	0.900	0.902	0.904	0.906
0.908	0.910	0.912	0.914	0.916
0.917	0.919	0.921	0.923	0.924
0.926	0.928	0.929	0.930	0.931
0.932	0.933	0.934	0.936	0.937
0.938	0.939	0.940	0.941	0.942
0.944	0.945	0.946	0.947	0.948
0.949	0.951	0.952	0.953	0.954
0.955	0.956	0.957	0.958	0.959
0.960	0.961	0.962	0.963	0.963

0.964	0.965	0.966	0.967	0.968
0.969	0.970	0.971	0.972	0.973
0.974	0.975	0.975	0.976	0.977
0.978	0.979	0.979	0.980	0.980
0.981	0.982	0.982	0.983	0.983
0.984	0.985	0.985	0.986	0.987
0.987	0.988	0.989	0.990	0.990
0.991	0.991	0.992	0.992	0.993
0.993	0.993	0.994	0.994	0.994
0.995	0.995	0.995	0.996	0.996
0.996	0.997	0.997	0.997	0.998
0.998	0.998	0.999	0.999	0.999
1.000	1.000			

```
1SITES -----------------------------------------------------------------------
 XEQ 01/20/2020             Piney Run Dam                      WSID= TR6072
 VER 2005.1.8                 Piney Run Dam                      SUBW= 01
 TIME 10:48:57            SITE = D1               PASS=    1     PART=   2
```

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF   10.6 SQ. MILES.

DESIGN 0.99647   PS-1 DAY 0.99154   PS-10 DAY 0.99866.

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935
221.	0.9938	0.9942	0.9945	0.9949	0.9952	0.9956	0.9959	0.9962	0.9966	0.9969
231.	0.9972	0.9975	0.9978	0.9982	0.9985	0.9988	0.9991	0.9994	0.9997	1.0000

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

```
NRCS-PSH  RAINFALL   1-DAY =   8.23 IN    10-DAY =  12.18 IN    DA =  10.56 SM
          RUNOFF     1-DAY =   4.90 IN    10-DAY =   5.78 IN

     CLIMATIC INDEX = 1.47    CN 10-DAY = 54.    CN 1-DAY =  72.


     AREAL CORRECTION 1 DAY =0.9915     AREAL CORRECTION 10 DAY =0.9987
     QRF  =     63.89 CFS      524.08 FEET,    GIVEN Value.

     PEAK =     11056.2 CFS, AT  121.3 HRS.


ROUTED RESULT - HYD TYPE      EMAX         VOL-MAX        AMAX        QMAX
                NRCS-PSH    531.22 FT    2755.1 ACFT      0.00 AC    222.5 CFS

     PS STORAGE    2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST        524.56 FT     474.7 ACFT    110.37 CFS
     CONTROL IS 0.150 DETENTION STORAGE

     TIME TO DDT TEST DISCHARGE IS   8.41 DAYS - DRAWDOWN CONTINUING.

     TIME LIMIT =  10.00 DAYS;  FLOW WAS    80.34 CFS,  ELEV =   524.27 FT


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  1
       ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET       CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.44     26.44      0.00    181.10      0.00
  3   524.22     74.77     74.77      0.00    365.87      0.00
  4   524.82    137.37    137.37      0.00    557.30      0.00
                                          FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43    211.49    211.49      0.00    748.74      0.00
  6   528.00    216.46    216.46      0.00   1596.73      0.00
  7   530.57    221.31    221.31      0.00   2515.53      0.00
  8   533.14    226.06    226.06      0.00   3508.90      0.00
  9   535.72    230.72    230.72      0.00   4572.12      0.00
 10   538.29    235.27    235.27      0.00   5720.34      0.00
 11   540.86    239.75    239.75      0.00   6957.10      0.00
 12   543.43    244.14    244.14      0.00   8280.12      0.00
 13   546.00    248.45    248.45      0.00   9678.13      0.00


1SITES -----------------------------------------------------------------------
XEQ 01/20/2020                Piney Run Dam                         WSID= TR6072
VER 2005.1.8                    Piney Run Dam                          SUBW= 01
TIME 10:48:57             SITE = D1                PASS=    1     PART=   3


AUX. CREST      531.22 FT    2755.1 ACFT      0.00 AC     222.5 CFS

     PS STORAGE   2755.1 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV      524.27 FT     382.9 ACFT      0.00 AC      80.3 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH      D=  72.00 HR    P= 17.32 IN     Q= 13.39 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=   7542.4 ACFT

     PEAK =     19811.1 CFS, AT   40.8 HRS.

NRCS-FBH      D=  72.00 HR    P= 38.91 IN     Q= 34.61 IN      DA=  10.56 SM
             TC=   2.87 HR   CN=  72.00     VOL=  19489.6 ACFT
```

```
     PEAK =     48729.6 CFS, AT   40.8 HRS.
              AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (  531.20) AND AUXILIARY
                CREST (  531.22) ELEVATION Do NOT MATCH.  MAXIMUM AUX. SURFACE
                PROFILE ELEVATION USED IN WSPVRT PROCEDURE.


********************************************************************************
RATING TABLE DEVELOPED, SITE = D1    :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  2
       ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET       CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.44     26.44      0.00    181.10      0.00
  3   524.22     74.77     74.77      0.00    365.87      0.00
  4   524.82    137.37    137.37      0.00    557.30      0.00
                                          FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43    211.49    211.49      0.00    748.74      0.00
  6   526.15    212.90    212.90      0.00    979.43      0.00
  7   526.88    214.30    214.30      0.00   1220.94      0.00
  8   527.60    215.69    215.69      0.00   1462.45      0.00
  9   528.32    217.07    217.07      0.00   1710.43      0.00
 10   529.05    218.45    218.45      0.00   1966.40      0.00
 11   529.77    219.81    219.81      0.00   2222.37      0.00
 12   530.49    221.16    221.16      0.00   2485.73      0.00
 13   531.22    222.51    222.51      0.00   2755.13      0.00
 14   531.95    452.98    223.88    229.10   3036.72      0.00
 15   532.69   1071.83    225.24    846.59   3329.80      0.00
 16   534.02   2896.81    227.67   2669.15   3859.32      0.00
 17   535.65   6255.66    230.60   6025.06   4544.79      0.00
 18   538.61  14514.76    235.84  14278.92   5871.82      0.00
 19   542.30  27744.23    242.23  27502.00   7687.12      0.00
 20   546.00  44280.93    248.45  44032.47   9678.00      0.00
 ***************************************************************************

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH  FROM     TO   SLOPE  RETARDANCE  VEGETAL  MAINT. ROOTING  REACH
       STA     STA            CURVE      COVER    CODE   DEPTH  LOCATION
       (ft)    (ft)   (%)     INDEX@     FACTOR           (ft)     *
-----  ----    ----  ------ ----------  -------  -----  ------- --------
  1      0.     34.    0.0     0.040       **       **      **    INLET
  2     34.    284.   -2.2     0.040       **       **      **    INLET
  3    284.    316.    0.0     0.040       **       **      **    CREST
  4    316.    438.    2.2     0.040     0.87       1      0.5    EXIT !
  5    438.    646.    1.1     0.040     0.87       1      0.5    EXIT
  6    646.    665.    5.8     0.100     0.87       2      2.0    EXIT
  7    665.    710.   36.9     0.100     0.87       2      2.0    exit
  8    710.    787.   11.8     0.100     0.87       2      2.0    exit

 @ The program interprets retardance curve index entries of less than 1 as
   Manning's n values.
 * Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and
     rooting depth for inlet and crest reaches in computations.
 ! Reach   4 used in computing exit channel velocities.
 ***************************************************************************

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-SDH        249.0    536.28    4817.7       0.0      5.07    2062.5

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      232.     7722.     7954.

                        CRITICAL  CRITICAL   CRITICAL  25% OF Q
                          DEPTH   VELOCITY   SLOPE-Sc     Sc
```

```
         AUXILIARY         FT      FT/SEC     FT/FT     FT/FT
         SPILLWAY ---     3.07      9.78     0.016     0.022

         AUXILIARY SPILLWAY DURATION FLOW =       40.4 HOURS

         EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  10.7 FT/SEC
                                          EXIT SLOPE  = 0.022 FT/FT
                                          FLOW DEPTH  =   2.8 FT
        ******************************************************************

        EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
        (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
          Aux. Spillway Discharge =    7722. cfs;   Bottom Width =   249. ft

                                                              TOTAL  EFFECTIVE
          REACH   FROM    TO    SLOPE  MANNING`S  VELOCITY  STRESS  STRESS
           NO.    STA     STA     %        n         ft/s    lb/ft^2 lb/ft^2
            4     316.    438.  2.21   0.040      10.74      3.87   0.096
            5     438.    646.  1.06   0.040       8.55      2.30   0.057
            6     646.    665.  5.79   0.100       8.21     13.12   0.243   max.
        ******************************************************************

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-FBH         249.0    543.52    8330.0       0.0     12.31    5574.9

         PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
         DISCHARGE  =      244.    32840.    33084.

                       CRITICAL  CRITICAL   CRITICAL  25% OF Q
                         DEPTH   VELOCITY   SLOPE-Sc     Sc
         AUXILIARY         FT      FT/SEC     FT/FT     FT/FT
         SPILLWAY ---     7.90     15.33     0.012     0.016

         AUXILIARY SPILLWAY DURATION FLOW =       48.0 HOURS
                            ATTACK, OE/B =       64.2 ACFT/FT

         EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  18.5 FT/SEC
                                          EXIT SLOPE  = 0.022 FT/FT
                                          FLOW DEPTH  =   6.6 FT
 -------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =        222.46 CFS  at  127.97 hrs.,  Location Point

 Inflow Hyd 1 SDH-Peak =       7953.90 CFS  at   43.02 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =      33084.43 CFS  at   41.93 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
 -------------------------------------------------------------------------------

 TR6072        Piney Run Dam

       0 SUBWATERSHED(S) ANALYZED.

       1 STRUCTURE(S) ANALYZED.

       3 HYDROGRAPHS ROUTED AT LOWEST SITE.

       0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 *******************************************************************************


 SITES.....COMPUTATIONS COMPLETE

                               SUMMARY TABLE  1          SITES VERSION 2005.1.8
                              ----------------                DATED 01/01/2005
```

WATERSHED ID	RUN DATE	RUN TIME
TR6072	01/20/2020	10:48:57

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	72.	2.87	10.56	TR60	C	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	36.0	531.2	249.0	12.3	543.5	0.	0.	18.5	NRCS-FBH

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
TR6072 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW72.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW72.OUT
DATED 01/20/2020 10:48:57

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW72.DRG
DATED 01/20/2020 10:48:57

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW72.DHY
DATED 01/20/2020 10:48:57

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Existing\ASW72.DEM
DATED 01/20/2020 10:48:57

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:28:29

************************* 80-80 LIST OF INPUT Data **************************

SITES      01/01/2005PRD10     Piney Run Dam                 10.56     I8
SAVMOV     0    101
SAVMOV     101  1                                                      1
*          Piney Run Watershed Study
*          Piney Run Dam (MD Dam No. 139, NID MD000139)
*          Sykesville, Maryland
*          10% Annual Exceedance Probability Event (24-hour duration)
*          Ultimate Conditions
*          AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0          0          0
                    523.61              26.4       0          181.1
                    524.22              74.8       0          365.9
                    524.82              137.4      0          557.3
                    525.43              211.5      0          748.7
                    526.22              213.0      0          1002.9
                    527.02              214.6      0          1268.0
                    527.81              216.1      0          1533.0
                    528.60              217.6      0          1810.1
                    529.40              219.1      0          2091.0
                    530.19              220.6      0          2374.7
                    530.99              222.1      0          2667.5
                    531.78              223.6      0          2969.6
                    532.49              224.9      652.8      3248.7
                    533.20              226.2      1466.5     3531.4
                    534.48              228.5      3551.9     4051.7
                    536.05              231.3      6999.3     4712.2
                    538.89              236.3      15154.7    6004.8
                    542.44              242.5      28049.7    7761.4
                    546.00              248.5      44032.5    9678.0
ENDTABLE
WSDATA     5S 01    75         10.56      2.49
BASEFLOW            1
STORM                          24                            1
RAINTABLE NOAAC     24         NOAA Type 'C' 24-Hour Distribution
                    0          0.00128    0.00231    0.00335    0.00441
                    0.00547    0.00654    0.00763    0.00872    0.00982
                    0.01093    0.01206    0.01319    0.01433    0.01548
                    0.01665    0.01782    0.019      0.02019    0.0214
                    0.02261    0.02383    0.02506    0.02631    0.02756
                    0.02882    0.03009    0.03137    0.03267    0.03397
                    0.03528    0.0366     0.03793    0.03927    0.04062
                    0.04199    0.04336    0.04474    0.04613    0.04753
                    0.04894    0.05036    0.05179    0.05324    0.05469
                    0.05615    0.05762    0.0591     0.06059    0.06209
                    0.0636     0.06512    0.06665    0.06819    0.06974
                    0.0713     0.07287    0.07445    0.07604    0.07764
                    0.07925    0.0809     0.08259    0.08432    0.08609
                    0.0879     0.08975    0.09164    0.09356    0.09553
                    0.09754    0.09959    0.10168    0.1038     0.10597
                    0.10818    0.11042    0.11271    0.11503    0.1174
                    0.11981    0.12225    0.12474    0.12726    0.12982
                    0.13243    0.13507    0.13776    0.14048    0.14324
                    0.14605    0.149      0.1521     0.15536    0.15876
                    0.16231    0.16602    0.16987    0.17387    0.17803
                    0.18233    0.18678    0.19139    0.19614    0.20104
                    0.2061     0.21173    0.21793    0.22471    0.23206
                    0.23999    0.24899    0.25907    0.27022    0.28245
                    0.2955     0.31572    0.337      0.36618    0.40669
                    0.4766     0.59331    0.63382    0.663      0.68428
                    0.7045     0.71755    0.72978    0.74093    0.75101
                    0.76001    0.76794    0.77529    0.78207    0.78827
                    0.7939     0.79896    0.80386    0.80861    0.81322
                    0.81767    0.82197    0.82613    0.83013    0.83398
                    0.83769    0.84124    0.84464    0.8479     0.851
                    0.85395    0.85676    0.85952    0.86224    0.86493
```

```
                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
ENDTABLE
POOLDATA  ELEV              523       523.0
GRAPHICS  I
GO,STORM  QLC       NOAAC     4.81                          523.0
SAVMOV    2    101  1                 D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE -------------------------------
       VER 2005.1.8                 Piney Run Dam                  WSID = PRD10


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 10% Annual Exceedance Probability Event (24-hour duration)

 Ultimate Conditions

 AECOM 20 January 2020


1SITES -------------------------------------------------------------------------
 XEQ 01/20/2020                Piney Run Dam                          WSID= PRD10
 VER 2005.1.8                    Piney Run Dam                          SUBW= 01
 TIME 11:28:29             SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    ********************************* 
 CLIMATE AREA - NOT DEFINED                          DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
               4.81        24.00          NOAAC

 WSDATA -        CN         DA-SM          TC/L           -/H           QRF
              75.00         10.56          2.49          0.00          0.00

 SITEDATA- PERM POOL     CREST PS       FP SED       VALLEY FL        378?
               0.00        523.00       523.00          0.00            NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
               1.00          0.00          0.00       SIMULATION

 PSDATA -  NO. COND        COND L         DIA/W           -/H
               0.00          0.00          0.00          0.00

               PS N            KE        WEIR L         TW EL
              0.000          0.00          0.00          0.00
```

```
          2ND STG          ORF H          ORF L      START AUX.
            0.00            0.00           0.00        523.00

 ASCRESTS -   AUX.1          AUX.2          AUX.3          AUX.4          AUX.5
            0.00            0.00           0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
               0            0.00           0.00               0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N     EXIT SLOPE     ACTUAL AUX?
            0.000           0.00          0.000          0.000            NO

 BTM WIDTH -    BW1            BW2            BW3            BW4            BW5
            0.00            0.00           0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     *********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS       WIDTH       U&D/S WIDTHS    DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft              ft           ft          U/S   D/S    U/S   D/S
 2.50 2.50      10.0             0.0         0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.007	0.008	0.009	0.010
0.011	0.012	0.013	0.014	0.015
0.017	0.018	0.019	0.020	0.021
0.023	0.024	0.025	0.026	0.028
0.029	0.030	0.031	0.033	0.034
0.035	0.037	0.038	0.039	0.041
0.042	0.043	0.045	0.046	0.048
0.049	0.050	0.052	0.053	0.055
0.056	0.058	0.059	0.061	0.062
0.064	0.065	0.067	0.068	0.070
0.071	0.073	0.074	0.076	0.078
0.079	0.081	0.083	0.084	0.086
0.088	0.090	0.092	0.094	0.096
0.098	0.100	0.102	0.104	0.106
0.108	0.110	0.113	0.115	0.117
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.140	0.143
0.146	0.149	0.152	0.155	0.159
0.162	0.166	0.170	0.174	0.178
0.182	0.187	0.191	0.196	0.201
0.206	0.212	0.218	0.225	0.232
0.240	0.249	0.259	0.270	0.282
0.296	0.316	0.337	0.366	0.407
0.477	0.593	0.634	0.663	0.684
0.705	0.718	0.730	0.741	0.751
0.760	0.768	0.775	0.782	0.788
0.794	0.799	0.804	0.809	0.813
0.818	0.822	0.826	0.830	0.834
0.838	0.841	0.845	0.848	0.851
0.854	0.857	0.860	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.883	0.885	0.887	0.890
0.892	0.894	0.896	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.916	0.917	0.919
0.921	0.922	0.924	0.926	0.927
0.929	0.930	0.932	0.933	0.935
0.936	0.938	0.939	0.941	0.942
0.944	0.945	0.947	0.948	0.950
0.951	0.952	0.954	0.955	0.957
0.958	0.959	0.961	0.962	0.963
0.965	0.966	0.967	0.969	0.970
0.971	0.972	0.974	0.975	0.976
0.977	0.979	0.980	0.981	0.982
0.983	0.985	0.986	0.987	0.988
0.989	0.990	0.991	0.992	0.993
0.995	0.996	0.997	0.998	0.999
1.000				

CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.4 ACFT	0.00 AC	10.6 CFS
AUX. CREST	531.78 FT	2969.6 ACFT	0.00 AC	223.6 CFS

PS STORAGE   2969.6 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS

```
STORM HYD     D=  24.00 HR    P=  4.81 IN     Q=  2.30 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=   1293.2 ACFT

     PEAK =      4140.8 CFS, AT   13.8 HRS.


********************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.


RATING TABLE NUMBER  2
       ELEV.   Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET      CFS      CFS       CFS       AC-FT     ACRE
  1   523.00      0.00     0.00      0.00      0.00      0.00
  2   523.61     26.40    26.40      0.00    181.10      0.00
  3   524.22     74.80    74.80      0.00    365.90      0.00
  4   524.82    137.40   137.40      0.00    557.30      0.00
  5   525.43    211.50   211.50      0.00    748.70      0.00
  6   526.22    213.00   213.00      0.00   1002.90      0.00
  7   527.02    214.60   214.60      0.00   1268.00      0.00
  8   527.81    216.10   216.10      0.00   1533.00      0.00
  9   528.60    217.60   217.60      0.00   1810.10      0.00
 10   529.40    219.10   219.10      0.00   2091.00      0.00
 11   530.19    220.60   220.60      0.00   2374.70      0.00
 12   530.99    222.10   222.10      0.00   2667.50      0.00
 13   531.78    223.60   223.60      0.00   2969.60      0.00
 14   532.49    877.70   224.90    652.80   3248.70      0.00
 15   533.20   1692.70   226.20   1466.50   3531.40      0.00
 16   534.48   3780.40   228.50   3551.90   4051.70      0.00
 17   536.05   7230.60   231.30   6999.30   4712.20      0.00
 18   538.89  15391.00   236.30  15154.70   6004.80      0.00
 19   542.44  28292.20   242.50  28049.70   7761.40      0.00
 20   546.00  44281.00   248.50  44032.50   9678.00      0.00

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED        BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT       AC         FT       ACFT
STORM HYD          0.0    526.68    1154.4       0.0      0.00       0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     213.9       0.0     213.9
--------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        213.91 CFS  at   25.22 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
--------------------------------------------------------------------------------

PRD10         Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

********************************************************************************


SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1          SITES VERSION 2005.1.8
```

---------------- DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
PRD10	01/20/2020	11:28:29

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	75.	2.49	10.56	TR60	S	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	531.8	0.0	-5.1	526.7	0.	0.	0.0	STORM HYD

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
PRD10 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\10.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\10.OUT
DATED 01/20/2020 11:28:29

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\10.DRG DATED 01/20/2020 11:28:29

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\10.DHY DATED 01/20/2020 11:28:29

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\10.DEM DATED 01/20/2020 11:28:29

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:28:37

************************** 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD50     Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         2% Annual Exceedance Probability Event (24-hour duration)
*         Ultimate Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.22              213.0     0         1002.9
                    527.02              214.6     0         1268.0
                    527.81              216.1     0         1533.0
                    528.60              217.6     0         1810.1
                    529.40              219.1     0         2091.0
                    530.19              220.6     0         2374.7
                    530.99              222.1     0         2667.5
                    531.78              223.6     0         2969.6
                    532.49              224.9     652.8     3248.7
                    533.20              226.2     1466.5    3531.4
                    534.48              228.5     3551.9    4051.7
                    536.05              231.3     6999.3    4712.2
                    538.89              236.3     15154.7   6004.8
                    542.44              242.5     28049.7   7761.4
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     75        10.56     2.49
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
```

```
                   0.86757   0.87018   0.87274   0.87526   0.87775
                   0.88019   0.8826    0.88497   0.88729   0.88958
                   0.89182   0.89403   0.8962    0.89832   0.90041
                   0.90246   0.90447   0.90644   0.90836   0.91025
                   0.9121    0.91391   0.91568   0.91741   0.9191
                   0.92075   0.92236   0.92396   0.92555   0.92713
                   0.9287    0.93026   0.93181   0.93335   0.93488
                   0.9364    0.93791   0.93941   0.9409    0.94238
                   0.94385   0.94531   0.94676   0.94821   0.94964
                   0.95106   0.95247   0.95387   0.95526   0.95664
                   0.95801   0.95938   0.96073   0.96207   0.9634
                   0.96472   0.96603   0.96733   0.96863   0.96991
                   0.97118   0.97244   0.97369   0.97494   0.97617
                   0.97739   0.9786    0.97981   0.981     0.98218
                   0.98335   0.98452   0.98567   0.98681   0.98794
                   0.98907   0.99018   0.99128   0.99237   0.99346
                   0.99453   0.99559   0.99665   0.99769   0.99872
                   1
ENDTABLE
POOLDATA  ELEV              523       523.0
GRAPHICS  I
GO,STORM  QLC       NOAAC   7.09                          523.0
SAVMOV    2    101  1                 D1
ENDJOB

*******************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE -------------------------------
      VER 2005.1.8                 Piney Run Dam                 WSID = PRD50


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 2% Annual Exceedance Probability Event (24-hour duration)

 Ultimate Conditions

 AECOM 20 January 2020


1SITES ------------------------------------------------------------------------
 XEQ 01/20/2020              Piney Run Dam                         WSID= PRD50
 VER 2005.1.8                  Piney Run Dam                         SUBW= 01
 TIME 11:28:37             SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 CLIMATE AREA - NOT DEFINED                         DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
              7.09         24.00          NOAAC

 WSDATA -       CN          DA-SM          TC/L            -/H           QRF
             75.00         10.56           2.49           0.00          0.00

 SITEDATA- PERM POOL     CREST PS        FP SED       VALLEY FL        378?
              0.00        523.00         523.00          0.00           NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00        SIMULATION

 PSDATA -  NO. COND        COND L         DIA/W            -/H
              0.00          0.00          0.00           0.00

              PS N            KE        WEIR L         TW EL
             0.000          0.00          0.00           0.00
```

```
           2ND STG          ORF H          ORF L      START AUX.
              0.00           0.00           0.00        523.00

 ASCRESTS -  AUX.1          AUX.2          AUX.3          AUX.4          AUX.5
              0.00           0.00           0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                 0           0.00           0.00             0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
             0.000           0.00          0.000          0.000             NO

 BTM WIDTH -    BW1            BW2            BW3            BW4            BW5
              0.00           0.00           0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S      ft             ft          ft          U/S   D/S    U/S   D/S
 2.50 2.50      10.0           0.0        0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

```
NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC  GIVEN DURATION =  24.0 HRS

      0.000      0.001      0.002      0.003      0.004
      0.005      0.007      0.008      0.009      0.010
      0.011      0.012      0.013      0.014      0.015
      0.017      0.018      0.019      0.020      0.021
      0.023      0.024      0.025      0.026      0.028
      0.029      0.030      0.031      0.033      0.034
      0.035      0.037      0.038      0.039      0.041
      0.042      0.043      0.045      0.046      0.048
      0.049      0.050      0.052      0.053      0.055
      0.056      0.058      0.059      0.061      0.062
      0.064      0.065      0.067      0.068      0.070
      0.071      0.073      0.074      0.076      0.078
      0.079      0.081      0.083      0.084      0.086
      0.088      0.090      0.092      0.094      0.096
      0.098      0.100      0.102      0.104      0.106
      0.108      0.110      0.113      0.115      0.117
      0.120      0.122      0.125      0.127      0.130
      0.132      0.135      0.138      0.140      0.143
      0.146      0.149      0.152      0.155      0.159
      0.162      0.166      0.170      0.174      0.178
      0.182      0.187      0.191      0.196      0.201
      0.206      0.212      0.218      0.225      0.232
      0.240      0.249      0.259      0.270      0.282
      0.296      0.316      0.337      0.366      0.407
      0.477      0.593      0.634      0.663      0.684
      0.705      0.718      0.730      0.741      0.751
      0.760      0.768      0.775      0.782      0.788
      0.794      0.799      0.804      0.809      0.813
      0.818      0.822      0.826      0.830      0.834
      0.838      0.841      0.845      0.848      0.851
      0.854      0.857      0.860      0.862      0.865
      0.868      0.870      0.873      0.875      0.878
      0.880      0.883      0.885      0.887      0.890
      0.892      0.894      0.896      0.898      0.900
      0.902      0.904      0.906      0.908      0.910
      0.912      0.914      0.916      0.917      0.919
      0.921      0.922      0.924      0.926      0.927
      0.929      0.930      0.932      0.933      0.935
      0.936      0.938      0.939      0.941      0.942
      0.944      0.945      0.947      0.948      0.950
      0.951      0.952      0.954      0.955      0.957
      0.958      0.959      0.961      0.962      0.963
      0.965      0.966      0.967      0.969      0.970
      0.971      0.972      0.974      0.975      0.976
      0.977      0.979      0.980      0.981      0.982
      0.983      0.985      0.986      0.987      0.988
      0.989      0.990      0.991      0.992      0.993
      0.995      0.996      0.997      0.998      0.999
      1.000

1SITES ----------------------------------------------------------------------
 XEQ 01/20/2020               Piney Run Dam                       WSID= PRD50
 VER 2005.1.8                   Piney Run Dam                       SUBW= 01
 TIME 11:28:37             SITE = D1                PASS=    1     PART=   2


 CREST PS         523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 SED ACCUM        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 BASEFLOW         523.24 FT      72.4 ACFT      0.00 AC      10.6 CFS

 AUX. CREST       531.78 FT    2969.6 ACFT      0.00 AC     223.6 CFS

      PS STORAGE   2969.6 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS
```

```
STORM HYD     D=  24.00 HR    P=  7.09 IN     Q=  4.23 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=   2381.7 ACFT

     PEAK =      7711.7 CFS, AT   13.7 HRS.


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.
```

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.40	26.40	0.00	181.10	0.00
3	524.22	74.80	74.80	0.00	365.90	0.00
4	524.82	137.40	137.40	0.00	557.30	0.00
5	525.43	211.50	211.50	0.00	748.70	0.00
6	526.22	213.00	213.00	0.00	1002.90	0.00
7	527.02	214.60	214.60	0.00	1268.00	0.00
8	527.81	216.10	216.10	0.00	1533.00	0.00
9	528.60	217.60	217.60	0.00	1810.10	0.00
10	529.40	219.10	219.10	0.00	2091.00	0.00
11	530.19	220.60	220.60	0.00	2374.70	0.00
12	530.99	222.10	222.10	0.00	2667.50	0.00
13	531.78	223.60	223.60	0.00	2969.60	0.00
14	532.49	877.70	224.90	652.80	3248.70	0.00
15	533.20	1692.70	226.20	1466.50	3531.40	0.00
16	534.48	3780.40	228.50	3551.90	4051.70	0.00
17	536.05	7230.60	231.30	6999.30	4712.20	0.00
18	538.89	15391.00	236.30	15154.70	6004.80	0.00
19	542.44	28292.20	242.50	28049.70	7761.40	0.00
20	546.00	44281.00	248.50	44032.50	9678.00	0.00

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
STORM HYD	0.0	529.75	2216.2	0.0	0.00	0.0

```
***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     219.8       0.0     219.8
-------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =        219.76 CFS  at   25.82 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

 PRD50         Piney Run Dam

       0 SUBWATERSHED(S) ANALYZED.

       1 STRUCTURE(S) ANALYZED.

       1 HYDROGRAPHS ROUTED AT LOWEST SITE.

       0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************


 SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1          SITES VERSION 2005.1.8
```

---------------- DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
PRD50	01/20/2020	11:28:37

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	D1	01	10.56	75.	2.49	10.56	TR60	S	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	531.8	0.0	-2.0	529.8	0.	0.	0.0	STORM HYD

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
PRD50 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\50.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical \434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\50.OUT
DATED 01/20/2020 11:28:37

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\50.DRG DATED 01/20/2020 11:28:37

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\50.DHY DATED 01/20/2020 11:28:37

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400 _Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\50.DEM DATED 01/20/2020 11:28:37

```
********************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:28:32

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD100    Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         1% Annual Exceedance Probability Event (24-hour duration)
*         Ultimate Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.22              213.0     0         1002.9
                    527.02              214.6     0         1268.0
                    527.81              216.1     0         1533.0
                    528.60              217.6     0         1810.1
                    529.40              219.1     0         2091.0
                    530.19              220.6     0         2374.7
                    530.99              222.1     0         2667.5
                    531.78              223.6     0         2969.6
                    532.49              224.9     652.8     3248.7
                    533.20              226.2     1466.5    3531.4
                    534.48              228.5     3551.9    4051.7
                    536.05              231.3     6999.3    4712.2
                    538.89              236.3     15154.7   6004.8
                    542.44              242.5     28049.7   7761.4
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     75        10.56     2.49
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
```

```
                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
ENDTABLE
POOLDATA  ELEV              523       523.0
GRAPHICS  I
GO,STORM  QLC       NOAAC     8.30                          523.0
SAVMOV    2    101  1                 D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE --------------------------------
       VER 2005.1.8                 Piney Run Dam                 WSID = PRD100


Piney Run Watershed Study

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

1% Annual Exceedance Probability Event (24-hour duration)

Ultimate Conditions

AECOM 20 January 2020


1SITES --------------------------------------------------------------------------------
XEQ 01/20/2020                Piney Run Dam                           WSID= PRD100
VER 2005.1.8                    Piney Run Dam                           SUBW= 01
TIME 11:28:32             SITE = D1                PASS=    1     PART=   1


****************************       BASIC Data     *********************************
CLIMATE AREA - NOT DEFINED                         DESIGN CLASS  S = USER DEFINED

STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

PRECIP. - STORM RF      DURATION      RF TABLE
              8.30        24.00          NOAAC

WSDATA -       CN          DA-SM          TC/L           -/H           QRF
             75.00         10.56          2.49           0.00          0.00

SITEDATA- PERM POOL     CREST PS        FP SED       VALLEY FL        378?
              0.00       523.00         523.00           0.00           NO

          BASEFLOW      INITIAL EL     EXTRA VOL     SITE TYPE
              1.00          0.00          0.00       SIMULATION

PSDATA -  NO. COND        COND L         DIA/W           -/H
              0.00          0.00          0.00           0.00

              PS N            KE        WEIR L         TW EL
             0.000          0.00          0.00          0.00
```

```
          2ND STG          ORF H          ORF L      START AUX.
            0.00            0.00           0.00        523.00

 ASCRESTS -  AUX.1         AUX.2          AUX.3          AUX.4          AUX.5
            0.00            0.00           0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
               0            0.00           0.00              0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
           0.000            0.00          0.000          0.000             NO

 BTM WIDTH -    BW1            BW2            BW3            BW4            BW5
            0.00            0.00           0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH       U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft              ft          ft         U/S   D/S    U/S   D/S
 2.50 2.50      10.0            0.0        0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.007	0.008	0.009	0.010
0.011	0.012	0.013	0.014	0.015
0.017	0.018	0.019	0.020	0.021
0.023	0.024	0.025	0.026	0.028
0.029	0.030	0.031	0.033	0.034
0.035	0.037	0.038	0.039	0.041
0.042	0.043	0.045	0.046	0.048
0.049	0.050	0.052	0.053	0.055
0.056	0.058	0.059	0.061	0.062
0.064	0.065	0.067	0.068	0.070
0.071	0.073	0.074	0.076	0.078
0.079	0.081	0.083	0.084	0.086
0.088	0.090	0.092	0.094	0.096
0.098	0.100	0.102	0.104	0.106
0.108	0.110	0.113	0.115	0.117
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.140	0.143
0.146	0.149	0.152	0.155	0.159
0.162	0.166	0.170	0.174	0.178
0.182	0.187	0.191	0.196	0.201
0.206	0.212	0.218	0.225	0.232
0.240	0.249	0.259	0.270	0.282
0.296	0.316	0.337	0.366	0.407
0.477	0.593	0.634	0.663	0.684
0.705	0.718	0.730	0.741	0.751
0.760	0.768	0.775	0.782	0.788
0.794	0.799	0.804	0.809	0.813
0.818	0.822	0.826	0.830	0.834
0.838	0.841	0.845	0.848	0.851
0.854	0.857	0.860	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.883	0.885	0.887	0.890
0.892	0.894	0.896	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.916	0.917	0.919
0.921	0.922	0.924	0.926	0.927
0.929	0.930	0.932	0.933	0.935
0.936	0.938	0.939	0.941	0.942
0.944	0.945	0.947	0.948	0.950
0.951	0.952	0.954	0.955	0.957
0.958	0.959	0.961	0.962	0.963
0.965	0.966	0.967	0.969	0.970
0.971	0.972	0.974	0.975	0.976
0.977	0.979	0.980	0.981	0.982
0.983	0.985	0.986	0.987	0.988
0.989	0.990	0.991	0.992	0.993
0.995	0.996	0.997	0.998	0.999
1.000				

```
1SITES ---------------------------------------------------------------------------
 XEQ 01/20/2020                 Piney Run Dam                          WSID= PRD100
 VER 2005.1.8                     Piney Run Dam                          SUBW= 01
 TIME 11:28:32            SITE = D1                PASS=    1      PART=   2


 CREST PS         523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 SED ACCUM        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 BASEFLOW         523.24 FT      72.4 ACFT      0.00 AC      10.6 CFS

 AUX. CREST       531.78 FT    2969.6 ACFT      0.00 AC     223.6 CFS

      PS STORAGE   2969.6 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS
```

```
STORM HYD     D=  24.00 HR    P=  8.30 IN     Q=  5.31 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=   2992.4 ACFT

     PEAK =      9705.0 CFS, AT   13.6 HRS.


********************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.
```

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.40	26.40	0.00	181.10	0.00
3	524.22	74.80	74.80	0.00	365.90	0.00
4	524.82	137.40	137.40	0.00	557.30	0.00
5	525.43	211.50	211.50	0.00	748.70	0.00
6	526.22	213.00	213.00	0.00	1002.90	0.00
7	527.02	214.60	214.60	0.00	1268.00	0.00
8	527.81	216.10	216.10	0.00	1533.00	0.00
9	528.60	217.60	217.60	0.00	1810.10	0.00
10	529.40	219.10	219.10	0.00	2091.00	0.00
11	530.19	220.60	220.60	0.00	2374.70	0.00
12	530.99	222.10	222.10	0.00	2667.50	0.00
13	531.78	223.60	223.60	0.00	2969.60	0.00
14	532.49	877.70	224.90	652.80	3248.70	0.00
15	533.20	1692.70	226.20	1466.50	3531.40	0.00
16	534.48	3780.40	228.50	3551.90	4051.70	0.00
17	536.05	7230.60	231.30	6999.30	4712.20	0.00
18	538.89	15391.00	236.30	15154.70	6004.80	0.00
19	542.44	28292.20	242.50	28049.70	7761.40	0.00
20	546.00	44281.00	248.50	44032.50	9678.00	0.00

```
ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
STORM HYD         0.0    531.38    2816.2       0.0      0.00       0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     222.8       0.0     222.8
--------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        222.84 CFS  at   26.00 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
--------------------------------------------------------------------------------

PRD100        Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

********************************************************************************


SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
```

```
                              ----------------            DATED 01/01/2005

WATERSHED ID                       RUN DATE                           RUN TIME
------------                       --------                           --------
PRD100                           01/20/2020                           11:28:32

>>>    SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
        ID      ID     (SQ MI)    NO.   (HRS)  (SQ MI)  DESIGN   CLASS
       -----   ----   --------   -----   ----   -------   -----   -----
       D1      01      10.56      75.   2.49     10.56    TR60      S

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.     EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH   HP     ELEV     VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)     (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1    0.0    531.8     0.0  -0.4    531.4       0.     0.     0.0  STORM HYD


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.



SITES.......SUMMARY TABLE 1 COMPLETED.


                   NRCS  SITES   VERSION 2005.1.8  ,01/01/2005
                            PRD100   FILES

INPUT  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\100.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\100.OUT
         DATED 01/20/2020 11:28:32

                          GRAPHICS FILES GENERATED

OPTION "L"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\100.DRG
DATED 01/20/2020 11:28:32

OPTION "P"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\100.DHY
DATED 01/20/2020 11:28:32

OPTION "E"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\100.DEM
DATED 01/20/2020 11:28:32
```

```
*******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:28:40

************************** 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005PRD500    Piney Run Dam                 10.56     I8
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         0.2% Annual Exceedance Probability Event (24-hour duration)
*         Ultimate Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                 0         0         0
                    523.61              26.4      0         181.1
                    524.22              74.8      0         365.9
                    524.82              137.4     0         557.3
                    525.43              211.5     0         748.7
                    526.22              213.0     0         1002.9
                    527.02              214.6     0         1268.0
                    527.81              216.1     0         1533.0
                    528.60              217.6     0         1810.1
                    529.40              219.1     0         2091.0
                    530.19              220.6     0         2374.7
                    530.99              222.1     0         2667.5
                    531.78              223.6     0         2969.6
                    532.49              224.9     652.8     3248.7
                    533.20              226.2     1466.5    3531.4
                    534.48              228.5     3551.9    4051.7
                    536.05              231.3     6999.3    4712.2
                    538.89              236.3     15154.7   6004.8
                    542.44              242.5     28049.7   7761.4
                    546.00              248.5     44032.5   9678.0
ENDTABLE
WSDATA    5S 01     75        10.56     2.49
BASEFLOW            1
STORM                         24                            1
RAINTABLE NOAAC     24        NOAA Type 'C' 24-Hour Distribution
                    0         0.00128   0.00231   0.00335   0.00441
                    0.00547   0.00654   0.00763   0.00872   0.00982
                    0.01093   0.01206   0.01319   0.01433   0.01548
                    0.01665   0.01782   0.019     0.02019   0.0214
                    0.02261   0.02383   0.02506   0.02631   0.02756
                    0.02882   0.03009   0.03137   0.03267   0.03397
                    0.03528   0.0366    0.03793   0.03927   0.04062
                    0.04199   0.04336   0.04474   0.04613   0.04753
                    0.04894   0.05036   0.05179   0.05324   0.05469
                    0.05615   0.05762   0.0591    0.06059   0.06209
                    0.0636    0.06512   0.06665   0.06819   0.06974
                    0.0713    0.07287   0.07445   0.07604   0.07764
                    0.07925   0.0809    0.08259   0.08432   0.08609
                    0.0879    0.08975   0.09164   0.09356   0.09553
                    0.09754   0.09959   0.10168   0.1038    0.10597
                    0.10818   0.11042   0.11271   0.11503   0.1174
                    0.11981   0.12225   0.12474   0.12726   0.12982
                    0.13243   0.13507   0.13776   0.14048   0.14324
                    0.14605   0.149     0.1521    0.15536   0.15876
                    0.16231   0.16602   0.16987   0.17387   0.17803
                    0.18233   0.18678   0.19139   0.19614   0.20104
                    0.2061    0.21173   0.21793   0.22471   0.23206
                    0.23999   0.24899   0.25907   0.27022   0.28245
                    0.2955    0.31572   0.337     0.36618   0.40669
                    0.4766    0.59331   0.63382   0.663     0.68428
                    0.7045    0.71755   0.72978   0.74093   0.75101
                    0.76001   0.76794   0.77529   0.78207   0.78827
                    0.7939    0.79896   0.80386   0.80861   0.81322
                    0.81767   0.82197   0.82613   0.83013   0.83398
                    0.83769   0.84124   0.84464   0.8479    0.851
                    0.85395   0.85676   0.85952   0.86224   0.86493
```

```
                    0.86757   0.87018   0.87274   0.87526   0.87775
                    0.88019   0.8826    0.88497   0.88729   0.88958
                    0.89182   0.89403   0.8962    0.89832   0.90041
                    0.90246   0.90447   0.90644   0.90836   0.91025
                    0.9121    0.91391   0.91568   0.91741   0.9191
                    0.92075   0.92236   0.92396   0.92555   0.92713
                    0.9287    0.93026   0.93181   0.93335   0.93488
                    0.9364    0.93791   0.93941   0.9409    0.94238
                    0.94385   0.94531   0.94676   0.94821   0.94964
                    0.95106   0.95247   0.95387   0.95526   0.95664
                    0.95801   0.95938   0.96073   0.96207   0.9634
                    0.96472   0.96603   0.96733   0.96863   0.96991
                    0.97118   0.97244   0.97369   0.97494   0.97617
                    0.97739   0.9786    0.97981   0.981     0.98218
                    0.98335   0.98452   0.98567   0.98681   0.98794
                    0.98907   0.99018   0.99128   0.99237   0.99346
                    0.99453   0.99559   0.99665   0.99769   0.99872
                    1
ENDTABLE
POOLDATA  ELEV              523       523.0
GRAPHICS  I
GO,STORM  QLC       NOAAC     11.8                          523.0
SAVMOV    2    101  1                 D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE -------------------------------
       VER 2005.1.8                 Piney Run Dam                  WSID = PRD500


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 0.2% Annual Exceedance Probability Event (24-hour duration)

 Ultimate Conditions

 AECOM 20 January 2020


1SITES -------------------------------------------------------------------------
 XEQ 01/20/2020               Piney Run Dam                          WSID= PRD500
 VER 2005.1.8                   Piney Run Dam                          SUBW= 01
 TIME 11:28:40            SITE = D1                PASS=    1     PART=   1


 ****************************      BASIC Data    *********************************
 CLIMATE AREA - NOT DEFINED                        DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....NOAA Type 'C' 24-Hour Distribution

 PRECIP. - STORM RF      DURATION      RF TABLE
              11.80         24.00          NOAAC

 WSDATA -       CN          DA-SM          TC/L            -/H           QRF
              75.00         10.56          2.49           0.00          0.00

 SITEDATA- PERM POOL     CREST PS       FP SED        VALLEY FL        378?
               0.00        523.00       523.00           0.00           NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
               1.00          0.00          0.00        SIMULATION

 PSDATA -  NO. COND        COND L         DIA/W            -/H
               0.00          0.00          0.00           0.00

               PS N            KE        WEIR L          TW EL
              0.000          0.00          0.00           0.00
```

```
          2ND STG          ORF H          ORF L      START AUX.
            0.00            0.00           0.00        523.00

ASCRESTS -  AUX.1          AUX.2          AUX.3          AUX.4          AUX.5
            0.00            0.00           0.00           0.00           0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
               0            0.00           0.00             0

AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
           0.000            0.00          0.000          0.000             NO

BTM WIDTH -   BW1            BW2            BW3            BW4            BW5
            0.00            0.00           0.00           0.00           0.00

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS       WIDTH       U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft              ft          ft          U/S   D/S    U/S   D/S
 2.50 2.50      10.0             0.0        0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000
```

NOAA Type 'C' 24-Hour Distribution
IDENTIFICATION NAME IS NOAAC GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.007	0.008	0.009	0.010
0.011	0.012	0.013	0.014	0.015
0.017	0.018	0.019	0.020	0.021
0.023	0.024	0.025	0.026	0.028
0.029	0.030	0.031	0.033	0.034
0.035	0.037	0.038	0.039	0.041
0.042	0.043	0.045	0.046	0.048
0.049	0.050	0.052	0.053	0.055
0.056	0.058	0.059	0.061	0.062
0.064	0.065	0.067	0.068	0.070
0.071	0.073	0.074	0.076	0.078
0.079	0.081	0.083	0.084	0.086
0.088	0.090	0.092	0.094	0.096
0.098	0.100	0.102	0.104	0.106
0.108	0.110	0.113	0.115	0.117
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.140	0.143
0.146	0.149	0.152	0.155	0.159
0.162	0.166	0.170	0.174	0.178
0.182	0.187	0.191	0.196	0.201
0.206	0.212	0.218	0.225	0.232
0.240	0.249	0.259	0.270	0.282
0.296	0.316	0.337	0.366	0.407
0.477	0.593	0.634	0.663	0.684
0.705	0.718	0.730	0.741	0.751
0.760	0.768	0.775	0.782	0.788
0.794	0.799	0.804	0.809	0.813
0.818	0.822	0.826	0.830	0.834
0.838	0.841	0.845	0.848	0.851
0.854	0.857	0.860	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.883	0.885	0.887	0.890
0.892	0.894	0.896	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.916	0.917	0.919
0.921	0.922	0.924	0.926	0.927
0.929	0.930	0.932	0.933	0.935
0.936	0.938	0.939	0.941	0.942
0.944	0.945	0.947	0.948	0.950
0.951	0.952	0.954	0.955	0.957
0.958	0.959	0.961	0.962	0.963
0.965	0.966	0.967	0.969	0.970
0.971	0.972	0.974	0.975	0.976
0.977	0.979	0.980	0.981	0.982
0.983	0.985	0.986	0.987	0.988
0.989	0.990	0.991	0.992	0.993
0.995	0.996	0.997	0.998	0.999
1.000				

```
1SITES ---------------------------------------------------------------------------
 XEQ 01/20/2020                Piney Run Dam                            WSID= PRD500
 VER 2005.1.8                    Piney Run Dam                            SUBW= 01
 TIME 11:28:40             SITE = D1                 PASS=    1     PART=   2


 CREST PS         523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 SED ACCUM        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

 BASEFLOW         523.24 FT      72.4 ACFT      0.00 AC      10.6 CFS

 AUX. CREST       531.78 FT    2969.6 ACFT      0.00 AC     223.6 CFS

      PS STORAGE   2969.6 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS
```

```
STORM HYD     D=  24.00 HR    P= 11.80 IN     Q=  8.57 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=   4825.5 ACFT

     PEAK =     15560.2 CFS, AT   13.6 HRS.


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1    :
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.


RATING TABLE NUMBER  2
       ELEV.   Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET      CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.40     26.40      0.00    181.10      0.00
  3   524.22     74.80     74.80      0.00    365.90      0.00
  4   524.82    137.40    137.40      0.00    557.30      0.00
  5   525.43    211.50    211.50      0.00    748.70      0.00
  6   526.22    213.00    213.00      0.00   1002.90      0.00
  7   527.02    214.60    214.60      0.00   1268.00      0.00
  8   527.81    216.10    216.10      0.00   1533.00      0.00
  9   528.60    217.60    217.60      0.00   1810.10      0.00
 10   529.40    219.10    219.10      0.00   2091.00      0.00
 11   530.19    220.60    220.60      0.00   2374.70      0.00
 12   530.99    222.10    222.10      0.00   2667.50      0.00
 13   531.78    223.60    223.60      0.00   2969.60      0.00
 14   532.49    877.70    224.90    652.80   3248.70      0.00
 15   533.20   1692.70    226.20   1466.50   3531.40      0.00
 16   534.48   3780.40    228.50   3551.90   4051.70      0.00
 17   536.05   7230.60    231.30   6999.30   4712.20      0.00
 18   538.89  15391.00    236.30  15154.70   6004.80      0.00
 19   542.44  28292.20    242.50  28049.70   7761.40      0.00
 20   546.00  44281.00    248.50  44032.50   9678.00      0.00

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION   523.00

ROUTED        BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS           FT        FT        ACFT      AC         FT       ACFT
STORM HYD          0.0    533.50    3655.2       0.0      1.72      685.6

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      227.     1963.     2189.
-------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =       2189.38 CFS  at   17.71 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

PRD500        Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************



SITES.....COMPUTATIONS COMPLETE


                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
```

```
                    ----------------             DATED 01/01/2005

WATERSHED ID                       RUN DATE                           RUN TIME
------------                       --------                           --------
PRD500                           01/20/2020                           11:28:40

>>>    SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
        ID     ID     (SQ MI)     NO.    (HRS)  (SQ MI)  DESIGN   CLASS
       -----  ----   --------   -----    ----  -------   -----    -----
       D1      01       10.56     75.    2.49    10.56    TR60      S

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1    0.0    531.8     0.0   1.7    533.5       0.     0.     0.0  STORM HYD


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.



SITES.......SUMMARY TABLE 1 COMPLETED.


                   NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                            PRD500   FILES

INPUT  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\500.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\500.OUT
         DATED 01/20/2020 11:28:40

                             GRAPHICS FILES GENERATED

OPTION "L"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\500.DRG
DATED 01/20/2020 11:28:40

OPTION "P"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\500.DHY
DATED 01/20/2020 11:28:40

OPTION "E"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\500.DEM
DATED 01/20/2020 11:28:40
```

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:28:53

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005TR606     Piney Run Dam                 10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph (FBH) Event
*         Ultimate Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                                     0
                    524                                     298
                    526                                     928
                    528                                     1596
                    530                                     2304
                    531                                     2673
                    532                                     3054
                    534                                     3849
                    536                                     4692
                    538                                     5585
                    540                                     6529
                    542                                     7527
                    544                                     8581
                    546                                     9678
ENDTABLE
WSDATA    2C 01     75        10.56     2.49                6.05
BASEFLOW            1
RAINTABLE HMR6      6         6-Hour Duration Distribution (HMR-52)
                    0.000     0.011     0.024     0.040     0.058
                    0.078     0.102     0.128     0.158     0.191
                    0.228     0.301     0.460     0.631     0.758
                    0.796     0.831     0.863     0.891     0.916
                    0.938     0.957     0.973     0.988     1.000
ENDTABLE
PDIRECT   1.47      8.3       12.2      10.80     26.30
POOLDATA  ELEV      523.0     523.0     523.0     540.5     468       SC
PSINLET             0.7       18
PSDATA    1         303       36                  0.013     471.3
ASSPRFL   41                            Auxiliary
          0         525.8     34        525.8     284       531.2
          316       531.2     438       528.5     646       526.3
          665       525.2     710       508.6     787       499.5
ENDTABLE
ASSURFACE 41        665       0.1
          0         646       0.04      0.87      1         0.5
          646       787       0.10      0.87      2         2
ENDTABLE
ASDATA    41                            2.8                           2
BTMWIDTH  FEET      249
GRAPHICS  I
GO,DESIGN HLC       HMR6      6
SAVMOV    2    101  1                   D1
ENDJOB

******************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
      VER 2005.1.8                Piney Run Dam                 WSID = TR606


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland
```

```
Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

Ultimate Conditions

AECOM 20 January 2020

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO   531.20
                FROM THE ASSPRFL RECORDS.


1SITES ------------------------------------------------------------------------------
 XEQ 01/20/2020              Piney Run Dam                       WSID= TR606
 VER 2005.1.8                  Piney Run Dam                       SUBW= 01
 TIME 11:28:53           SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 HUMID- SUBHUMID CLIMATE AREA                        DESIGN CLASS  C

 STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

 STORM DISTRIBUTION AUX. -6-Hour Duration Distribution (HMR-52)

 PRECIP. - P-PS,1-DAY    P-PS,10-DAY       P-SD           P-FB
              8.30         12.20          10.80          26.30

 WSDATA -       CN          DA-SM          TC/L             -/H           QRF
             75.00         10.56           2.49           0.00          6.05

 SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL        378?
            523.00        523.00        523.00         468.00            NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00          DESIGN

 PSDATA -  NO. COND        COND L         DIA/W             -/H
              1.00        303.00         36.00           0.00

              PS N            KE         WEIR L         TW EL
             0.013          0.70         18.00         471.30

            2ND STG         ORF H          ORF L     START AUX.
              0.00          0.00          0.00           0.00

 ASCRESTS -  AUX.1         AUX.2          AUX.3           AUX.4          AUX.5
            531.20          0.00          0.00           0.00           0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                41          0.00        316.00              0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE     ACTUAL AUX?
             0.040          2.80         0.040          0.022             NO

 BTM WIDTH -    BW1           BW2            BW3             BW4            BW5
   ft       249.00          0.00          0.00           0.00           0.00

 AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493
```

```
MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
  RATIOS       WIDTH       U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
 U/S  D/S       ft              ft          ft         U/S   D/S    U/S   D/S
2.50 2.50      10.0            0.0        0.00        0.00  0.00   0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

     0.0000     0.0300     0.1000     0.1900     0.3100
     0.4700     0.6600     0.8200     0.9300     0.9900
     1.0000     0.9900     0.9300     0.8600     0.7800
     0.6800     0.5600     0.4600     0.3900     0.3300
     0.2800     0.2410     0.2070     0.1740     0.1470
     0.1260     0.1070     0.0910     0.0770     0.0660
     0.0550     0.0470     0.0400     0.0340     0.0290
     0.0250     0.0210     0.0180     0.0150     0.0130
     0.0110     0.0090     0.0080     0.0070     0.0060
     0.0050     0.0040     0.0030     0.0020     0.0010
     0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

      0.000      0.008      0.016      0.025      0.033
      0.043      0.052      0.063      0.074      0.086
      0.099      0.112      0.126      0.142      0.160
      0.180      0.205      0.255      0.345      0.437
      0.530      0.603      0.633      0.660      0.684
      0.705      0.724      0.742      0.759      0.775
      0.790      0.804      0.818      0.831      0.844
      0.856      0.868      0.879      0.890      0.900
      0.910      0.920      0.930      0.939      0.948
      0.957      0.966      0.975      0.983      0.992
      1.000


6-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR6   GIVEN DURATION =   6.0 HRS

      0.000      0.011      0.024      0.040      0.058
      0.078      0.102      0.128      0.158      0.191
      0.228      0.301      0.460      0.631      0.758
      0.796      0.831      0.863      0.891      0.916
      0.938      0.957      0.973      0.988      1.000


1SITES ------------------------------------------------------------------------
 XEQ 01/20/2020                 Piney Run Dam                         WSID= TR606
 VER 2005.1.8                     Piney Run Dam                         SUBW= 01
 TIME 11:28:53             SITE = D1                PASS=    1     PART=   2


***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF   10.6 SQ. MILES.

                DESIGN 0.99647     PS-1 DAY 0.99154     PS-10 DAY 0.99866.

PERM POOL       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

CREST PS        523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

SED ACCUM       523.00 FT       0.0 ACFT      0.00 AC       0.0 CFS

BASEFLOW        523.24 FT      72.3 ACFT      0.00 AC      10.6 CFS
```

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0004	0.0007	0.0011	0.0015	0.0018	0.0022	0.0026	0.0030	0.0034	0.0038
11.	0.0042	0.0046	0.0050	0.0054	0.0058	0.0062	0.0066	0.0070	0.0074	0.0079
21.	0.0083	0.0087	0.0092	0.0096	0.0101	0.0105	0.0110	0.0114	0.0119	0.0124
31.	0.0128	0.0133	0.0138	0.0143	0.0148	0.0153	0.0158	0.0163	0.0168	0.0173
41.	0.0179	0.0184	0.0189	0.0195	0.0200	0.0206	0.0212	0.0217	0.0223	0.0229
51.	0.0235	0.0241	0.0247	0.0254	0.0260	0.0266	0.0273	0.0279	0.0286	0.0293
61.	0.0300	0.0307	0.0314	0.0321	0.0328	0.0336	0.0343	0.0351	0.0359	0.0367
71.	0.0375	0.0383	0.0392	0.0401	0.0409	0.0418	0.0428	0.0437	0.0447	0.0456
81.	0.0466	0.0477	0.0487	0.0498	0.0509	0.0520	0.0532	0.0544	0.0556	0.0569
91.	0.0582	0.0596	0.0610	0.0624	0.0639	0.0655	0.0671	0.0688	0.0706	0.0724
101.	0.0743	0.0763	0.0785	0.0807	0.0831	0.0856	0.0883	0.0912	0.0944	0.0978
111.	0.1016	0.1057	0.1104	0.1158	0.1221	0.1298	0.1395	0.1532	0.1769	0.7983
121.	0.8368	0.8541	0.8655	0.8741	0.8810	0.8868	0.8918	0.8962	0.9002	0.9038
131.	0.9070	0.9101	0.9129	0.9155	0.9179	0.9202	0.9224	0.9245	0.9265	0.9284
141.	0.9301	0.9319	0.9335	0.9351	0.9366	0.9381	0.9395	0.9409	0.9422	0.9435
151.	0.9448	0.9460	0.9472	0.9483	0.9495	0.9506	0.9516	0.9527	0.9537	0.9547
161.	0.9556	0.9566	0.9575	0.9584	0.9593	0.9602	0.9610	0.9619	0.9627	0.9635
171.	0.9643	0.9651	0.9659	0.9666	0.9674	0.9681	0.9688	0.9695	0.9702	0.9709
181.	0.9716	0.9722	0.9729	0.9735	0.9742	0.9748	0.9754	0.9760	0.9766	0.9772
191.	0.9778	0.9784	0.9789	0.9795	0.9801	0.9806	0.9812	0.9817	0.9822	0.9827
201.	0.9833	0.9838	0.9843	0.9848	0.9853	0.9858	0.9863	0.9867	0.9872	0.9877
211.	0.9882	0.9886	0.9891	0.9895	0.9900	0.9904	0.9909	0.9913	0.9917	0.9922
221.	0.9926	0.9930	0.9934	0.9938	0.9942	0.9947	0.9951	0.9955	0.9959	0.9962
231.	0.9966	0.9970	0.9974	0.9978	0.9982	0.9985	0.9989	0.9993	0.9996	1.0000

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 5.25 IN 10-DAY = 6.41 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 58. CN 1-DAY = 75.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12829.7 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE	EMAX	VOL-MAX	AMAX	QMAX
NRCS-PSH	531.78 FT	2969.7 ACFT	0.00 AC	223.5 CFS

PS STORAGE 2969.7 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.66 FT 507.0 ACFT 120.90 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.86 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 90.93 CFS, ELEV = 524.37 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

```
RATING TABLE NUMBER  1
       ELEV.   Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET      CFS      CFS       CFS       AC-FT     ACRE
  1   523.00     0.00     0.00      0.00       0.00      0.00
  2   523.61    26.44    26.44      0.00     181.10      0.00
  3   524.22    74.77    74.77      0.00     365.87      0.00
  4   524.82   137.37   137.37      0.00     557.30      0.00
                                         FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43   211.49   211.49      0.00     748.74      0.00
  6   528.00   216.46   216.46      0.00    1596.73      0.00
  7   530.57   221.31   221.31      0.00    2515.53      0.00
  8   533.14   226.06   226.06      0.00    3508.90      0.00
  9   535.72   230.72   230.72      0.00    4572.12      0.00
 10   538.29   235.27   235.27      0.00    5720.34      0.00
 11   540.86   239.75   239.75      0.00    6957.10      0.00
 12   543.43   244.14   244.14      0.00    8280.12      0.00
 13   546.00   248.45   248.45      0.00    9678.13      0.00


1SITES ------------------------------------------------------------------------------
 XEQ 01/20/2020                  Piney Run Dam                      WSID= TR606
 VER 2005.1.8                      Piney Run Dam                      SUBW= 01
 TIME 11:28:53            SITE = D1                PASS=    1     PART=   3


 AUX. CREST      531.78 FT    2969.7 ACFT      0.00 AC     223.5 CFS

      PS STORAGE   2969.7 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV      524.37 FT     415.3 ACFT      0.00 AC      90.9 CFS

 ***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

 NRCS-SDH      D=   6.00 HR    P= 10.76 IN     Q=  7.59 IN      DA=  10.56 SM
              TC=   2.49 HR   CN=  75.00     VOL=   4274.3 ACFT

      PEAK =     17235.8 CFS, AT    4.8 HRS.

 NRCS-FBH      D=   6.00 HR    P= 26.21 IN     Q= 22.59 IN      DA=  10.56 SM
              TC=   2.49 HR   CN=  75.00     VOL=  12723.7 ACFT

      PEAK =     50306.2 CFS, AT    4.6 HRS.
               AUX. AREAL CORRECTION USED =0.9965

 ***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (  531.20) AND AUXILIARY
                 CREST (  531.78) ELEVATION Do NOT MATCH.  MAXIMUM AUX. SURFACE
                 PROFILE ELEVATION USED IN WSPVRT PROCEDURE.


 ********************************************************************************
 RATING TABLE DEVELOPED, SITE = D1   :
  BY PROGRAM FOR PS AND AUX. SPILLWAYS
  AUX. RATING USED WSPVRT METHOD.


 RATING TABLE NUMBER  2
       ELEV.   Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET      CFS      CFS       CFS       AC-FT     ACRE
  1   523.00     0.00     0.00      0.00       0.00      0.00
  2   523.61    26.44    26.44      0.00     181.10      0.00
  3   524.22    74.77    74.77      0.00     365.87      0.00
  4   524.82   137.37   137.37      0.00     557.30      0.00
                                         FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43   211.49   211.49      0.00     748.74      0.00
  6   526.22   213.04   213.04      0.00    1002.94      0.00
  7   527.02   214.57   214.57      0.00    1267.95      0.00
  8   527.81   216.10   216.10      0.00    1532.97      0.00
  9   528.60   217.61   217.61      0.00    1810.08      0.00
 10   529.40   219.11   219.11      0.00    2090.96      0.00
 11   530.19   220.60   220.60      0.00    2374.72      0.00
 12   530.99   222.08   222.08      0.00    2667.50      0.00
 13   531.78   223.55   223.55      0.00    2969.63      0.00
 14   532.49   877.67   224.86    652.81    3248.72      0.00
```

15	533.20	1692.67	226.17	1466.50	3531.37	0.00
16	534.48	3780.36	228.49	3551.87	4051.67	0.00
17	536.05	7230.62	231.30	6999.32	4712.17	0.00
18	538.89	15391.06	236.33	15154.73	6004.80	0.00
19	542.44	28292.17	242.47	28049.70	7761.36	0.00
20	546.00	44280.93	248.45	44032.47	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	34.	0.0	0.040	**	**	**	INLET
2	34.	284.	-2.2	0.040	**	**	**	INLET
3	284.	316.	0.0	0.040	**	**	**	CREST
4	316.	438.	2.2	0.040	0.87	1	0.5	EXIT !
5	438.	646.	1.1	0.040	0.87	1	0.5	EXIT
6	646.	665.	5.8	0.100	0.87	2	2.0	EXIT
7	665.	710.	36.9	0.100	0.87	2	2.0	exit
8	710.	787.	11.8	0.100	0.87	2	2.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 4 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	534.27	3962.4	0.0	2.49	992.8

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	228.	3194.	3422.

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	1.71	7.35	0.020	0.027

AUXILIARY SPILLWAY DURATION FLOW = 15.5 HOURS

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 7.6 FT/SEC
EXIT SLOPE = 0.022 FT/FT
FLOW DEPTH = 1.7 FT

****

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
Aux. Spillway Discharge = 3194. cfs; Bottom Width = 249. ft

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2	
4	316.	438.	2.21	0.040	7.62	2.28	0.056	
5	438.	646.	1.06	0.040	6.09	1.36	0.034	
6	646.	665.	5.79	0.100	5.84	7.75	0.222	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	541.86	7454.9	0.0	10.08	4485.3

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	241.	25800.	26041.

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	6.76	14.25	0.013	0.017

```
          AUXILIARY SPILLWAY DURATION FLOW =       20.3 HOURS
                             ATTACK, OE/B =       39.2 ACFT/FT

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  17.0 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   5.7 FT
 -------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =        223.49 CFS  at  128.74 hrs.,  Location Point

 Inflow Hyd 1 SDH-Peak =       3422.26 CFS  at    7.49 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =      26041.38 CFS  at    6.02 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
 -------------------------------------------------------------------------------

 TR606         Piney Run Dam

       0 SUBWATERSHED(S) ANALYZED.

       1 STRUCTURE(S) ANALYZED.

       3 HYDROGRAPHS ROUTED AT LOWEST SITE.

       0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 *******************************************************************************



 SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1          SITES VERSION 2005.1.8
                             ----------------                DATED 01/01/2005


 WATERSHED ID                          RUN DATE                          RUN TIME
 ------------                          --------                          --------
 TR606                               01/20/2020                          11:28:53

 >>>   SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
        ID     ID     (SQ MI)     NO.    (HRS)  (SQ MI)  DESIGN   CLASS
       -----   ----   ---------   -----   ----  -------   -----   -----
       D1      01       10.56      75.   2.49     10.56    TR60     C

 PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
  NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
      (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
 ----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
    1   36.0    531.8   249.0  10.1    541.9       0.     0.    17.0  NRCS-FBH


 *  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
    HYDROGRAPH SHOWN UNDER TYPE HYD.



 SITES.......SUMMARY TABLE 1 COMPLETED.


                   NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                            TR606    FILES

INPUT  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW6.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW6.OUT
```

DATED 01/20/2020 11:28:53

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW6.DRG
DATED 01/20/2020 11:28:53

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW6.DHY
DATED 01/20/2020 11:28:53

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW6.DEM
DATED 01/20/2020 11:28:53

```
******************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8              (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:28:42

************************* 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005TR6024    Piney Run Dam                 10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph (FBH) Event
*         Ultimate Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                                     0
                    524                                     298
                    526                                     928
                    528                                     1596
                    530                                     2304
                    531                                     2673
                    532                                     3054
                    534                                     3849
                    536                                     4692
                    538                                     5585
                    540                                     6529
                    542                                     7527
                    544                                     8581
                    546                                     9678
ENDTABLE
WSDATA    2C 01     75        10.56     2.49                 6.05
BASEFLOW            1
RAINTABLE HMR24     24        24-Hour Duration Distribution (HMR-52)
                    0.000     0.001     0.003     0.004     0.005
                    0.007     0.008     0.009     0.011     0.012
                    0.014     0.015     0.017     0.018     0.020
                    0.021     0.023     0.025     0.026     0.028
                    0.030     0.031     0.033     0.035     0.037
                    0.040     0.044     0.047     0.051     0.055
                    0.059     0.063     0.067     0.072     0.077
                    0.081     0.087     0.092     0.097     0.103
                    0.109     0.115     0.122     0.128     0.135
                    0.143     0.150     0.158     0.166     0.175
                    0.185     0.197     0.211     0.227     0.245
                    0.266     0.289     0.314     0.343     0.400
                    0.523     0.656     0.754     0.784     0.811
                    0.835     0.857     0.876     0.894     0.908
                    0.921     0.933     0.942     0.945     0.948
                    0.952     0.955     0.957     0.960     0.963
                    0.966     0.968     0.971     0.973     0.975
                    0.978     0.980     0.982     0.984     0.986
                    0.988     0.990     0.992     0.994     0.996
                    0.998     1.000
ENDTABLE
PDIRECT   1.47      8.3       12.2      15.00     33.90
POOLDATA  ELEV      523.0     523.0     523.0     540.5     468       SC
PSINLET             0.7       18
PSDATA    1         303       36                  0.013     471.3
ASSPRFL   41                            Auxiliary
          0         525.8     34        525.8     284       531.2
          316       531.2     438       528.5     646       526.3
          665       525.2     710       508.6     787       499.5
ENDTABLE
ASSURFACE 41        665       0.1
          0         646       0.04      0.87      1         0.5
          646       787       0.10      0.87      2         2
ENDTABLE
ASDATA    41                            2.8                           2
BTMWIDTH  FEET      249
GRAPHICS  I
GO,DESIGN HLC       HMR24     24
```

```
SAVMOV    2    101  1                  D1
ENDJOB

*******************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
      VER 2005.1.8                 Piney Run Dam                WSID = TR6024


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

 Ultimate Conditions

 AECOM 20 January 2020

 ***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO   531.20
                 FROM THE ASSPRFL RECORDS.


1SITES -----------------------------------------------------------------------
 XEQ 01/20/2020                Piney Run Dam                     WSID= TR6024
 VER 2005.1.8                    Piney Run Dam                     SUBW= 01
 TIME 11:28:42            SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    *********************************
 HUMID- SUBHUMID CLIMATE AREA                        DESIGN CLASS  C

 STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

 STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

 PRECIP. - P-PS,1-DAY    P-PS,10-DAY       P-SD          P-FB
              8.30          12.20         15.00         33.90

 WSDATA -       CN          DA-SM          TC/L            -/H           QRF
             75.00          10.56          2.49           0.00          6.05

 SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL        378?
            523.00        523.00        523.00         468.00            NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
              1.00          0.00          0.00         DESIGN

 PSDATA -  NO. COND        COND L          DIA/W           -/H
              1.00        303.00         36.00           0.00

              PS N            KE         WEIR L          TW EL
             0.013          0.70         18.00         471.30

           2ND STG         ORF H          ORF L      START AUX.
              0.00          0.00          0.00           0.00

 ASCRESTS -   AUX.1         AUX.2         AUX.3          AUX.4         AUX.5
            531.20          0.00          0.00           0.00          0.00

 AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                41          0.00        316.00              0

 AUX.Data - INLET N     SIDE SLOPE       EXIT N     EXIT SLOPE    ACTUAL AUX?
             0.040          2.80         0.040          0.022            NO

 BTM WIDTH -    BW1            BW2           BW3            BW4           BW5
   ft       249.00          0.00          0.00           0.00          0.00

 AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.
```

```
1********************     DETAILED LIST OF BASIC Data     ********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS       WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft             ft          ft         U/S   D/S    U/S   D/S
  2.50 2.50      10.0           0.0        0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000


 24-Hour Duration Distribution (HMR-52)
 IDENTIFICATION NAME IS HMR24  GIVEN DURATION =  24.0 HRS

       0.000      0.001      0.003      0.004      0.005
       0.007      0.008      0.009      0.011      0.012
       0.014      0.015      0.017      0.018      0.020
       0.021      0.023      0.025      0.026      0.028
       0.030      0.031      0.033      0.035      0.037
       0.040      0.044      0.047      0.051      0.055
       0.059      0.063      0.067      0.072      0.077
       0.081      0.087      0.092      0.097      0.103
       0.109      0.115      0.122      0.128      0.135
       0.143      0.150      0.158      0.166      0.175
```

0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948
0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975
0.978	0.980	0.982	0.984	0.986
0.988	0.990	0.992	0.994	0.996
0.998	1.000			

1SITES ---

XEQ 01/20/2020 Piney Run Dam WSID= TR6024

VER 2005.1.8 Piney Run Dam SUBW= 01

TIME 11:28:42 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0004	0.0007	0.0011	0.0015	0.0018	0.0022	0.0026	0.0030	0.0034	0.0038
11.	0.0042	0.0046	0.0050	0.0054	0.0058	0.0062	0.0066	0.0070	0.0074	0.0079
21.	0.0083	0.0087	0.0092	0.0096	0.0101	0.0105	0.0110	0.0114	0.0119	0.0124
31.	0.0128	0.0133	0.0138	0.0143	0.0148	0.0153	0.0158	0.0163	0.0168	0.0173
41.	0.0179	0.0184	0.0189	0.0195	0.0200	0.0206	0.0212	0.0217	0.0223	0.0229
51.	0.0235	0.0241	0.0247	0.0254	0.0260	0.0266	0.0273	0.0279	0.0286	0.0293
61.	0.0300	0.0307	0.0314	0.0321	0.0328	0.0336	0.0343	0.0351	0.0359	0.0367
71.	0.0375	0.0383	0.0392	0.0401	0.0409	0.0418	0.0428	0.0437	0.0447	0.0456
81.	0.0466	0.0477	0.0487	0.0498	0.0509	0.0520	0.0532	0.0544	0.0556	0.0569
91.	0.0582	0.0596	0.0610	0.0624	0.0639	0.0655	0.0671	0.0688	0.0706	0.0724
101.	0.0743	0.0763	0.0785	0.0807	0.0831	0.0856	0.0883	0.0912	0.0944	0.0978
111.	0.1016	0.1057	0.1104	0.1158	0.1221	0.1298	0.1395	0.1532	0.1769	0.7983
121.	0.8368	0.8541	0.8655	0.8741	0.8810	0.8868	0.8918	0.8962	0.9002	0.9038
131.	0.9070	0.9101	0.9129	0.9155	0.9179	0.9202	0.9224	0.9245	0.9265	0.9284
141.	0.9301	0.9319	0.9335	0.9351	0.9366	0.9381	0.9395	0.9409	0.9422	0.9435
151.	0.9448	0.9460	0.9472	0.9483	0.9495	0.9506	0.9516	0.9527	0.9537	0.9547
161.	0.9556	0.9566	0.9575	0.9584	0.9593	0.9602	0.9610	0.9619	0.9627	0.9635
171.	0.9643	0.9651	0.9659	0.9666	0.9674	0.9681	0.9688	0.9695	0.9702	0.9709
181.	0.9716	0.9722	0.9729	0.9735	0.9742	0.9748	0.9754	0.9760	0.9766	0.9772
191.	0.9778	0.9784	0.9789	0.9795	0.9801	0.9806	0.9812	0.9817	0.9822	0.9827
201.	0.9833	0.9838	0.9843	0.9848	0.9853	0.9858	0.9863	0.9867	0.9872	0.9877
211.	0.9882	0.9886	0.9891	0.9895	0.9900	0.9904	0.9909	0.9913	0.9917	0.9922
221.	0.9926	0.9930	0.9934	0.9938	0.9942	0.9947	0.9951	0.9955	0.9959	0.9962
231.	0.9966	0.9970	0.9974	0.9978	0.9982	0.9985	0.9989	0.9993	0.9996	1.0000

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM

```
     RUNOFF     1-DAY =   5.25 IN    10-DAY =   6.41 IN

  CLIMATIC INDEX = 1.47    CN 10-DAY = 58.    CN 1-DAY =  75.


  AREAL CORRECTION 1 DAY =0.9915     AREAL CORRECTION 10 DAY =0.9987
  QRF  =     63.89 CFS      524.08 FEET,    GIVEN Value.

  PEAK =     12829.7 CFS, AT  121.0 HRS.


ROUTED RESULT - HYD TYPE      EMAX         VOL-MAX        AMAX        QMAX
                NRCS-PSH    531.78 FT    2969.7 ACFT      0.00 AC    223.5 CFS

  PS STORAGE    2969.7 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST        524.66 FT     507.0 ACFT    120.90 CFS
  CONTROL IS 0.150 DETENTION STORAGE

  TIME TO DDT TEST DISCHARGE IS   8.86 DAYS - DRAWDOWN CONTINUING.

  TIME LIMIT =  10.00 DAYS;  FLOW WAS    90.93 CFS,  ELEV =   524.37 FT


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  1
       ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET       CFS       CFS       CFS       AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.44     26.44      0.00    181.10      0.00
  3   524.22     74.77     74.77      0.00    365.87      0.00
  4   524.82    137.37    137.37      0.00    557.30      0.00
                                          FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43    211.49    211.49      0.00    748.74      0.00
  6   528.00    216.46    216.46      0.00   1596.73      0.00
  7   530.57    221.31    221.31      0.00   2515.53      0.00
  8   533.14    226.06    226.06      0.00   3508.90      0.00
  9   535.72    230.72    230.72      0.00   4572.12      0.00
 10   538.29    235.27    235.27      0.00   5720.34      0.00
 11   540.86    239.75    239.75      0.00   6957.10      0.00
 12   543.43    244.14    244.14      0.00   8280.12      0.00
 13   546.00    248.45    248.45      0.00   9678.13      0.00


1SITES -------------------------------------------------------------------------
XEQ 01/20/2020                  Piney Run Dam                       WSID= TR6024
VER 2005.1.8                      Piney Run Dam                       SUBW= 01
TIME 11:28:42            SITE = D1                PASS=    1     PART=   3


AUX. CREST      531.78 FT    2969.7 ACFT      0.00 AC     223.5 CFS

  PS STORAGE   2969.7 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV      524.37 FT     415.3 ACFT      0.00 AC      90.9 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH      D=  24.00 HR    P= 14.95 IN     Q= 11.58 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=   6520.6 ACFT

  PEAK =     21546.3 CFS, AT   16.6 HRS.

NRCS-FBH      D=  24.00 HR    P= 33.78 IN     Q= 30.09 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=  16943.8 ACFT

  PEAK =     53145.1 CFS, AT   16.7 HRS.
              AUX. AREAL CORRECTION USED =0.9965
```

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.20) AND AUXILIARY CREST (531.78) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****

RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
					FULL CONDUIT FLOW, ELEV = 525.43 FT	
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.22	213.04	213.04	0.00	1002.94	0.00
7	527.02	214.57	214.57	0.00	1267.95	0.00
8	527.81	216.10	216.10	0.00	1532.97	0.00
9	528.60	217.61	217.61	0.00	1810.08	0.00
10	529.40	219.11	219.11	0.00	2090.96	0.00
11	530.19	220.60	220.60	0.00	2374.72	0.00
12	530.99	222.08	222.08	0.00	2667.50	0.00
13	531.78	223.55	223.55	0.00	2969.63	0.00
14	532.49	877.67	224.86	652.81	3248.72	0.00
15	533.20	1692.67	226.17	1466.50	3531.37	0.00
16	534.48	3780.36	228.49	3551.87	4051.67	0.00
17	536.05	7230.62	231.30	6999.32	4712.17	0.00
18	538.89	15391.06	236.33	15154.73	6004.80	0.00
19	542.44	28292.17	242.47	28049.70	7761.36	0.00
20	546.00	44280.93	248.45	44032.47	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	34.	0.0	0.040	**	**	**	INLET
2	34.	284.	-2.2	0.040	**	**	**	INLET
3	284.	316.	0.0	0.040	**	**	**	CREST
4	316.	438.	2.2	0.040	0.87	1	0.5	EXIT !
5	438.	646.	1.1	0.040	0.87	1	0.5	EXIT
6	646.	665.	5.8	0.100	0.87	2	2.0	EXIT
7	665.	710.	36.9	0.100	0.87	2	2.0	exit
8	710.	787.	11.8	0.100	0.87	2	2.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 4 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	536.17	4767.0	0.0	4.39	1797.4

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	232.	7345.	7577.

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	2.97	9.62	0.016	0.022

```
          AUXILIARY SPILLWAY DURATION FLOW =       19.5 HOURS

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  10.5 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   2.7 FT
         *******************************************************************

         EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
         (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
           Aux. Spillway Discharge =    7345. cfs;   Bottom Width =   249. ft

                                                              TOTAL  EFFECTIVE
           REACH   FROM    TO    SLOPE  MANNING`S  VELOCITY  STRESS  STRESS
            NO.    STA     STA     %        n        ft/s    lb/ft^2 lb/ft^2
             4     316.    438.  2.21   0.040      10.53      3.75   0.093
             5     438.    646.  1.06   0.040       8.39      2.24   0.055
             6     646.    665.  5.79   0.100       8.05     12.74   0.242   max.
         *******************************************************************

 ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
 RESULTS          FT        FT        ACFT      AC         FT       ACFT
 NRCS-FBH        249.0    543.57    8355.5       0.0     11.79    5385.9

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      244.    33004.    33249.

                        CRITICAL  CRITICAL   CRITICAL  25% OF Q
                          DEPTH   VELOCITY   SLOPE-Sc     Sc
          AUXILIARY        FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---    7.92     15.36      0.012     0.016

          AUXILIARY SPILLWAY DURATION FLOW =       23.4 HOURS
                             ATTACK, OE/B =       55.6 ACFT/FT

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  18.6 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   6.6 FT
 -------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =        223.49 CFS  at  128.74 hrs.,  Location Point

 Inflow Hyd 1 SDH-Peak =       7576.95 CFS  at   18.80 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =      33248.72 CFS  at   17.75 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
 -------------------------------------------------------------------------------

 TR6024        Piney Run Dam

       0 SUBWATERSHED(S) ANALYZED.

       1 STRUCTURE(S) ANALYZED.

       3 HYDROGRAPHS ROUTED AT LOWEST SITE.

       0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 *******************************************************************************


 SITES.....COMPUTATIONS COMPLETE

                              SUMMARY TABLE  1         SITES VERSION 2005.1.8
                             ----------------               DATED 01/01/2005

 WATERSHED ID                         RUN DATE                          RUN TIME
 ------------                         --------                          --------
```

>>> SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS <<<
D1	01	10.56	75.	2.49	10.56	TR60	C

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	36.0	531.8	249.0	11.8	543.6	0.	0.	18.6	NRCS-FBH

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005
TR6024 FILES

INPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW24.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW24.OUT
DATED 01/20/2020 11:28:42

GRAPHICS FILES GENERATED

OPTION "L" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW24.DRG
DATED 01/20/2020 11:28:42

OPTION "P" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW24.DHY
DATED 01/20/2020 11:28:42

OPTION "E" = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW24.DEM
DATED 01/20/2020 11:28:42

```
********************************************************************************
SITES XEQ 01/20/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8               (USER MANUAL - DATED DECEMBER 2005)
     TIME 11:29:02

************************** 80-80 LIST OF INPUT Data **************************

SITES     01/01/2005TR6072    Piney Run Dam                 10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                                      1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph (FBH) Event
*         Ultimate Conditions
*         AECOM 20 January 2020
STRUCTURE D1        Piney Run Dam
                    523                                     0
                    524                                     298
                    526                                     928
                    528                                     1596
                    530                                     2304
                    531                                     2673
                    532                                     3054
                    534                                     3849
                    536                                     4692
                    538                                     5585
                    540                                     6529
                    542                                     7527
                    544                                     8581
                    546                                     9678
ENDTABLE
WSDATA    2C 01     75        10.56     2.49                6.05
BASEFLOW            1
RAINTABLE HMR24     72        72-Hour Duration Distribution (HMR-52)
                    0.000     0.0003    0.0005    0.0008    0.0010
                    0.0013    0.0015    0.0018    0.0020    0.0023
                    0.0026    0.0028    0.0031    0.0033    0.0036
                    0.0038    0.0041    0.0044    0.0046    0.0049
                    0.0051    0.0054    0.0056    0.0059    0.0061
                    0.0066    0.0070    0.0075    0.0079    0.0083
                    0.0088    0.0092    0.0096    0.0101    0.0105
                    0.0109    0.0114    0.0118    0.0122    0.0127
                    0.0131    0.0135    0.0140    0.0144    0.0149
                    0.0153    0.0157    0.0162    0.0166    0.0174
                    0.0182    0.0190    0.0198    0.0206    0.0214
                    0.0221    0.0229    0.0237    0.0245    0.0253
                    0.0261    0.0269    0.0277    0.0285    0.0293
                    0.0301    0.0309    0.0317    0.0325    0.0333
                    0.0341    0.0349    0.0356    0.0367    0.0377
                    0.0387    0.0397    0.0408    0.0418    0.0428
                    0.0438    0.0449    0.0459    0.0469    0.0479
                    0.0490    0.0500    0.0510    0.0520    0.0531
                    0.0541    0.0551    0.0561    0.0572    0.0582
                    0.0592    0.0602    0.0614    0.0625    0.0637
                    0.0648    0.0660    0.0672    0.0684    0.0696
                    0.0709    0.0721    0.0734    0.0747    0.0760
                    0.0773    0.0787    0.0801    0.0815    0.0829
                    0.0844    0.0859    0.0874    0.0889    0.0905
                    0.0921    0.0951    0.0981    0.1012    0.1045
                    0.1078    0.1113    0.1149    0.1187    0.1226
                    0.1267    0.1309    0.1353    0.1399    0.1446
                    0.1496    0.1548    0.1601    0.1658    0.1716
                    0.1776    0.1839    0.1905    0.1972    0.2043
                    0.2118    0.2208    0.2312    0.2571    0.2729
                    0.2907    0.3107    0.3330    0.3577    0.4069
                    0.5139    0.6291    0.7141    0.7401    0.7636
                    0.7847    0.8036    0.8204    0.8352    0.8481
                    0.8594    0.8690    0.8772    0.8801    0.8828
                    0.8855    0.8881    0.8906    0.8930    0.8954
                    0.8976    0.8999    0.9020    0.9041    0.9062
                    0.9082    0.9101    0.9120    0.9139    0.9157
                    0.9174    0.9192    0.9209    0.9226    0.9243
```

```
                    0.9259    0.9275    0.9287    0.9298    0.9310
                    0.9321    0.9333    0.9344    0.9356    0.9368
                    0.9379    0.9391    0.9402    0.9414    0.9425
                    0.9437    0.9448    0.9460    0.9471    0.9483
                    0.9494    0.9506    0.9517    0.9529    0.9540
                    0.9551    0.9561    0.9570    0.9579    0.9588
                    0.9597    0.9607    0.9616    0.9625    0.9634
                    0.9644    0.9653    0.9662    0.9671    0.9680
                    0.9690    0.9699    0.9708    0.9717    0.9727
                    0.9736    0.9745    0.9754    0.9763    0.9773
                    0.9779    0.9785    0.9791    0.9797    0.9803
                    0.9809    0.9816    0.9822    0.9828    0.9834
                    0.9840    0.9846    0.9853    0.9859    0.9865
                    0.9871    0.9883    0.9889    0.9896    0.9902
                    0.9908    0.9914    0.9920    0.9923    0.9927
                    0.9930    0.9933    0.9937    0.9940    0.9943
                    0.9947    0.9950    0.9953    0.9957    0.9960
                    0.9963    0.9967    0.9970    0.9973    0.9977
                    0.9980    0.9983    0.9987    0.9990    0.9993
                    0.9997    1.0000
ENDTABLE
PDIRECT   1.47      8.3       12.2      17.38     39.05
POOLDATA  ELEV      523.0     523.0     523.0     540.5     468       SC
PSINLET             0.7       18
PSDATA    1         303       36                  0.013     471.3
ASSPRFL   41                            Auxiliary
          0         525.8     34        525.8     284       531.2
          316       531.2     438       528.5     646       526.3
          665       525.2     710       508.6     787       499.5
ENDTABLE
ASSURFACE 41        665       0.1
          0         646       0.04      0.87      1         0.5
          646       787       0.10      0.87      2         2
ENDTABLE
ASDATA    41                            2.8                           2
BTMWIDTH  FEET      249
GRAPHICS  I
GO,DESIGN HLC       HMR24     72
SAVMOV    2    101  1                   D1
ENDJOB

********************************************************************************

1SITES XEQ 01/20/2020 ------------- COMMENT PAGE ------------------------------
       VER 2005.1.8                 Piney Run Dam                 WSID = TR6072


 Piney Run Watershed Study

 Piney Run Dam (MD Dam No. 139, NID MD000139)

 Sykesville, Maryland

 Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

 Ultimate Conditions

 AECOM 20 January 2020

 ***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO   531.20
                 FROM THE ASSPRFL RECORDS.


1SITES ------------------------------------------------------------------------
 XEQ 01/20/2020              Piney Run Dam                      WSID= TR6072
 VER 2005.1.8                  Piney Run Dam                      SUBW= 01
 TIME 11:29:02            SITE = D1                PASS=    1     PART=   1


 ****************************    BASIC Data    ********************************
 HUMID- SUBHUMID CLIMATE AREA                     DESIGN CLASS  C

 STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).
```

```
STORM DISTRIBUTION AUX. -72-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY    P-PS,10-DAY       P-SD            P-FB
             8.30         12.20         17.38           39.05

WSDATA -       CN          DA-SM          TC/L             -/H           QRF
            75.00         10.56          2.49            0.00          6.05

SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL        378?
           523.00        523.00        523.00          468.00           NO

          BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
             1.00          0.00          0.00          DESIGN

PSDATA -  NO. COND        COND L         DIA/W             -/H
             1.00        303.00         36.00            0.00

             PS N            KE         WEIR L           TW EL
            0.013          0.70         18.00          471.30

          2ND STG         ORF H          ORF L       START AUX.
             0.00          0.00          0.00            0.00

ASCRESTS -   AUX.1         AUX.2         AUX.3           AUX.4         AUX.5
           531.20          0.00          0.00            0.00          0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
               41          0.00        316.00               0

AUX.Data - INLET N     SIDE SLOPE       EXIT N      EXIT SLOPE    ACTUAL AUX?
            0.040          2.80         0.040           0.022            NO

BTM WIDTH -    BW1           BW2           BW3             BW4           BW5
  ft       249.00          0.00          0.00            0.00          0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************     DETAILED LIST OF BASIC Data     *********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS       WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft             ft          ft         U/S   D/S    U/S   D/S
  2.50 2.50      10.0           0.0        0.00        0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH
 STANDARD DIMENSIONLESS UNIT HYDROGRAPH
 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
```

0.6800	0.5600	0.4600	0.3900	0.3300
0.2800	0.2410	0.2070	0.1740	0.1470
0.1260	0.1070	0.0910	0.0770	0.0660
0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

72-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 72.0 HRS

0.000	0.000	0.001	0.001	0.001
0.001	0.002	0.002	0.002	0.002
0.003	0.003	0.003	0.003	0.004
0.004	0.004	0.004	0.005	0.005
0.005	0.005	0.006	0.006	0.006
0.007	0.007	0.008	0.008	0.008
0.009	0.009	0.010	0.010	0.011
0.011	0.011	0.012	0.012	0.013
0.013	0.014	0.014	0.014	0.015
0.015	0.016	0.016	0.017	0.017
0.018	0.019	0.020	0.021	0.021
0.022	0.023	0.024	0.025	0.025
0.026	0.027	0.028	0.029	0.029
0.030	0.031	0.032	0.033	0.033
0.034	0.035	0.036	0.037	0.038
0.039	0.040	0.041	0.042	0.043
0.044	0.045	0.046	0.047	0.048
0.049	0.050	0.051	0.052	0.053
0.054	0.055	0.056	0.057	0.058
0.059	0.060	0.061	0.063	0.064
0.065	0.066	0.067	0.068	0.070
0.071	0.072	0.073	0.075	0.076
0.077	0.079	0.080	0.082	0.083
0.084	0.086	0.087	0.089	0.091
0.092	0.095	0.098	0.101	0.105
0.108	0.111	0.115	0.119	0.123
0.127	0.131	0.135	0.140	0.145
0.150	0.155	0.160	0.166	0.172
0.178	0.184	0.191	0.197	0.204
0.212	0.221	0.231	0.257	0.273
0.291	0.311	0.333	0.358	0.407
0.514	0.629	0.714	0.740	0.764
0.785	0.804	0.820	0.835	0.848
0.859	0.869	0.877	0.880	0.883
0.886	0.888	0.891	0.893	0.895
0.898	0.900	0.902	0.904	0.906
0.908	0.910	0.912	0.914	0.916
0.917	0.919	0.921	0.923	0.924
0.926	0.928	0.929	0.930	0.931
0.932	0.933	0.934	0.936	0.937
0.938	0.939	0.940	0.941	0.942
0.944	0.945	0.946	0.947	0.948
0.949	0.951	0.952	0.953	0.954
0.955	0.956	0.957	0.958	0.959
0.960	0.961	0.962	0.963	0.963

0.964	0.965	0.966	0.967	0.968
0.969	0.970	0.971	0.972	0.973
0.974	0.975	0.975	0.976	0.977
0.978	0.979	0.979	0.980	0.980
0.981	0.982	0.982	0.983	0.983
0.984	0.985	0.985	0.986	0.987
0.987	0.988	0.989	0.990	0.990
0.991	0.991	0.992	0.992	0.993
0.993	0.993	0.994	0.994	0.994
0.995	0.995	0.995	0.996	0.996
0.996	0.997	0.997	0.997	0.998
0.998	0.998	0.999	0.999	0.999
1.000	1.000			

1SITES --

XEQ 01/20/2020 Piney Run Dam WSID= TR6072

VER 2005.1.8 Piney Run Dam SUBW= 01

TIME 11:29:02 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0004	0.0007	0.0011	0.0015	0.0018	0.0022	0.0026	0.0030	0.0034	0.0038
11.	0.0042	0.0046	0.0050	0.0054	0.0058	0.0062	0.0066	0.0070	0.0074	0.0079
21.	0.0083	0.0087	0.0092	0.0096	0.0101	0.0105	0.0110	0.0114	0.0119	0.0124
31.	0.0128	0.0133	0.0138	0.0143	0.0148	0.0153	0.0158	0.0163	0.0168	0.0173
41.	0.0179	0.0184	0.0189	0.0195	0.0200	0.0206	0.0212	0.0217	0.0223	0.0229
51.	0.0235	0.0241	0.0247	0.0254	0.0260	0.0266	0.0273	0.0279	0.0286	0.0293
61.	0.0300	0.0307	0.0314	0.0321	0.0328	0.0336	0.0343	0.0351	0.0359	0.0367
71.	0.0375	0.0383	0.0392	0.0401	0.0409	0.0418	0.0428	0.0437	0.0447	0.0456
81.	0.0466	0.0477	0.0487	0.0498	0.0509	0.0520	0.0532	0.0544	0.0556	0.0569
91.	0.0582	0.0596	0.0610	0.0624	0.0639	0.0655	0.0671	0.0688	0.0706	0.0724
101.	0.0743	0.0763	0.0785	0.0807	0.0831	0.0856	0.0883	0.0912	0.0944	0.0978
111.	0.1016	0.1057	0.1104	0.1158	0.1221	0.1298	0.1395	0.1532	0.1769	0.7983
121.	0.8368	0.8541	0.8655	0.8741	0.8810	0.8868	0.8918	0.8962	0.9002	0.9038
131.	0.9070	0.9101	0.9129	0.9155	0.9179	0.9202	0.9224	0.9245	0.9265	0.9284
141.	0.9301	0.9319	0.9335	0.9351	0.9366	0.9381	0.9395	0.9409	0.9422	0.9435
151.	0.9448	0.9460	0.9472	0.9483	0.9495	0.9506	0.9516	0.9527	0.9537	0.9547
161.	0.9556	0.9566	0.9575	0.9584	0.9593	0.9602	0.9610	0.9619	0.9627	0.9635
171.	0.9643	0.9651	0.9659	0.9666	0.9674	0.9681	0.9688	0.9695	0.9702	0.9709
181.	0.9716	0.9722	0.9729	0.9735	0.9742	0.9748	0.9754	0.9760	0.9766	0.9772
191.	0.9778	0.9784	0.9789	0.9795	0.9801	0.9806	0.9812	0.9817	0.9822	0.9827
201.	0.9833	0.9838	0.9843	0.9848	0.9853	0.9858	0.9863	0.9867	0.9872	0.9877
211.	0.9882	0.9886	0.9891	0.9895	0.9900	0.9904	0.9909	0.9913	0.9917	0.9922
221.	0.9926	0.9930	0.9934	0.9938	0.9942	0.9947	0.9951	0.9955	0.9959	0.9962
231.	0.9966	0.9970	0.9974	0.9978	0.9982	0.9985	0.9989	0.9993	0.9996	1.0000

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

```
NRCS-PSH  RAINFALL   1-DAY =   8.23 IN    10-DAY =  12.18 IN    DA =  10.56 SM
          RUNOFF     1-DAY =   5.25 IN    10-DAY =   6.41 IN

     CLIMATIC INDEX = 1.47    CN 10-DAY = 58.    CN 1-DAY =  75.


     AREAL CORRECTION 1 DAY =0.9915     AREAL CORRECTION 10 DAY =0.9987
     QRF  =     63.89 CFS      524.08 FEET,    GIVEN Value.

     PEAK =     12829.7 CFS, AT  121.0 HRS.


ROUTED RESULT - HYD TYPE      EMAX         VOL-MAX        AMAX        QMAX
                NRCS-PSH    531.78 FT    2969.7 ACFT      0.00 AC    223.5 CFS

     PS STORAGE    2969.7 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST        524.66 FT     507.0 ACFT    120.90 CFS
     CONTROL IS 0.150 DETENTION STORAGE

     TIME TO DDT TEST DISCHARGE IS   8.86 DAYS - DRAWDOWN CONTINUING.

     TIME LIMIT =  10.00 DAYS;  FLOW WAS    90.93 CFS,  ELEV =   524.37 FT


******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  1
       ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
       FEET       CFS       CFS       CFS      AC-FT     ACRE
  1   523.00      0.00      0.00      0.00      0.00      0.00
  2   523.61     26.44     26.44      0.00    181.10      0.00
  3   524.22     74.77     74.77      0.00    365.87      0.00
  4   524.82    137.37    137.37      0.00    557.30      0.00
                                          FULL CONDUIT FLOW, ELEV =  525.43 FT
  5   525.43    211.49    211.49      0.00    748.74      0.00
  6   528.00    216.46    216.46      0.00   1596.73      0.00
  7   530.57    221.31    221.31      0.00   2515.53      0.00
  8   533.14    226.06    226.06      0.00   3508.90      0.00
  9   535.72    230.72    230.72      0.00   4572.12      0.00
 10   538.29    235.27    235.27      0.00   5720.34      0.00
 11   540.86    239.75    239.75      0.00   6957.10      0.00
 12   543.43    244.14    244.14      0.00   8280.12      0.00
 13   546.00    248.45    248.45      0.00   9678.13      0.00
```



```
AUX. CREST       531.78 FT    2969.7 ACFT      0.00 AC     223.5 CFS

     PS STORAGE   2969.7 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV       524.37 FT     415.3 ACFT      0.00 AC      90.9 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH      D=  72.00 HR    P= 17.32 IN     Q= 13.87 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=   7814.1 ACFT

     PEAK =     22235.5 CFS, AT   40.7 HRS.

NRCS-FBH      D=  72.00 HR    P= 38.91 IN     Q= 35.18 IN      DA=  10.56 SM
             TC=   2.49 HR   CN=  75.00     VOL=  19812.9 ACFT
```

PEAK = 53557.5 CFS, AT 40.7 HRS.
AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.20) AND AUXILIARY CREST (531.78) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****

RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
					FULL CONDUIT FLOW, ELEV = 525.43 FT	
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.22	213.04	213.04	0.00	1002.94	0.00
7	527.02	214.57	214.57	0.00	1267.95	0.00
8	527.81	216.10	216.10	0.00	1532.97	0.00
9	528.60	217.61	217.61	0.00	1810.08	0.00
10	529.40	219.11	219.11	0.00	2090.96	0.00
11	530.19	220.60	220.60	0.00	2374.72	0.00
12	530.99	222.08	222.08	0.00	2667.50	0.00
13	531.78	223.55	223.55	0.00	2969.63	0.00
14	532.49	877.67	224.86	652.81	3248.72	0.00
15	533.20	1692.67	226.17	1466.50	3531.37	0.00
16	534.48	3780.36	228.49	3551.87	4051.67	0.00
17	536.05	7230.62	231.30	6999.32	4712.17	0.00
18	538.89	15391.06	236.33	15154.73	6004.80	0.00
19	542.44	28292.17	242.47	28049.70	7761.36	0.00
20	546.00	44280.93	248.45	44032.47	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	34.	0.0	0.040	**	**	**	INLET
2	34.	284.	-2.2	0.040	**	**	**	INLET
3	284.	316.	0.0	0.040	**	**	**	CREST
4	316.	438.	2.2	0.040	0.87	1	0.5	EXIT !
5	438.	646.	1.1	0.040	0.87	1	0.5	EXIT
6	646.	665.	5.8	0.100	0.87	2	2.0	EXIT
7	665.	710.	36.9	0.100	0.87	2	2.0	exit
8	710.	787.	11.8	0.100	0.87	2	2.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 4 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	536.62	4968.2	0.0	4.84	1998.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	232.	8615.	8847.

CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc

```
          AUXILIARY         FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---     3.30     10.12     0.016     0.021

          AUXILIARY SPILLWAY DURATION FLOW =       33.6 HOURS

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  11.2 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   3.0 FT

***** WARNING - SOD STRIPPING WILL PROBABLY OCCUR DUE TO GROSSSTRESS LIMIT IN
                STABILITY CONTROL REACH WHICH STARTS AT STATION   646.00.
         ******************************************************************

         EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
         (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
           Aux. Spillway Discharge =    8615. cfs;   Bottom Width =   249. ft

                                                                 TOTAL  EFFECTIVE
          REACH   FROM    TO    SLOPE  MANNING`S  VELOCITY  STRESS  STRESS
           NO.    STA     STA     %        n        ft/s    lb/ft^2 lb/ft^2
            4     316.    438.  2.21   0.040      11.20      4.13   0.102
            5     438.    646.  1.06   0.040       8.92      2.46   0.061
            6     646.    665.  5.79   0.100       8.56     14.00   0.247   max.
         ******************************************************************

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-FBH        249.0    544.02    8591.5       0.0     12.24    5621.9

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      245.    34972.    35217.

                        CRITICAL  CRITICAL   CRITICAL  25% OF Q
                          DEPTH   VELOCITY   SLOPE-Sc     Sc
          AUXILIARY         FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---     8.23     15.63     0.012     0.016

          AUXILIARY SPILLWAY DURATION FLOW =       40.3 HOURS
                             ATTACK, OE/B =       65.2 ACFT/FT

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  19.0 FT/SEC
                                           EXIT SLOPE  = 0.022 FT/FT
                                           FLOW DEPTH  =   6.9 FT
-------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =        223.49 CFS  at  128.74 hrs.,  Location Point

Inflow Hyd 1 SDH-Peak =       8847.22 CFS  at   42.54 hrs.,  Location Point

Inflow Hyd 1 FBH-Peak =      35217.28 CFS  at   41.61 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

TR6072        Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      3 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************


SITES.....COMPUTATIONS COMPLETE
```

```
                           SUMMARY TABLE  1         SITES VERSION 2005.1.8
                          ----------------                DATED 01/01/2005


WATERSHED ID                        RUN DATE                           RUN TIME
------------                        --------                           --------
TR6072                            01/20/2020                           11:29:02

>>>   SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA  TYPE    STRUC    <<<
       ID     ID     (SQ MI)     NO.   (HRS)  (SQ MI)  DESIGN   CLASS
      -----  ----   --------   -----   ----   -------  -----   -----
      D1      01      10.56     75.   2.49     10.56    TR60      C

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1   36.0    531.8   249.0  12.2    544.0       0.     0.    19.0  NRCS-FBH


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.



SITES.......SUMMARY TABLE 1 COMPLETED.


                   NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                            TR6072   FILES

INPUT  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW72.D2C
OUTPUT = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400_Technical
\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW72.OUT
         DATED 01/20/2020 11:29:02

                        GRAPHICS FILES GENERATED

OPTION "L"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW72.DRG
DATED 01/20/2020 11:29:02

OPTION "P"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW72.DHY
DATED 01/20/2020 11:29:02

OPTION "E"  = q:\Projects\ENG\Dam&Reservoir Projects\Piney Run Watershed Study\400
_Technical\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Ultimate\ASW72.DEM
DATED 01/20/2020 11:29:02
```

Appendix E – SITES Spillway Integrity Analysis Model Output

Log of Test Boring ASW- 1

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626380.9096 E 1319128.5351**

DATE STARTED: **12/4/2019**
DATE COMPLETED: **12/5/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **70.2 FT**
SURFACE ELEVATION: **526.29 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	12-04-2019	N/A	39.0	N/A
24-hour ▼	12-06-2019	N/A	31.5	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
			Top-soil													
	525	0.3 - 19.0 ft: Moist, loose, light orangish brown with speckles of black, nonplastic, SILTY SAND, 55.5% fine to medium sand, 44.5% fines, contains mica														
5						S-1	S	5- 5- 4- 6 (N=9)	14" (58%)							
	520															
10		8.0 ft: changes to Slightly moist, medium dense, light black with streaks of dark brown, 62.7% fine to coarse sand, 37.3% fines				S-2	S	4- 5- 8- 8 (N=13)	24" (100%)		10.6	NP	NP			
		9.0 ft: changes to estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, light orangish brown with streaks of dark brown	SM													
	515	10.0 ft: changes to 55.1% fine to medium sand, 44.9% fines				T-1	T		20" (83%)		11.5					
15		13.0 ft: changes to light brown and light orange with streaks of black, 53.5% fine to coarse sand, 46.5% fines				S-4	S	9- 8- 9- 10 (N=17)	8" (33%)							
	510															
		18.0 ft: changes to light orangish brown, estimated 75 - 85% fine to coarse sand, estimated 15 - 25% fines				S-5	S	4- 12- 50/4" (N=12+50/4")	20" (125%)							
20	505	19.0 - 23.0 ft: Slightly moist, very dense, light brown and dark brown, nonplastic, SILTY SAND WITH GRAVEL, 57.5% fine to coarse sand, 26.4% gravel and gravel-sized pieces of mica, 16.2% fines	SM													
25		23.0 - 43.0 ft: Slightly moist, dense, light orangish brown with streaks of dark brown, low plasticity, SILTY SAND, 56.8% fine to medium sand, 43.2% fines, contains mica				S-6	S	19- 16- 16- 15 (N=32)	16" (67%)							
	500		SM													
30		28.0 ft: changes to medium dense, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines				S-7	S	11- 10- 12- 12 (N=22)	2" (8%)							28.0ft: Coarse subangular quartz gravel obstructed split spoon recovery

AECOM TECHNICAL SERVICES, INC.
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876
Phone: 301.820.3000 Fax: 301.820.3009

B = Bulk Sample S = Split Spoon Sample P = Pitcher Sample
G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring ASW- 1

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

Depth (ft): 35, 40, 45, 50, 55, 60, 65 — Elev. (ft): 495, 490, 485, 480, 475, 470, 465

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
	495	23.0 - 43.0 ft: Slightly moist, dense, light orangish brown with streaks of dark brown, low plasticity, SILTY SAND, 56.8% fine to medium sand, 43.2% fines, contains mica*(continued)*	SM													
35		33.0 ft: changes to Slightly moist, light brown and dark brown, nonplastic, 70.8% fine to coarse sand, 21.9% fines, 7.3% gravel				S-8		7- 7- 20- 34 (N=27)	24" (100%)							
40	490	38.0 ft: changes to Slightly moist, very dense, 69.7% fine to coarse sand, 17.6% fines, 12.7% gravel				S-9		28- 38- 50/5" (N=38+50/5")	17" (100%)							
45	485	43.0 - 48.0 ft: Slightly moist, very dense, light orangish brown and dark brown, SILTY SAND WITH GRAVEL, low-no plasticity, 46.5% fine to coarse sand, 27.3% fines, 26.2% gravel and gravel-sized pieces of mica	SM			S-10		44- 50/5" (N=50/5")	10" (91%)							
50	480	48.0 - 53.0 ft: Weak, highly weathered, highly fractured to intensely fractured, dark gray with speckles of orange, MICA SCHIST, fine to medium grained, strongly foliated, non-cylindrical core shape with worn and chipped edges. Fractures generally 45 degrees with one vertical fracture at 52.1 feet depth, partial iron and dark brown staining infill, slightly rough				S-11		50/2" (N=50/2")	2" (100%)							48.0ft: Began rock coring prior to auger refusal to sample transition material. Split core barrel used to sample 48-53 feet
	475					RC-1			16" (27%)	13						
55		53.0 - 55.0 ft: Moist, very dense, dark gray and dark brown, nonplastic, SILTY SAND WITH GRAVEL, 43.5% fine to coarse sand, 31.3% gravel and gravel-sized pieces of mica, 25.2% fines	SM			S-12		3- 50/3" (N=50/3")	3" (100%)							53.0ft: Stopped for day on 12/04/2019, continued on 12/05/2019 53.0ft: Re-continued sampling with split spoon due to poor RC-1 quality and recovery
	470	55.0 - 70.2 ft: Medium strong, slightly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, quartz inclusions, fractures generally 10 to 70 degrees, partial iron and dark brown staining infill				S-13		50/1" (N=50/1")	1" (100%)							55.0ft: Auger refusal at 55 feet 55.5ft: Rock unconfined compressive strength of 6,353 psi, with 0.1% strain
60		58.0 ft: changes to Medium strong, moderately weathered, highly fractured to intensely fractured, dark brownish gray, quartz inclusions, fractures generally 10 to 70 degrees, partial iron and dark brown staining and some micaceous soil infill				RC-2			62" (100%)	74						
65	465	60.2 ft: changes to Medium strong, highly weathered to moderately weathered, gray orange, strongly foliated, fractures generally 10-60 degrees, partial iron and dark brown staining infill, smooth to rough. One very worn 70 degree fracture at 60.7 feet depth				RC-3			54" (90%)	42						

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Log of Test Boring ASW- 1

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
70	460	65.2 ft: changes to Same but dark gray. A 1/4-inch lens of clay was at the top of the core, brown lean clay with sand 55.0 - 70.2 ft: Medium strong, slightly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, quartz inclusions, fractures generally 10 to 70 degrees, partial iron and dark brown staining infill*(continued)*				RC-4			39" (65%)	35						

Boring terminated at 70.2 FT on 12/5/2019.

1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 2

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626473.8819 E 1319032.585**

DATE STARTED: **12/3/2019**	DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
DATE COMPLETED: **12/4/2019**	HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
LOGGED BY: **N. Schluter**	CASING TYPE: **HSA**
CHECKED BY: **E. Wenz**	CASING SIZE: **3-1/4**
DRILLING CONTRACTOR: **Connelly&Assoc.**	BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
DRILL RIG: **CME-55 (Track)**	BOREHOLE DEPTH: **38.0 FT**
DRILLER: **B. Mullendore**	SURFACE ELEVATION: **527.85 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-03-2019	N/A	Dry	N/A
24-hour	12-05-2019	N/A	31.6	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
			Topsoil											
	525	0.3 - 5.0 ft: Slightly moist, stiff, strong brown with streaks of black, nonplastic, SANDY SILT, 68.8% fines, 31.2% fine sand, contains mica	ML	S-1		3- 5- 7- 10 (N=12)	20" (83%)		24.3	NP	NP			
5		5.0 - 8.0 ft: Slightly moist, strong brown with speckles of black, nonplastic, SILTY GRAVEL WITH SAND, 52.0% gravel, 29.2% fine to coarse sand, 18.7% fines	GM	T-1			20" (100%)		15.7	NP	NP			5.0ft: Shelby tube advanced from 5-7 feet
10	520	8.0 - 13.0 ft: Slightly moist, medium dense, strong brown with speckles of black, low plasticity, SILTY SAND, 43.0% fines, 42.7% fine to coarse sand, 14.3% angular quartz gravel	SM	S-3		5- 9- 10- 12 (N=19)	18" (75%)							
15	515	13.0 - 18.1 ft: Slightly moist, very dense, gray, nonplastic, SILTY SAND WITH GRAVEL, 50.9% fine to coarse sand, 31.6% fines, 17.5% gravel	SM	S-4		36- 50/5" (N=50/5")	9" (82%)							17.0ft: Rig chattering
	510	18.0 ft: changes to 40.4% fine to coarse sand, 36.9% gravel, 22.7% fines		S-5		50/1" (N=50/1")	1" (100%)							18.0ft: Auger refusal at 18 feet
20	505	18.1 - 38.0 ft: Medium strong, slightly weathered, moderately fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, contains quartz inclusions. Fractures generally 15-70 degrees, partial iron and dark brown staining infill, slightly rough to rough 21.0 ft: changes to dark brownish gray, moderately weathered, highly to intensely fractured 23.0 ft: changes to dark gray, slightly weathered, moderately fractured		RC-1			55" (92%)	75						
25	500	25.5 ft: changes to dark brownish gray, moderately weathered, highly to intensely fractured 28.0 ft: changes to highly weathered, strongly foliated, no fractures were mechanical. Fractures generally 30-60 degrees, partial iron stain and dark brown spot infill, slightly		RC-2			60" (100%)	72						
30														

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Log of Test Boring ASW- 2

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		rough. Dark gray, medium plasticity LEAN CLAY lens from approximately 30.1 to 30.4 feet				RC-3			50" (83%)	43				1.75	3.0	
	495	18.1 - 38.0 ft: Medium strong, slightly weathered, moderately fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, contains quartz inclusions. Fractures generally 15-70 degrees, partial iron and dark brown staining infill, slightly rough to rough*(continued)*														33.0ft: Stopped for day on 12/03/2019, continued on 12/04/2019
35	490	33.0 ft: changes to Very strong to strong, slightly weathered, highly fractured, very dark gray, moderately foliated, contains quartz inclusions and a 6-inch layer of quartz at approimately 33.5-34.0 feet depth. Fractures generally 30-60 degrees with spotty iron staining and micaceous soil infill				RC-4			59" (98%)	57						

Boring terminated at 38.0 FT on 12/4/2019.

1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 3

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626612.6521 E 1318891.0237**

DATE STARTED: **11/25/2019**	DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**	Groundwater Observations							
DATE COMPLETED: **11/26/2019**	HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**	Event		Date	Time	Depth (ft)	Cave in Depth (ft)		
LOGGED BY: **N. Schluter**	CASING TYPE: **HSA**								
CHECKED BY: **E. Wenz**	CASING SIZE: **3-1/4**	Encountered	∇	11-25-2019	N/A	12.0	N/A		
DRILLING CONTRACTOR: **Connelly&Assoc.**	BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**	Completion	▼	11-26-2019	N/A	8.4	32.2		
DRILL RIG: **CME-55 (Track)**	BOREHOLE DEPTH: **53.8 FT**	24-hour	▼	11-27-2019	N/A	9.0	25.6		
DRILLER: **B. Mullendore**	SURFACE ELEVATION: **531.16 FT**								

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	530	0.3 - 4.0 ft: Moist, medium stiff, light brown, nonplastic, SANDY SILT, 70.8% fines, 29.2% fine sand	Top-soil / ML			S-1	S	2- 3- 5- 7 (N=8)	24" (100%)		32.5	NP	NP	1.50	3.8	
5	525	4.0 - 13.0 ft: Slightly moist, loose, orange and dark brown, nonplastic, SILTY SAND, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica														
10	520	8.0 ft: changes to Slightly moist, very dense, light grayish brown and orange, 60.2% fine to coarse sand, 27.0% fines, 12.8% gravel	SM			S-2	S	14- 32- 32- 18 (N=64)	18" (75%)							
15	515	13.0 - 18.0 ft: Slightly moist, very dense, gray and brown, nonplastic, SILTY SAND WITH GRAVEL, 55.7% fine to coarse sand, 25.4% gravel, 18.9% fines, contains mica	SM			S-3	S	38- 50/3" (N=50/3")	20" (222%)							
20	510	18.0 - 28.0 ft: Slightly moist, very stiff, gray and orange, low plasticity, SANDY SILT, 70.9% fines, 29.1% fine sand, contains mica				S-4	S	3- 9- 14- 17 (N=23)	24" (100%)					1.25	2.8	
25	505	23.0 ft: changes to light brownish gray, nonplastic, 51.9% fines, 47.5% fine to coarse sand, 0.6% gravel	ML			S-5	S	10- 13- 16- 20 (N=29)	18" (75%)							
30		28.0 - 33.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND, 56.7% fine to coarse sand, 32.9% fines, 10.4% gravel, contains mica	SM			S-6	S	39- 50/3" (N=50/3")	9" (100%)							

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Log of Test Boring ASW- 3

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	SAMPLES REC (IN) (%)	SAMPLES RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	500	28.0 - 33.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND, 56.7% fine to coarse sand, 32.9% fines, 10.4% gravel, contains mica *(continued)*	SM													
35	495	33.0 - 37.5 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 50.8% fine to coarse sand, 30.9% gravel, 18.3% fines, contains mica	SM			S-7		38- 50/3" (N=50/3")	9" (100%)							
40	490	37.5 - 53.8 ft: Strong, fresh to slightly weathered, moderately fractured, dark gray, SCHIST, fine to medium grained, strongly foliated, most fractures 60 degrees, spotty iron staining infill, rough to slightly rough. One vertical fracture at 39.6 feet				RC-1			54" (90%)	67						37.5ft: Auger refusal at 37.5 feet 38.4ft: Rock unconfined compressive strength of 8,203 psi, with 0.1% strain
45	485	42.5 ft: changes to Very strong, fresh, very slightly fractured, contains quartz inclusions. All fractures appeared mechanical and were approximately 0-55 degrees				RC-2			76" (100%)	100						42.5ft: Stopped for day on 11/25/2019, continued 11/26/2019
50	480	48.8 ft: changes to all fractures appeared mechanical and were approximately 40-60 degrees				RC-3			60" (100%)	100						

Boring terminated at 53.8 FT on 11/26/2019.

Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 4

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626541.581 E 1318961.575**

DATE STARTED: **12/18/2019**
DATE COMPLETED: **12/18/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **28.9 FT**
SURFACE ELEVATION: **529.11 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-18-2019	N/A	Dry	N/A
5-day	12-23-2019	N/A	8.8	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Topsoil	Top soil													
		0.3 - 8.0 ft: Moist, very dense, gray and brown, nonplastic, SANDY SILT, 50.1% fines, 47.1% fine to coarse sand, 2.8% gravel	ML			S-1		30- 50/5" (N=50/5")	12" (109%)		11.3	NP	NP			
5	525															
		8.0 - 8.5 ft: Slightly moist, very dense, grayish brown, nonplastic, SILTY SAND WITH GRAVEL, 46.5% fines, 32.4% fine to coarse sand, 21.1% angular gravel	SM			S-2		9- 50/2" (N=50/2")	8" (100%)							
10	520	8.5 - 28.9 ft: Weak to very weak, severely weathered to highly weathered, intensely fractured to highly fractured, dark greenish gray and white, MICA SCHIST, fine to medium grained, strongly foliated, contains some quartz. Most fractures 10-20 degrees, partial iron and dark brown staining infill, rough to slightly rough. Gravel-sized rock fragmets from 8.5 to 8.65 feet				RC-1			48" (80%)	42						8.5ft: Began rock coring prior to auger refusal to sample transition material. Split core barrel used to sample 8.5-13.5 feet
15	515	9.5 ft: changes to Medium strong to weak, moderately weathered, highly fractured to intensely fractured, dark gray, strongly foliated, most fractures 10-20 degrees, partial iron and dark brown staining infill, rough to slightly rough. Dark gray clayey soil layer from 9.3 to 9.5 feet				RC-2			60" (100%)	65						13.5ft: Began rock coring with solid core barrel due to high quality and recovery of RC-1
20	510	13.5 ft: changes to strong to medium strong, moderately weathered, moderately to intensely fractured. Most fractures 10-60 degrees, partial iron and dark brown spots staining infill. One approximate 80-degree fracture at 15.0 feet. One completely weathered section at approximately 22.3-22.4 feet 18.5 ft: changes to highly fractured, dark brownish gray, poorly foliated. More quartz than previous run, with a quartz layer extending approximately 18.8-19.0 feet				RC-3			62" (100%)	40						
25	505	23.7 ft: changes to very strong to strong, moderately to slightly weathered, highly fractured to intensely fractured, dark gray. Most fractures 10-50 degrees, partial and spotty iron and dark brown spots staining infill, some spotty soil infill. One quartz layer extended approximately 27.0-27.3 feet				RC-4			62" (100%)	55						23.7ft: Gray effluent

Boring terminated at 28.9 FT on 12/18/2019.
1-inch slotted temporary PVC standpipe installed for 5-day groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 5

AECOM

PROJECT: **Piney Run Watershed Study**
PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**
PROJECT NUMBER: **60614688** COORDINATES: **N 626769.7739 E 1318768.062**

DATE STARTED: **11/25/2019**	DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
DATE COMPLETED: **11/25/2019**	HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
LOGGED BY: **N. Schluter**	CASING TYPE: **HSA**
CHECKED BY: **E. Wenz**	CASING SIZE: **3-1/4**
DRILLING CONTRACTOR: **Connelly&Assoc.**	BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
DRILL RIG: **CME-55 (Track)**	BOREHOLE DEPTH: **27.6 FT**
DRILLER: **B. Mullendore**	SURFACE ELEVATION: **526.05 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Completion	11-25-2019	N/A	3.5	7.0
24-hour	11-26-2019	N/A	3.2	7.6

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	SAMPLE NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.5 ft: Topsoil = 6 inches	Top-soil											
	525	0.5 - 6.0 ft: Moist, loose, light olive brown, nonplastic, SILTY SAND, estimated 50 - 65% sand, estimated 35 - 50% fines	SM	S-1		4- 4- 6- 5 (N=10)	24" (100%)							
		2.0 ft: changes to medium dense, 61.8% fine to coarse sand, 30.2% fines, 8.0% gravel, contains mica		S-2		6- 8- 15- 13 (N=23)	16" (67%)			NP	NP			
5		4.0 ft: changes to loose, light brownish gray, estimated 75 - 85% sand, estimated 15 - 25% fines		S-3		4- 3- 2- 4 (N=5)	16" (67%)							
	520	6.0 - 8.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY GRAVEL WITH SAND, 56.1% gravel, 29.5% fine to coarse sand, 14.4% fines, contains mica	GM	S-4		14- 21- 50/4" (N=21+50/4")	13" (81%)							
10		8.0 - 27.6 ft: Slightly moist, very dense, grayish brown, nonplastic, SILTY SAND WITH GRAVEL, 44.5% fine to coarse sand, 38.3% fines, 17.2% gravel		S-5		38- 34- 22- 34 (N=56)	20" (83%)							
	515													
15		13.0 ft: changes to medium dense, light brownish gray, 46.5% fine to coarse sand, 30.5% fines, 23.0% gravel, contains mica		S-6		4- 7- 23- 50/3" (N=30)	18" (86%)		27.3					
	510													
20		18.0 ft: changes to very dense, low plasticity, 49.3% fine to coarse sand, 31.1% fines, 19.6% gravel, contains mica	SM	S-7		27- 34- 50/2" (N=34+50/2")	11" (79%)							
	505													
25		23.0 ft: changes to grayish brown, 49.6% fine to coarse sand, 35.0% fines, 15.4% gravel, contains mica		S-8		50/5" (N=50/5")	5" (100%)							
	500													26.0ft: Rig chattering
		27.5 ft: changes to nonplastic, 51.2% fine to coarse sand, 24.8% fines, 24.1% gravel		S-9		50/1" (N=50/1")	1" (100%)							27.5ft: Auger refusal at 27.5 feet

Boring terminated at 27.6 FT on 11/25/2019.

Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 6

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626389.1519 E 1318788.984**

DATE STARTED: **12/20/2019**
DATE COMPLETED: **12/23/2019**
LOGGED BY: **N. Schluter/K. Wachtel**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **63.0 FT**
SURFACE ELEVATION: **530.06 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	12-20-2019	N/A	16.0	N/A
72-hour ▼	12-23-2019	N/A	8.1	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
0	530		Top soil											
		0.3 - 8.0 ft: Moist, medium dense, reddish brown and light brown, nonplastic, SILTY SAND, 50.1% fine to medium sand, 49.9% fines	SM	S-1	S	4- 5- 10- 16 (N=15)	24" (100%)							
5	525													
▼		8.0 - 13.0 ft: Slightly moist, stiff, orange and brown, medium plasticity, SANDY LEAN CLAY, 57.1% fines, 42.2% fine to coarse sand, 0.8% gravel	CL	S-2	S	5- 6- 6- 8 (N=12)	18" (75%)					1.25	2.3	
10	520													
		13.0 - 15.0 ft: Slightly moist, medium stiff, grayish brown with speckles of black, low plasticity, SANDY SILTY CLAY, 51.1% fines, 48.9% fine to medium sand	CL-ML	S-3	S	2- 3- 4- 7 (N=7)	24" (100%)					1.50	2.0	
15	515													
▽		15.0 - 18.0 ft: Moist, grayish brown, SANDY SILT, 56.8% fines, 43.2% fine to medium sand	ML	T-1	T		17" (100%)		29.2	NP	NP	3.25	2.5	15.0ft: Shelby tube advanced from 15-16.4 feet. Refusal at 16.4 feet
		18.0 - 23.0 ft: Slightly moist, medium dense, grayish brown, low plasticity, SILTY CLAYEY SAND, 50.4% fine to coarse sand, 47.0% fines, 2.5% angular quartz gravel	SC-SM	S-5	S	6- 11- 18- 32 (N=29)	16" (67%)							
20	510													
		23.0 - 28.0 ft: Slightly moist, very stiff, grayish brown with streaks of black, medium plasticity, SANDY SILTY CLAY, 53.6% fines, 45.8% fine to coarse sand, 0.6% gravel	CL-ML	S-6	S	5- 10- 15- 17 (N=25)	18" (75%)					4.00	3.8	
25	505													
		28.0 - 33.0 ft: Slightly moist, hard, grayish brown with streaks of black, low plasticity, SANDY SILT, 60.5% fines, 39.5% fine to medium sand, contains mica	ML	S-7	S	50/6" (N=50/6")	6" (100%)					2.00	2.0	
30														

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AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		28.0 - 33.0 ft: Slightly moist, hard, grayish brown with streaks of black, low plasticity, SANDY SILT, 60.5% fines, 39.5% fine to medium sand, contains mica *(continued)*	ML													32.0ft: Rig chatter at 32 feet
35	495	33.0 - 38.2 ft: Very moist, very dense, brown and white, nonplastic, SILTY SAND WITH GRAVEL, 47.8% fine to coarse sand, 29.5% gravel angular to subangular gravel, 22.7% fines, contains mica	SM			S-8		14- 48- 50/4" (N=48+50/4")	12" (75%)							
		38.0 ft: changes to Slightly moist, grayish brown, 52.5% fine to coarse sand, 26.2% fines, 21.3% gravel, contains mica				S-9		50/2" (N=50/2")	2" (100%)							38.0ft: Began rock coring prior to auger refusal to sample transition material. Split core barrel used to sample 38-43 feet. Difficulty removing split core barrel from outer barrel jostled sample
40	490	38.2 - 63.0 ft: Weak to very weak, severely weathered, intensely fractured, dark grayish brown, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 30 degrees, silty and clayey soil infill, slightly rough. Interlayered rock and decomposed rock				RC-1			34" (57%)	10						
		43.0 ft: changes to Very weak, dark grayish brown with speckles of orange, strongly foliated, contains quartz inclusions														43.0ft: Began rock coring with solid core barrel due to high quality and recovery of RC-1
45	485	44.8 ft: changes to Weak, highly weathered, highly fractured, dark brownish gray white, moderately foliated, most fractures 30-45 degrees, spotty to partial iron staining, black spots, and micaceous soil infill, very rough to slightly rough				RC-2			48" (80%)	7						
50	480	48.0 ft: changes to Medium strong, moderately weathered to slightly weathered, dark grayish brown, most fractures 15-60 degrees, spotty iron and dark brown staining, and micaceous soil infill, rough to slightly rough				RC-3			63" (105%)	65						
55	475	53.0 ft: changes to Weak, highly weathered to severely weathered, highly fractured to intensely fractured, dark brownish gray, strongly foliated, most fractures 45 degrees, partial iron staining and soil infill, slightly rough to smooth. No quartz inclusions				RC-4			22" (37%)	7						53.0ft: Stopped for day on 12/20/2019, continued 12/23/2019
60	470	59.5 ft: changes to Strong to medium strong, slightly weathered, highly fractured, dark gray, slightly foliated, contains quartz inclusions, most fractures 5-45 degrees, spotty iron staining and soil infill, slightly rough to smooth				RC-5			49" (82%)	45						

Boring terminated at 63.0 FT on 12/23/2019.

1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 7

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626463.7244 E 1318872.7146**

DATE STARTED: **12/6/2019**	DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
DATE COMPLETED: **12/6/2019**	HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
LOGGED BY: **N. Schluter**	CASING TYPE: **HSA**
CHECKED BY: **E. Wenz**	CASING SIZE: **3-1/4**
DRILLING CONTRACTOR: **Connelly&Assoc.**	BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
DRILL RIG: **CME-55 (Track)**	BOREHOLE DEPTH: **53.0 FT**
DRILLER: **B. Mullendore**	SURFACE ELEVATION: **529.40 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	12-06-2019	N/A	22.0	N/A
72-hour ▼	12-09-2019	N/A	10.4	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
			Topsoil													
		0.3 - 8.0 ft: Slightly moist, very dense, light orangish brown with streaks of dark brown, low plasticity, SILTY SAND WITH GRAVEL, 54.9% fine to coarse sand, 23.6% fines, 21.5% angular quartz gravel (lens), contains mica	SM			S-1		11- 21- 35- 42 (N=56)	18" (75%)							
5	525															
		8.0 - 28.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND, 66.1% fine to coarse sand, 30.6% fines, 3.4% gravel, contains mica				S-2		7- 12- 13- 15 (N=25)	24" (100%)							
10	520	10.0 ft: changes to estimated 50 - 65% fine to coarse sand, estimated 35 - 50% fines, contains mica				T-1			15" (63%)		20.6	NP	NP			10.0ft: Shelby tube advanced from 10-12 feet
		13.0 ft: changes to dense, light gray and brown, 59.2% fine to coarse sand, 30.5% fines, 10.3% gravel, contains significant mica				S-4		9- 14- 23- 40 (N=37)	20" (83%)							
15	515															
		18.0 ft: changes to very dense, brownish gray with streaks of dark brown, 70.4% fine to coarse sand, 26.8% fines, 2.8% gravel, contains mica. Quartz lens at approximately 20 feet.	SM			S-5		13- 30- 50/4" (N=30+50/4")	20" (125%)							
20	510															
		23.0 ft: changes to brownish gray, low to no plasticity, 62.6% fine to coarse sand, 37.4% fines, contains mica				S-6		16- 25- 43- 50/1" (N=68)	16" (84%)							
25	505															
		28.0 - 37.5 ft: Slightly moist, very dense, brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 47.4% fine to coarse sand, 26.7% gravel, 26.0% fines, contains mica	SM			S-7		42- 50/2" (N=50/2")	8" (100%)							
30	500															

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Log of Test Boring ASW- 7

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	SAMPLES REC (IN) (%)	SAMPLES RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
35	495	28.0 - 37.5 ft: Slightly moist, very dense, brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 47.4% fine to coarse sand, 26.7% gravel, 26.0% fines, contains mica*(continued)* 33.0 ft: changes to grayish brown, 53.0% fine to coarse sand, 28.5% fines, 18.5% gravel, contains mica	SM			S-8		10- 50/5.5" (N=50/5.5")	11" (96%)							
						S-9		50/3" (N=50/3")	3" (100%)							37.0ft: Rig chattering 37.5ft: Auger refusal at 37.5 feet
40	490	37.5 - 53.0 ft: Strong to medium strong, highly weathered to severely weathered, moderately fractured to highly fractured, dark gray and brownish gray, MICA SCHIST, fine to medium grained, moderately foliated, contains few quartz inclusions. Most fractures 10-60 degrees, partial iron staining and miaceous soil infill, slightly rough to smooth				RC-1			55" (92%)	80						
45	485	42.5 ft: changes to very strong, fresh, moderately fractured, dark gray. most fractures 45-55 degrees, no infill, slightly rough to smooth				RC-2			62" (100%)	98						42.5ft: Gray effluent
50	480	47.7 ft: changes to moderately to highly fractured, strongly foliated. Most fractures mechanical. Natural fractures generally 5-50 degrees, spotty iron stain infill, rough to smooth				RC-3			63" (100%)	92						

Boring terminated at 53.0 FT on 12/6/2019.

1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 8

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626285.7035 E 1319035.2072**

DATE STARTED: **12/5/2019**
DATE COMPLETED: **12/5/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **41.0 FT**
SURFACE ELEVATION: **526.36 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-05-2019	N/A	Dry	N/A
24-hour	12-06-2019	N/A	22.0	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
			Top soil													
	525	0.3 - 8.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND, 69.2% fine to coarse sand, 30.7% fines, 0.1% gravel, contains mica	SM			S-1		5- 10- 11- 12 (N=21)	24" (100%)							
5	520															5.0ft: Bulk sample taken 5-15 feet. Slightly moist, light brown, nonplastic, SILTY SAND, 42.2% fine to coarse sand, 29.2% fines, 28.6% subangular gravel, contains mica
10	515	8.0 - 13.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND WITH GRAVEL, 51.3% fine to coarse sand, 28.5% fines, 20.2% subangular quartz gravel, contains mica	SM			S-2		7- 8- 8- 9 (N=16)	16" (67%)							
15	510	13.0 - 23.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND, 62.2% fine to coarse sand, 34.0% fines, 3.8% angular quartz gravel, contains mica				S-3		4- 10- 14- 13 (N=24)	20" (83%)		16.3					
20	505	18.0 ft: changes to Slightly moist, very dense, light grayish brown with streaks of dark brown, 53.9% fine to coarse sand, 37.9% fines, 8.3% gravel	SM			S-4		29- 38- 36- 29 (N=74)	20" (83%)							
25	500	23.0 - 28.0 ft: Slightly moist, dense, light grayish brown with streaks of dark brown, nonplastic, SILTY SAND WITH GRAVEL, 60.2% fine to coarse sand, 25.7% angular quartz gravel and gravel-sized pieces of mica, 14.1% fines	SM			S-5		10- 15- 22- 33 (N=37)	20" (83%)							27.0ft: Rig chattering/struggling at approximately 27.0 feet. Possible cobble or boulder.
30			SM			S-6		35- 38- 50/3" (N=38+50/3")	14" (93%)							

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Log of Test Boring ASW- 8

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	495	28.0 - 33.0 ft: Slightly moist, very dense, light grayish brown, nonplastic, SILTY SAND, 50.9% fine to coarse sand, 45.4% fines, 3.7% gravel, no mica. Large piece of gravel at top of spoon*(continued)*	SM													
35		33.0 - 36.0 ft: Slightly moist, very dense, light grayish brown, nonplastic, SILTY SAND WITH GRAVEL, estimated 75 - 85% fine to coarse sand, estimated 15 - 25% fines, 50.5% fine to coarse sand, 34.4% fines, 15.1% angular quartz gravel	SM			S-7		50/3" (N=50/3")	3" (100%)							
40	490	36.0 - 41.0 ft: Medium strong, highly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, strongly foliated, contains quartz inclusions. Most fractures 30-60 degrees, partial iron and dark spots staining and micaceous soil infill, rough to slightly rough. Possible completely weathered section section				S-8 RC-1		50/0" (N=50/0")	0" (NR) 34" (57%)	27						36.0ft: Auger refusal at 36 feet 36.0ft: The driller felt resistance during the entire RC-1 run despite the low recovery; a completely weathered section may have washed away

Boring terminated at 41.0 FT on 12/5/2019.

1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW- 9

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626203.1441 E 1318966.4746**

DATE STARTED: **1/9/2020**	DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
DATE COMPLETED: **1/10/2020**	HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
LOGGED BY: **N. Schluter**	CASING TYPE: **HSA**
CHECKED BY: **E. Wenz**	CASING SIZE: **3-1/4**
DRILLING CONTRACTOR: **Connelly&Assoc.**	BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
DRILL RIG: **CME-55 (Track)**	BOREHOLE DEPTH: **48.2 FT**
DRILLER: **B. Mullendore**	SURFACE ELEVATION: **526.40 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	01-09-2020	N/A	32.7	N/A
72-hour ▼	01-13-2020	N/A	19.4	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	SAMPLES REC (IN) (%)	SAMPLES RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
			Top soil													
	525	0.3 - 33.0 ft: Moist, medium dense, olive yellow with streaks of black, nonplastic, SILTY SAND, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica														
5						S-1		8- 5- 6- 8 (N=11)	18" (75%)							
	520															
10		8.0 ft: changes to light yellowish brown, 55.4% fine to medium sand, 44.6% fines, contains mica				S-2		5- 12- 18- 23 (N=30)	16" (67%)							
	515															
15		13.0 ft: changes to dense, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, contains mica	SM			S-3		9- 23- 27- 30 (N=50)	16" (67%)							
	510															
20	▼	18.0 ft: changes to light yellowish brown, 58.9% fine to coarse sand, 37.2% fines, 3.9% subangular quartz gravel, contains mica				S-4		8- 13- 21- 27 (N=34)	22" (92%)							
	505															
25		23.0 ft: changes to very dense, light yellowish brown with streaks of dark brown, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica, no gravel				S-5		17- 21- 31- 41 (N=52)	24" (100%)							
	500															
30		28.0 ft: changes to Slightly moist, 61.8% fine to coarse sand, 38.2% fines, contains mica				S-6		50/5.5" (N=50/5.5")	5.5" (100%)							

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Log of Test Boring ASW- 9

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	SAMPLES REC (IN) (%)	SAMPLES RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	495	0.3 - 33.0 ft: Moist, medium dense, olive yellow with streaks of black, nonplastic, SILTY SAND, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica*(continued)*	SM													
35	490	33.0 - 48.2 ft: Strong to medium strong, moderately weathered, highly fractured to intensely fractured, brownish gray white, MICA SCHIST, fine to medium grained, strongly foliated, some quartz inclusions. Most fractures 20-50 degrees, partial iron stain and dark brown spots infill, slightly rough to smooth. 33.0-33.1 feet gravel-sized rock fragments				S-7		50/1.5" (N=50/1.5")	1.5" (100%)							33.0ft: Stopped for day on 1/9/2020, continued 1/10/2020 33.0ft: Split core barrel used to sample 12.5-17.5 feet. Grayish brown effluent 33.8ft: Rock unconfined compressive strength of 7,798 psi, with 0.2% strain
						RC-1			55" (92%)	55						
40	485	38.0 ft: changes to highly weathered, highly fractured, brownish gray, most fractures 45-90 degrees, partial iron stain and dark brown infill, few fractures with micaceous soil infill, slightly rough to smooth				RC-2			62" (100%)	65						
45	480	43.2 ft: changes to no visible quartz. Most fractures 0-45 degrees, partial iron stain and dark brown spots infill, slightly rough to smooth. Layer from 43.5 to 43.7 feet of white, grainy material- likely highly weathered pegmatite 46.0 ft: changes to dark gray				RC-3			55" (92%)	48						

Boring terminated at 48.2 FT on 1/10/2020.

1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW-10

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626336.2409 E 1318902.0644**

DATE STARTED: **12/2/2019**	DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
DATE COMPLETED: **12/3/2019**	HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
LOGGED BY: **N. Schluter**	CASING TYPE: **HSA**
CHECKED BY: **E. Wenz**	CASING SIZE: **3-1/4**
DRILLING CONTRACTOR: **Connelly&Assoc.**	BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
DRILL RIG: **CME-55 (Track)**	BOREHOLE DEPTH: **42.2 FT**
DRILLER: **B. Mullendore**	SURFACE ELEVATION: **528.06 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-03-2019	N/A	15.1	N/A
24-hour	12-04-2019	N/A	17.6	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.3 ft: Topsoil = 4 inches	Top-soil													
		0.3 - 0.5 ft: Moist, medium stiff, brown, medium plasticity, SANDY LEAN CLAY, estimated 50 - 65% fines, est 35 - 50% fine to medium sand	CL			S-1		2- 2- 5- 10 (N=7)	24" (100%)							
	525	0.5 - 13.0 ft: Slightly moist, loose, strong brown with streaks of black, nonplastic, SILTY SAND WITH GRAVEL, estimated 50 - 65% fine to medium sand, estimated 10 - 25% fines, estimated 10 - 25% gravel, contains mica				S-2		2- 21- 50/5" (N=21+50/5")	20" (118%)							
5		3.0 ft: changes to very dense, 62.7% fine to coarse sand, 19.4% gravel, 17.9% fines	SM													
	520	8.0 ft: changes to dense, light yellowish brown and white, 41.7% fine to coarse sand, 30.2% angular quartz gravel, 28.1 fines				S-3		4- 17- 28- 28 (N=45)	18" (75%)							
10	515															
15		13.0 - 18.0 ft: very stiff, brownish yellow with speckles of black, nonplastic, SANDY SILT, 51.2% fines, 45.3% fine to coarse sand, 3.5% gravel	ML			S-4		7- 7- 11- 17 (N=18)	20" (83%)							
20	510	18.0 - 23.0 ft: medium dense, yellowish brown with speckles of black, nonplastic, SILTY SAND, 51.4% fine to coarse sand, 47.8% fines, 0.7% gravel	SM			S-5		3- 4- 7- 8 (N=11)	24" (100%)		21.4	NP	NP			
25	505	23.0 - 28.5 ft: dense, brown with streaks of black, low plasticity, SILTY SAND WITH GRAVEL, 50.8% fine to coarse sand, 25.0% fines, 24.2% gravel	SM			S-6		WOH- 8- 25- 19 (N=33)	20" (83%)							27.0ft: Rig chattering
30	500					S-7		50/3" (N=50/3")	2" (67%)							28.5ft: Auger refusal at 28.5 feet

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Log of Test Boring ASW-10

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	SAMPLES REC (IN) (%)	SAMPLES RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	495	28.5 - 42.2 ft: Medium strong, moderately weathered to slightly weathered, moderately fractured to highly fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 30-70 degrees, partial to spotty iron staining infill, rough to slightly rough *(continued)*				RC-1			41" (68%)	63						28.5ft: Stopped for day on 12/02/2019, continued on 12/03/2019 28.5ft: Split core barrel used to sample 28.5-33.6 feet. Gray effluent
35		33.6 ft: changes to moderately weathered to highly weathered, highly fractured, dark gray to brownish gray, contains quartz inclusions. Most fractures 30-60 degrees, partial iron staining and spotty soil infill, rough to slightly rough				RC-2			41" (100%)	66						
40	490	37.0 ft: changes to slightly weathered, dark gray, strongly foliated, about half of fractures mechanical breaks. Most natural fractures 30-45 degrees, spotty iron staining infill, rough to smooth. One 75-degree fracture at approximately 40.3 feet				RC-3			62" (100%)	83						

Boring terminated at 42.2 FT on 12/3/2019.

1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW-11

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626486.4407 E 1318761.7274**

DATE STARTED: **11/26/2019**
DATE COMPLETED: **11/27/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **70.1 FT**
SURFACE ELEVATION: **531.16 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	11-26-2019	N/A	11.0	N/A
5-day ▼	12-02-2019	N/A	6.6	64.8

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	NUMBER	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	530	0.3 - 3.5 ft: (FILL) sampled as moist, very dense, brown, medium plasticity, CLAYEY SAND, estimated 50 - 65% sand, estimated 35 - 50% fines, contains mica	Topsoil / SC										3.0ft: Possible cobble or boulder
5		3.5 - 4.0 ft: (FILL) sampled as slightly moist, very dense, black and white, nonplastic, SILTY GRAVEL WITH SAND, estimated 35 - 45% gravel, estimated 35 - 45% sand, estimated 10 - 30% fines, contains mica	GM	S-1	7- 25- 35- 28 (N=60)	24" (100%)							
	525	4.0 - 8.0 ft: Moist, very dense, light yellowish brown, nonplastic, SILTY SAND WITH GRAVEL, 48.8% fine to coarse sand, 26.3% gravel, 24.9% fines, contains mica	SM										
10	520	8.0 - 13.0 ft: Slightly moist, very stiff, light yellowish brown with streaks of black, low plasticity, SANDY SILT, 64.4% fines, 35.6% fine sand	ML	S-2	6- 7- 10- 12 (N=17)	24" (100%)		21.9	NP	NP			
				T-1		6" (100%)							10.0ft: Shelby tube advanced from 10.0-10.5 feet. Refusal at 10.5 feet
15	515	13.0 - 18.0 ft: Slightly moist, dense, light yellowish brown, nonplastic, SILTY SAND WITH GRAVEL, 55.5% fine to coarse sand, 27.0% fines, 17.5% gravel	SM	S-4	5- 10- 35- 50/4" (N=45)	18" (82%)							
20	510	18.0 - 23.0 ft: Slightly moist, dense, light yellowish brown, nonplastic, SILTY SAND, 47.2% fine to coarse sand, 44.2% fines, 8.6% gravel	SM	S-5	50- 20- 22- 25 (N=42)	16" (67%)							
				S-6	50/3" (N=50/3")	3" (100%)							
25	505	23.0 - 28.0 ft: Slightly moist, very dense, light yellowish brown, nonplastic, SILTY GRAVEL WITH SAND, 67.2% gravel, 20.5% fine to coarse sand, 12.3% fines	GM										
30		28.0 - 48.0 ft: Slightly moist, dense, light yellowish brown, low plasticity, SILTY SAND, 52.6% fine to coarse sand, 42.6% fines, 4.8% gravel	SM	S-7	3- 7- 32- 50/3" (N=39)	18" (86%)							

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Log of Test Boring ASW-11

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PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	500	28.0 - 48.0 ft: Slightly moist, dense, light yellowish brown, low plasticity, SILTY SAND, 52.6% fine to coarse sand, 42.6% fines, 4.8% gravel*(continued)*														
		33.0 ft: changes to 55.9% fine to coarse sand, 34.0% fines, 10.1% angular quartz gravel, contains mica				S-8		33- 26- 23- 22 (N=49)	18" (75%)							
35	495															
		38.0 ft: changes to very dense, nonplastic, 68.6% fine to coarse sand, 24.8% fines, 6.5% gravel	SM			S-9		48- 50/5" (N=50/5")	9" (82%)							
40	490															
		43.0 ft: changes to light brownish gray, low plasticity, 47.6% fine to coarse sand, 41.5% fines, 10.9% subangular gravel				S-10		50/5" (N=50/5")	5" (100%)							
45	485															
		48.0 - 53.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 35.5% fines, 33.7% fine to coarse sand, 30.9% gravel	SM			S-11		50/3" (N=50/3")	3" (100%)							
50	480															50.0ft: Stopped for day on 11/26/2019, continued on 11/27/2019
		53.0 - 55.0 ft: Slightly moist, very dense, orangish brown and white, nonplastic, SILTY SAND, estimated 75 - 85% sand, estimated 15 - 25% fines, estimated 5% angular gravel	SM			S-12		50/5" (N=50/5")	5" (100%)							54.0ft: Rig chatter at 54 feet
55	475	55.0 - 70.1 ft: Medium strong to weak, moderately weathered, highly fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 25-70 degrees, partial to spotty iron staining infill, rough to smooth				S-13		50/0" (N=50/0")	0" (NR)							55.0ft: Auger refusal at 55 feet
						RC-1			51" (85%)	65						56.8ft: Rock unconfined compressive strength of 19,296 psi, with 0.3% strain
60	470	60.0 ft: changes to Weak to very weak, highly weathered, intensely fractured, dark brownish gray, strongly foliated, most fractures partial iron staining and some mica and black areas infill, slightly rough to smooth 61.5 ft: changes to Medium strong to weak, moderately weathered to highly weathered, highly fractured to intensely fractured, dark gray white, moderately foliated, contains quartz inclusions. Most fractures partially infilled with light-colored sand, slightly rough				RC-2			49" (82%)	22						
65																

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Log of Test Boring ASW-11

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PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
70	465	to smooth 65.0 ft: changes to Strong to medium strong, moderately weathered to slightly weathered, intensely fractured, dark gray, most fractures spotty iron staining and a few with light-colored sandy infill 55.0 - 70.1 ft: Medium strong to weak, moderately weathered, highly fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 25-70 degrees, partial to spotty iron staining infill, rough to smooth*(continued)* 66.0 ft: changes to moderately fractured				RC-3			61" (100%)	77						

Boring terminated at 70.1 FT on 11/27/2019.

Boring tremie grouted after final water level measurement.

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Log of Test Boring ASW-12

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626288.931 E 1319135.0379**

DATE STARTED: **1/8/2020**
DATE COMPLETED: **1/9/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **53.0 FT**
SURFACE ELEVATION: **507.65 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ∇	01-08-2020	N/A	22.0	N/A
24-hour ▼	01-10-2020	N/A	7.5	N/A
96-hour ▼	01-13-2020	N/A	8.1	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.3 ft: Topsoil = 3 inches	Top soil													
	505	0.3 - 3.0 ft: Moist, very loose, strong brown, low plasticity, CLAYEY SAND, estimated 50 - 75% fine to medium sand, estimated 20 - 45% fines, estimated 5% subrounded gravel	SC			S-1		1- 2- 2- 2 (N=4)	14" (58%)							
5	500	3.0 - 8.0 ft: Moist, medium dense, strong brown, medium plasticity, SILTY GRAVEL WITH SAND, 44.7% fines, 29.6% subangular gravel, 25.7% fine to coarse sand	GM			S-2		2- 2- 9- 6 (N=11)	20" (83%)		25.8	37	25			
10	495	8.0 - 13.0 ft: Moist, loose, light yellowish brown, nonplastic, SILTY SAND, estimated 50 - 75% fine to medium sand, estimated 15 - 25% fines, estimated 15 - 25% gravel	SM			S-3		3- 3- 5- 5 (N=8)	4" (17%)							
15	490	13.0 - 18.0 ft: Moist, medium dense, light olive brown, nonplastic, SILTY SAND WITH GRAVEL, 53.9% fine to coarse sand, 26.5% gravel, 19.7% fines	SM			S-4		4- 8- 19- 33 (N=27)	20" (83%)							
20	485	18.0 - 42.7 ft: Moist, medium dense, olive yellow with streaks of dark brown, low plasticity, SILTY SAND, estimated 50 - 65% medium to coarse sand, est 25 - 40% fines, estimated 10% gravel				S-5		2- 8- 11- 16 (N=19)	18" (75%)							
25	480	23.0 ft: changes to light olive brown with streaks of black, nonplastic	SM			S-6		14- 17- 10- 13 (N=27)	16" (67%)							25.0ft: Stopped for day on 01/08/2020, continued on 01/09/2020
30		28.0 ft: changes to Slightly moist, very dense, olive yellow with streaks of dark brown				S-7		22- 50/5.5" (N=50/5.5")	14" (122%)							

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Log of Test Boring ASW-12

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PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	475	18.0 - 42.7 ft: Moist, medium dense, olive yellow with streaks of dark brown, low plasticity, SILTY SAND, estimated 50 - 65% medium to coarse sand, est 25 - 40% fines, estimated 10% gravel*(continued)*	SM													
35		33.0 ft: changes to light olive brown, low-no plasticity				S-8		7- 19- 37- 50/5" (N=56)	16" (70%)							
	470	38.0 ft: changes to light brown				S-9		50/3" (N=50/3")	3" (100%)							
40																41.0ft: Rig chattering at 41.0 feet. High effort to reach 42.5 feet 42.5ft: Auger refusal at 42.5 feet
	465					S-10		50/3" (N=50/3")	3" (100%)							
45		42.7 - 52.8 ft: Strong to medium strong, slightly weathered, slightly fractured to highly fractured, dark gray, MICA SCHIST, fine to medium grained, slightly foliated, most fractures 5-35 degrees, spotty iron and dark brown staining and orangish silty sand soil infill, slightly rough to smooth. Gravel at section 46.6-46.7 feet				RC-1			63" (100%)	92						
50	460	47.8 ft: changes to mostly mechanical breaks; one natural fracture 30 degrees. Large quartz inclusion 49.0-49.4 feet				RC-2			58" (97%)	95						
	455															

Boring terminated at 53.0 FT on 1/9/2020.

1-inch slotted temporary PVC standpipe installed for 24- and 96-hr groundwater reading.
Boring tremie grouted after final water level measurement.

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Project: Piney Run Dam
Project No.: 60614688

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SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2µ (%)			Stress (psi)	Strain (%)	UU	CIU		
ABT- 1 S-1A	3.0-4.0									15									
ABT- 1 S-1B	4.0-5.0	Brown SILTY GRAVEL with SAND	GM			33	28			38	8								
ABT- 1 S-2	8.0-10.0									31	4								
ABT- 2 UD-1	3.0-5.0			26.6	81.4														
ASW- 1 S-1	3.0-5.0									44									
ASW- 1 S-2	8.0-10.0	Brown SILTY SAND	SM	10.6		NP	NP			37	0								
ASW- 1 UD-1	10.0-12.0			11.5	102.7					45									
ASW- 1 S-4	13.0-15.0									46									
ASW- 1 S-5	18.0-20.0									16	0								
ASW- 1 S-6	23.0-25.0									43									
ASW- 1 S-8	33.0-35.0									22									
ASW- 1 S-9	38.0-40.0									18									
ASW- 1 S-10	43.0-45.0									27									
ASW- 1 S-12	48.0-50.0									25									
ASW- 1 RC-2	55.5-56.7	Rock Core		0.1	178.9									6,353	0.1				
ASW- 2 S-1	3.0-5.0	Brown SANDY SILT	ML	24.3		NP	NP			69	4								
ASW- 2 UD-1	5.0-7.0	Brown SILTY GRAVEL with SAND	GM	15.7	106.9	NP	NP	2.74		19									
ASW- 2 S-3	13.0-15.0									43									
ASW- 2 S-4	18.0-20.0									32	2								

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

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SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
ASW- 2 S-5	23.0-25.0									23									
ASW- 3 S-1	3.0-5.0	Brown SILT with SAND	ML	32.5		NP	NP			71	5								
ASW- 3 S-2	8.0-10.0									27									
ASW- 3 S-3	13.0-15.0									19									
ASW- 3 S-4	18.0-20.0									71	5								
ASW- 3 S-5	23.0-25.0									52									
ASW- 3 S-6	28.0-30.0									33									
ASW- 3 S-7	33.0-35.0									18									
ASW- 3 RC-1	38.4-39.2	Rock Core		0.1	177.6									8,203	0.1				
ASW- 4 S-1	3.0-5.0	Brown SANDY SILT	ML	11.3		NP	NP			50	1								
ASW- 4 S-2	8.0-10.0									47									
ASW- 5 S-2	2.0-4.0	Brown SILTY SAND	SM			NP	NP			30	2								
ASW- 5 S-4	6.0-8.0									14									
ASW- 5 S-5	8.0-10.0									38									
ASW- 5 S-6	13.0-15.0			27.3						31	4								
ASW- 5 S-7	18.0-20.0									31									
ASW- 5 S-8	23.0-25.0									35									
ASW- 5 S-9	27.0-27.1									25									
ASW- 6 S-1	3.0-5.0									50									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

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SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Specific Gravity D854	Specific Gravity C128	Grain Size: <#200 (%)	Grain Size: <2µ (%)	Compaction	Consolidation	Unconfined Compression: Stress (psi)	Unconfined Compression: Strain (%)	Triaxial Compression: UU	Triaxial Compression: CIU	Permeability (cm/sec)	Special Tests
ASW- 6 S-2	8.0-10.0									57									
ASW- 6 S-3	13.0-15.0									51									
ASW- 6 UD-1	15.0-16.5	Brown SANDY SILT	ML	29.2	93.0	NP	NP			57									
ASW- 6 S-5	18.0-20.0									47									
ASW- 6 S-6	23.0-25.0									54									
ASW- 6 S-7	28.0-30.0									60	2								
ASW- 6 S-8	33.0-35.0									23									
ASW- 6 S-9	38.0-40.0									26									
ASW- 7 S-1	3.0-5.0									24									
ASW- 7 S-2	8.0-10.0									31									
ASW- 7 U-1	10.0-12.0			20.6	107.3	NP	NP												
ASW- 7 S-4	13.0-15.0									30									
ASW- 7 S-5	18.0-20.0									27									
ASW- 7 S-6	23.0-25.0									37									
ASW- 7 S-7	28.0-30.0									26	1								
ASW- 7 S-8	33.0-35.0									28									
ASW- 8 S-1	3.0-5.0									31									
ASW- 8 BULK	5.0-15.0	Brown SILTY SAND with GRAVEL	SM			NP	NP			29	2								
ASW- 8 S-2	8.0-10.0									28									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

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SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
ASW- 8 S-3	13.0-15.0			16.3						34									
ASW- 8 S-4	18.0-20.0									38	2								
ASW- 8 S-5	23.0-25.0									14									
ASW- 8 S-6	28.0-30.0									45									
ASW- 8 S-7	33.0-35.0									34									
ASW-10 S-2	3.0-5.0									18	1								
ASW-10 S-3	8.0-10.0									28									
ASW-10 S-4	13.0-15.0									51									
ASW-10 S-5	18.0-20.0	Brown SILTY SAND	SM	21.4		NP	NP			48	3								
ASW-10 S-6	23.0-25.0									25									
ASW-11 S-1	3.0-5.0									25									
ASW-11 S-2	8.0-10.0	Brown SANDY SILT	ML	21.9		NP	NP			64	3								
ASW-11 S-4	13.0-15.0									27									
ASW-11 S-5	18.0-20.0									44									
ASW-11 S-6	23.0-25.0									12									
ASW-11 S-7	28.0-30.0									43									
ASW-11 S-8	33.0-35.0									34									
ASW-11 S-9	38.0-40.0									25	1								
ASW-11 S-10	43.0-45.0									42									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
ASW-11 S-11	48.0-50.0									35									
ASW-11 RC-1	56.8-57.7	Rock Core		0.1	170.1									19,296	0.3				
EMB- 1 UD-1	15.0-17.0			18.2	81.5					39									
EMB- 2 S-1	0.0-2.0									31									
EMB- 2 S-2	3.0-5.0									45									
EMB- 2 S-3	8.0-10.0									44									
EMB- 2 S-4	13.0-15.0									33									
EMB- 2 S-5A	18.0-20.0									16									
EMB- 2 S-6	23.0-25.0									39									
EMB- 2 UD-1	25.0-27.0	Brown SILTY SAND	SM	22.5		NP	NP	2.80		47	7							9.3E-06	
EMB- 2 UD-2	31.0-32.7									25						*			
EMB- 2 S-11	33.0-35.0									33									
EMB- 2 S-12	38.0-40.0									41									
EMB- 2 S-13	43.0-45.0			16.6						55									
EMB- 2 S-14	48.0-50.0									62	16								
EMB- 2 S-15	53.0-55.0									56									
EMB- 2 S-16	58.0-60.0									61									
EMB- 2 S-17	63.0-65.0									59									
EMB- 2 S-18	68.0-70.0									63									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

AECOM

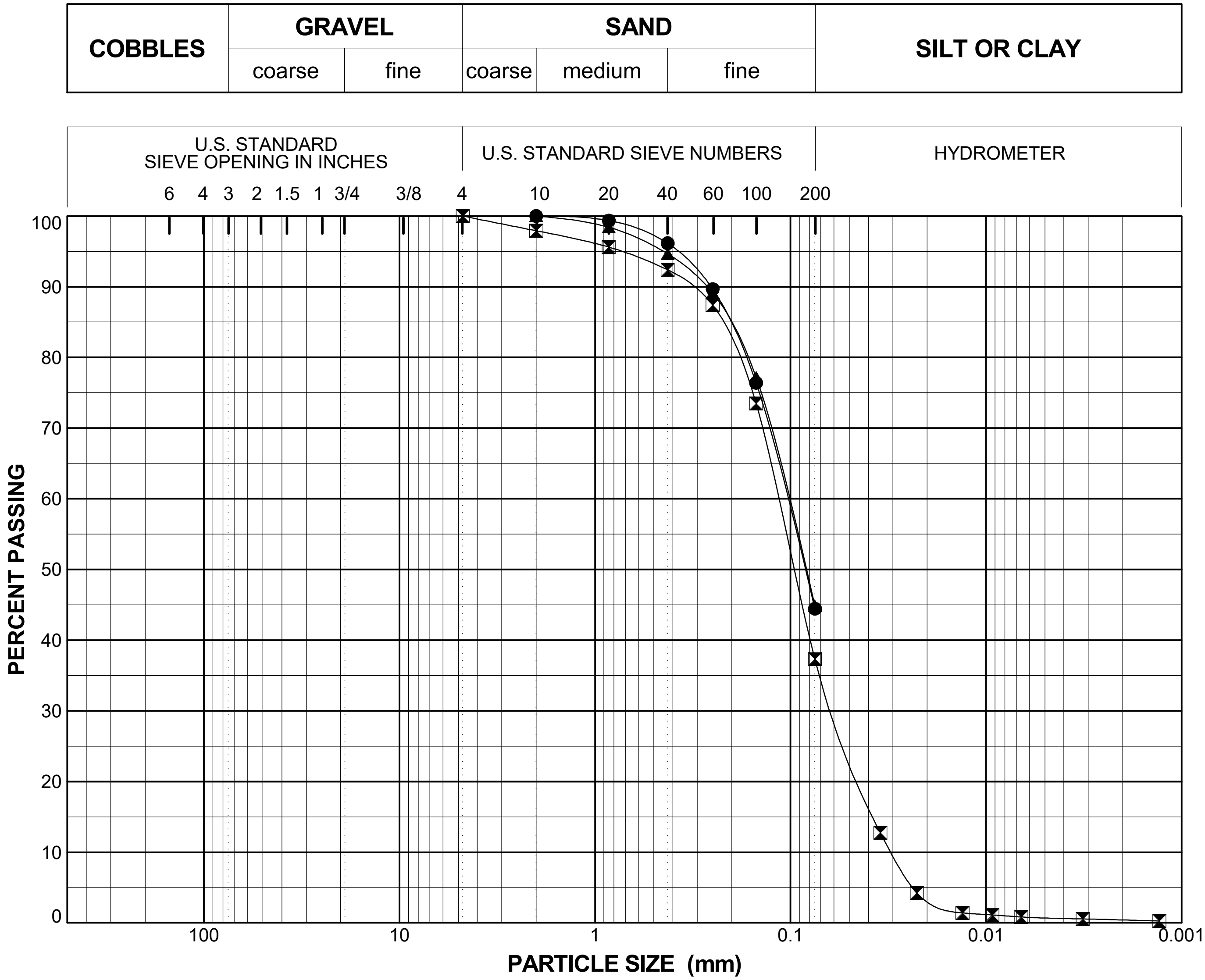
SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2µ (%)			Stress (psi)	Strain (%)	UU	CIU		
ABT-3 S-2	3.0-5.0									31									
ABT-3 S-3	8.0-10.0	Brown SILTY SAND	SM	22.3		NP	NP			43	2								
ABT-3 S-5	18.0-20.0									48	2								
ABT-3 S-7	28.0-30.0									29									
ABT-3 S-8	33.0-35.0									22									
ASW- 9 S-2	8.0-10.0									45	1								
ASW- 9 S-4	18.0-20.0									37									
ASW- 9 S-6	28.0-30.0									38									
ASW- 9 RC-1	33.8-34.4	Rock Core		0.3	170.1									7,798	0.2				
ASW-12 S-2	3.0-5.0	Brown SILTY GRAVEL with SAND	GM	25.8		37	25			45	11								
ASW-12 S-4	13.0-15.0									20	1								
EMB-1 S-1	3.0-5.0			10.3						27	2								
EMB-1 S-7	28.0-30.0	Brown SANDY LEAN CLAY	CL			34	22			66	20								
EMB-1 S-9	38.0-40.0									59									
EMB-5 S-2	3.0-5.0									31									
EMB-5 S-4	13.0-15.0			11.4						44	2								
EXP-1 S-1	3.0-5.0	Brown SANDY ELASTIC SILT	MH	43.1		57	46			68	4								
EXP-1 S-3	13.0-15.0									39									
EXP-2 S- 4	13.0-15.0									33									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:



SYMBOL	●	⧗	▲
Boring	ASW- 1	ASW- 1	ASW- 1
Sample	S-1	S-2	UD-1
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	10.0-12.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	0.0
% Sand	55.5	62.7	55.1
% Fines	44.5	37.3	44.9
% -2μ		0.4	
Cc		1.02	
Cu		3.83	
LL		NP	
PL		NP	
PI		NP	
USCS		SM	
w (%)		10.6	11.5

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"			
3/8"			
4		100.0	
10	100.0	97.9	100.0
20	99.4	95.6	98.4
40	96.2	92.4	94.7
60	89.7	87.4	89.1
100	76.4	73.5	77.2
200	44.5	37.3	44.9

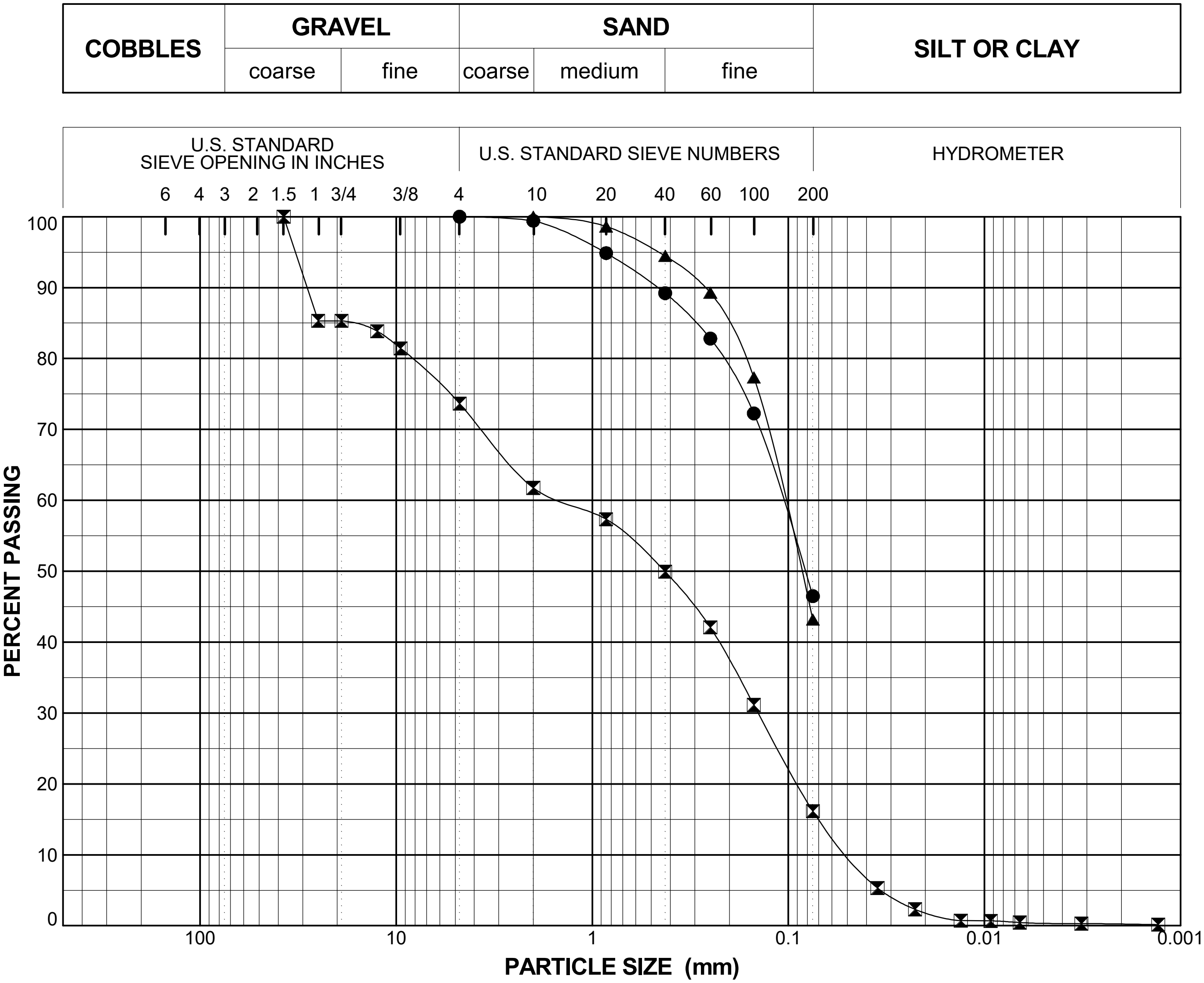
SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown SILTY SAND (SM)
▲	Brown ()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 2

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 1	ASW- 1	ASW- 1
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	26.4	0.0
% Sand	53.5	57.5	56.8
% Fines	46.5	16.2	43.2
% -2μ		0.2	
Cc		0.29	
Cu		29.23	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	PERCENT FINER ⧗	PERCENT FINER ▲
2"			
1 1/2"		100.0	
1"		85.3	
3/4"		85.3	
1/2"		83.9	
3/8"		81.4	
4	100.0	73.6	
10	99.4	61.8	100.0
20	94.9	57.3	98.6
40	89.2	50.0	94.5
60	82.8	42.1	89.3
100	72.3	31.1	77.4
200	46.5	16.2	43.2

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

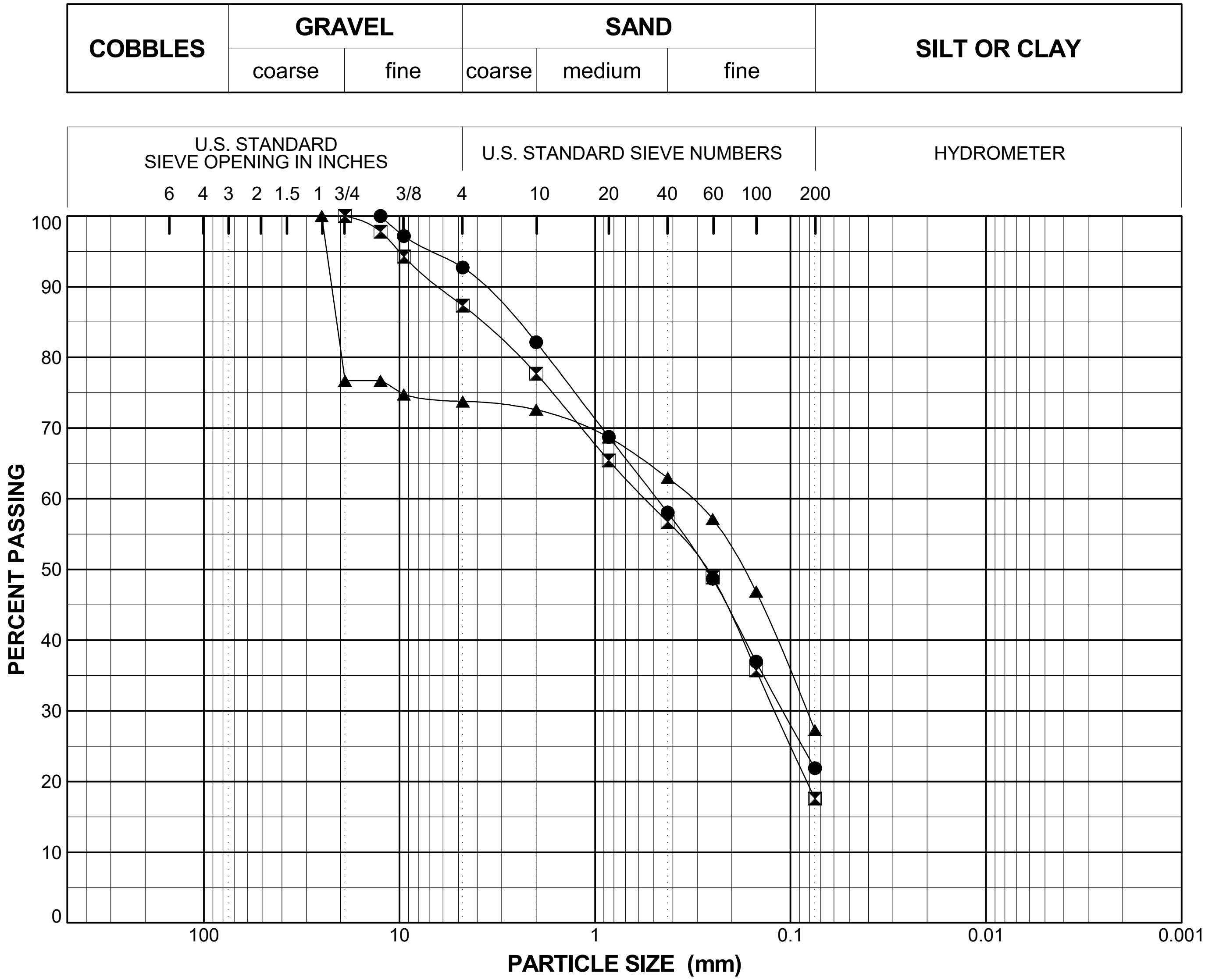
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 3

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 1	ASW- 1	ASW- 1
Sample	S-8	S-9	S-10
Spec			
Depth (ft)	33.0-35.0	38.0-40.0	43.0-45.0
% +3"	0.0	0.0	0.0
% Gravel	7.3	12.7	26.2
% Sand	70.8	69.7	46.5
% Fines	21.9	17.6	27.3
% -2µ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			100.0
3/4"		100.0	76.7
1/2"	100.0	97.8	76.7
3/8"	97.2	94.3	74.8
4	92.7	87.3	73.8
10	82.2	77.7	72.6
20	68.8	65.4	68.7
40	58.0	56.7	63.0
60	48.7	48.9	57.1
100	37.0	35.7	46.9
200	21.9	17.6	27.3

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

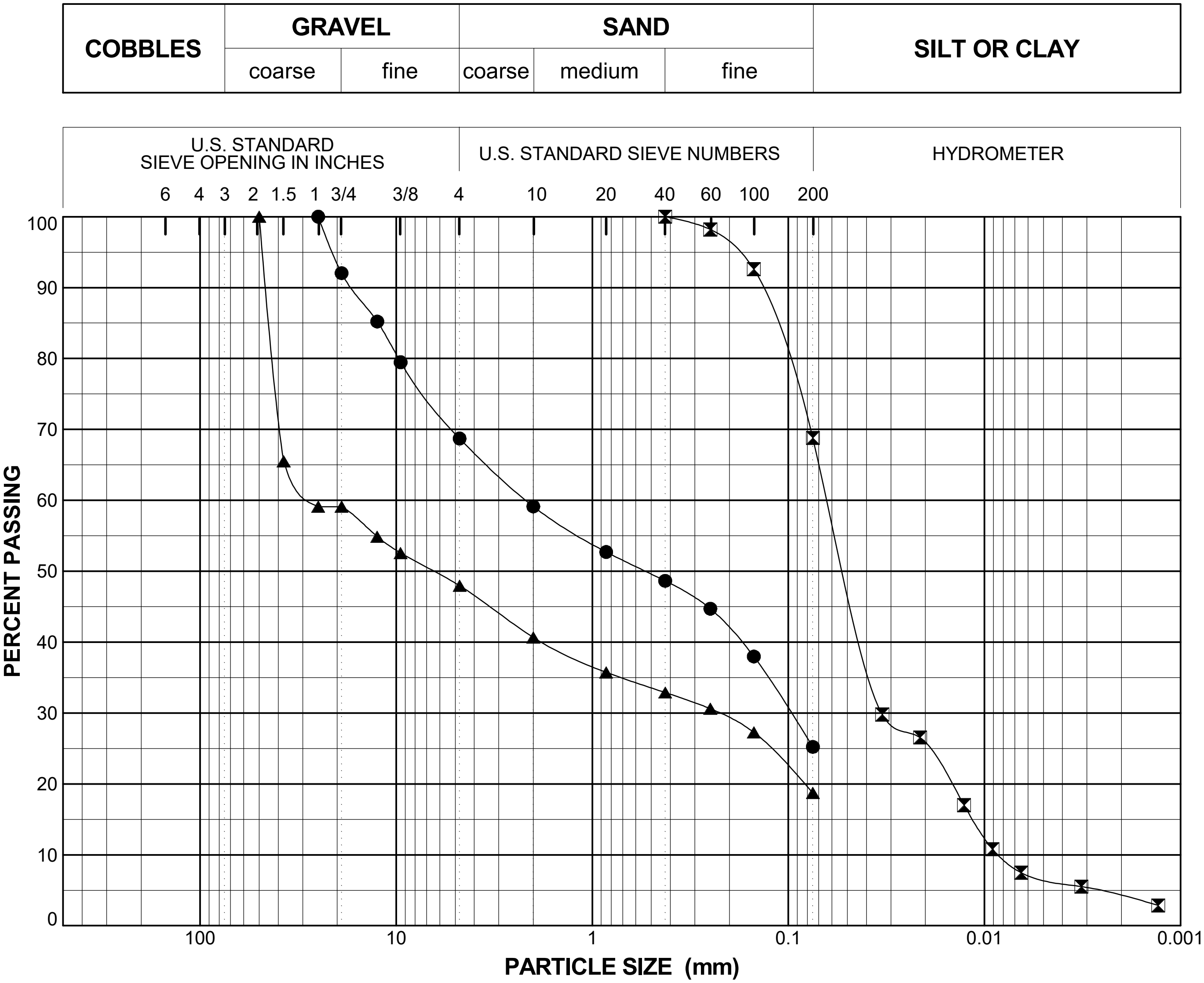
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 4

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 1	ASW- 2	ASW- 2
Sample	S-12	S-1	UD-1
Spec			
Depth (ft)	48.0-50.0	3.0-5.0	5.0-7.0
% +3"	0.0	0.0	0.0
% Gravel	31.3	0.0	52.0
% Sand	43.5	31.2	29.2
% Fines	25.2	68.8	18.7
% -2μ		4.1	
Cc		2.12	
Cu		7.44	
LL		NP	NP
PL		NP	NP
PI		NP	NP
USCS		ML	GM
w (%)		24.3	15.7

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			100.0
1 1/2"			65.5
1"	100.0		59.1
3/4"	92.0		59.1
1/2"	85.2		54.9
3/8"	79.5		52.6
4	68.7		48.0
10	59.1		40.7
20	52.7		35.7
40	48.6	100.0	32.9
60	44.7	98.2	30.6
100	38.0	92.6	27.3
200	25.2	68.8	18.7

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown SANDY SILT (ML)
▲	Brown SILTY GRAVEL with SAND (GM)

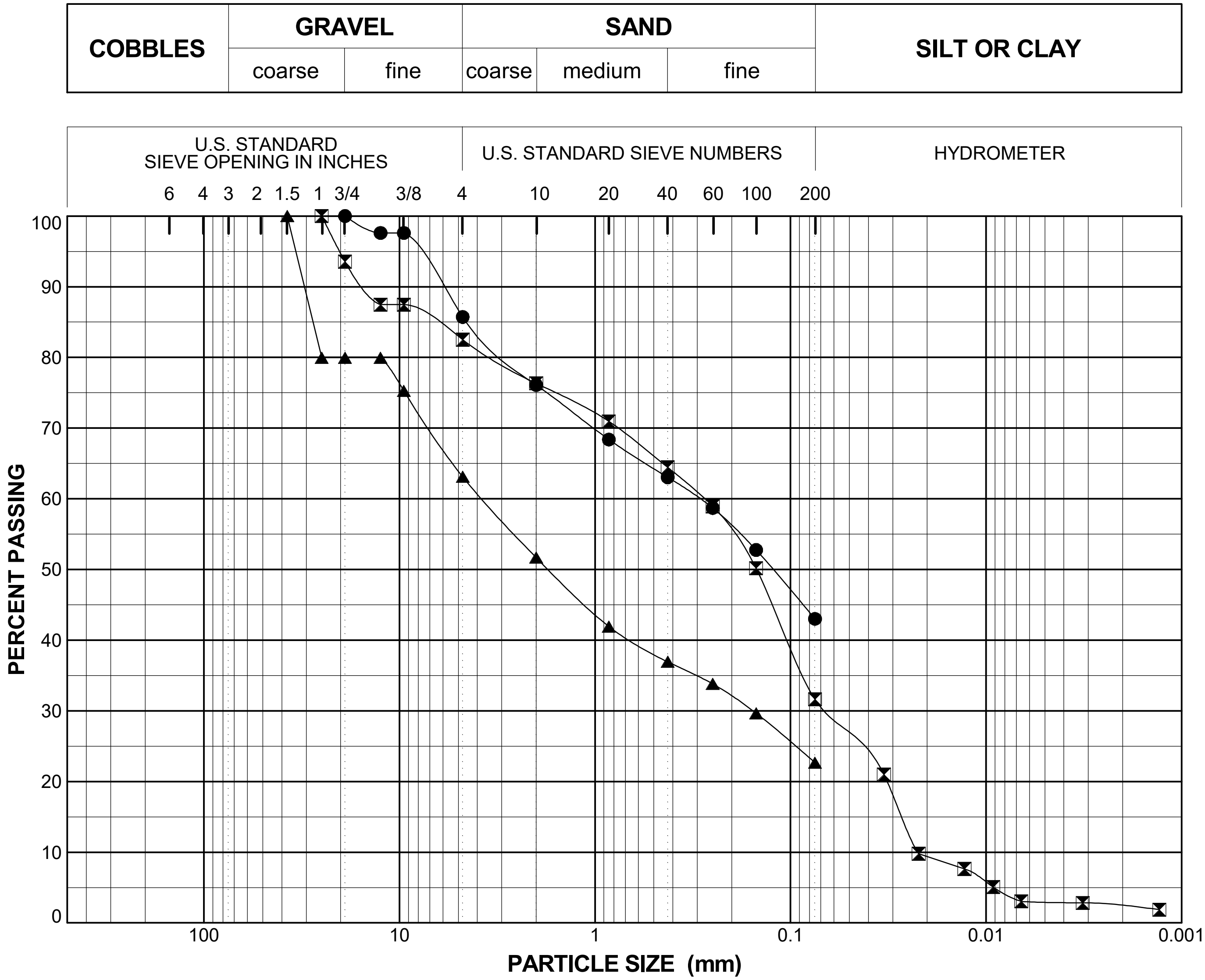
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 5

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 2	ASW- 2	ASW- 2
Sample	S-3	S-4	S-5
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	14.3	17.5	36.9
% Sand	42.7	50.9	40.4
% Fines	43.0	31.6	22.7
% -2μ		2.3	
Cc		0.71	
Cu		12.43	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	PERCENT FINER ⧗	PERCENT FINER ▲
2"			
1 1/2"			100.0
1"		100.0	80.0
3/4"	100.0	93.6	80.0
1/2"	97.6	87.5	80.0
3/8"	97.6	87.5	75.3
4	85.7	82.5	63.1
10	76.1	76.3	51.7
20	68.4	71.0	41.9
40	63.1	64.5	36.9
60	58.7	58.9	33.8
100	52.8	50.2	29.7
200	43.0	31.6	22.7

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

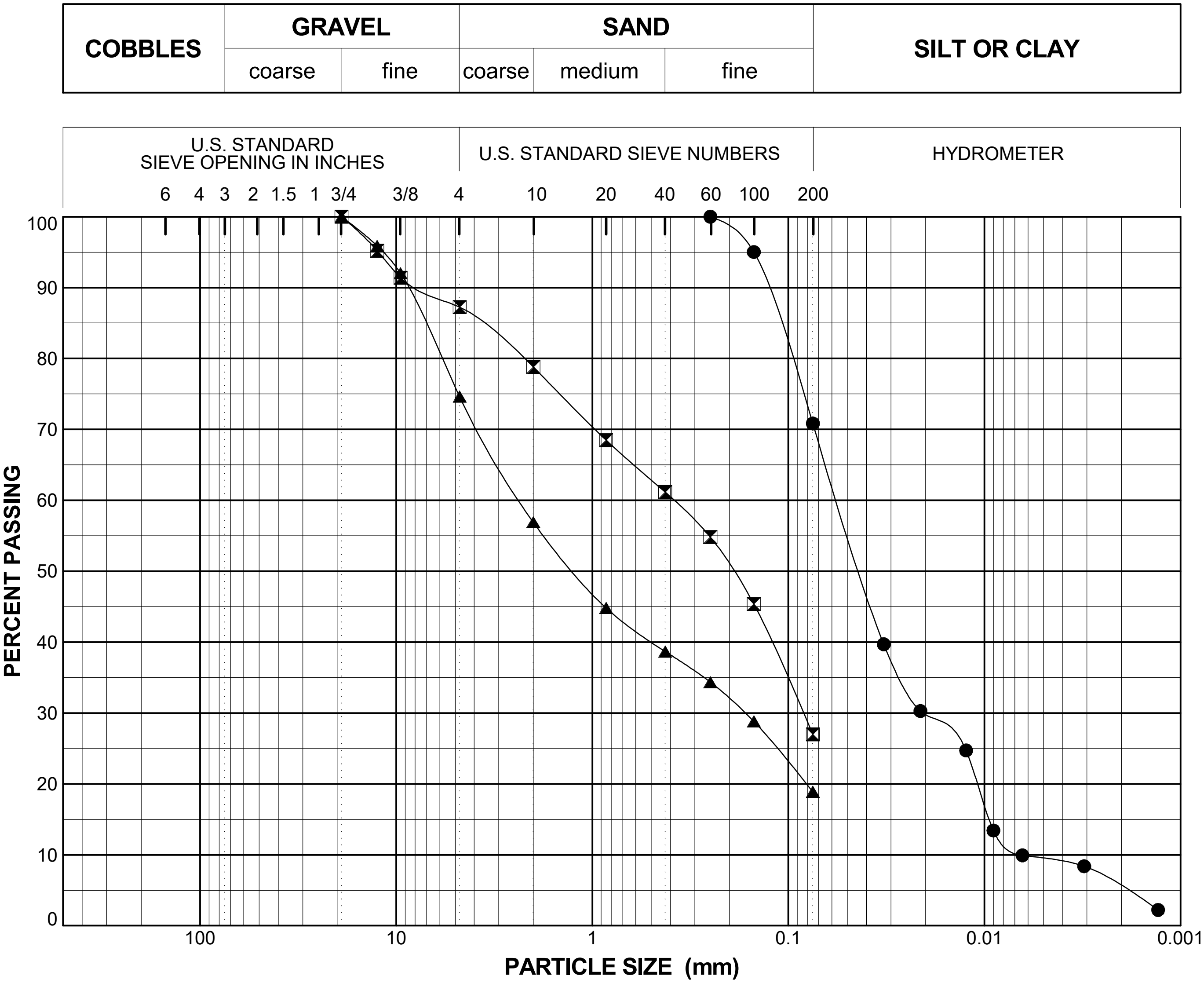
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 6

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 3	ASW- 3	ASW- 3
Sample	S-1	S-2	S-3
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	12.8	25.4
% Sand	29.2	60.2	55.7
% Fines	70.8	27.0	18.9
% -2µ	5.3		
Cc	1.18		
Cu	8.71		
LL	NP		
PL	NP		
PI	NP		
USCS	ML		
w (%)	32.5		

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"		100.0	100.0
1/2"		95.2	95.9
3/8"		91.4	92.0
4		87.2	74.6
10		78.8	56.9
20		68.5	44.8
40		61.2	38.7
60	100.0	54.8	34.4
100	95.0	45.4	28.8
200	70.8	27.0	18.9

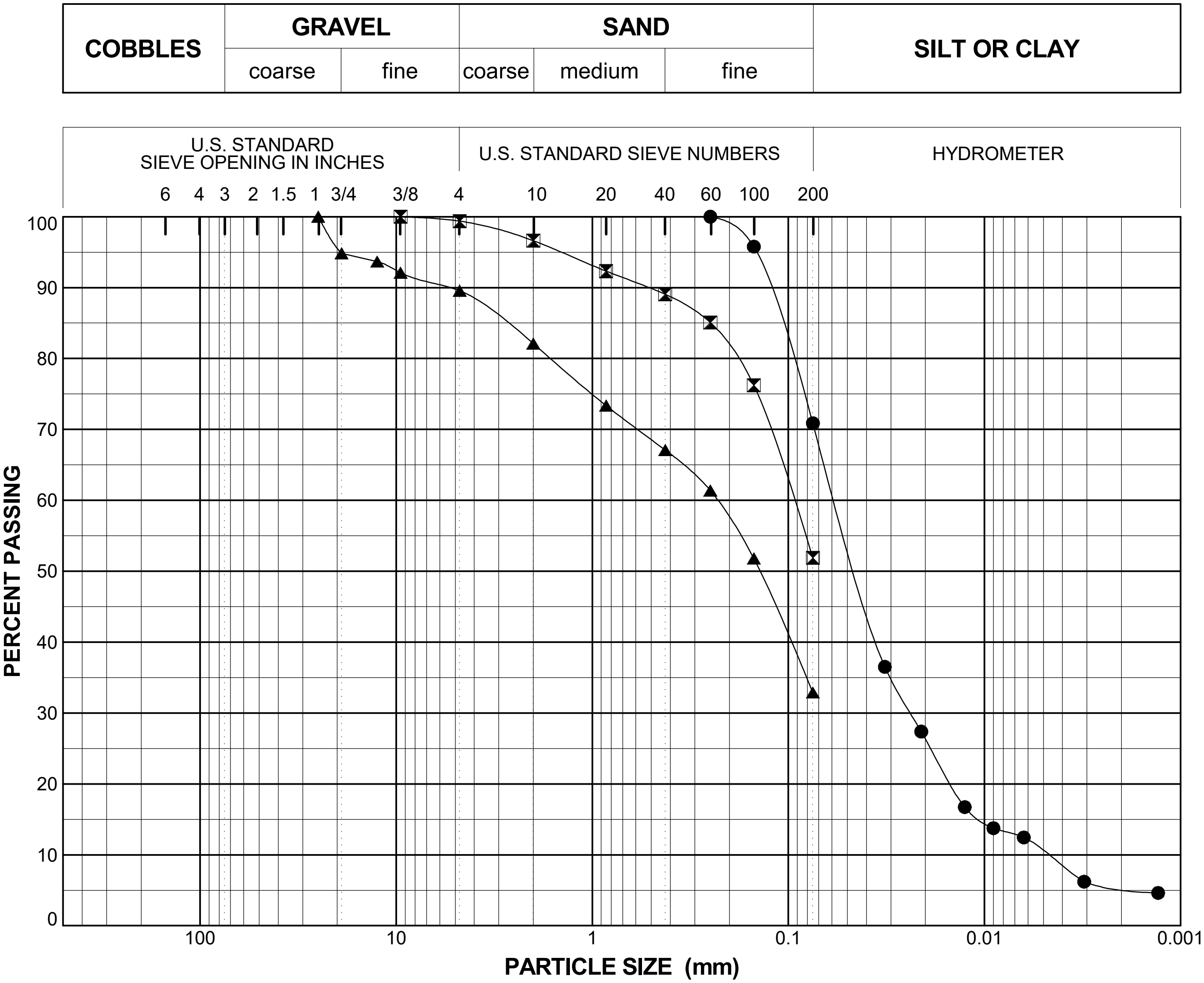
SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILT with SAND (ML)
⧗	()
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 7

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 3	ASW- 3	ASW- 3
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.6	10.4
% Sand	29.1	47.5	56.7
% Fines	70.9	51.9	32.9
% -2μ	5.4		
Cc	2.06		
Cu	12.04		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			100.0
3/4"			94.8
1/2"			93.7
3/8"		100.0	92.1
4		99.4	89.6
10		96.6	82.1
20		92.3	73.4
40		89.1	67.1
60	100.0	85.1	61.4
100	95.8	76.2	51.8
200	70.9	51.9	32.9

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

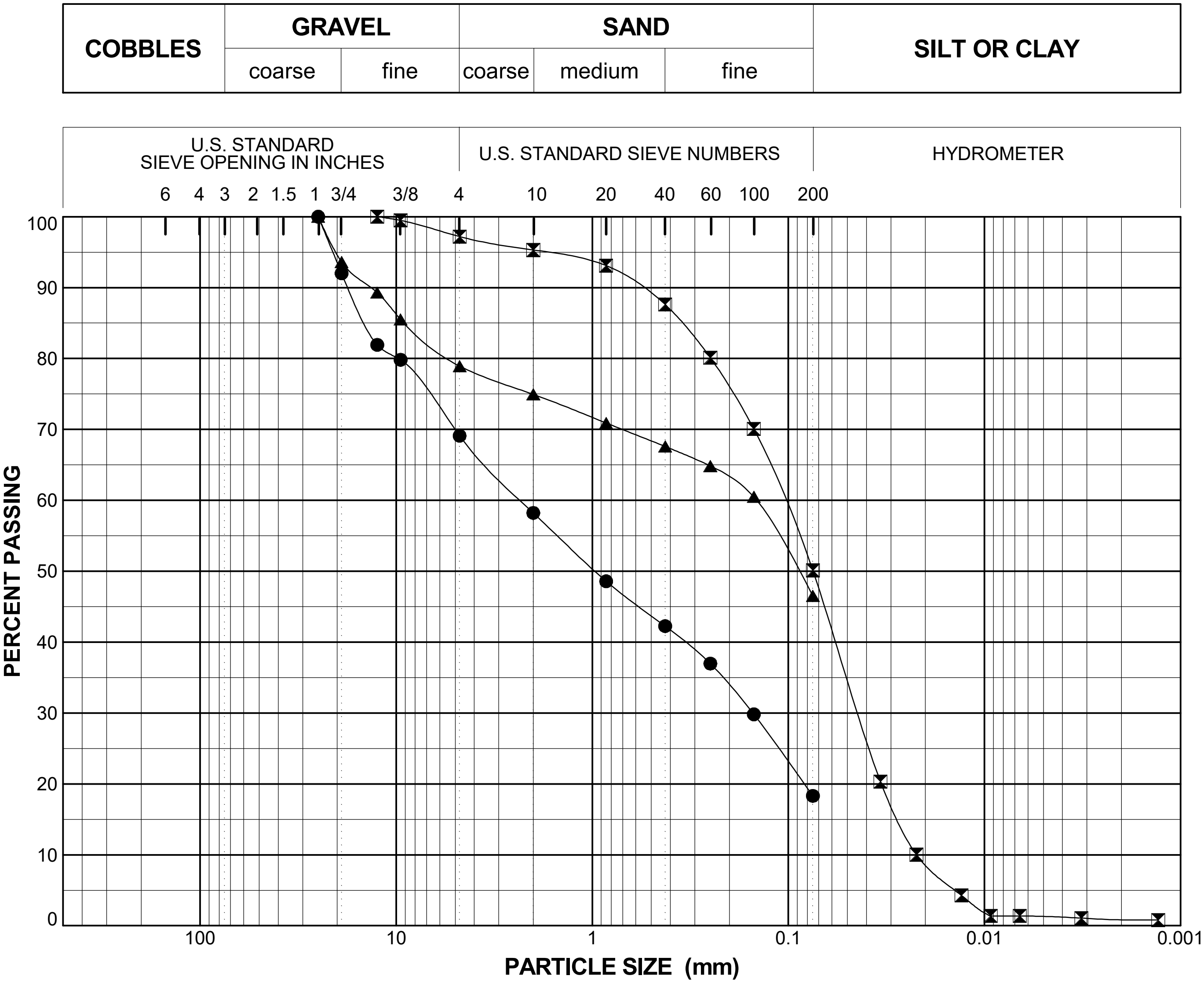
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 8

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

SYMBOL	●	⧗	▲
Boring	ASW- 3	ASW- 4	ASW- 4
Sample	S-7	S-1	S-2
Spec			
Depth (ft)	33.0-35.0	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	30.9	2.8	21.1
% Sand	50.8	47.1	32.4
% Fines	18.3	50.1	46.5
% -2μ		0.9	
Cc		0.82	
Cu		4.77	
LL		NP	
PL		NP	
PI		NP	
USCS		ML	
w (%)		11.3	

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"	100.0		100.0
3/4"	92.0		93.6
1/2"	81.9	100.0	89.3
3/8"	79.8	99.5	85.5
4	69.1	97.2	78.9
10	58.2	95.3	74.9
20	48.6	93.1	70.9
40	42.3	87.6	67.6
60	37.0	80.1	64.8
100	29.8	70.1	60.5
200	18.3	50.1	46.5

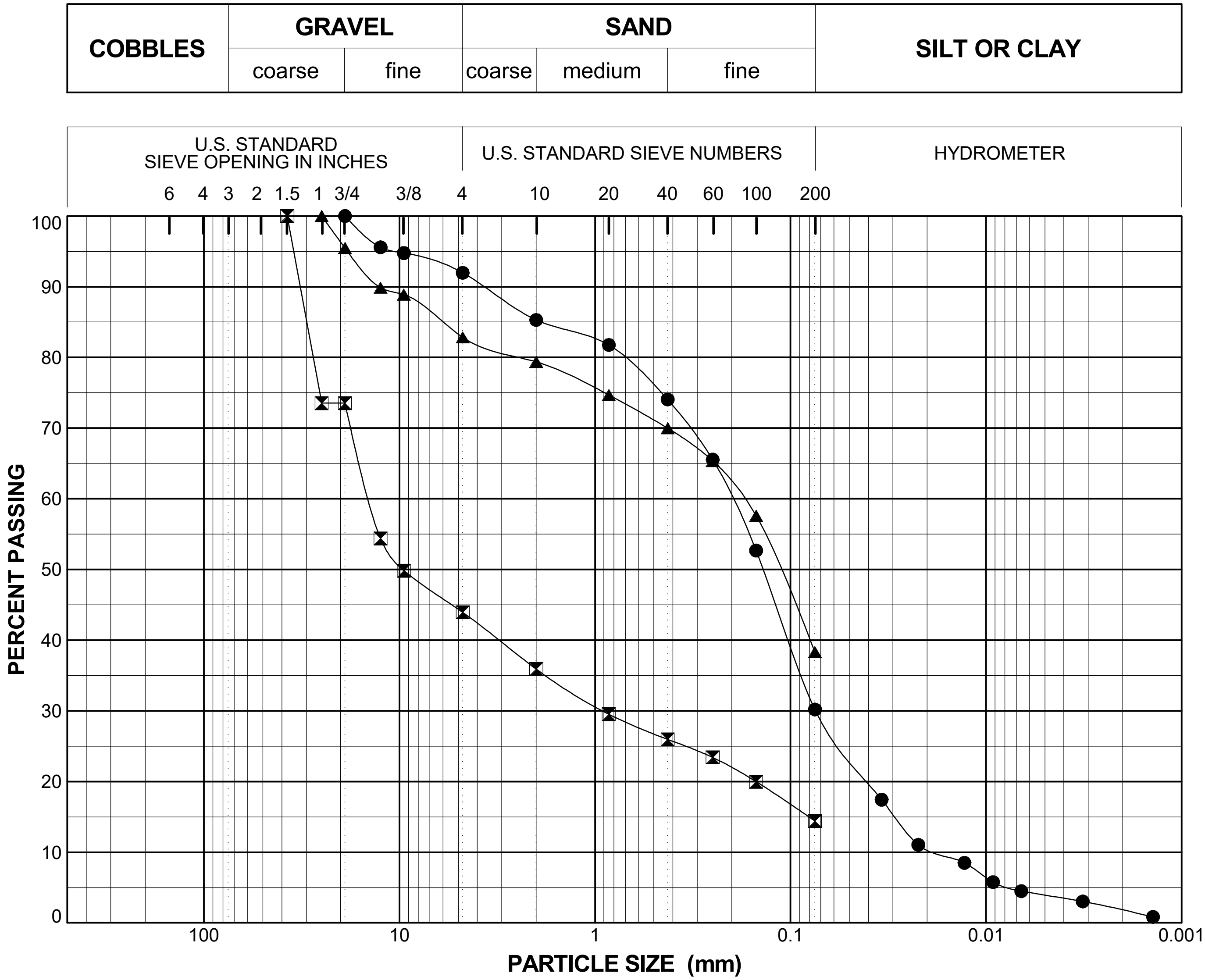
SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown SANDY SILT (ML)
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 9

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 5	ASW- 5	ASW- 5
Sample	S-2	S-4	S-5
Spec			
Depth (ft)	2.0-4.0	6.0-8.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	8.0	56.1	17.2
% Sand	61.8	29.5	44.5
% Fines	30.2	14.4	38.3
% -2μ	1.8		
Cc	1.54		
Cu	11.31		
LL	NP		
PL	NP		
PI	NP		
USCS	SM		
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"		100.0	
1"		73.5	100.0
3/4"	100.0	73.5	95.5
1/2"	95.6	54.4	89.9
3/8"	94.8	49.8	88.9
4	92.0	43.9	82.8
10	85.3	35.9	79.4
20	81.8	29.5	74.7
40	74.1	26.0	70.0
60	65.5	23.4	65.4
100	52.7	20.0	57.6
200	30.2	14.4	38.3

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND (SM)
⧗	()
▲	()

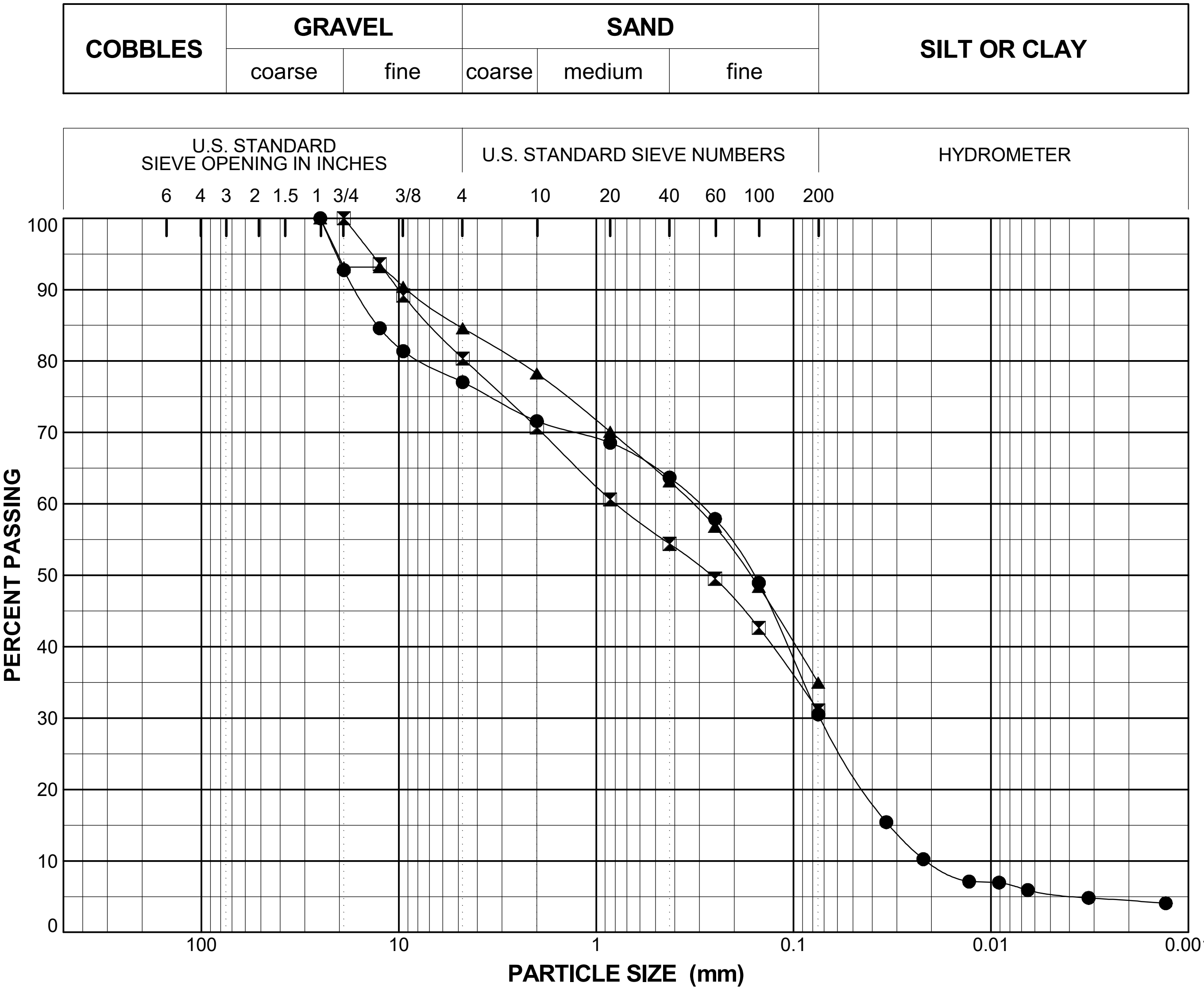
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 10

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 5	ASW- 5	ASW- 5
Sample	S-6	S-7	S-8
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	23.0	19.6	15.4
% Sand	46.5	49.3	49.6
% Fines	30.5	31.1	35.0
% -2μ	4.4		
Cc	0.83		
Cu	14.37		
LL			
PL			
PI			
USCS			
w (%)	27.3		

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"	100.0		100.0
3/4"	92.7	100.0	93.2
1/2"	84.6	93.6	93.2
3/8"	81.4	89.2	90.4
4	77.0	80.4	84.6
10	71.6	70.7	78.3
20	68.6	60.6	70.1
40	63.7	54.4	63.1
60	57.9	49.5	56.8
100	49.0	42.7	48.4
200	30.5	31.1	35.0

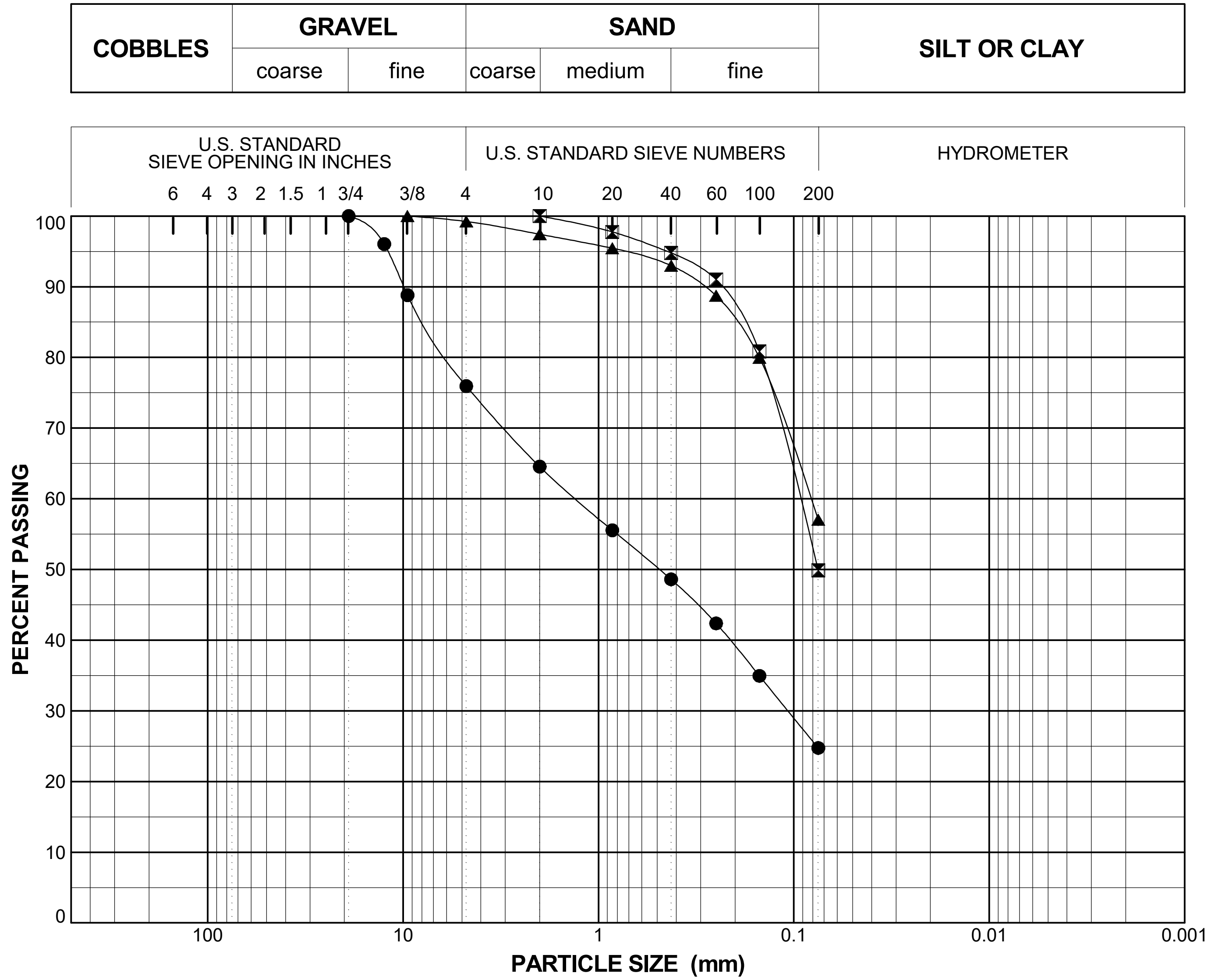
SYMBOL	DESCRIPTION AND REMARKS
●	Gray ()
⧗	()
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 11

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 5	ASW- 6	ASW- 6
Sample	S-9	S-1	S-2
Spec			
Depth (ft)	27.0-27.1	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	24.1	0.0	0.8
% Sand	51.2	50.1	42.2
% Fines	24.8	49.9	57.1
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"			
3/4"	100.0		
1/2"	96.0		
3/8"	88.8		100.0
4	75.9		99.2
10	64.6	100.0	97.4
20	55.5	97.8	95.5
40	48.6	94.8	93.0
60	42.4	91.0	88.7
100	35.0	80.8	80.0
200	24.8	49.9	57.1

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

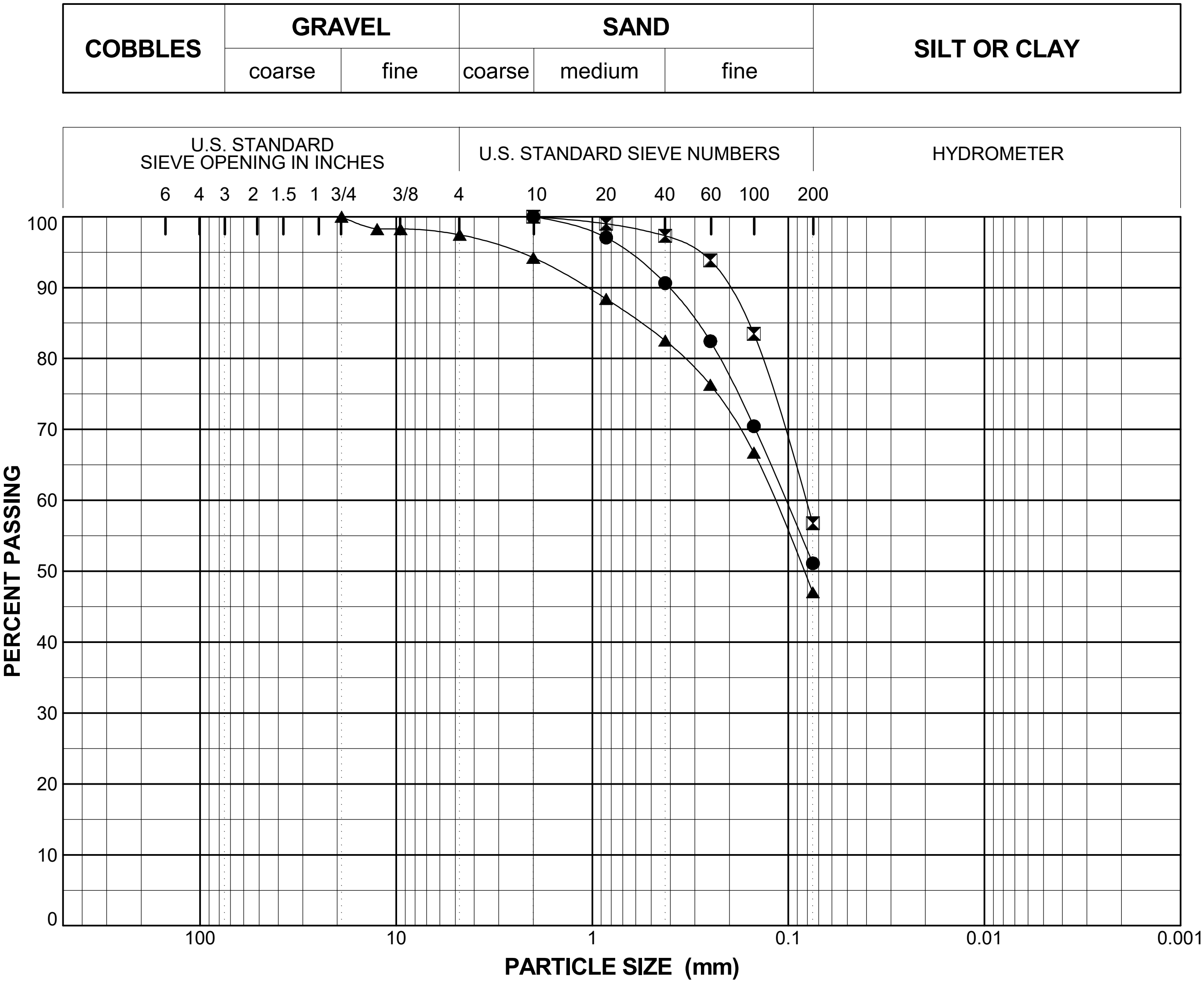
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 12

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

SYMBOL	●	⧗	▲
Boring	ASW- 6	ASW- 6	ASW- 6
Sample	S-3	UD-1	S-5
Spec			
Depth (ft)	13.0-15.0	15.0-16.5	18.0-20.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	2.5
% Sand	48.9	43.2	50.4
% Fines	51.1	56.8	47.0
% -2μ			
Cc			
Cu			
LL		NP	
PL		NP	
PI		NP	
USCS		ML	
w (%)		29.2	

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"			98.3
3/8"			98.3
4			97.5
10	100.0	100.0	94.2
20	97.1	99.0	88.4
40	90.6	97.3	82.5
60	82.4	93.9	76.3
100	70.5	83.5	66.7
200	51.1	56.8	47.0

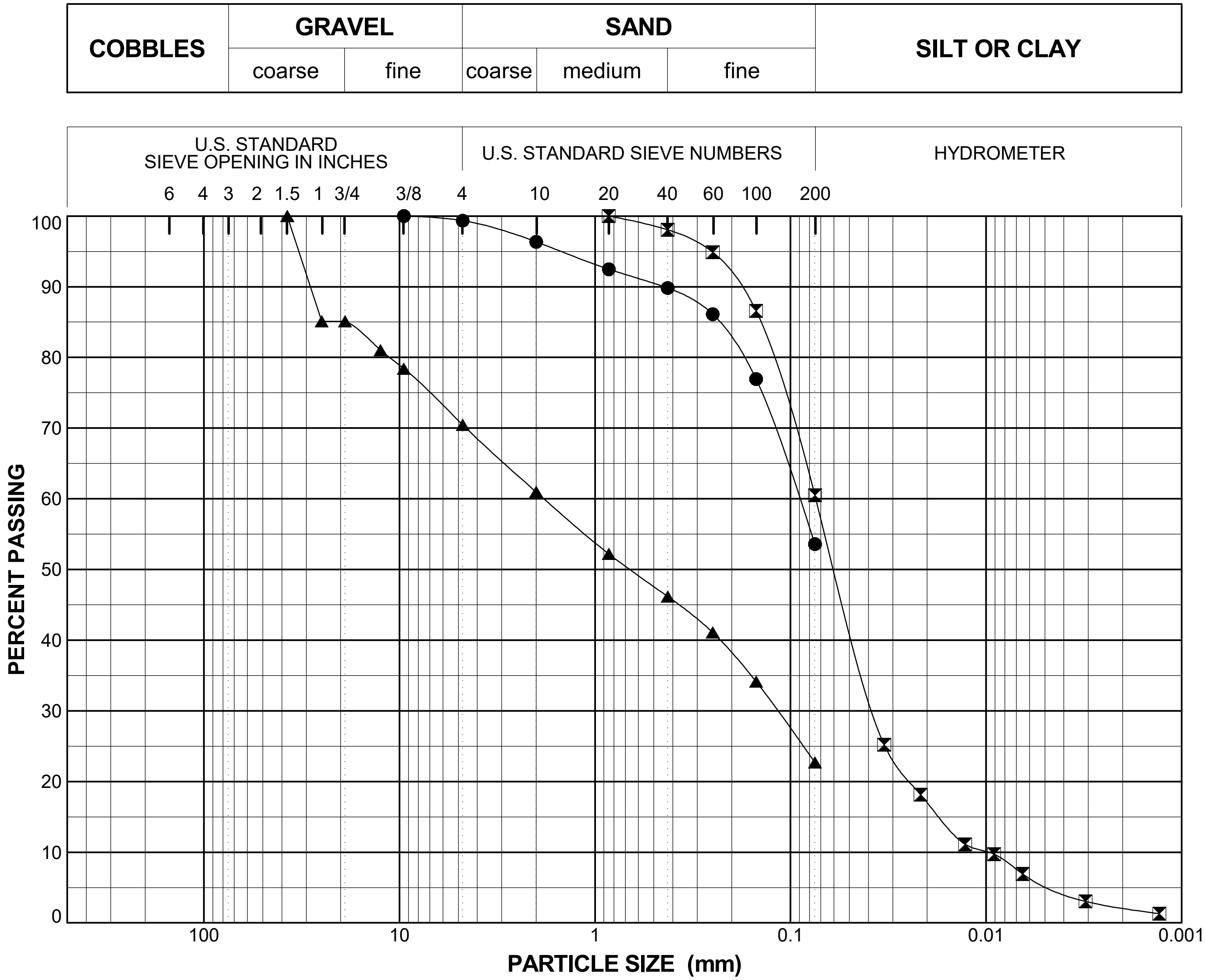
SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown SANDY SILT (ML)
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 13

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 6	ASW- 6	ASW- 6
Sample	S-6	S-7	S-8
Spec			
Depth (ft)	23.0-25.0	28.0-30.0	33.0-35.0
% +3"	0.0	0.0	0.0
% Gravel	0.6	0.0	29.5
% Sand	45.8	39.5	47.8
% Fines	53.6	60.5	22.7
% -2μ		2.2	
Cc		1.91	
Cu		7.63	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			100.0
1"			85.1
3/4"			85.1
1/2"			81.0
3/8"	100.0		78.4
4	99.4		70.5
10	96.4		61.0
20	92.5	100.0	52.2
40	89.8	98.1	46.2
60	86.1	94.9	41.1
100	76.9	86.6	34.1
200	53.6	60.5	22.7

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

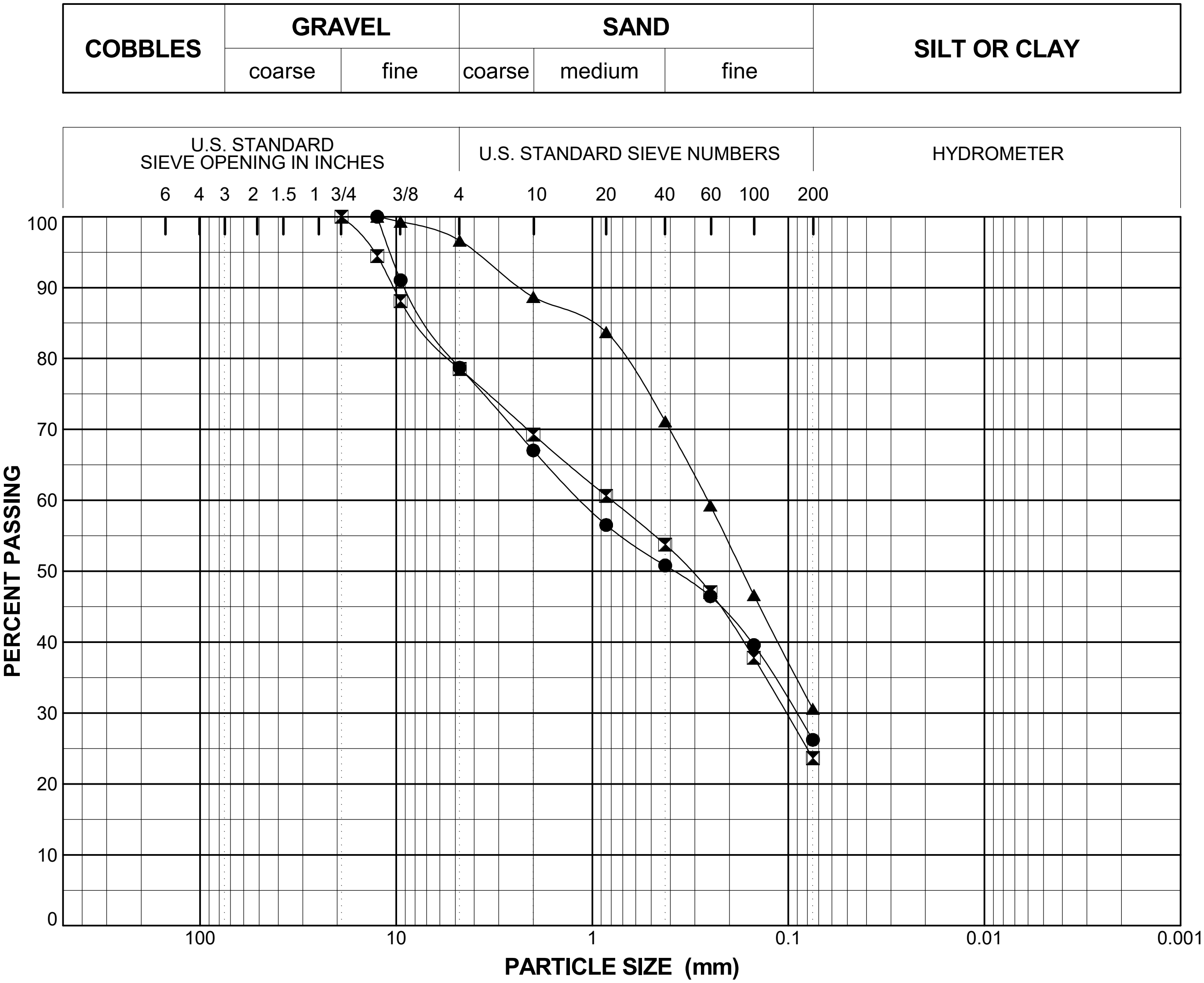
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 14

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 6	ASW- 7	ASW- 7
Sample	S-9	S-1	S-2
Spec			
Depth (ft)	38.0-40.0	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	21.3	21.5	3.4
% Sand	52.5	54.9	66.1
% Fines	26.2	23.6	30.6
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"			
3/4"		100.0	
1/2"	100.0	94.5	100.0
3/8"	91.0	88.1	99.3
4	78.7	78.5	96.6
10	67.0	69.3	88.7
20	56.5	60.6	83.7
40	50.8	53.8	71.2
60	46.5	47.0	59.3
100	39.6	37.8	46.6
200	26.2	23.6	30.6

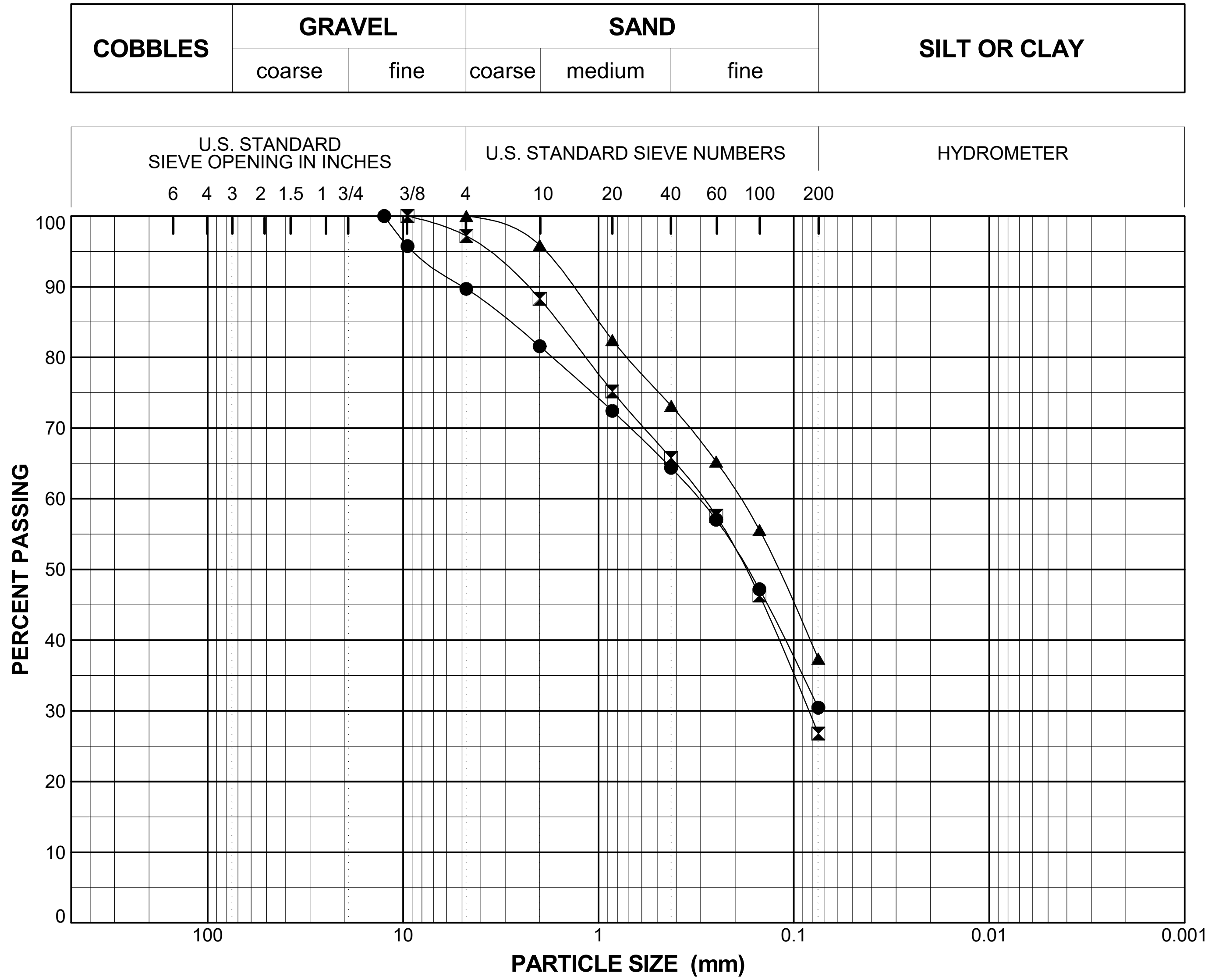
SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 15

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 7	ASW- 7	ASW- 7
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	10.3	2.8	0.0
% Sand	59.2	70.4	62.6
% Fines	30.5	26.8	37.4
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"	100.0		
3/8"	95.8	100.0	
4	89.7	97.2	100.0
10	81.6	88.3	95.9
20	72.4	75.2	82.5
40	64.4	65.8	73.2
60	57.1	57.6	65.3
100	47.2	46.3	55.6
200	30.5	26.8	37.4

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

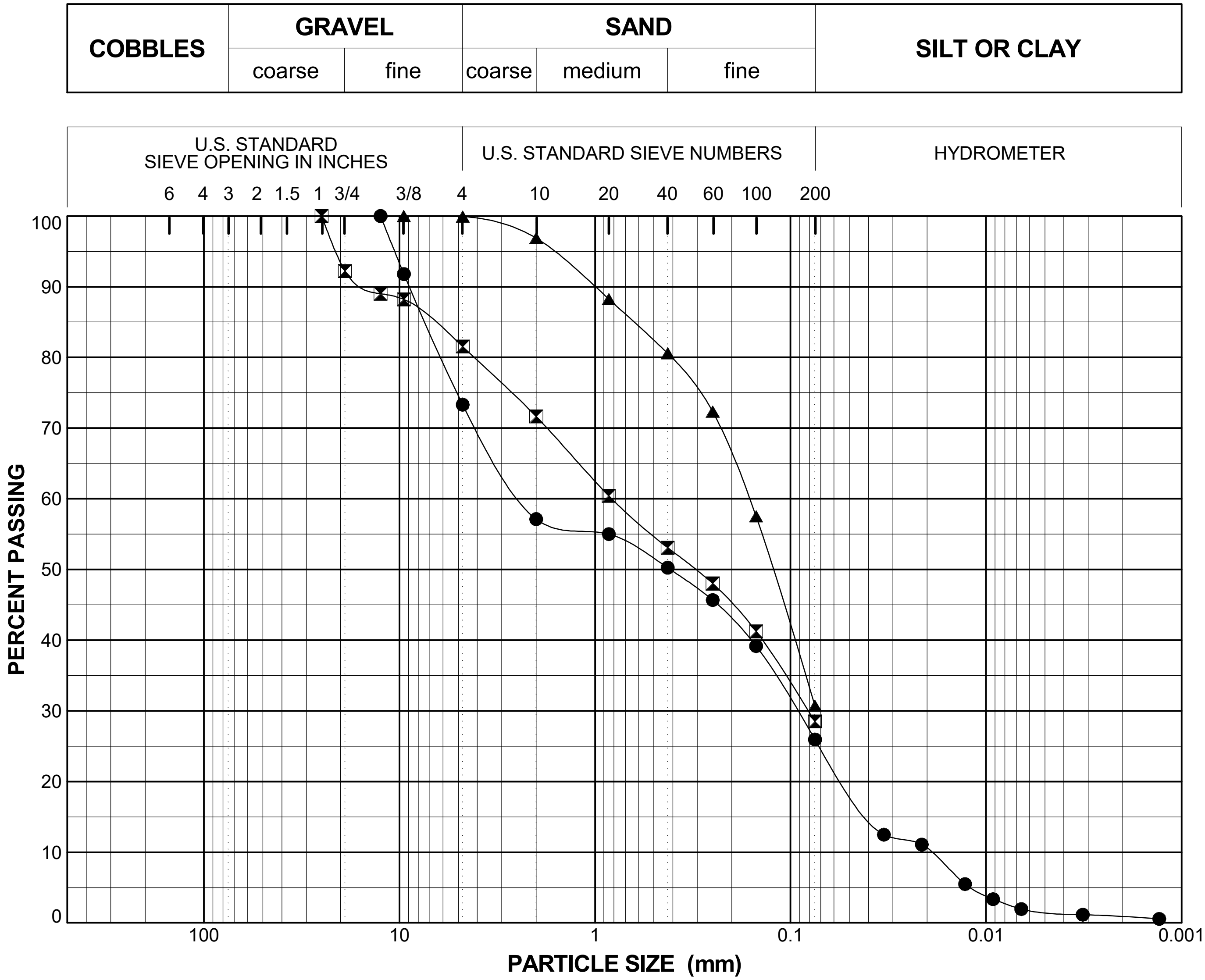
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 16

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 7	ASW- 7	ASW- 8
Sample	S-7	S-8	S-1
Spec			
Depth (ft)	28.0-30.0	33.0-35.0	3.0-5.0
% +3"	0.0	0.0	0.0
% Gravel	26.7	18.5	0.1
% Sand	47.4	53.0	69.2
% Fines	26.0	28.5	30.7
% -2μ	0.8		
Cc	0.19		
Cu	120.86		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"		100.0	
3/4"		92.2	
1/2"	100.0	89.0	
3/8"	91.8	88.2	100.0
4	73.3	81.5	99.9
10	57.1	71.7	96.9
20	55.0	60.4	88.3
40	50.3	53.1	80.6
60	45.7	48.0	72.3
100	39.2	41.2	57.5
200	26.0	28.5	30.7

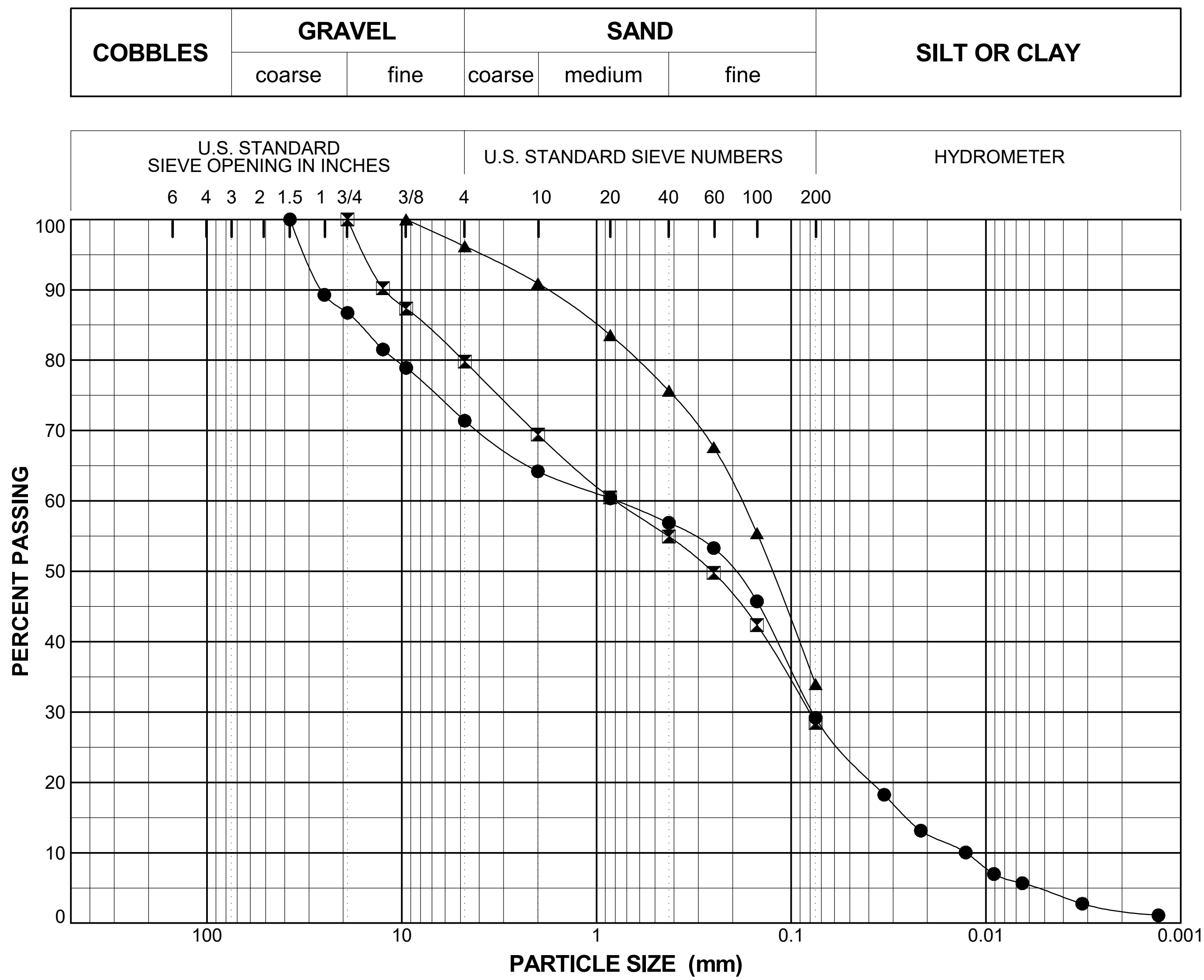
SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 17

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 8	ASW- 8	ASW- 8
Sample	BULK	S-2	S-3
Spec			
Depth (ft)	5.0-15.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	28.6	20.2	3.8
% Sand	42.2	51.3	62.2
% Fines	29.2	28.5	34.0
% -2μ	1.9		
Cc	0.60		
Cu	62.56		
LL	NP		
PL	NP		
PI	NP		
USCS	SM		
w (%)			16.3

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"	100.0		
1"	89.3		
3/4"	86.7	100.0	
1/2"	81.5	90.2	
3/8"	78.9	87.3	100.0
4	71.4	79.8	96.2
10	64.2	69.4	90.9
20	60.4	60.5	83.6
40	56.9	54.9	75.7
60	53.3	49.8	67.6
100	45.7	42.4	55.4
200	29.2	28.5	34.0

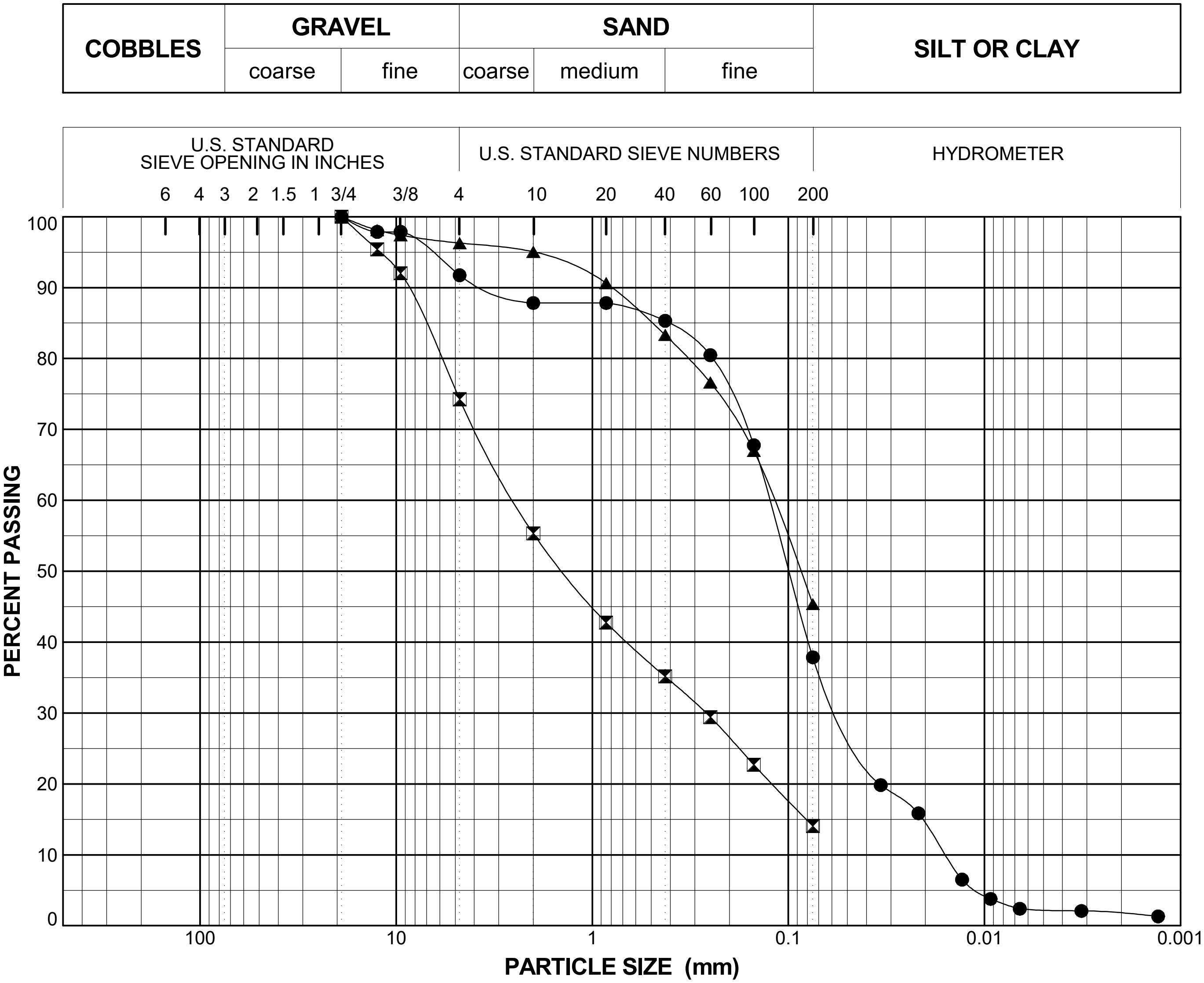
SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND with GRAVEL (SM)
⧗	()
▲	Brown ()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 18

AECOM



SYMBOL	●	⧗	▲
Boring	ASW- 8	ASW- 8	ASW- 8
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	8.3	25.7	3.7
% Sand	53.9	60.2	50.9
% Fines	37.9	14.1	45.4
% -2μ	1.7		
Cc	1.42		
Cu	7.96		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"			
3/4"	100.0	100.0	100.0
1/2"	97.9	95.4	98.1
3/8"	97.9	92.0	97.4
4	91.7	74.3	96.3
10	87.8	55.3	95.1
20	87.8	42.8	90.6
40	85.3	35.2	83.3
60	80.5	29.4	76.6
100	67.8	22.7	67.0
200	37.9	14.1	45.4

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

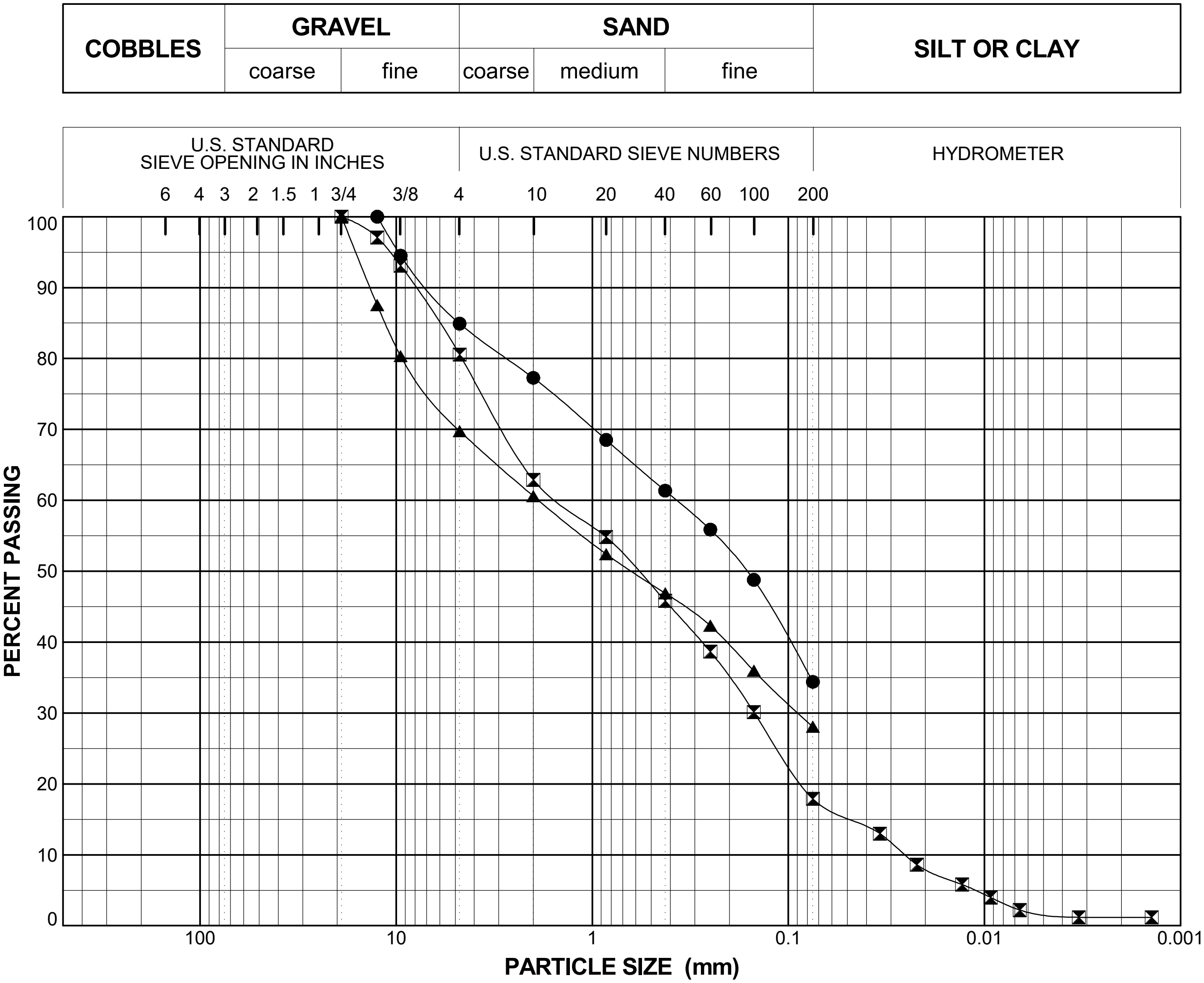
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 19

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW- 8	ASW-10	ASW-10
Sample	S-7	S-2	S-3
Spec			
Depth (ft)	33.0-35.0	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	15.1	19.4	30.2
% Sand	50.5	62.7	41.7
% Fines	34.4	17.9	28.1
% -2μ		1.2	
Cc		0.59	
Cu		58.03	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"		100.0	100.0
1/2"	100.0	97.1	87.5
3/8"	94.5	93.1	80.3
4	84.9	80.6	69.8
10	77.3	62.9	60.6
20	68.5	54.8	52.4
40	61.4	45.8	46.9
60	55.9	38.7	42.3
100	48.8	30.1	36.0
200	34.4	17.9	28.1

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

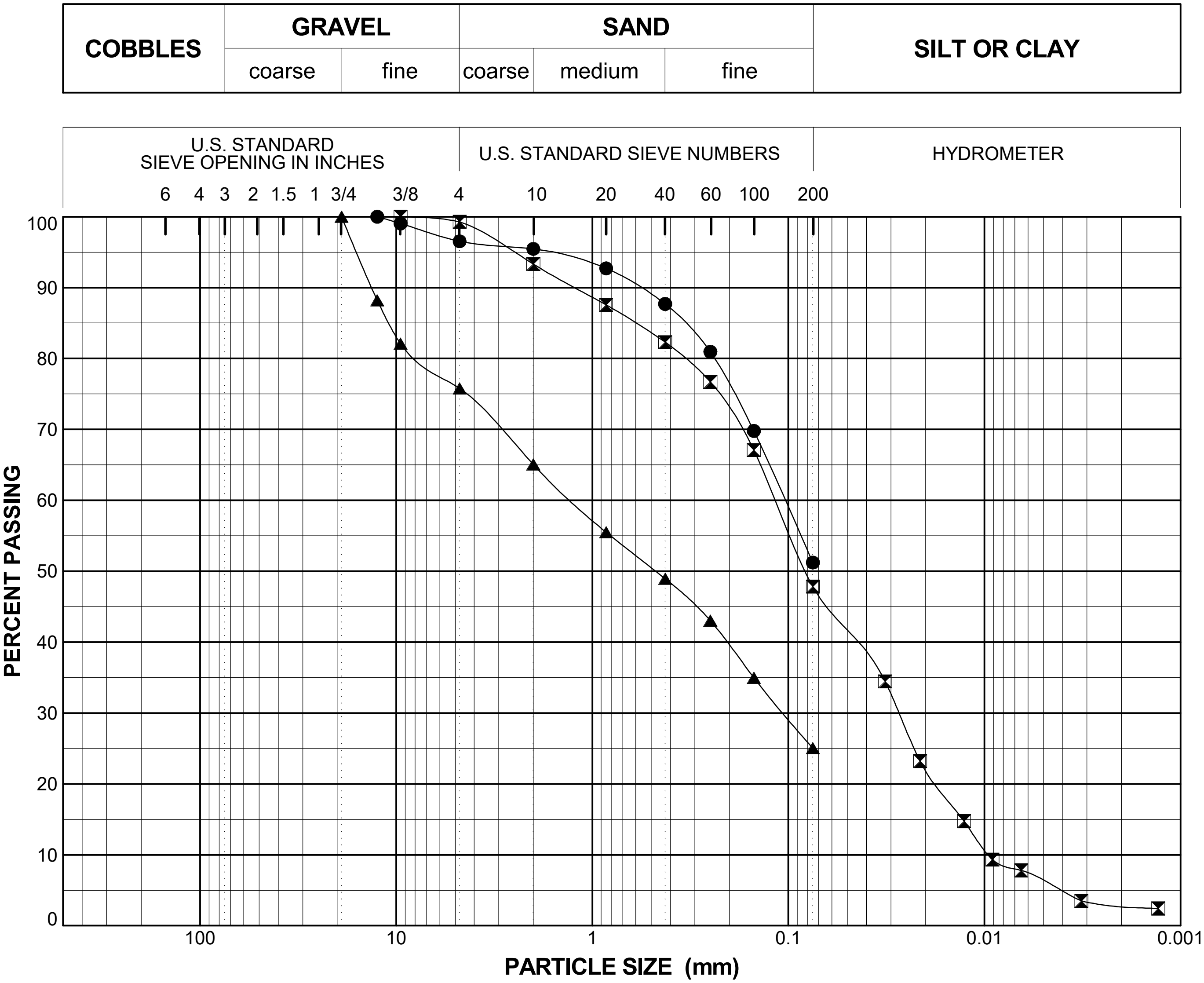
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 20

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW-10	ASW-10	ASW-10
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	3.5	0.7	24.2
% Sand	45.3	51.4	50.8
% Fines	51.2	47.8	25.0
% -2μ		2.9	
Cc		0.68	
Cu		12.25	
LL		NP	
PL		NP	
PI		NP	
USCS		SM	
w (%)		21.4	

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"	100.0		88.2
3/8"	99.0	100.0	82.1
4	96.5	99.3	75.8
10	95.5	93.3	65.1
20	92.7	87.6	55.5
40	87.7	82.3	49.0
60	81.0	76.7	43.0
100	69.8	67.1	35.0
200	51.2	47.8	25.0

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown SILTY SAND (SM)
▲	()

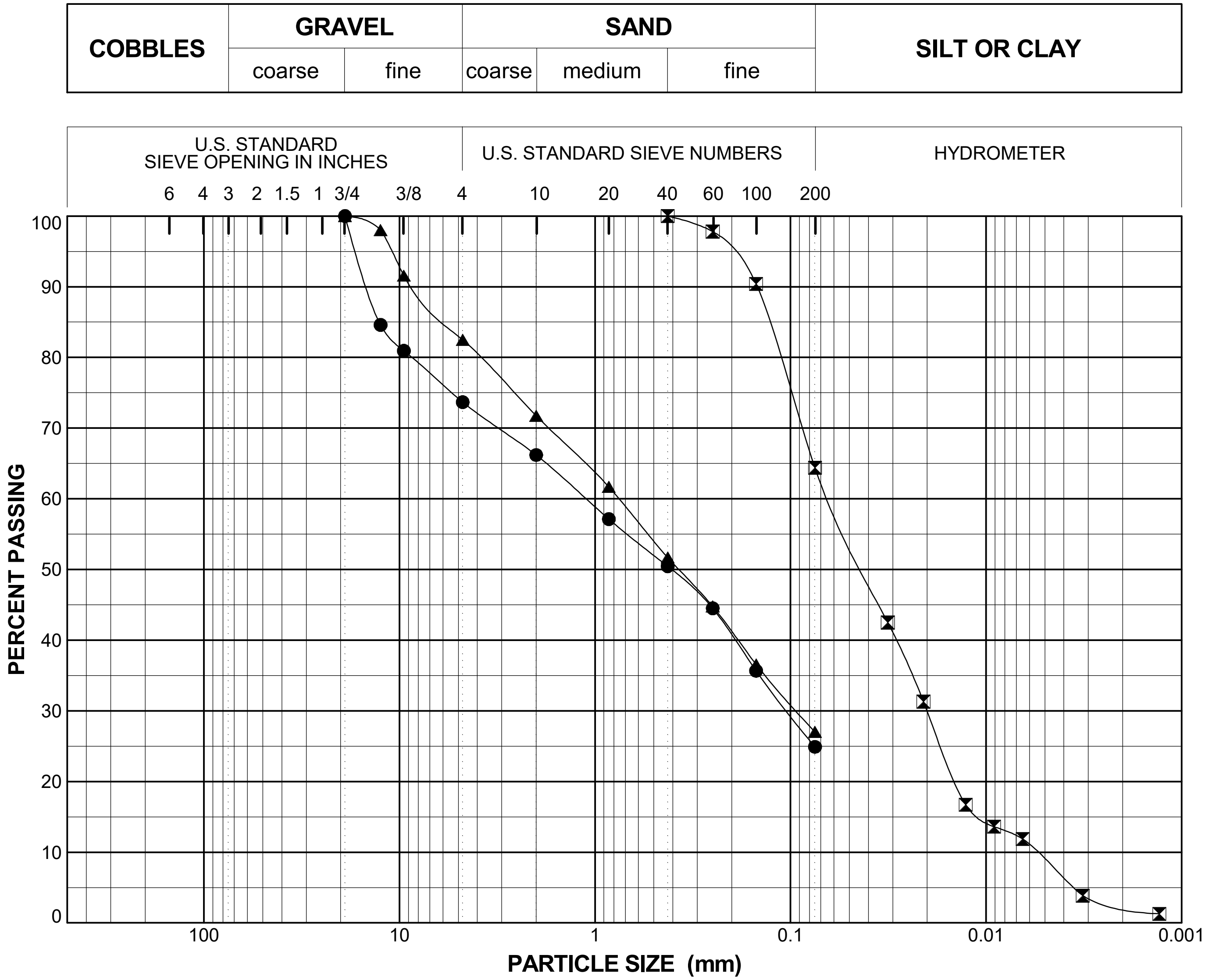
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 21

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW-11	ASW-11	ASW-11
Sample	S-1	S-2	S-4
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	26.3	0.0	17.5
% Sand	48.8	35.6	55.5
% Fines	24.9	64.4	27.0
% -2μ		2.5	
Cc		1.15	
Cu		11.46	
LL		NP	
PL		NP	
PI		NP	
USCS		ML	
w (%)		21.9	

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"			
3/4"	100.0		100.0
1/2"	84.6		98.0
3/8"	80.9		91.6
4	73.7		82.5
10	66.2		71.8
20	57.1		61.7
40	50.5	100.0	51.7
60	44.5	97.8	44.8
100	35.7	90.4	36.6
200	24.9	64.4	27.0

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown SANDY SILT (ML)
▲	()

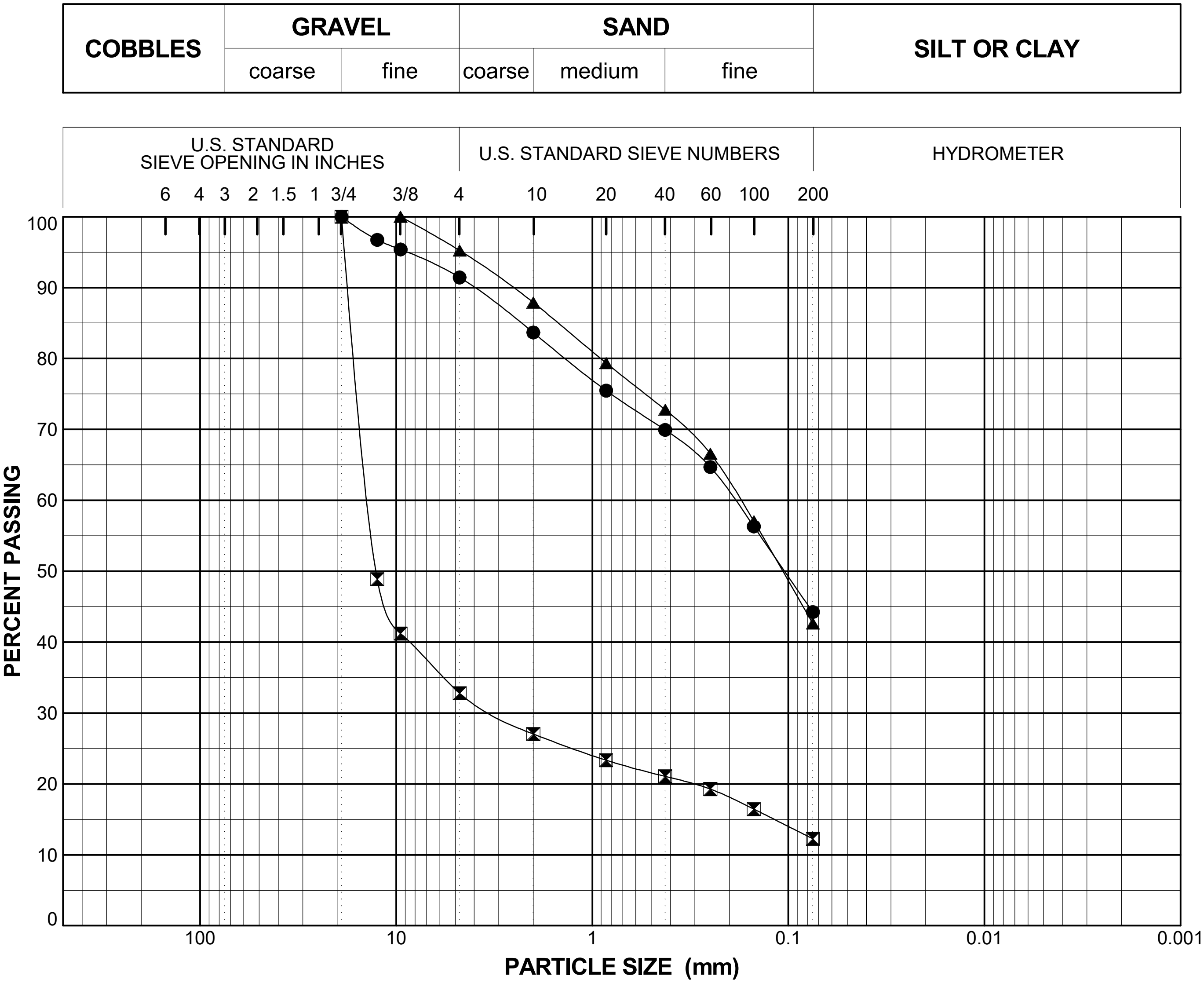
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 22

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW-11	ASW-11	ASW-11
Sample	S-5	S-6	S-7
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	8.6	67.2	4.8
% Sand	47.2	20.5	52.6
% Fines	44.2	12.3	42.6
% -2μ			
Cc		13.83	
Cu		266.00	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"	100.0	100.0	
1/2"	96.7	48.9	
3/8"	95.4	41.2	100.0
4	91.4	32.8	95.2
10	83.7	27.0	87.9
20	75.5	23.3	79.4
40	69.9	21.1	72.8
60	64.7	19.3	66.6
100	56.3	16.4	57.1
200	44.2	12.3	42.6

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

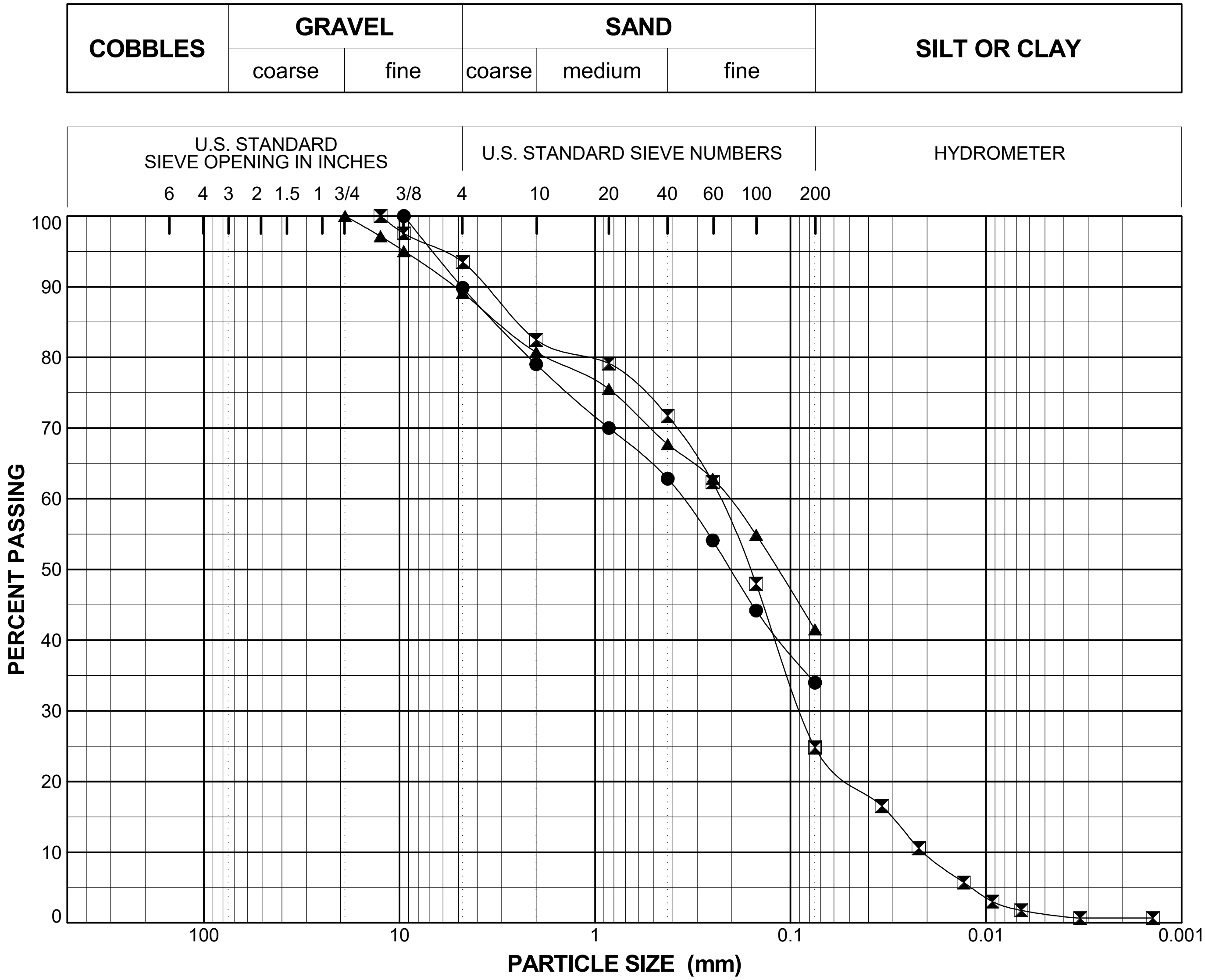
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 23

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ASW-11	ASW-11	ASW-11
Sample	S-8	S-9	S-10
Spec			
Depth (ft)	33.0-35.0	38.0-40.0	43.0-45.0
% +3"	0.0	0.0	0.0
% Gravel	10.1	6.5	10.9
% Sand	55.9	68.6	47.6
% Fines	34.0	24.8	41.5
% -2μ		0.7	
Cc		1.61	
Cu		11.08	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"		100.0	97.1
3/8"	100.0	97.5	95.1
4	89.9	93.5	89.1
10	79.0	82.5	80.7
20	70.0	79.1	75.5
40	62.9	71.7	67.7
60	54.1	62.4	62.8
100	44.2	48.0	54.9
200	34.0	24.8	41.5

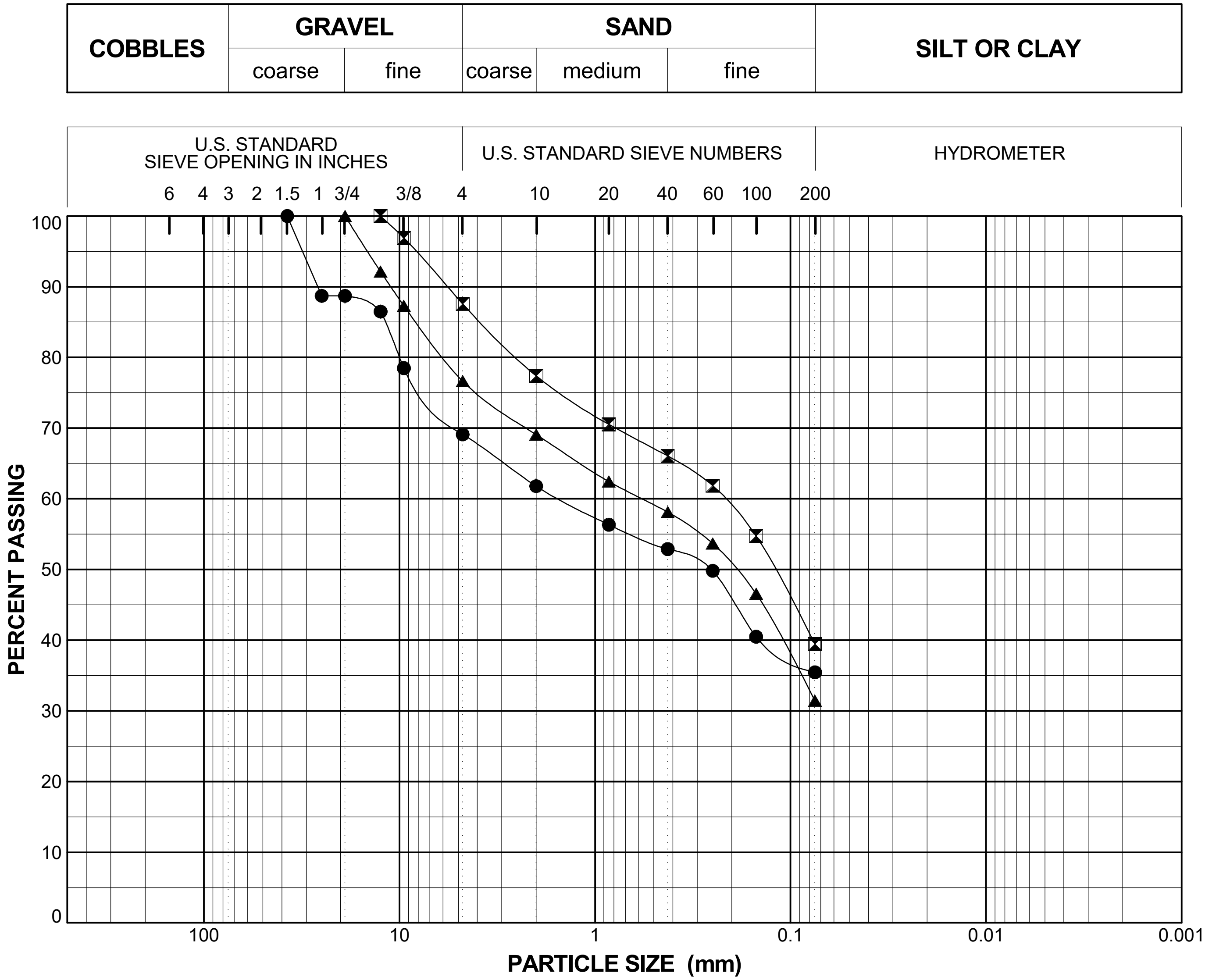
SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	()
▲	()

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 24

AECOM



SYMBOL	●	⧗	▲
Boring	ASW-11	EMB- 1	EMB- 2
Sample	S-11	UD-1	S-1
Spec			
Depth (ft)	48.0-50.0	15.0-17.0	0.0-2.0
% +3"	0.0	0.0	0.0
% Gravel	30.9	12.4	23.4
% Sand	33.7	48.1	45.2
% Fines	35.5	39.4	31.4
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)		18.2	

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"	100.0		
1"	88.7		
3/4"	88.7		100.0
1/2"	86.5	100.0	92.1
3/8"	78.5	96.9	87.3
4	69.1	87.6	76.6
10	61.8	77.4	69.1
20	56.3	70.5	62.4
40	52.9	66.1	58.1
60	49.8	61.9	53.7
100	40.5	54.7	46.6
200	35.5	39.4	31.4

SYMBOL	DESCRIPTION AND REMARKS
●	()
⧗	Brown ()
▲	()

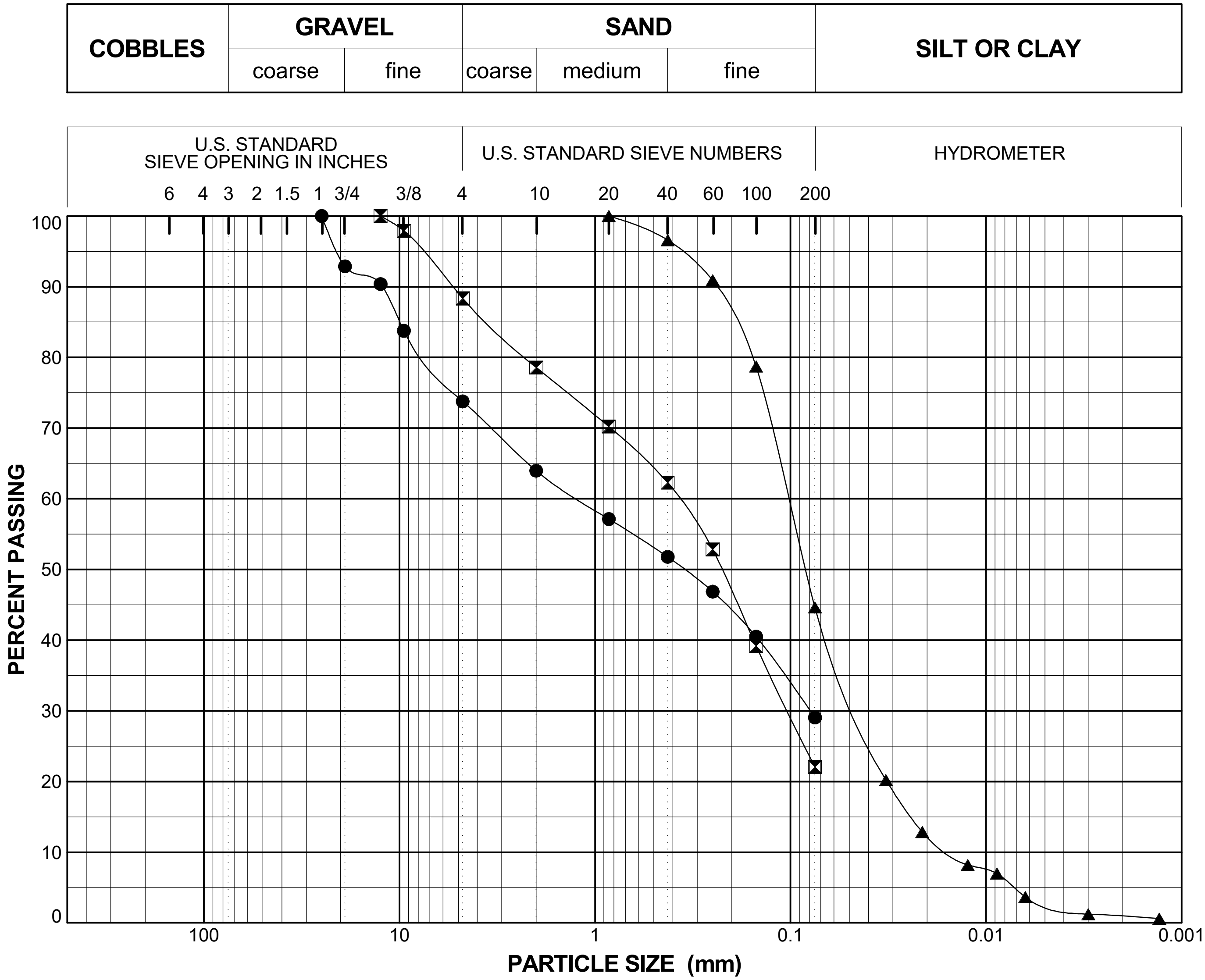
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 25

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20



SYMBOL	●	⧗	▲
Boring	ABT-3	ABT-3	ASW- 9
Sample	S-7	S-8	S-2
Spec			
Depth (ft)	28.0-30.0	33.0-35.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	26.2	11.6	0.0
% Sand	44.7	66.3	55.4
% Fines	29.1	22.1	44.6
% -2μ			0.9
Cc			1.32
Cu			6.72
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧗	▲
2"			
1 1/2"			
1"	100.0		
3/4"	92.9		
1/2"	90.4	100.0	
3/8"	83.8	97.9	
4	73.8	88.4	
10	64.0	78.6	
20	57.1	70.2	100.0
40	51.8	62.3	96.6
60	46.9	52.8	90.9
100	40.5	39.2	78.7
200	29.1	22.1	44.6

SYMBOL	DESCRIPTION AND REMARKS
●	
⧗	
▲	

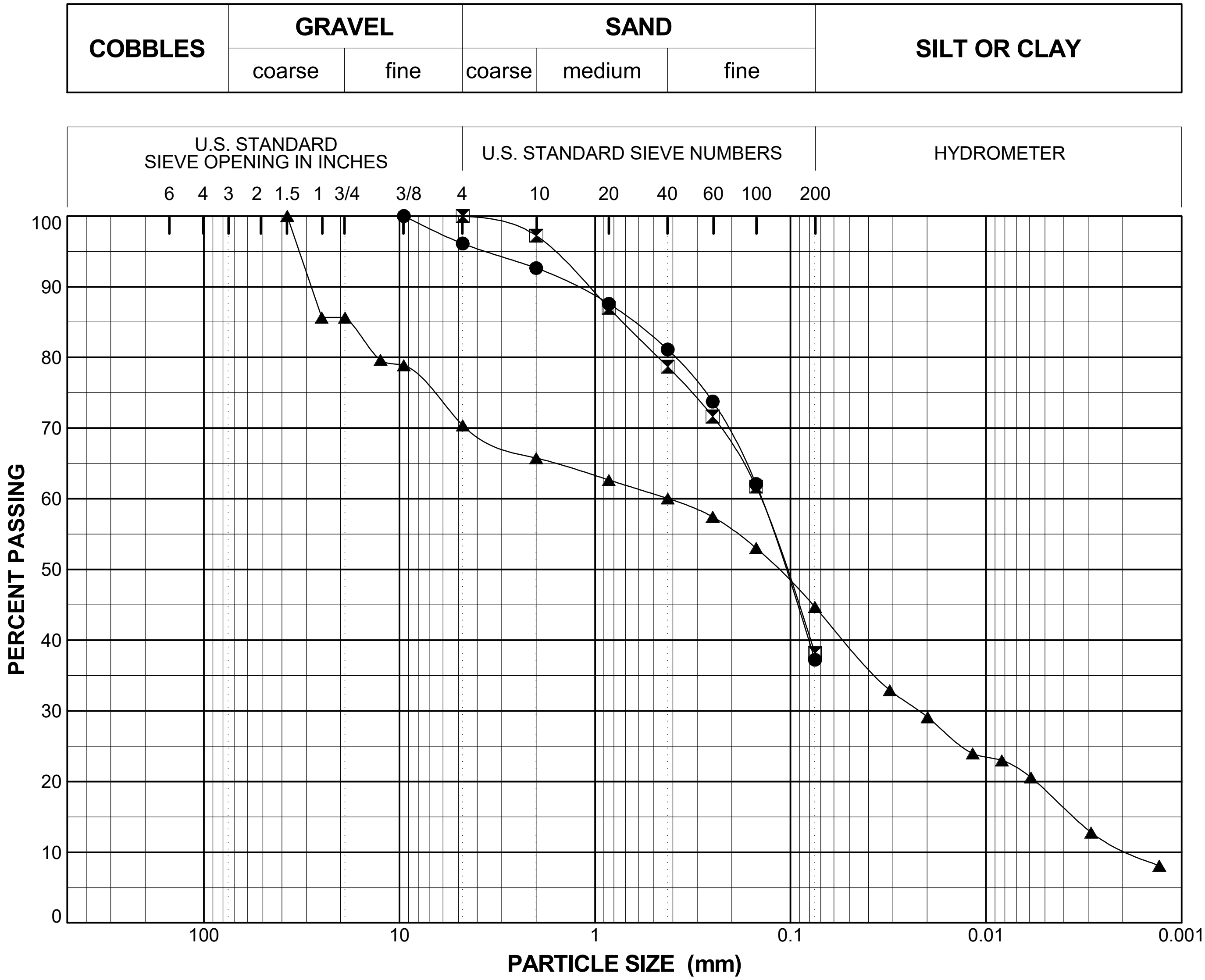
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 2

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20



SYMBOL	●	⧗	▲
Boring	ASW- 9	ASW- 9	ASW-12
Sample	S-4	S-6	S-2
Spec			
Depth (ft)	18.0-20.0	28.0-30.0	3.0-5.0
% +3"	0.0	0.0	0.0
% Gravel	3.9	0.0	29.6
% Sand	58.9	61.8	25.7
% Fines	37.2	38.2	44.7
% -2μ			10.6
Cc			0.65
Cu			234.40
LL			37
PL			25
PI			12
USCS			GM
w (%)			25.8

Particle Size (Sieve #)	PERCENT FINER ●	PERCENT FINER ⧗	PERCENT FINER ▲
2"			
1 1/2"			100.0
1"			85.6
3/4"			85.6
1/2"			79.7
3/8"	100.0		78.9
4	96.1	100.0	70.4
10	92.6	97.2	65.8
20	87.6	87.0	62.7
40	81.1	78.7	60.0
60	73.8	71.6	57.4
100	62.1	61.7	53.0
200	37.2	38.2	44.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧗	
▲	Brown SILTY GRAVEL with SAND (GM)

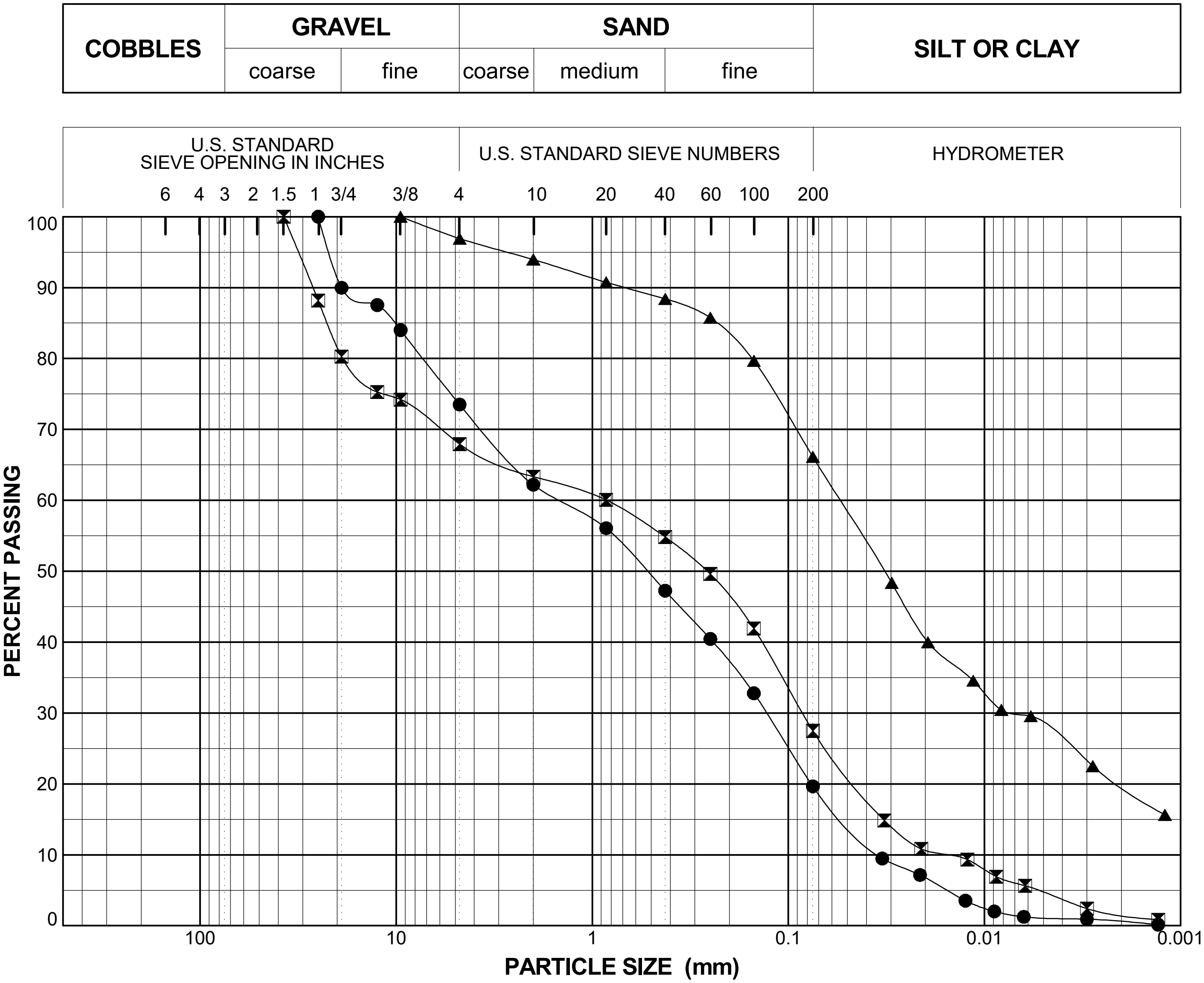
PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 3

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20



SYMBOL	●	⧗	▲
Boring	ASW-12	EMB-1	EMB-1
Sample	S-4	S-1	S-7
Spec			
Depth (ft)	13.0-15.0	3.0-5.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	26.5	32.1	3.1
% Sand	53.9	40.4	30.8
% Fines	19.7	27.5	66.1
% -2μ	0.5	1.6	19.8
Cc	0.33	0.54	
Cu	42.51	54.15	
LL			34
PL			22
PI			12
USCS			CL
w (%)		10.3	

Particle Size (Sieve #)	PERCENT FINER ●	⧗	▲
2"			
1 1/2"		100.0	
1"	100.0	88.2	
3/4"	90.0	80.3	
1/2"	87.5	75.3	
3/8"	84.0	74.2	100.0
4	73.5	67.9	96.9
10	62.2	63.3	94.0
20	56.1	60.1	90.7
40	47.3	54.8	88.4
60	40.5	49.6	85.8
100	32.8	41.9	79.7
200	19.7	27.5	66.1

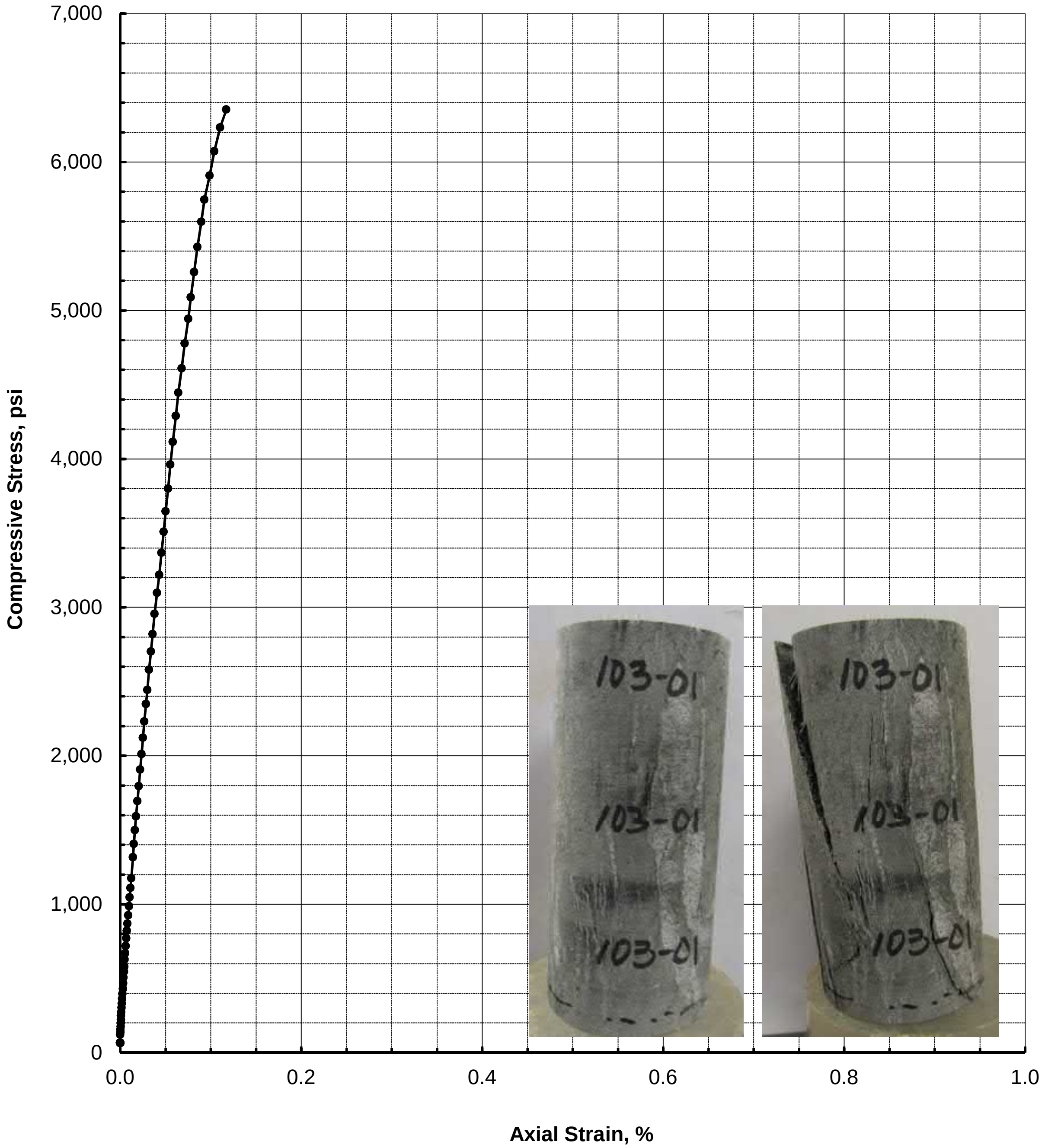
SYMBOL	DESCRIPTION AND REMARKS
●	
⧗	
▲	Brown SANDY LEAN CLAY (CL)

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 4

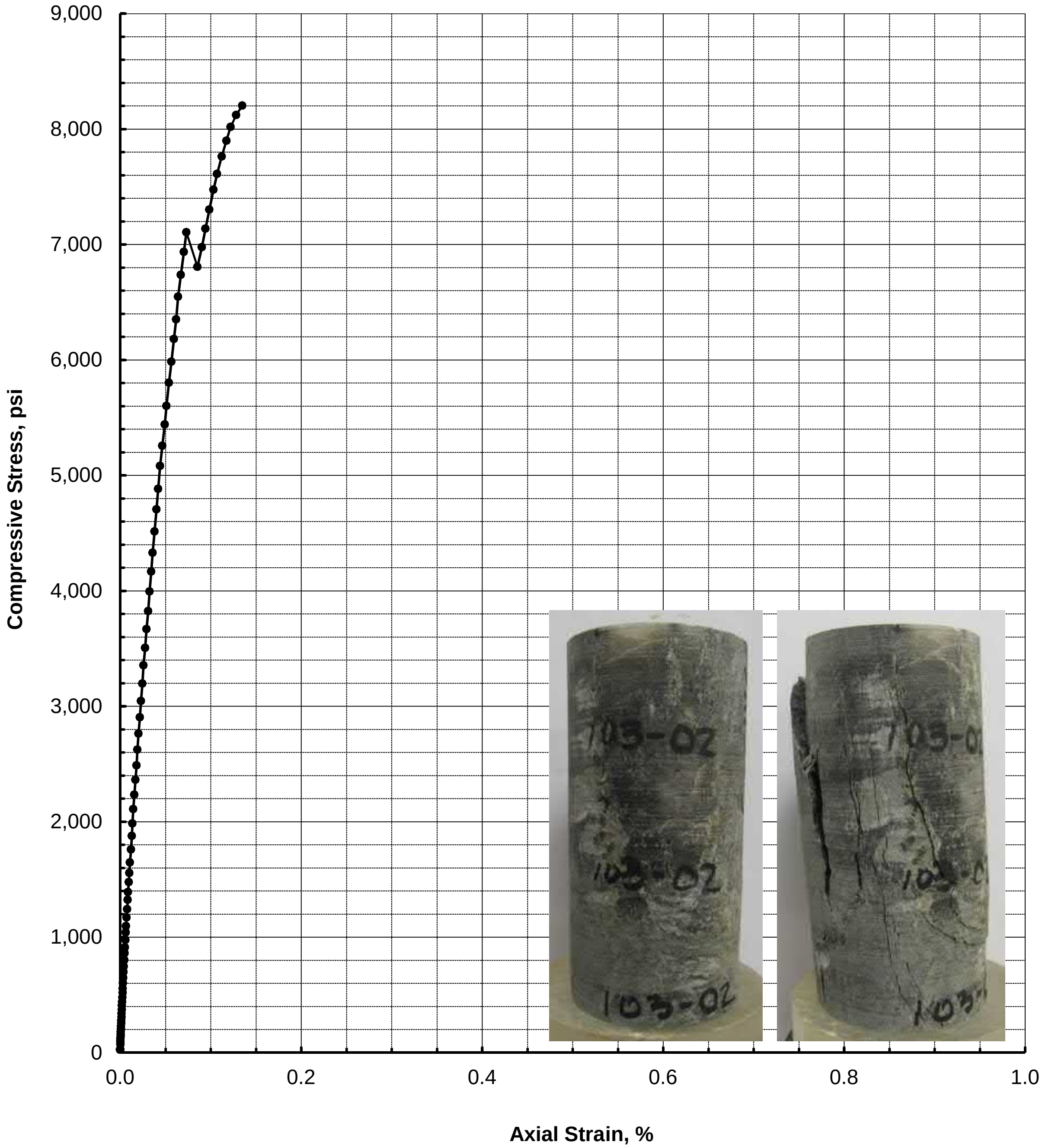
AECOM



Specimen Information					Test Summary		
Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.1	179.0	178.9	4.23	1.97	6,353	0.12	0.28

Tested by: BS Test Date: 1/23/2020 Reviewed by: MHD

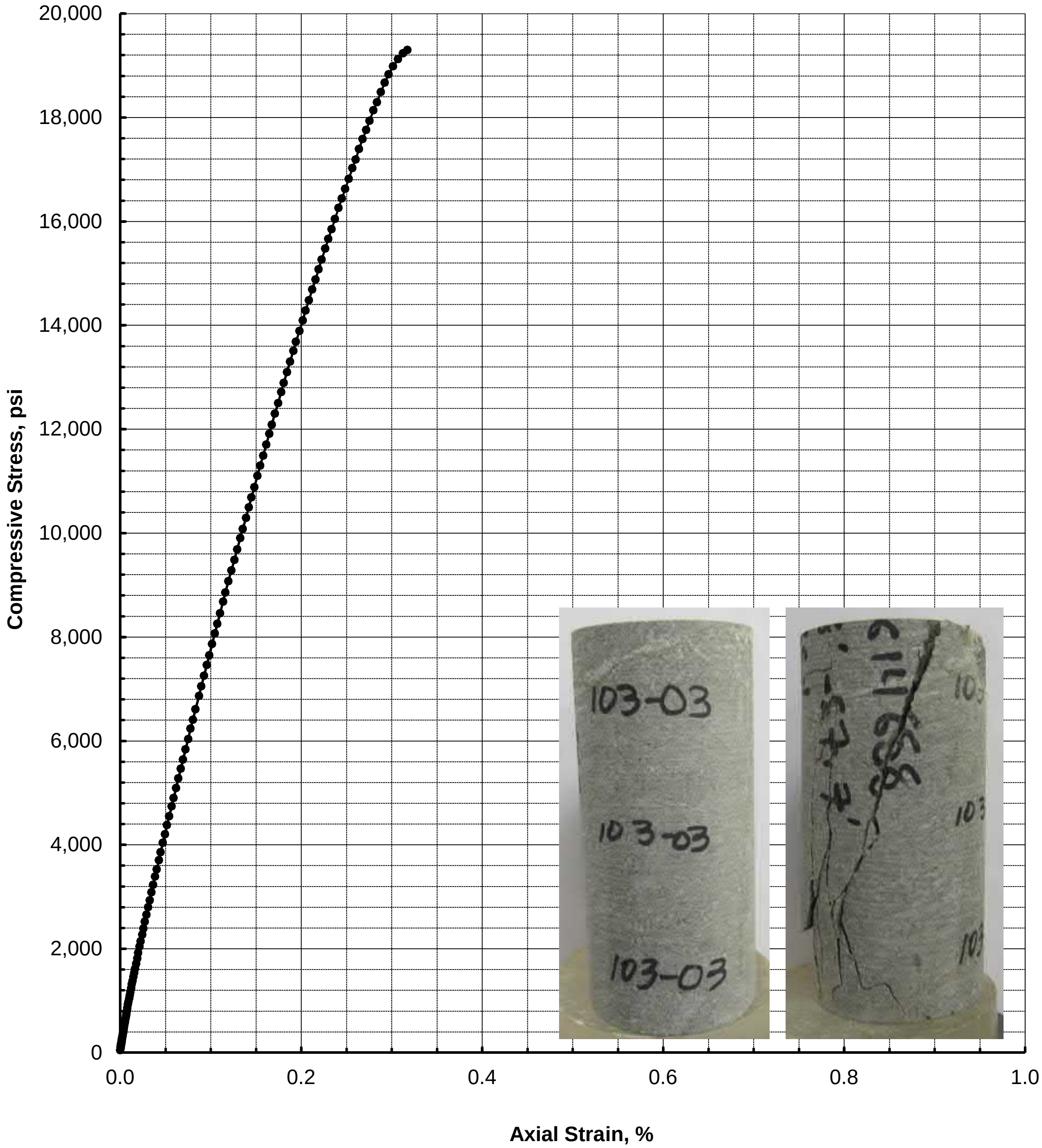
Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: ASW-1 Sample: RC-2 Depth:55.5-56.7	January 2020



Specimen Information					Test Summary		
Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.1	177.7	177.6	4.20	1.96	8,203	0.13	0.28

Tested by: BS Test Date: 1/23/2020 Reviewed by: MHD

Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: ASW-3 Sample: RC-1 Depth:38.4-39.2	January 2020

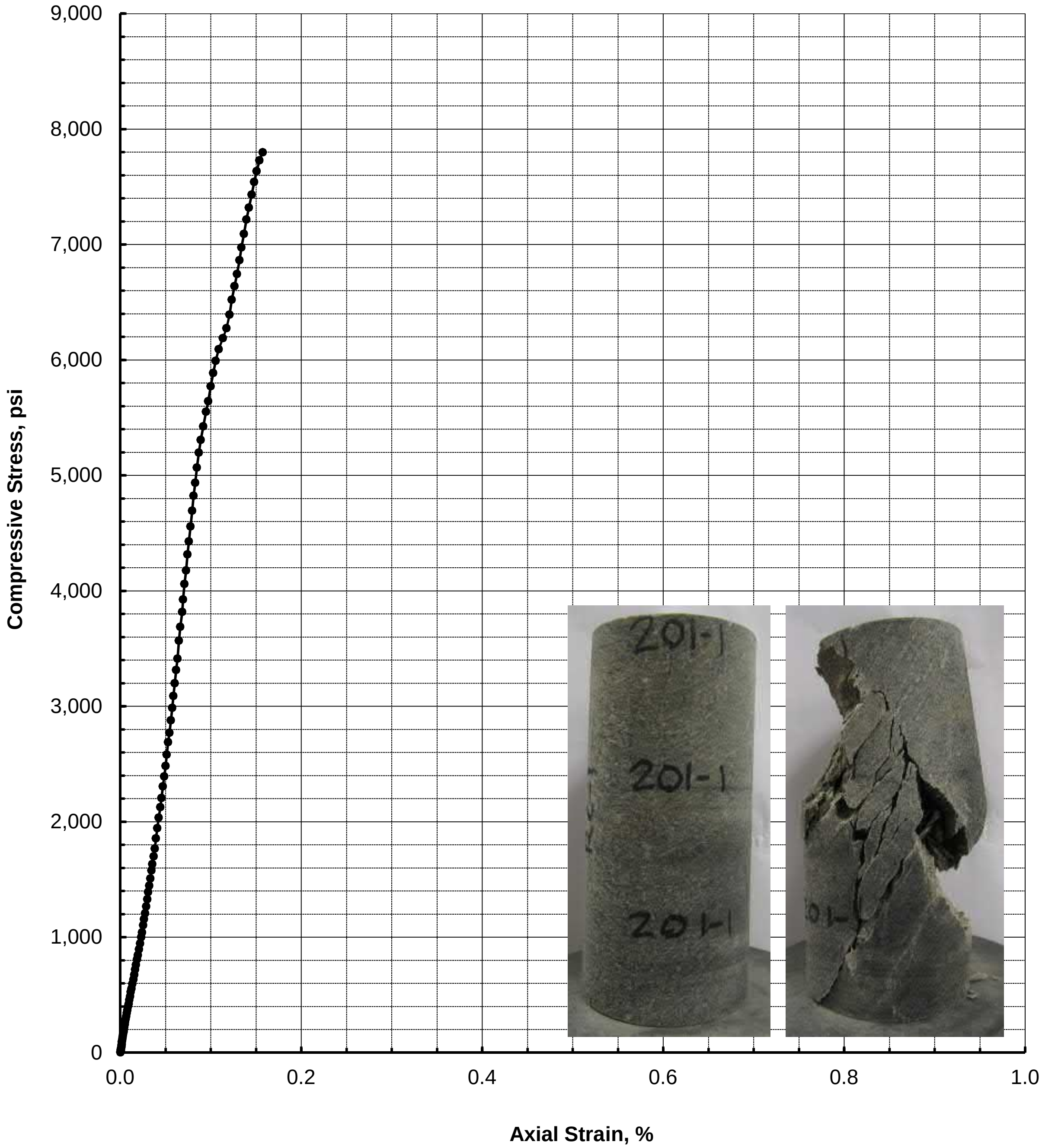


Specimen Information | **Test Summary**

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.1	170.4	170.1	4.22	1.98	19,296	0.32	0.28

Tested by: BS Test Date: 1/23/2020 Reviewed by: MHD

Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: ASW-11 Sample: RC-1 Depth:56.8-57.7	January 2020



Specimen Information / **Test Summary**

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.3	170.6	170.1	4.18	1.97	7,798	0.16	0.28

Tested by: BS Test Date: 2/7/2020 Reviewed by: MHD

Project No. 60614688	Piney Run Dam	UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN	
AECOM		Boring: ASW-9 Sample: RC-1 Depth:33.8-34.4	February 2020

24 Hour Existing Conditions PMF – Inside Edge Profile

```
*******************************************************************************
SITES XEQ 04/06/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
    VER 2005.1.8          (USER MANUAL - DATED DECEMBER 2005)
    TIME 09:11:13

************************** 80-80 LIST OF INPUT Data ***************************

SITES     01/01/2005TR6024    Piney Run Dam             10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                    1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph
*         AECOM March 2020
STRUCTURE D1       Piney Run Dam
              523                  0
              524                  298
              526                  928
              528                  1596
              530                  2304
              531                  2673
              532                  3054
              534                  3849
              536                  4692
              538                  5585
              540                  6529
              542                  7527
              544                  8581
              546                  9678
ENDTABLE
WSDATA    2C 01    72       10.56    2.49              6.05
BASEFLOW         1
RAINTABLE HMR24    24       24-Hour Duration Distribution (HMR-52)
              0.000    0.001    0.003    0.004    0.005
              0.007    0.008    0.009    0.011    0.012
              0.014    0.015    0.017    0.018    0.020
              0.021    0.023    0.025    0.026    0.028
              0.030    0.031    0.033    0.035    0.037
              0.040    0.044    0.047    0.051    0.055
              0.059    0.063    0.067    0.072    0.077
              0.081    0.087    0.092    0.097    0.103
              0.109    0.115    0.122    0.128    0.135
              0.143    0.150    0.158    0.166    0.175
              0.185    0.197    0.211    0.227    0.245
              0.266    0.289    0.314    0.343    0.400
              0.523    0.656    0.754    0.784    0.811
              0.835    0.857    0.876    0.894    0.908
              0.921    0.933    0.942    0.945    0.948
              0.952    0.955    0.957    0.960    0.963
              0.966    0.968    0.971    0.973    0.975
              0.978    0.980    0.982    0.984    0.986
              0.988    0.990    0.992    0.994    0.996
              0.998    1.000
ENDTABLE
```

```
PDIRECT   1.47     8.3      12.2     15.00    33.90
POOLDATA  ELEV     523.0    523.0    523.0    540.5    496      SC
PSINLET            0.7      18
PSDATA    1        303      36                0.013    471.3
ASSPRFL   41       0.5               Inside Edg
       0.0      525.0    83.5     529.3    124.0    530.7
       139.4    531.0    147.6    531.0    156.1    530.9
       218.3    529.7    243.7    529.1    341.8    527.8
       390.9    527.2    418.3    527.1    475.4    526.2
       485.7    525.9    505.3    524.7    511.4    523.8
       541.7    512.5    570.2    505.6    599.6    501.0
       771.6    489.1    798.0    481.9    1122.0   468.0
ENDTABLE
ASSURFACE 41       505.3    0.011
       0        505.3    0.04     0.87     1        1
       505.3    1122     0.10     0.5      2        5
ENDTABLE
ASDATA    41                         2.8                      1
BTMWIDTH  FEET     249
ASMATERIAL
       1        0        0.01     3        100      0.06
       2        0        0.14     1        105      0.16
       3        12       0.26     11       110      0.12
       4        0        12       0        178      10
ENDTABLE
ASCOORD   1        ML       N
       0.0      525.0    83.5     529.3    124.0    530.7
       139.4    531.0    147.6    531.0    156.1    530.9
       218.3    529.7    243.7    529.1    341.8    527.8
       390.9    527.2    418.3    527.1    475.4    526.2
ENDTABLE
ASCOORD   2        SM
       0.0      517.0    83.5     521.3    124.0    522.7
       139.4    523.0    147.6    523.0    243.7    527.1
       341.8    514.8    475.4    507.2    570.2    497.6
       599.6    493.0    771.6    483.1    798.0    477.9
       1122.0   466.0
ENDTABLE
ASCOORD   3        GM
       475.4    526.2    485.7    525.9    505.3    524.7
       511.4    523.8    541.7    512.5    570.2    505.6
       599.6    501.0    771.6    489.1    798.0    481.9
       1122.0   468.0
ENDTABLE
ASCOORD   4        MICASCHIST
       0.0      487.5    83.5     491.8    124.0    493.2
       139.4    493.5    147.6    493.5    243.7    520.6
       341.8    509.7    475.4    478.2    570.2    463.1
       1122.0   462
ENDTABLE
GRAPHICS  I
GO,DESIGN LC       HMR24    24
SAVMOV    2   101  1                 D1
ENDJOB
```

****

1SITES XEQ 04/06/2020 ------------- COMMENT PAGE -------------------------------

VER 2005.1.8 Piney Run Dam WSID = TR6024

Piney Run Watershed Study

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph

AECOM March 2020

***** MESSAGE - DEFAULT TOPSOIL FILL MATERIAL PARAMETERS USED.

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO 531.00
FROM THE ASSPRFL RECORDS.

```
1SITES -------------------------------------------------------------------------
XEQ 04/06/2020      Piney Run Dam       WSID= TR6024
VER 2005.1.8        Piney Run Dam       SUBW= 01
TIME 09:11:13   SITE = D1     PASS=  1   PART=  1
```

********************** MATERIAL PROPERTIES ****************************

MATERIAL	PI	DRY DENSITY lbs/CuFt	Kh	PERCENT CLAY	DETACH. RATE (Ft/H)/(lb/SqFt)	REP. DIAMETER inches
ML	0.	100.	0.06	3.0	--	0.01000
SM	0.	105.	0.16	1.0	--	0.14000
GM	12.	110.	0.12	11.0	--	0.26000
MICASCHIST	0.	178.	10.00	0.0	--	12.00000
TS_FILL	0.	100.	0.05	0.0	--	0.05000
GEN_FILL	0.	100.	0.06	3.0	--	0.01000

**************************** BASIC Data *********************************

HUMID- SUBHUMID CLIMATE AREA DESIGN CLASS C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

```
PRECIP. - P-PS,1-DAY   P-PS,10-DAY    P-SD      P-FB
           8.30        12.20        15.00      33.90

WSDATA -     CN      DA-SM      TC/L      -/H       QRF
          72.00     10.56       2.49      0.00      6.05

SITEDATA- PERM POOL   CREST PS    FP SED    VALLEY FL    378?
           523.00     523.00     523.00     496.00       NO

       BASEFLOW    INITIAL EL   EXTRA VOL   SITE TYPE
         1.00        0.00         0.00       DESIGN

PSDATA -  NO. COND    COND L     DIA/W      -/H
           1.00      303.00     36.00      0.00
```

PS N	KE	WEIR L	TW EL
0.013	0.70	18.00	471.30

2ND STG	ORF H	ORF L	START AUX.
0.00	0.00	0.00	0.00

ASCRESTS -	AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
	531.00	0.00	0.00	0.00	0.00

AUX.Data -	REF.NO.	RETARD. Ci	TIE STATION	INLET LENGTH
	41	0.00	147.60	0

AUX.Data - INLET N	SIDE SLOPE	EXIT N	EXIT SLOPE	ACTUAL AUX?
0.040	2.80	0.040	0.012	NO

BTM WIDTH -	BW1	BW2	BW3	BW4	BW5
ft	249.00	0.00	0.00	0.00	0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1********************* DETAILED LIST OF BASIC Data *********************
WEIR COEF. FOR ORIFICES.......... 3.10 RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10 TIME INCS TO PEAK OF UNIT HYD. 10.
DISCHARGE COEF. FOR ORIFICES..... 0.60 NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .... 0.60 DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. .... 0.60 DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. .... 0.00 OTHER DRAWDOWN RATIOS APPLY ?. NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01 WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00 WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16 AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545 AUX. SPILLWAY MIN. CAP. EXP. 0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00 MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00 PRECISION OF BW SOLUTION...... 1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00 OLD TR60 CRITERIA USED .... NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00 OLD NHCP378 CRITERIA USED .... NO

EMBANKMENT TEMPLATE: TOP WIDTH = (calc.), MAX. CROWN = 0.667 ft,

SIDE SLOPE RATIOS		WAVE BERM WIDTH	MULTIPLE STABILITY BERMS U&D/S WIDTHS	DELTA H	SEPARATE STABILITY BERMS WIDTHS, ft		HEIGHTS, ft	
U/S	D/S	ft	ft	ft	U/S	D/S	U/S	D/S
2.50	2.50	10.0	0.0	0.00	0.00	0.00	0.00	0.00

DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK = 10.
VOLUME FACTOR = 48.3429

0.0000	0.0300	0.1000	0.1900	0.3100
0.4700	0.6600	0.8200	0.9300	0.9900
1.0000	0.9900	0.9300	0.8600	0.7800
0.6800	0.5600	0.4600	0.3900	0.3300
0.2800	0.2410	0.2070	0.1740	0.1470

0.1260	0.1070	0.0910	0.0770	0.0660
0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

EXISTING NATURAL SURFACE AT AUXILIARY SPILLWAY SITE - X,Y COORDINATES:

0.	525.00
84.	529.30
124.	530.70
139.	531.00
148.	531.00
156.	530.90
218.	529.70
244.	529.10
342.	527.80
391.	527.20
418.	527.10
475.	526.20
486.	525.90
505.	524.70
511.	523.80
542.	512.50
570.	505.60
600.	501.00
672.	496.00

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.003	0.004	0.005
0.007	0.008	0.009	0.011	0.012
0.014	0.015	0.017	0.018	0.020
0.021	0.023	0.025	0.026	0.028
0.030	0.031	0.033	0.035	0.037
0.040	0.044	0.047	0.051	0.055
0.059	0.063	0.067	0.072	0.077
0.081	0.087	0.092	0.097	0.103
0.109	0.115	0.122	0.128	0.135
0.143	0.150	0.158	0.166	0.175

0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948
0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975
0.978	0.980	0.982	0.984	0.986
0.988	0.990	0.992	0.994	0.996
0.998	1.000			

1SITES --
XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 09:11:13 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
CREST PS	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	523.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS
START ELEV	523.24 FT	72.3 ACFT	0.00 AC	10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935

221. 0.9938 0.9942 0.9945 0.9949 0.9952 0.9956 0.9959 0.9962 0.9966 0.9969
231. 0.9972 0.9975 0.9978 0.9982 0.9985 0.9988 0.9991 0.9994 0.9997 1.0000

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 4.90 IN 10-DAY = 5.78 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 54. CN 1-DAY = 72.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12433.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE	EMAX	VOL-MAX	AMAX	QMAX
NRCS-PSH	531.22 FT	2758.5 ACFT	0.00 AC	222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.56 FT 475.3 ACFT 110.54 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.43 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 80.56 CFS, ELEV = 524.27 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	528.00	216.46	216.46	0.00	1596.73	0.00
7	530.57	221.31	221.31	0.00	2515.53	0.00
8	533.14	226.06	226.06	0.00	3508.90	0.00
9	535.72	230.72	230.72	0.00	4572.12	0.00

10	538.29	235.27	235.27	0.00	5720.34	0.00
11	540.86	239.75	239.75	0.00	6957.10	0.00
12	543.43	244.14	244.14	0.00	8280.12	0.00
13	546.00	248.45	248.45	0.00	9678.13	0.00

1SITES ---
XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 09:11:13 SITE = D1 PASS= 1 PART= 3

AUX. CREST 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 524.27 FT 383.6 ACFT 0.00 AC 80.6 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH D= 24.00 HR P= 14.95 IN Q= 11.12 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 6261.5 ACFT

PEAK = 20911.3 CFS, AT 16.6 HRS.

NRCS-FBH D= 24.00 HR P= 33.78 IN Q= 29.52 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 16627.6 ACFT

PEAK = 52564.4 CFS, AT 16.6 HRS.
AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.00) AND AUXILIARY
CREST (531.22) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE
PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.16	212.91	212.91	0.00	979.80	0.00
7	526.88	214.31	214.31	0.00	1221.68	0.00
8	527.60	215.70	215.70	0.00	1463.55	0.00
9	528.33	217.08	217.08	0.00	1711.98	0.00
10	529.05	218.46	218.46	0.00	1968.34	0.00
11	529.78	219.82	219.82	0.00	2224.70	0.00
12	530.50	221.18	221.18	0.00	2488.57	0.00

13	531.22	222.53	222.53	0.00	2758.48	0.00
14	531.96	752.76	223.89	528.87	3039.93	0.00
15	532.70	1613.64	225.25	1388.39	3333.01	0.00
16	534.03	3754.07	227.68	3526.39	3862.35	0.00
17	535.66	7335.96	230.61	7105.35	4547.44	0.00
18	538.61	16188.71	235.85	15952.86	5873.95	0.00
19	542.31	30173.18	242.23	29930.95	7688.31	0.00
20	546.00	47455.33	248.45	47206.88	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE +	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	84.	-5.1	0.040	**	**	**	INLET
2	84.	124.	-3.5	0.040	**	**	**	INLET
3	124.	139.	-1.9	0.040	**	**	**	INLET
4	139.	148.	0.0	0.040	**	**	**	CREST
5	148.	156.	1.2	0.040	0.87	1	1.0	EXIT !
6	156.	218.	1.9	0.040	0.87	1	1.0	EXIT
7	218.	244.	2.4	0.040	0.87	1	1.0	EXIT
8	244.	342.	1.3	0.040	0.87	1	1.0	EXIT
9	342.	391.	1.2	0.040	0.87	1	1.0	EXIT
10	391.	418.	0.4	0.040	0.87	1	1.0	EXIT
11	418.	475.	1.6	0.040	0.87	1	1.0	EXIT
12	475.	486.	2.9	0.040	0.87	1	1.0	EXIT
13	486.	505.	6.1	0.040	0.87	1	1.0	EXIT
14	505.	511.	14.8	0.100	0.50	2	5.0	exit
15	511.	542.	37.3	0.100	0.50	2	5.0	exit
16	542.	570.	24.2	0.100	0.50	2	5.0	exit
17	570.	600.	15.6	0.100	0.50	2	5.0	exit
18	600.	672.	6.9	0.100	0.50	2	5.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
+ The minimum maintenance code value of 2 is used in INTEGRITY computations (the program changes values of 1 to 2 during computation).
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 5 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	535.65	4543.1	0.0	4.42	1784.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	231.	7083.	7313.

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	2.90	9.51	0.017	0.022

AUXILIARY SPILLWAY DURATION FLOW = 20.7 HOURS

EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY= 8.6 FT/SEC
EXIT SLOPE = 0.012 FT/FT
FLOW DEPTH = 3.2 FT
****

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
Aux. Spillway Discharge = 7083. cfs; Bottom Width = 249. ft

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2	
5	148.	156.	1.18	0.040	8.55	2.36	0.047	
6	156.	218.	1.93	0.040	9.96	3.34	0.066	
7	218.	244.	2.36	0.040	10.60	3.85	0.076	
8	244.	342.	1.33	0.040	8.87	2.56	0.051	
9	342.	391.	1.22	0.040	8.65	2.42	0.048	
10	391.	418.	0.37	0.040	5.95	1.04	0.020	
11	418.	475.	1.58	0.040	9.36	2.90	0.057	
12	475.	486.	2.91	0.040	11.30	4.45	0.088	
13	486.	505.	6.12	0.040	14.18	7.50	0.148	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	543.00	8051.9	0.0	11.77	5293.4

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	243.	33088.	33331.

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	7.94	15.37	0.012	0.016

INTEGRITY ANALYSIS - REACH SURFACE PERFORMANCE SUMMARY
(The auxiliary spillway began flow at time = 14.7 hours
and peaked at time = 17.8 hours.)

REACH 5: FROM STATION 148. TO 156. ON 1.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 18.0 hours.

REACH 6: FROM STATION 156. TO 218. ON 1.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 7: FROM STATION 218. TO 244. ON 2.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 8: FROM STATION 244. TO 342. ON 1.3% SLOPE.
Vegetal cover failed and concentrated flow developed

at time = 16.7 hours.

REACH 9: FROM STATION 342. TO 391. ON 1.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.3 hours.

REACH 10: FROM STATION 391. TO 418. ON 0.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 18.0 hours.

REACH 11: FROM STATION 418. TO 475. ON 1.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.0 hours.

REACH 12: FROM STATION 475. TO 486. ON 2.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 13: FROM STATION 486. TO 505. ON 6.1% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.2 hours.

REACH 14: FROM STATION 505. TO 511. ON 14.8% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.3 hours.

REACH 15: FROM STATION 511. TO 542. ON 37.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 16: FROM STATION 542. TO 570. ON 24.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 17: FROM STATION 570. TO 600. ON 15.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 18: FROM STATION 600. TO 672. ON 6.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.9 hours.

INTEGRITY ANALYSIS - HEADCUT EROSION DAMAGE SUMMARY

The headcut BREACHED the spillway crest at
time equal approximately 17.7 hours.
Computations terminated at that point!

The most upstream headcut began at station 156.
and progressed upstream to station 139.
The final height of the headcut was 12.3 ft.

The headcut having the maximum final overfall height began
at station 218. and progressed upstream to station 139.
The final height of the headcut was 35.0 ft.

THE HYDROGRAPH WAS NOT ADJUSTED FOR THE EFFECTS OF EROSION.

	DURATION FLOW	ATTACK OE/B	DIST. FROM MOST U/S HEADCUT TO U/S EDGE
AUXILIARY	HRS	ACFT/FT	AUX. CREST, FT
SPILLWAY----	24.8	55.0	>>>BREACH<<<
			Depth = 12.3 ft

EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY= 15.2 FT/SEC
EXIT SLOPE = 0.012 FT/FT
FLOW DEPTH = 8.0 FT

Inflow Hyd 1 PSH-Peak = 222.48 CFS at 127.33 hrs., Location Point

Inflow Hyd 1 SDH-Peak = 7313.36 CFS at 18.84 hrs., Location Point

Inflow Hyd 1 FBH-Peak = 33331.38 CFS at 17.66 hrs., Location Point
HYDOUT 1 D1

1SITES....JOB NO. 1 COMPLETE.

TR6024 Piney Run Dam

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

3 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

****

SITES.....COMPUTATIONS COMPLETE

SUMMARY TABLE 1 SITES VERSION 2005.1.8
---------------- DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
TR6024	04/06/2020	09:11:13

```
>>>  SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC   <<<
      ID     ID     (SQ MI)    NO.    (HRS)  (SQ MI)  DESIGN   CLASS
     -----  ----  --------  -----  ----  -------  -----  -----
     D1      01      10.56     72.   2.49     10.56    TR60     C

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
    (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1   36.0    531.2   249.0  11.8    543.0       0.<BREACH>   15.2  NRCS-FBH


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.




SITES.......SUMMARY TABLE 1 COMPLETED.


              NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                    TR6024   FILES
```

INPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Inside.D2C
OUTPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Inside.OUT
DATED 04/06/2020 09:11:13

GRAPHICS FILES GENERATED

OPTION "L" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Inside.DRG DATED 04/06/2020 09:11:13

OPTION "P" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Inside.DHY DATED 04/06/2020 09:11:13

OPTION "E" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Inside.DEM DATED 04/06/2020 09:11:13

AUX.GRAPHICS = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Inside.DG* DATED 04/06/2020 09:11:13

24 Hour Existing Conditions PMF – Centerline Profile

```
******************************************************************************
SITES XEQ 04/06/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
    VER 2005.1.8           (USER MANUAL - DATED DECEMBER 2005)
    TIME 09:08:12

************************* 80-80 LIST OF INPUT Data ***************************

SITES    01/01/2005TR6024    Piney Run Dam             10.56     C3
SAVMOV   0   101
SAVMOV   101  1                                1
*        Piney Run Watershed Study
*        Piney Run Dam (MD Dam No. 139, NID MD000139)
*        Sykesville, Maryland
*        Stability Design Hydrograph (SDH) and Freeboard Hydrograph
*        AECOM March 2020
STRUCTURE D1       Piney Run Dam
              523                   0
              524                   298
              526                   928
              528                   1596
              530                   2304
              531                   2673
              532                   3054
              534                   3849
              536                   4692
              538                   5585
              540                   6529
              542                   7527
              544                   8581
              546                   9678
ENDTABLE
WSDATA   2C 01    72      10.56    2.49            6.05
BASEFLOW        1
RAINTABLE HMR24    24      24-Hour Duration Distribution (HMR-52)
              0.000    0.001    0.003    0.004    0.005
              0.007    0.008    0.009    0.011    0.012
              0.014    0.015    0.017    0.018    0.020
              0.021    0.023    0.025    0.026    0.028
              0.030    0.031    0.033    0.035    0.037
              0.040    0.044    0.047    0.051    0.055
              0.059    0.063    0.067    0.072    0.077
              0.081    0.087    0.092    0.097    0.103
              0.109    0.115    0.122    0.128    0.135
              0.143    0.150    0.158    0.166    0.175
              0.185    0.197    0.211    0.227    0.245
              0.266    0.289    0.314    0.343    0.400
              0.523    0.656    0.754    0.784    0.811
              0.835    0.857    0.876    0.894    0.908
              0.921    0.933    0.942    0.945    0.948
              0.952    0.955    0.957    0.960    0.963
              0.966    0.968    0.971    0.973    0.975
              0.978    0.980    0.982    0.984    0.986
              0.988    0.990    0.992    0.994    0.996
              0.998    1.000
ENDTABLE
PDIRECT  1.47     8.3      12.2     15.00    33.90
```

```
POOLDATA  ELEV     523.0    523.0    523.0    540.5    496      SC
PSINLET           0.7      18
PSDATA   1       303      36               0.013    471.3
ASSPRFL  41       0.5              Inside Edg
        0.0      525.5    46.8     526.1    237.0    530.2
        266.0    531.3    324.2    531.3    393.6    529.5
        443.9    528.5    582.6    527.0    634.5    526.3
        656.0    525.6    702.5    508.6    728.1    504.0
        763.4    500.4    778.7    499.4    780.7    496.0
        860.0    494.6    973.6    489.1    1000.0   481.9
        1324.0   468.0
ENDTABLE
ASSURFACE 41       656      0.02
        0        656      0.04     0.87     1        1
        656      1122     0.10     0.5      2        5
ENDTABLE
ASDATA   41                        2.8                      1
BTMWIDTH  FEET     249
ASMATERIAL
        1        0        0.09     1        107      0.06
        2        0        0.10     2        110      0.16
        3        12       0.26     11       110      0.12
        4        0        36       0        178      50
ENDTABLE
ASCOORD   1       SM-1     N
        0.0      525.5    46.8     526.1    237.0    530.2
        266.0    531.3    324.2    531.3    393.6    529.5
        443.9    528.5    582.6    527.0    634.5    526.3
ENDTABLE
ASCOORD   2       SM-2
        0.0      519.5    46.8     520.1    393.6    525.5
        634.5    508.3    702.5    490.6    763.4    485.0
        1000.0   475.0    1324.0   464.0
ENDTABLE
ASCOORD   3       GM
        634.5    526.3    656.0    525.6    702.5    508.6
        728.1    504.0    763.4    500.4    778.7    499.4
        780.7    496.0    860.0    494.6    973.6    489.1
        1000.0   481.9    1324.0   468.0
ENDTABLE
ASCOORD   4       MICASCHIST
        0.0      488.0    46.8     488.6    237.0    492.7
        266.0    493.8    324.2    493.8    393.6    492.0
        634.5    490.3    702.5    466.1    778.7    464.0
        1324.0   460.0
ENDTABLE
GRAPHICS  I
GO,DESIGN LC       HMR24    24
SAVMOV   2   101  1                D1
ENDJOB

*******************************************************************************

1SITES XEQ 04/06/2020 ------------- COMMENT PAGE -------------------------------
     VER 2005.1.8             Piney Run Dam             WSID = TR6024


Piney Run Watershed Study
```

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph

AECOM March 2020

***** MESSAGE - DEFAULT TOPSOIL FILL MATERIAL PARAMETERS USED.

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO 531.30
FROM THE ASSPRFL RECORDS.

***** WARNING - ELEVATION VALLEY FLOOR 496.00 IS HIGHER THAN HIGHEST POINT
493.80 ON LOWEST MATERIAL IN THE ASCOORD TABLE.

```
1SITES -------------------------------------------------------------------------
XEQ 04/06/2020        Piney Run Dam          WSID= TR6024
VER 2005.1.8          Piney Run Dam          SUBW= 01
TIME 09:08:12     SITE = D1        PASS=   1    PART=   1
```

********************** MATERIAL PROPERTIES ****************************

MATERIAL	PI	DRY DENSITY lbs/CuFt	Kh	PERCENT CLAY	DETACH. RATE (Ft/H)/(lb/SqFt)	REP. DIAMETER inches
SM-1	0.	107.	0.06	1.0	--	0.09000
SM-2	0.	110.	0.16	2.0	--	0.10000
GM	12.	110.	0.12	11.0	--	0.26000
MICASCHIST	0.	178.	50.00	0.0	--	36.00000
TS_FILL	0.	100.	0.05	0.0	--	0.05000
GEN_FILL	0.	107.	0.06	1.0	--	0.09000

**************************** BASIC Data *********************************

HUMID- SUBHUMID CLIMATE AREA   DESIGN CLASS C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY	P-PS,10-DAY	P-SD	P-FB
8.30	12.20	15.00	33.90

WSDATA - CN	DA-SM	TC/L	-/H	QRF
72.00	10.56	2.49	0.00	6.05

SITEDATA- PERM POOL	CREST PS	FP SED	VALLEY FL	378?
523.00	523.00	523.00	496.00	NO

BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE
1.00	0.00	0.00	DESIGN

PSDATA - NO. COND	COND L	DIA/W	-/H
1.00	303.00	36.00	0.00

```
          PS N        KE       WEIR L       TW EL
         0.013       0.70       18.00       471.30

        2ND STG      ORF H        ORF L     START AUX.
          0.00        0.00        0.00        0.00

ASCRESTS -   AUX.1       AUX.2       AUX.3       AUX.4       AUX.5
           531.30        0.00        0.00        0.00        0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
              41        0.00       324.20           0

AUX.Data - INLET N    SIDE SLOPE      EXIT N     EXIT SLOPE    ACTUAL AUX?
          0.040        2.80        0.040        0.026         NO

BTM WIDTH -    BW1         BW2         BW3         BW4         BW5
  ft       249.00        0.00        0.00        0.00        0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************    DETAILED LIST OF BASIC Data    *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS     WIDTH     U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S      ft          ft         ft       U/S   D/S   U/S   D/S
 2.50 2.50     10.0          0.0       0.00      0.00  0.00  0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

    0.0000    0.0300    0.1000    0.1900    0.3100
    0.4700    0.6600    0.8200    0.9300    0.9900
    1.0000    0.9900    0.9300    0.8600    0.7800
    0.6800    0.5600    0.4600    0.3900    0.3300
    0.2800    0.2410    0.2070    0.1740    0.1470
    0.1260    0.1070    0.0910    0.0770    0.0660
```

0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

EXISTING NATURAL SURFACE AT AUXILIARY SPILLWAY SITE - X,Y COORDINATES:

0.	525.50
47.	526.10
237.	530.20
266.	531.30
324.	531.30
394.	529.50
444.	528.50
583.	527.00
634.	526.30
656.	525.60
702.	508.60
728.	504.00
763.	500.40
779.	499.40
781.	496.00

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.003	0.004	0.005
0.007	0.008	0.009	0.011	0.012
0.014	0.015	0.017	0.018	0.020
0.021	0.023	0.025	0.026	0.028
0.030	0.031	0.033	0.035	0.037
0.040	0.044	0.047	0.051	0.055
0.059	0.063	0.067	0.072	0.077
0.081	0.087	0.092	0.097	0.103
0.109	0.115	0.122	0.128	0.135
0.143	0.150	0.158	0.166	0.175
0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948

0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975
0.978	0.980	0.982	0.984	0.986
0.988	0.990	0.992	0.994	0.996
0.998	1.000			

1SITES ---
XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 09:08:12 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935
221.	0.9938	0.9942	0.9945	0.9949	0.9952	0.9956	0.9959	0.9962	0.9966	0.9969
231.	0.9972	0.9975	0.9978	0.9982	0.9985	0.9988	0.9991	0.9994	0.9997	1.0000

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 4.90 IN 10-DAY = 5.78 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 54. CN 1-DAY = 72.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12433.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
NRCS-PSH 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.56 FT 475.3 ACFT 110.54 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.43 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 80.56 CFS, ELEV = 524.27 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
	FULL CONDUIT FLOW, ELEV = 525.43 FT					
5	525.43	211.49	211.49	0.00	748.74	0.00
6	528.00	216.46	216.46	0.00	1596.73	0.00
7	530.57	221.31	221.31	0.00	2515.53	0.00
8	533.14	226.06	226.06	0.00	3508.90	0.00
9	535.72	230.72	230.72	0.00	4572.12	0.00
10	538.29	235.27	235.27	0.00	5720.34	0.00
11	540.86	239.75	239.75	0.00	6957.10	0.00
12	543.43	244.14	244.14	0.00	8280.12	0.00
13	546.00	248.45	248.45	0.00	9678.13	0.00

1SITES --
XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 09:08:12 SITE = D1 PASS= 1 PART= 3

AUX. CREST 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 524.27 FT 383.6 ACFT 0.00 AC 80.6 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH D= 24.00 HR P= 14.95 IN Q= 11.12 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 6261.5 ACFT

PEAK = 20911.3 CFS, AT 16.6 HRS.

NRCS-FBH D= 24.00 HR P= 33.78 IN Q= 29.52 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 16627.6 ACFT

PEAK = 52564.4 CFS, AT 16.6 HRS.
AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.30) AND AUXILIARY
CREST (531.22) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE
PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.16	212.91	212.91	0.00	979.80	0.00
7	526.88	214.31	214.31	0.00	1221.68	0.00
8	527.60	215.70	215.70	0.00	1463.55	0.00
9	528.33	217.08	217.08	0.00	1711.98	0.00
10	529.05	218.46	218.46	0.00	1968.34	0.00
11	529.78	219.82	219.82	0.00	2224.70	0.00
12	530.50	221.18	221.18	0.00	2488.57	0.00
13	531.22	222.53	222.53	0.00	2758.48	0.00
14	531.96	421.57	223.89	197.68	3039.93	0.00
15	532.70	1008.71	225.25	783.46	3333.01	0.00
16	534.03	2809.03	227.68	2581.35	3862.35	0.00
17	535.66	5907.52	230.61	5676.91	4547.44	0.00

```
 18   538.61  14020.81   235.85  13784.97   5873.95     0.00
 19   542.31  27110.45   242.23  26868.22   7688.31     0.00
 20   546.00  43519.95   248.45  43271.49   9678.00     0.00
 *************************************************************************

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH  FROM    TO   SLOPE  RETARDANCE  VEGETAL  MAINT. ROOTING  REACH
     STA    STA          CURVE     COVER    CODE   DEPTH  LOCATION
     (ft)   (ft)  (%)    INDEX@     FACTOR    +   (ft)    *
-----  ----    ----  ------ ----------  -------  -----  ------- --------
  1     0.    47.  -1.3    0.040      **      **    **   INLET
  2    47.   237.  -2.2    0.040      **      **    **   INLET
  3   237.   266.  -3.8    0.040      **      **    **   INLET
  4   266.   324.   0.0    0.040      **      **    **   CREST
  5   324.   394.   2.6    0.040    0.87      1    1.0   EXIT !
  6   394.   444.   2.0    0.040    0.87      1    1.0   EXIT
  7   444.   583.   1.1    0.040    0.87      1    1.0   EXIT
  8   583.   634.   1.3    0.040    0.87      1    1.0   EXIT
  9   634.   656.   3.3    0.040    0.87      1    1.0   EXIT
 10   656.   702.  36.6    0.100    0.50      2    5.0   exit
 11   702.   728.  18.0    0.100    0.50      2    5.0   exit
 12   728.   763.  10.2    0.100    0.50      2    5.0   exit
 13   763.   779.   6.5    0.100    0.50      2    5.0   exit
 14   779.   781. 170.0    0.100    0.50      2    5.0   exit

 @ The program interprets retardance curve index entries of less than 1 as
   Manning's n values.
 + The minimum maintenance code value of 2 is used in INTEGRITY computations
    (the program changes values of 1 to 2 during computation).
 * Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and
    rooting depth for inlet and crest reaches in computations.
 ! Reach   5 used in computing exit channel velocities.
 *************************************************************************

ROUTED      BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS        FT       FT       ACFT      AC       FT      ACFT
NRCS-SDH       249.0    535.98    4683.7      0.0     4.76    1925.2

        PEAK - CFS       Q-PS     Q-AUX.    Q-TOT.
        DISCHARGE =      231.     6510.     6741.

                   CRITICAL  CRITICAL   CRITICAL  25% OF Q
                     DEPTH   VELOCITY   SLOPE-Sc     Sc
        AUXILIARY       FT      FT/SEC     FT/FT     FT/FT
        SPILLWAY ---    2.74      9.26     0.017     0.023

        AUXILIARY SPILLWAY DURATION FLOW =      28.1 HOURS

        EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  10.6 FT/SEC
                          EXIT SLOPE  = 0.026 FT/FT
                          FLOW DEPTH  =   2.4 FT
       *****************************************************************

       EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
       (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
        Aux. Spillway Discharge =    6510. cfs;   Bottom Width =   249. ft
```

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2	
5	324.	394.	2.59	0.040	10.55	3.90	0.077	
6	394.	444.	1.99	0.040	9.73	3.24	0.064	
7	444.	583.	1.08	0.040	8.07	2.11	0.042	
8	583.	634.	1.35	0.040	8.63	2.47	0.049	
9	634.	656.	3.26	0.040	11.32	4.58	0.091	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	543.50	8318.0	0.0	12.28	5559.5

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	244.	32059.	32303.

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	7.78	15.22	0.012	0.016

INTEGRITY ANALYSIS - REACH SURFACE PERFORMANCE SUMMARY
(The auxiliary spillway began flow at time = 14.7 hours
and peaked at time = 17.8 hours.)

REACH 5: FROM STATION 324. TO 394. ON 2.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 6: FROM STATION 394. TO 444. ON 2.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 7: FROM STATION 444. TO 583. ON 1.1% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.0 hours.

REACH 8: FROM STATION 583. TO 634. ON 1.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.3 hours.

REACH 9: FROM STATION 634. TO 656. ON 3.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 10: FROM STATION 656. TO 702. ON 36.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

```
REACH  11: FROM STATION    702. TO    728. ON   18.0% SLOPE.
  Vegetal cover failed and concentrated flow developed
  at time =   15.5 hours.


REACH  12: FROM STATION    728. TO    763. ON   10.2% SLOPE.
  Vegetal cover failed and concentrated flow developed
  at time =   15.8 hours.


REACH  13: FROM STATION    763. TO    779. ON    6.5% SLOPE.
  Vegetal cover failed and concentrated flow developed
  at time =   16.1 hours.


REACH  14: FROM STATION    779. TO    781. ON  170.0% SLOPE.
  Vegetal cover failed and concentrated flow developed
  at time =   15.3 hours.


INTEGRITY ANALYSIS - HEADCUT EROSION DAMAGE SUMMARY

 The headcut BREACHED the spillway crest at
 time equal approximately    18.4 hours.
 Computations terminated at that point!

 The most upstream headcut began at station    324.
 and progressed upstream to station    266.
 The final height of the headcut was   22.0 ft.

 The headcut having the maximum final overfall height began
 at station    394. and progressed upstream to station   266.
 The final height of the headcut was   35.3 ft.

THE HYDROGRAPH WAS NOT ADJUSTED FOR THE EFFECTS OF EROSION.

          DURATION    ATTACK   DIST. FROM MOST U/S
            FLOW       OE/B    HEADCUT TO U/S EDGE
AUXILIARY        HRS     ACFT/FT     AUX. CREST, FT
SPILLWAY----     32.2      54.4        >>>BREACH<<<
                             Depth =   22.0 ft

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  19.3 FT/SEC
                         EXIT SLOPE  = 0.026 FT/FT
                         FLOW DEPTH  =   6.2 FT
-------------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak =       222.48 CFS  at  127.33 hrs.,  Location Point

Inflow Hyd 1 SDH-Peak =      6740.83 CFS  at   19.00 hrs.,  Location Point

Inflow Hyd 1 FBH-Peak =     32303.33 CFS  at   17.66 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

TR6024       Piney Run Dam
```

```
0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

3 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*****************************************************************************
SITES.....COMPUTATIONS COMPLETE

                SUMMARY TABLE  1        SITES VERSION 2005.1.8
                ----------------              DATED 01/01/2005

WATERSHED ID              RUN DATE                  RUN TIME
------------              --------                  --------
TR6024                    04/06/2020                09:08:12

>>>  SITE   SUBWS   SUBWS DA   CURVE   TC   TOTAL DA   TYPE    STRUC   <<<
     ID     ID    (SQ MI)   NO.    (HRS)  (SQ MI)  DESIGN   CLASS
     -----  ----  --------  -----  ----  -------  -----  -----
     D1     01     10.56    72.   2.49    10.56   TR60    C

PASS  DIA./  AUX.CREST  BTM.  MAX.   MAX.   EMB.  INTEGR.*  EXIT*   TYPE
 NO.  WIDTH    ELEV   WIDTH  HP    ELEV   VOL.  DIST.    VEL.    HYD
    (IN/FT)  (FT)    (FT)  (FT)   (FT)   (CY)  (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1   36.0   531.2   249.0  12.3   543.5      0.<BREACH>   19.3  NRCS-FBH


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

             NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                  TR6024   FILES
```

INPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline.D2C
OUTPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline.OUT
DATED 04/06/2020 09:08:12

GRAPHICS FILES GENERATED

OPTION "L" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline.DRG DATED 04/06/2020 09:08:12

OPTION "P" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline.DHY DATED 04/06/2020 09:08:12

OPTION "E" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline.DEM DATED 04/06/2020 09:08:12

AUX.GRAPHICS = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline.DG* DATED 04/06/2020 09:08:12

24 Hour Existing Conditions PMF – Outside Edge Profile

```
********************************************************************************
SITES XEQ 04/06/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
    VER 2005.1.8          (USER MANUAL - DATED DECEMBER 2005)
    TIME 09:20:25

************************* 80-80 LIST OF INPUT Data ***************************

SITES    01/01/2005TR6024    Piney Run Dam              10.56     C3
SAVMOV   0   101
SAVMOV   101  1                                  1
*        Piney Run Watershed Study
*        Piney Run Dam (MD Dam No. 139, NID MD000139)
*        Sykesville, Maryland
*        Stability Design Hydrograph (SDH) and Freeboard Hydrograph
*        AECOM March 2020
STRUCTURE D1       Piney Run Dam
              523                  0
              524                  298
              526                  928
              528                  1596
              530                  2304
              531                  2673
              532                  3054
              534                  3849
              536                  4692
              538                  5585
              540                  6529
              542                  7527
              544                  8581
              546                  9678
ENDTABLE
WSDATA   2C 01    72      10.56    2.49          6.05
BASEFLOW        1
RAINTABLE HMR24    24      24-Hour Duration Distribution (HMR-52)
              0.000   0.001   0.003   0.004   0.005
              0.007   0.008   0.009   0.011   0.012
              0.014   0.015   0.017   0.018   0.020
              0.021   0.023   0.025   0.026   0.028
              0.030   0.031   0.033   0.035   0.037
              0.040   0.044   0.047   0.051   0.055
              0.059   0.063   0.067   0.072   0.077
              0.081   0.087   0.092   0.097   0.103
              0.109   0.115   0.122   0.128   0.135
              0.143   0.150   0.158   0.166   0.175
              0.185   0.197   0.211   0.227   0.245
              0.266   0.289   0.314   0.343   0.400
              0.523   0.656   0.754   0.784   0.811
              0.835   0.857   0.876   0.894   0.908
              0.921   0.933   0.942   0.945   0.948
              0.952   0.955   0.957   0.960   0.963
              0.966   0.968   0.971   0.973   0.975
              0.978   0.980   0.982   0.984   0.986
              0.988   0.990   0.992   0.994   0.996
              0.998   1.000
ENDTABLE
PDIRECT   1.47     8.3      12.2     15.00    33.90
```

```
POOLDATA  ELEV     523.0    523.0    523.0    540.5    496      SC
PSINLET          0.7      18
PSDATA   1       303      36              0.013    471.3
ASSPRFL  41      0.5              Inside Edg
       0.0      525.1    129.7    527.6    250.1    528.7
       399.7    531.3    439.0    531.3    446.2    531.2
       477.8    530.9    536.6    529.7    574.1    528.8
       635.6    528.5    651.8    528.1    750.4    527.1
       793.6    525.8    798.0    525.6    879.6    501.3
       1003.4   498.2    1215.2   489.1    1241.6   481.9
       1565.6   468.0
ENDTABLE
ASSURFACE 41     798      0.02
       0       798      0.04     0.87     1       1
       798     1565.6   0.10     0.5      2       5
ENDTABLE
ASDATA   41                     2.8                     1
BTMWIDTH  FEET     249
ASMATERIAL
       1       0        0.10     1        93       0.06
       2       0        0.09     2        110      0.16
       3       0        24       0        170      20
ENDTABLE
ASCOORD   1      SM-1     N
       0.0      525.1    129.7    527.6    250.1    528.7
       399.7    531.3    439.0    531.3    446.2    531.2
       477.8    530.9    536.6    529.7    574.1    528.8
       635.6    528.5    651.8    528.1    750.4    527.1
       793.6    525.8    798.0    525.6    879.6    501.3
       1003.4   498.2    1215.2   489.1    1241.6   481.9
       1565.6   468.0
ENDTABLE
ASCOORD   2      SM-2
       0.0      523.1    129.7    525.6    250.1    526.7
       399.7    529.3    439.0    529.3    446.2    529.2
       536.6    511.7    651.8    525.1    793.6    512.8
       879.6    496.3    1003.4   493.2    1215.2   484.1
       1241.6   478.9    1565.6   465.0
ENDTABLE
ASCOORD   3      MICASCHIST
       0.0      470.1    129.7    472.6    250.1    473.7
       399.7    476.3    439.0    476.3    446.2    476.2
       536.6    491.5    651.8    499.6    793.6    492.8
       879.6    488.3    1003.4   486.2    1241.6   475.9
       1565.6   463.0
ENDTABLE
GRAPHICS  I
GO,DESIGN LC       HMR24     24
SAVMOV   2   101  1              D1
ENDJOB

******************************************************************************

1SITES XEQ 04/06/2020 ------------- COMMENT PAGE -------------------------------
     VER 2005.1.8              Piney Run Dam              WSID = TR6024


Piney Run Watershed Study
```

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph

AECOM March 2020

***** MESSAGE - DEFAULT TOPSOIL FILL MATERIAL PARAMETERS USED.

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO 531.30
FROM THE ASSPRFL RECORDS.

```
1SITES ------------------------------------------------------------------------
XEQ 04/06/2020         Piney Run Dam          WSID= TR6024
VER 2005.1.8           Piney Run Dam          SUBW= 01
TIME 09:20:25     SITE = D1       PASS=   1    PART=   1



*********************   MATERIAL PROPERTIES   ***************************
                  DRY            PERCENT    DETACH.    REP.
   MATERIAL    PI  DENSITY    Kh      CLAY      RATE    DIAMETER
               lbs/CuFt             (Ft/H)/(lb/SqFt)  inches
   SM-1       0.     93.    0.06     1.0       --     0.10000
   SM-2       0.    110.    0.16     2.0       --     0.09000
   MICASCHIST    0.    170.   20.00     0.0      --     24.00000
   TS_FILL     0.    100.    0.05     0.0      --     0.05000
   GEN_FILL     0.     93.    0.06     1.0      --     0.10000

***************************   BASIC Data   ********************************
HUMID- SUBHUMID CLIMATE AREA              DESIGN CLASS  C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY   P-PS,10-DAY    P-SD      P-FB
          8.30      12.20      15.00      33.90

WSDATA -     CN        DA-SM       TC/L        -/H        QRF
         72.00      10.56       2.49       0.00       6.05

SITEDATA- PERM POOL    CREST PS    FP SED    VALLEY FL     378?
        523.00      523.00      523.00      496.00        NO

       BASEFLOW     INITIAL EL    EXTRA VOL    SITE TYPE
          1.00        0.00        0.00       DESIGN

PSDATA -  NO. COND     COND L      DIA/W       -/H
          1.00      303.00      36.00       0.00

          PS N        KE      WEIR L     TW EL
         0.013       0.70      18.00     471.30

        2ND STG       ORF H       ORF L     START AUX.
```

```
          0.00        0.00        0.00         0.00

ASCRESTS -   AUX.1       AUX.2       AUX.3       AUX.4       AUX.5
        531.30        0.00        0.00        0.00        0.00

AUX.Data -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
            41        0.00       439.00           0

AUX.Data - INLET N    SIDE SLOPE      EXIT N     EXIT SLOPE     ACTUAL AUX?
          0.040        2.80        0.040        0.014          NO

BTM WIDTH -    BW1         BW2         BW3          BW4         BW5
  ft       249.00        0.00        0.00         0.00        0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************    DETAILED LIST OF BASIC Data     *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
   RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
  U/S  D/S       ft           ft         ft        U/S   D/S    U/S   D/S
 2.50 2.50      10.0           0.0       0.00       0.00  0.00   0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

    0.0000    0.0300    0.1000    0.1900    0.3100
    0.4700    0.6600    0.8200    0.9300    0.9900
    1.0000    0.9900    0.9300    0.8600    0.7800
    0.6800    0.5600    0.4600    0.3900    0.3300
    0.2800    0.2410    0.2070    0.1740    0.1470
    0.1260    0.1070    0.0910    0.0770    0.0660
    0.0550    0.0470    0.0400    0.0340    0.0290
    0.0250    0.0210    0.0180    0.0150    0.0130
    0.0110    0.0090    0.0080    0.0070    0.0060
    0.0050    0.0040    0.0030    0.0020    0.0010
```

0.0000

EXISTING NATURAL SURFACE AT AUXILIARY SPILLWAY SITE - X,Y COORDINATES:

0.	525.10
130.	527.60
250.	528.70
400.	531.30
439.	531.30
446.	531.20
478.	530.90
537.	529.70
574.	528.80
636.	528.50
652.	528.10
750.	527.10
794.	525.80
798.	525.60
880.	501.30
1003.	498.20
1055.	496.00

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.003	0.004	0.005
0.007	0.008	0.009	0.011	0.012
0.014	0.015	0.017	0.018	0.020
0.021	0.023	0.025	0.026	0.028
0.030	0.031	0.033	0.035	0.037
0.040	0.044	0.047	0.051	0.055
0.059	0.063	0.067	0.072	0.077
0.081	0.087	0.092	0.097	0.103
0.109	0.115	0.122	0.128	0.135
0.143	0.150	0.158	0.166	0.175
0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948
0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975

0.978 0.980 0.982 0.984 0.986
0.988 0.990 0.992 0.994 0.996
0.998 1.000

```
1SITES ------------------------------------------------------------------------
 XEQ 04/06/2020            Piney Run Dam                WSID= TR6024
 VER 2005.1.8              Piney Run Dam                SUBW= 01
 TIME 09:20:25        SITE = D1           PASS=   1     PART=   2

 ***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF   10.6 SQ. MILES.

            DESIGN 0.99647     PS-1 DAY 0.99154     PS-10 DAY 0.99866.

 PERM POOL      523.00 FT      0.0 ACFT     0.00 AC      0.0 CFS

 CREST PS       523.00 FT      0.0 ACFT     0.00 AC      0.0 CFS

 SED ACCUM      523.00 FT      0.0 ACFT     0.00 AC      0.0 CFS

 BASEFLOW       523.24 FT     72.3 ACFT     0.00 AC     10.6 CFS

 START ELEV     523.24 FT     72.3 ACFT     0.00 AC     10.6 CFS

               Principal Spillway Runoff Distribution

Hour    1      2      3      4      5      6      7      8      9      10

  1.  0.0003 0.0006 0.0009 0.0012 0.0015 0.0018 0.0022 0.0025 0.0028 0.0031
 11.  0.0035 0.0038 0.0041 0.0045 0.0048 0.0051 0.0055 0.0058 0.0062 0.0065
 21.  0.0069 0.0073 0.0076 0.0080 0.0084 0.0087 0.0091 0.0095 0.0099 0.0103
 31.  0.0107 0.0111 0.0115 0.0119 0.0123 0.0127 0.0131 0.0136 0.0140 0.0144
 41.  0.0149 0.0153 0.0158 0.0162 0.0167 0.0172 0.0176 0.0181 0.0186 0.0191
 51.  0.0196 0.0201 0.0206 0.0212 0.0217 0.0222 0.0228 0.0233 0.0239 0.0244
 61.  0.0250 0.0256 0.0262 0.0268 0.0274 0.0281 0.0287 0.0293 0.0300 0.0307
 71.  0.0314 0.0321 0.0328 0.0335 0.0343 0.0350 0.0358 0.0366 0.0374 0.0382
 81.  0.0391 0.0399 0.0408 0.0417 0.0427 0.0436 0.0446 0.0456 0.0467 0.0478
 91.  0.0489 0.0500 0.0512 0.0524 0.0537 0.0550 0.0564 0.0579 0.0594 0.0609
101.  0.0626 0.0643 0.0661 0.0680 0.0701 0.0722 0.0745 0.0770 0.0797 0.0827
111.  0.0859 0.0895 0.0936 0.0983 0.1037 0.1104 0.1190 0.1311 0.1521 0.8256
121.  0.8602 0.8754 0.8854 0.8929 0.8990 0.9040 0.9083 0.9122 0.9156 0.9187
131.  0.9215 0.9241 0.9265 0.9287 0.9308 0.9328 0.9347 0.9364 0.9381 0.9397
141.  0.9413 0.9427 0.9441 0.9455 0.9468 0.9480 0.9492 0.9504 0.9515 0.9526
151.  0.9537 0.9547 0.9557 0.9567 0.9577 0.9586 0.9595 0.9604 0.9612 0.9621
161.  0.9629 0.9637 0.9645 0.9652 0.9660 0.9667 0.9674 0.9681 0.9688 0.9695
171.  0.9702 0.9708 0.9715 0.9721 0.9727 0.9733 0.9739 0.9745 0.9751 0.9757
181.  0.9763 0.9768 0.9774 0.9779 0.9784 0.9790 0.9795 0.9800 0.9805 0.9810
191.  0.9815 0.9820 0.9824 0.9829 0.9834 0.9838 0.9843 0.9847 0.9852 0.9856
201.  0.9861 0.9865 0.9869 0.9873 0.9878 0.9882 0.9886 0.9890 0.9894 0.9898
211.  0.9901 0.9905 0.9909 0.9913 0.9917 0.9920 0.9924 0.9928 0.9931 0.9935
221.  0.9938 0.9942 0.9945 0.9949 0.9952 0.9956 0.9959 0.9962 0.9966 0.9969
231.  0.9972 0.9975 0.9978 0.9982 0.9985 0.9988 0.9991 0.9994 0.9997 1.0000

 PERM POOL      523.00 FT      0.0 ACFT     0.00 AC      0.0 CFS

 CREST PS       523.00 FT      0.0 ACFT     0.00 AC      0.0 CFS
```

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 4.90 IN 10-DAY = 5.78 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 54. CN 1-DAY = 72.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12433.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE	EMAX	VOL-MAX	AMAX	QMAX
NRCS-PSH	531.22 FT	2758.5 ACFT	0.00 AC	222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.56 FT 475.3 ACFT 110.54 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.43 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 80.56 CFS, ELEV = 524.27 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	528.00	216.46	216.46	0.00	1596.73	0.00
7	530.57	221.31	221.31	0.00	2515.53	0.00
8	533.14	226.06	226.06	0.00	3508.90	0.00
9	535.72	230.72	230.72	0.00	4572.12	0.00
10	538.29	235.27	235.27	0.00	5720.34	0.00
11	540.86	239.75	239.75	0.00	6957.10	0.00
12	543.43	244.14	244.14	0.00	8280.12	0.00
13	546.00	248.45	248.45	0.00	9678.13	0.00

1SITES ---

XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 09:20:25 SITE = D1 PASS= 1 PART= 3

AUX. CREST 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 524.27 FT 383.6 ACFT 0.00 AC 80.6 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH D= 24.00 HR P= 14.95 IN Q= 11.12 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 6261.5 ACFT

PEAK = 20911.3 CFS, AT 16.6 HRS.

NRCS-FBH D= 24.00 HR P= 33.78 IN Q= 29.52 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 16627.6 ACFT

PEAK = 52564.4 CFS, AT 16.6 HRS.
AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.30) AND AUXILIARY
CREST (531.22) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE
PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
	FULL CONDUIT FLOW, ELEV = 525.43 FT					
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.16	212.91	212.91	0.00	979.80	0.00
7	526.88	214.31	214.31	0.00	1221.68	0.00
8	527.60	215.70	215.70	0.00	1463.55	0.00
9	528.33	217.08	217.08	0.00	1711.98	0.00
10	529.05	218.46	218.46	0.00	1968.34	0.00
11	529.78	219.82	219.82	0.00	2224.70	0.00
12	530.50	221.18	221.18	0.00	2488.57	0.00
13	531.22	222.53	222.53	0.00	2758.48	0.00
14	531.96	430.49	223.89	206.59	3039.93	0.00
15	532.70	1013.33	225.25	788.07	3333.01	0.00
16	534.03	2750.89	227.68	2523.21	3862.35	0.00
17	535.66	5744.05	230.61	5513.44	4547.44	0.00
18	538.61	13667.52	235.85	13431.67	5873.95	0.00
19	542.31	26440.28	242.23	26198.05	7688.31	0.00

```
20  546.00  42516.31   248.45  42267.86  9678.00     0.00
****************************************************************************

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH  FROM    TO   SLOPE  RETARDANCE  VEGETAL  MAINT. ROOTING  REACH
       STA     STA         CURVE       COVER    CODE   DEPTH    LOCATION
       (ft)    (ft)  (%)   INDEX@      FACTOR    +     (ft)     *
-----  ----    ----  ------ ---------- -------  -----  ------- --------
  1      0.    130.  -1.9   0.040       **       **     **      INLET
  2    130.    250.  -0.9   0.040       **       **     **      INLET
  3    250.    400.  -1.7   0.040       **       **     **      INLET
  4    400.    439.   0.0   0.040       **       **     **      CREST
  5    439.    446.   1.4   0.040      0.87      1      1.0     EXIT !
  6    446.    478.   0.9   0.040      0.87      1      1.0     EXIT
  7    478.    537.   2.0   0.040      0.87      1      1.0     EXIT
  8    537.    574.   2.4   0.040      0.87      1      1.0     EXIT
  9    574.    636.   0.5   0.040      0.87      1      1.0     EXIT
 10    636.    652.   2.5   0.040      0.87      1      1.0     EXIT
 11    652.    750.   1.0   0.040      0.87      1      1.0     EXIT
 12    750.    794.   3.0   0.040      0.87      1      1.0     EXIT
 13    794.    798.   4.5   0.040      0.87      1      1.0     EXIT
 14    798.    880.  29.8   0.100      0.50      2      5.0     exit
 15    880.   1003.   2.5   0.100      0.50      2      5.0     exit
 16   1003.   1055.   4.3   0.100      0.50      2      5.0     exit

 @ The program interprets retardance curve index entries of less than 1 as
   Manning's n values.
 + The minimum maintenance code value of 2 is used in INTEGRITY computations
    (the program changes values of 1 to 2 during computation).
 * Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and
    rooting depth for inlet and crest reaches in computations.
 ! Reach   5 used in computing exit channel velocities.
****************************************************************************

ROUTED      BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS        FT        FT        ACFT      AC         FT        ACFT
NRCS-SDH      249.0    536.02     4699.5     0.0       4.79     1941.0

       PEAK - CFS       Q-PS     Q-AUX.    Q-TOT.
       DISCHARGE =      231.     6421.     6652.

                 CRITICAL  CRITICAL   CRITICAL  25% OF Q
                  DEPTH    VELOCITY   SLOPE-Sc     Sc
       AUXILIARY    FT      FT/SEC     FT/FT     FT/FT
       SPILLWAY ---  2.72    9.22      0.017     0.023

       AUXILIARY SPILLWAY DURATION FLOW =      28.1 HOURS

       EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY=   8.7 FT/SEC
                         EXIT SLOPE  = 0.014 FT/FT
                         FLOW DEPTH  =   2.9 FT
      ******************************************************************

      EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
      (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
       Aux. Spillway Discharge =    6421. cfs;   Bottom Width =   249. ft
```

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2	
5	439.	446.	1.39	0.040	8.67	2.50	0.049	
6	446.	478.	0.95	0.040	7.71	1.91	0.038	
7	478.	537.	2.04	0.040	9.75	3.27	0.065	
8	537.	574.	2.40	0.040	10.25	3.67	0.072	
9	574.	636.	0.49	0.040	6.27	1.20	0.024	
10	636.	652.	2.47	0.040	10.34	3.74	0.074	
11	652.	750.	1.01	0.040	7.87	2.00	0.040	
12	750.	794.	3.01	0.040	10.99	4.30	0.085	
13	794.	798.	4.55	0.040	12.46	5.74	0.113	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	543.61	8374.1	0.0	12.38	5615.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	244.	31737.	31981.

AUXILIARY	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
SPILLWAY ---	7.73	15.18	0.012	0.016

INTEGRITY ANALYSIS - REACH SURFACE PERFORMANCE SUMMARY
(The auxiliary spillway began flow at time = 14.7 hours
and peaked at time = 17.8 hours.)

REACH 5: FROM STATION 439. TO 446. ON 1.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.3 hours.

REACH 6: FROM STATION 446. TO 478. ON 0.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.5 hours.

REACH 7: FROM STATION 478. TO 537. ON 2.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.0 hours.

REACH 8: FROM STATION 537. TO 574. ON 2.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 9: FROM STATION 574. TO 636. ON 0.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 10: FROM STATION 636. TO 652. ON 2.5% SLOPE.

Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 11: FROM STATION 652. TO 750. ON 1.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 12: FROM STATION 750. TO 794. ON 3.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 13: FROM STATION 794. TO 798. ON 4.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.6 hours.

REACH 14: FROM STATION 798. TO 880. ON 29.8% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.6 hours.

REACH 15: FROM STATION 880. TO 1003. ON 2.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.4 hours.

REACH 16: FROM STATION 1003. TO 1055. ON 4.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.4 hours.

INTEGRITY ANALYSIS - HEADCUT EROSION DAMAGE SUMMARY

The headcut BREACHED the spillway crest at
time equal approximately 18.9 hours.
Computations terminated at that point!

The most upstream headcut began at station 439.
and progressed upstream to station 400.
The final height of the headcut was 16.4 ft.

The headcut having the maximum final overfall height began
at station 537. and progressed upstream to station 400.
The final height of the headcut was 35.3 ft.

THE HYDROGRAPH WAS NOT ADJUSTED FOR THE EFFECTS OF EROSION.

	DURATION FLOW	ATTACK OE/B	DIST. FROM MOST U/S HEADCUT TO U/S EDGE
AUXILIARY	HRS	ACFT/FT	AUX. CREST, FT
SPILLWAY----	32.2	54.4	>>>BREACH<<<
		Depth = 16.4 ft	

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 15.8 FT/SEC
EXIT SLOPE = 0.014 FT/FT

```
                         FLOW DEPTH  =   7.4 FT
 -----------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =       222.48 CFS  at  127.33 hrs.,  Location Point

 Inflow Hyd 1 SDH-Peak =      6652.34 CFS  at   19.00 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =     31980.95 CFS  at   17.66 hrs.,  Location Point
HYDOUT   1    D1

1SITES....JOB NO.  1 COMPLETE.
 -----------------------------------------------------------------------------

 TR6024       Piney Run Dam

     0 SUBWATERSHED(S) ANALYZED.

     1 STRUCTURE(S) ANALYZED.

     3 HYDROGRAPHS ROUTED AT LOWEST SITE.

     0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 ******************************************************************************



 SITES.....COMPUTATIONS COMPLETE


                    SUMMARY TABLE  1         SITES VERSION 2005.1.8
                    ----------------              DATED 01/01/2005


 WATERSHED ID                  RUN DATE                      RUN TIME
 ------------                  --------                      --------
 TR6024                        04/06/2020                    09:20:25

 >>>  SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
       ID     ID     (SQ MI)    NO.    (HRS)  (SQ MI)  DESIGN   CLASS
      -----  ----  --------  -----  ----  -------  -----  -----
      D1      01      10.56     72.   2.49     10.56    TR60     C

 PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
  NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)    (FT/SEC)
 ----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
    1   36.0    531.2   249.0  12.4    543.6      0.&lt;BREACH&gt;   15.8  NRCS-FBH


 *  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
    HYDROGRAPH SHOWN UNDER TYPE HYD.



 SITES.......SUMMARY TABLE 1 COMPLETED.
```

NRCS SITES VERSION 2005.1.8 ,01/01/2005
TR6024 FILES

INPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside.D2C
OUTPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside.OUT
DATED 04/06/2020 09:20:25

GRAPHICS FILES GENERATED

OPTION "L" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside.DRG DATED 04/06/2020 09:20:25

OPTION "P" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside.DHY DATED 04/06/2020 09:20:25

OPTION "E" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside.DEM DATED 04/06/2020 09:20:25

AUX.GRAPHICS = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside.DG* DATED 04/06/2020 09:20:25

24 Hour Existing Conditions PMF – Inside Edge Profile – Sensitivity Analysis

```
********************************************************************************
 SITES XEQ 04/06/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.8           (USER MANUAL - DATED DECEMBER 2005)
     TIME 09:05:44

 ************************* 80-80 LIST OF INPUT Data ***************************

 SITES     01/01/2005TR6024    Piney Run Dam              10.56     C3
 SAVMOV   0   101
 SAVMOV   101  1                                   1
 *        Piney Run Watershed Study
 *        Piney Run Dam (MD Dam No. 139, NID MD000139)
 *        Sykesville, Maryland
 *        Stability Design Hydrograph (SDH) and Freeboard Hydrograph (
 *        AECOM March 2020
 STRUCTURE D1       Piney Run Dam
               523                     0
               524                     298
               526                     928
               528                     1596
               530                     2304
               531                     2673
               532                     3054
               534                     3849
               536                     4692
               538                     5585
               540                     6529
               542                     7527
               544                     8581
               546                     9678
 ENDTABLE
 WSDATA    2C pl     72       10.56     2.49              6.05
 BASEFLOW          1
 RAINTABLE HMR24     24       24-Hour Duration Distribution (HMR-52)
               0.000    0.001    0.003    0.004    0.005
               0.007    0.008    0.009    0.011    0.012
               0.014    0.015    0.017    0.018    0.020
               0.021    0.023    0.025    0.026    0.028
               0.030    0.031    0.033    0.035    0.037
               0.040    0.044    0.047    0.051    0.055
               0.059    0.063    0.067    0.072    0.077
               0.081    0.087    0.092    0.097    0.103
               0.109    0.115    0.122    0.128    0.135
               0.143    0.150    0.158    0.166    0.175
               0.185    0.197    0.211    0.227    0.245
               0.266    0.289    0.314    0.343    0.400
               0.523    0.656    0.754    0.784    0.811
               0.835    0.857    0.876    0.894    0.908
               0.921    0.933    0.942    0.945    0.948
               0.952    0.955    0.957    0.960    0.963
               0.966    0.968    0.971    0.973    0.975
               0.978    0.980    0.982    0.984    0.986
               0.988    0.990    0.992    0.994    0.996
               0.998    1.000
 ENDTABLE
 PDIRECT   1.47     8.3      12.2     15.00    33.90
```

```
POOLDATA  ELEV     523.0    523.0    523.0    540.5    496      SC
PSINLET          0.7      18
PSDATA   1       303      36              0.013    471.3
ASSPRFL  41      0.5              Inside Edg
       0.0      525.0    83.5     529.3    124.0    530.7
       139.4    531.0    147.6    531.0    156.1    530.9
       218.3    529.7    243.7    529.1    341.8    527.8
       390.9    527.2    418.3    527.1    475.4    526.2
       485.7    525.9    505.3    524.7    511.4    523.8
       541.7    512.5    570.2    505.6    599.6    501.0
       771.6    489.1    798.0    481.9    1122.0   468.0
ENDTABLE
ASSURFACE 41      505.3    0.011
       0        505.3    0.04     0.87     1        1
       505.3    1122     0.10     0.5      2        5
ENDTABLE
ASDATA   41                       2.8                      1
BTMWIDTH  FEET     249
ASMATERIAL
       1        5        0.1      5        110      0.2
       2        5        0.6      5        115      0.5
       3        20       0.35     20       110      0.2
       4        0        48       0        185      2000
ENDTABLE
ASCOORD   1       ML       N
       0        525.0    83.5     529.3    124.0    530.7
       139.4    531.0    147.6    531.0    156.1    530.9
       218.3    529.7    243.7    529.1    341.8    527.8
       390.9    527.2    418.3    527.1    475.4    526.2
ENDTABLE
ASCOORD   2       SM
       0        517.0    83.5     521.3    124      522.7
       139.4    523      147.6    523      200      527.1
       243.7    527.1    300      526.5    341.8    514.8
       475.4    507.2    570.2    497.6    599.6    493
       771.6    483.1    798      477.9    1122     466
ENDTABLE
ASCOORD   3       GM
       475.4    526.2    485.7    525.9    505.3    524.7
       511.4    523.8    541.7    512.5    570.2    505.6
       599.6    501.0    771.6    489.1    798.0    481.9
       1122.0   468.0
ENDTABLE
ASCOORD   4       MICASCHIST
       0        487.5    83.5     491.8    124      493.2
       139.4    493.5    147.6    493.5    200      520.6
       243.7    520.6    300      520.6    341.8    509.7
       475.4    478.2    570.2    463.1    1122     462
ENDTABLE
GRAPHICS  I
GO,DESIGN LC       HMR24    24
SAVMOV   2   101  1               D1
ENDJOB
```

****

1SITES XEQ 04/06/2020 ------------- COMMENT PAGE -------------------------------
VER 2005.1.8   Piney Run Dam   WSID = TR6024

Piney Run Watershed Study

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph (

AECOM March 2020

***** MESSAGE - DEFAULT TOPSOIL FILL MATERIAL PARAMETERS USED.

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO 531.00
FROM THE ASSPRFL RECORDS.

```
1SITES --------------------------------------------------------------------------
XEQ 04/06/2020          Piney Run Dam              WSID= TR6024
VER 2005.1.8            Piney Run Dam              SUBW= pl
TIME 09:05:44      SITE = D1        PASS=   1    PART=   1
```

********************** MATERIAL PROPERTIES ****************************

MATERIAL	PI	DRY DENSITY lbs/CuFt	Kh	PERCENT CLAY	DETACH. RATE (Ft/H)/(lb/SqFt)	REP. DIAMETER inches
ML	5.	110.	0.20	5.0	--	0.10000
SM	5.	115.	0.50	5.0	--	0.60000
GM	20.	110.	0.20	20.0	--	0.35000
MICASCHIST	0.	185.	2000.00	0.0	--	48.00000
TS_FILL	0.	100.	0.05	0.0	--	0.05000
GEN_FILL	5.	110.	0.20	5.0	--	0.10000

**************************** BASIC Data **********************************
HUMID- SUBHUMID CLIMATE AREA   DESIGN CLASS C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY	P-PS,10-DAY	P-SD	P-FB
8.30	12.20	15.00	33.90

WSDATA - CN	DA-SM	TC/L	-/H	QRF
72.00	10.56	2.49	0.00	6.05

SITEDATA- PERM POOL	CREST PS	FP SED	VALLEY FL	378?
523.00	523.00	523.00	496.00	NO

BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE
1.00	0.00	0.00	DESIGN

PSDATA - NO. COND	COND L	DIA/W	-/H
1.00	303.00	36.00	0.00

PS N	KE	WEIR L	TW EL
0.013	0.70	18.00	471.30

2ND STG	ORF H	ORF L	START AUX.
0.00	0.00	0.00	0.00

ASCRESTS -	AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
	531.00	0.00	0.00	0.00	0.00

AUX.Data -	REF.NO.	RETARD. Ci	TIE STATION	INLET LENGTH
	41	0.00	147.60	0

AUX.Data -	INLET N	SIDE SLOPE	EXIT N	EXIT SLOPE	ACTUAL AUX?
	0.040	2.80	0.040	0.012	NO

BTM WIDTH -	BW1	BW2	BW3	BW4	BW5
ft	249.00	0.00	0.00	0.00	0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1********************* DETAILED LIST OF BASIC Data *********************
WEIR COEF. FOR ORIFICES.......... 3.10 RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10 TIME INCS TO PEAK OF UNIT HYD. 10.
DISCHARGE COEF. FOR ORIFICES..... 0.60 NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .... 0.60 DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. .... 0.60 DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. .... 0.00 OTHER DRAWDOWN RATIOS APPLY ?. NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01 WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00 WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16 AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545 AUX. SPILLWAY MIN. CAP. EXP. 0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00 MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00 PRECISION OF BW SOLUTION...... 1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00 OLD TR60 CRITERIA USED .... NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00 OLD NHCP378 CRITERIA USED .... NO

EMBANKMENT TEMPLATE: TOP WIDTH = (calc.), MAX. CROWN = 0.667 ft,

SIDE SLOPE RATIOS U/S	D/S	WAVE BERM WIDTH ft	MULTIPLE STABILITY BERMS U&D/S WIDTHS ft	DELTA H ft	SEPARATE STABILITY BERMS WIDTHS, ft U/S	D/S	HEIGHTS, ft U/S	D/S
2.50	2.50	10.0	0.0	0.00	0.00	0.00	0.00	0.00

DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK = 10.
VOLUME FACTOR = 48.3429

0.0000	0.0300	0.1000	0.1900	0.3100
0.4700	0.6600	0.8200	0.9300	0.9900
1.0000	0.9900	0.9300	0.8600	0.7800
0.6800	0.5600	0.4600	0.3900	0.3300
0.2800	0.2410	0.2070	0.1740	0.1470
0.1260	0.1070	0.0910	0.0770	0.0660

0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

EXISTING NATURAL SURFACE AT AUXILIARY SPILLWAY SITE - X,Y COORDINATES:

0.	525.00
84.	529.30
124.	530.70
139.	531.00
148.	531.00
156.	530.90
218.	529.70
244.	529.10
342.	527.80
391.	527.20
418.	527.10
475.	526.20
486.	525.90
505.	524.70
511.	523.80
542.	512.50
570.	505.60
600.	501.00
672.	496.00

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.003	0.004	0.005
0.007	0.008	0.009	0.011	0.012
0.014	0.015	0.017	0.018	0.020
0.021	0.023	0.025	0.026	0.028
0.030	0.031	0.033	0.035	0.037
0.040	0.044	0.047	0.051	0.055
0.059	0.063	0.067	0.072	0.077
0.081	0.087	0.092	0.097	0.103
0.109	0.115	0.122	0.128	0.135
0.143	0.150	0.158	0.166	0.175
0.185	0.197	0.211	0.227	0.245

0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948
0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975
0.978	0.980	0.982	0.984	0.986
0.988	0.990	0.992	0.994	0.996
0.998	1.000			

1SITES --
XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= pl
TIME 09:05:44 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935
221.	0.9938	0.9942	0.9945	0.9949	0.9952	0.9956	0.9959	0.9962	0.9966	0.9969

231. 0.9972 0.9975 0.9978 0.9982 0.9985 0.9988 0.9991 0.9994 0.9997 1.0000

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 4.90 IN 10-DAY = 5.78 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 54. CN 1-DAY = 72.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12433.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
NRCS-PSH 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.56 FT 475.3 ACFT 110.54 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.43 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 80.56 CFS, ELEV = 524.27 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	528.00	216.46	216.46	0.00	1596.73	0.00
7	530.57	221.31	221.31	0.00	2515.53	0.00
8	533.14	226.06	226.06	0.00	3508.90	0.00
9	535.72	230.72	230.72	0.00	4572.12	0.00
10	538.29	235.27	235.27	0.00	5720.34	0.00

11	540.86	239.75	239.75	0.00	6957.10	0.00
12	543.43	244.14	244.14	0.00	8280.12	0.00
13	546.00	248.45	248.45	0.00	9678.13	0.00

```
1SITES -----------------------------------------------------------------------
XEQ 04/06/2020        Piney Run Dam          WSID= TR6024
VER 2005.1.8          Piney Run Dam          SUBW= pl
TIME 09:05:44    SITE = D1       PASS=   1   PART=   3


AUX. CREST    531.22 FT   2758.5 ACFT    0.00 AC    222.5 CFS

  PS STORAGE   2758.5 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV    524.27 FT    383.6 ACFT    0.00 AC    80.6 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH    D=  24.00 HR   P= 14.95 IN    Q= 11.12 IN     DA=  10.56 SM
         TC=   2.49 HR  CN=  72.00    VOL=   6261.5 ACFT

  PEAK =    20911.3 CFS, AT   16.6 HRS.

NRCS-FBH    D=  24.00 HR   P= 33.78 IN    Q= 29.52 IN     DA=  10.56 SM
         TC=   2.49 HR  CN=  72.00    VOL=  16627.6 ACFT

  PEAK =    52564.4 CFS, AT   16.6 HRS.
         AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (  531.00) AND AUXILIARY
           CREST (  531.22) ELEVATION Do NOT MATCH.  MAXIMUM AUX. SURFACE
           PROFILE ELEVATION USED IN WSPVRT PROCEDURE.


*******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.
```

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.16	212.91	212.91	0.00	979.80	0.00
7	526.88	214.31	214.31	0.00	1221.68	0.00
8	527.60	215.70	215.70	0.00	1463.55	0.00
9	528.33	217.08	217.08	0.00	1711.98	0.00
10	529.05	218.46	218.46	0.00	1968.34	0.00
11	529.78	219.82	219.82	0.00	2224.70	0.00
12	530.50	221.18	221.18	0.00	2488.57	0.00
13	531.22	222.53	222.53	0.00	2758.48	0.00

14	531.96	752.76	223.89	528.87	3039.93	0.00
15	532.70	1613.64	225.25	1388.39	3333.01	0.00
16	534.03	3754.07	227.68	3526.39	3862.35	0.00
17	535.66	7335.96	230.61	7105.35	4547.44	0.00
18	538.61	16188.71	235.85	15952.86	5873.95	0.00
19	542.31	30173.18	242.23	29930.95	7688.31	0.00
20	546.00	47455.33	248.45	47206.88	9678.00	0.00

****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE +	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	84.	-5.1	0.040	**	**	**	INLET
2	84.	124.	-3.5	0.040	**	**	**	INLET
3	124.	139.	-1.9	0.040	**	**	**	INLET
4	139.	148.	0.0	0.040	**	**	**	CREST
5	148.	156.	1.2	0.040	0.87	1	1.0	EXIT !
6	156.	218.	1.9	0.040	0.87	1	1.0	EXIT
7	218.	244.	2.4	0.040	0.87	1	1.0	EXIT
8	244.	342.	1.3	0.040	0.87	1	1.0	EXIT
9	342.	391.	1.2	0.040	0.87	1	1.0	EXIT
10	391.	418.	0.4	0.040	0.87	1	1.0	EXIT
11	418.	475.	1.6	0.040	0.87	1	1.0	EXIT
12	475.	486.	2.9	0.040	0.87	1	1.0	EXIT
13	486.	505.	6.1	0.040	0.87	1	1.0	EXIT
14	505.	511.	14.8	0.100	0.50	2	5.0	exit
15	511.	542.	37.3	0.100	0.50	2	5.0	exit
16	542.	570.	24.2	0.100	0.50	2	5.0	exit
17	570.	600.	15.6	0.100	0.50	2	5.0	exit
18	600.	672.	6.9	0.100	0.50	2	5.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
+ The minimum maintenance code value of 2 is used in INTEGRITY computations (the program changes values of 1 to 2 during computation).
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 5 used in computing exit channel velocities.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	535.65	4543.1	0.0	4.42	1784.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	231.	7083.	7313.

AUXILIARY	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
SPILLWAY ---	2.90	9.51	0.017	0.022

AUXILIARY SPILLWAY DURATION FLOW = 20.7 HOURS

EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY= 8.6 FT/SEC
EXIT SLOPE = 0.012 FT/FT
FLOW DEPTH = 3.2 FT
****

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
Aux. Spillway Discharge = 7083. cfs; Bottom Width = 249. ft

REACH	FROM	TO	SLOPE	MANNING`S	VELOCITY	TOTAL STRESS	EFFECTIVE STRESS	
NO.	STA	STA	%	n	ft/s	lb/ft^2	lb/ft^2	
5	148.	156.	1.18	0.040	8.55	2.36	0.047	
6	156.	218.	1.93	0.040	9.96	3.34	0.066	
7	218.	244.	2.36	0.040	10.60	3.85	0.076	
8	244.	342.	1.33	0.040	8.87	2.56	0.051	
9	342.	391.	1.22	0.040	8.65	2.42	0.048	
10	391.	418.	0.37	0.040	5.95	1.04	0.020	
11	418.	475.	1.58	0.040	9.36	2.90	0.057	
12	475.	486.	2.91	0.040	11.30	4.45	0.088	
13	486.	505.	6.12	0.040	14.18	7.50	0.148	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	543.00	8051.9	0.0	11.77	5293.4

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	243.	33088.	33331.

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	7.94	15.37	0.012	0.016

INTEGRITY ANALYSIS - REACH SURFACE PERFORMANCE SUMMARY
(The auxiliary spillway began flow at time = 14.7 hours
and peaked at time = 17.8 hours.)

REACH 5: FROM STATION 148. TO 156. ON 1.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 18.0 hours.

REACH 6: FROM STATION 156. TO 218. ON 1.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 7: FROM STATION 218. TO 244. ON 2.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 8: FROM STATION 244. TO 342. ON 1.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 9: FROM STATION 342. TO 391. ON 1.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.3 hours.

REACH 10: FROM STATION 391. TO 418. ON 0.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 18.0 hours.

REACH 11: FROM STATION 418. TO 475. ON 1.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.0 hours.

REACH 12: FROM STATION 475. TO 486. ON 2.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 13: FROM STATION 486. TO 505. ON 6.1% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.2 hours.

REACH 14: FROM STATION 505. TO 511. ON 14.8% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.3 hours.

REACH 15: FROM STATION 511. TO 542. ON 37.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 16: FROM STATION 542. TO 570. ON 24.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 17: FROM STATION 570. TO 600. ON 15.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 18: FROM STATION 600. TO 672. ON 6.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.9 hours.

INTEGRITY ANALYSIS - HEADCUT EROSION DAMAGE SUMMARY

The headcut BREACHED the spillway crest at
time equal approximately 18.3 hours.
Computations terminated at that point!

```
    The most upstream headcut began at station    156.
    and progressed upstream to station    139.
    The final height of the headcut was   11.6 ft.

    The headcut having the maximum final overfall height began
    at station    518. and progressed upstream to station   343.
    The final height of the headcut was   31.8 ft.

   THE HYDROGRAPH WAS NOT ADJUSTED FOR THE EFFECTS OF EROSION.

              DURATION    ATTACK   DIST. FROM MOST U/S
                FLOW      OE/B    HEADCUT TO U/S EDGE
   AUXILIARY        HRS     ACFT/FT     AUX. CREST, FT
   SPILLWAY----     24.8      55.0        >>>BREACH<<<
                                 Depth =   11.6 ft

   EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY=  15.2 FT/SEC
                           EXIT SLOPE  = 0.012 FT/FT
                           FLOW DEPTH  =   8.0 FT
-------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =       222.48 CFS  at  127.33 hrs.,  Location Point

 Inflow Hyd 1 SDH-Peak =      7313.36 CFS  at   18.84 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =     33331.38 CFS  at   17.66 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------

 TR6024       Piney Run Dam

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      3 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************



 SITES.....COMPUTATIONS COMPLETE


                    SUMMARY TABLE  1        SITES VERSION 2005.1.8
                   ----------------              DATED 01/01/2005


 WATERSHED ID                  RUN DATE                    RUN TIME
 ------------                 --------                  --------
 TR6024                       04/06/2020                  09:05:44

 >>>   SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
```

```
   ID    ID    (SQ MI)   NO.    (HRS)  (SQ MI)  DESIGN   CLASS
  -----  ----  --------  -----  ----  -------  -----  -----
   D1     pl     10.56    72.   2.49    10.56   TR60    C

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.   EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV   WIDTH   HP    ELEV   VOL.  DIST.    VEL.    HYD
    (IN/FT)   (FT)    (FT)  (FT)    (FT)   (CY)  (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
  1   36.0    531.2   249.0  11.8    543.0      0.<BREACH>   15.2  NRCS-FBH


*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.



SITES.......SUMMARY TABLE 1 COMPLETED.


              NRCS  SITES    VERSION 2005.1.8  ,01/01/2005
                    TR6024   FILES

INPUT  = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run
Integrity\ASW24_Inside_LeastErodible.D2C
OUTPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run
Integrity\ASW24_Inside_LeastErodible.OUT
       DATED 04/06/2020 09:05:44

                   GRAPHICS FILES GENERATED

OPTION "L"  = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run
Integrity\ASW24_Inside_LeastErodible.DRG DATED 04/06/2020 09:05:44

OPTION "P"  = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run
Integrity\ASW24_Inside_LeastErodible.DHY DATED 04/06/2020 09:05:44

OPTION "E"  = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run
Integrity\ASW24_Inside_LeastErodible.DEM DATED 04/06/2020 09:05:44

AUX.GRAPHICS = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run
Integrity\ASW24_Inside_LeastErodible.DG* DATED 04/06/2020 09:05:44
```

24 Hour Existing Conditions PMF – Centerline Profile – Sensitivity Analysis

```
********************************************************************************
SITES XEQ 03/31/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
    VER 2005.1.8           (USER MANUAL - DATED DECEMBER 2005)
    TIME 14:42:39

************************* 80-80 LIST OF INPUT Data ***************************

SITES     01/01/2005TR6024    Piney Run Dam              10.56     C3
SAVMOV    0   101
SAVMOV    101  1                              1
*        Piney Run Watershed Study
*        Piney Run Dam (MD Dam No. 139, NID MD000139)
*        Sykesville, Maryland
*        Stability Design Hydrograph (SDH) and Freeboard Hydrograph
*        AECOM March 2020
STRUCTURE D1       Piney Run Dam
          523                  0
          524                  298
          526                  928
          528                  1596
          530                  2304
          531                  2673
          532                  3054
          534                  3849
          536                  4692
          538                  5585
          540                  6529
          542                  7527
          544                  8581
          546                  9678
ENDTABLE
WSDATA    2C 01     72       10.56     2.49            6.05
BASEFLOW         1
RAINTABLE HMR24     24       24-Hour Duration Distribution (HMR-52)
          0.000   0.001   0.003   0.004   0.005
          0.007   0.008   0.009   0.011   0.012
          0.014   0.015   0.017   0.018   0.020
          0.021   0.023   0.025   0.026   0.028
          0.030   0.031   0.033   0.035   0.037
          0.040   0.044   0.047   0.051   0.055
          0.059   0.063   0.067   0.072   0.077
          0.081   0.087   0.092   0.097   0.103
          0.109   0.115   0.122   0.128   0.135
          0.143   0.150   0.158   0.166   0.175
          0.185   0.197   0.211   0.227   0.245
          0.266   0.289   0.314   0.343   0.400
          0.523   0.656   0.754   0.784   0.811
          0.835   0.857   0.876   0.894   0.908
          0.921   0.933   0.942   0.945   0.948
          0.952   0.955   0.957   0.960   0.963
          0.966   0.968   0.971   0.973   0.975
          0.978   0.980   0.982   0.984   0.986
          0.988   0.990   0.992   0.994   0.996
          0.998   1.000
ENDTABLE
PDIRECT   1.47     8.3      12.2     15.00     33.90
```

```
POOLDATA  ELEV     523.0    523.0    523.0    540.5    496      SC
PSINLET          0.7     18
PSDATA   1       303     36              0.013    471.3
ASSPRFL  41      0.5             Inside Edg
       0.0      525.5    46.8     526.1    237.0    530.2
       266.0    531.3    324.2    531.3    393.6    529.5
       443.9    528.5    582.6    527.0    634.5    526.3
       656.0    525.6    702.5    508.6    728.1    504.0
       763.4    500.4    778.7    499.4    780.7    496.0
       860.0    494.6    973.6    489.1    1000.0   481.9
       1324.0   468.0
ENDTABLE
ASSURFACE 41      656      0.02
       0        656      0.04     0.87     1        1
       656      1122     0.10     0.5      2        5
ENDTABLE
ASDATA   41                    2.8                    1
BTMWIDTH  FEET     249
ASMATERIAL
       1        5        0.2      5        115      0.2
       2        5        0.2      5        115      0.5
       3        20       0.35     20       120      0.3
       4        0        60       0        185      2000
ENDTABLE
ASCOORD   1      SM-1     N
       0.0      525.5    46.8     526.1    237.0    530.2
       266.0    531.3    324.2    531.3    393.6    529.5
       443.9    528.5    582.6    527.0    634.5    526.3
ENDTABLE
ASCOORD   2      SM-2
       0.0      519.5    46.8     520.1    393.6    525.5
       634.5    508.3    702.5    490.6    763.4    489
       1000.0   480      1324.0   466
ENDTABLE
ASCOORD   3      GM
       634.5    526.3    656.0    525.6    702.5    508.6
       728.1    504.0    763.4    500.4    778.7    499.4
       780.7    496.0    860.0    494.6    973.6    489.1
       1000.0   481.9    1324.0   468.0
ENDTABLE
ASCOORD   4      MICASCHIST
       0.0      488.0    46.8     488.6    237.0    492.7
       266.0    493.8    324.2    493.8    393.6    492.0
       634.5    490.3    702.5    485      1000     475
       1324.0   465
ENDTABLE
GRAPHICS  I
GO,DESIGN LC       HMR24    24
SAVMOV   2   101  1               D1
ENDJOB

*****************************************************************************

1SITES XEQ 03/31/2020 ------------- COMMENT PAGE ------------------------------
    VER 2005.1.8              Piney Run Dam              WSID = TR6024


Piney Run Watershed Study
```

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph

AECOM March 2020

***** MESSAGE - DEFAULT TOPSOIL FILL MATERIAL PARAMETERS USED.

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO 531.30
FROM THE ASSPRFL RECORDS.

***** WARNING - ELEVATION VALLEY FLOOR 496.00 IS HIGHER THAN HIGHEST POINT
493.80 ON LOWEST MATERIAL IN THE ASCOORD TABLE.

```
1SITES -------------------------------------------------------------------------
XEQ 03/31/2020        Piney Run Dam          WSID= TR6024
VER 2005.1.8          Piney Run Dam          SUBW= 01
TIME 14:42:39     SITE = D1       PASS=  1   PART=  1
```

********************* MATERIAL PROPERTIES ****************************

MATERIAL	PI	DRY DENSITY lbs/CuFt	Kh	PERCENT CLAY	DETACH. RATE (Ft/H)/(lb/SqFt)	REP. DIAMETER inches
SM-1	5.	115.	0.20	5.0	--	0.20000
SM-2	5.	115.	0.50	5.0	--	0.20000
GM	20.	120.	0.30	20.0	--	0.35000
MICASCHIST	0.	185.	2000.00	0.0	--	60.00000
TS_FILL	0.	100.	0.05	0.0	--	0.05000
GEN_FILL	5.	115.	0.20	5.0	--	0.20000

*************************** BASIC Data *********************************

HUMID- SUBHUMID CLIMATE AREA DESIGN CLASS C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

PRECIP. -	P-PS,1-DAY	P-PS,10-DAY	P-SD	P-FB
	8.30	12.20	15.00	33.90

WSDATA -	CN	DA-SM	TC/L	-/H	QRF
	72.00	10.56	2.49	0.00	6.05

SITEDATA-	PERM POOL	CREST PS	FP SED	VALLEY FL	378?
	523.00	523.00	523.00	496.00	NO

BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE
1.00	0.00	0.00	DESIGN

PSDATA -	NO. COND	COND L	DIA/W	-/H
	1.00	303.00	36.00	0.00

```
      PS N       KE      WEIR L      TW EL
     0.013      0.70      18.00      471.30

    2ND STG      ORF H       ORF L     START AUX.
      0.00       0.00       0.00       0.00

ASCRESTS -   AUX.1      AUX.2      AUX.3      AUX.4      AUX.5
          531.30      0.00      0.00      0.00      0.00

AUX.Data -  REF.NO.   RETARD. Ci   TIE STATION   INLET LENGTH
           41       0.00      324.20          0

AUX.Data - INLET N    SIDE SLOPE     EXIT N    EXIT SLOPE    ACTUAL AUX?
        0.040       2.80      0.040      0.026        NO

BTM WIDTH -   BW1       BW2       BW3       BW4       BW5
  ft      249.00      0.00      0.00      0.00      0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************    DETAILED LIST OF BASIC Data    *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS   SEPARATE STABILITY BERMS
  RATIOS     WIDTH     U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
 U/S  D/S      ft          ft        ft       U/S   D/S   U/S   D/S
 2.50 2.50     10.0         0.0       0.00      0.00  0.00  0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

   0.0000    0.0300    0.1000    0.1900    0.3100
   0.4700    0.6600    0.8200    0.9300    0.9900
   1.0000    0.9900    0.9300    0.8600    0.7800
   0.6800    0.5600    0.4600    0.3900    0.3300
   0.2800    0.2410    0.2070    0.1740    0.1470
   0.1260    0.1070    0.0910    0.0770    0.0660
```

0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

EXISTING NATURAL SURFACE AT AUXILIARY SPILLWAY SITE - X,Y COORDINATES:

0.	525.50
47.	526.10
237.	530.20
266.	531.30
324.	531.30
394.	529.50
444.	528.50
583.	527.00
634.	526.30
656.	525.60
702.	508.60
728.	504.00
763.	500.40
779.	499.40
781.	496.00

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.003	0.004	0.005
0.007	0.008	0.009	0.011	0.012
0.014	0.015	0.017	0.018	0.020
0.021	0.023	0.025	0.026	0.028
0.030	0.031	0.033	0.035	0.037
0.040	0.044	0.047	0.051	0.055
0.059	0.063	0.067	0.072	0.077
0.081	0.087	0.092	0.097	0.103
0.109	0.115	0.122	0.128	0.135
0.143	0.150	0.158	0.166	0.175
0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948

0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975
0.978	0.980	0.982	0.984	0.986
0.988	0.990	0.992	0.994	0.996
0.998	1.000			

1SITES ---
XEQ 03/31/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 14:42:39 SITE = D1 PASS= 1 PART= 2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF 10.6 SQ. MILES.

DESIGN 0.99647 PS-1 DAY 0.99154 PS-10 DAY 0.99866.

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

Principal Spillway Runoff Distribution

Hour	1	2	3	4	5	6	7	8	9	10
1.	0.0003	0.0006	0.0009	0.0012	0.0015	0.0018	0.0022	0.0025	0.0028	0.0031
11.	0.0035	0.0038	0.0041	0.0045	0.0048	0.0051	0.0055	0.0058	0.0062	0.0065
21.	0.0069	0.0073	0.0076	0.0080	0.0084	0.0087	0.0091	0.0095	0.0099	0.0103
31.	0.0107	0.0111	0.0115	0.0119	0.0123	0.0127	0.0131	0.0136	0.0140	0.0144
41.	0.0149	0.0153	0.0158	0.0162	0.0167	0.0172	0.0176	0.0181	0.0186	0.0191
51.	0.0196	0.0201	0.0206	0.0212	0.0217	0.0222	0.0228	0.0233	0.0239	0.0244
61.	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	0.0293	0.0300	0.0307
71.	0.0314	0.0321	0.0328	0.0335	0.0343	0.0350	0.0358	0.0366	0.0374	0.0382
81.	0.0391	0.0399	0.0408	0.0417	0.0427	0.0436	0.0446	0.0456	0.0467	0.0478
91.	0.0489	0.0500	0.0512	0.0524	0.0537	0.0550	0.0564	0.0579	0.0594	0.0609
101.	0.0626	0.0643	0.0661	0.0680	0.0701	0.0722	0.0745	0.0770	0.0797	0.0827
111.	0.0859	0.0895	0.0936	0.0983	0.1037	0.1104	0.1190	0.1311	0.1521	0.8256
121.	0.8602	0.8754	0.8854	0.8929	0.8990	0.9040	0.9083	0.9122	0.9156	0.9187
131.	0.9215	0.9241	0.9265	0.9287	0.9308	0.9328	0.9347	0.9364	0.9381	0.9397
141.	0.9413	0.9427	0.9441	0.9455	0.9468	0.9480	0.9492	0.9504	0.9515	0.9526
151.	0.9537	0.9547	0.9557	0.9567	0.9577	0.9586	0.9595	0.9604	0.9612	0.9621
161.	0.9629	0.9637	0.9645	0.9652	0.9660	0.9667	0.9674	0.9681	0.9688	0.9695
171.	0.9702	0.9708	0.9715	0.9721	0.9727	0.9733	0.9739	0.9745	0.9751	0.9757
181.	0.9763	0.9768	0.9774	0.9779	0.9784	0.9790	0.9795	0.9800	0.9805	0.9810
191.	0.9815	0.9820	0.9824	0.9829	0.9834	0.9838	0.9843	0.9847	0.9852	0.9856
201.	0.9861	0.9865	0.9869	0.9873	0.9878	0.9882	0.9886	0.9890	0.9894	0.9898
211.	0.9901	0.9905	0.9909	0.9913	0.9917	0.9920	0.9924	0.9928	0.9931	0.9935
221.	0.9938	0.9942	0.9945	0.9949	0.9952	0.9956	0.9959	0.9962	0.9966	0.9969
231.	0.9972	0.9975	0.9978	0.9982	0.9985	0.9988	0.9991	0.9994	0.9997	1.0000

PERM POOL 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

CREST PS 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 4.90 IN 10-DAY = 5.78 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 54. CN 1-DAY = 72.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12433.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
NRCS-PSH 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.56 FT 475.3 ACFT 110.54 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.43 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 80.56 CFS, ELEV = 524.27 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
	FULL CONDUIT FLOW, ELEV = 525.43 FT					
5	525.43	211.49	211.49	0.00	748.74	0.00
6	528.00	216.46	216.46	0.00	1596.73	0.00
7	530.57	221.31	221.31	0.00	2515.53	0.00
8	533.14	226.06	226.06	0.00	3508.90	0.00
9	535.72	230.72	230.72	0.00	4572.12	0.00
10	538.29	235.27	235.27	0.00	5720.34	0.00
11	540.86	239.75	239.75	0.00	6957.10	0.00
12	543.43	244.14	244.14	0.00	8280.12	0.00
13	546.00	248.45	248.45	0.00	9678.13	0.00

```
1SITES ------------------------------------------------------------------------
XEQ 03/31/2020          Piney Run Dam            WSID= TR6024
VER 2005.1.8            Piney Run Dam            SUBW= 01
TIME 14:42:39      SITE = D1          PASS=    1     PART=   3


AUX. CREST     531.22 FT    2758.5 ACFT     0.00 AC     222.5 CFS

    PS STORAGE   2758.5 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV     524.27 FT     383.6 ACFT     0.00 AC      80.6 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH     D=  24.00 HR    P= 14.95 IN     Q= 11.12 IN      DA=  10.56 SM
          TC=   2.49 HR   CN=  72.00    VOL=   6261.5 ACFT

    PEAK =     20911.3 CFS, AT   16.6 HRS.

NRCS-FBH     D=  24.00 HR    P= 33.78 IN     Q= 29.52 IN      DA=  10.56 SM
          TC=   2.49 HR   CN=  72.00    VOL=  16627.6 ACFT

    PEAK =     52564.4 CFS, AT   16.6 HRS.
           AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (  531.30) AND AUXILIARY
            CREST (  531.22) ELEVATION Do NOT MATCH.  MAXIMUM AUX. SURFACE
            PROFILE ELEVATION USED IN WSPVRT PROCEDURE.


******************************************************************************
RATING TABLE DEVELOPED, SITE = D1   :
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.


RATING TABLE NUMBER  2
     ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
     FEET      CFS       CFS       CFS      AC-FT     ACRE
  1  523.00      0.00      0.00      0.00      0.00      0.00
  2  523.61     26.44     26.44      0.00    181.10      0.00
  3  524.22     74.77     74.77      0.00    365.87      0.00
  4  524.82    137.37    137.37      0.00    557.30      0.00
                              FULL CONDUIT FLOW, ELEV =  525.43 FT
  5  525.43    211.49    211.49      0.00    748.74      0.00
  6  526.16    212.91    212.91      0.00    979.80      0.00
  7  526.88    214.31    214.31      0.00   1221.68      0.00
  8  527.60    215.70    215.70      0.00   1463.55      0.00
  9  528.33    217.08    217.08      0.00   1711.98      0.00
 10  529.05    218.46    218.46      0.00   1968.34      0.00
 11  529.78    219.82    219.82      0.00   2224.70      0.00
 12  530.50    221.18    221.18      0.00   2488.57      0.00
 13  531.22    222.53    222.53      0.00   2758.48      0.00
 14  531.96    421.57    223.89    197.68   3039.93      0.00
 15  532.70   1008.71    225.25    783.46   3333.01      0.00
 16  534.03   2809.03    227.68   2581.35   3862.35      0.00
 17  535.66   5907.52    230.61   5676.91   4547.44      0.00
```

```
18  538.61 14020.81  235.85 13784.97  5873.95   0.00
19  542.31 27110.45  242.23 26868.22  7688.31   0.00
20  546.00 43519.95  248.45 43271.49  9678.00   0.00
**************************************************************************

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH  FROM   TO  SLOPE  RETARDANCE  VEGETAL  MAINT. ROOTING  REACH
       STA    STA        CURVE       COVER    CODE   DEPTH    LOCATION
       (ft)   (ft)  (%)  INDEX@      FACTOR    +     (ft)       *
-----  ----   ----  ------ ---------- ------- -----  ------- --------
  1     0.    47.   -1.3    0.040      **      **     **     INLET
  2    47.   237.   -2.2    0.040      **      **     **     INLET
  3   237.   266.   -3.8    0.040      **      **     **     INLET
  4   266.   324.    0.0    0.040      **      **     **     CREST
  5   324.   394.    2.6    0.040     0.87      1     1.0    EXIT !
  6   394.   444.    2.0    0.040     0.87      1     1.0    EXIT
  7   444.   583.    1.1    0.040     0.87      1     1.0    EXIT
  8   583.   634.    1.3    0.040     0.87      1     1.0    EXIT
  9   634.   656.    3.3    0.040     0.87      1     1.0    EXIT
 10   656.   702.   36.6    0.100     0.50      2     5.0    exit
 11   702.   728.   18.0    0.100     0.50      2     5.0    exit
 12   728.   763.   10.2    0.100     0.50      2     5.0    exit
 13   763.   779.    6.5    0.100     0.50      2     5.0    exit
 14   779.   781.  170.0    0.100     0.50      2     5.0    exit

 @ The program interprets retardance curve index entries of less than 1 as
   Manning's n values.
 + The minimum maintenance code value of 2 is used in INTEGRITY computations
   (the program changes values of 1 to 2 during computation).
 * Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and
   rooting depth for inlet and crest reaches in computations.
 ! Reach   5 used in computing exit channel velocities.
**************************************************************************

ROUTED     BTM WIDTH  MAX ELEV  VOL-MAX  AREA-MAX  AUX.-HP  VOL-AUX.
RESULTS       FT         FT       ACFT      AC        FT      ACFT
NRCS-SDH     249.0     535.98    4683.7     0.0      4.76    1925.2

      PEAK - CFS     Q-PS    Q-AUX.   Q-TOT.
      DISCHARGE =    231.    6510.    6741.

               CRITICAL  CRITICAL   CRITICAL  25% OF Q
                 DEPTH   VELOCITY   SLOPE-Sc     Sc
      AUXILIARY    FT     FT/SEC     FT/FT     FT/FT
      SPILLWAY ---  2.74    9.26      0.017     0.023

      AUXILIARY SPILLWAY DURATION FLOW =     28.1 HOURS

      EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  10.6 FT/SEC
                          EXIT SLOPE  = 0.026 FT/FT
                          FLOW DEPTH  =  2.4 FT
     *****************************************************************

     EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
     (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
      Aux. Spillway Discharge =    6510. cfs;   Bottom Width =   249. ft
```

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2	
5	324.	394.	2.59	0.040	10.55	3.90	0.077	
6	394.	444.	1.99	0.040	9.73	3.24	0.064	
7	444.	583.	1.08	0.040	8.07	2.11	0.042	
8	583.	634.	1.35	0.040	8.63	2.47	0.049	
9	634.	656.	3.26	0.040	11.32	4.58	0.091	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	543.50	8318.0	0.0	12.28	5559.5

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	244.	32059.	32303.

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	7.78	15.22	0.012	0.016

INTEGRITY ANALYSIS - REACH SURFACE PERFORMANCE SUMMARY
(The auxiliary spillway began flow at time = 14.7 hours
and peaked at time = 17.8 hours.)

REACH 5: FROM STATION 324. TO 394. ON 2.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 6: FROM STATION 394. TO 444. ON 2.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 7: FROM STATION 444. TO 583. ON 1.1% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.0 hours.

REACH 8: FROM STATION 583. TO 634. ON 1.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.3 hours.

REACH 9: FROM STATION 634. TO 656. ON 3.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 10: FROM STATION 656. TO 702. ON 36.6% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 11: FROM STATION 702. TO 728. ON 18.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.5 hours.

REACH 12: FROM STATION 728. TO 763. ON 10.2% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.8 hours.

REACH 13: FROM STATION 763. TO 779. ON 6.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.1 hours.

REACH 14: FROM STATION 779. TO 781. ON 170.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.3 hours.

INTEGRITY ANALYSIS - HEADCUT EROSION DAMAGE SUMMARY

The headcut BREACHED the spillway crest at
time equal approximately 19.5 hours.
Computations terminated at that point!

The most upstream headcut began at station 324.
and progressed upstream to station 266.
The final height of the headcut was 17.8 ft.

The headcut having the maximum final overfall height began
at station 444. and progressed upstream to station 266.
The final height of the headcut was 35.3 ft.

THE HYDROGRAPH WAS NOT ADJUSTED FOR THE EFFECTS OF EROSION.

```
              DURATION    ATTACK   DIST. FROM MOST U/S
                FLOW       OE/B    HEADCUT TO U/S EDGE
AUXILIARY        HRS     ACFT/FT     AUX. CREST, FT
SPILLWAY----     32.2      54.4        >>>BREACH<<<
                              Depth =   17.8 ft
```

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 19.3 FT/SEC
EXIT SLOPE = 0.026 FT/FT
FLOW DEPTH = 6.2 FT

Inflow Hyd 1 PSH-Peak = 222.48 CFS at 127.33 hrs., Location Point

Inflow Hyd 1 SDH-Peak = 6740.83 CFS at 19.00 hrs., Location Point

Inflow Hyd 1 FBH-Peak = 32303.33 CFS at 17.66 hrs., Location Point
HYDOUT 1 D1

1SITES....JOB NO. 1 COMPLETE.

TR6024 Piney Run Dam

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

3 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

****

SITES.....COMPUTATIONS COMPLETE

```
                  SUMMARY TABLE  1        SITES VERSION 2005.1.8
                  ----------------             DATED 01/01/2005


WATERSHED ID                RUN DATE                RUN TIME
------------             --------             --------
TR6024                 03/31/2020               14:42:39

>>>  SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
      ID     ID    (SQ MI)    NO.    (HRS)  (SQ MI)  DESIGN   CLASS
     -----  ----  --------  -----  ----  -------  -----  -----
     D1      01      10.56     72.  2.49     10.56    TR60     C

PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.  DIST.     VEL.     HYD
    (IN/FT)   (FT)    (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1   36.0    531.2   249.0  12.3    543.5      0.<BREACH>   19.3  NRCS-FBH
```

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
  HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.8 ,01/01/2005

TR6024 FILES

INPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline_LeastErodible.D2C
OUTPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline_LeastErodible.OUT
DATED 03/31/2020 14:42:39

GRAPHICS FILES GENERATED

OPTION "L" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline_LeastErodible.DRG DATED 03/31/2020 14:42:39

OPTION "P" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline_LeastErodible.DHY DATED 03/31/2020 14:42:39

OPTION "E" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline_LeastErodible.DEM DATED 03/31/2020 14:42:39

AUX.GRAPHICS = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Centerline_LeastErodible.DG* DATED 03/31/2020 14:42:39

24 Hour Existing Conditions PMF – Outside Edge Profile – Sensitivity Analysis

```
*******************************************************************************
SITES XEQ 04/06/2020   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
    VER 2005.1.8           (USER MANUAL - DATED DECEMBER 2005)
    TIME 09:06:52

************************* 80-80 LIST OF INPUT Data ***************************

SITES     01/01/2005TR6024    Piney Run Dam              10.56     C3
SAVMOV    0    101
SAVMOV    101  1                                1
*         Piney Run Watershed Study
*         Piney Run Dam (MD Dam No. 139, NID MD000139)
*         Sykesville, Maryland
*         Stability Design Hydrograph (SDH) and Freeboard Hydrograph
*         AECOM March 2020
STRUCTURE D1        Piney Run Dam
              523                     0
              524                     298
              526                     928
              528                     1596
              530                     2304
              531                     2673
              532                     3054
              534                     3849
              536                     4692
              538                     5585
              540                     6529
              542                     7527
              544                     8581
              546                     9678
ENDTABLE
WSDATA    2C 01     72       10.56     2.49            6.05
BASEFLOW          1
RAINTABLE HMR24     24       24-Hour Duration Distribution (HMR-52)
              0.000    0.001    0.003    0.004    0.005
              0.007    0.008    0.009    0.011    0.012
              0.014    0.015    0.017    0.018    0.020
              0.021    0.023    0.025    0.026    0.028
              0.030    0.031    0.033    0.035    0.037
              0.040    0.044    0.047    0.051    0.055
              0.059    0.063    0.067    0.072    0.077
              0.081    0.087    0.092    0.097    0.103
              0.109    0.115    0.122    0.128    0.135
              0.143    0.150    0.158    0.166    0.175
              0.185    0.197    0.211    0.227    0.245
              0.266    0.289    0.314    0.343    0.400
              0.523    0.656    0.754    0.784    0.811
              0.835    0.857    0.876    0.894    0.908
              0.921    0.933    0.942    0.945    0.948
              0.952    0.955    0.957    0.960    0.963
              0.966    0.968    0.971    0.973    0.975
              0.978    0.980    0.982    0.984    0.986
              0.988    0.990    0.992    0.994    0.996
              0.998    1.000
ENDTABLE
PDIRECT   1.47     8.3      12.2     15.00    33.90
```

```
POOLDATA  ELEV     523.0    523.0    523.0    540.5    496      SC
PSINLET          0.7      18
PSDATA   1       303      36              0.013    471.3
ASSPRFL  41      0.5             Inside Edg
       0.0      525.1    129.7    527.6    250.1    528.7
       399.7    531.3    439.0    531.3    446.2    531.2
       477.8    530.9    536.6    529.7    574.1    528.8
       635.6    528.5    651.8    528.1    750.4    527.1
       793.6    525.8    798.0    525.6    879.6    501.3
       1003.4   498.2    1215.2   489.1    1241.6   481.9
       1565.6   468.0
ENDTABLE
ASSURFACE 41      798      .1
       0       798      0.04     0.87     1       1
       798      1565.6   0.10     0.5      2       5
ENDTABLE
ASDATA   41                     2.8                     1
BTMWIDTH  FEET     249
ASMATERIAL
       1       5       0.3      5       115      0.2
       2       5       0.3      5       115      0.5
       3       0       60       0       185      2000
ENDTABLE
ASCOORD   1      SM-1     N
       0.0      525.1    129.7    527.6    250.1    528.7
       399.7    531.3    439.0    531.3    446.2    531.2
       477.8    530.9    536.6    529.7    574.1    528.8
       635.6    528.5    651.8    528.1    750.4    527.1
       793.6    525.8    798.0    525.6    879.6    501.3
       1003.4   498.2    1215.2   489.1    1241.6   481.9
       1565.6   468.0
ENDTABLE
ASCOORD   2      SM-2
       0.0      523.1    129.7    525.6    250.1    526.7
       399.7    529.3    439.0    529.3    446.2    529.2
       536.6    525      651.8    525.1    793.6    512.8
       879.6    496.3    1003.4   493.2    1215.2   484.1
       1241.6   478.9    1565.6   465.0
ENDTABLE
ASCOORD   3      MICASCHIST
       0.0      489.4    129.7    490.5    250.1    493.1
       399.7    493.1    439.0    493      446.2    492.7
       536.6    491.5    651.8    499.6    793.6    492.8
       879.6    488.3    1003.4   486.2    1241.6   475.9
       1565.6   463.0
ENDTABLE
GRAPHICS  I
GO,DESIGN LC       HMR24    24
SAVMOV   2   101  1               D1
ENDJOB

*******************************************************************************

1SITES XEQ 04/06/2020 ------------- COMMENT PAGE -------------------------------
     VER 2005.1.8              Piney Run Dam              WSID = TR6024


Piney Run Watershed Study
```

Piney Run Dam (MD Dam No. 139, NID MD000139)

Sykesville, Maryland

Stability Design Hydrograph (SDH) and Freeboard Hydrograph

AECOM March 2020

***** MESSAGE - DEFAULT TOPSOIL FILL MATERIAL PARAMETERS USED.

***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO 531.30
FROM THE ASSPRFL RECORDS.

```
1SITES -------------------------------------------------------------------------
XEQ 04/06/2020        Piney Run Dam          WSID= TR6024
VER 2005.1.8          Piney Run Dam          SUBW= 01
TIME 09:06:52     SITE = D1       PASS=  1   PART=  1



*********************   MATERIAL PROPERTIES   ***************************
                 DRY             PERCENT    DETACH.    REP.
   MATERIAL    PI  DENSITY    Kh     CLAY      RATE    DIAMETER
               lbs/CuFt              (Ft/H)/(lb/SqFt)  inches
   SM-1        5.    115.    0.20     5.0       --     0.30000
   SM-2        5.    115.    0.50     5.0       --     0.30000
   MICASCHIST  0.    185.  2000.00    0.0       --    60.00000
   TS_FILL     0.    100.    0.05     0.0       --     0.05000
   GEN_FILL    5.    115.    0.20     5.0       --     0.30000

***************************  BASIC Data  *********************************
HUMID- SUBHUMID CLIMATE AREA              DESIGN CLASS  C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION AUX. -24-Hour Duration Distribution (HMR-52)

PRECIP. - P-PS,1-DAY   P-PS,10-DAY    P-SD      P-FB
          8.30      12.20      15.00     33.90

WSDATA -    CN       DA-SM      TC/L       -/H       QRF
         72.00      10.56      2.49      0.00      6.05

SITEDATA- PERM POOL   CREST PS    FP SED    VALLEY FL    378?
         523.00     523.00     523.00     496.00       NO

       BASEFLOW    INITIAL EL   EXTRA VOL   SITE TYPE
          1.00       0.00        0.00      DESIGN

PSDATA -  NO. COND     COND L      DIA/W       -/H
          1.00     303.00      36.00       0.00

          PS N       KE      WEIR L     TW EL
         0.013      0.70     18.00     471.30

        2ND STG      ORF H       ORF L    START AUX.
```

```
      0.00      0.00      0.00      0.00

ASCRESTS -   AUX.1     AUX.2     AUX.3     AUX.4     AUX.5
      531.30      0.00      0.00      0.00      0.00

AUX.Data -  REF.NO.   RETARD. Ci   TIE STATION   INLET LENGTH
        41      0.00    439.00         0

AUX.Data - INLET N    SIDE SLOPE     EXIT N    EXIT SLOPE    ACTUAL AUX?
      0.040      2.80      0.040      0.014        NO

BTM WIDTH -   BW1       BW2       BW3       BW4       BW5
 ft     249.00      0.00      0.00      0.00      0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************    DETAILED LIST OF BASIC Data    *********************
WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT.......... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS   SEPARATE STABILITY BERMS
  RATIOS     WIDTH     U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
 U/S  D/S      ft           ft         ft       U/S   D/S   U/S   D/S
 2.50 2.50    10.0          0.0       0.00      0.00  0.00  0.00  0.00


DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
VOLUME FACTOR =  48.3429

    0.0000    0.0300    0.1000    0.1900    0.3100
    0.4700    0.6600    0.8200    0.9300    0.9900
    1.0000    0.9900    0.9300    0.8600    0.7800
    0.6800    0.5600    0.4600    0.3900    0.3300
    0.2800    0.2410    0.2070    0.1740    0.1470
    0.1260    0.1070    0.0910    0.0770    0.0660
    0.0550    0.0470    0.0400    0.0340    0.0290
    0.0250    0.0210    0.0180    0.0150    0.0130
    0.0110    0.0090    0.0080    0.0070    0.0060
    0.0050    0.0040    0.0030    0.0020    0.0010
```

0.0000

EXISTING NATURAL SURFACE AT AUXILIARY SPILLWAY SITE - X,Y COORDINATES:

0.	525.10
130.	527.60
250.	528.70
400.	531.30
439.	531.30
446.	531.20
478.	530.90
537.	529.70
574.	528.80
636.	528.50
652.	528.10
750.	527.10
794.	525.80
798.	525.60
880.	501.30
1003.	498.20
1055.	496.00

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24-Hour Duration Distribution (HMR-52)
IDENTIFICATION NAME IS HMR24 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.003	0.004	0.005
0.007	0.008	0.009	0.011	0.012
0.014	0.015	0.017	0.018	0.020
0.021	0.023	0.025	0.026	0.028
0.030	0.031	0.033	0.035	0.037
0.040	0.044	0.047	0.051	0.055
0.059	0.063	0.067	0.072	0.077
0.081	0.087	0.092	0.097	0.103
0.109	0.115	0.122	0.128	0.135
0.143	0.150	0.158	0.166	0.175
0.185	0.197	0.211	0.227	0.245
0.266	0.289	0.314	0.343	0.400
0.523	0.656	0.754	0.784	0.811
0.835	0.857	0.876	0.894	0.908
0.921	0.933	0.942	0.945	0.948
0.952	0.955	0.957	0.960	0.963
0.966	0.968	0.971	0.973	0.975

```
0.978 0.980 0.982 0.984 0.986
0.988 0.990 0.992 0.994 0.996
0.998 1.000

1SITES ------------------------------------------------------------------------
XEQ 04/06/2020        Piney Run Dam          WSID= TR6024
VER 2005.1.8          Piney Run Dam          SUBW= 01
TIME 09:06:52     SITE = D1       PASS=  1   PART=  2

***** MESSAGE - AREAL CORRECTIONS BASED ON DRAINAGE AREA OF   10.6 SQ. MILES.

      DESIGN 0.99647    PS-1 DAY 0.99154    PS-10 DAY 0.99866.

PERM POOL    523.00 FT    0.0 ACFT    0.00 AC    0.0 CFS

CREST PS    523.00 FT    0.0 ACFT    0.00 AC    0.0 CFS

SED ACCUM    523.00 FT    0.0 ACFT    0.00 AC    0.0 CFS

BASEFLOW    523.24 FT    72.3 ACFT    0.00 AC    10.6 CFS

START ELEV    523.24 FT    72.3 ACFT    0.00 AC    10.6 CFS

        Principal Spillway Runoff Distribution

Hour   1    2    3    4    5    6    7    8    9    10

  1.  0.0003 0.0006 0.0009 0.0012 0.0015 0.0018 0.0022 0.0025 0.0028 0.0031
 11.  0.0035 0.0038 0.0041 0.0045 0.0048 0.0051 0.0055 0.0058 0.0062 0.0065
 21.  0.0069 0.0073 0.0076 0.0080 0.0084 0.0087 0.0091 0.0095 0.0099 0.0103
 31.  0.0107 0.0111 0.0115 0.0119 0.0123 0.0127 0.0131 0.0136 0.0140 0.0144
 41.  0.0149 0.0153 0.0158 0.0162 0.0167 0.0172 0.0176 0.0181 0.0186 0.0191
 51.  0.0196 0.0201 0.0206 0.0212 0.0217 0.0222 0.0228 0.0233 0.0239 0.0244
 61.  0.0250 0.0256 0.0262 0.0268 0.0274 0.0281 0.0287 0.0293 0.0300 0.0307
 71.  0.0314 0.0321 0.0328 0.0335 0.0343 0.0350 0.0358 0.0366 0.0374 0.0382
 81.  0.0391 0.0399 0.0408 0.0417 0.0427 0.0436 0.0446 0.0456 0.0467 0.0478
 91.  0.0489 0.0500 0.0512 0.0524 0.0537 0.0550 0.0564 0.0579 0.0594 0.0609
101.  0.0626 0.0643 0.0661 0.0680 0.0701 0.0722 0.0745 0.0770 0.0797 0.0827
111.  0.0859 0.0895 0.0936 0.0983 0.1037 0.1104 0.1190 0.1311 0.1521 0.8256
121.  0.8602 0.8754 0.8854 0.8929 0.8990 0.9040 0.9083 0.9122 0.9156 0.9187
131.  0.9215 0.9241 0.9265 0.9287 0.9308 0.9328 0.9347 0.9364 0.9381 0.9397
141.  0.9413 0.9427 0.9441 0.9455 0.9468 0.9480 0.9492 0.9504 0.9515 0.9526
151.  0.9537 0.9547 0.9557 0.9567 0.9577 0.9586 0.9595 0.9604 0.9612 0.9621
161.  0.9629 0.9637 0.9645 0.9652 0.9660 0.9667 0.9674 0.9681 0.9688 0.9695
171.  0.9702 0.9708 0.9715 0.9721 0.9727 0.9733 0.9739 0.9745 0.9751 0.9757
181.  0.9763 0.9768 0.9774 0.9779 0.9784 0.9790 0.9795 0.9800 0.9805 0.9810
191.  0.9815 0.9820 0.9824 0.9829 0.9834 0.9838 0.9843 0.9847 0.9852 0.9856
201.  0.9861 0.9865 0.9869 0.9873 0.9878 0.9882 0.9886 0.9890 0.9894 0.9898
211.  0.9901 0.9905 0.9909 0.9913 0.9917 0.9920 0.9924 0.9928 0.9931 0.9935
221.  0.9938 0.9942 0.9945 0.9949 0.9952 0.9956 0.9959 0.9962 0.9966 0.9969
231.  0.9972 0.9975 0.9978 0.9982 0.9985 0.9988 0.9991 0.9994 0.9997 1.0000

PERM POOL    523.00 FT    0.0 ACFT    0.00 AC    0.0 CFS

CREST PS    523.00 FT    0.0 ACFT    0.00 AC    0.0 CFS
```

SED ACCUM 523.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

START ELEV 523.24 FT 72.3 ACFT 0.00 AC 10.6 CFS

NRCS-PSH RAINFALL 1-DAY = 8.23 IN 10-DAY = 12.18 IN DA = 10.56 SM
RUNOFF 1-DAY = 4.90 IN 10-DAY = 5.78 IN

CLIMATIC INDEX = 1.47 CN 10-DAY = 54. CN 1-DAY = 72.

AREAL CORRECTION 1 DAY =0.9915 AREAL CORRECTION 10 DAY =0.9987
QRF = 63.89 CFS 524.08 FEET, GIVEN Value.

PEAK = 12433.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE	EMAX	VOL-MAX	AMAX	QMAX
NRCS-PSH	531.22 FT	2758.5 ACFT	0.00 AC	222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 524.56 FT 475.3 ACFT 110.54 CFS
CONTROL IS 0.150 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 8.43 DAYS - DRAWDOWN CONTINUING.

TIME LIMIT = 10.00 DAYS; FLOW WAS 80.56 CFS, ELEV = 524.27 FT

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
			FULL CONDUIT FLOW, ELEV = 525.43 FT			
5	525.43	211.49	211.49	0.00	748.74	0.00
6	528.00	216.46	216.46	0.00	1596.73	0.00
7	530.57	221.31	221.31	0.00	2515.53	0.00
8	533.14	226.06	226.06	0.00	3508.90	0.00
9	535.72	230.72	230.72	0.00	4572.12	0.00
10	538.29	235.27	235.27	0.00	5720.34	0.00
11	540.86	239.75	239.75	0.00	6957.10	0.00
12	543.43	244.14	244.14	0.00	8280.12	0.00
13	546.00	248.45	248.45	0.00	9678.13	0.00

1SITES ---

XEQ 04/06/2020 Piney Run Dam WSID= TR6024
VER 2005.1.8 Piney Run Dam SUBW= 01
TIME 09:06:52 SITE = D1 PASS= 1 PART= 3

AUX. CREST 531.22 FT 2758.5 ACFT 0.00 AC 222.5 CFS

PS STORAGE 2758.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 524.27 FT 383.6 ACFT 0.00 AC 80.6 CFS

***** WARNING - AUXILIARY CREST LOWER THAN LOW POINT IN SITE.

NRCS-SDH D= 24.00 HR P= 14.95 IN Q= 11.12 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 6261.5 ACFT

PEAK = 20911.3 CFS, AT 16.6 HRS.

NRCS-FBH D= 24.00 HR P= 33.78 IN Q= 29.52 IN DA= 10.56 SM
TC= 2.49 HR CN= 72.00 VOL= 16627.6 ACFT

PEAK = 52564.4 CFS, AT 16.6 HRS.
AUX. AREAL CORRECTION USED =0.9965

***** WARNING - MAXIMUM AUX. SURFACE PROFILE ELEVATION (531.30) AND AUXILIARY
CREST (531.22) ELEVATION Do NOT MATCH. MAXIMUM AUX. SURFACE
PROFILE ELEVATION USED IN WSPVRT PROCEDURE.

****
RATING TABLE DEVELOPED, SITE = D1 :
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	523.00	0.00	0.00	0.00	0.00	0.00
2	523.61	26.44	26.44	0.00	181.10	0.00
3	524.22	74.77	74.77	0.00	365.87	0.00
4	524.82	137.37	137.37	0.00	557.30	0.00
	FULL CONDUIT FLOW, ELEV = 525.43 FT					
5	525.43	211.49	211.49	0.00	748.74	0.00
6	526.16	212.91	212.91	0.00	979.80	0.00
7	526.88	214.31	214.31	0.00	1221.68	0.00
8	527.60	215.70	215.70	0.00	1463.55	0.00
9	528.33	217.08	217.08	0.00	1711.98	0.00
10	529.05	218.46	218.46	0.00	1968.34	0.00
11	529.78	219.82	219.82	0.00	2224.70	0.00
12	530.50	221.18	221.18	0.00	2488.57	0.00
13	531.22	222.53	222.53	0.00	2758.48	0.00
14	531.96	430.49	223.89	206.59	3039.93	0.00
15	532.70	1013.33	225.25	788.07	3333.01	0.00
16	534.03	2750.89	227.68	2523.21	3862.35	0.00
17	535.66	5744.05	230.61	5513.44	4547.44	0.00
18	538.61	13667.52	235.85	13431.67	5873.95	0.00
19	542.31	26440.28	242.23	26198.05	7688.31	0.00

20 546.00 42516.31 248.45 42267.86 9678.00 0.00
****

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE +	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	130.	-1.9	0.040	**	**	**	INLET
2	130.	250.	-0.9	0.040	**	**	**	INLET
3	250.	400.	-1.7	0.040	**	**	**	INLET
4	400.	439.	0.0	0.040	**	**	**	CREST
5	439.	446.	1.4	0.040	0.87	1	1.0	EXIT !
6	446.	478.	0.9	0.040	0.87	1	1.0	EXIT
7	478.	537.	2.0	0.040	0.87	1	1.0	EXIT
8	537.	574.	2.4	0.040	0.87	1	1.0	EXIT
9	574.	636.	0.5	0.040	0.87	1	1.0	EXIT
10	636.	652.	2.5	0.040	0.87	1	1.0	EXIT
11	652.	750.	1.0	0.040	0.87	1	1.0	EXIT
12	750.	794.	3.0	0.040	0.87	1	1.0	EXIT
13	794.	798.	4.5	0.040	0.87	1	1.0	EXIT
14	798.	880.	29.8	0.100	0.50	2	5.0	exit
15	880.	1003.	2.5	0.100	0.50	2	5.0	exit
16	1003.	1055.	4.3	0.100	0.50	2	5.0	exit

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.
+ The minimum maintenance code value of 2 is used in INTEGRITY computations (the program changes values of 1 to 2 during computation).
* Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.
! Reach 5 used in computing exit channel velocities.
****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	249.0	536.02	4699.5	0.0	4.79	1941.0

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	231.	6421.	6652.

AUXILIARY	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
SPILLWAY ---	2.72	9.22	0.017	0.023

AUXILIARY SPILLWAY DURATION FLOW = 28.1 HOURS

EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY= 8.7 FT/SEC
EXIT SLOPE = 0.014 FT/FT
FLOW DEPTH = 2.9 FT
****

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
Aux. Spillway Discharge = 6421. cfs; Bottom Width = 249. ft

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2	
5	439.	446.	1.39	0.040	8.67	2.50	0.062	
6	446.	478.	0.95	0.040	7.71	1.91	0.047	
7	478.	537.	2.04	0.040	9.75	3.27	0.081	
8	537.	574.	2.40	0.040	10.25	3.67	0.091	
9	574.	636.	0.49	0.040	6.27	1.20	0.030	
10	636.	652.	2.47	0.040	10.34	3.74	0.093	
11	652.	750.	1.01	0.040	7.87	2.00	0.050	
12	750.	794.	3.01	0.040	10.99	4.30	0.106	
13	794.	798.	4.55	0.040	12.46	5.74	0.142	max.

****

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	249.0	543.61	8374.1	0.0	12.38	5615.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	244.	31737.	31981.

AUXILIARY	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
SPILLWAY ---	7.73	15.18	0.012	0.016

INTEGRITY ANALYSIS - REACH SURFACE PERFORMANCE SUMMARY
(The auxiliary spillway began flow at time = 14.7 hours
and peaked at time = 17.8 hours.)

REACH 5: FROM STATION 439. TO 446. ON 1.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.3 hours.

REACH 6: FROM STATION 446. TO 478. ON 0.9% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.5 hours.

REACH 7: FROM STATION 478. TO 537. ON 2.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 17.0 hours.

REACH 8: FROM STATION 537. TO 574. ON 2.4% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 9: FROM STATION 574. TO 636. ON 0.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 10: FROM STATION 636. TO 652. ON 2.5% SLOPE.

Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 11: FROM STATION 652. TO 750. ON 1.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.9 hours.

REACH 12: FROM STATION 750. TO 794. ON 3.0% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.7 hours.

REACH 13: FROM STATION 794. TO 798. ON 4.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.6 hours.

REACH 14: FROM STATION 798. TO 880. ON 29.8% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 15.6 hours.

REACH 15: FROM STATION 880. TO 1003. ON 2.5% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.6 hours.

REACH 16: FROM STATION 1003. TO 1055. ON 4.3% SLOPE.
Vegetal cover failed and concentrated flow developed
at time = 16.4 hours.

INTEGRITY ANALYSIS - HEADCUT EROSION DAMAGE SUMMARY

The headcut BREACHED the spillway crest at
time equal approximately 20.2 hours.
Computations terminated at that point!

The most upstream headcut began at station 439.
and progressed upstream to station 400.
The final height of the headcut was 13.7 ft.

The headcut having the maximum final overfall height began
at station 537. and progressed upstream to station 400.
The final height of the headcut was 35.3 ft.

THE HYDROGRAPH WAS NOT ADJUSTED FOR THE EFFECTS OF EROSION.

	DURATION FLOW HRS	ATTACK OE/B ACFT/FT	DIST. FROM MOST U/S HEADCUT TO U/S EDGE AUX. CREST, FT
AUXILIARY SPILLWAY----	32.2	54.4	>>>BREACH<<< Depth = 13.7 ft

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 15.8 FT/SEC
EXIT SLOPE = 0.014 FT/FT

```
                          FLOW DEPTH  =   7.4 FT
 ------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =       222.48 CFS  at  127.33 hrs.,  Location Point

 Inflow Hyd 1 SDH-Peak =      6652.34 CFS  at   19.00 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =     31980.95 CFS  at   17.66 hrs.,  Location Point
HYDOUT   1     D1

1SITES....JOB NO.  1 COMPLETE.
 ------------------------------------------------------------------------------

 TR6024        Piney Run Dam

     0 SUBWATERSHED(S) ANALYZED.

     1 STRUCTURE(S) ANALYZED.

     3 HYDROGRAPHS ROUTED AT LOWEST SITE.

     0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 ********************************************************************************



 SITES.....COMPUTATIONS COMPLETE


                      SUMMARY TABLE  1         SITES VERSION 2005.1.8
                      ----------------         DATED 01/01/2005


 WATERSHED ID                RUN DATE                   RUN TIME
 ------------                --------                   --------
 TR6024                      04/06/2020                 09:06:52

 >>>  SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
       ID     ID     (SQ MI)    NO.    (HRS)  (SQ MI)   DESIGN   CLASS
      -----  ----   --------   -----   ----   -------   -----    -----
      D1      01      10.56     72.    2.49    10.56    TR60      C

 PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
  NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
      (IN/FT)   (FT)    (FT)   (FT)    (FT)    (CY)   (FT)    (FT/SEC)
 ----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
    1   36.0    531.2   249.0  12.4    543.6       0.<BREACH>   15.8  NRCS-FBH


 *  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
    HYDROGRAPH SHOWN UNDER TYPE HYD.



 SITES.......SUMMARY TABLE 1 COMPLETED.
```

NRCS SITES VERSION 2005.1.8 ,01/01/2005
TR6024 FILES

INPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside_LeastErodible.D2C
OUTPUT = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside_LeastErodible.OUT
DATED 04/06/2020 09:06:52

GRAPHICS FILES GENERATED

OPTION "L" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside_LeastErodible.DRG DATED 04/06/2020 09:06:52

OPTION "P" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside_LeastErodible.DHY DATED 04/06/2020 09:06:52

OPTION "E" = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside_LeastErodible.DEM DATED 04/06/2020 09:06:52

AUX.GRAPHICS = C:\Users\wesley.hollenbach\Desktop\Piney Run\434_Hydrology and Hydraulics\Computations\SITES\Piney Run Integrity\ASW24_Outside_LeastErodible.DG* DATED 04/06/2020 09:06:52

Appendix F – Flood Frequency Routing Downstream Discharge Estimates and Inundation Maps

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
PINEY RUN DAM
REGION: Blue Ridge & Piedmont
area= 10.60:lime = 0.00:forest = 23.50 :Impervious Area= 10.40 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	594.	44.6	2.65	0.1851
1.50	762.	41.2	2.73	0.1720
2.00	1010.	37.8	3.42	0.1588
5.00	1870.	32.1	8.55	0.1360
10.00	2690.	29.8	14.77	0.1267
25.00	4060.	28.8	23.99	0.1226
50.00	5370.	30.0	28.63	0.1275
100.00	6980.	32.0	31.41	0.1357
200.00	8670.	36.0	32.16	0.1514
500.00	11900.	42.3	29.59	0.1761

P R E D I C T I O N I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	447.	791.	388.	910.	295.	1200.	258.	1370.
1.50	584.	993.	513.	1130.	398.	1460.	351.	1660.
2.00	790.	1290.	700.	1450.	554.	1840.	493.	2070.
5.00	1520.	2310.	1370.	2560.	1120.	3130.	1010.	3460.
10.00	2210.	3270.	2010.	3600.	1660.	4330.	1520.	4760.
25.00	3360.	4910.	3060.	5390.	2560.	6450.	2330.	7060.
50.00	4420.	6540.	4010.	7210.	3320.	8700.	3020.	9550.
100.00	5660.	8610.	5110.	9540.	4180.	11700.	3780.	12900.
200.00	6870.	11000.	6120.	12300.	4900.	15400.	4380.	17200.
500.00	9070.	15600.	7940.	17900.	6120.	23100.	5380.	26400.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
SYKESVILLE ROAD (MD 32)
REGION: Blue Ridge & Piedmont
area= 11.20:lime = 0.00:forest = 24.20 :Impervious Area= 10.70 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	614.	44.7	2.64	0.1852
1.50	786.	41.2	2.72	0.1720
2.00	1040.	37.8	3.41	0.1589
5.00	1930.	32.1	8.52	0.1361
10.00	2770.	29.8	14.72	0.1268
25.00	4190.	28.8	23.90	0.1227
50.00	5540.	30.0	28.54	0.1275
100.00	7200.	32.0	31.30	0.1357
200.00	8920.	36.0	32.16	0.1515
500.00	12200.	42.3	29.59	0.1761

P R E D I C T I O N   I N T E R V A L S

Return Period	50 PERCENT lower	50 PERCENT upper	67 PERCENT lower	67 PERCENT upper	90 PERCENT lower	90 PERCENT upper	95 PERCENT lower	95 PERCENT upper
1.25	461.	817.	401.	940.	305.	1240.	266.	1420.
1.50	603.	1030.	529.	1170.	411.	1510.	362.	1710.
2.00	815.	1330.	722.	1500.	571.	1900.	508.	2130.
5.00	1570.	2380.	1410.	2640.	1150.	3230.	1040.	3570.
10.00	2280.	3370.	2070.	3710.	1720.	4470.	1560.	4910.
25.00	3460.	5060.	3160.	5550.	2630.	6650.	2410.	7280.
50.00	4550.	6750.	4130.	7430.	3420.	8970.	3120.	9850.
100.00	5840.	8880.	5270.	9840.	4310.	12000.	3900.	13300.
200.00	7060.	11300.	6290.	12600.	5030.	15800.	4500.	17700.
500.00	9330.	16100.	8160.	18400.	6300.	23800.	5530.	27100.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
BUTTERCUP ROAD
REGION: Blue Ridge & Piedmont
area=   11.70:lime =   0.00:forest = 23.90 :Impervious Area= 11.20 :skew=   0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	640.	44.7	2.61	0.1852
1.50	819.	41.2	2.69	0.1721
2.00	1080.	37.9	3.36	0.1589
5.00	2000.	32.1	8.40	0.1361
10.00	2860.	29.8	14.51	0.1268
25.00	4320.	28.8	23.56	0.1227
50.00	5710.	30.0	28.13	0.1276
100.00	7410.	32.0	30.85	0.1358
200.00	9140.	36.0	32.16	0.1515
500.00	12500.	42.3	29.59	0.1761

P R E D I C T I O N   I N T E R V A L S

Return Period	50 PERCENT lower	50 PERCENT upper	67 PERCENT lower	67 PERCENT upper	90 PERCENT lower	90 PERCENT upper	95 PERCENT lower	95 PERCENT upper
1.25	481.	852.	418.	981.	318.	1290.	278.	1480.
1.50	628.	1070.	551.	1220.	427.	1570.	377.	1780.
2.00	846.	1380.	750.	1560.	593.	1970.	528.	2220.
5.00	1620.	2470.	1460.	2730.	1200.	3340.	1080.	3690.
10.00	2350.	3480.	2140.	3830.	1770.	4620.	1610.	5070.
25.00	3570.	5220.	3250.	5730.	2720.	6860.	2480.	7510.
50.00	4690.	6950.	4260.	7660.	3530.	9240.	3210.	10200.
100.00	6010.	9130.	5420.	10100.	4440.	12400.	4010.	13700.
200.00	7240.	11600.	6450.	13000.	5160.	16200.	4620.	18100.
500.00	9560.	16500.	8360.	18800.	6450.	24400.	5660.	27800.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
SLACKS ROAD
REGION: Blue Ridge & Piedmont
area=   12.40:lime =   0.00:forest = 22.90 :Impervious Area= 12.20 :skew=   0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	687.	44.7	2.53	0.1853
1.50	874.	41.2	2.61	0.1721
2.00	1150.	37.9	3.26	0.1590
5.00	2110.	32.1	8.16	0.1362
10.00	3010.	29.8	14.10	0.1268
25.00	4520.	28.8	22.90	0.1227
50.00	5960.	30.0	27.33	0.1276
100.00	7720.	32.1	29.98	0.1358
200.00	9470.	36.0	32.15	0.1515
500.00	13000.	42.3	29.58	0.1761

P R E D I C T I O N   I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	516.	914.	448.	1050.	341.	1380.	298.	1590.
1.50	670.	1140.	588.	1300.	456.	1680.	402.	1900.
2.00	900.	1470.	798.	1660.	631.	2100.	561.	2360.
5.00	1710.	2600.	1540.	2890.	1260.	3530.	1140.	3900.
10.00	2470.	3660.	2240.	4030.	1860.	4850.	1700.	5330.
25.00	3740.	5460.	3410.	6000.	2840.	7190.	2600.	7870.
50.00	4900.	7260.	4440.	8000.	3680.	9650.	3350.	10600.
100.00	6260.	9520.	5640.	10600.	4620.	12900.	4180.	14300.
200.00	7500.	12000.	6690.	13400.	5350.	16800.	4780.	18800.
500.00	9870.	17000.	8640.	19400.	6660.	25200.	5850.	28700.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
BRANGLES ROAD
REGION: Blue Ridge & Piedmont
area= 15.90:lime = 0.00:forest = 21.70 :Impervious Area= 15.60 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	868.	44.8	2.34	0.1856
1.50	1090.	41.3	2.41	0.1725
2.00	1420.	37.9	3.01	0.1593
5.00	2550.	32.2	7.53	0.1364
10.00	3600.	29.9	13.02	0.1271
25.00	5370.	28.9	21.13	0.1230
50.00	7030.	30.1	25.23	0.1278
100.00	9050.	32.1	27.67	0.1361
200.00	10900.	36.0	32.12	0.1516
500.00	14800.	42.3	29.55	0.1762

P R E D I C T I O N   I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	652.	1160.	566.	1330.	431.	1750.	376.	2010.
1.50	837.	1430.	734.	1620.	570.	2100.	502.	2380.
2.00	1110.	1820.	985.	2050.	779.	2590.	693.	2920.

5.00	2070.	3150.	1870.	3500.	1530.	4270.	1380.	4730.
10.00	2960.	4380.	2690.	4830.	2230.	5820.	2030.	6390.
25.00	4440.	6490.	4050.	7130.	3380.	8540.	3080.	9350.
50.00	5770.	8570.	5240.	9440.	4340.	11400.	3950.	12500.
100.00	7340.	11200.	6620.	12400.	5420.	15100.	4900.	16700.
200.00	8640.	13800.	7700.	15500.	6160.	19300.	5510.	21600.
500.00	11300.	19500.	9880.	22300.	7620.	28800.	6700.	32800.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
ARRINGTON ROAD
REGION: Blue Ridge & Piedmont
area= 17.50:lime = 0.00:forest = 23.70 :Impervious Area= 15.10 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	895.	44.8	2.37	0.1857
1.50	1130.	41.3	2.44	0.1725
2.00	1470.	38.0	3.05	0.1593
5.00	2650.	32.2	7.62	0.1365
10.00	3750.	29.9	13.17	0.1271
25.00	5600.	28.9	21.38	0.1230
50.00	7350.	30.1	25.52	0.1279
100.00	9480.	32.1	28.00	0.1361
200.00	11400.	36.0	32.11	0.1516
500.00	15600.	42.3	29.54	0.1762

P R E D I C T I O N I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	672.	1190.	584.	1370.	444.	1800.	387.	2070.
1.50	865.	1470.	758.	1680.	588.	2160.	518.	2460.
2.00	1150.	1880.	1020.	2120.	806.	2680.	716.	3020.
5.00	2150.	3270.	1940.	3630.	1580.	4440.	1430.	4910.
10.00	3080.	4560.	2800.	5020.	2320.	6060.	2110.	6650.
25.00	4630.	6770.	4220.	7440.	3520.	8920.	3220.	9760.
50.00	6030.	8950.	5480.	9870.	4540.	11900.	4130.	13100.
100.00	7680.	11700.	6930.	13000.	5670.	15900.	5130.	17500.
200.00	9040.	14400.	8050.	16200.	6440.	20200.	5760.	22600.
500.00	11900.	20400.	10400.	23300.	7990.	30200.	7020.	34400.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
MARRIOTTSVILLE ROAD
REGION: Blue Ridge & Piedmont
area= 18.20:lime = 0.00:forest = 26.40 :Impervious Area= 14.60 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	878.	44.8	2.43	0.1858
1.50	1110.	41.4	2.50	0.1726
2.00	1450.	38.0	3.13	0.1594

5.00	2640.	32.2	7.83	0.1365
10.00	3750.	29.9	13.52	0.1272
25.00	5640.	28.9	21.96	0.1231
50.00	7420.	30.1	26.21	0.1279
100.00	9600.	32.1	28.75	0.1362
200.00	11600.	36.0	32.10	0.1516
500.00	15800.	42.3	29.54	0.1762

P R E D I C T I O N   I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	659.	1170.	573.	1350.	435.	1770.	380.	2030.
1.50	852.	1450.	747.	1650.	579.	2130.	510.	2420.
2.00	1140.	1860.	1010.	2100.	796.	2650.	708.	2990.
5.00	2140.	3260.	1930.	3620.	1580.	4430.	1430.	4890.
10.00	3090.	4570.	2800.	5030.	2320.	6070.	2110.	6670.
25.00	4660.	6810.	4250.	7480.	3540.	8970.	3230.	9820.
50.00	6090.	9040.	5530.	9960.	4580.	12000.	4170.	13200.
100.00	7780.	11900.	7020.	13100.	5740.	16100.	5190.	17800.
200.00	9150.	14600.	8150.	16400.	6520.	20500.	5830.	22900.
500.00	12000.	20700.	10500.	23700.	8120.	30700.	7130.	35000.

2016 Maryland Fixed Region Equations v2.1 (10/30/2017)

Flood frequency estimates for
CONFLUENCE OF PINEY RUN WITH SOUTH BRANCH PATAPSCO RIVER
REGION: Blue Ridge & Piedmont
area= 85.20:lime = 0.00:forest = 31.30 :Impervious Area= 11.00 :skew= 0.48

Return Period	Discharge (cfs)	Standard Error of Prediction (percent)	Equivalent Years of Record	Standard Error of Prediction (logs)
1.25	2420.	45.1	1.99	0.1868
1.50	3000.	41.6	2.05	0.1736
2.00	3840.	38.2	2.56	0.1603
5.00	6670.	32.4	6.42	0.1373
10.00	9210.	30.1	11.09	0.1279
25.00	13500.	29.1	18.00	0.1238
50.00	17400.	30.3	21.49	0.1287
100.00	22200.	32.3	23.57	0.1370
200.00	26600.	36.3	31.66	0.1527
500.00	35700.	42.6	29.13	0.1775

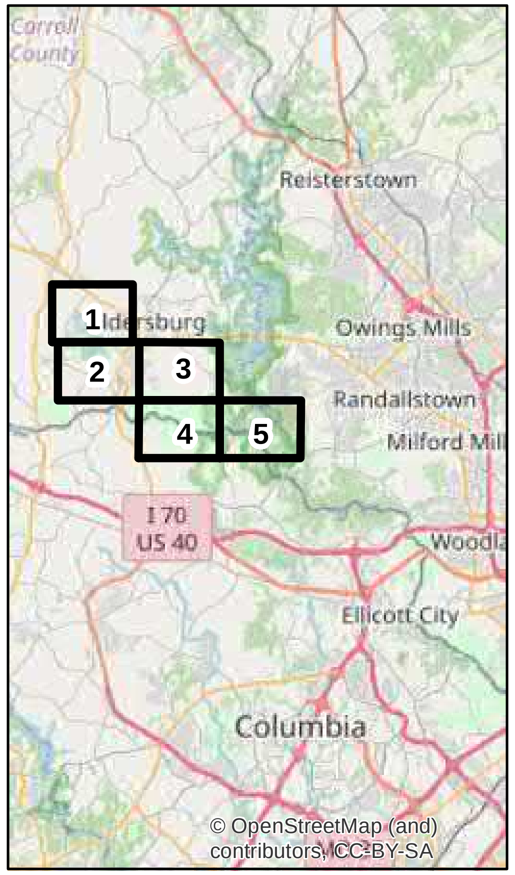
P R E D I C T I O N   I N T E R V A L S

Return	50 PERCENT		67 PERCENT		90 PERCENT		95 PERCENT	
Period	lower	upper	lower	upper	lower	upper	lower	upper
1.25	1810.	3220.	1570.	3710.	1190.	4890.	1040.	5610.
1.50	2300.	3920.	2010.	4480.	1560.	5780.	1370.	6570.
2.00	3000.	4920.	2660.	5560.	2100.	7040.	1860.	7920.
5.00	5400.	8240.	4860.	9150.	3970.	11200.	3590.	12400.
10.00	7560.	11200.	6860.	12400.	5680.	14900.	5170.	16400.
25.00	11100.	16300.	10100.	17900.	8450.	21500.	7710.	23600.
50.00	14300.	21300.	13000.	23400.	10700.	28300.	9750.	31100.
100.00	17900.	27400.	16200.	30400.	13200.	37200.	11900.	41100.
200.00	21000.	33700.	18700.	37800.	15000.	47400.	13400.	53000.
500.00	27200.	47000.	23700.	53800.	18300.	69800.	16000.	79600.

Legend

- Railroad
- Surface Road
- Impacted Structure
- Decommissioned Inundation Limits
- Dam-in-Place Inundation Limits

Index Map



NOTES: The information contained on this map is prepared for use in the notification of downstream property owners by emergency management personnel. Timing and extent of actual inundation may differ from the inundation presented on this map. Times in this map are calculated from initiation of precipitation.

April 2020
Sheet 1 of 5

0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
10% Probability Event
Inundation Map

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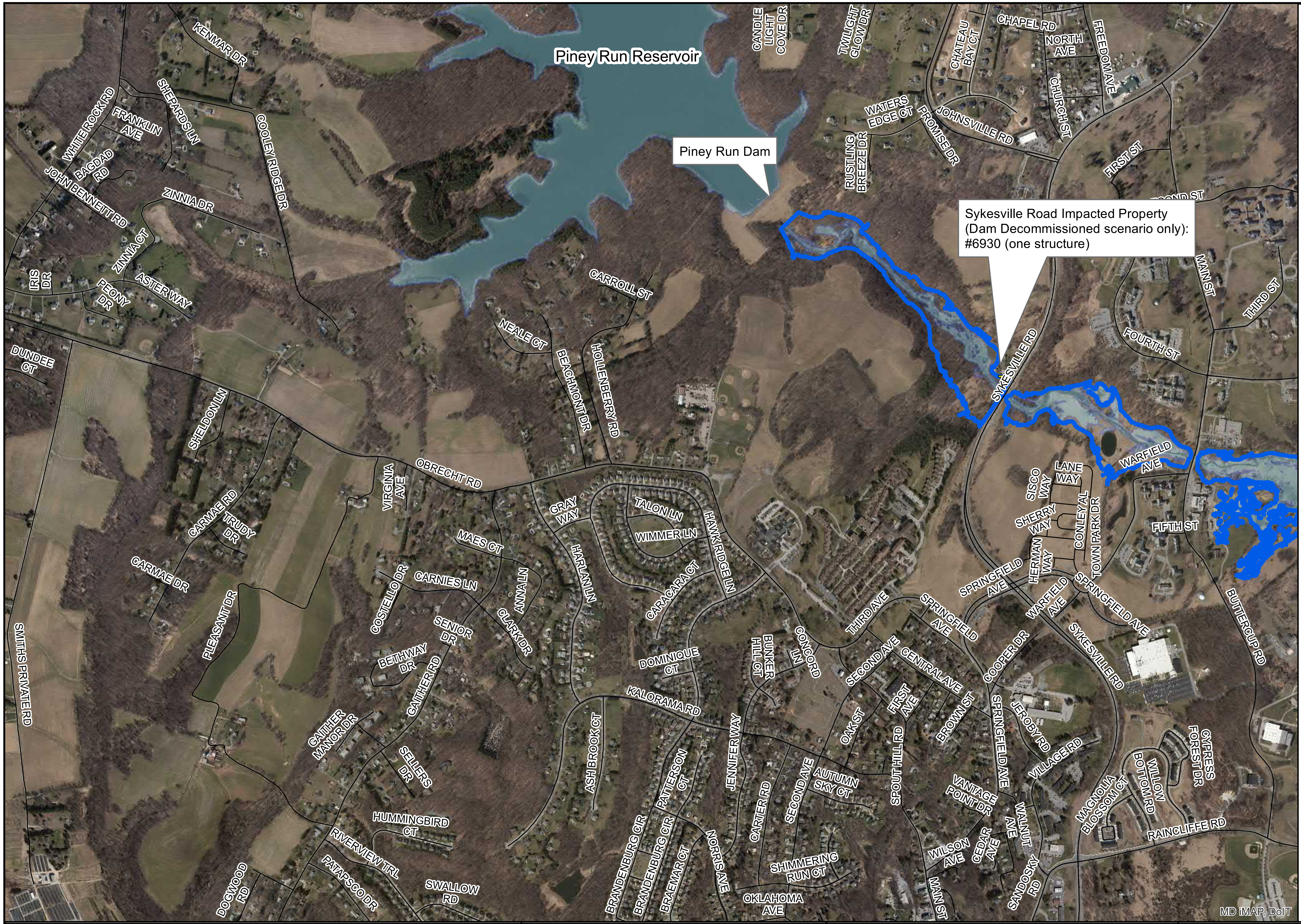
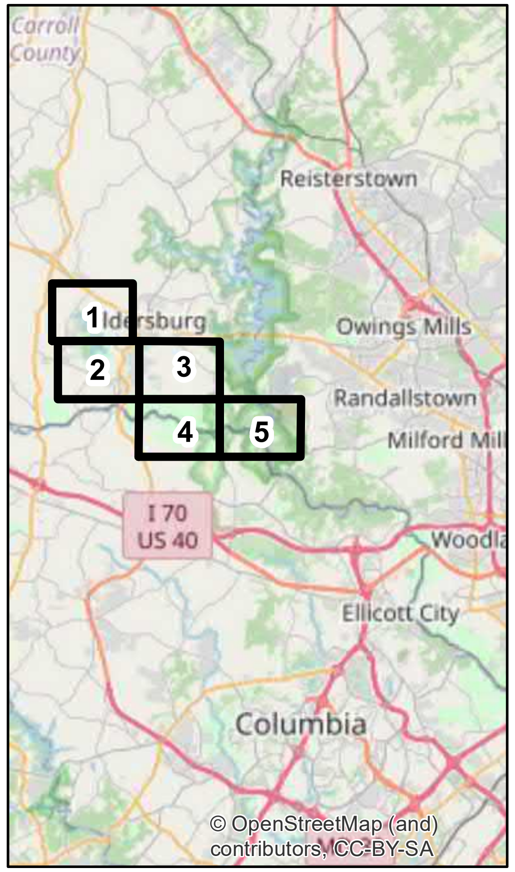


Legend

- Railroad
- Surface Road
- Impacted Structure
- Decommissioned Inundation Limits
- Dam-in-Place Inundation Limits

Index Map



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April 2020
Sheet 2 of 5

0 500 1,000 2,000 3,000 4,000
Feet

N W E S

Piney Run Dam
10% Probability Event
Inundation Map

Carroll County 1837 MARYLAND
NRCS
AECOM

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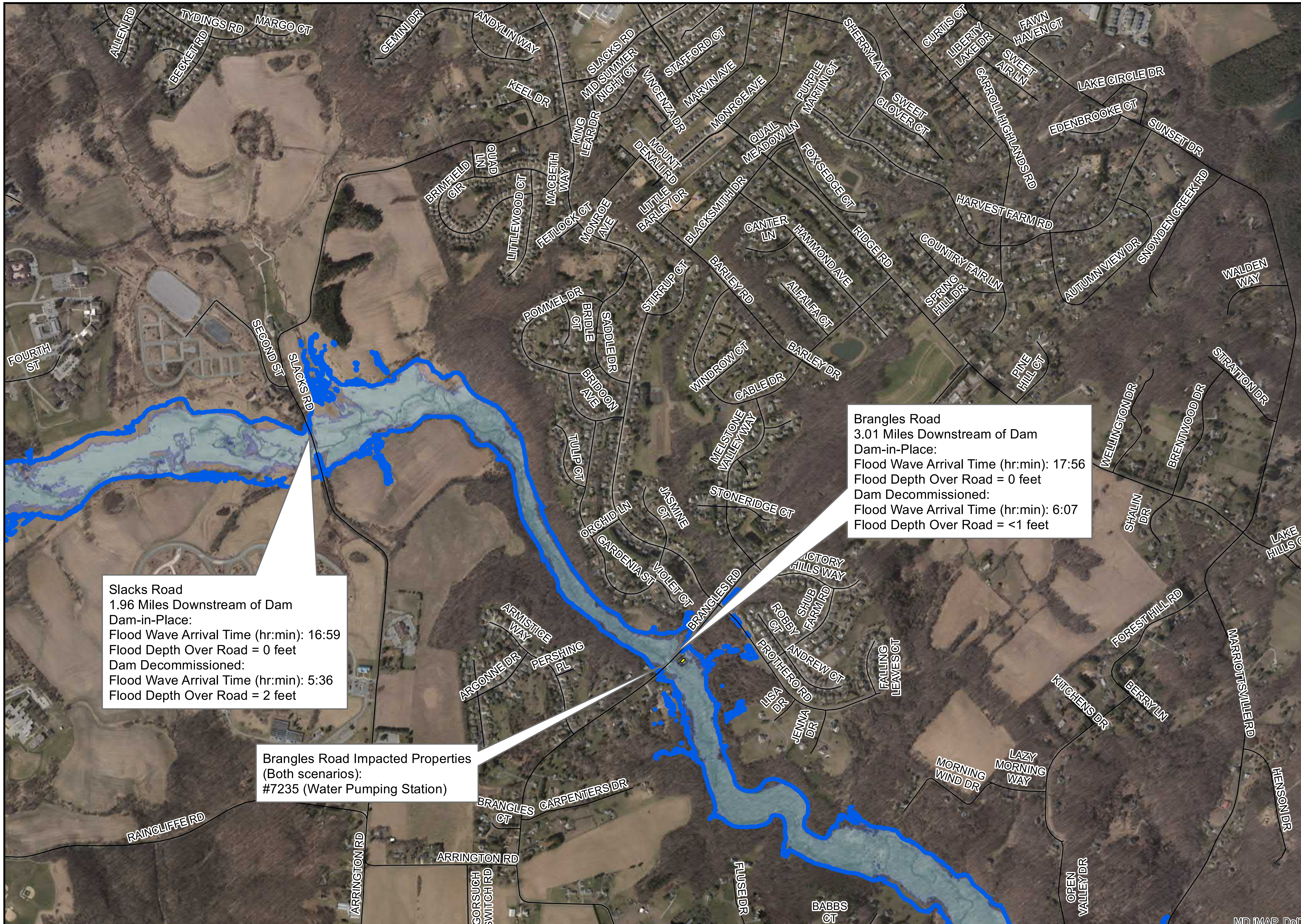
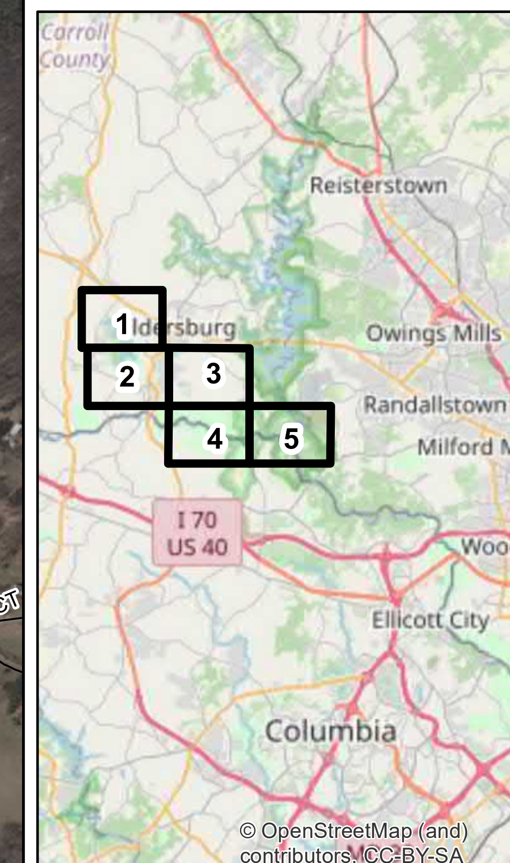


Legend

- Railroad
- Surface Road
- Impacted Structure
- Decommissioned Inundation Limits
- Dam-in-Place Inundation Limits

Index Map



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April 2020
Sheet 3 of 5

0 500 1,000 2,000 3,000 4,000
Feet

N W E S

Piney Run Dam 10% Probability Event Inundation Map

Carroll County 1837 Maryland

NRCS

AECOM

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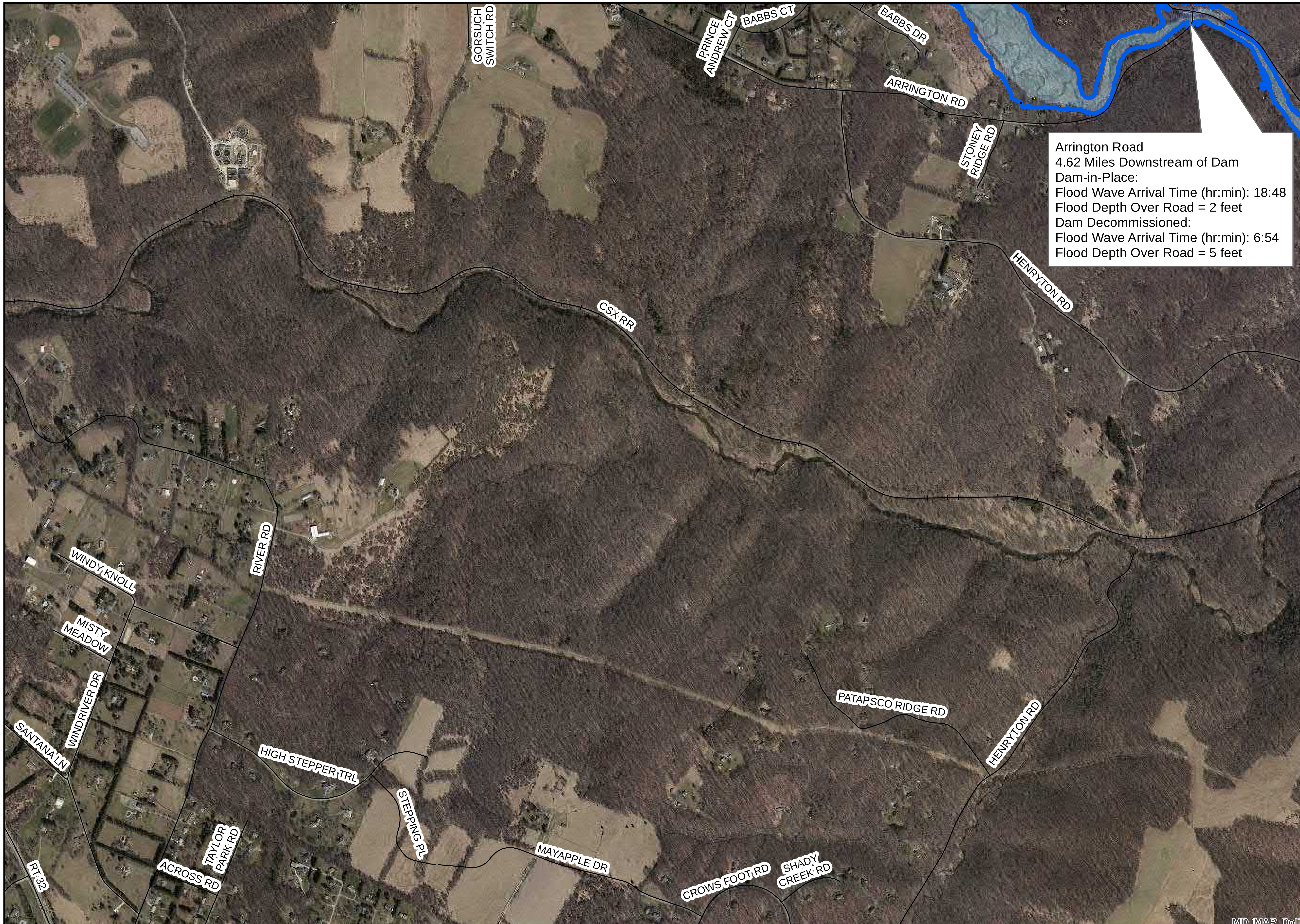


Legend

Railroad

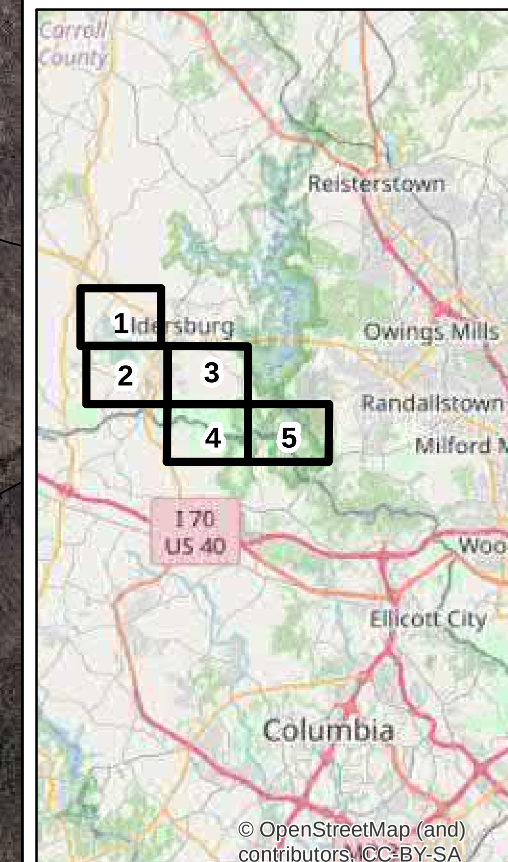
Surface Road

Impacted Structure

Decommissioned Inundation Limits

Dam-in-Place Inundation Limits

Index Map



NOTES: The information contained on this map is prepared for use in the notification of downstream property owners by emergency management personnel. Timing and extent of actual inundation may differ from the inundation presented on this map. Times in this map are calculated from initiation of precipitation.

April 2020
Sheet 4 of 5

0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
10% Probability Event
Inundation Map

NRCS AECOM

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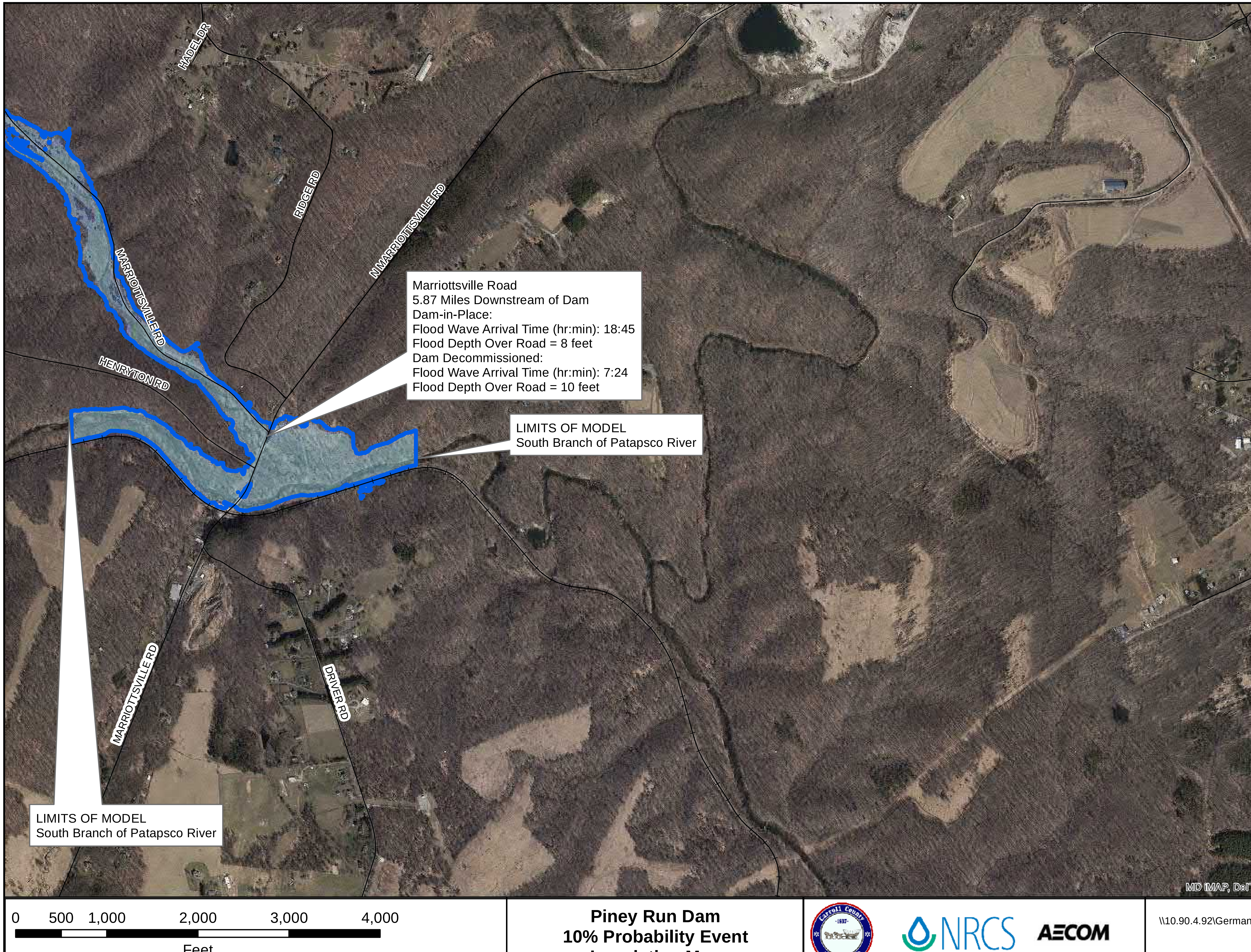
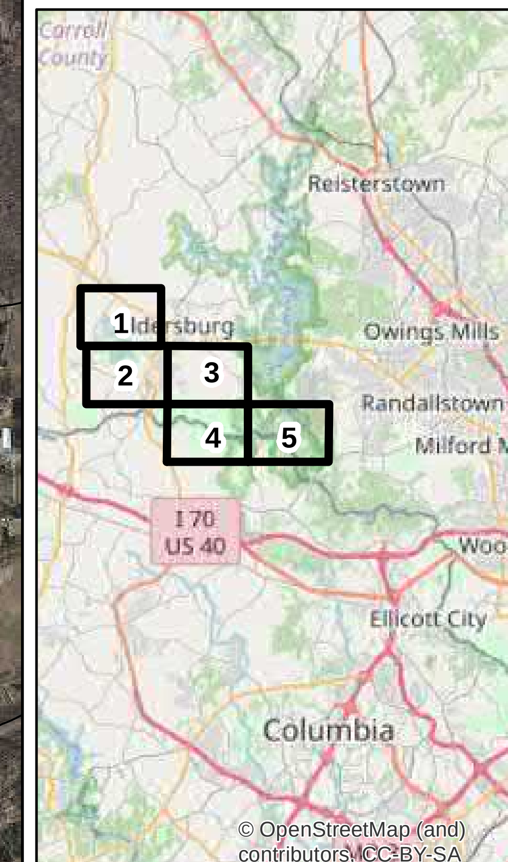


Legend

- Railroad
- Surface Road
- Impacted Structure
- Decommissioned Inundation Limits
- Dam-in-Place Inundation Limits

Index Map



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April 2020
Sheet 5 of 5

Piney Run Dam
10% Probability Event
Inundation Map

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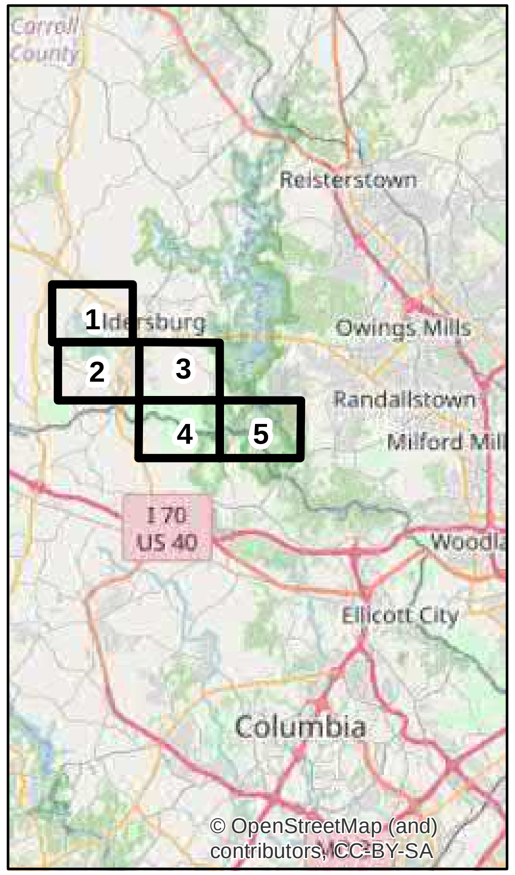
Legend

- Railroad
- Surface Road
- Impacted Structure
- Decommissioned Inundation Limits
- Dam-in-Place Inundation Limits

Index Map



NOTES: The information contained on this map is prepared for use in the notification of downstream property owners by emergency management personnel. Timing and extent of actual inundation may differ from the inundation presented on this map. Times in this map are calculated from initiation of precipitation.

April 2020
Sheet 1 of 5

0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
2% Probability Event
Inundation Map

NRCS AECOM

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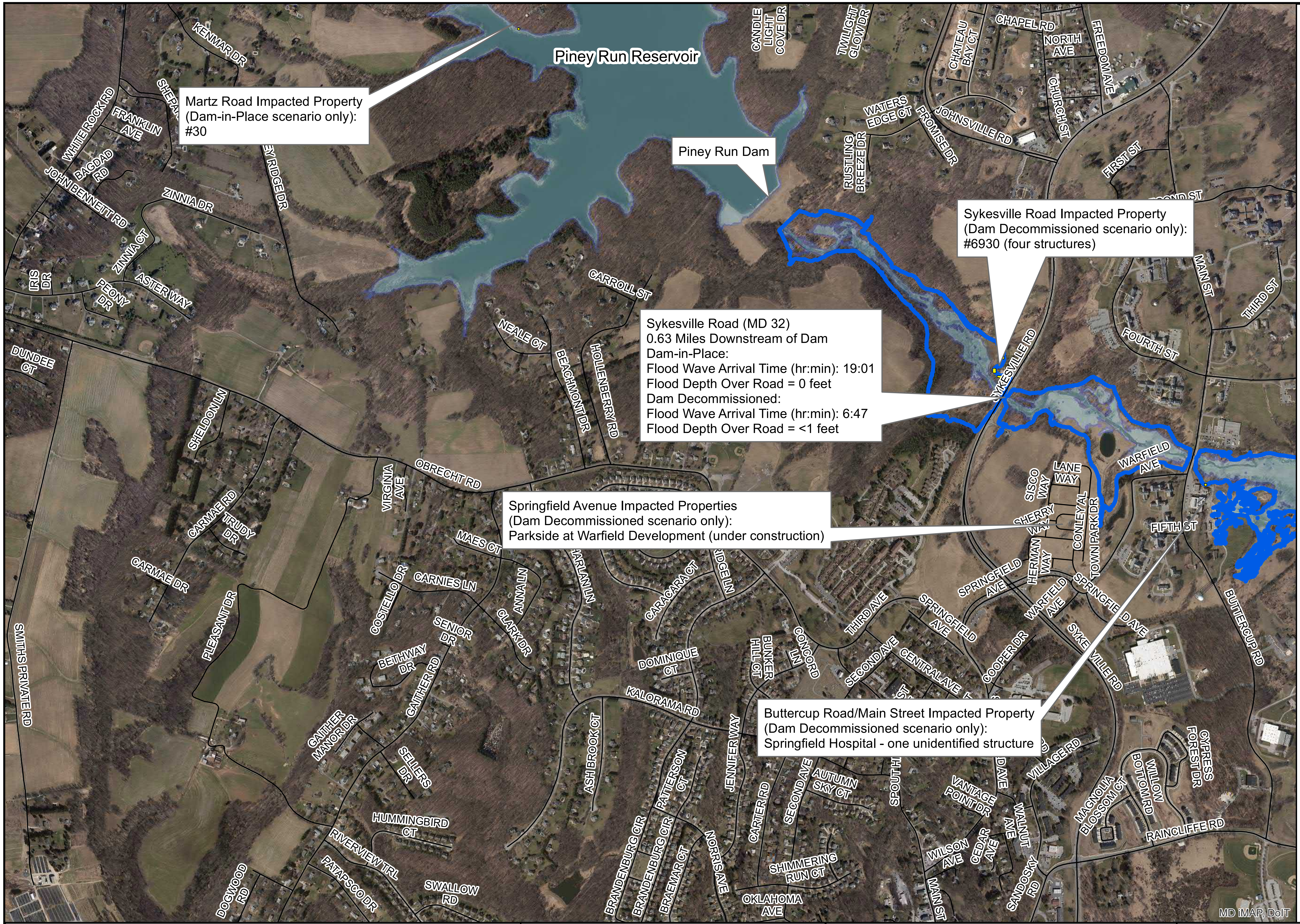

Legend

- Railroad
- Surface Road
- Impacted Structure
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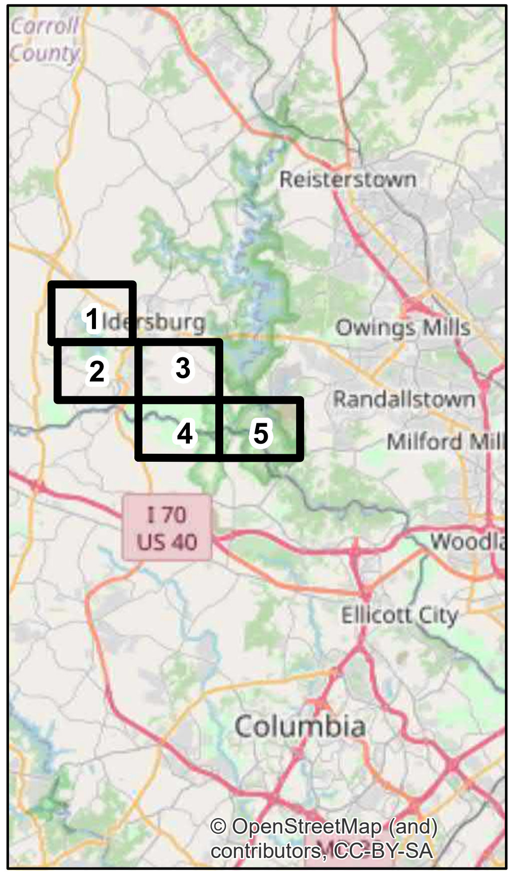
- Dam-in-Place Inundation Limits

Index Map



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0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
2% Probability Event
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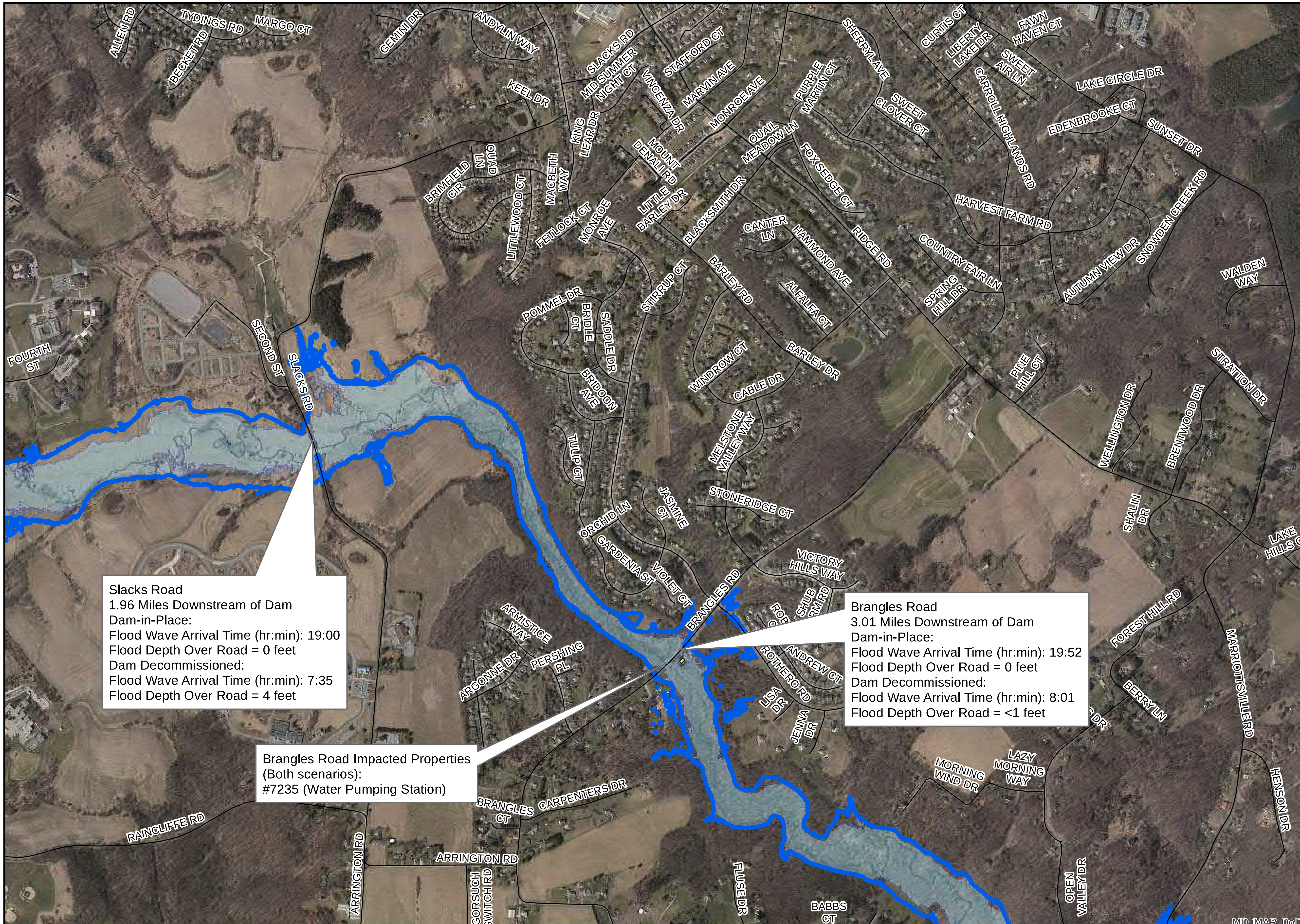

Legend

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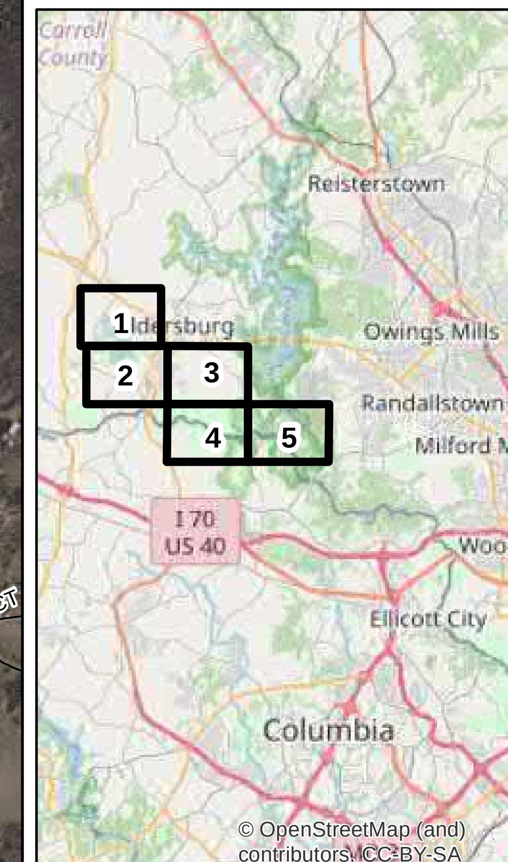

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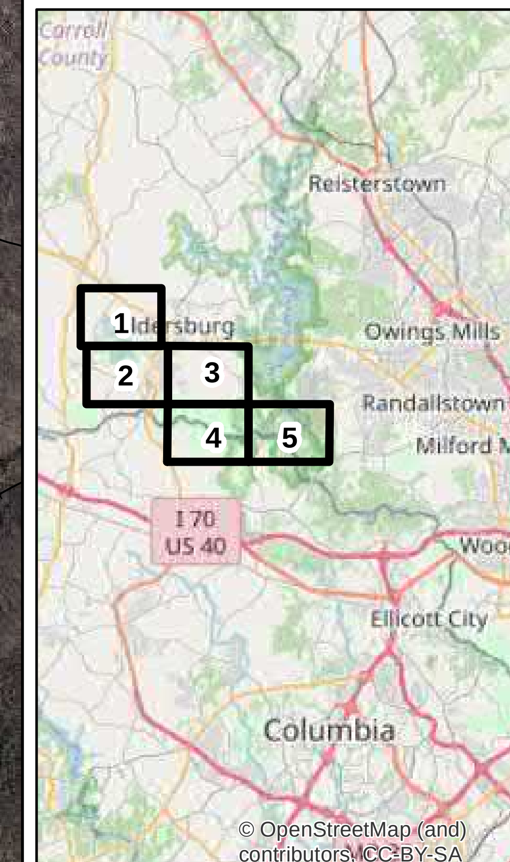

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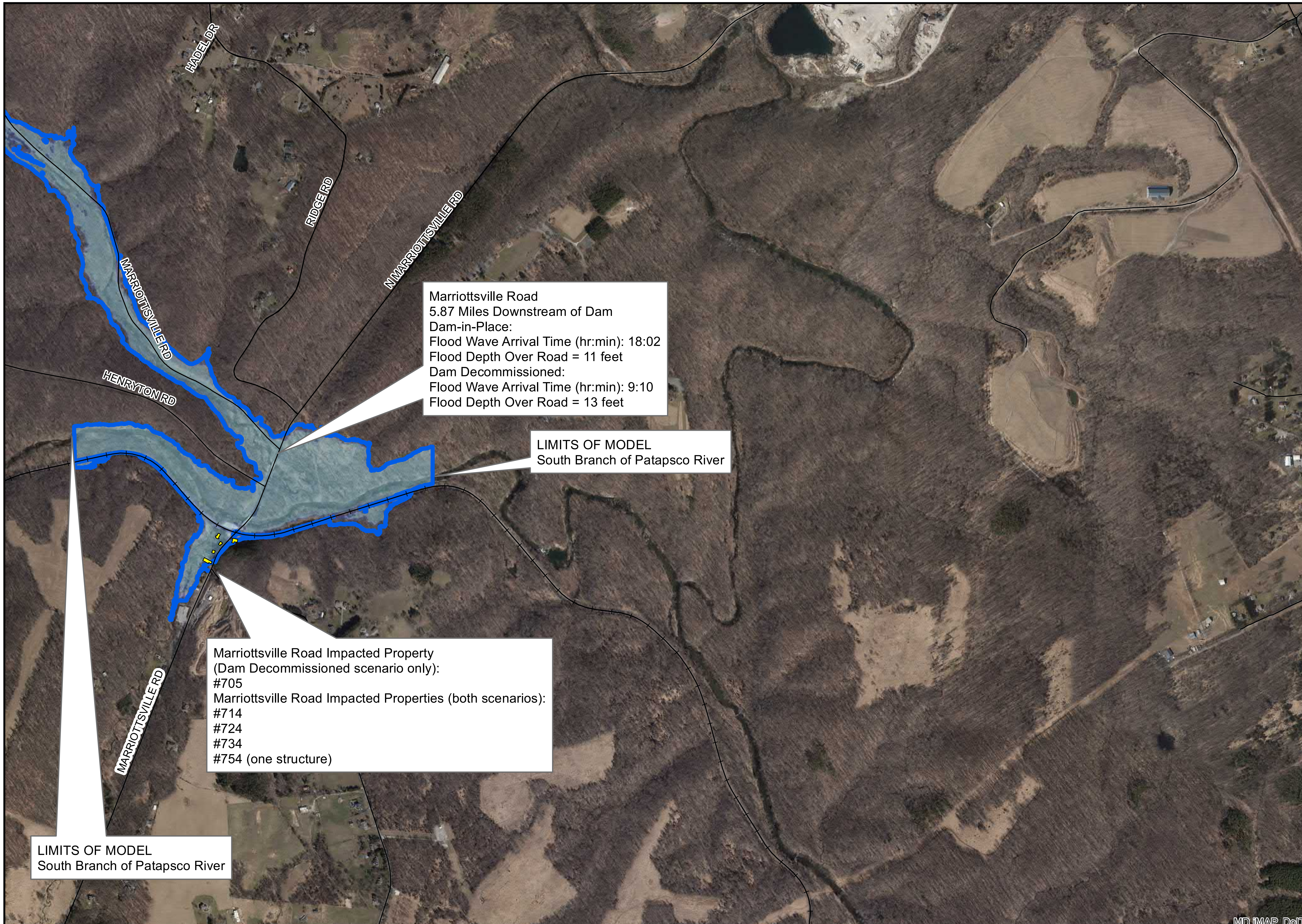

Legend

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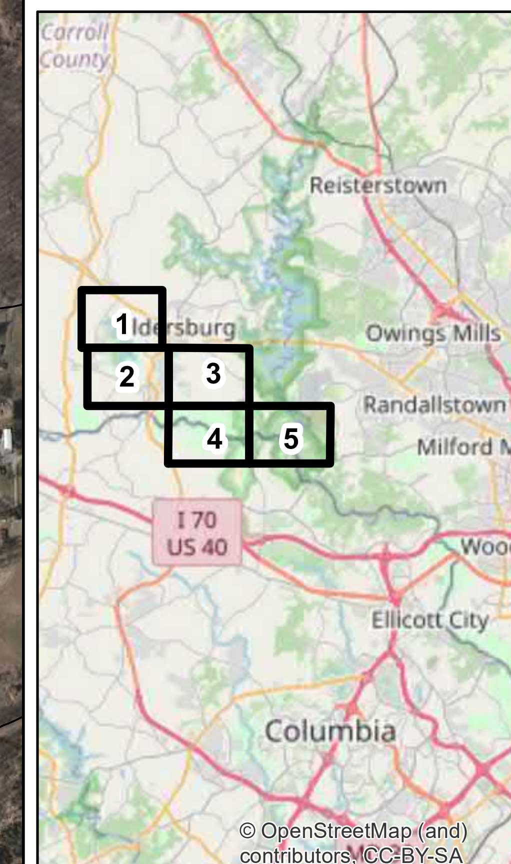

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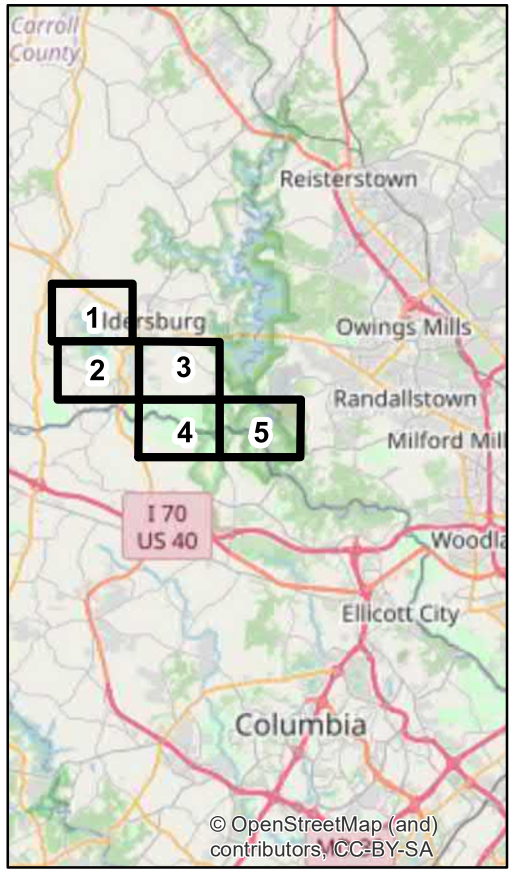

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Piney Run Dam
1% Probability Event
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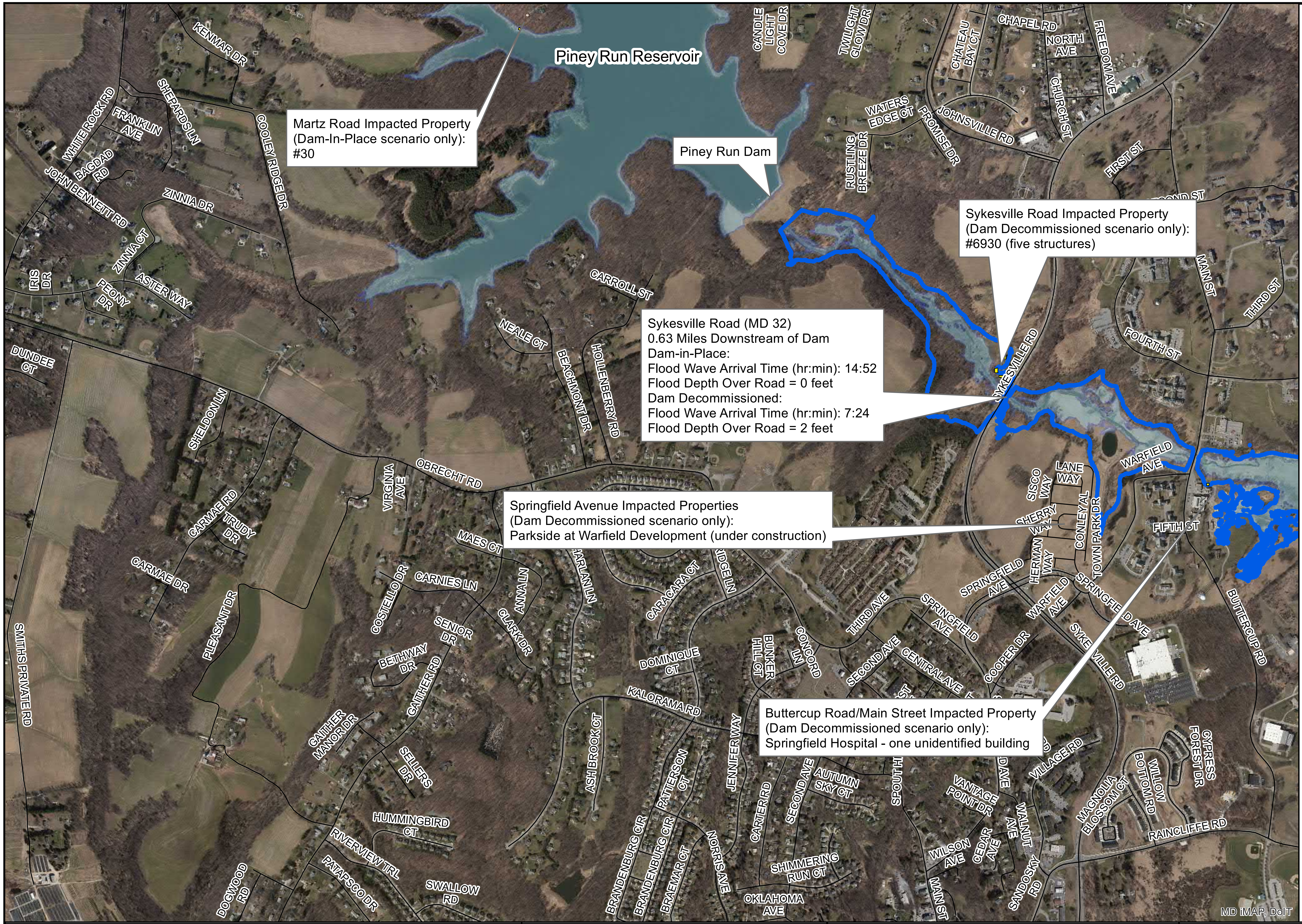

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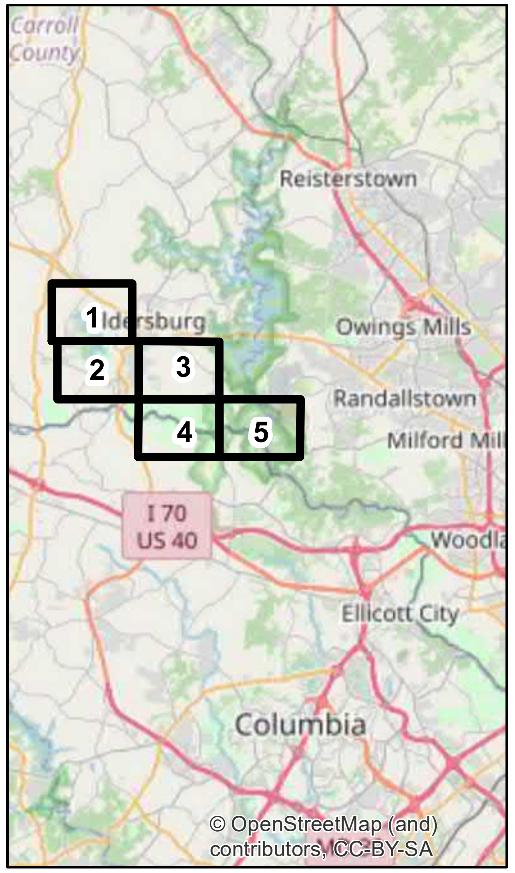

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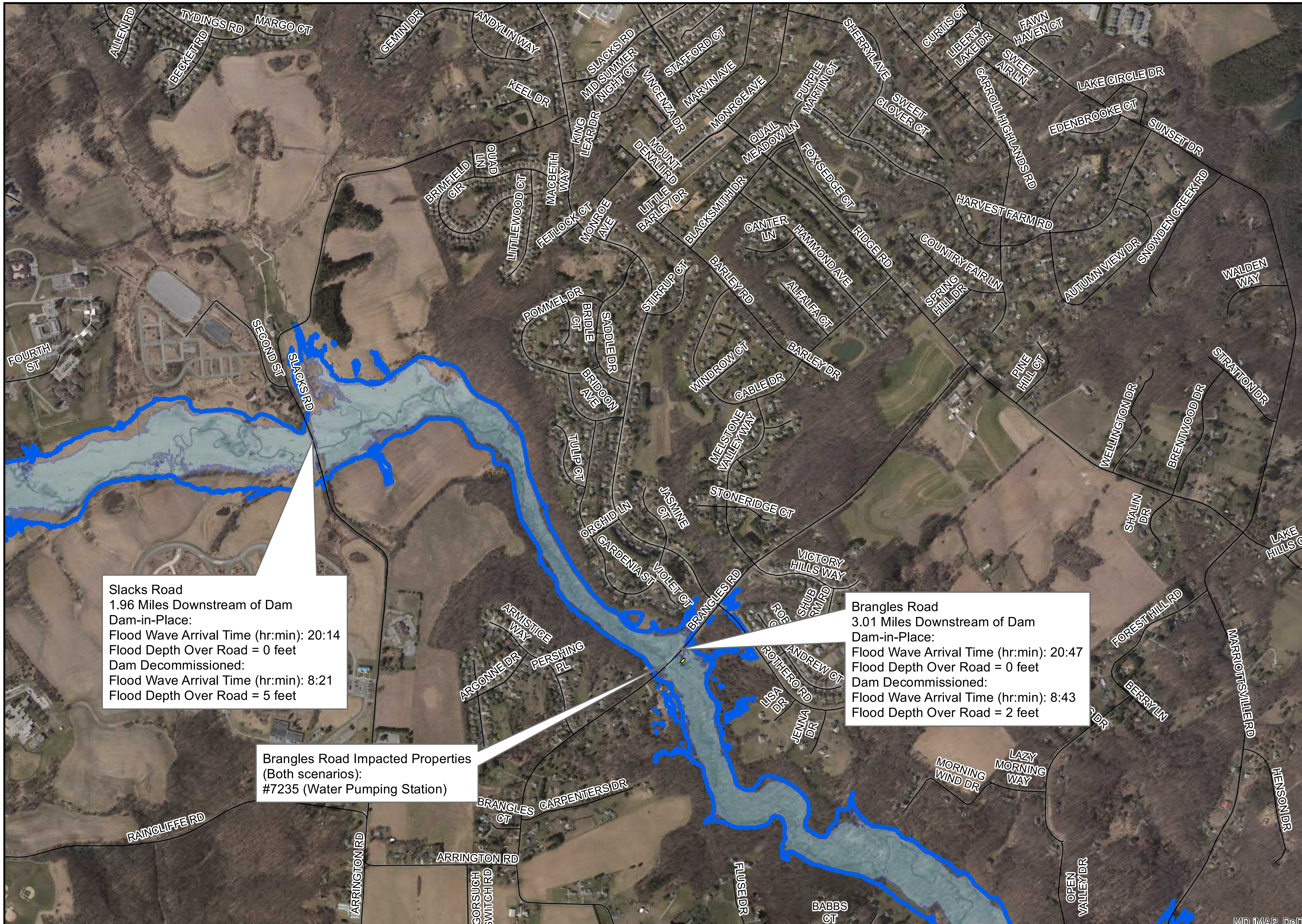

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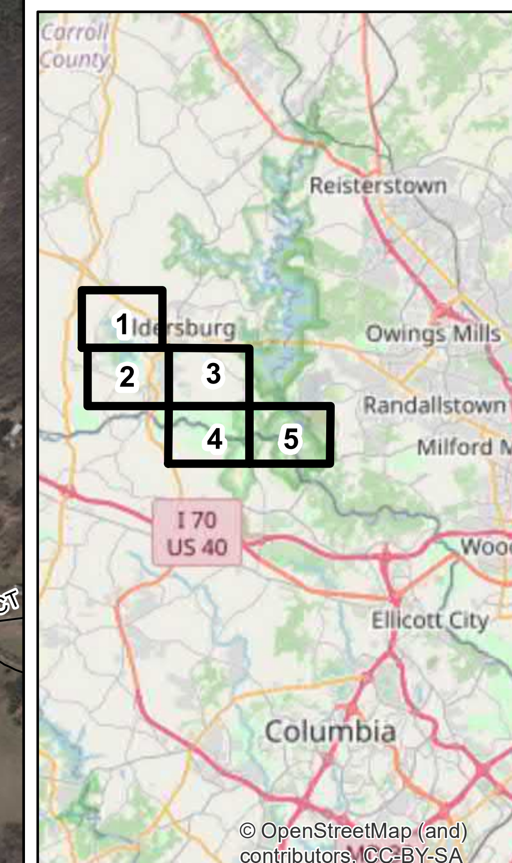

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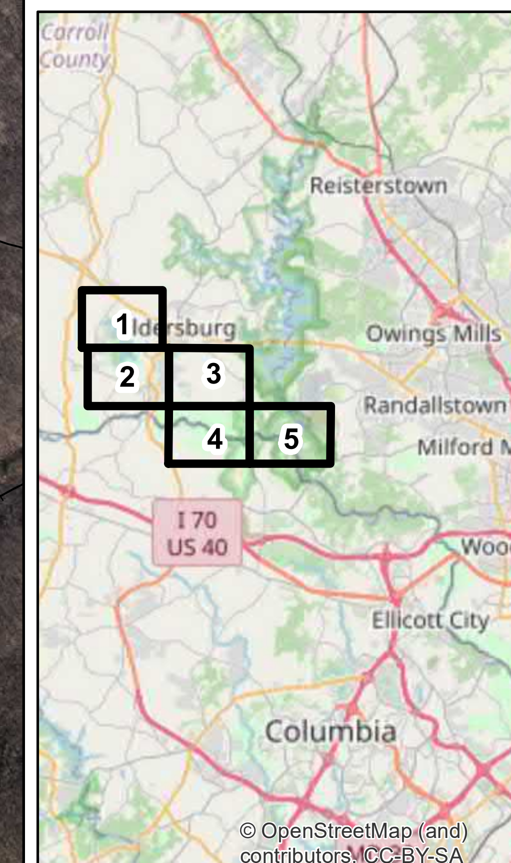

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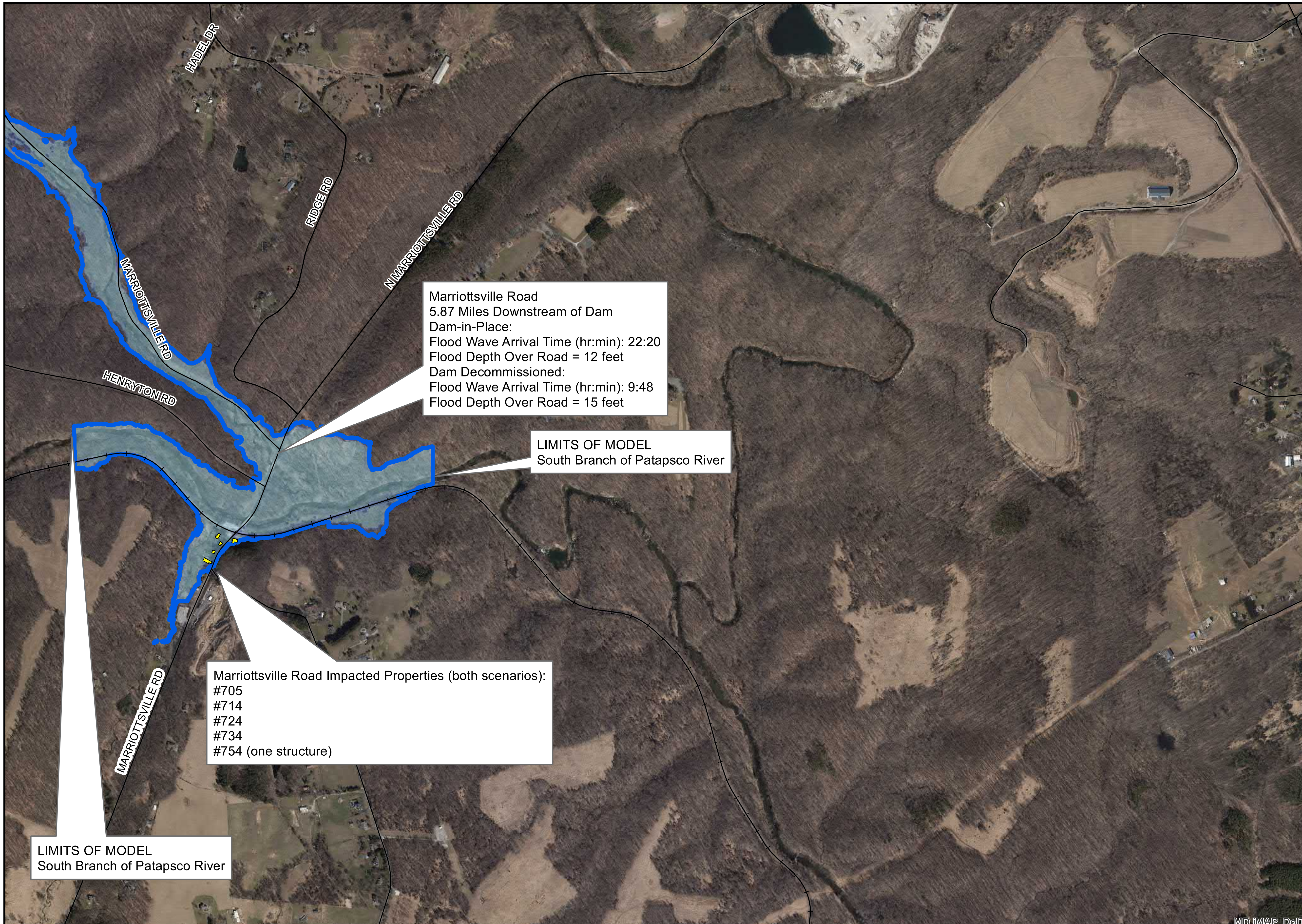

Legend

Railroad

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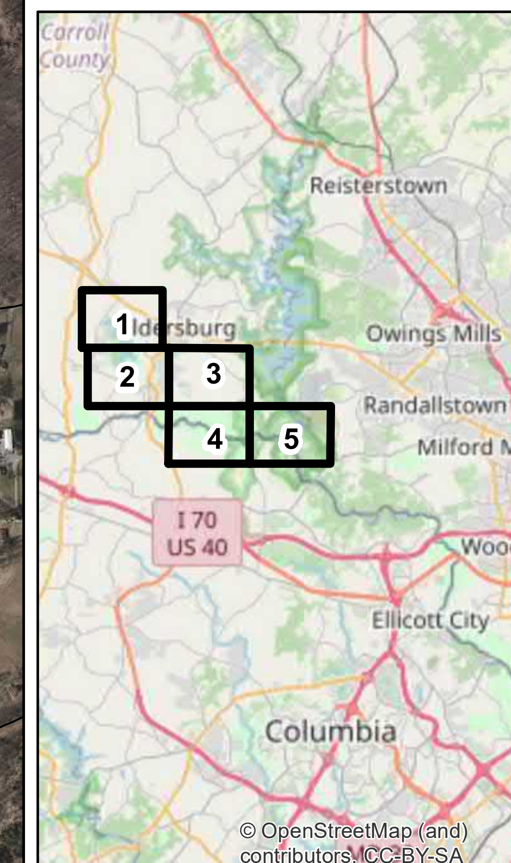

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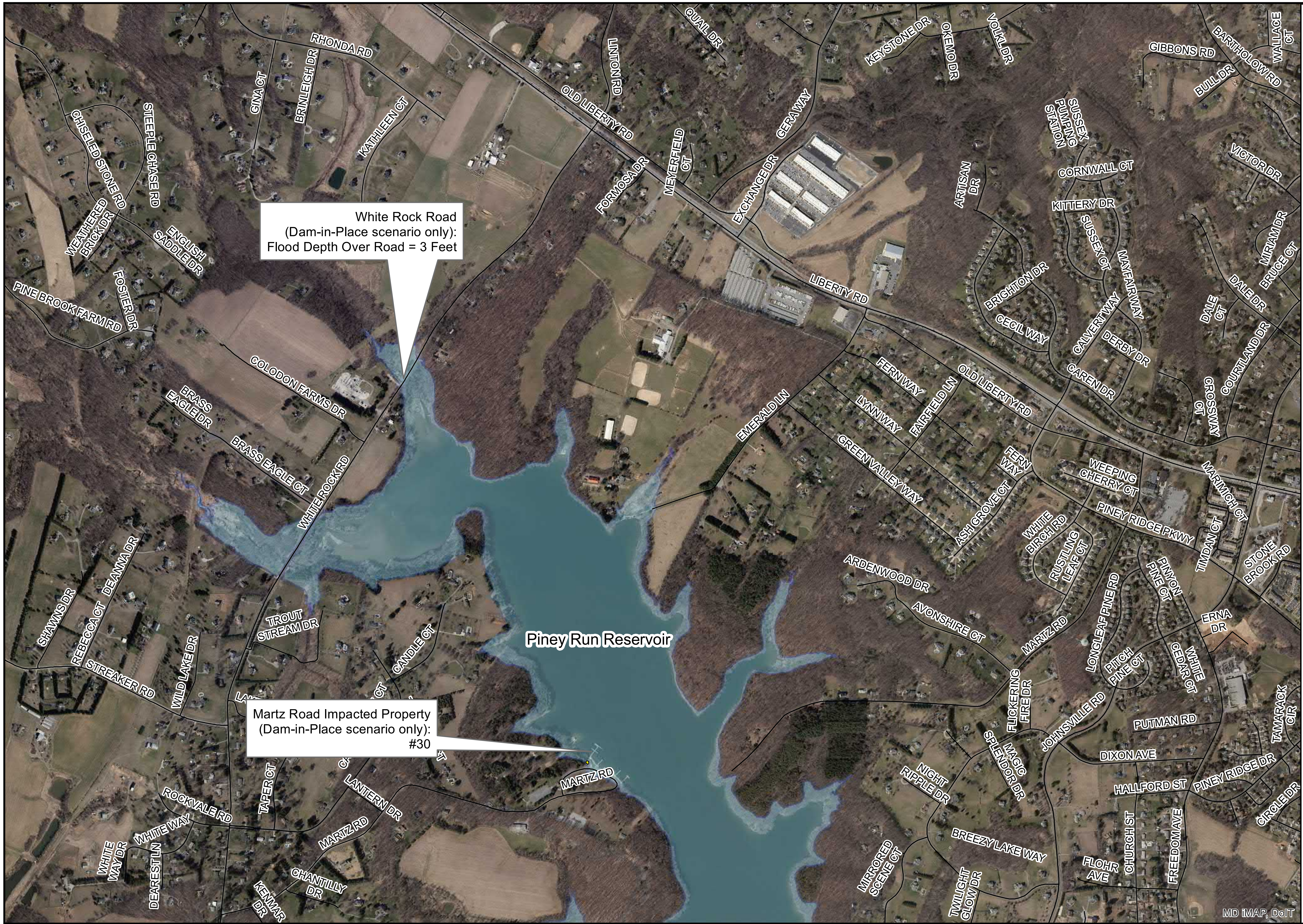

Legend

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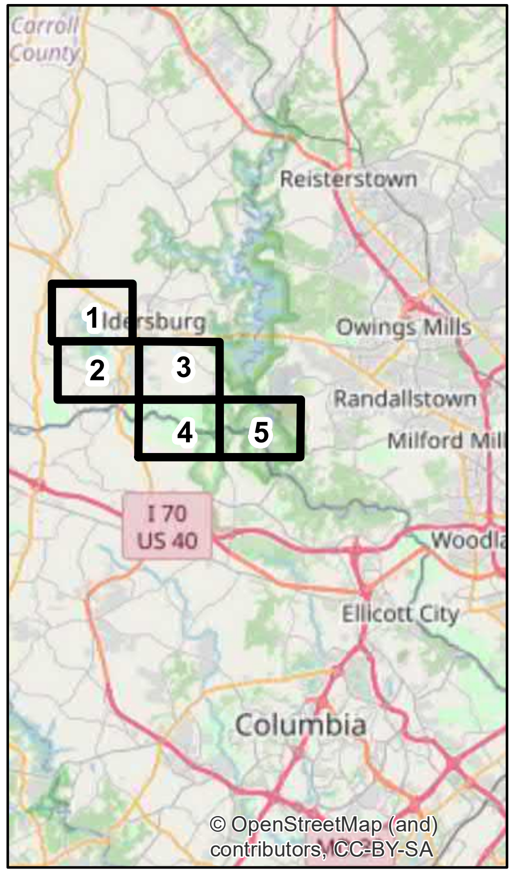

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Feet

N W E S

Piney Run Dam
0.2% Probability Event
Inundation Map

Carroll County 1837 Maryland

NRCS

AECOM

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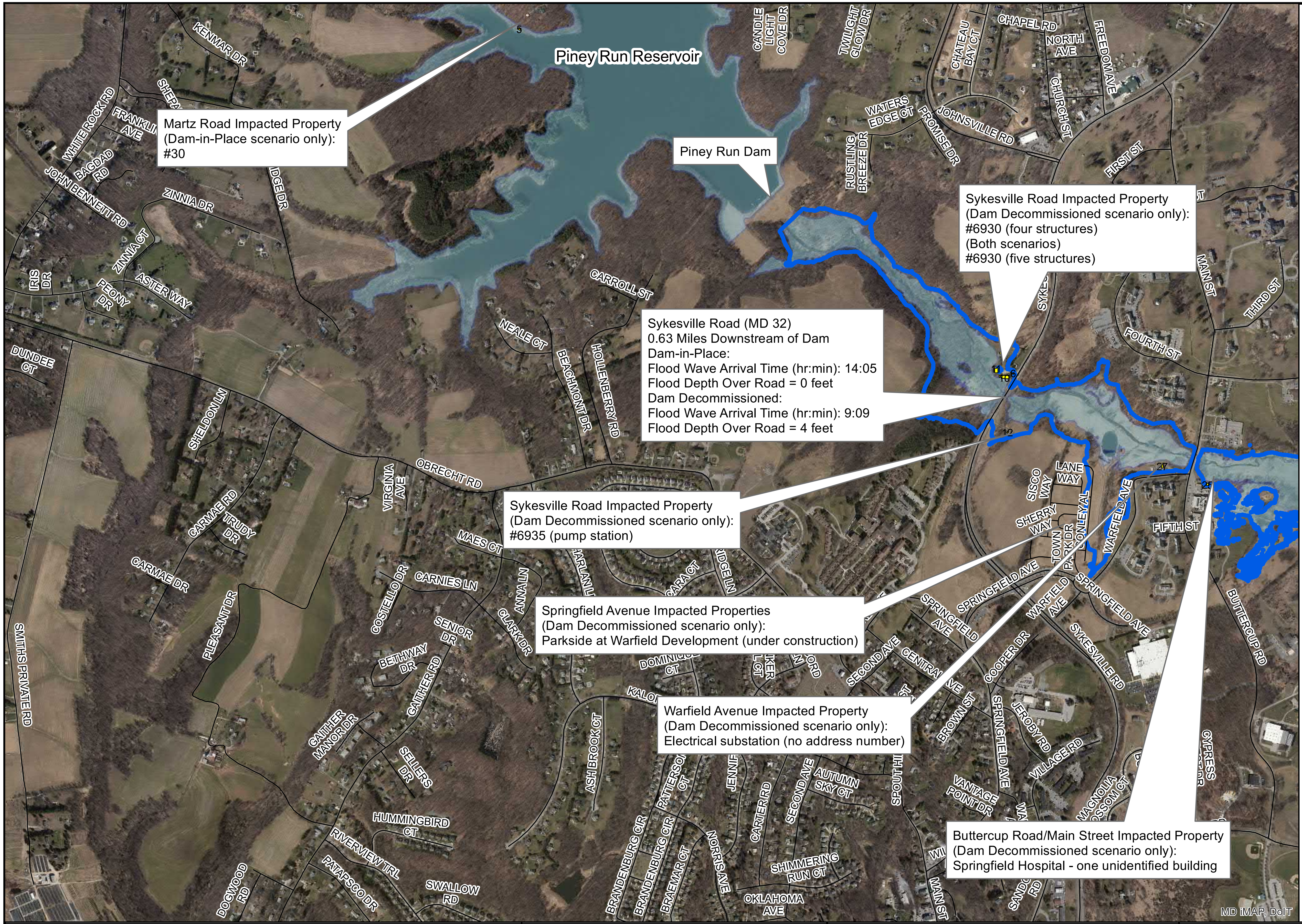

Legend

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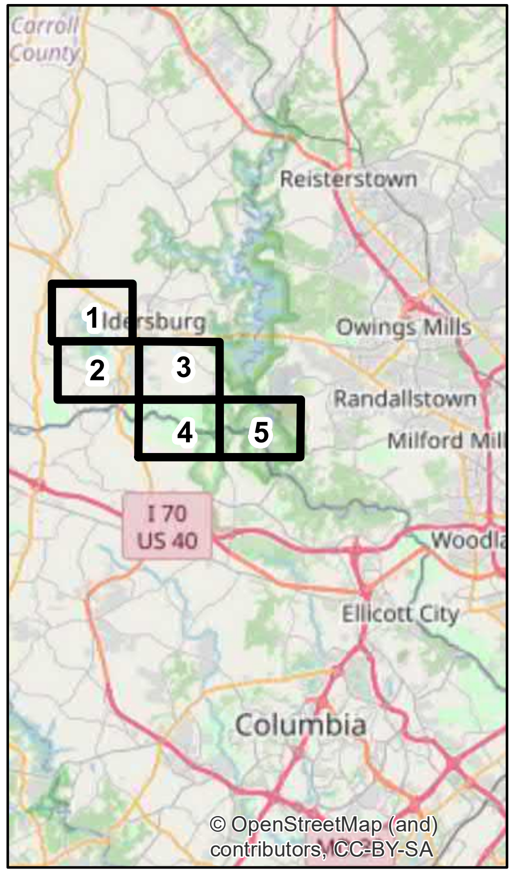

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Feet

Piney Run Dam 0.2% Probability Event Inundation Map

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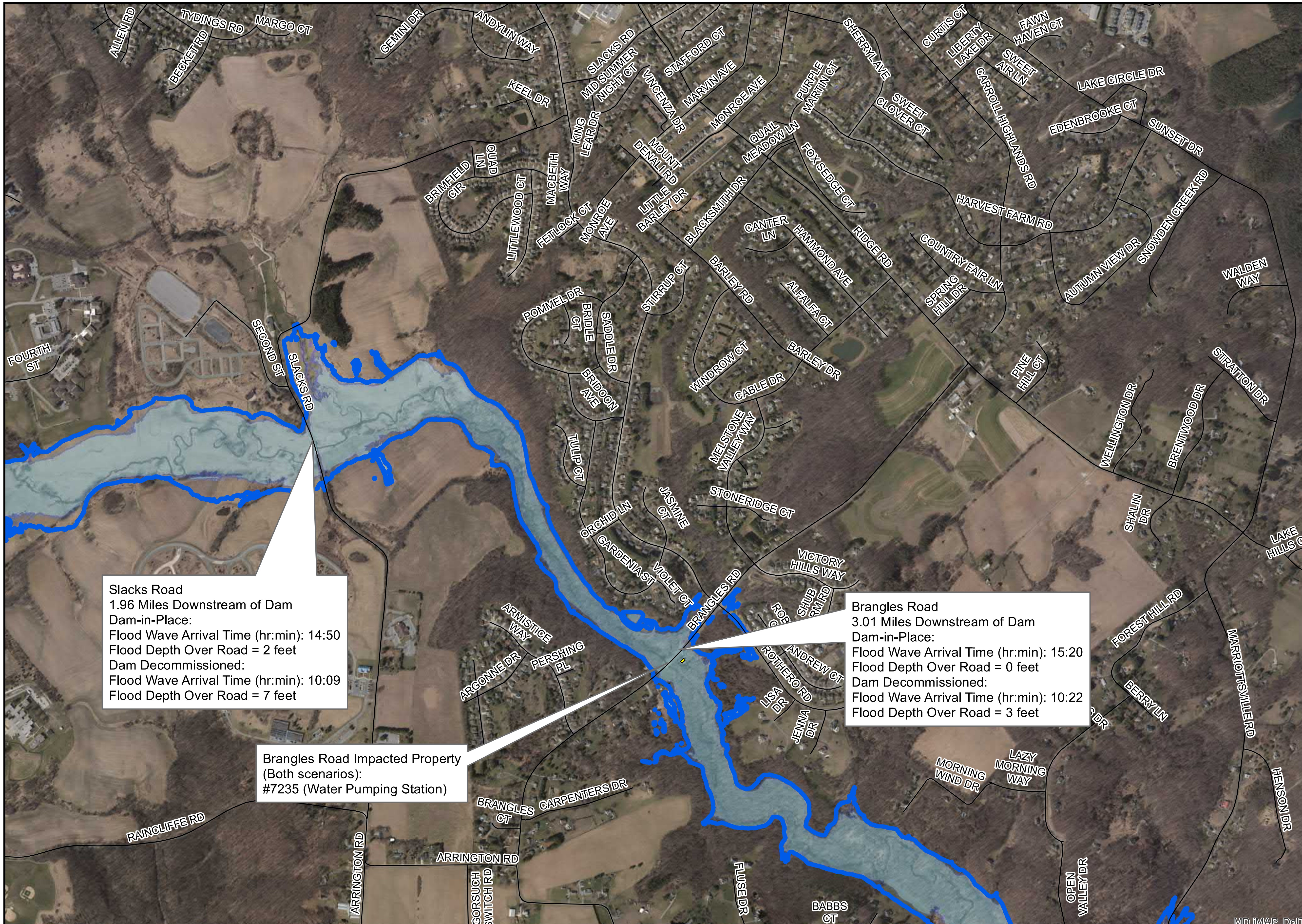

Legend

Railroad

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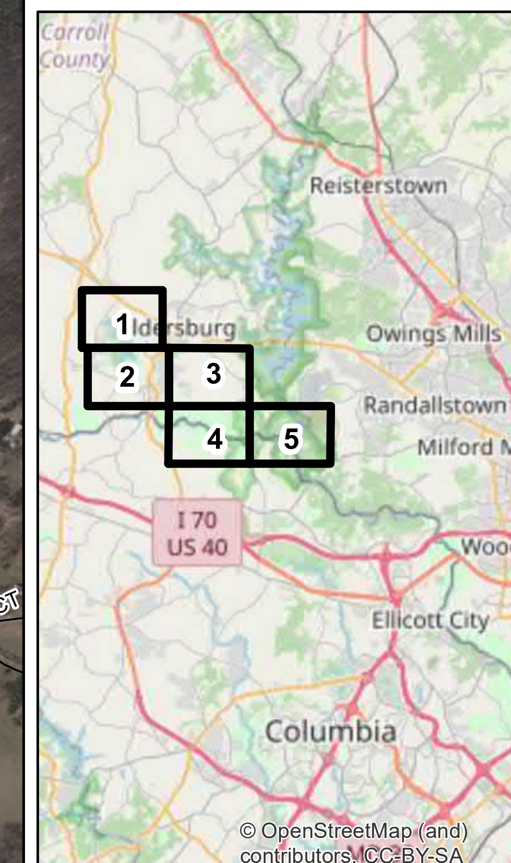

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N W E S

Piney Run Dam
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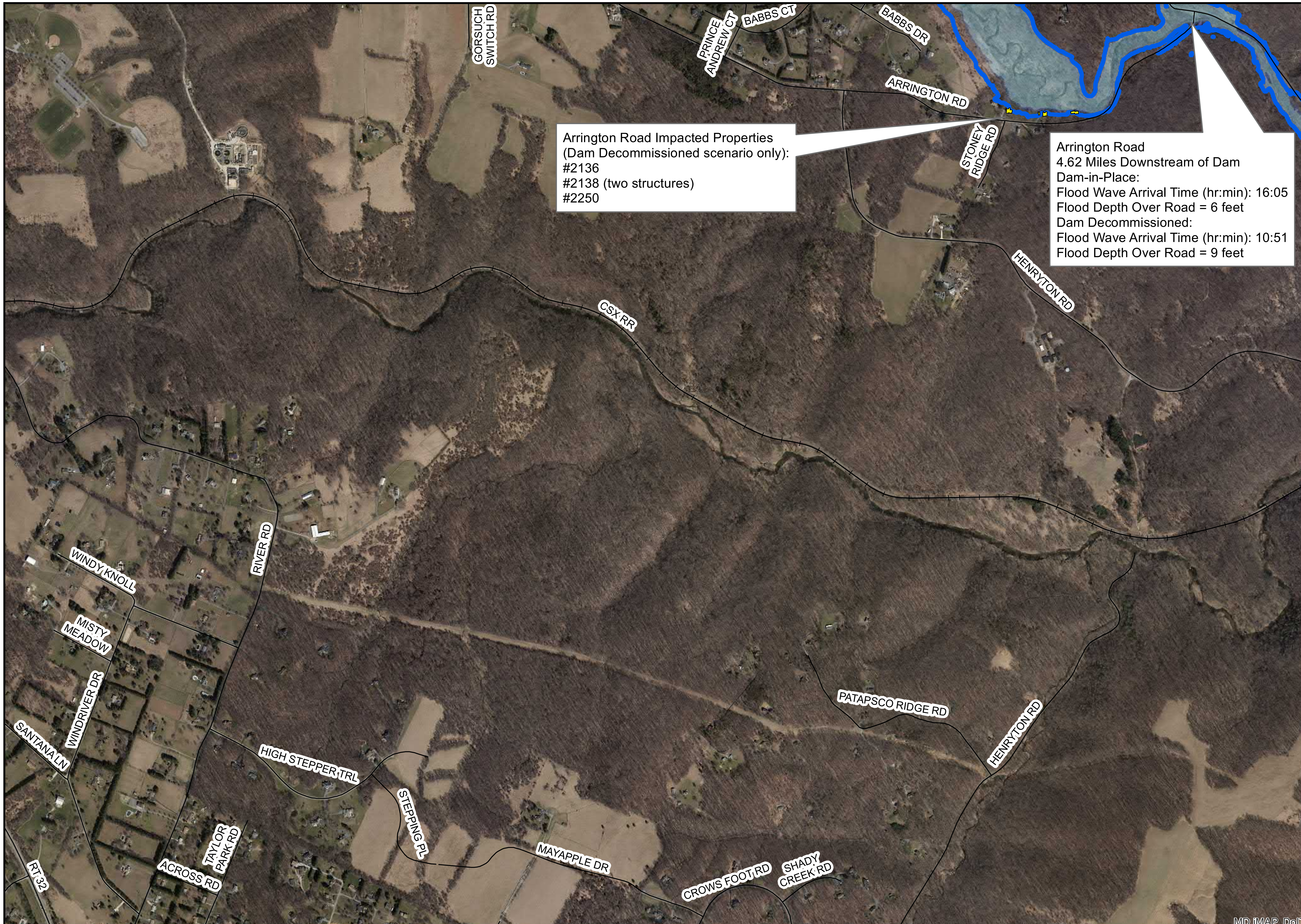

Legend

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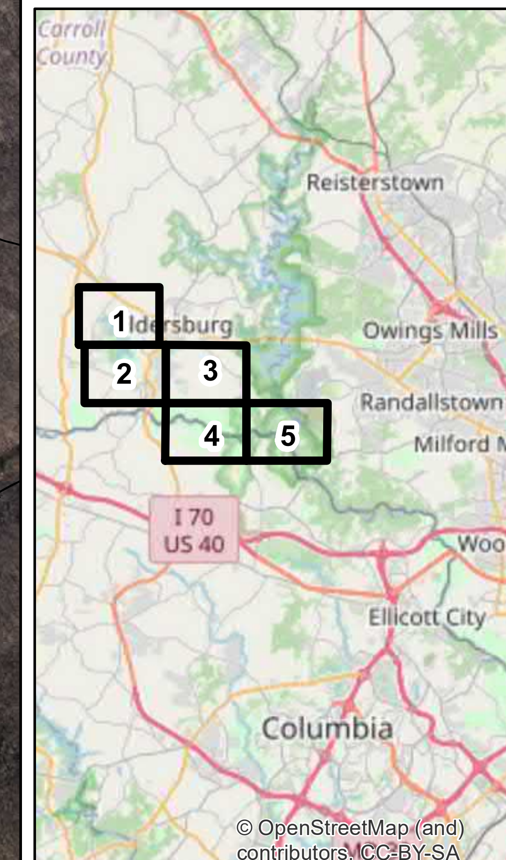

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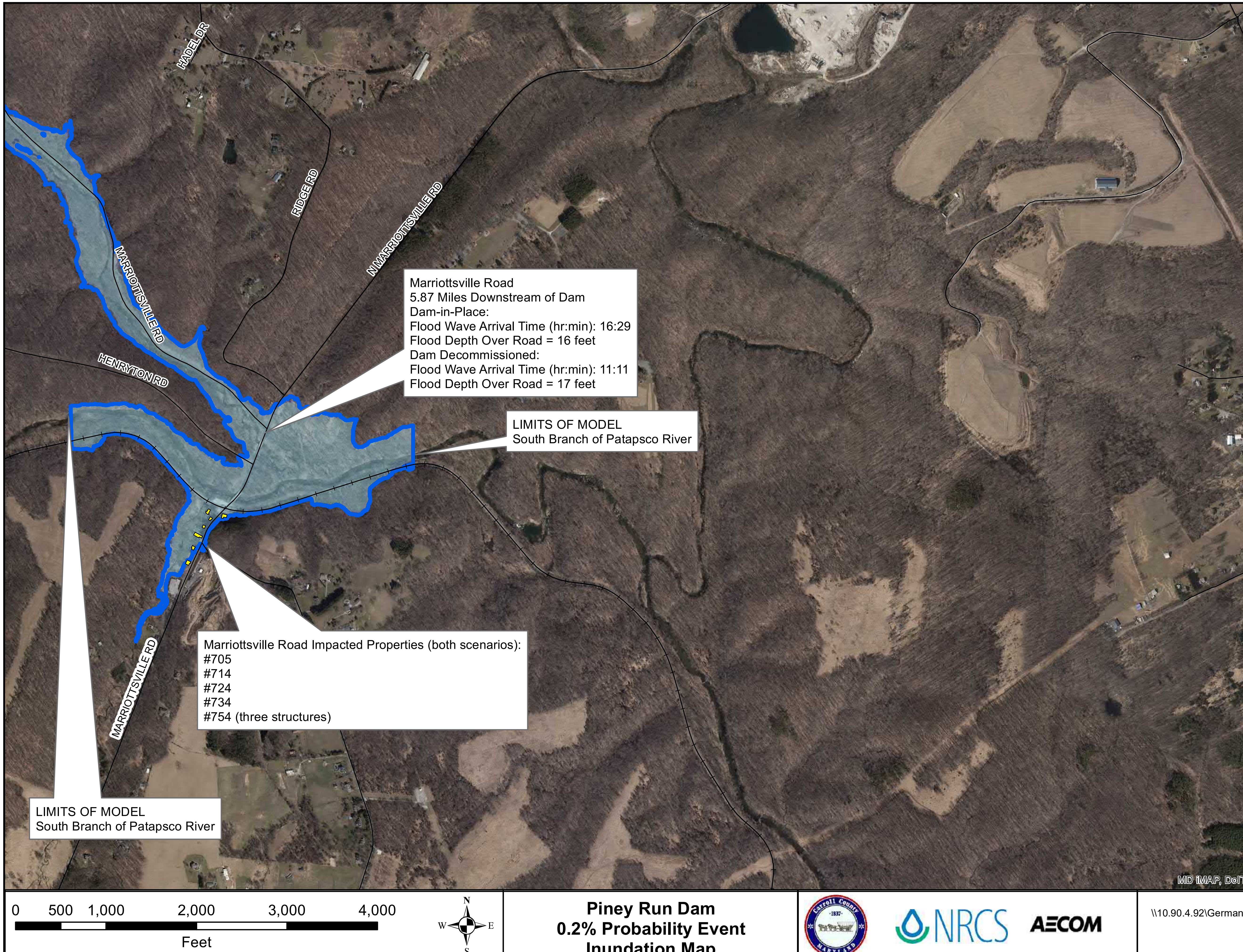

Legend

Railroad

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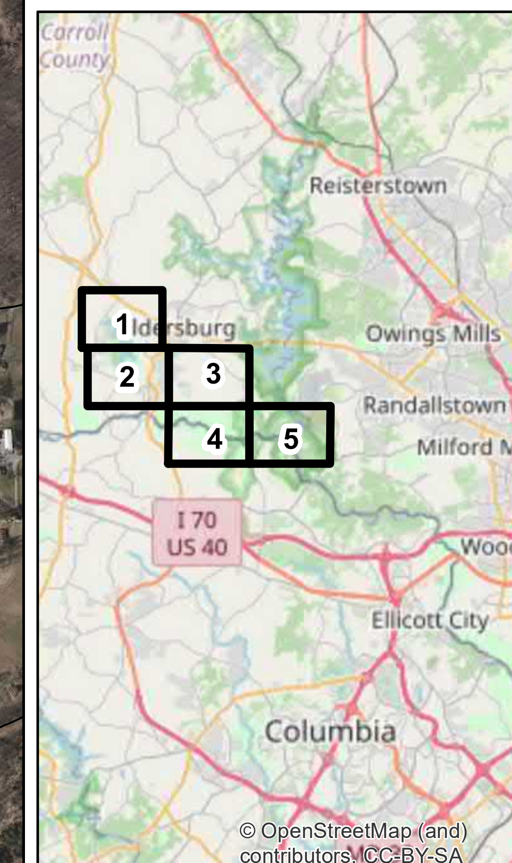

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Appendix G – Dam Breach Computations and Inundation Maps

Dam Name:	Piney Run Dam (MD Dam No. 139)	Prepared by:	JB
Location:	Sykesville, Maryland	Date:	5/18/2020
Breach Scenario:	Seismic (Normal Pool)		

Height of Dam (ft):	72.5
Breach Bottom Elevation:	468
Height of water above breach bottom (ft):	55
Reservoir Storage Volume at Failure (acre-feet):	5339
Reservoir Surface Area at Failure (acres):	290
Failure Scenario:	Piping
Discharge through spillways at failure (Q_o, cfs):	11

Breach Parameters

Froelich (2008)

Avg. Breach Width (ft):	150.8	Breach Side Slopes:	0.7	H:1V
Breach Bottom Width (ft):	100.0	K_o Factor:	1.0	
Time of failure (hrs):	0.86			

Froelich (1995)

Avg. Breach Width (ft):	154.8	Breach Side Slopes:	0.9	H:1V
Breach Bottom Width (ft):	89.6	K_o Factor:	0.7	
Time of failure (hrs):	0.87			

MacDonald & Langridge-Monopolis (1984)

[For Piping Scenario Only when Storage Volume is less than 100 acre-feet]

Avg. Breach Width (ft):	#DIV/0!	Breach Side Slopes:	0.5	H:1V
Breach Bottom Width (ft):	#DIV/0!	Upstream Slopes:		H:1V
Time of failure (hrs):	0.84	Downstream Slopes:		H:1V
	Storage exceeds 100 ac-ft	Crest Width (ft):		

VALUES USED FOR ANALYSIS (To be Entered by Engineer)

Avg. Breach Width (ft):	150.75	Breach Side Slopes:	0.7	H:1V
Breach Bottom Width (ft):	100	(based on on selected values)		
Time of failure (hrs):	0.87			

Check for: Time of Failure too long

Check for: Time of Failure less than recommended minimum value

Notes:

- The average breach width cannot be wider than The width of The stream valley at The particular elevation.
- The check for time of failures are based on minimum reasonable value (based on MDE experience) and the maximum reasonable valuesbased on expected erosion rate (Von Thun & Gillette (1990)).

Dam Name:	Piney Run Dam (MD Dam No. 139)	Prepared by:	JB
Location:	Sykesville, Maryland	Date:	5/18/2020
Breach Scenario:	Static (WSE at Auxiliary Spillway)		

Height of Dam (ft):	72.5
Breach Bottom Elevation:	468
Height of water above breach bottom (ft):	63.2
Reservoir Storage Volume at Failure (acre-feet):	8088
Reservoir Surface Area at Failure (acres):	377
Failure Scenario:	Piping
Discharge through spillways at failure (Q_o, cfs):	11

Breach Parameters

Froelich (2008)

Avg. Breach Width (ft):	173.1	Breach Side Slopes:	0.7	H:1V
Breach Bottom Width (ft):	122.4	K_o Factor:	1.0	
Time of failure (hrs):	0.92			

Froelich (1995)

Avg. Breach Width (ft):	177.8	Breach Side Slopes:	0.9	H:1V
Breach Bottom Width (ft):	112.6	K_o Factor:	0.7	
Time of failure (hrs):	0.93			

MacDonald & Langridge-Monopolis (1984)

[For Piping Scenario Only when Storage Volume is less than 100 acre-feet]

Avg. Breach Width (ft):	#DIV/0!	Breach Side Slopes:	0.5	H:1V
Breach Bottom Width (ft):	#DIV/0!	Upstream Slopes:		H:1V
Time of failure (hrs):	0.98	Downstream Slopes:		H:1V
	Storage exceeds 100 ac-ft	Crest Width (ft):		

VALUES USED FOR ANALYSIS (To be Entered by Engineer)

Avg. Breach Width (ft):	173.15	Breach Side Slopes:	0.7	H:1V
Breach Bottom Width (ft):	122.4	(based on on selected values)		
Time of failure (hrs):	0.92			

Check for: Time of Failure too long

Check for: Time of Failure less than recommended minimum value

Notes:

- The average breach width cannot be wider than The width of The stream valley at The particular elevation.
- The check for time of failures are based on minimum reasonable value (based on MDE experience) and the maximum reasonable valuesbased on expected erosion rate (Von Thun & Gillette (1990)).

Dam Name:	Piney Run Dam (MD Dam No. 139)	Prepared by:	JB
Location:	Sykesville, Maryland	Date:	5/18/2020
Breach Scenario:	PMF		

Height of Dam (ft):	72.5
Breach Bottom Elevation:	468
Height of water above breach bottom (ft):	75.5
Reservoir Storage Volume at Failure (acre-feet):	13650
Reservoir Surface Area at Failure (acres):	535
Failure Scenario:	Overtopping
Discharge through spillways at failure (Q_o, cfs):	32100

Breach Parameters

Froelich (2008)

Avg. Breach Width (ft):	268.0	Breach Side Slopes:	1.0	H:1V
Breach Bottom Width (ft):	195.5	K_o Factor:	1.3	
Time of failure (hrs):	1.00			

Froelich (1995)

Avg. Breach Width (ft):	302.7	Breach Side Slopes:	1.4	H:1V
Breach Bottom Width (ft):	201.2	K_o Factor:	1.0	
Time of failure (hrs):	1.01			

MacDonald & Langridge-Monopolis (1984)

[For Piping Scenario Only when Storage Volume is less than 100 acre-feet]

Avg. Breach Width (ft):	#DIV/0!	Breach Side Slopes:	0.5	H:1V
Breach Bottom Width (ft):	#DIV/0!	Upstream Slopes:		H:1V
Time of failure (hrs):	1.19	Downstream Slopes:		H:1V
	Storage exceeds 100 ac-ft	Crest Width (ft):		

VALUES USED FOR ANALYSIS (To be Entered by Engineer)

Avg. Breach Width (ft):	268	Breach Side Slopes:	1	H:1V
Breach Bottom Width (ft):	195.5	(based on on selected values)		
Time of failure (hrs):	1			

Check for: Time of Failure too long

Check for: Time of Failure less than recommended minimum value

Notes:

- The average breach width cannot be wider than The width of The stream valley at The particular elevation.
- The check for time of failures are based on minimum reasonable value (based on MDE experience) and the maximum reasonable valuesbased on expected erosion rate (Von Thun & Gillette (1990)).

Impacted Buildings																			
Street Address								Impact Event											
							Elevation	Dam Decommissioned				Dam-in-Place					Dam Breach		
ID	Number	Road	Town	State	Zip	Structure Description	(feet)	10% AE	2% AE	1% AE	0.2% AE	10% AE	2% AE	1% AE	0.2% AE	PMF	Seismic	Static	Hydrologic (PMF)
1	6150	Emerald Lane	Sykesville	Maryland	21784	Single Family House	535.9									X			X
2	6150	Emerald Lane	Sykesville	Maryland	21784	Farm Structure	534.7									X			X
3	6150	Emerald Lane	Sykesville	Maryland	21784	Farm Structure	533.1									X			X
4	30	Martz Road	Sykesville	Maryland	21784	Park Structure	531.7								X	X			X
5	30	Martz Road	Sykesville	Maryland	21784	Park Structure	526.5						X	X	X	X		X	X
6	6930	Sykesville Road	Sykesville	Maryland	21784	Commercial Building	469.5			X	X					X	X	X	X
7	6930	Sykesville Road	Sykesville	Maryland	21784	Farm Structure	471.8									X	X	X	X
8	6930	Sykesville Road	Sykesville	Maryland	21784	Shed	461.9		X	X	X					X	X	X	X
9	6930	Sykesville Road	Sykesville	Maryland	21784	Single Family House	467.1		X	X	X					X	X	X	X
10	6930	Sykesville Road	Sykesville	Maryland	21784	Single Family House	456.7	X	X	X	X				X	X	X	X	X
11	6930	Sykesville Road	Sykesville	Maryland	21784	Barn	472.3		X	X	X					X	X	X	X
12	6935	Sykesville Road	Sykesville	Maryland	21784	Pump Station	461.5				X					X	X	X	X
13	7025	Main Street	Sykesville	Maryland	21784	General Storeroom	475.6												X
14	N\A	Buttercup Road	Sykesville	Maryland	21784	Firehouse	464.3									X	X	X	X
15	N\A	Buttercup Road	Sykesville	Maryland	21784	Paint Shop	455.0									X	X	X	X
16	N\A	Buttercup Road	Sykesville	Maryland	21784	Carpentry Shop	458.2										X	X	X
17	N\A	Buttercup Road	Sykesville	Maryland	21784	Metal Shop	459.8												X
18	N\A	Buttercup Road	Sykesville	Maryland	21784	Storage Building	461.0												X
19	N\A	Buttercup Road	Sykesville	Maryland	21784	Water Treatment Plant	469.7												X
20	7105	Buttercup Road	Sykesville	Maryland	21784	Maintenance Building	452.3									X	X	X	X
21	7107	Buttercup Road	Sykesville	Maryland	21784	Central Linen Building	449.5									X	X	X	X
22	N\A	Buttercup Road	Sykesville	Maryland	21784	Unidentified Building	459.7												X
23	N\A	Buttercup Road	Sykesville	Maryland	21784	Unidentified Building	460.7												X
24	N\A	Buttercup Road	Sykesville	Maryland	21784	Unidentified Building	468.7												X
25	N\A	Buttercup Road	Sykesville	Maryland	21784	Unidentified Building	444.0		X	X	X					X	X	X	X
26	N\A	Buttercup Road	Sykesville	Maryland	21784	Unidentified Building	447.8									X	X	X	X
N\A	N\A	Springfield Avenue	Sykesville	Maryland	21784	Proposed Townhouses	N\A			X	X					X	X	X	X
27	N\A	Warfield Avenue	Sykesville	Maryland	21784	Electrical Substation	457.6				X					X	X	X	X
28	6915	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	488.9												X
29	6917	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	489.1												X
30	6919	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	489.1												X
31	6921	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	489.4												X
32	6923	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	489.2												X
33	6925	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	490.6												X
34	6927	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	493.8												X
35	6929	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	493.5												X
36	6931	Warfield Avenue	Sykesville	Maryland	21784	Institutional Building	490.9												X
37	6937	Warfield Avenue	Sykesville	Maryland	21784	Nursing Home	495.5												X
38	7310	Slacks Road	Sykesville	Maryland	21784	Municipal Building	458.6												X
39	7310	Slacks Road	Sykesville	Maryland	21784	Municipal Building	459.1												X
40	7310	Slacks Road	Sykesville	Maryland	21784	Municipal Building	445.9											X	X
41	6900	Slacks Road	Sykesville	Maryland	21784	Barn	443.8											X	X
42	1909	Gardenia Street	Sykesville	Maryland	21784	Single Family House	447.8												X
43	1911	Gardenia Street	Sykesville	Maryland	21784	Single Family House	444.6												X
44	1915	Gardenia Street	Sykesville	Maryland	21784	Single Family House	441.4												X
45	1917	Gardenia Street	Sykesville	Maryland	21784	Single Family House	440.5												X

Street Address						Structure Description	Elevation (feet)	Impact Event											
								Dam Decommissioned				Dam-in-Place					Dam Breach		
ID	Number	Road	Town	State	Zip			10% AE	2% AE	1% AE	0.2% AE	10% AE	2% AE	1% AE	0.2% AE	PMF	Seismic	Static	Hydrologic (PMF)
46	1919	Gardenia Street	Sykesville	Maryland	21784	Single Family House	444.1												X
47	1921	Gardenia Street	Sykesville	Maryland	21784	Single Family House	439.0												X
48	1923	Gardenia Street	Sykesville	Maryland	21784	Single Family House	445.1												X
49	7206	Violet Court	Sykesville	Maryland	21784	Single Family House	447.3												X
50	7207	Violet Court	Sykesville	Maryland	21784	Single Family House	438.1												X
51	7208	Violet Court	Sykesville	Maryland	21784	Single Family House	445.9												X
52	7208	Violet Court	Sykesville	Maryland	21784	Detached Garage	437.3												X
53	7209	Violet Court	Sykesville	Maryland	21784	Single Family House	435.8												X
54	7132	MacBeth Way	Sykesville	Maryland	21784	Single Family House	444.5												X
55	7133	MacBeth Way	Sykesville	Maryland	21784	Single Family House	439.5												X
56	7134	MacBeth Way	Sykesville	Maryland	21784	Single Family House	439.7												X
57	7102	Melstone Valley Way	Marriottsville	Maryland	21104	Single Family House	447.3												X
58	7104	Melstone Valley Way	Marriottsville	Maryland	21104	Single Family House	443.6												X
59	7146	Melstone Valley Way	Marriottsville	Maryland	21104	Single Family House	441.7												X
60	7148	Melstone Valley Way	Marriottsville	Maryland	21104	Single Family House	440.8												X
61	7150	Melstone Valley Way	Marriottsville	Maryland	21104	Single Family House	448.0												X
62	7152	Brangles Road	Marriottsville	Maryland	21104	Single Family House	437.5												X
63	7154	Brangles Road	Marriottsville	Maryland	21104	Single Family House	435.2												X
64	7235	Brangles Road	Marriottsville	Maryland	21104	Pump Station	407.9	X	X	X	X				X	X	X	X	X
65	7308	Brangles Road	Marriottsville	Maryland	21104	Single Family House	425.5									X	X	X	X
66	7311	Brangles Road	Marriottsville	Maryland	21104	Garage	420.3									X	X	X	X
67	7311	Brangles Road	Marriottsville	Maryland	21104	Single Family House	423.8									X	X	X	X
68	7317	Brangles Road	Marriottsville	Maryland	21104	Single Family House	441.6												X
69	7573	Shub Drive	Marriottsville	Maryland	21104	Single Family House	420.3												X
70	7575	Shub Drive	Marriottsville	Maryland	21104	Single Family House	420.3												X
71	7576	Shub Drive	Marriottsville	Maryland	21104	Single Family House	417.1												X
72	2134	Arrington Road	Marriottsville	Maryland	21104	Single Family House	403.7									X	X	X	X
73	2136	Arrington Road	Marriottsville	Maryland	21104	Single Family House	402.5			X	X					X	X	X	X
74	2138	Arrington Road	Marriottsville	Maryland	21104	Garage	395.0			X	X					X	X	X	X
75	2138	Arrington Road	Marriottsville	Maryland	21104	Single Family House	393.9				X					X	X	X	X
76	2211	Arrington Road	Marriottsville	Maryland	21104	Single Family House	416.1												X
77	2250	Arrington Road	Marriottsville	Maryland	21104	Single Family House	389.5		X	X	X					X	X	X	X
78	N\A	Arrington Road	Marriottsville	Maryland	21104	Church	414.2											X	X
79	2133	Arrington Road	Marriottsville	Maryland	21104	Single Family House	426.1												X
80	11410	Marriottsville Road	Marriottsville	Maryland	21104	Commercial Building	302.8	*	*	*	*	*	*	*	*	X			X
81	11410	Marriottsville Road	Marriottsville	Maryland	21104	Commercial Building	305.9	*	*	*	*	*	*	*	*				X
82	11410	Marriottsville Road	Marriottsville	Maryland	21104	Industrial Building	305.7	*	*	*	*	*	*	*	*				X
83	11411	Marriottsville Road	Marriottsville	Maryland	21104	Industrial Building	296.9	*	*	*	*	*	*	*	*	X			X
84	11518	Marriottsville Road	Marriottsville	Maryland	21104	Commercial Building	296.5	*	*	*	*	*	*	*	*	X			X
85	11518	Marriottsville Road	Marriottsville	Maryland	21104	Commercial Building	295.5	*	*	*	*	*	*	*	*	X			X
86	705	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	295.8		X	X	X			X	X	X	X	X	X
87	714	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	291.5		X	X	X		X	X	X	X	X	X	X
88	724	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	294.5		X	X	X		X	X	X	X	X	X	X
89	734	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	293.5		X	X	X		X	X	X	X	X	X	X
90	754	Marriottsville Road	Marriottsville	Maryland	21104	Garage	293.3		X	X	X		X	X	X	X	X	X	X
91	754	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	301.1				X				X	X	X	X	X
92	754	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	305.6				X				X	X	X	X	X

Street Address							Elevation	Impact Event											
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ID	Number	Road	Town	State	Zip	Structure Description	(feet)	10% AE	2% AE	1% AE	0.2% AE	10% AE	2% AE	1% AE	0.2% AE	PMF	Seismic	Static	Hydrologic (PMF)
93	798	Marriottsville Road	Marriottsville	Maryland	21104	Industrial Building	323.0												X
94	840	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	318.7												X
95	850	Marriottsville Road	Marriottsville	Maryland	21104	Single Family House	317.3												X
96	10900	Old Court Road	Woodstock	Maryland	21163	State Park Building	277.4	*	*	*	*	*	*	*	*	X			X
97	10900	Old Court Road	Woodstock	Maryland	21163	State Park Building	283.4	*	*	*	*	*	*	*	*	X			X
98	1415	Woodstock Road	Woodstock	Maryland	21163	Commercial Building	257.0	*	*	*	*	*	*	*	*	X			X
99	1415	Woodstock Road	Woodstock	Maryland	21163	Outbuilding	263.3	*	*	*	*	*	*	*	*	X			X
100	1415	Woodstock Road	Woodstock	Maryland	21163	Outbuilding	265.9	*	*	*	*	*	*	*	*	X			X
101	1443	Woodstock Road	Woodstock	Maryland	21163	Single Family House	273.6	*	*	*	*	*	*	*	*	X			X
102	1443	Woodstock Road	Woodstock	Maryland	21163	Garage	272.4	*	*	*	*	*	*	*	*	X			X
103	1447	Woodstock Road	Woodstock	Maryland	21163	Single Family House	276.5	*	*	*	*	*	*	*	*	X			X
104	1447	Woodstock Road	Woodstock	Maryland	21163	Garage	281.3	*	*	*	*	*	*	*	*	X			X
105	2020	Daniels Road	Ellicott City	Maryland	21043	Office/Industrial Building	216.3	*	*	*	*	*	*	*	*	X	X	X	X
106	2020	Daniels Road	Ellicott City	Maryland	21043	Office/Industrial Building	220.9	*	*	*	*	*	*	*	*	X	X	X	X
107	2020	Daniels Road	Ellicott City	Maryland	21043	Office/Industrial Building	217.4	*	*	*	*	*	*	*	*	X	X	X	X
108	2020	Daniels Road	Ellicott City	Maryland	21043	Office/Industrial Building	215.5	*	*	*	*	*	*	*	*	X	X	X	X
109	8106	Alberton Road	Baltimore	Maryland	21244	Single Family House	208.8	*	*	*	*	*	*	*	*	X			X
110	8100	Dogwood Road	Baltimore	Maryland	21244	Single Family House	205.0	*	*	*	*	*	*	*	*	X			X
111	8036	Dogwood Road	Baltimore	Maryland	21244	Single Family House	215.5	*	*	*	*	*	*	*	*	X			X
112	8030	Dogwood Road	Baltimore	Maryland	21244	Single Family House	219.4	*	*	*	*	*	*	*	*	X			X
113	8030	Dogwood Road	Baltimore	Maryland	21244	Garage	222.2	*	*	*	*	*	*	*	*	X			X
114	8024	Dogwood Road	Baltimore	Maryland	21244	Single Family House	238.1	*	*	*	*	*	*	*	*				X
115	706	Race Road	Ellicott City	Maryland	21043	Single Family House	164.0	*	*	*	*	*	*	*	*	X	*	*	X
116	840	Oella Avenue	Ellicott City	Maryland	21043	Apartment Building	151.5	*	*	*	*	*	*	*	*	X	*	*	X
117	870	Oella Avenue	Ellicott City	Maryland	21043	Apartment Building	152.9	*	*	*	*	*	*	*	*	X	*	*	X
118	929	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
119	931	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
120	933	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
121	935	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
122	937	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
123	939	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
124	941	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
125	943	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
126	945	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
127	947	Oella Avenue	Ellicott City	Maryland	21043	Townhouse	156.3	*	*	*	*	*	*	*	*	X	*	*	X
128	970	Oella Avenue	Ellicott City	Maryland	21043	Single Family House	139.5	*	*	*	*	*	*	*	*	X	*	*	X
129	1010	Oella Avenue	Ellicott City	Maryland	21043	Single Family House	141.0	*	*	*	*	*	*	*	*	X	*	*	X
130	6	Oella Avenue	Ellicott City	Maryland	21043	Commercial Building	125.6	*	*	*	*	*	*	*	*	X	*	*	X
131	4	Frederick Road	Ellicott City	Maryland	21043	Commercial Building	124.9	*	*	*	*	*	*	*	*	X	*	*	X
132	3022	Westchester Avenue	Ellicott City	Maryland	21043	Single Family House	130.7	*	*	*	*	*	*	*	*	X	*	*	X
133	3015	Westchester Avenue	Ellicott City	Maryland	21043	Single Family House	151.6	*	*	*	*	*	*	*	*	X	*	*	X
134	3012	Westchester Avenue	Ellicott City	Maryland	21043	Townhouse	138.9	*	*	*	*	*	*	*	*	X	*	*	X
135	3010	Westchester Avenue	Ellicott City	Maryland	21043	Townhouse	147.7	*	*	*	*	*	*	*	*	X	*	*	X
136	3008	Westchester Avenue	Ellicott City	Maryland	21043	Townhouse	143.6	*	*	*	*	*	*	*	*	X	*	*	X
137	3006	Westchester Avenue	Ellicott City	Maryland	21043	Townhouse	151.5	*	*	*	*	*	*	*	*	X	*	*	X
138	3005	Westchester Avenue	Ellicott City	Maryland	21043	Single Family House	151.7	*	*	*	*	*	*	*	*	X	*	*	X
139	3004	Westchester Avenue	Ellicott City	Maryland	21043	Townhouse	140.0	*	*	*	*	*	*	*	*	X	*	*	X
140	3003	Westchester Avenue	Ellicott City	Maryland	21043	Single Family House	151.5	*	*	*	*	*	*	*	*		*	*	X
141	3002	Westchester Avenue	Ellicott City	Maryland	21043	Single Family House	151.7	*	*	*	*	*	*	*	*		*	*	X
142	3000	Westchester Avenue	Ellicott City	Maryland	21043	Single Family House	140.0	*	*	*	*	*	*	*	*	X	*	*	X
143	24	Frederick Road	Ellicott City	Maryland	21043	Commercial Building	133.9	*	*	*	*	*	*	*	*	X	*	*	X
144	27	Frederick Road	Ellicott City	Maryland	21043	Industrial Building	115.5	*	*	*	*	*	*	*	*	X	*	*	X
145	8000	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.7	*	*	*	*	*	*	*	*	X	*	*	X
146	8004	Main Street	Ellicott City	Maryland	21043	Commercial Building	122.8	*	*	*	*	*	*	*	*	X	*	*	X

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ID	Number	Road	Town	State	Zip	Structure Description	(feet)	10% AE	2% AE	1% AE	0.2% AE	10% AE	2% AE	1% AE	0.2% AE	PMF	Seismic	Static	Hydrologic (PMF)
147	8016	Main Street	Ellicott City	Maryland	21043	Commercial Building	123.2	*	*	*	*	*	*	*	*	X	*	*	X
148	8020	Main Street	Ellicott City	Maryland	21043	Commercial Building	123.4	*	*	*	*	*	*	*	*	X	*	*	X
149	8030	Main Street	Ellicott City	Maryland	21043	Commercial Building	124.5	*	*	*	*	*	*	*	*	X	*	*	X
150	8044	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.5	*	*	*	*	*	*	*	*	X	*	*	X
151	8048	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.5	*	*	*	*	*	*	*	*	X	*	*	X
152	8052	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.6	*	*	*	*	*	*	*	*	X	*	*	X
153	8056	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.6	*	*	*	*	*	*	*	*	X	*	*	X
154	8060	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.8	*	*	*	*	*	*	*	*	X	*	*	X
155	8066	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.8	*	*	*	*	*	*	*	*	X	*	*	X
156	8070	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.0	*	*	*	*	*	*	*	*	X	*	*	X
157	8074	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.1	*	*	*	*	*	*	*	*	X	*	*	X
158	8080	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.6	*	*	*	*	*	*	*	*	X	*	*	X
159	8086	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.6	*	*	*	*	*	*	*	*	X	*	*	X
160	8092	Main Street	Ellicott City	Maryland	21043	Commercial Building	127.0	*	*	*	*	*	*	*	*	X	*	*	X
161	8098	Main Street	Ellicott City	Maryland	21043	Commercial Building	127.7	*	*	*	*	*	*	*	*	X	*	*	X
162	8104	Main Street	Ellicott City	Maryland	21043	Commercial Building	129.1	*	*	*	*	*	*	*	*	X	*	*	X
163	8116	Main Street	Ellicott City	Maryland	21043	Commercial Building	130.4	*	*	*	*	*	*	*	*	X	*	*	X
164	8120	Main Street	Ellicott City	Maryland	21043	Commercial Building	131.4	*	*	*	*	*	*	*	*	X	*	*	X
165	8134	Main Street	Ellicott City	Maryland	21043	Commercial Building	133.4	*	*	*	*	*	*	*	*	X	*	*	X
166	8156	Main Street	Ellicott City	Maryland	21043	Commercial Building	136.4	*	*	*	*	*	*	*	*	X	*	*	X
167	8180	Main Street	Ellicott City	Maryland	21043	Commercial Building	143.7	*	*	*	*	*	*	*	*	X	*	*	X
168	8186	Main Street	Ellicott City	Maryland	21043	Commercial Building	145.1	*	*	*	*	*	*	*	*	X	*	*	X
169	8192	Main Street	Ellicott City	Maryland	21043	Commercial Building	143.9	*	*	*	*	*	*	*	*	X	*	*	X
170	8197	Main Street	Ellicott City	Maryland	21043	Commercial Building	150.5	*	*	*	*	*	*	*	*	X	*	*	X
171	8191	Main Street	Ellicott City	Maryland	21043	Commercial Building	143.4	*	*	*	*	*	*	*	*	X	*	*	X
172	8185	Main Street	Ellicott City	Maryland	21043	Commercial Building	143.2	*	*	*	*	*	*	*	*	X	*	*	X
173	8181	Main Street	Ellicott City	Maryland	21043	Commercial Building	142.6	*	*	*	*	*	*	*	*	X	*	*	X
174	8173	Main Street	Ellicott City	Maryland	21043	Commercial Building	140.0	*	*	*	*	*	*	*	*	X	*	*	X
175	8167	Main Street	Ellicott City	Maryland	21043	Commercial Building	139.5	*	*	*	*	*	*	*	*	X	*	*	X
176	8145	Main Street	Ellicott City	Maryland	21043	Commercial Building	137.4	*	*	*	*	*	*	*	*	X	*	*	X
177	8141	Main Street	Ellicott City	Maryland	21043	Commercial Building	134.8	*	*	*	*	*	*	*	*	X	*	*	X
178	8137	Main Street	Ellicott City	Maryland	21043	Commercial Building	132.8	*	*	*	*	*	*	*	*	X	*	*	X
179	8133	Main Street	Ellicott City	Maryland	21043	Commercial Building	131.8	*	*	*	*	*	*	*	*	X	*	*	X
180	8125	Main Street	Ellicott City	Maryland	21043	Commercial Building	129.5	*	*	*	*	*	*	*	*	X	*	*	X
181	8109	Main Street	Ellicott City	Maryland	21043	Commercial Building	128.8	*	*	*	*	*	*	*	*	X	*	*	X
182	8101	Main Street	Ellicott City	Maryland	21043	Commercial Building	127.1	*	*	*	*	*	*	*	*	X	*	*	X
183	8095	Main Street	Ellicott City	Maryland	21043	Commercial Building	127.0	*	*	*	*	*	*	*	*	X	*	*	X
184	8081	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.3	*	*	*	*	*	*	*	*	X	*	*	X
185	8069	Main Street	Ellicott City	Maryland	21043	Commercial Building	127.6	*	*	*	*	*	*	*	*	X	*	*	X
186	8059	Main Street	Ellicott City	Maryland	21043	Commercial Building	125.7	*	*	*	*	*	*	*	*	X	*	*	X
187	8049	Main Street	Ellicott City	Maryland	21043	Commercial Building	126.4	*	*	*	*	*	*	*	*	X	*	*	X
188	8069	Tiber Alley	Ellicott City	Maryland	21043	Commercial Building	128.6	*	*	*	*	*	*	*	*	X	*	*	X
189	8061	Tiber Alley	Ellicott City	Maryland	21043	Commercial Building	128.6	*	*	*	*	*	*	*	*	X	*	*	X
190	3744	St. Paul Street	Ellicott City	Maryland	21043	Single Family House	151.3	*	*	*	*	*	*	*	*	X	*	*	X
191	3738	St. Paul Street	Ellicott City	Maryland	21043	Townhouse	152.6	*	*	*	*	*	*	*	*	X	*	*	X
192	3732	St. Paul Street	Ellicott City	Maryland	21043	Townhouse	152.6	*	*	*	*	*	*	*	*	X	*	*	X
193	3720	Maryland Avenue	Ellicott City	Maryland	21043	Commercial Building	128.5	*	*	*	*	*	*	*	*	X	*	*	X
194	3711	Maryland Avenue	Ellicott City	Maryland	21043	Commercial Building	128.3	*	*	*	*	*	*	*	*	X	*	*	X
195	64	Frederick Road	Ellicott City	Maryland	21043	Commercial Building	113.4	*	*	*	*	*	*	*	*	X	*	*	X
196	76	Frederick Road	Ellicott City	Maryland	21043	Commercial Building	114.1	*	*	*	*	*	*	*	*	X	*	*	X
197	98	Frederick Road	Ellicott City	Maryland	21043	Commercial Building	130.3	*	*	*	*	*	*	*	*	X	*	*	X
198	152	Frederick Road	Ellicott City	Maryland	21043	Single Family House	133.1	*	*	*	*	*	*	*	*	X	*	*	X
199	156	Frederick Road	Ellicott City	Maryland	21043	Townhouse	122.4	*	*	*	*	*	*	*	*	X	*	*	X
200	161	Frederick Road	Ellicott City	Maryland	21043	Single Family House	122.7	*	*	*	*	*	*	*	*	X	*	*	X

Street Address						Structure Description	Elevation (feet)	Impact Event											
								Dam Decommissioned				Dam-in-Place					Dam Breach		
ID	**Number**	**Road**	**Town**	**State**	**Zip**	**Structure Description**	**(feet)**	**10% AE**	**2% AE**	**1% AE**	**0.2% AE**	**10% AE**	**2% AE**	**1% AE**	**0.2% AE**	**PMF**	**Seismic**	**Static**	**Hydrologic (PMF)**
201	167	Frederick Road	Ellicott City	Maryland	21043	Single Family House	125.8	*	*	*	*	*	*	*	*	X	*	*	X
202	169	Frederick Road	Ellicott City	Maryland	21043	Commercial Building	127.8	*	*	*	*	*	*	*	*	X	*	*	X
203	2	River Road	Ellicott City	Maryland	21043	Single Family House	102.8	*	*	*	*	*	*	*	*	X	*	*	X
204	4	River Road	Ellicott City	Maryland	21043	Single Family House	105.1	*	*	*	*	*	*	*	*	X	*	*	X
205	10	River Road	Ellicott City	Maryland	21043	Single Family House	105.7	*	*	*	*	*	*	*	*	X	*	*	X
206		River Road	Ellicott City	Maryland	21043	Single Family House	119.0	*	*	*	*	*	*	*	*	X	*	*	X
207		Gun Road	Ellicott City	Maryland	21043	Park Structure	42.6	*	*	*	*	*	*	*	*	X	*	*	X
208	6151	Rockburn Hill Road	Elkridge	Maryland	21075	Single Family House	42.6	*	*	*	*	*	*	*	*	X	*	*	X
210	5481	Levering Avenue	Elkridge	Maryland	21075	Commercial Building	29.6	*	*	*	*	*	*	*	*	X	*	*	X
211	5471	Levering Avenue	Elkridge	Maryland	21075	Industrial Building	29.0	*	*	*	*	*	*	*	*	X	*	*	X
212	5495	Levering Avenue	Elkridge	Maryland	21075	Commercial Building	32.4	*	*	*	*	*	*	*	*	X	*	*	X
213	5530	Levering Avenue	Elkridge	Maryland	21075	Single Family House	45.3	*	*	*	*	*	*	*	*	X	*	*	X
214	5534	Levering Avenue	Elkridge	Maryland	21075	Single Family House	42.2	*	*	*	*	*	*	*	*	X	*	*	X
215	5538	Levering Avenue	Elkridge	Maryland	21075	Single Family House	40.7	*	*	*	*	*	*	*	*	X	*	*	X
216	5542	Levering Avenue	Elkridge	Maryland	21075	Single Family House	41.1	*	*	*	*	*	*	*	*	X	*	*	X
217	5585	Levering Avenue	Elkridge	Maryland	21075	Commercial Building	40.4	*	*	*	*	*	*	*	*	X	*	*	X
218	5230	Washington Boulevard	Elkridge	Maryland	21075	Commercial Building	35.0	*	*	*	*	*	*	*	*	X	*	*	X
219	5790	Washington Boulevard	Elkridge	Maryland	21075	Commercial Building	36.5	*	*	*	*	*	*	*	*	X	*	*	X
220	5790	Washington Boulevard	Elkridge	Maryland	21075	Commercial Building	34.1	*	*	*	*	*	*	*	*	X	*	*	X
221	5816	Washington Boulevard	Elkridge	Maryland	21075	Commercial Building	35.0	*	*	*	*	*	*	*	*	X	*	*	X
222	5711	Washington Boulevard	Elkridge	Maryland	21075	Commercial Building	29.1	*	*	*	*	*	*	*	*	X	*	*	X
223	5811	Washington Boulevard	Elkridge	Maryland	21075	Commercial Building	36.0	*	*	*	*	*	*	*	*	X	*	*	X
224	5695	Main Street	Elkridge	Maryland	21075	Church	40.0	*	*	*	*	*	*	*	*	X	*	*	X
225	5681	Main Street	Elkridge	Maryland	21075	Industrial Building	30.3	*	*	*	*	*	*	*	*	X	*	*	X
226	5635	Furnace Avenue	Elkridge	Maryland	21075	Industrial Building	39.0	*	*	*	*	*	*	*	*	X	*	*	X
227	5659	Furnace Avenue	Elkridge	Maryland	21075	Industrial Building	39.0	*	*	*	*	*	*	*	*	X	*	*	X
228	5673	Furnace Avenue	Elkridge	Maryland	21075	Townhouse	35.8	*	*	*	*	*	*	*	*		*	*	X
229	5673	Furnace Avenue	Elkridge	Maryland	21075	Townhouse	37.4	*	*	*	*	*	*	*	*		*	*	X
230	5706	Furnace Avenue	Elkridge	Maryland	21075	Single Family House	35.8	*	*	*	*	*	*	*	*		*	*	X
231	5708	Furnace Avenue	Elkridge	Maryland	21075	Single Family House	35.5	*	*	*	*	*	*	*	*	X	*	*	X
232	5797	Railroad Avenue	Elkridge	Maryland	21075	Single Family House	37.5	*	*	*	*	*	*	*	*	X	*	*	X
233	5799	Railroad Avenue	Elkridge	Maryland	21075	Single Family House	35.6	*	*	*	*	*	*	*	*		*	*	X
234	5741	Furnace Avenue	Elkridge	Maryland	21075	Single Family House	32.3	*	*	*	*	*	*	*	*	X	*	*	X
235	5728	Furnace Avenue	Elkridge	Maryland	21075	Single Family House	32.3	*	*	*	*	*	*	*	*	X	*	*	X
236	5750	Furnace Avenue	Elkridge	Maryland	21075	Single Family House	30.9	*	*	*	*	*	*	*	*	X	*	*	X
237	5735	Race Road	Elkridge	Maryland	21075	Single Family House	30.5	*	*	*	*	*	*	*	*	X	*	*	X
238	5737	Race Road	Elkridge	Maryland	21075	Single Family House	29.3	*	*	*	*	*	*	*	*	X	*	*	X
239	5743	Race Road	Elkridge	Maryland	21075	Single Family House	30.2	*	*	*	*	*	*	*	*	X	*	*	X
240	5747	Race Road	Elkridge	Maryland	21075	Single Family House	30.0	*	*	*	*	*	*	*	*	X	*	*	X
241	5710	Furnace Avenue	Elkridge	Maryland	21075	Commercial Building	34.8	*	*	*	*	*	*	*	*	X	*	*	X
242	5780	Race Road	Elkridge	Maryland	21075	Single Family House	34.8	*	*	*	*	*	*	*	*	X	*	*	X
243	5800	Race Road	Elkridge	Maryland	21075	Single Family House	36.1	*	*	*	*	*	*	*	*	X	*	*	X

Legend

Railroad

Surface Road

Impacted Structure

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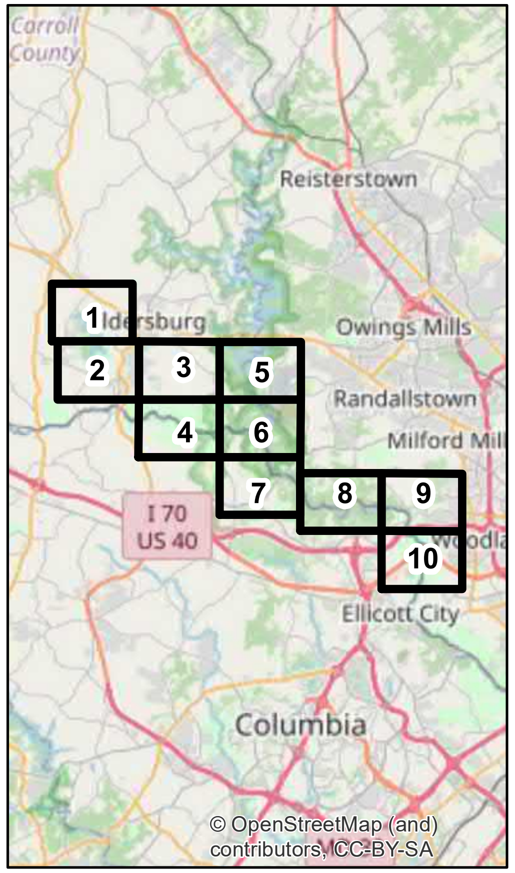

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0 500 1,000 2,000 3,000 4,000
Feet

N W E S

Piney Run Dam
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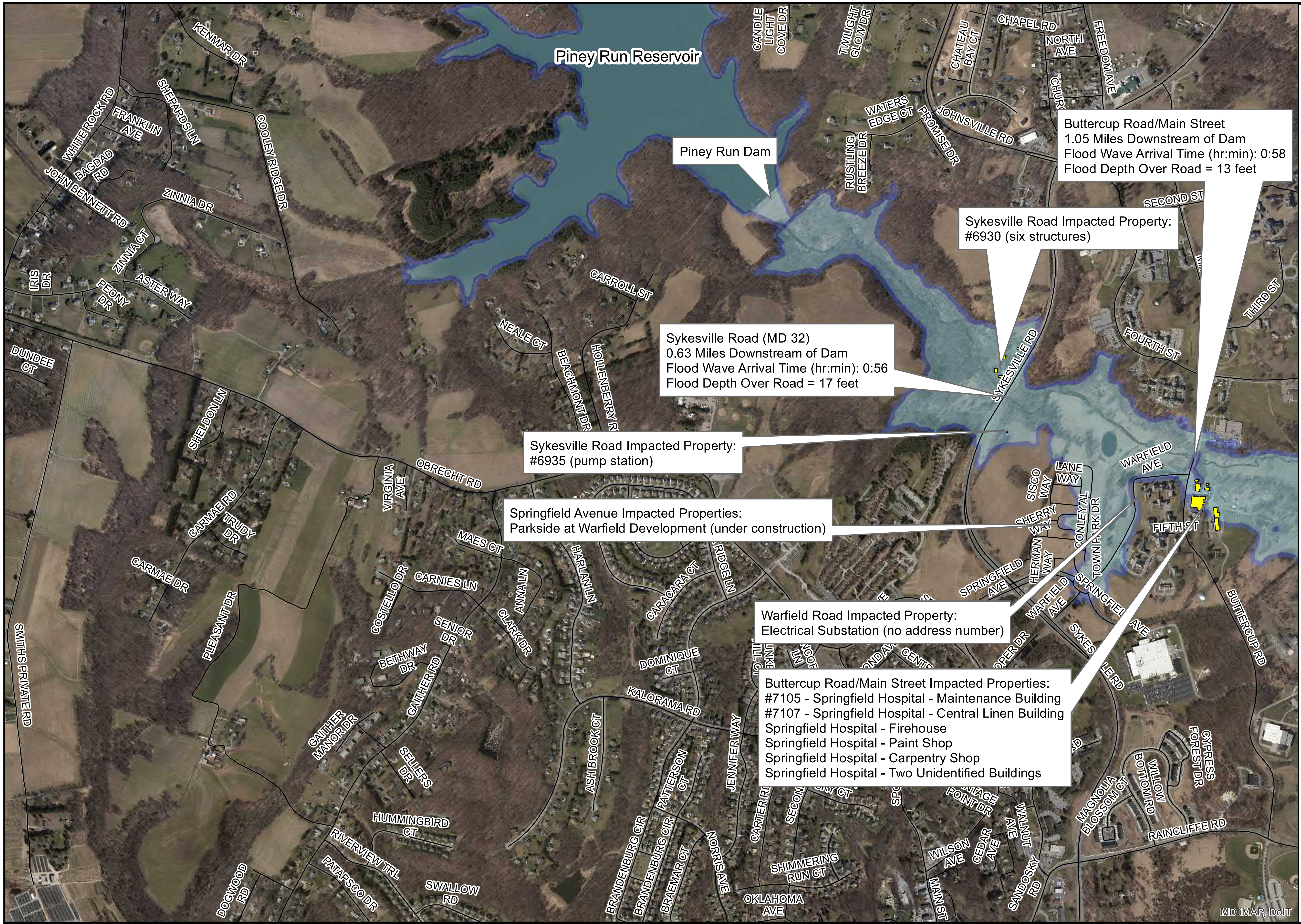

Legend

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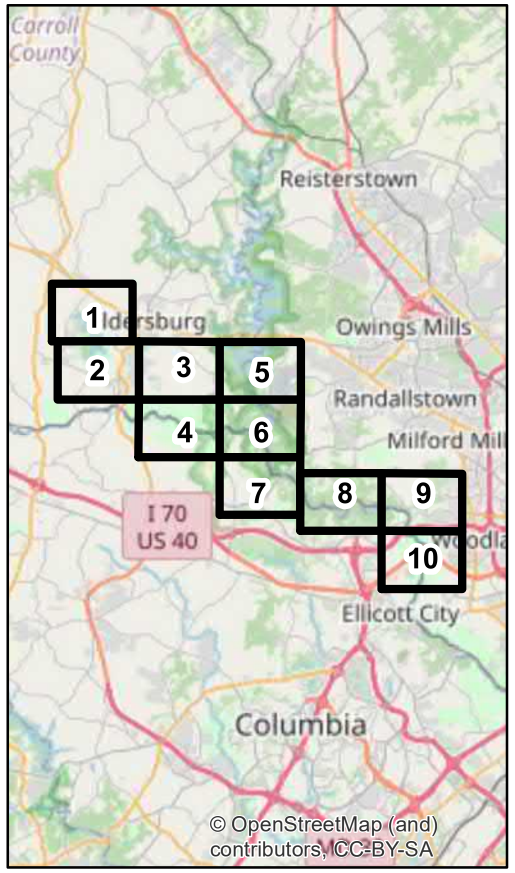

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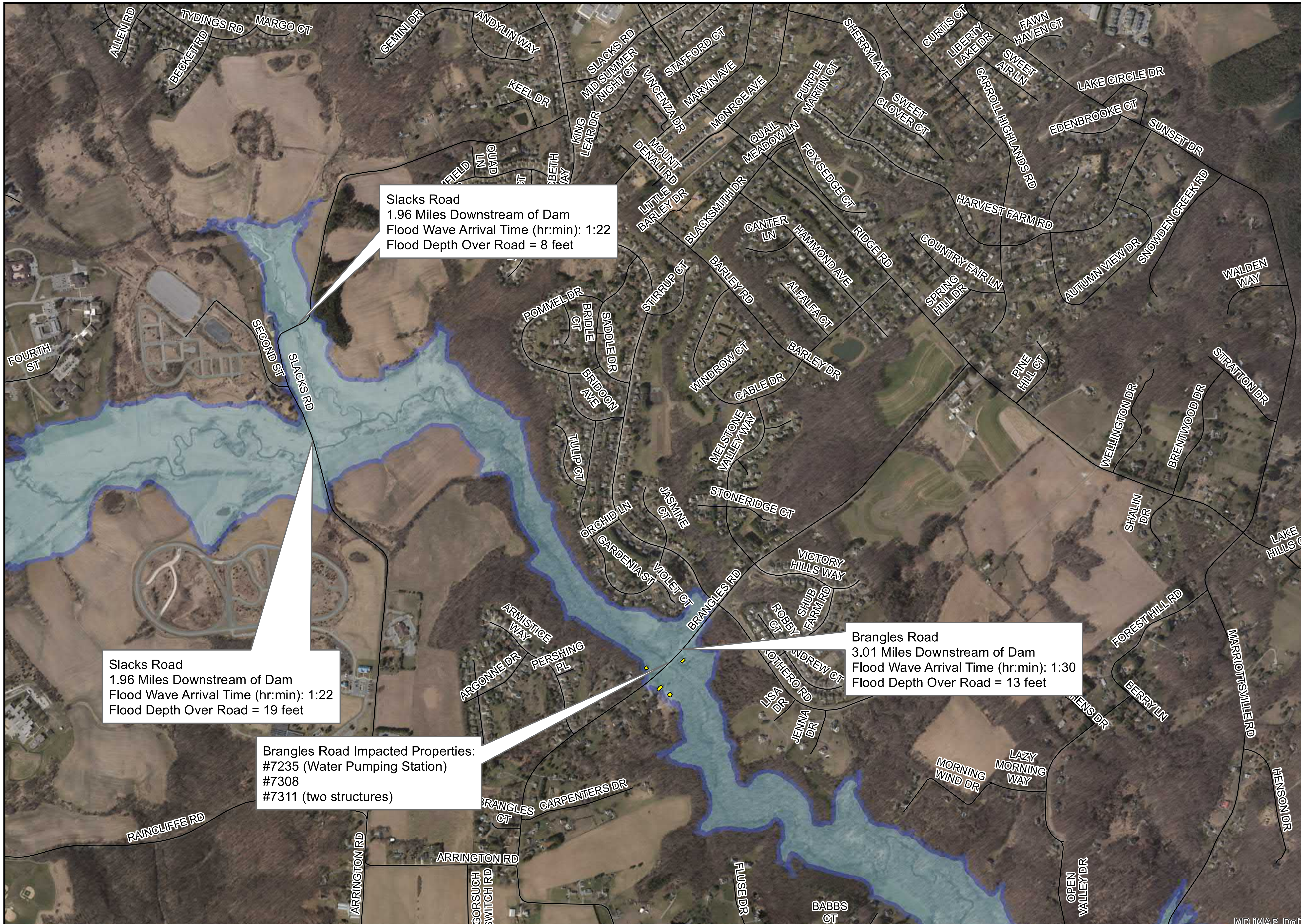

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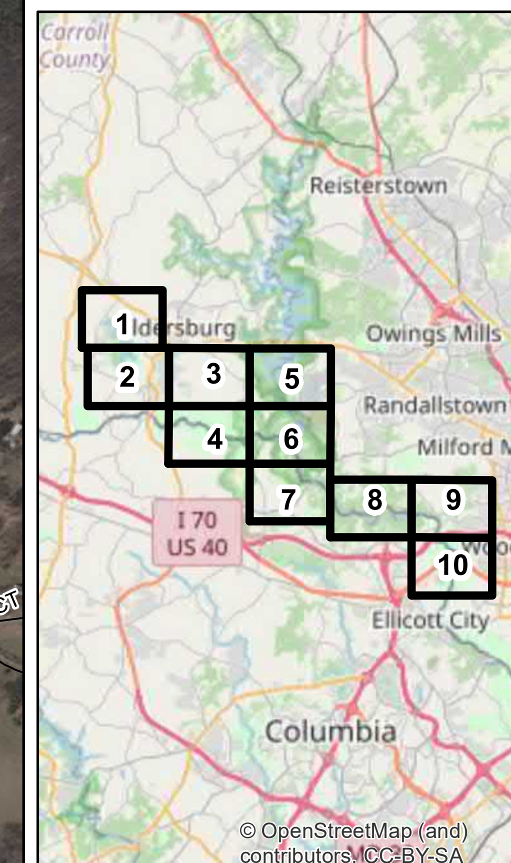

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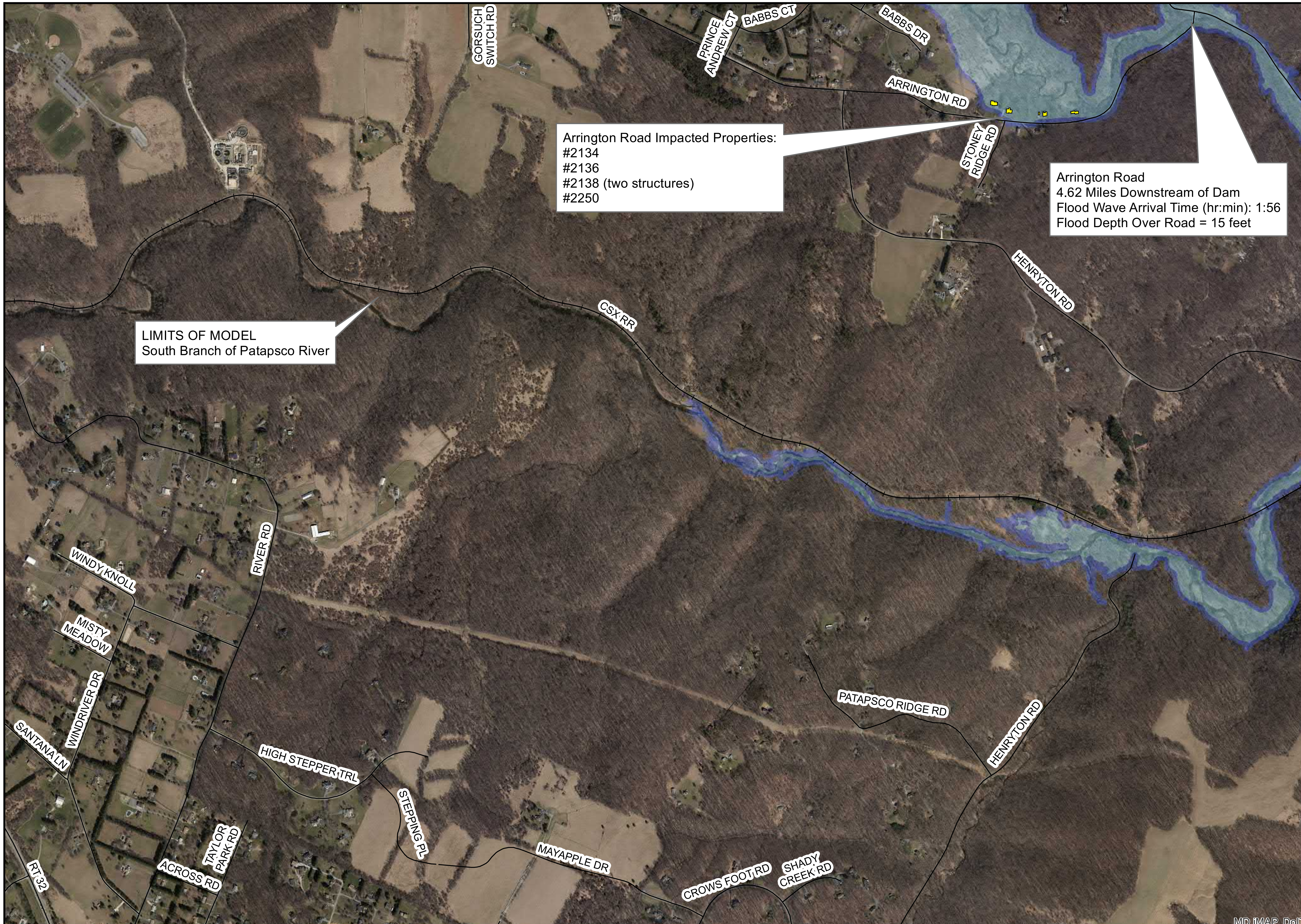

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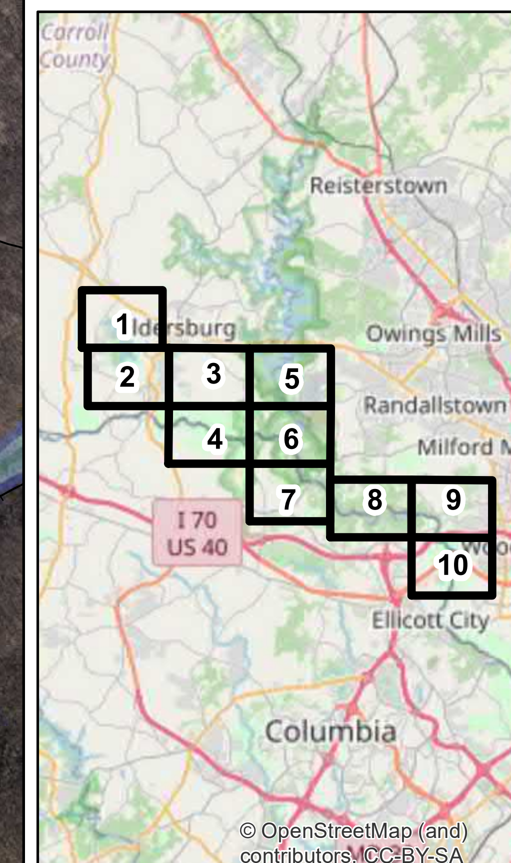

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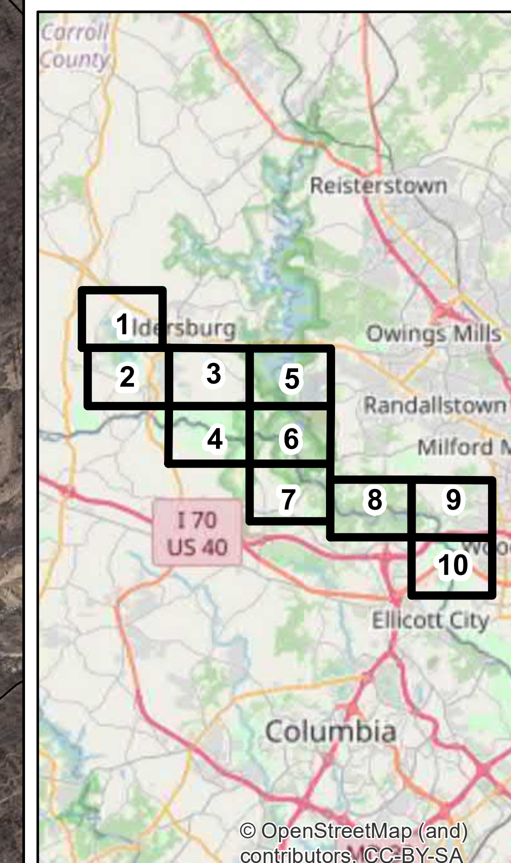

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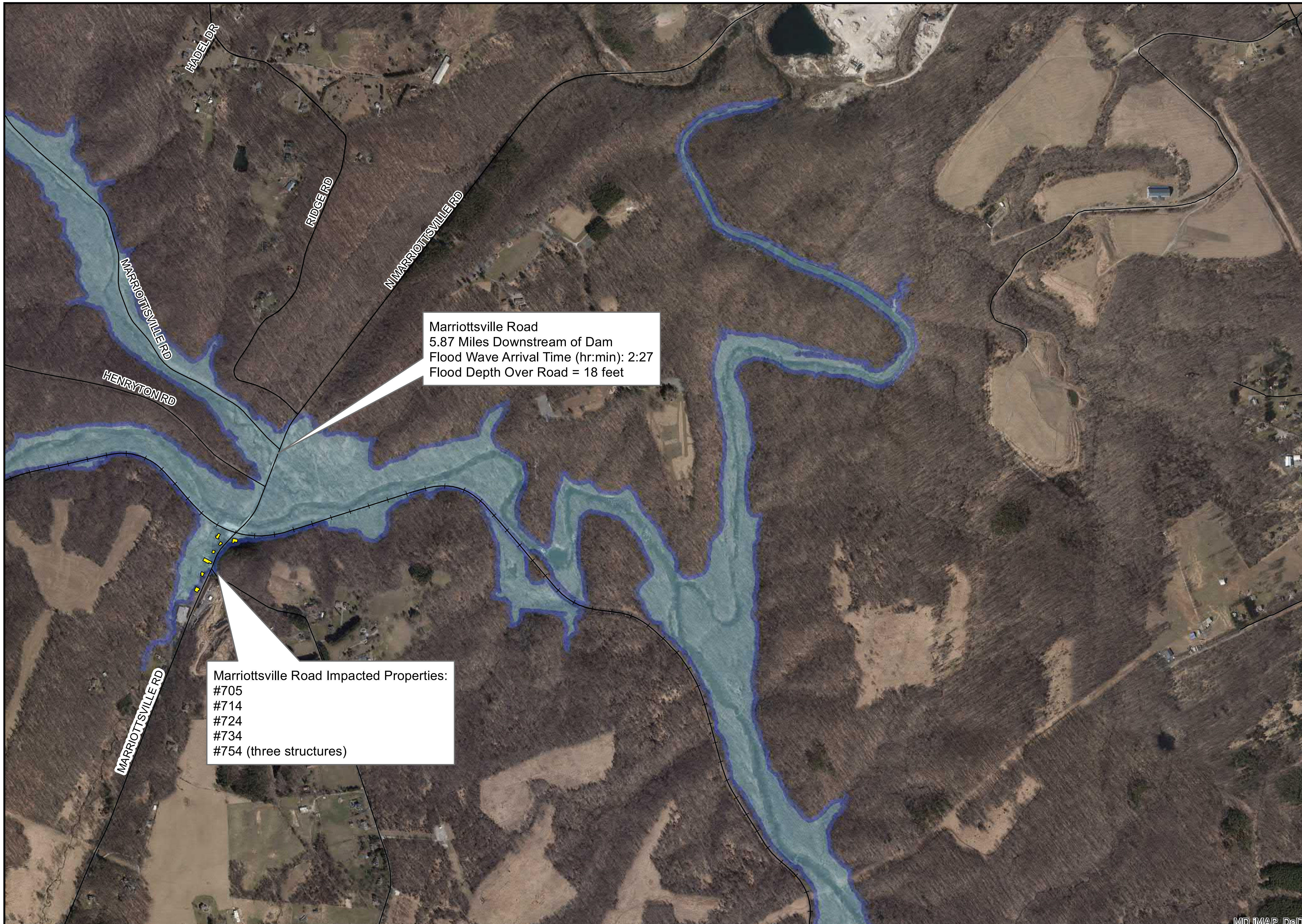

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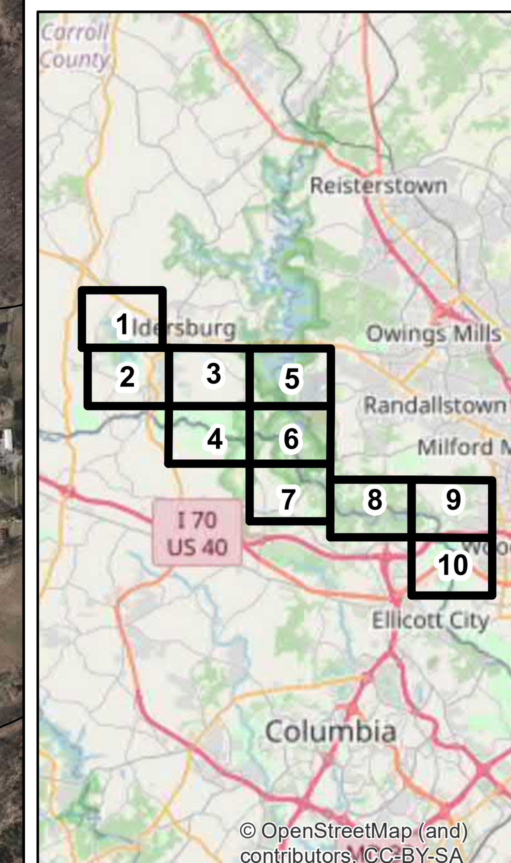

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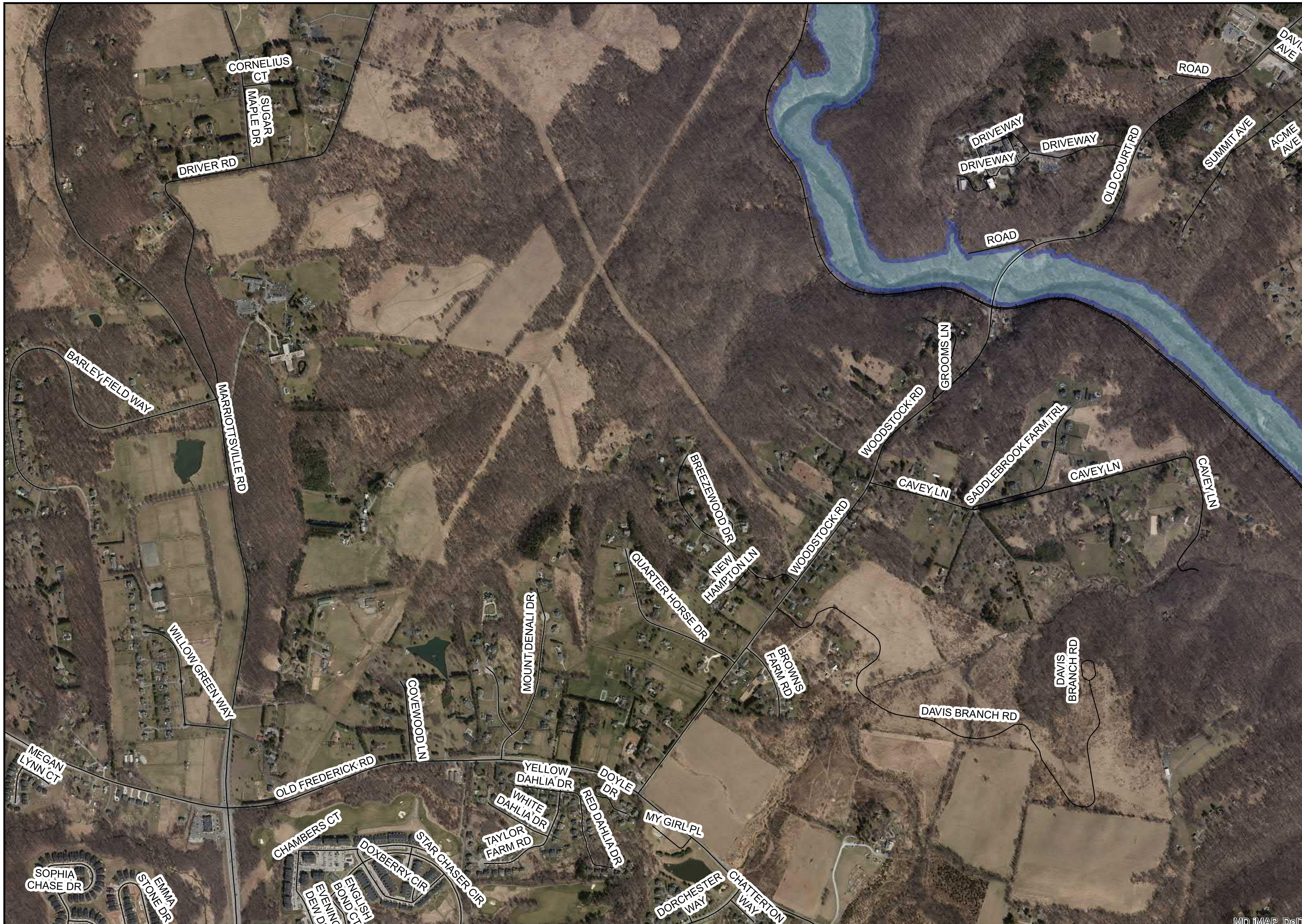

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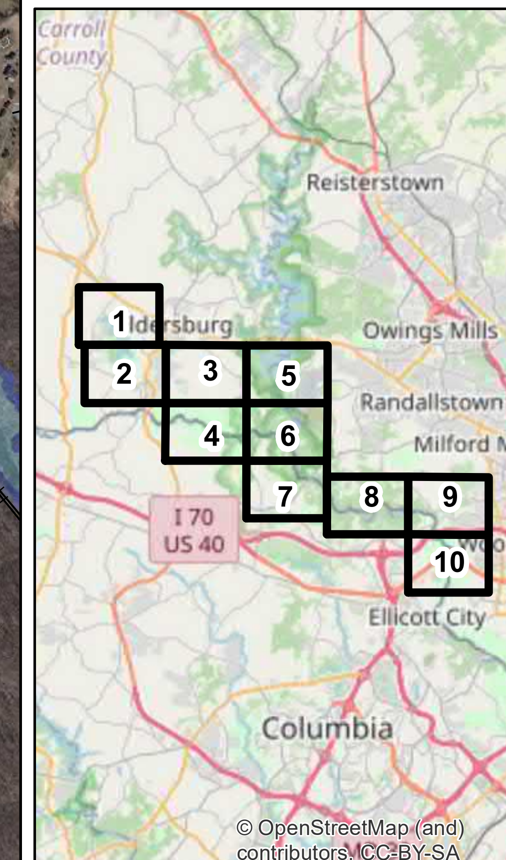

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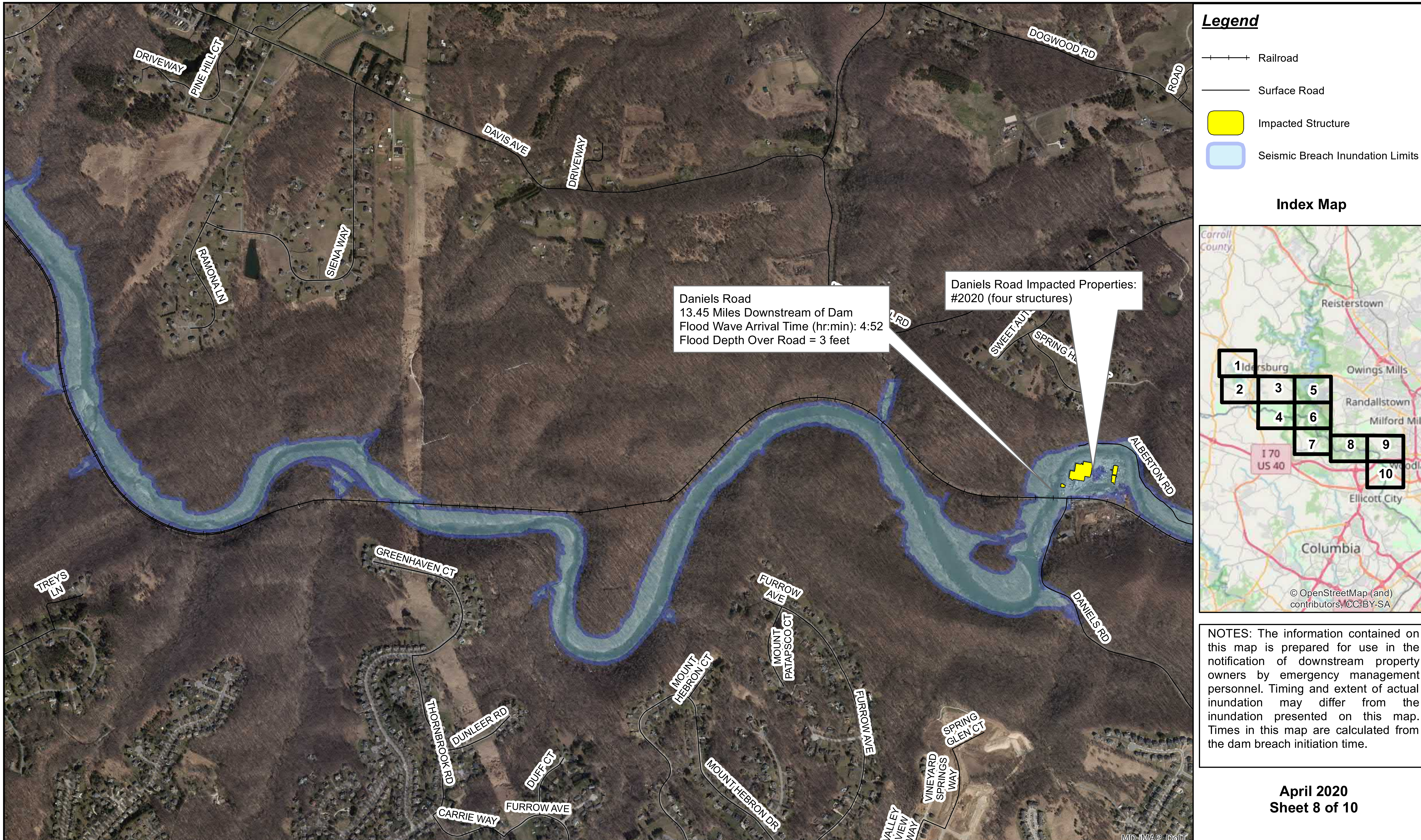

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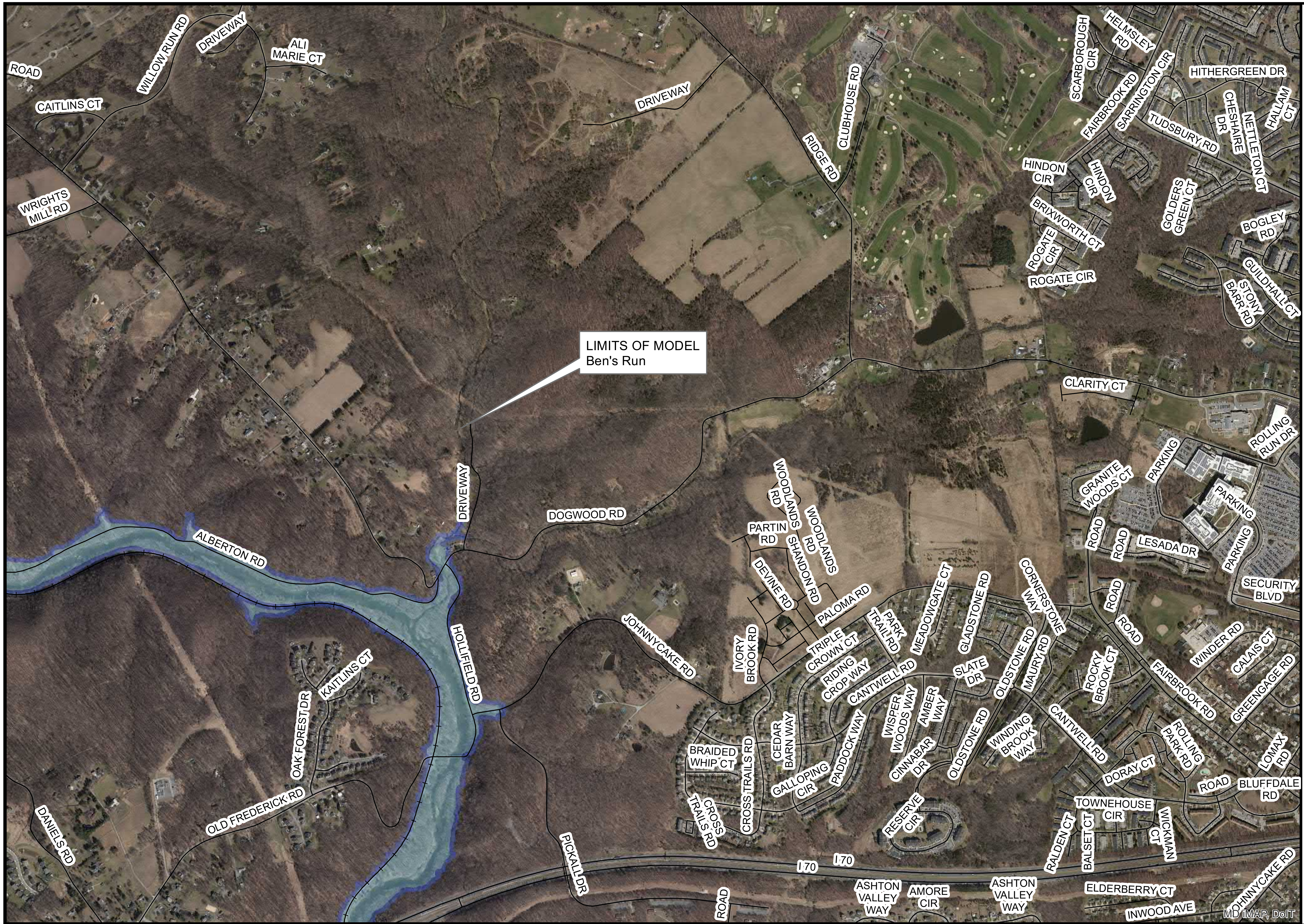

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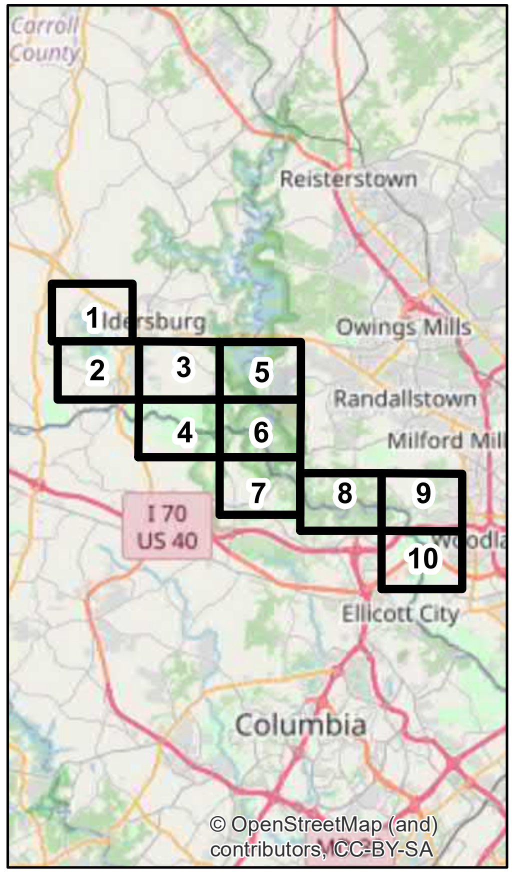

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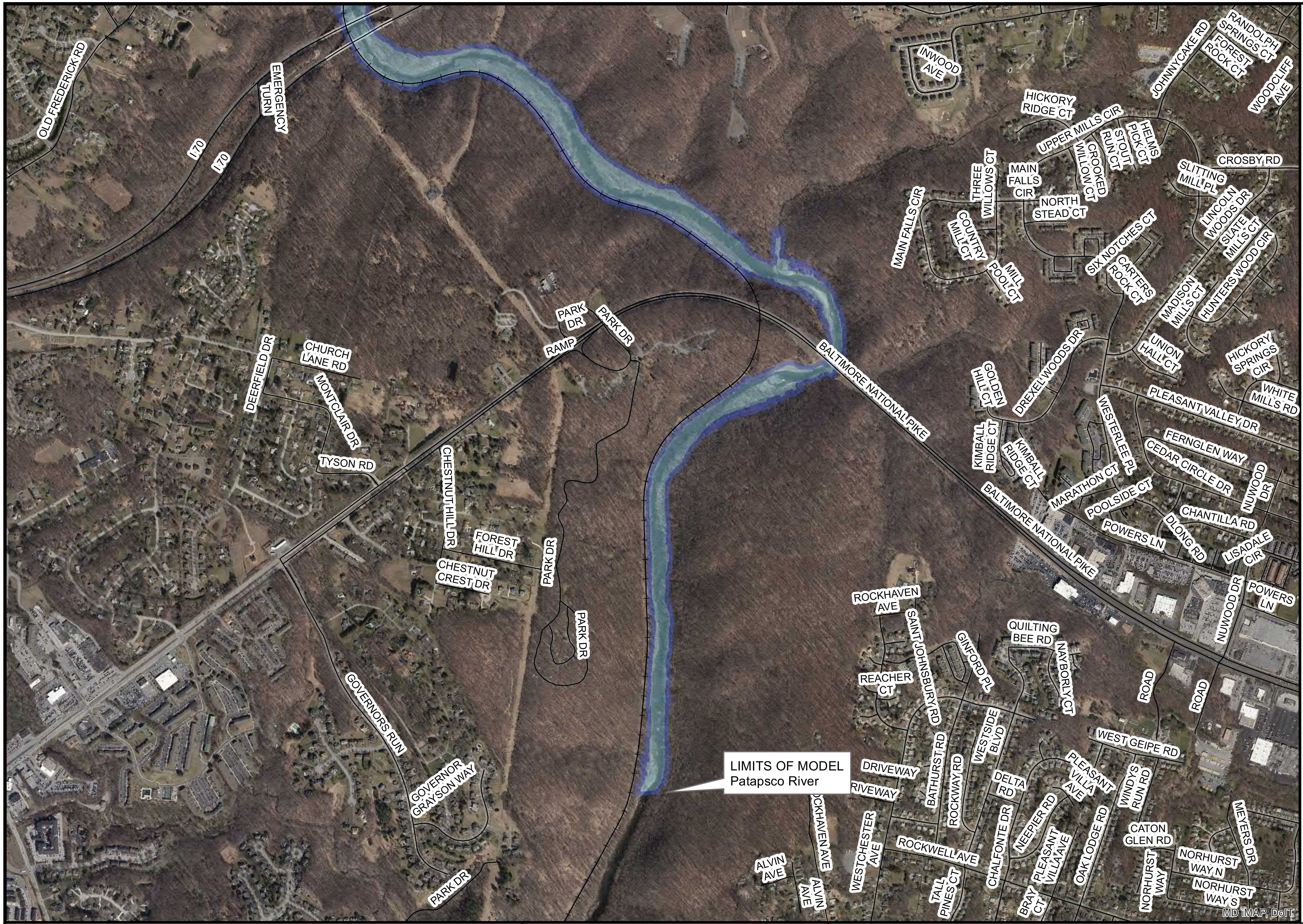

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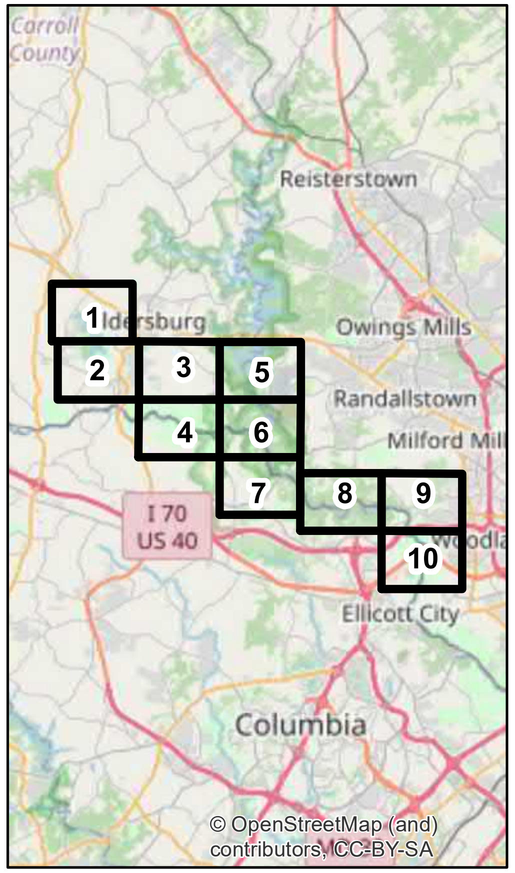

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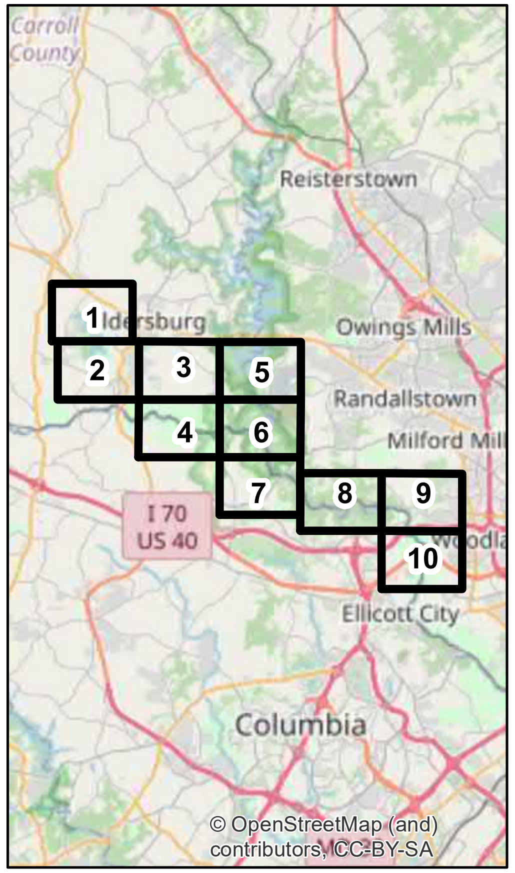

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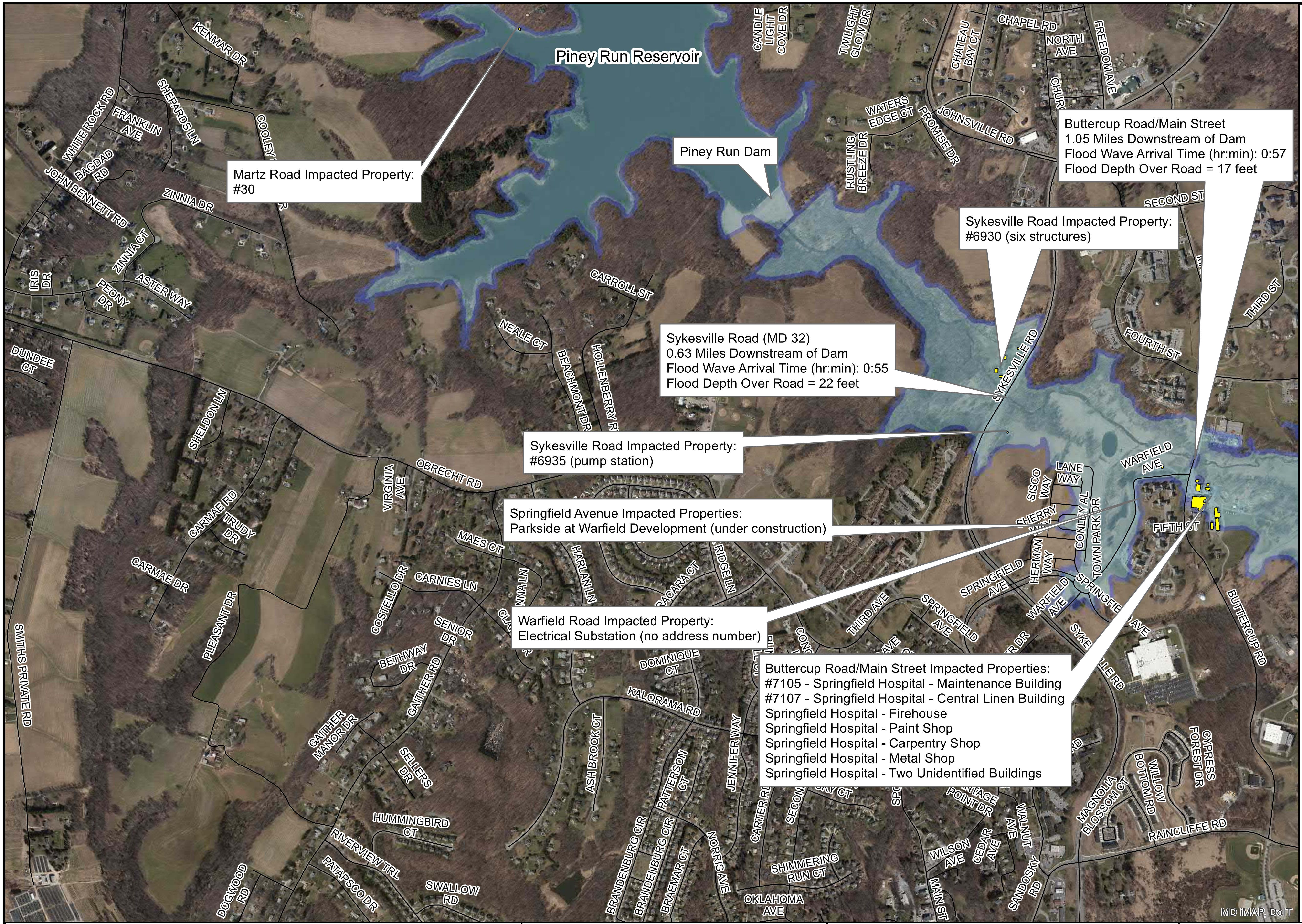

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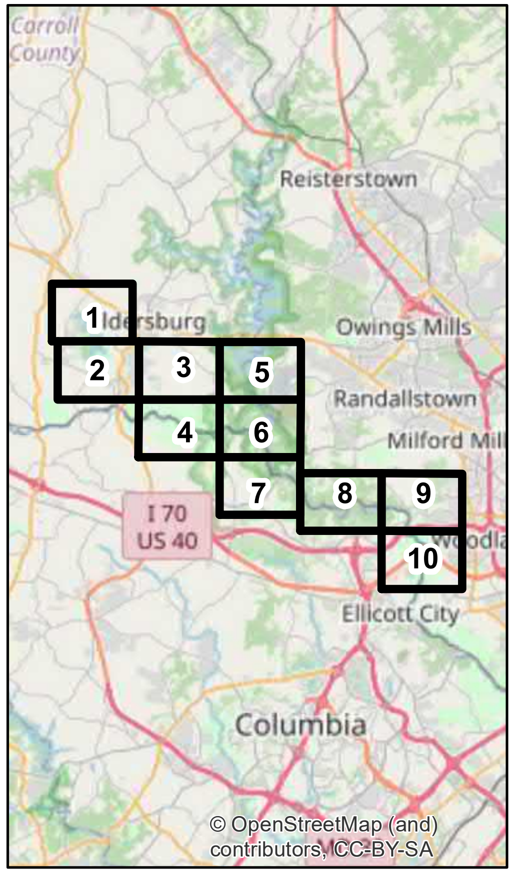

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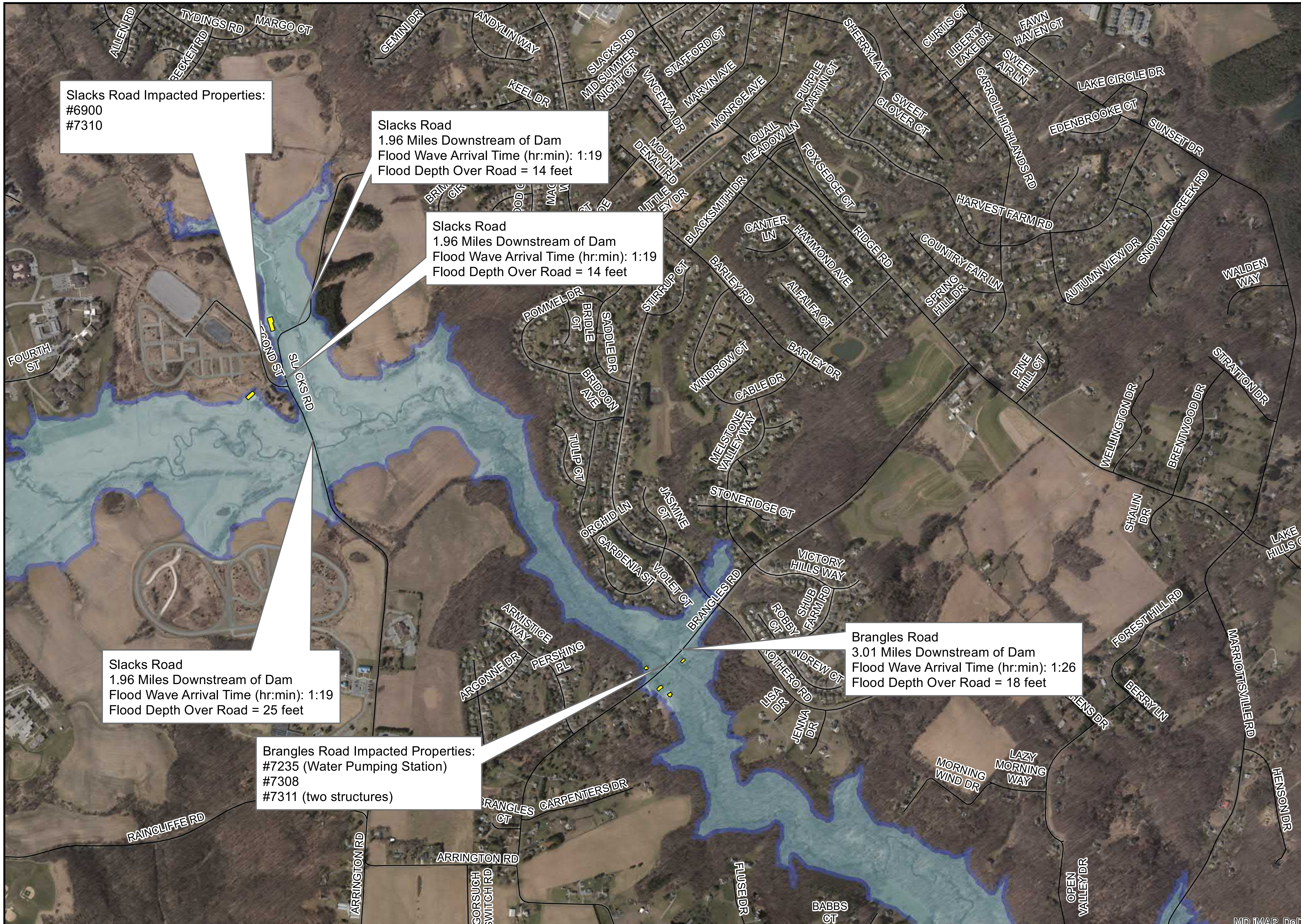

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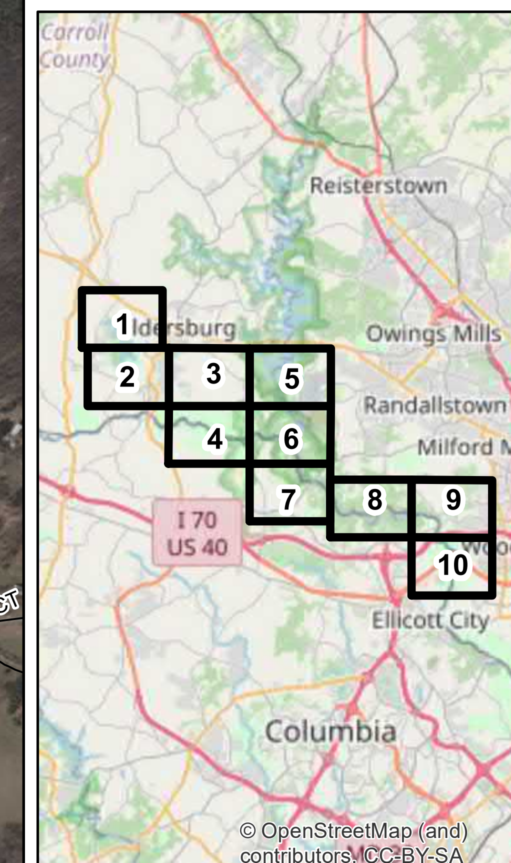

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0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
Static Breach Inundation Map

NRCS AECOM

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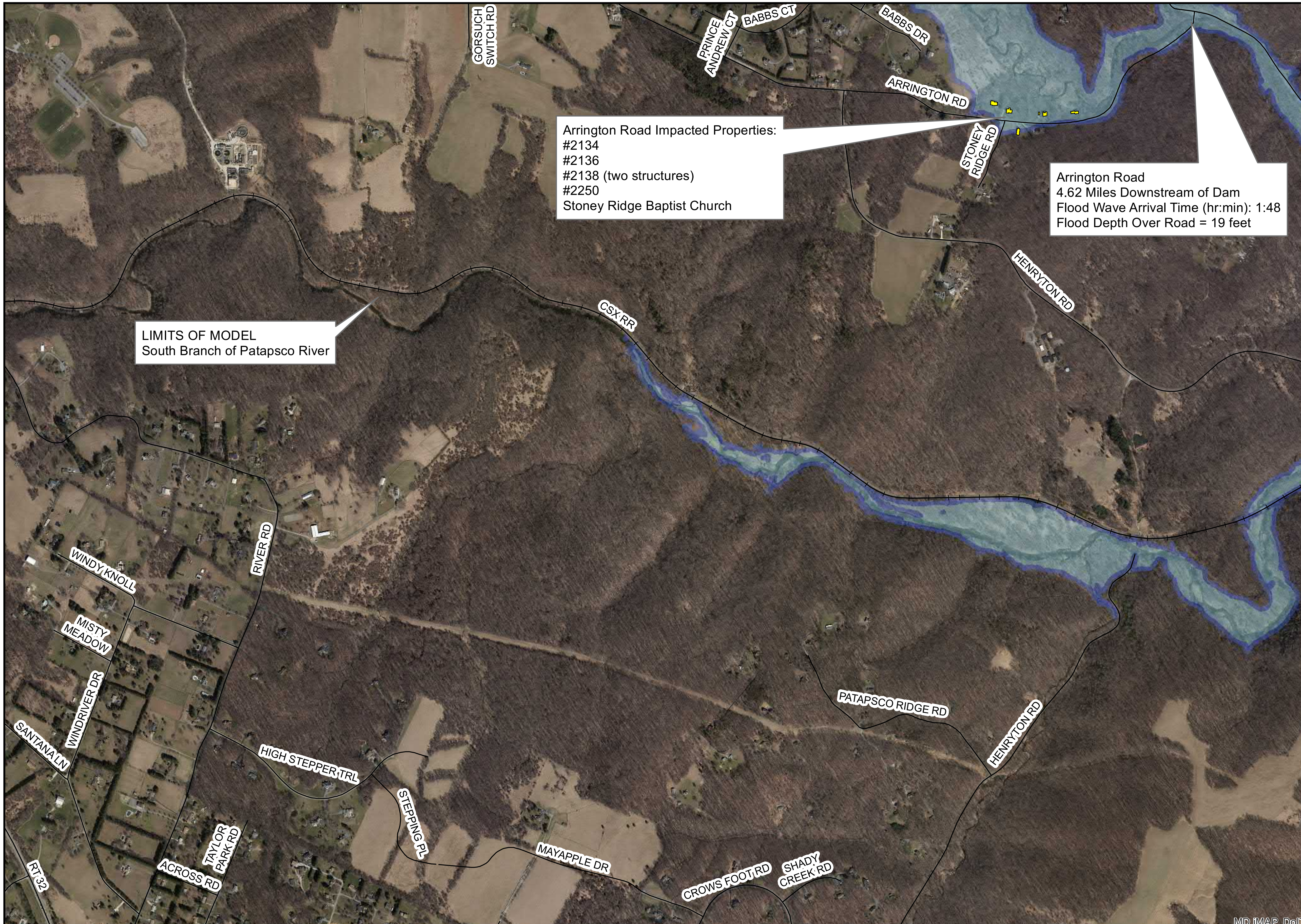

Legend

- Railroad
- Surface Road
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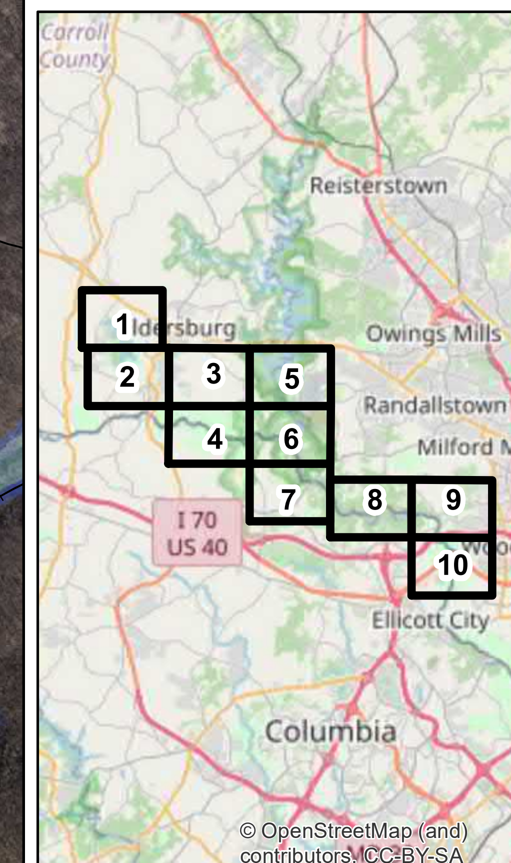
- Static Breach Inundation Limits

Index Map



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0 500 1,000 2,000 3,000 4,000
Feet

N W E S

Piney Run Dam
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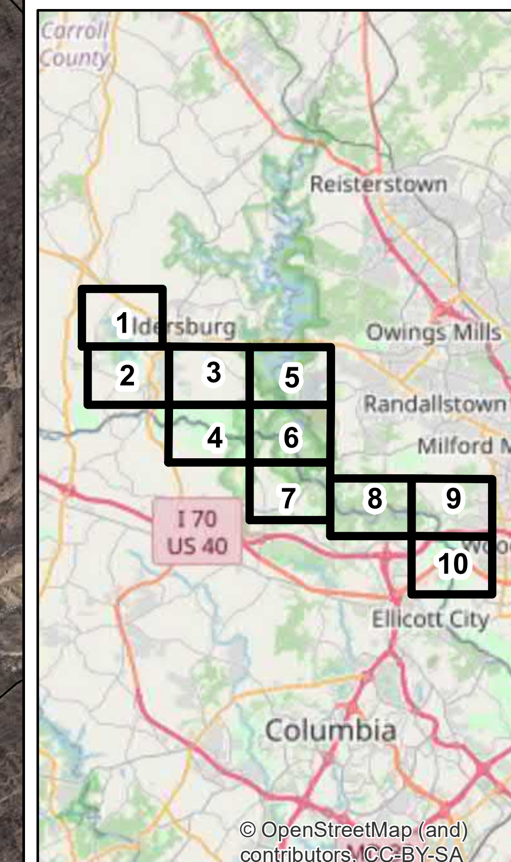

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0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
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NRCS AECOM

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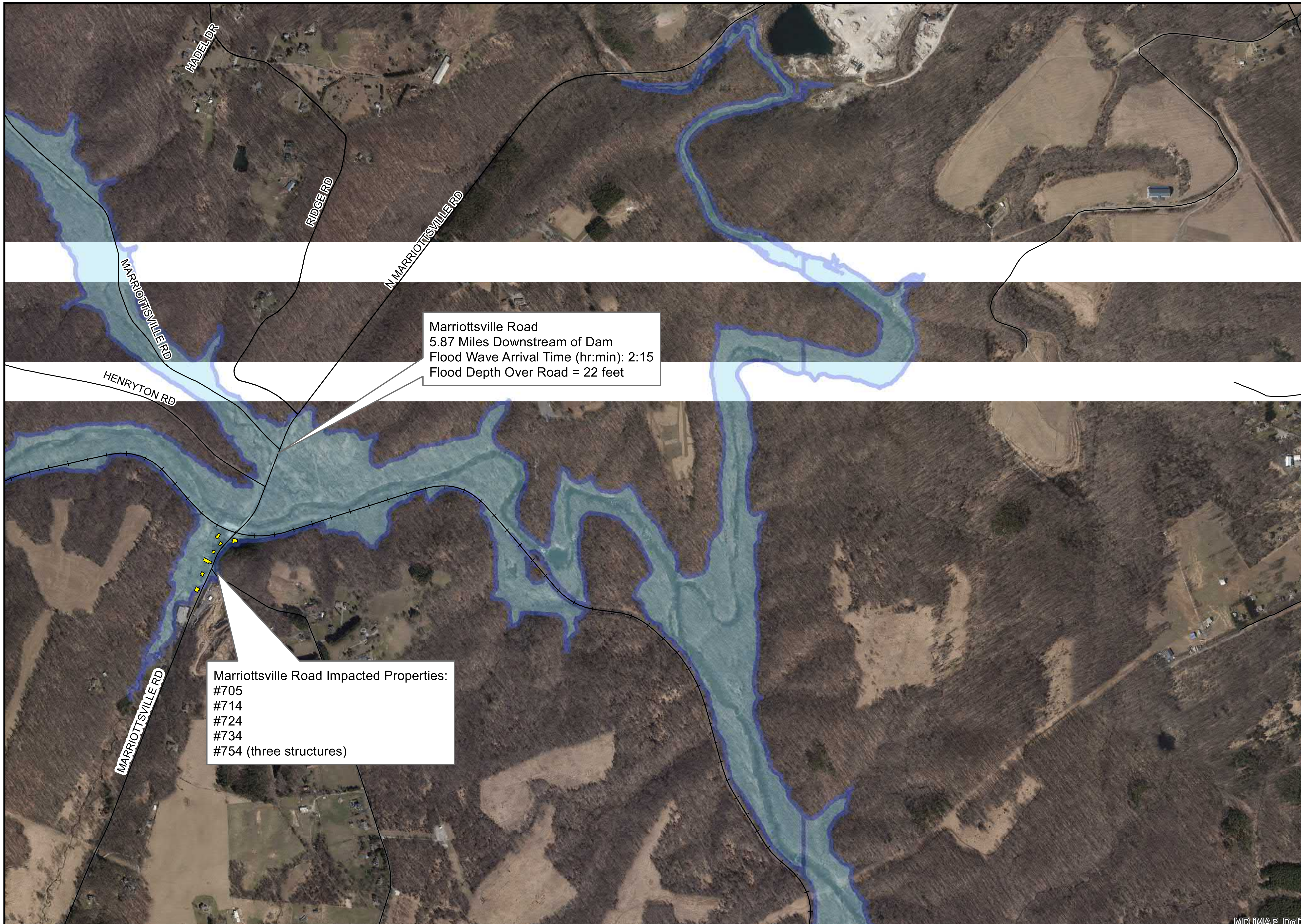

Legend

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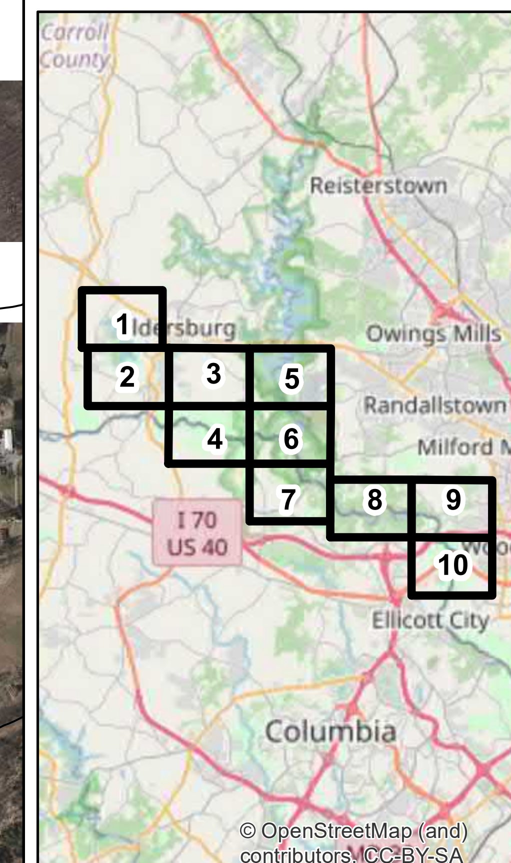

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0 500 1,000 2,000 3,000 4,000

Feet

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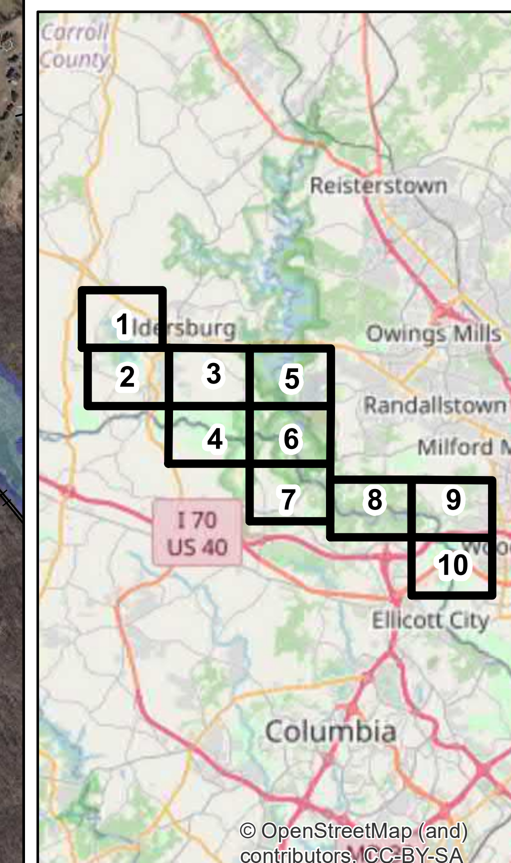

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0 500 1,000 2,000 3,000 4,000
Feet

N S E W

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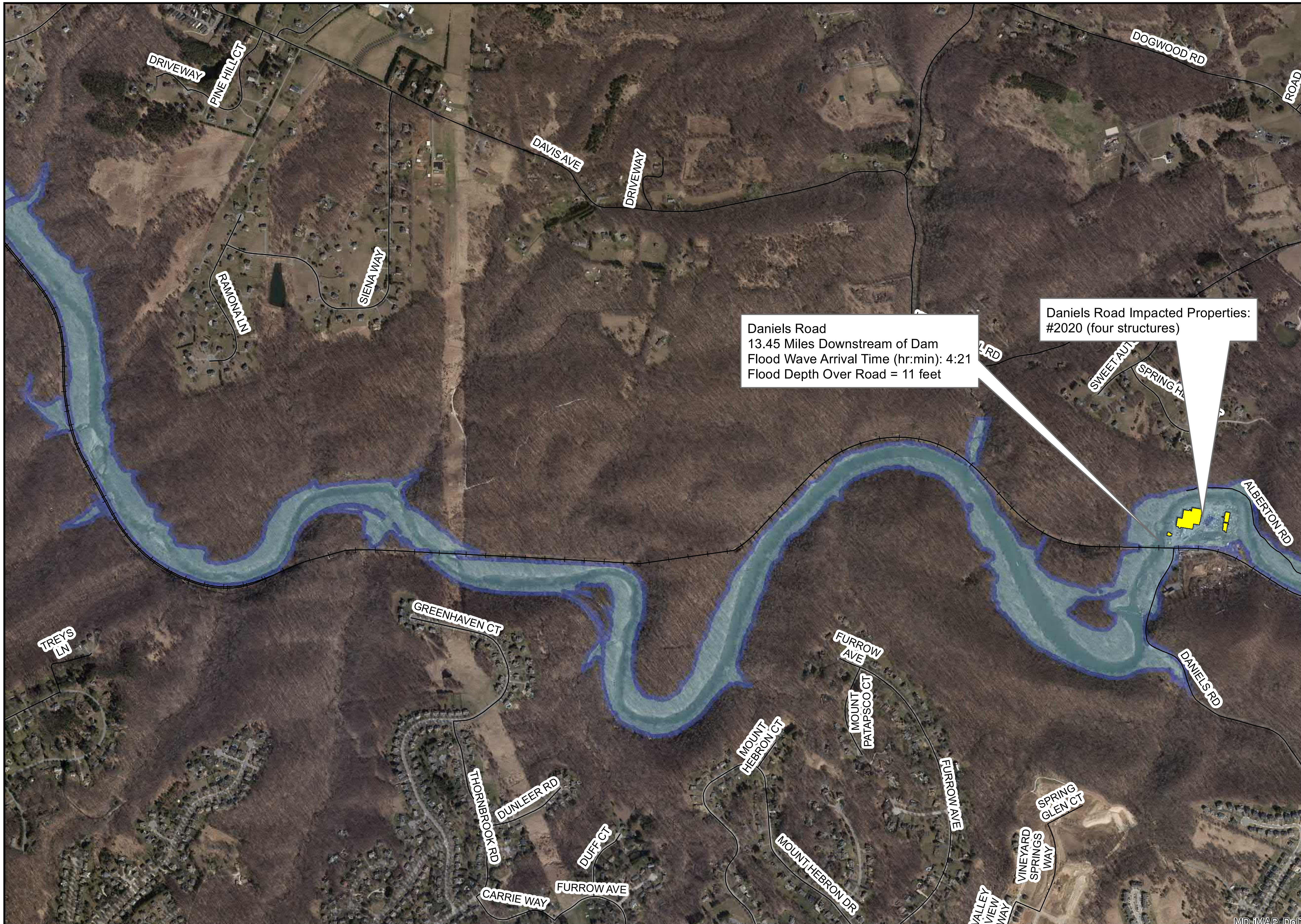

Legend

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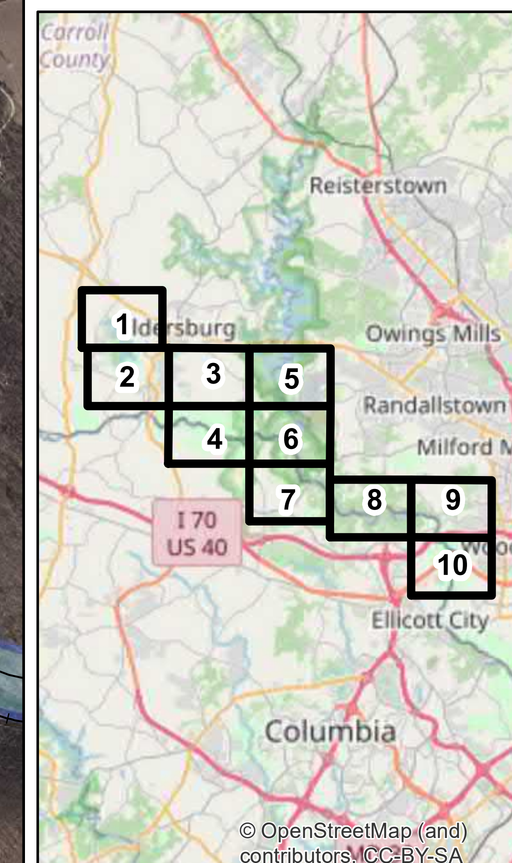

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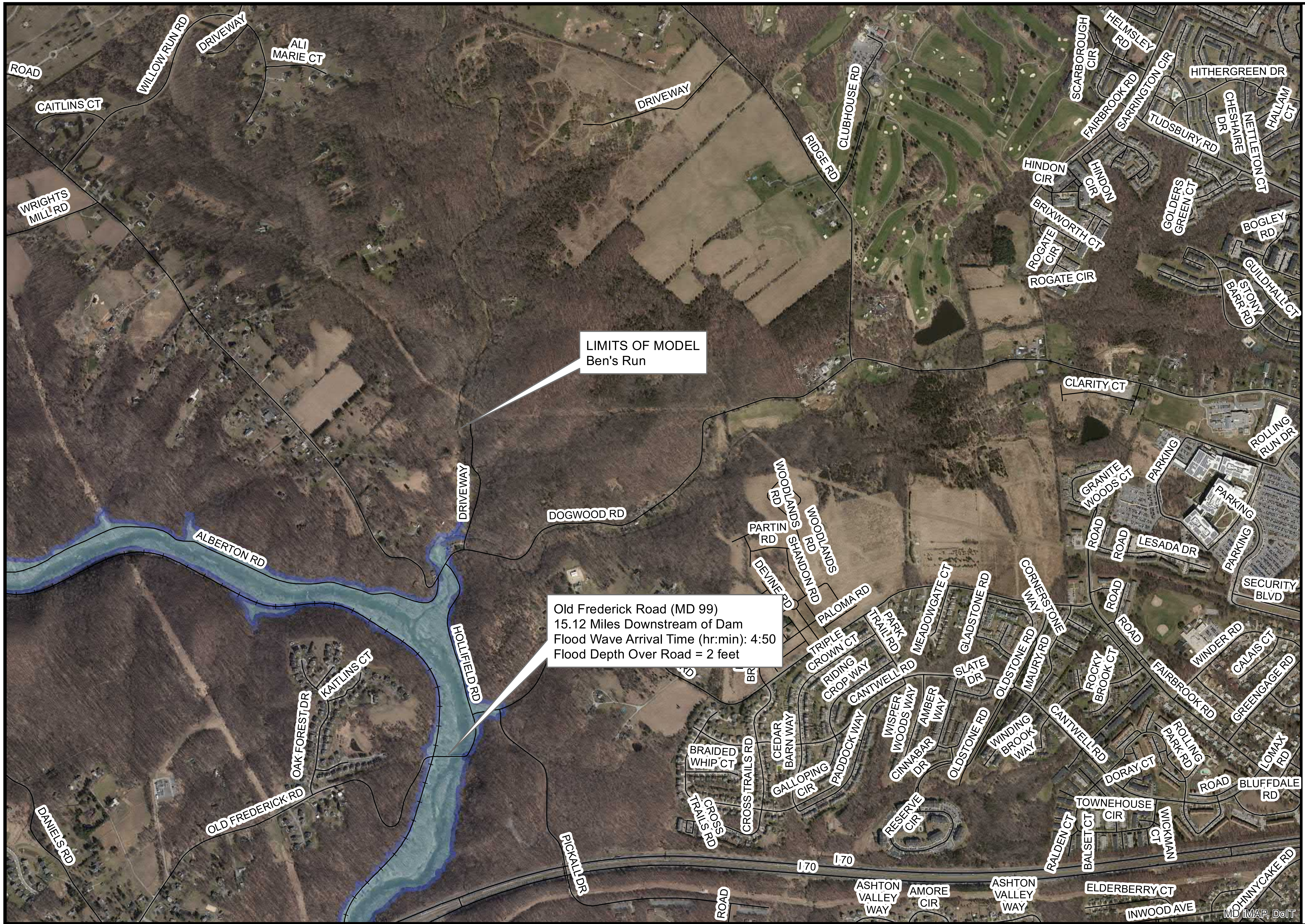

Legend

- Railroad
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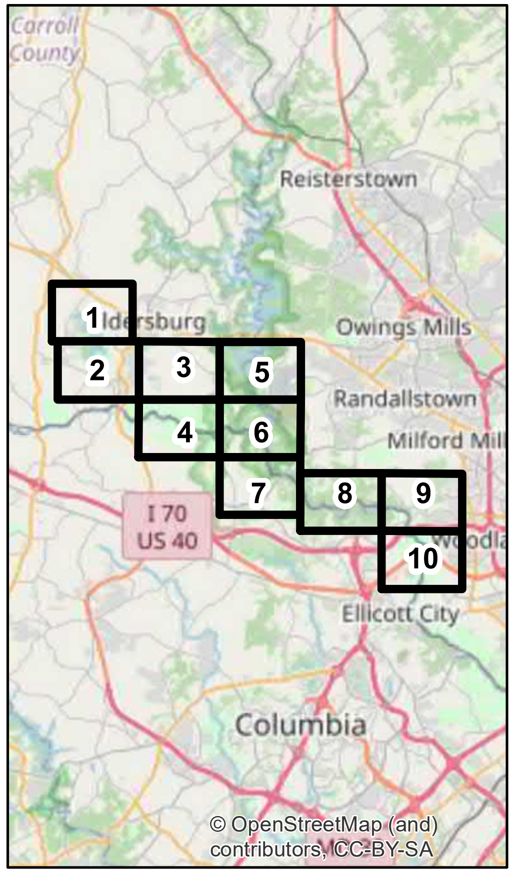

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0 500 1,000 2,000 3,000 4,000
Feet

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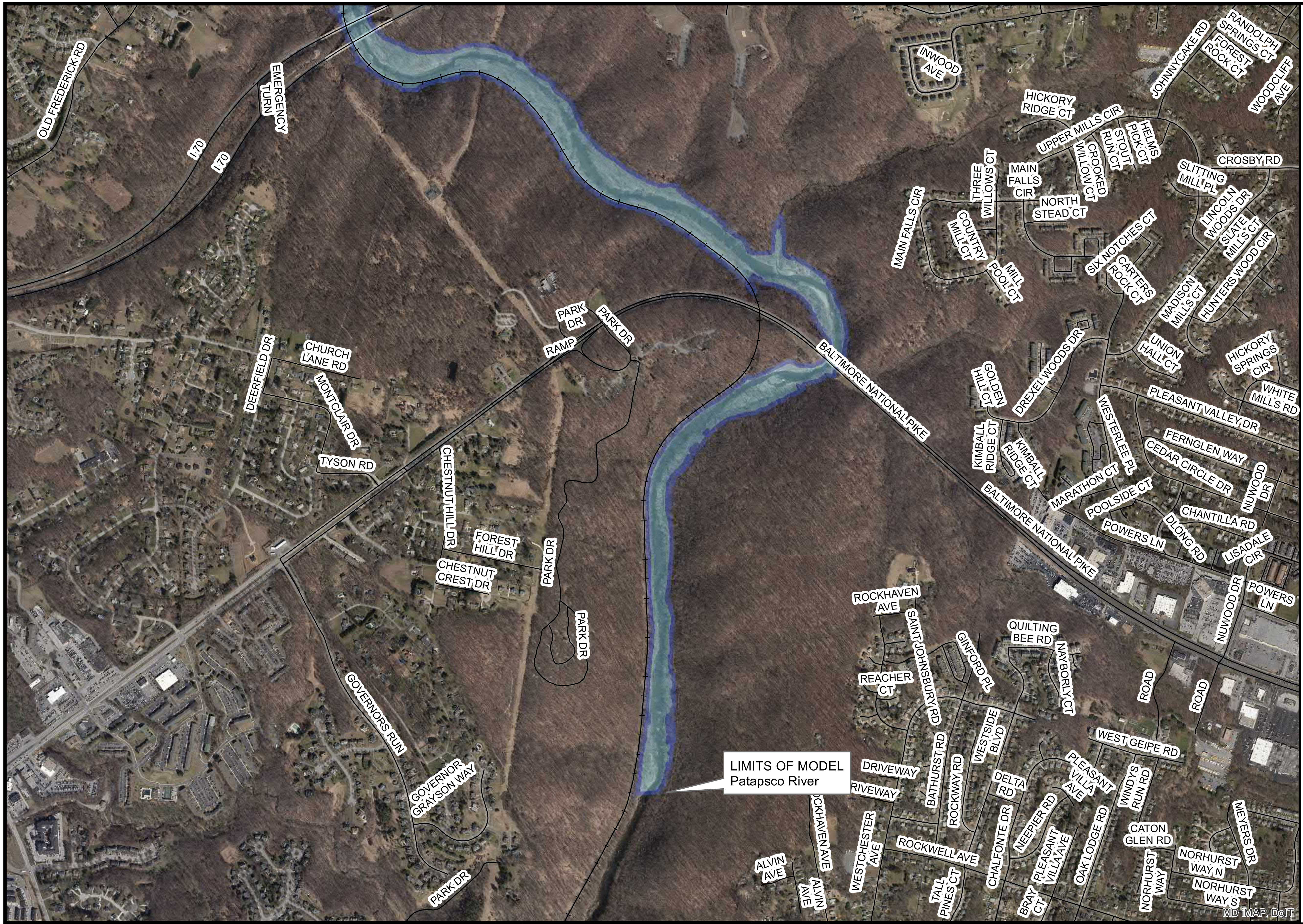

Legend

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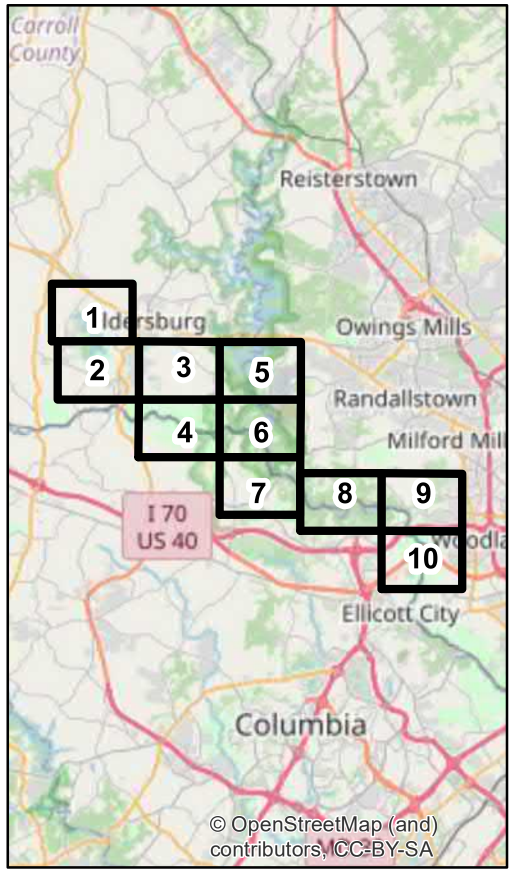

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0 500 1,000 2,000 3,000 4,000
Feet

N W E S

Piney Run Dam
Static Breach Inundation Map

Carroll County 1837 MARYLAND

NRCS

AECOM

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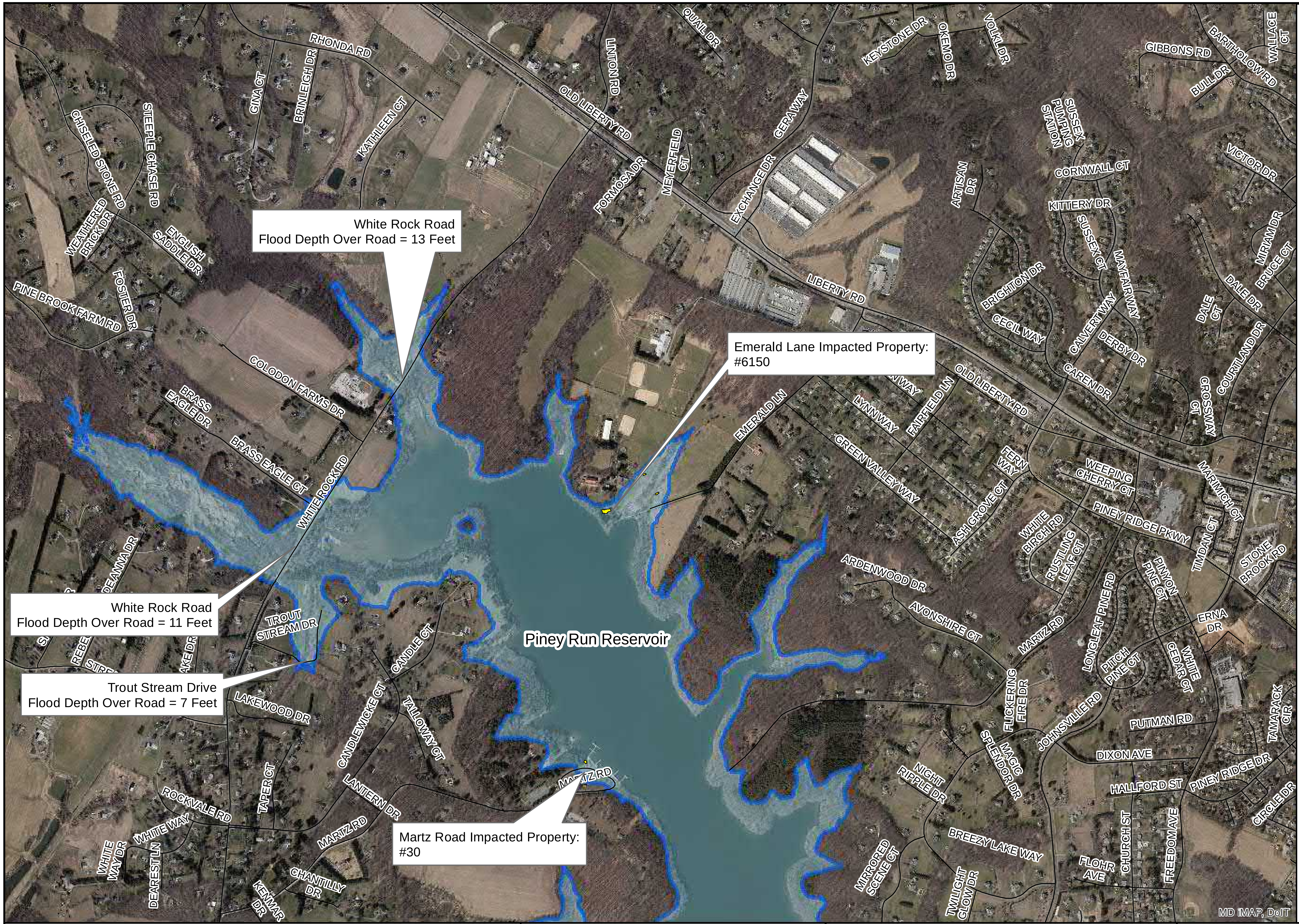

Legend

- Railroad
- Surface Road
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- PMF Inundation Limits

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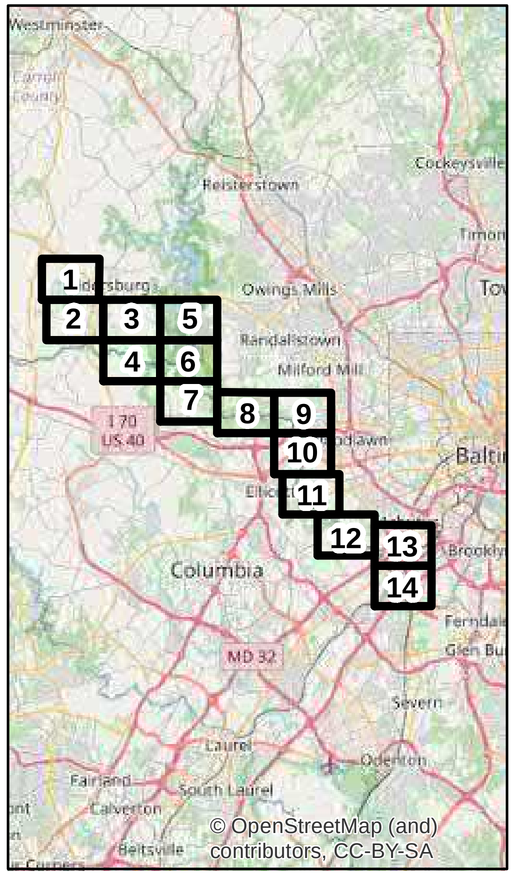

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0 500 1,000 2,000 3,000 4,000
Feet

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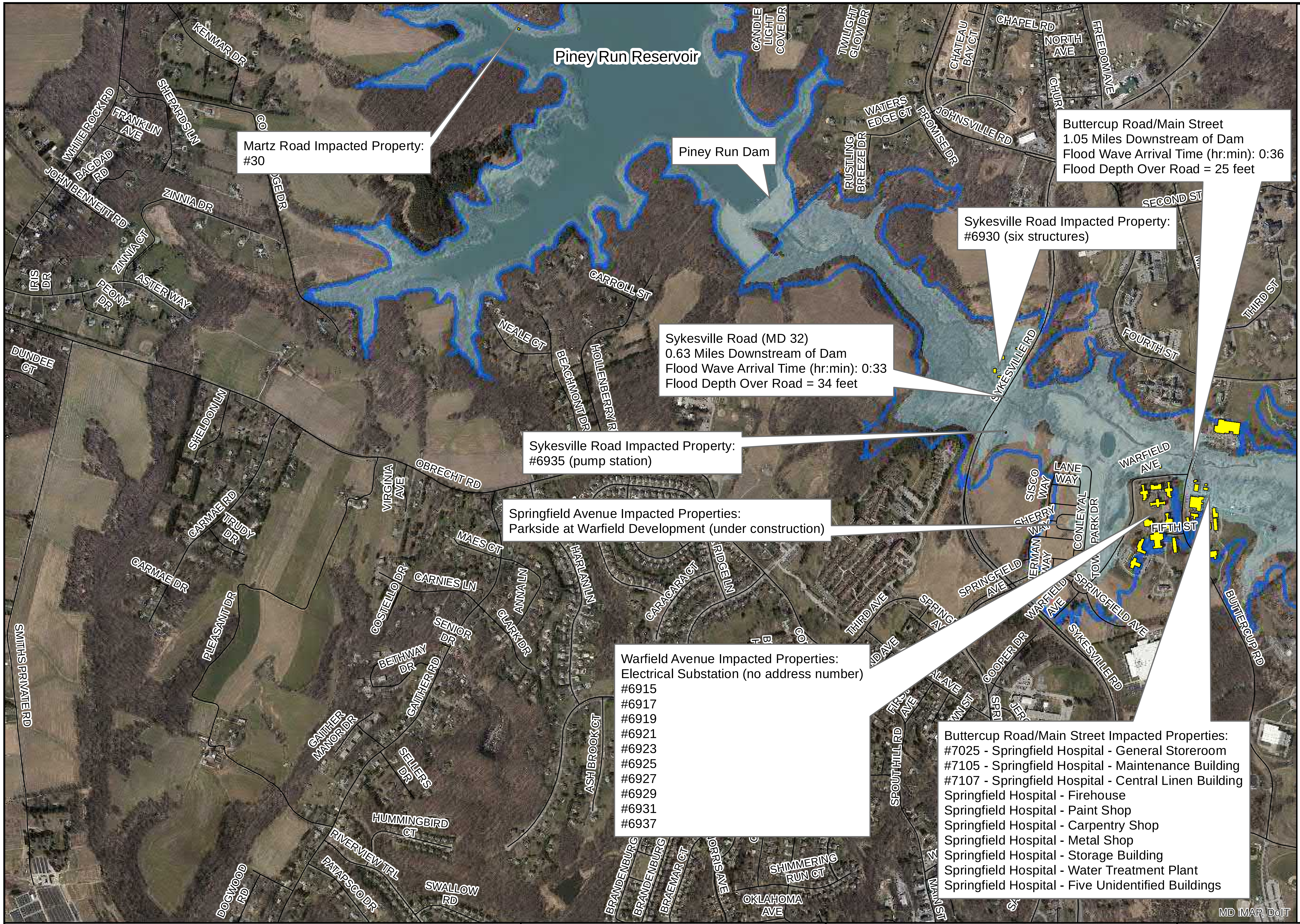

Legend

Railroad

Surface Road

Impacted Structure

PMF Breach Inundation Limits

PMF Inundation Limits

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0 500 1,000 2,000 3,000 4,000

Feet

Piney Run Dam
PMF Breach Inundation Map

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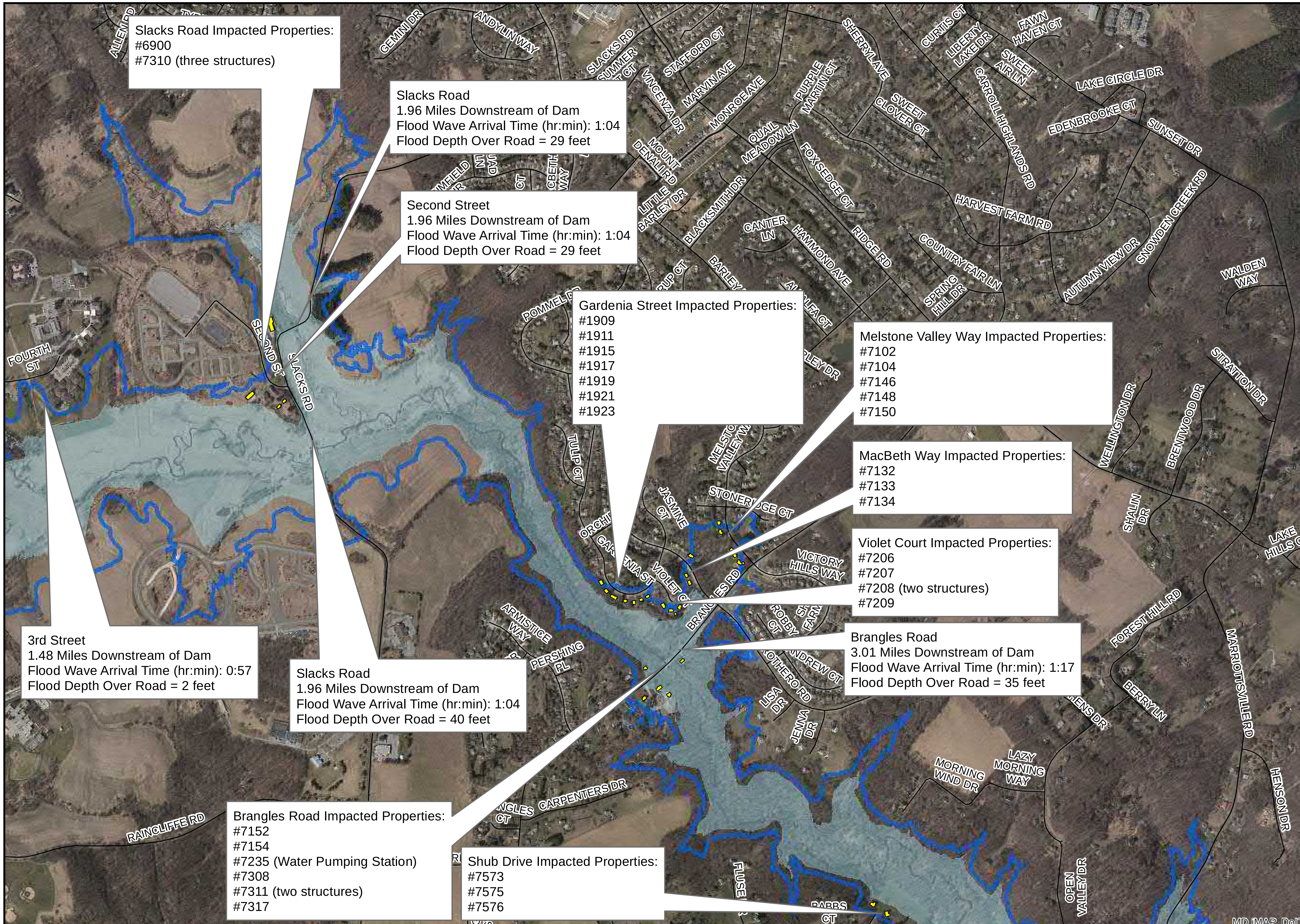

Legend

Railroad

Surface Road

Impacted Structure

PMF Breach Inundation Limits

PMF Inundation Limits

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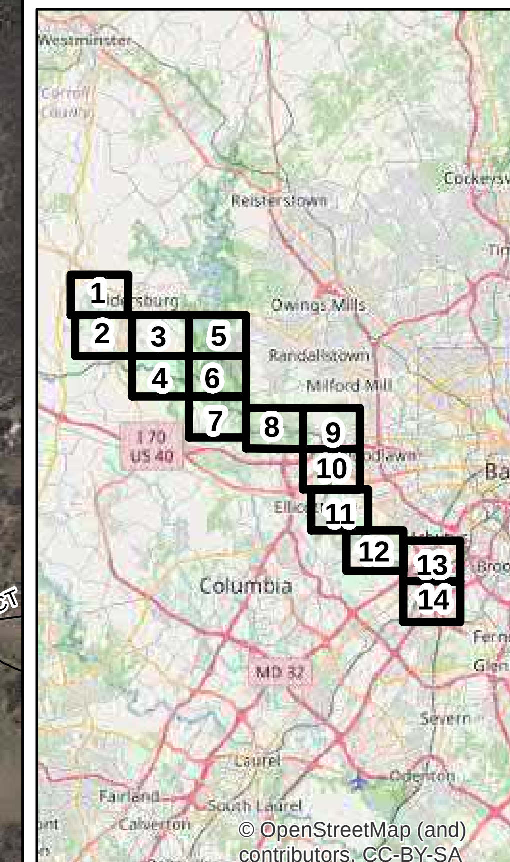

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0 500 1,000 2,000 3,000 4,000
Feet

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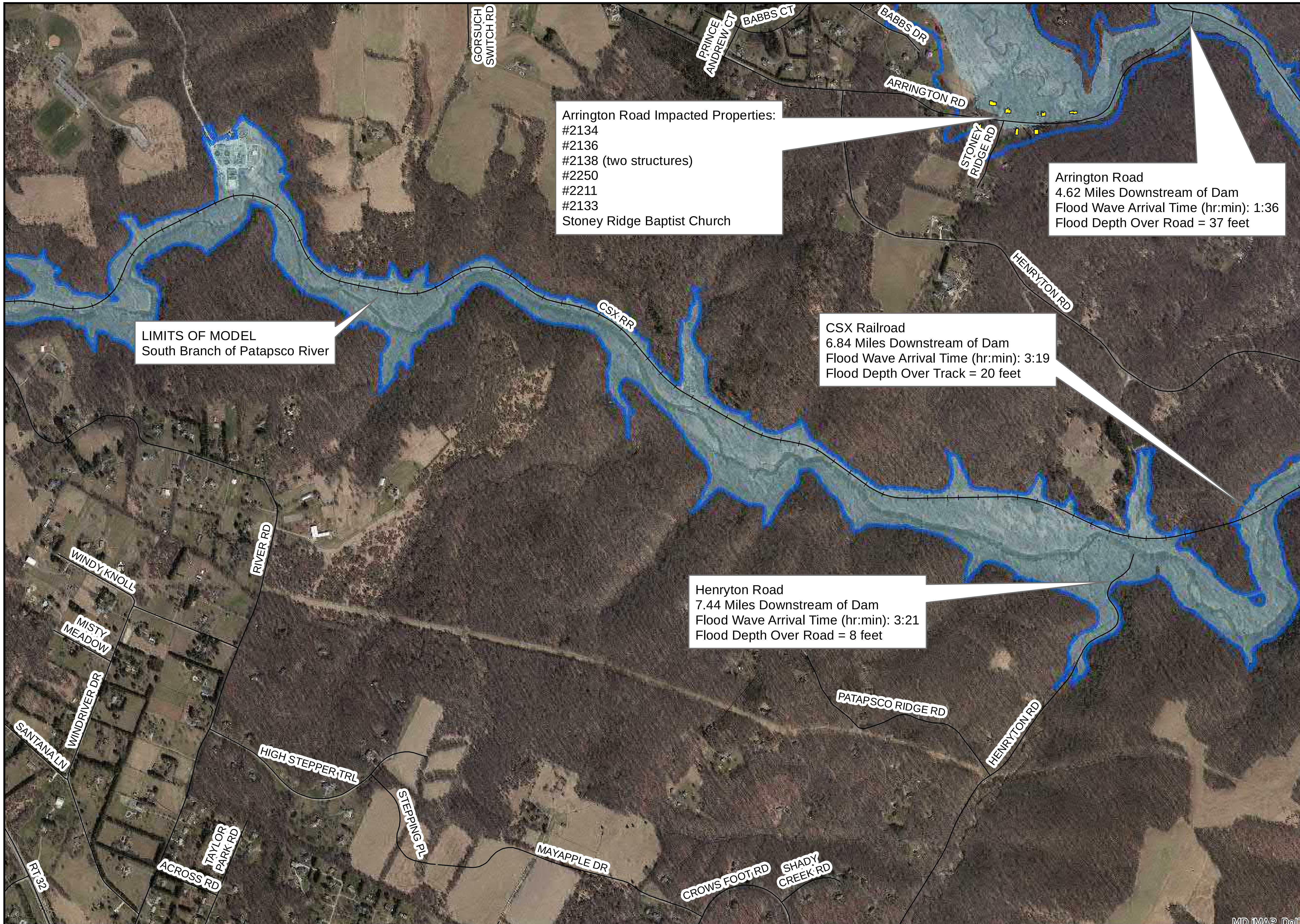

Legend

- Railroad
- Surface Road
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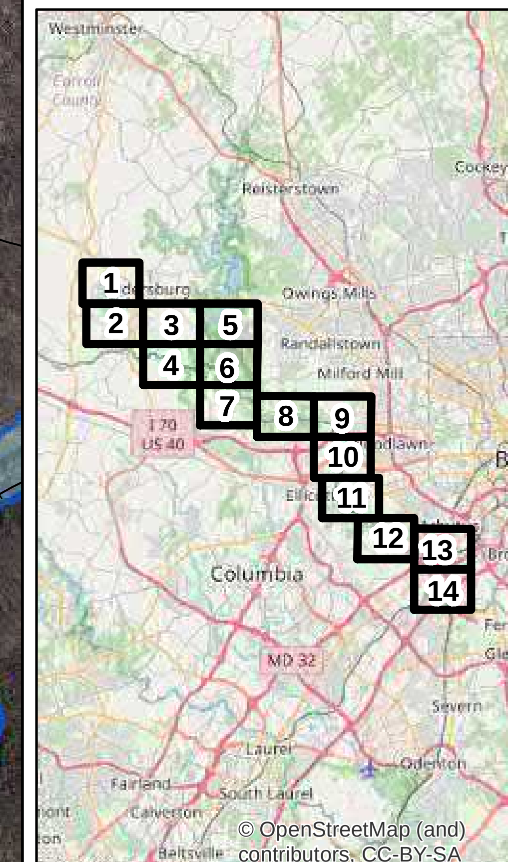

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0 500 1,000 2,000 3,000 4,000
Feet

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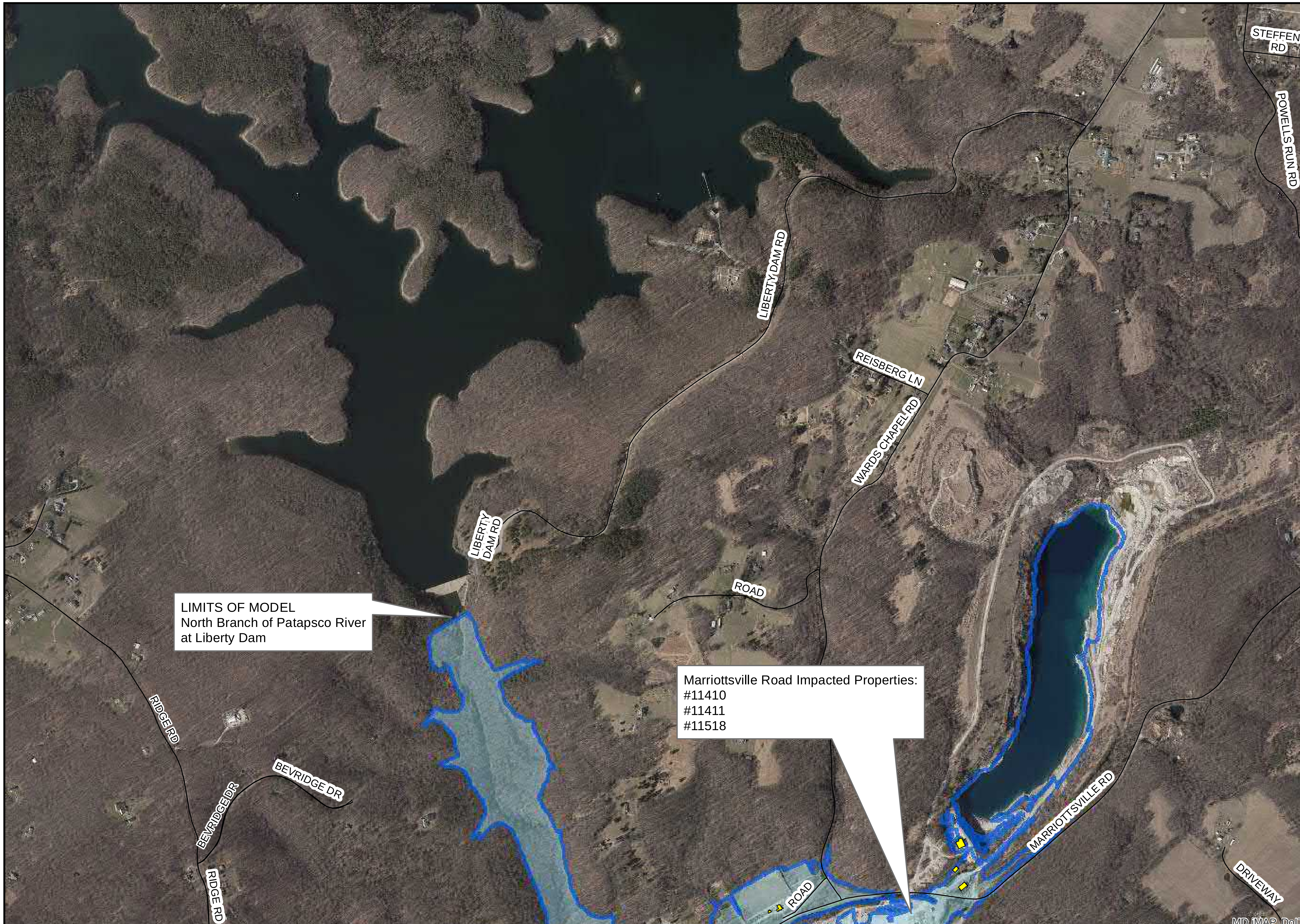

Legend

- Railroad
- Surface Road
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0 500 1,000 2,000 3,000 4,000
Feet

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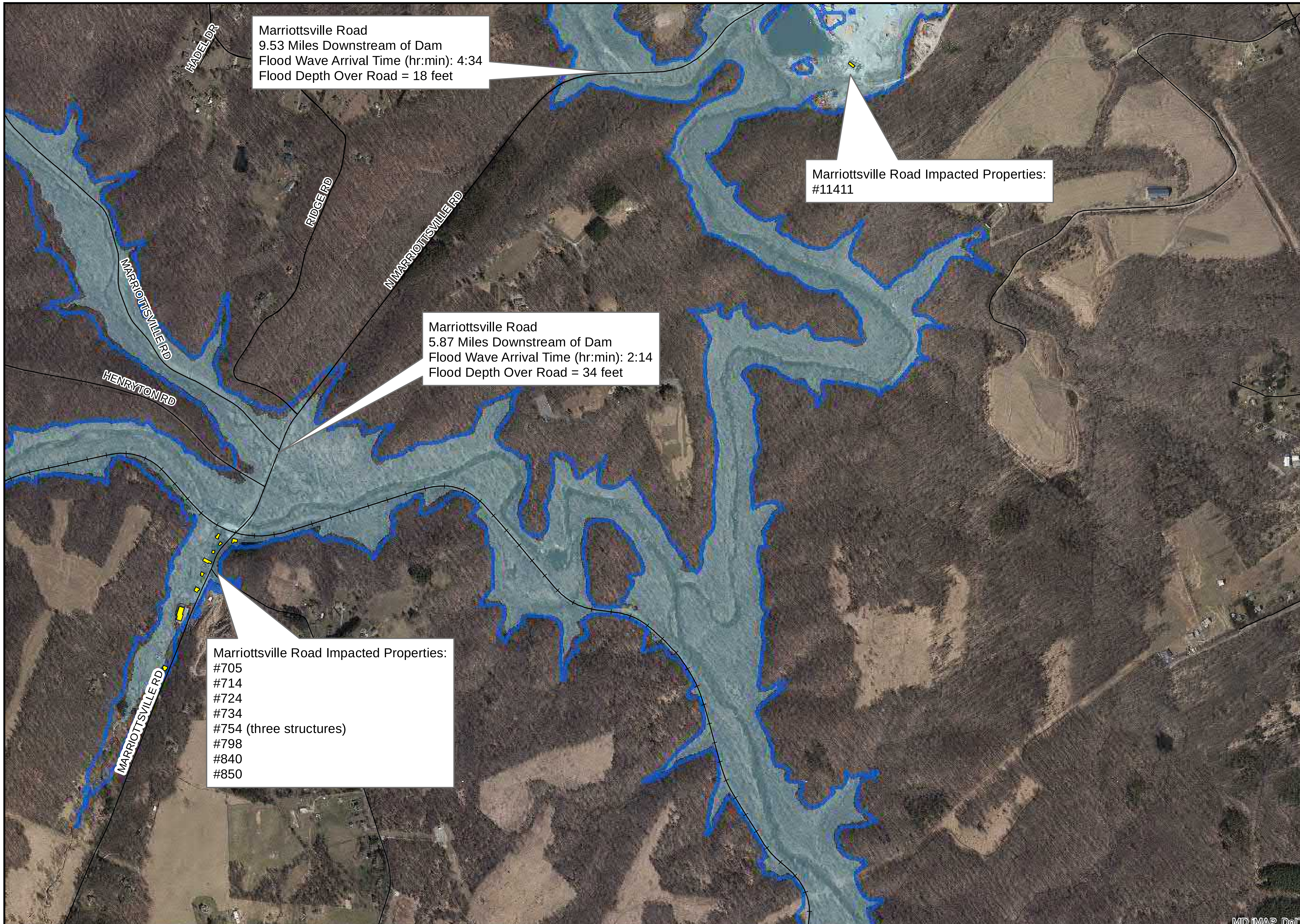

Legend

Railroad

Surface Road

Roads_Baltimore

Impacted Structure

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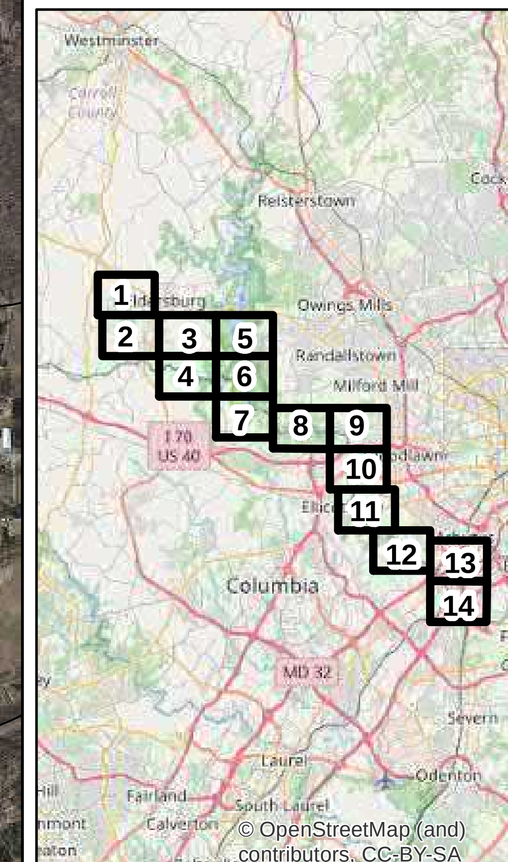

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0 500 1,000 2,000 3,000 4,000
Feet

Piney Run Dam
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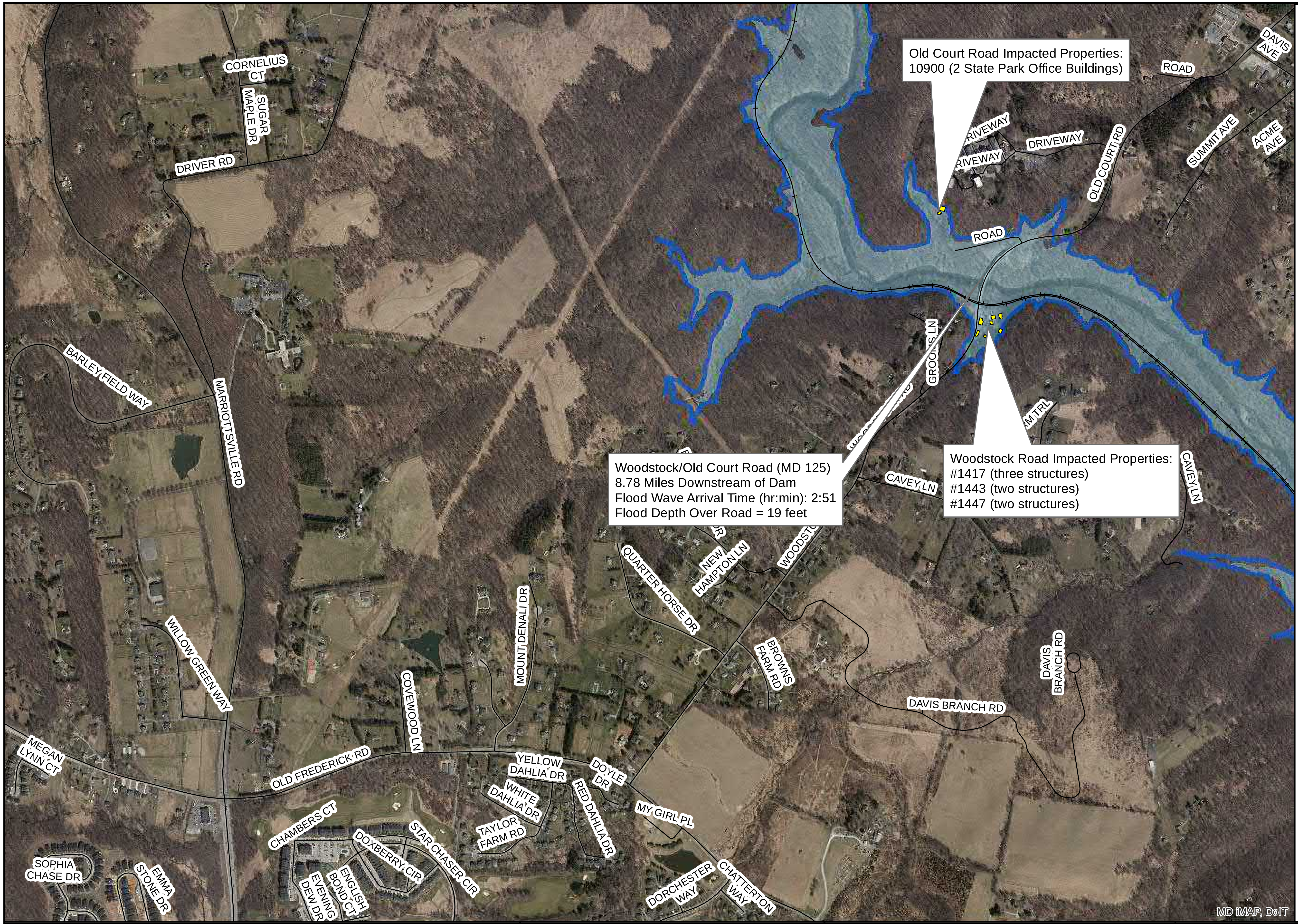

Legend

- Railroad
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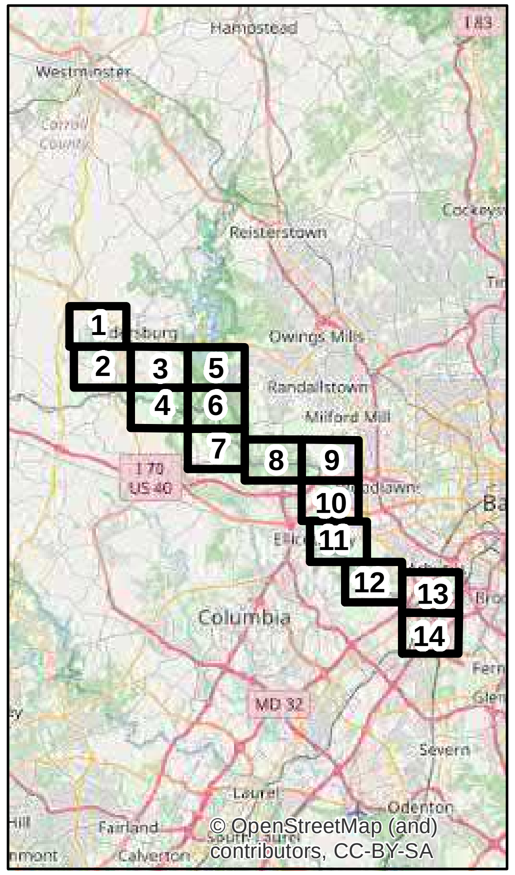

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0 500 1,000 2,000 3,000 4,000

Feet

Piney Run Dam
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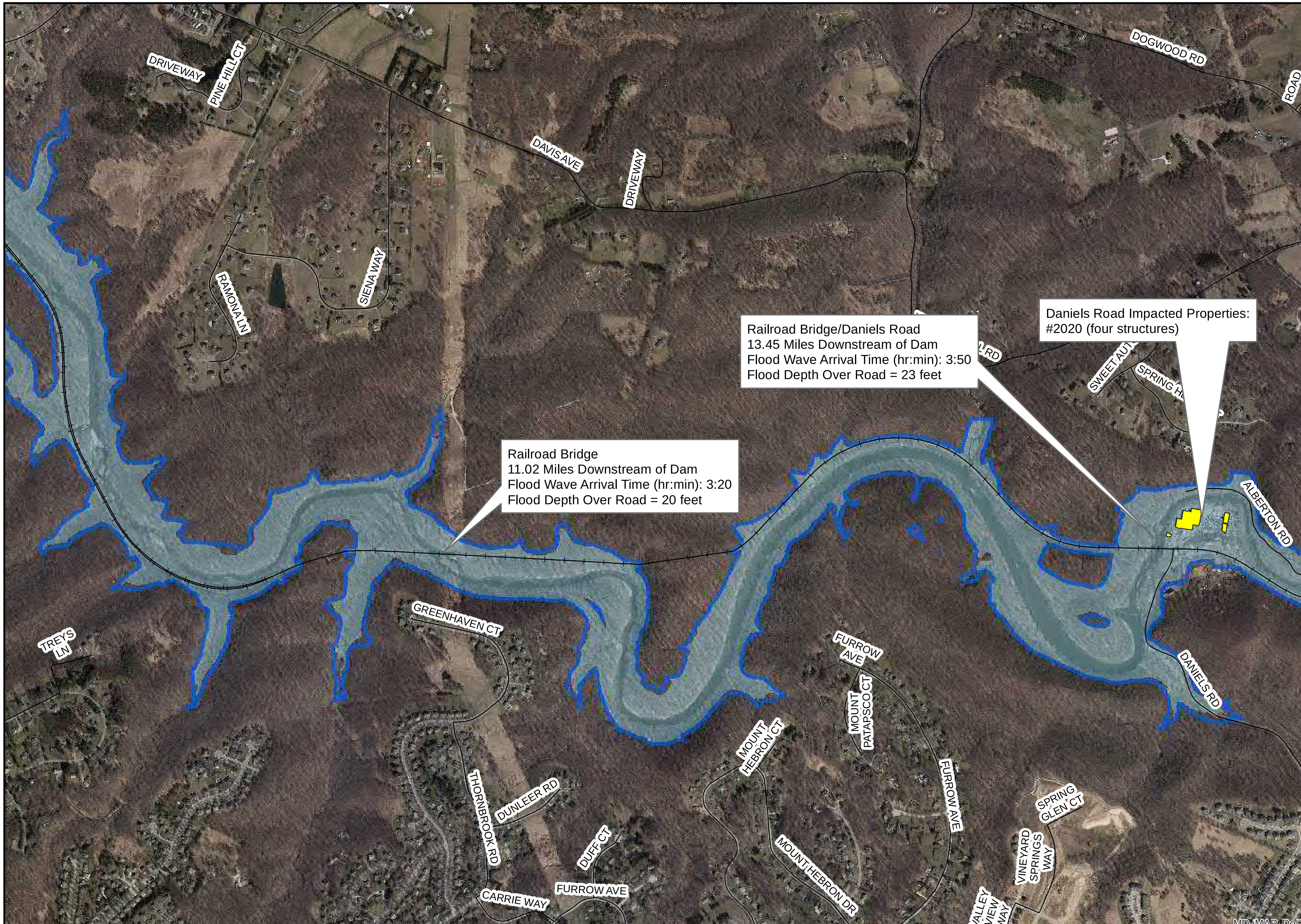

Legend

- Railroad
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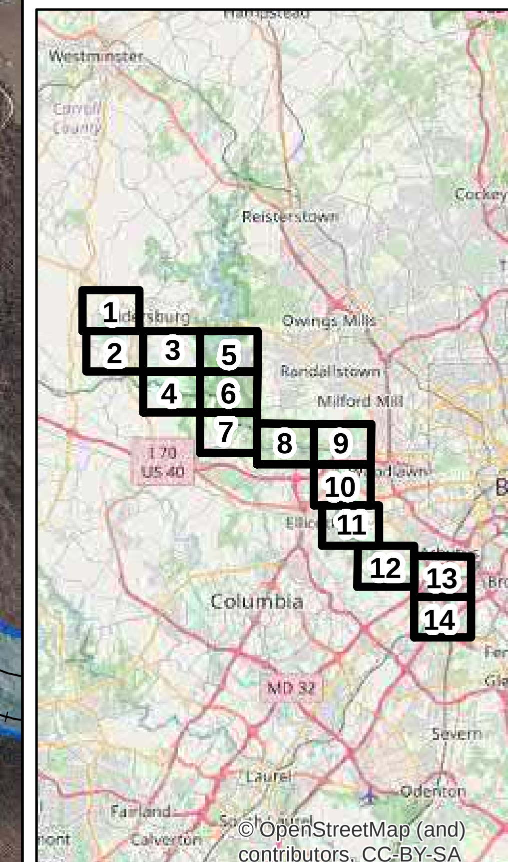

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0 500 1,000 2,000 3,000 4,000
Feet

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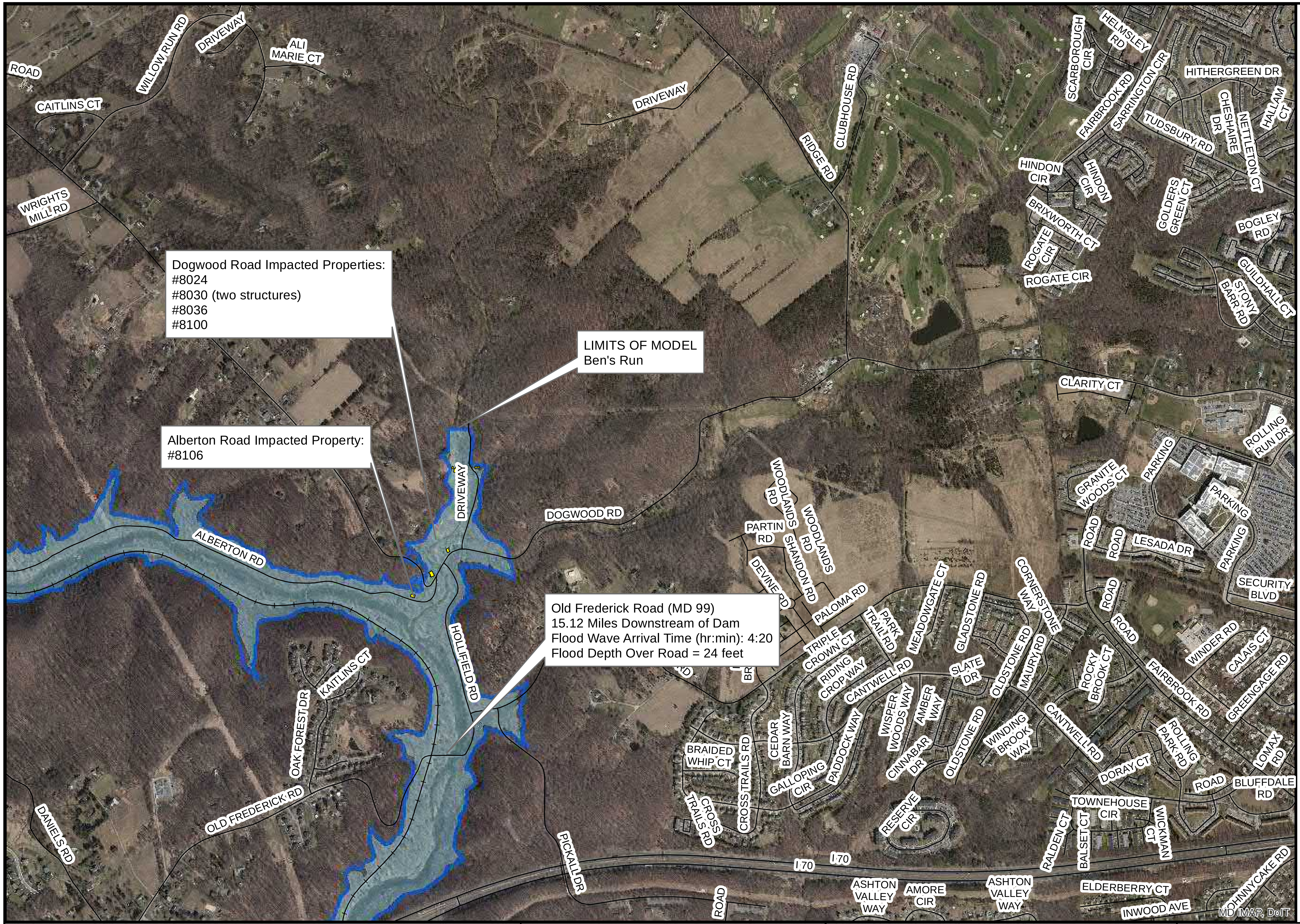

Legend

- Railroad
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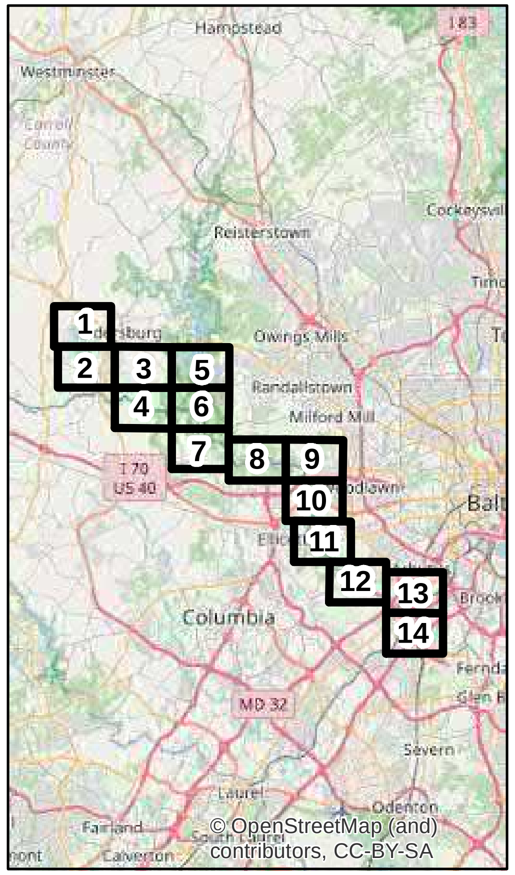

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0 500 1,000 2,000 3,000 4,000
Feet

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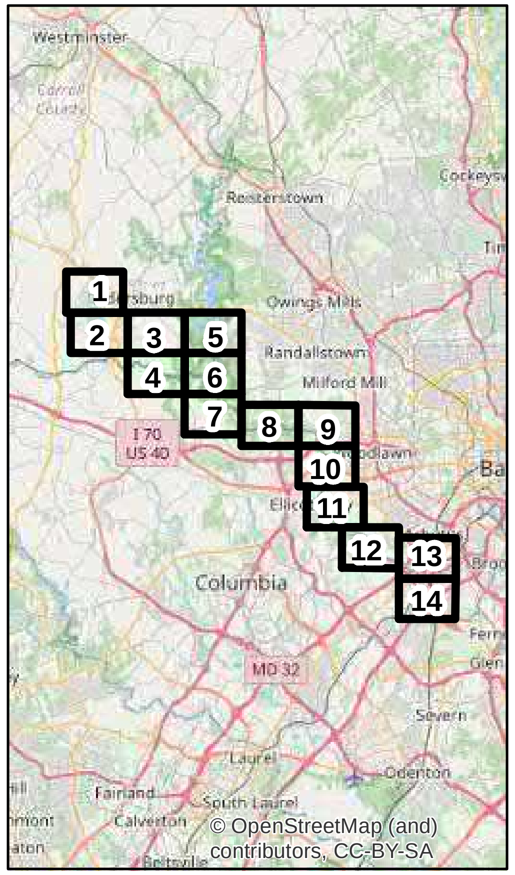

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0 500 1,000 2,000 3,000 4,000

Feet

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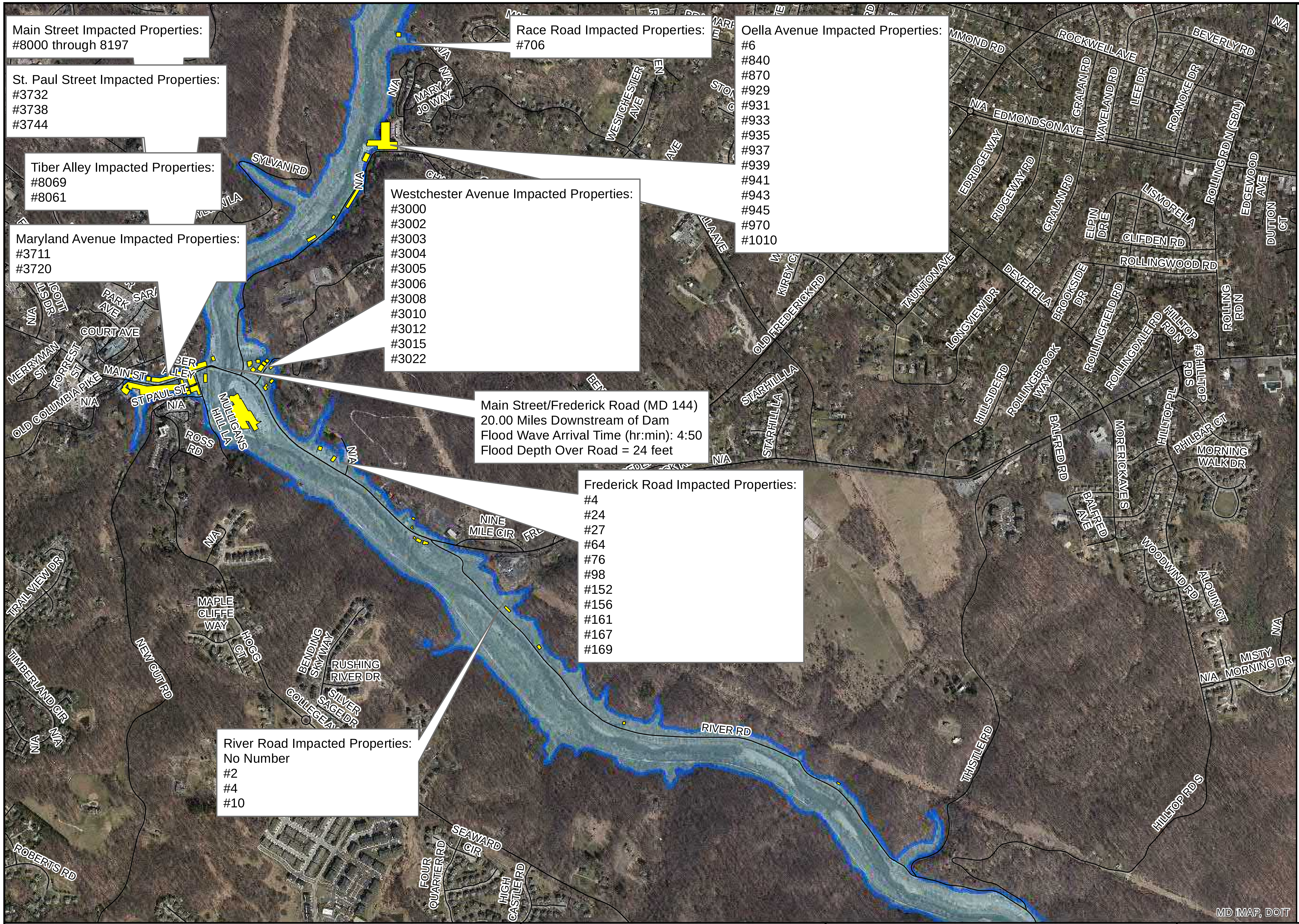

Legend

- Railroad
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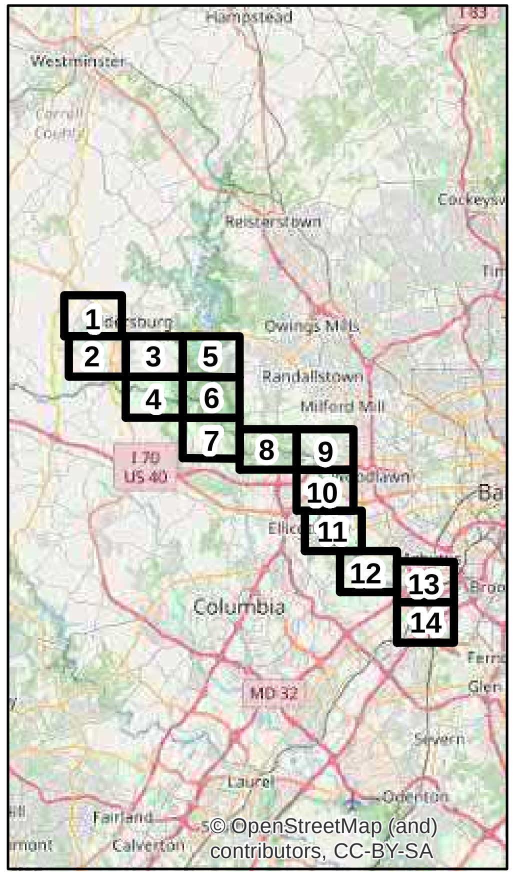

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0 29,500 59,000 118,000 177,000 236,000
Feet

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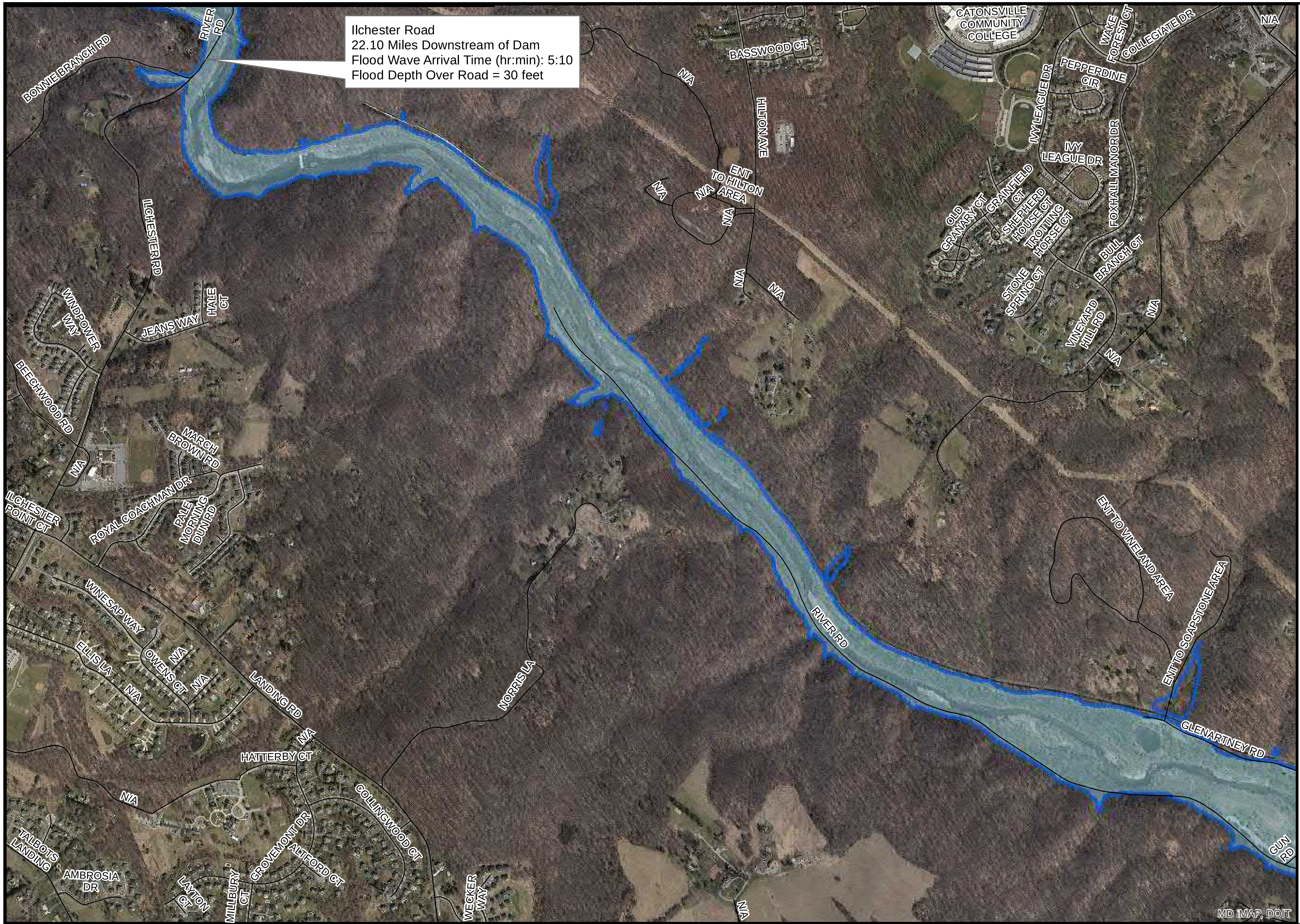

Legend

- Railroad
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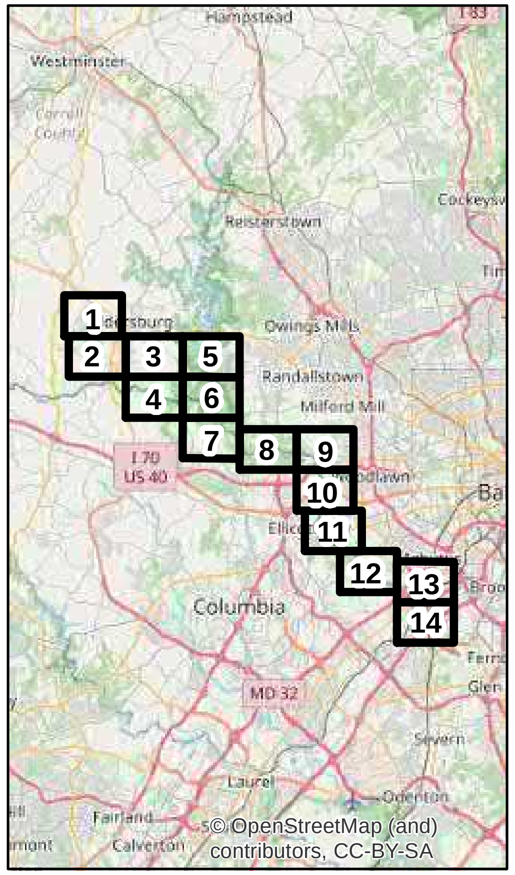

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0 29,500 59,000 118,000 177,000 236,000
Feet

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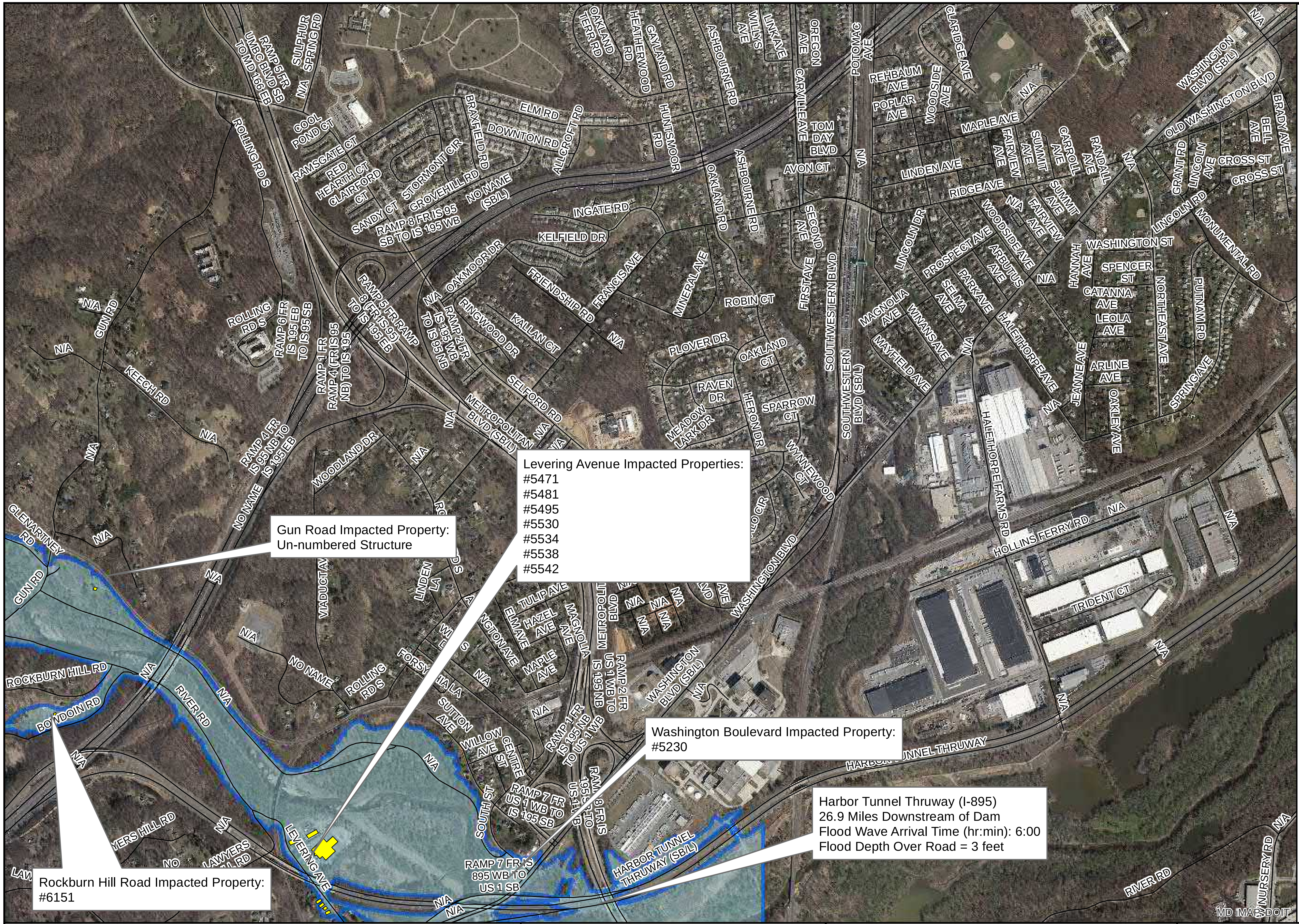

Legend

- Railroad
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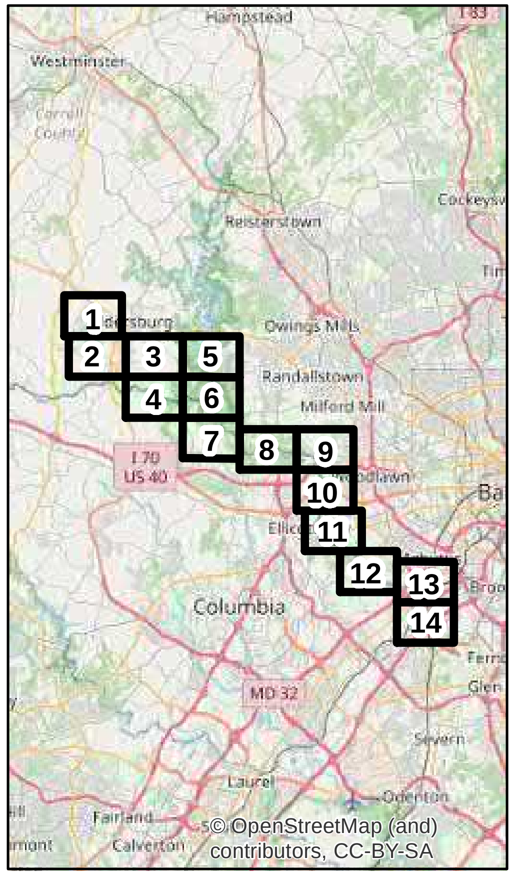

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0 500 1,000 2,000 3,000 4,000
Feet

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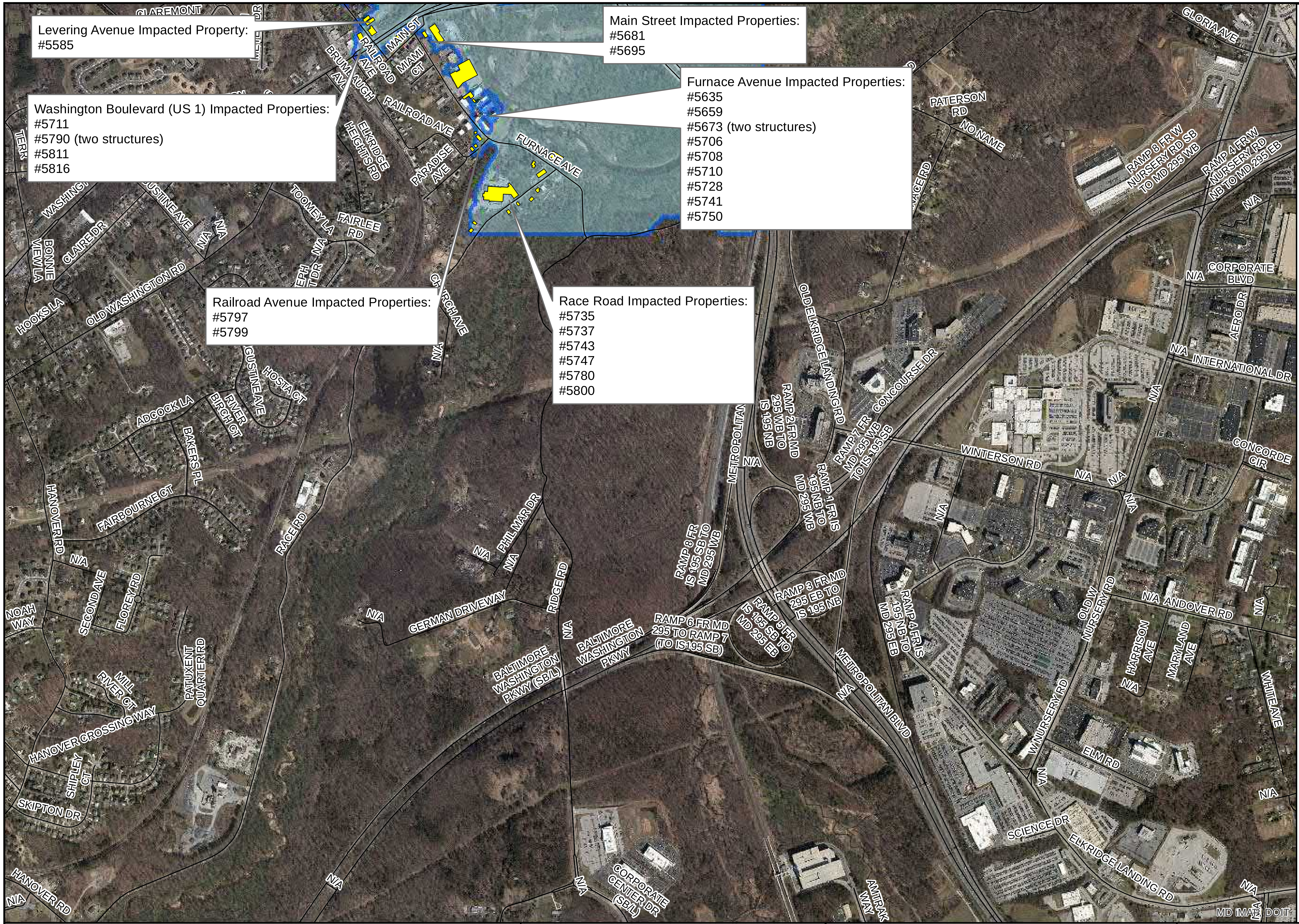

Legend

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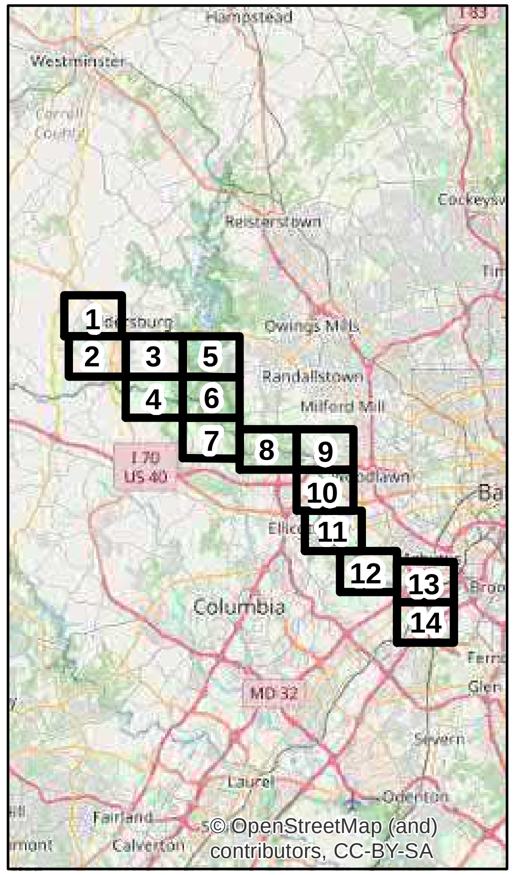

NOTES: The information contained on this map is prepared for use in the notification of downstream property owners by emergency management personnel. Timing and extent of actual inundation may differ from the inundation presented on this map. Times in this map are calculated from the dam breach initiation time.

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0 29,500 59,000 118,000 177,000 236,000
Feet

Piney Run Dam
PMF Breach Inundation Map

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