

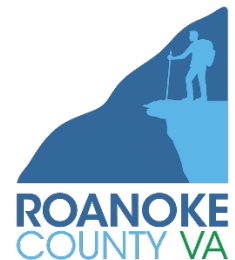
# **EMERGENCY ACTION PLAN**

## **WOODS END DAM (ALSO KNOWN AS HIDDEN VALLEY HIGH SCHOOL DAM)**

**INVENTORY # 161005**



**ROANOKE COUNTY, VIRGINIA**  
**JUNE 28, 2019**



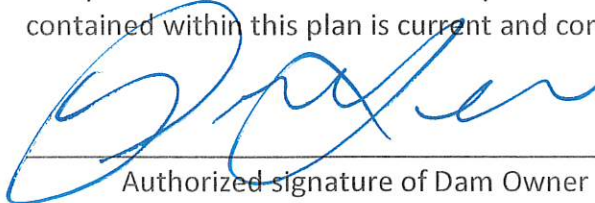
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## I. CERTIFICATIONS

### *Certification of Dam Owner*

I certify that the contents of this Emergency Action Plan have been provided to and coordinated with the Virginia Department of Emergency Management and Roanoke County Emergency Manager as described in this plan. The Dam Break Inundation Map has been provided to the local government office with development planning and approval authority (Roanoke County Department of Community Development) in which the dam break inundation zone encumbers. This plan shall be maintained and updated during the life of the project and the information contained within this plan is current and correct to the best of my knowledge.

  
Authorized signature of Dam Owner

Richard Caywood

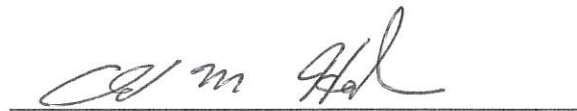
Printed Name

June 27, 2019

Date

### *Certification of Preparer*

I certify that the information provided in this plan has been prepared and reviewed by me and is correct to the best of my knowledge and professional judgment.

  
Signature of Preparer

DAVID M. HENDERSON

Printed Name

6/27/19  
Date

## II. NOTIFICATION FLOWCHART

- A. During periods of severe rains, when flooding is likely, the Cave Spring Fire Station shall have the primary responsibility to periodically observe the dam to monitor rising water levels. In the event that the Cave Spring Fire Station is unavailable, the Back Creek Fire Station will provide backup. If the severity of the storm, or observed rising water, makes it possible that Stage I (as described below) could occur; then, increased surveillance will occur. The increased surveillance will continue until the severe rain conditions pass.
- B. Stage I Condition – Occurs when ponded water behind the dam reaches the crest of the emergency spillway (three 12-1/2 foot diameter structural steel culverts) and water has just begun to flow through the culverts. Observe at least once every 2 hours, until the ponded water drops below the crest of the emergency spillway. The Cave Spring Fire Station (or Back Creek Fire Station as backup) will continue observations and will notify the County Stormwater Operations Manager and the County Engineer.

The Cave Spring Fire Station (or Back Creek Fire Station as backup) will remain responsible for observing the dam, unless either the County Stormwater Operations Manager, or the County Engineer arrives at the dam and assumes this responsibility.

Stage II Condition – Occurs when the ponded water has risen to the mid-point of the emergency spillway (three 12-1/2 foot diameter structural steel culverts). In other words, water is flowing 6 foot deep in the emergency culverts. Observe at least once every 1 hour, until the ponded water drops below 6 foot deep in the emergency culverts; then revert to Stage I until the ponded water drops below the crest of the emergency spillway. The Cave Spring Fire Station (or Back Creek Fire Station as backup) will continue observations and will notify the County Stormwater Operations Manager and the County Engineer. The Cave Spring Fire Station (or Back Creek Fire Station as backup) will remain responsible for observing the dam, unless either the County Stormwater Operations Manager, or the County Engineer arrives at the dam and assumes this responsibility.

When Stage II is reached, notify Emergency Dispatch, and the County Emergency Manager that evacuation may be necessary and that preparations should be made.

Stage III Condition – Occurs when ponded water has reached the top of the emergency spillway (three 12-1/2 foot diameter structural steel culverts). There is approximately 2 foot of freeboard before the dam is overtopped. Observe dam

continuously, until the ponded level drops below the top of the emergency spillway culverts, and is dropping; then revert to Stage II, until the ponded water drops below 6 foot deep in the emergency culverts; then revert to Stage I until the ponded water drops below the crest of the emergency spillway. The Cave Spring Fire Station (or Back Creek Fire Station as backup) will remain responsible for observing the dam, unless either the County Stormwater Operations Manager, or the County Engineer arrives at the dam and assumes this responsibility.

When Stage III is reached, notify Emergency Dispatch, and the County Emergency Manager that dam failure is imminent and that evacuations must occur immediately. Evacuate the inundation area and close Titan Drive, Farmington Drive, Cedar Ridge Road, McVitty Road, and Castle Rock Road.

After evacuations have been ordered, the County Emergency Manager shall contact the Virginia Department of Emergency Management; and the County Engineer shall contact the Virginia Department of Conservation and Recreation Regional Dam Engineer.

**WOODS END DAM; NOTIFICATION FLOW CHART - STAGE I CONDITIONS**  
**PONDED WATER IS AT THE CREST OF THE EMERGENCY SPILLWAY CULVERTS (FLOW HAS JUST BEGUN IN THE EMERGENCY SPILLWAY CULVERTS)**  
**ALERT CONDITION**

Observations and Notifications  
**Cave Spring Fire Station**  
**(Back Creek Fire Station as backup)**  
24 hour Phone: 540.798.4275  
(Battalion Chief on duty)

*Cave Spring Fire Station (or Back Creek Fire Station as backup) is responsible for observing and notifications, until either the County Engineer or the County Stormwater Operations Manager arrives at the dam. Observe the dam at least once/2 hours.*

*County Engineer or the County Stormwater Operations Manager may take over the observation and notification responsibilities, if they are physically on the site.*

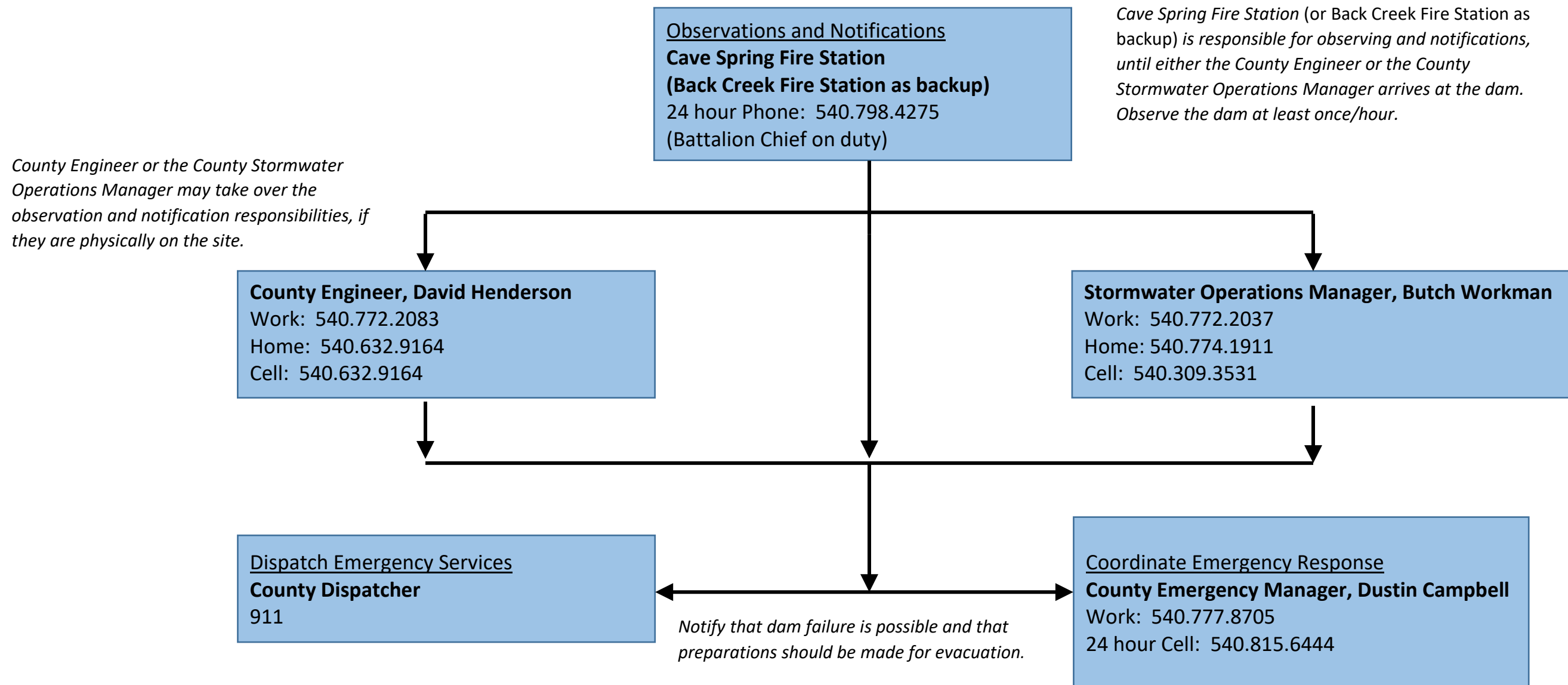
**County Engineer, David Henderson**  
Work: 540.772.2083  
Home: 540.632.9164  
Cell: 540.632.9164

**Stormwater Operations Manager, Butch Workman**  
Work: 540.772.2037  
Home: 540.774.1911  
Cell: 540.309.3531

## WOODS END DAM; NOTIFICATION FLOW CHART - **STAGE II CONDITIONS**

**PONDED WATER IS AT THE MID-POINT OF THE EMERGENCY SPILLWAY CULVERTS (~6 FOOT DEPTH IN THE EMERGENCY SPILLWAY CULVERTS)**

### **WARNING CONDITION**

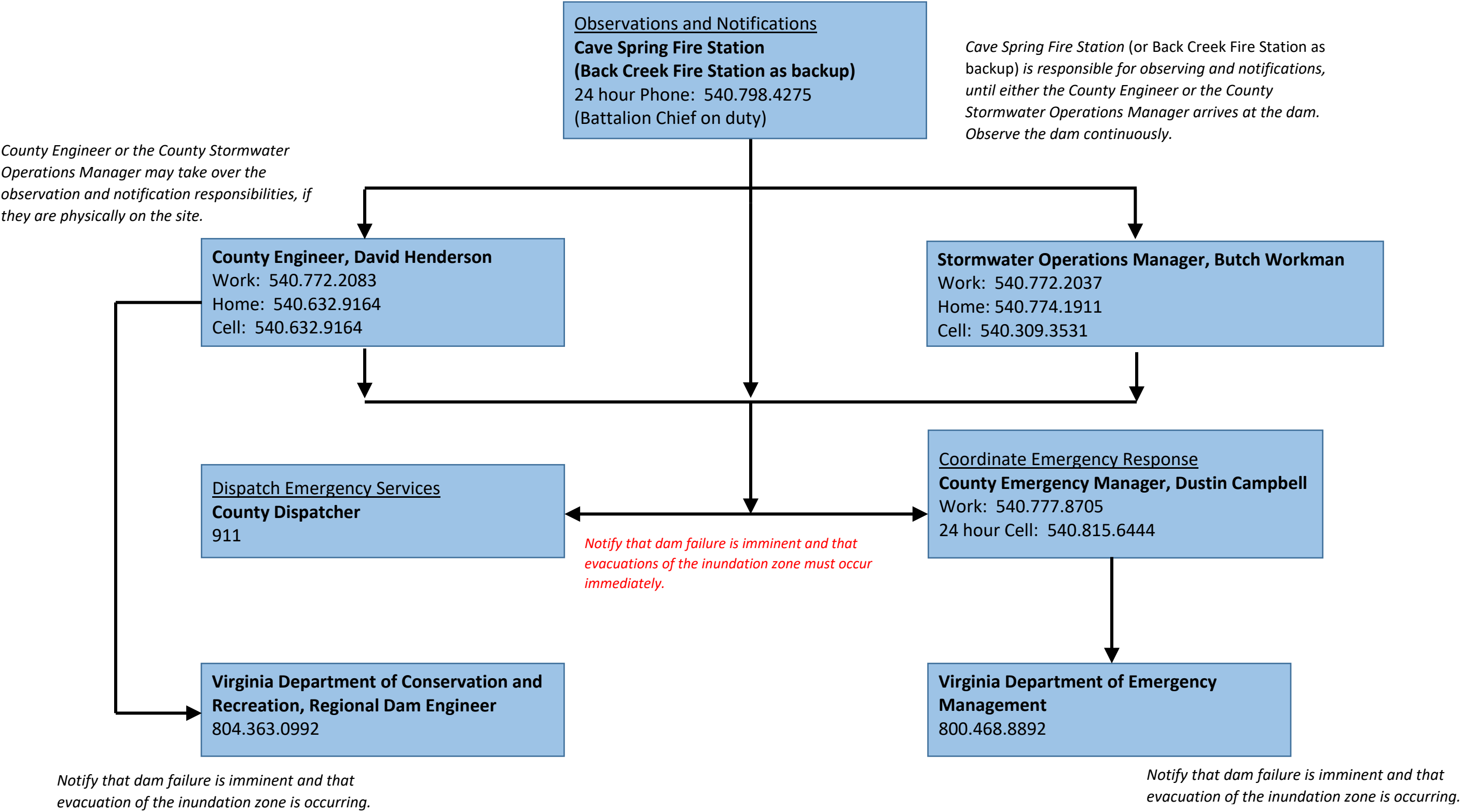




**WOODS END DAM; NOTIFICATION FLOW CHART - STAGE III CONDITIONS**

**PONDED WATER AT THE TOP OF THE EMERGENCY SPILLWAY CULVERTS (~2 FOOT OF FREEBOARD REMAINS)**

**FAILURE NOTICE: DAM FAILURE IS IMMINENT**





### **III. STATEMENT OF PURPOSE**

The purpose of the Emergency Action Plan (EAP) is to protect life and reduce property damage to those who are within the downstream limits of the dam inundation zone of Woods End Dam, in the event of flooding from dam overtopping or other dam failure.

This EAP should be used as a resource, along with the sound judgment of emergency management personnel, to guide the appropriate persons in evaluating conditions and making the proper decisions in response to changing and emergency conditions at the dam.

### **IV. PROJECT DESCRIPTION**

Woods End Dam (also known as Hidden Valley High School Dam) is a High Hazard dam located in Roanoke County at Hidden Valley High School. Titan Trail (private road) that serves the high school passes across the dam, where the road crosses Mud Lick Creek. The dam is owned and operated by Roanoke County and its purpose is flood reduction and water quality enhancement. The drainage area to the dam is 1.9 square miles.

The reservoir area is normally dry and Mud Lick Creek freely flows through the facility through the principal spillway, which is a 24-inch diameter concrete pipe.

During rain events, as the creek flow increases, water that cannot pass through the principal spillway (24" pipe) is detained behind the dam. If the storm is severe enough, water will continue to rise, until the crest of the emergency spillway is reached. The emergency spillway consists of three 12-1/2 foot diameter structural steel culverts. The emergency spillway is sized to pass the probably maximum flood (PMF).

### **V. EMERGENCY DETECTION, EVALUATION, AND CLASSIFICATION**

#### **A. Detection**

Whenever mowing or other routine maintenance or repairs are performed at the dam, personnel shall observe conditions. If any significant changes or other unusual conditions are observed, the County Engineer shall be immediately notified.

During periods of severe rains, when flooding is likely, the Cave Spring Fire Station (Back Creek Fire Station as backup) shall periodically observe the dam to monitor rising water levels. If the severity of the storm, or observed rising water, makes it possible that Stage I (as described below) could occur; then, increased surveillance

will occur. The increased surveillance will continue until the heavy rain conditions pass.

B. Evaluation

Emergency conditions can potentially occur during various situations. Following is a discussion of some possible situations that could result in emergency conditions.

1. *Normal Operating Conditions*

This facility is normally empty, except for the run of the stream through the facility. Therefore, a sunny day failure is highly unlikely. It is possible that the principal spillway (24" diameter concrete pipe) that carries the normal flow of the stream could leak, resulting in piping, and erosion of material around the pipe. Whenever mowing or other work is being performed at the dam, the inlet and outlet of the principal spillway should be observed to look for any evidence of this type of failure. This area should also be observed during the annual safety inspection. If any signs of piping with erosion of material are observed, appropriate follow up investigations should be immediately performed.

2. *Extreme Loading Conditions*

Flood related conditions are most likely to trigger an emergency condition. If the dam is overtopped, failure is likely due to erosion of earthen material causing a dam breach. A dam breach would send a sudden flood surge downstream. The possible extent of flooding is depicted on the Inundation Maps contained in this Plan.

Flood or high water events are monitored using a system of stages:

- a. **Stage I** – Initiates when the ponding elevation reaches the crest of the emergency spillway (three 12-1/2 foot diameter structural steel culverts). The dam shall be observed at least once every 2 hours.
- b. **Stage II** – Initiates when the ponding elevation reaches the mid-point of the emergency spillway (depth of 6 feet in the emergency spillway). The dam shall be observed at least once every hour.
- c. **Stage III** – Initiates with the ponding elevation reaches the top of the emergency spillway pipes (approximately 2-foot of freeboard remaining prior to dam overtopping). The dam shall be observed continuously.

Also during high water events, seeps could develop on the downstream face of the dam. If they develop, they should be closely monitored. If the seepage is

essentially stagnant and clear in color; then, it is generally not an urgent condition. However, if the flow increases and becomes turbid, an emergency should be declared. It is important to note that seeps can change in character very quickly.

### 3. *Earthquake*

Earthquakes could cause damage to the dam's principal spillway, emergency spillway; and/or earthen embankment material. In the event of an earthquake, the dam should be visually inspected, as soon as possible; and then weekly for the next four weeks, in order to detect any changes in the dam. Changes could include cracks, sags, sloughs, slides, misalignments, or new seeps. In the event of a significant earthquake, consideration should be made as to whether video inspection of the principal spillway (24" diameter pipe) is warranted, to check for misaligned joints, sags, or structural damage to the pipes.

## C. Classification

Emergency conditions are classified as:

### 1. *Alert Condition*

Indicates a situation where there is no current danger of dam failure, but conditions are such that increased surveillance is warranted. During high flow conditions, Alert Condition should be declared whenever Stage I is reached.

### 2. *Warning Condition*

Indicates a situation where dam failure is possible; however, there is some time available for further observations and evaluations to be made before dam failure is considered imminent. During this condition, preparations should be made to notify persons downstream and to close roads that would be within the inundation zone. During high flow conditions, Warning Condition should be declared whenever Stage II is reached.

### 3. *Failure Notice*

Indicates a situation where the dam is in imminent danger of failing. The areas indicated on the Inundation Maps should be evacuated and closed immediately. Also, Titan Trail should be closed where it crosses over the dam. During high flow conditions, Failure Notice should be declared whenever Stage III is reached.

## **VI. GENERAL RESPONSIBILITIES UNDER THE EAP**

### **A. Impounding Structure Owner Responsibilities**

Roanoke County, as the impounding structure owner, is responsible to operate and maintain the dam in a safe condition. The Department of Community Development is responsible for periodic inspections, routine maintenance, and repairs as needed.

### **B. Responsibility for Notification**

In the event of an emergency, Emergency Services shall be responsible for notification of occupants, owners, or lessees of downstream properties that are potentially impacted by the impounding structure's failure.

The method of notification, will be by going door to door and physically visiting each property. This method of notification is the most feasible due to the low number of structures and properties involved, and due to the inability to obtain cell phone numbers. Street addresses for all impacted structures and property are contained in the Inundation Mapping.

### **C. Responsibility for Evacuation**

If a decision is made to evacuate the downstream areas, the evacuations will be performed by the Fire and Rescue Department and Police Department.

### **D. Responsibility for Termination and Follow-Up**

Once emergency conditions pass, the emergency will be terminated by the Fire and Rescue Department Incident Commander. Follow up actions, to evaluate damage and to perform repairs, as needed, are the responsibility of the Department of Community Development.

### **E. EAP Coordinator Responsibility**

The County Engineer is the EAP Coordinator. Responsibilities of the EAP Coordinator include preparing revisions to the EAP, and coordinating with other County departments, as appropriate, to coordinate a drill annually; and a table top exercise, at least once every 6 years. The EAP Coordinator shall also maintain documentation of drills and table top exercises.

## **VII. PREPAREDNESS**

The best way to be prepared is to keep the dam in good repair at all times, and regularly review and exercise the EAP.

### **Available Resources**

- Emergency Services – Furnish emergency lighting and manpower

- County Drainage Crew – Furnish heavy construction equipment, materials, and manpower
- Contractor Assistance – The County Department of Community Development has relationships with contractors that can be utilized, if needed, in an emergency.

#### Dam Overtopping

In the event that Stage III is reached, immediately evacuate the downstream inundation zone.

After a dam overtopping event, as the water level drops, personnel will assess the situation. If additional rains are expected, and if the work can be performed safely; then dam repairs will be performed. If a partial breach has occurred, the situation will be evaluated to determine whether it would be better to repair the breach, or to enlarge it so that future flood waters are not impounded.

#### Piping through the Embankment

If a small boil develops whose flow is relatively slow, it may be controlled by constructing an inverted filter over it. An inverted filter is constructed by placing layers of granular material over the affected area. Each layer has an increasing grain size, with the lowest layer ideally sand, followed by VDOT #78 stone, VDOT #57 stone, and VDOT #3 stone. The purpose of the filter is to allow the water to drain out, but to prevent soil from being transported out of the dam.

#### Outworks Failure

If the principal spillway (24" diameter pipe) becomes totally blocked during non-high flow conditions. Water will rise up until it can flow out of the emergency spillway (three 12-1/2 foot diameter structural steel pipes). It may be necessary to pump or siphon the impounded water to lower the water level to allow access to the principal spillway to clear the blockage.

If the emergency spillway becomes blocked with debris, it is unlikely that it can be cleared during a high flow event. After the water level has dropped, and work can be performed safely, personnel shall clear the debris.

#### After an Emergency Event

The dam shall be inspected, as soon as safely possible, after the conclusion of an emergency event to ascertain its condition and need for repairs.

## **VIII. INUNDATION MAPS**

See Woods End Dam – Inundation Mapping, prepared by Engineering Concepts, dated April 29, 2013; with property ownership updated by Roanoke County on June 14, 2019; in Appendix A.

There have been no significant changes to the watershed, upstream or downstream; or changes to the dam that would necessitate any map changes.

## **IX. APPENDICES**

## **APPENDIX A – INVESTIGATION AND ANALYSES OF IMPOUNDING STRUCTURE FAILURE FLOODS**

Woods End Dam – Inundation Mapping, prepared by Engineering Concepts, dated April 29, 2013; with property ownership updated by Roanoke County on June 14, 2019.



**Roanoke County, Va.**

**Woods End Dam - Inundation Mapping  
Inventory #1605  
(Hidden Valley High School)**

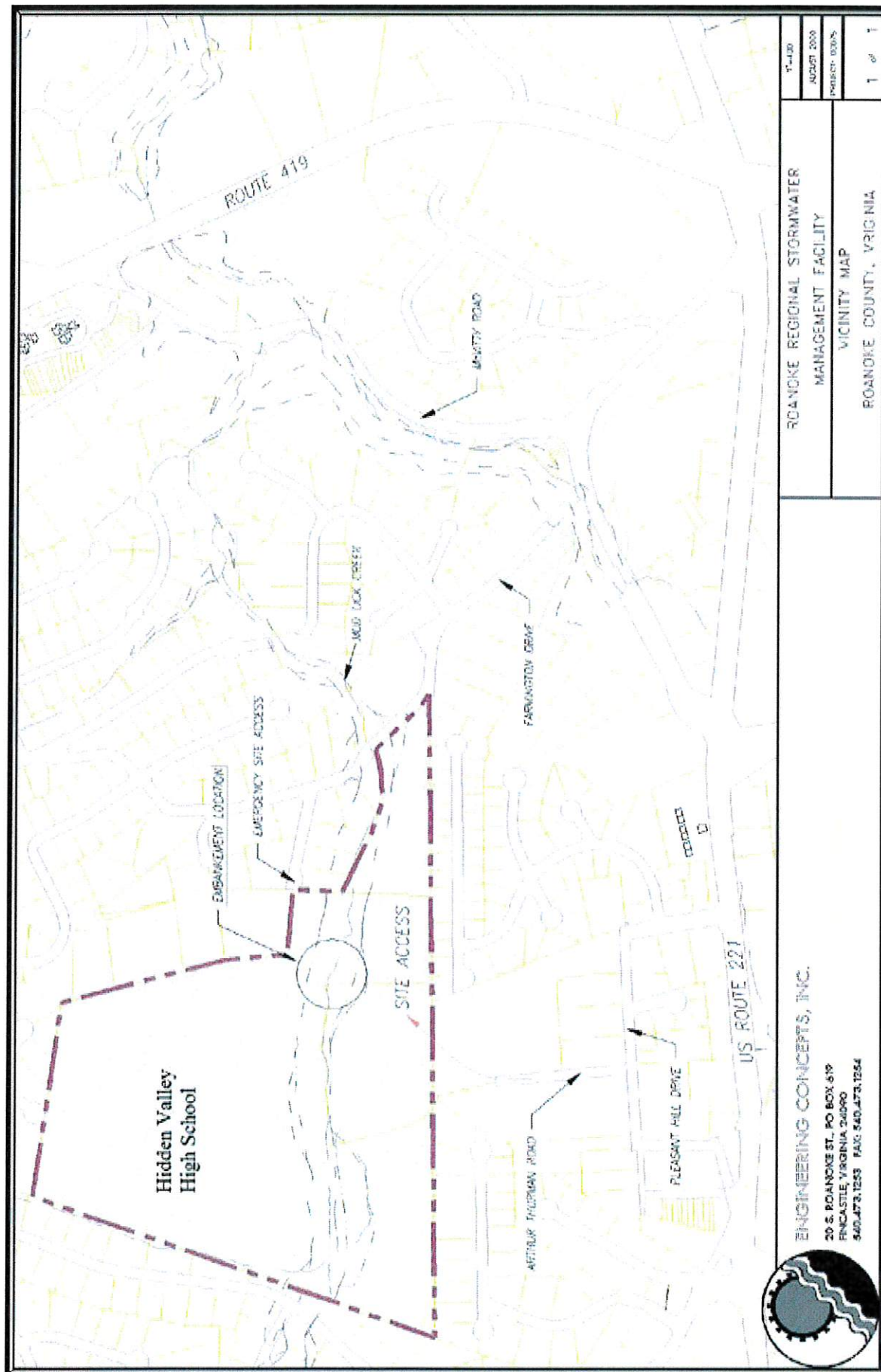


**Prepared for Roanoke County  
Community Development  
5204 Bernard Drive  
Roanoke, Virginia 24018**

**Prepared by Engineering Concepts, Inc.  
20 South Roanoke Street  
Fincastle, Va. 24090**

**April 29, 2013**









FEASIBILITY STUDY  
REGIONAL STORM WATER  
MANAGEMENT FACILITY  
SOUTH ROANOKE COUNTY  
HIGH SCHOOL SITE

OVERALL  
HIGH SCHOOL  
SITE PLAN



November 3, 1999



## **Executive Summary:**

The purpose of this report is to prepare an inundation mapping downstream of the Woods End Dam that will aid in implementing the Emergency Action Plan for this facility.

The mapping was performed in accordance with 4VAC50-20-54 of the Impounding Structure Regulations (Hazard Potential Classification of Impounding Structures).

Hydrology data was reviewed from ECI August 2000 report and the report titled "The Effects of Impervious Fraction on Downstream Flood Damages" dated September 9, 2004 (The Report) was prepared by Matthew Troy Biggs, a masters student (at that time) in the Department of Civil and Environmental Engineering department at Virginia Tech. The advisors listed for the report are Dr. Kibler and Dr. Loganathan.

The data in the report was found to be consistent with good engineering principals related to determining the Probable Maximum Flood (PMF) by analyzing the drainage area's land cover (Manning's  $n$ ), meteorological data (SCS type II), the criteria set forth in the Hydrometeorological Report 55A, Probable Maximum Precipitation (PMP) data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and the United States Army Corps of Engineers (USACE). (Please see Appendix A for the HEC-HMS Output). This data was imported into HEC-RAS for PMF run simulations.

The PMF generated for the inundation mapping is from the expected 2020 land use data contained in The Report.

The software used to verify the above hydrological data is from the USACE Hydrologic Modeling Systems (HEC-HMS).

The flow regime was assumed to be unsteady mixed flow (sub and supercritical flow). Previous simulations used steady flow which is not allowed as of July 2010 from the Department of Conservation and Recreation (DCR) for dam break analysis.

The creek alignment used for the mapping starts at Route 419 (Electric Road) and stops at approximately 1,000 feet above the dam. The total length of the alignment modeled is approximately 6,300 LF. The total length of analysis downstream of the dam is approximately 5,100 lf.

Topographical data was provided to ECI from Roanoke County in 1999. Manning's "N" was adjusted based on field inspection of the land cover upstream and downstream of the dam in September 2012.

Cross sections for the model were generated in AutoCAD Civil 3D and imported into the HEC-RAS model.

### **Background:**

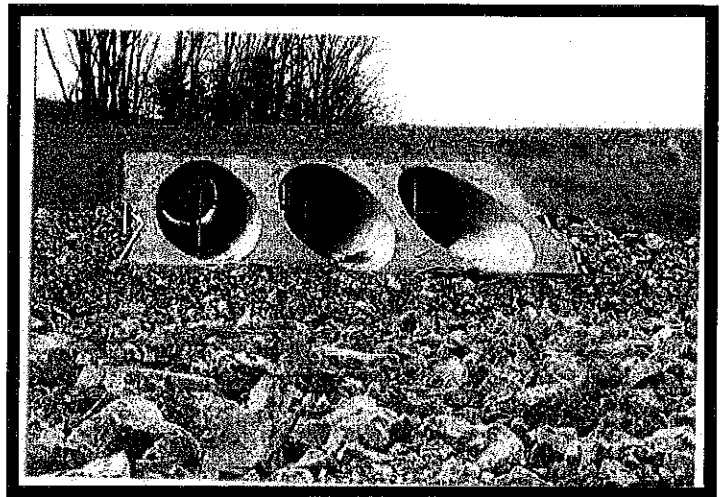
The dam was constructed in 1999 along Mud Lick Creek adjacent to the Hidden Valley High School. The total drainage area that is tributary to Mud Lick Creek is 1,236 acres. The dam consists of earthen embankment with side slopes of 3:1 on the downside slope and 2:1 slope on the upstream face.

The principal spillway consists of 235 LF of 24-inch culvert at a 1.3% slope. This culvert conveys dry weather flow from the creek through the dam's embankment. This flow is estimated to be 1.1 cfs. The invert of the 24-inch inlet is at El 1100.88'.

It was observed on a field visit in September that sediment has accumulated in areas around the toe of the embankment as well as upstream of the dam.

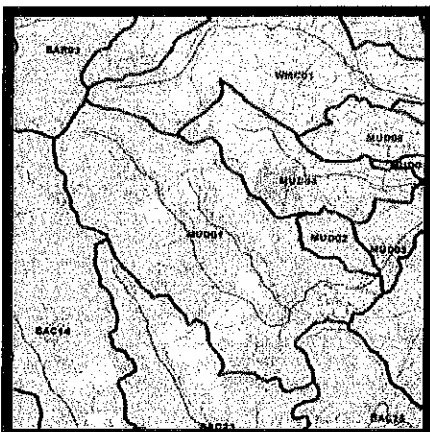
The emergency spillway consists of 3-12.5' corrugated metal pipes each at 154 LF at a slope of 3.66%. The culverts inlet invert is 1110.51.

The low point of the top of the dam is at El 1129.50'.



The dam has a storage capacity of approximately 113 ac-ft based on the inventory report filed with dam safety by ECI.

The peak flow results from the report and model is 4,209.8 cfs. The hydrograph that produced this peak flow was used in routing the storm for the dam break analysis for the inundation mapping downstream of the dam. The USACE River Analysis System (HEC-RAS) was used to analyze the effects of downstream flooding.



### **Hydrology:**

The Mud Lick Creek watershed is a 9.6-square mile drainage basin located in east central Roanoke County and southeast of Roanoke City. The watershed is fan shaped and has a length of about 4.5 miles to its confluence with the Roanoke River, and a maximum width of about 3.5 miles near its headwaters.

The Mud Lick Creek basin, upstream of the dam, is located entirely within Roanoke County. Mud Lick Creek originates on Long Ridge, near Poor Mountain, at an elevation of approximately 2300 feet above sea level and flows in a southeasterly direction.

Land along the main stem of Mud Lick Creek is relatively undeveloped until the stream intersects with Farmington Drive where the downstream land use becomes primarily residential with some scattered commercial development. The Wood's End Dam is located approximately 1100' upstream from Farmington Drive and serves 1,218.8 acres (1.9 mi.<sup>2</sup>).

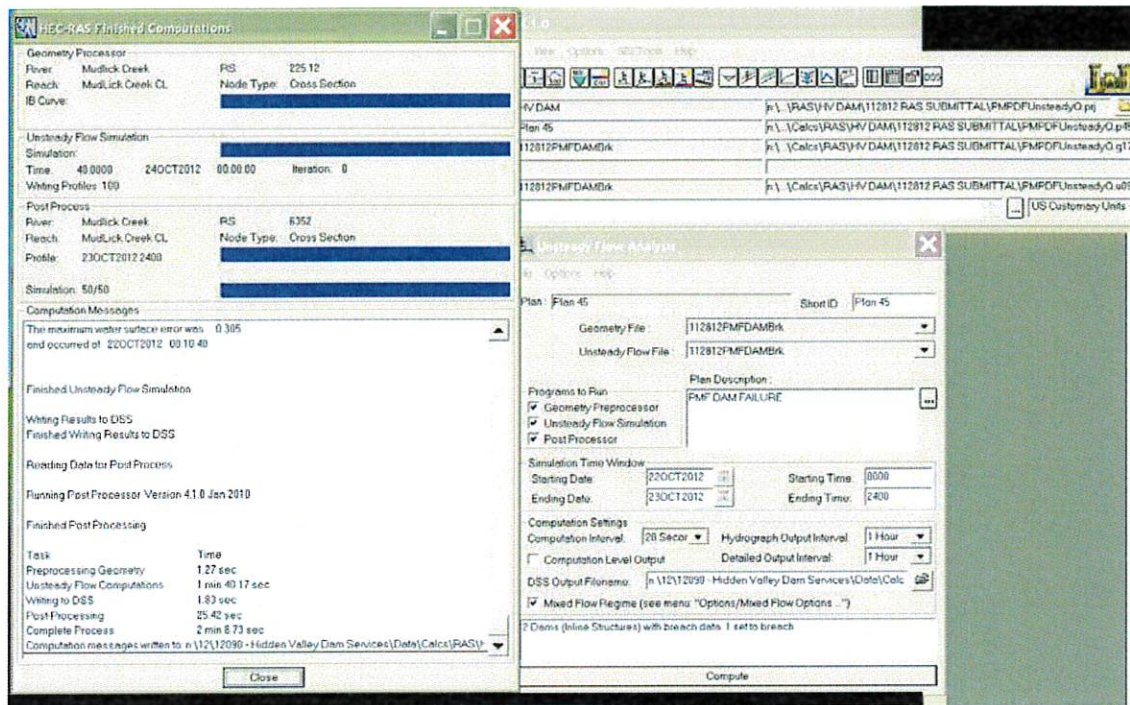
For further information please refer to ECI Design Report dated August 2000 as well as THE REPORT by Matthew Troy Biggs, dated September 9, 2004

**Model:**

Three simulations were modeled for the Hidden Valley Dam break analysis per DCR. They are as follows:

1. Sunny Day Break utilizing the volume retained at the normal or typical water surface elevation of the impounding structure. In this case, this scenario was modeled by assuming the 24-inch principal spillway was blocked and the water surface elevation rose to the invert of the emergency spillway (3-12.5' diameter CMP's). A dam breach was set to full formation in (6) six minutes. Creek flow modeled was 1.10 cfs.
2. A dam break analysis utilizing the spillway flood (1.0 PMF) with dam failure. This scenario was modeled by routing the PMF hydrograph through the dam. Piping failure was modeled per the requirements of DCR. The dam was breached in (6) minutes.
3. Routing the spillway design flood (1.0 PMF) through the dam without failure.





The dam breach parameters that were used in the HEC-RAS model is as follows:

1. Side slopes modeled were 1:1
2. Breach Width = 60'
3. Failure time = 6 minutes (National Weather service)

The inundation mapping limits per DCR occurs when the water surface elevation from items 2 and 3 above, converge within 1.0' of each other.



## Results:

Please see Appendix B for the Output Tables for each of the run simulations mentioned above. Velocity profiles are also included for each simulation.

As expected, the required hydrographs begin to converge approximately 4,800 feet south of the Woods End Dam at cross section 3+69.22. This is where the inundation mapping ends. (Please see Appendix C.)

All structures that are impacted along the flood way are shown on the map with addresses.

The high water mark at Farmington Drive is as follows (Includes 2004 result):

2004 HEC-RAS Result	= 1,095.47' (1985 flood WSEL = 1096.23')
2012 Sunny Day Break	= 1,094.25'
2012 PMF Spillway Pass	= 1092.81'
2012 PMF Pipe Failure	= 1098.13'

For more hydraulic information please see the output tables in Appendix B

The 2004 run simulation assumed steady flow throughout the length of the creek. The method used was overtopping the road in lieu of the required piping failure set forth by DCR.

For a flood coursing through a floodplain, typically there is flow attenuation that occurs which means that the volume of flow of one cross section may not quite equal the volume of flow in the next downstream cross section. There will be pockets of water moving back up stream or contained in depressions in typical floodplain topography. To model this correctly, the unsteady flow simulation was used to model the breach simulations of the dam. This is a requirement of DCR.

The difference in flood elevations for the 2012 dam analysis is due to the amount of storage behind the dam that had accumulated to when the dam reached full failure mode. For instance, 13,484 CFS was released through the breach for the PMF piping failure. The sunny day break released 2,957 cfs. This volume is what accumulated from the base flow of Mud Lick Creek of 1.1 cfs. The PMF of 4,209 CFS was routed through the emergency spillway which is what flowed in the downstream cross sections.

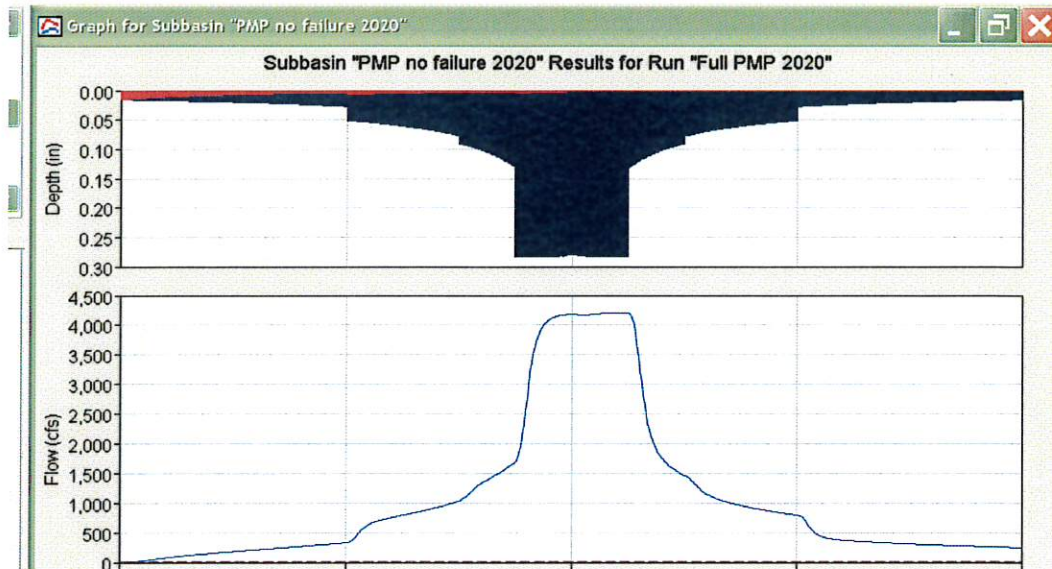
The difference in the 2004 run simulation and the 2012 PMF Pipe failure simulation is due to the different methods employed as well as different hydraulic parameters (Manning's N). This model shows worst case, and as in any model, the results are only as good as the data that was used for analysis and can vary greatly depending on the methods employed.

# Appendix A

## (HEC-HMS OUTPUT)

## WATERSHED RUNOFF HYDROGRAPH (ROANOKE COUNTY 2020 LAND USE)

### HYDROLOGY DATA USED FOR ALL HEC-RAS RUN SIMULATIONS



# Appendix B

## (HEC- RAS OUTPUT)

# PMF THRU SPILLWAY NO DAM FAILURE

HEC-RAS Plan: Plan 42 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	6352	Max WS	4209.68	1104.91	1122.14		1122.17	0.000069	1.64	2970.82	277.16	0.08
Mudlick Creek CL	5200	Max WS	4208.78	1100.00	1122.10	1103.90	1122.12	0.000028	1.05	4023.28	268.60	0.05
Mudlick Creek CL	5105	Inl Struct										
Mudlick Creek CL	4977.98	Max WS	4208.80	1094.00	1103.24		1104.24	0.006235	9.91	618.66	140.35	0.62
Mudlick Creek CL	4866.96	Max WS	4208.73	1093.49	1102.65		1103.58	0.005492	9.62	652.22	140.65	0.59
Mudlick Creek CL	4755.94	Max WS	4208.69	1092.99	1099.44	1100.09	1102.17	0.028262	15.71	374.62	112.56	1.16
Mudlick Creek CL	4644.92	Max WS	4208.65	1091.89	1098.90		1099.68	0.006333	9.44	773.54	166.28	0.64
Mudlick Creek CL	4543.08	Max WS	4208.65	1091.32	1098.21		1099.00	0.006646	9.66	747.06	163.23	0.65
Mudlick Creek CL	4441.24	Max WS	4208.67	1090.65	1097.48		1098.29	0.007025	9.88	715.68	160.05	0.67
Mudlick Creek CL	4339.4	Max WS	4208.65	1089.97	1096.66		1097.53	0.007871	10.31	672.66	157.56	0.71
Mudlick Creek CL	4237.56	Max WS	4208.56	1089.30	1095.32		1096.54	0.012609	12.16	555.89	149.91	0.88
Mudlick Creek CL	4012	Max WS	4208.64	1083.05	1094.33	1091.36	1094.62	0.001483	5.83	1158.56	239.57	0.31
Mudlick Creek CL	4010	Inl Struct										
Mudlick Creek CL	4004.56	Max WS	4208.47	1083.05	1091.41	1091.51	1092.94	0.012354	12.96	526.74	177.38	0.85
Mudlick Creek CL	3873.44	Max WS	4208.40	1083.00	1090.42		1091.34	0.009086	8.88	617.96	205.78	0.70
Mudlick Creek CL	3742.92	Max WS	4208.59	1082.74	1090.07		1090.47	0.002778	5.81	936.44	235.84	0.41
Mudlick Creek CL	3611.2	Max WS	4208.49	1082.35	1089.45		1090.02	0.004512	7.07	793.20	229.28	0.52
Mudlick Creek CL	3490.08	Max WS	4208.62	1081.95	1088.69		1089.39	0.005580	8.07	726.18	216.07	0.58
Mudlick Creek CL	3348.96	Max WS	4208.46	1081.57	1087.83		1088.56	0.007172	9.45	678.70	193.77	0.67
Mudlick Creek CL	3217.84	Max WS	4208.53	1080.36	1086.83		1087.62	0.007420	9.79	648.47	177.10	0.68
Mudlick Creek CL	3096.72	Max WS	4208.54	1079.15	1085.82		1086.65	0.007562	10.05	631.07	167.88	0.69
Mudlick Creek CL	2955.6	Max WS	4208.50	1077.95	1084.81		1085.67	0.007630	10.28	621.00	162.49	0.70
Mudlick Creek CL	2824.48	Max WS	4208.48	1076.74	1083.80		1084.68	0.007641	10.43	615.67	159.26	0.70
Mudlick Creek CL	2693.36	Max WS	4208.38	1075.54	1082.76		1083.68	0.007923	10.76	611.23	161.25	0.72
Mudlick Creek CL	2562.24	Max WS	4208.49	1074.33	1081.70		1082.64	0.008176	11.03	608.05	161.90	0.73
Mudlick Creek CL	2431.72	Max WS	4208.47	1073.12	1080.49		1081.63	0.009264	11.68	580.16	159.61	0.77
Mudlick Creek CL	2300	Max WS	4208.40	1070.71	1080.23		1080.61	0.002856	7.66	958.26	226.11	0.45
Mudlick Creek CL	2260.77	Max WS	4208.43	1070.25	1078.82		1080.08	0.008006	12.03	514.33	105.27	0.74
Mudlick Creek CL	2221.54	Max WS	4208.46	1069.79	1078.07		1079.78	0.010418	13.50	440.96	87.49	0.84
Mudlick Creek CL	2182.32	Max WS	4208.35	1069.33	1077.60		1079.38	0.010381	13.54	428.63	80.56	0.84
Mudlick Creek CL	2143.1	Max WS	4208.34	1068.87	1077.33		1078.98	0.009090	12.94	443.14	78.36	0.79
Mudlick Creek CL	2103.86	Max WS	4208.43	1068.41	1077.18		1078.63	0.007482	12.08	470.88	78.06	0.72
Mudlick Creek CL	2064.66	Max WS	4208.40	1068.41	1075.13	1075.72	1078.32	0.022617	17.55	319.43	69.55	1.20
Mudlick Creek CL	1961.53	Max WS	4208.47	1066.99	1072.67	1073.39	1075.88	0.025541	16.42	316.34	77.96	1.23
Mudlick Creek CL	1858.4	Max WS	4208.49	1066.06	1070.72		1072.45	0.013781	11.52	425.29	106.10	0.90
Mudlick Creek CL	1755.27	Max WS	4208.51	1064.09	1069.56		1071.06	0.012901	10.61	454.78	120.74	0.88
Mudlick Creek CL	1662.14	Max WS	4208.45	1063.13	1068.90		1069.93	0.008479	8.77	551.55	144.17	0.70
Mudlick Creek CL	1549.01	Max WS	4208.48	1062.16	1066.73	1066.96	1068.46	0.021566	11.21	429.34	162.21	1.05
Mudlick Creek CL	1445.88	Max WS	4208.63	1061.20	1066.08		1066.83	0.007771	7.79	670.06	238.36	0.72
Mudlick Creek CL	1336.36	Max WS	4208.49	1060.15	1064.62		1065.79	0.012159	9.43	532.37	200.91	0.89
Mudlick Creek CL	1237.78	Max WS	4208.45	1059.09	1063.35		1064.58	0.012388	9.56	508.90	176.04	0.90
Mudlick Creek CL	1139.2	Max WS	4208.48	1058.04	1062.27		1063.34	0.012481	8.85	530.39	168.80	0.81
Mudlick Creek CL	1040.62	Max WS	4208.46	1056.98	1061.73		1062.40	0.006403	7.16	675.39	205.80	0.60
Mudlick Creek CL	657.36	Max WS	4208.49	1055.93	1061.81		1061.92	0.000812	3.19	1672.03	362.92	0.23
Mudlick Creek CL	513.28*	Max WS	4208.36	1054.62	1061.57		1061.79	0.001331	4.68	1283.20	302.21	0.31
Mudlick Creek CL	369.216*	Max WS	4208.46	1053.31	1060.94		1061.31	0.005618	1.05	1072.18	261.66	0.07
Mudlick Creek CL	225.12	Max WS	4208.33	1052.00	1059.29	1059.40	1060.59	0.009979	13.82	629.81	238.56	0.91

## HEC-RAS Plan: Plan 45 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	6352	Max WS	1.10	1104.91	1124.80		1124.80	0.000000	0.00	3741.81	300.67	0.00
Mudlick Creek CL	6064.*	Max WS	16.46	1103.68	1124.80		1124.80	0.000000	0.00	3669.36	299.23	0.00
Mudlick Creek CL	5776.*	Max WS	31.92	1102.46	1124.80		1124.80	0.000000	0.01	3822.98	296.02	0.00
Mudlick Creek CL	5488.*	Max WS	46.64	1101.23	1124.80		1124.80	0.000000	0.01	4275.04	276.82	0.00
Mudlick Creek CL	5200	Max WS	61.46	1100.00	1124.80	1100.41	1124.80	0.000000	0.01	4791.37	295.98	0.00
Mudlick Creek CL	5105	Inl Struct										
Mudlick Creek CL	4977.98	Max WS	13745.93	1094.00	1107.58		1109.83	0.008486	15.47	1312.30	178.86	0.78
Mudlick Creek CL	4866.96	Max WS	13666.97	1093.49	1106.32		1108.90	0.010670	16.46	1238.01	177.37	0.84
Mudlick Creek CL	4844.75*	Max WS	13648.15	1093.39	1105.99		1108.70	0.011410	16.90	1213.09	176.74	0.87
Mudlick Creek CL	4822.55*	Max WS	13626.52	1093.29	1105.61		1108.49	0.012406	17.45	1181.94	175.79	0.91
Mudlick Creek CL	4800.34*	Max WS	13594.01	1093.19	1105.14	1105.05	1108.28	0.013907	18.19	1138.59	173.93	0.96
Mudlick Creek CL	4778.14*	Max WS	13561.55	1093.09	1104.12	1104.84	1108.21	0.019853	20.65	1003.54	166.71	1.14
Mudlick Creek CL	4755.94	Max WS	13537.08	1092.99	1103.65	1104.60	1108.12	0.022510	21.59	964.85	165.06	1.21
Mudlick Creek CL	4742.06*	Max WS	13520.88	1092.86	1103.33	1104.33	1107.87	0.023195	21.80	965.23	166.26	1.23
Mudlick Creek CL	4728.18*	Max WS	13503.61	1092.74	1103.00	1104.07	1107.59	0.023904	21.99	969.16	169.03	1.25
Mudlick Creek CL	4714.30*	Max WS	13484.74	1092.61	1102.67	1103.82	1107.26	0.024503	22.11	978.79	172.95	1.26
Mudlick Creek CL	4700.43*	Max WS	13464.40	1092.49	1102.32	1103.40	1106.84	0.024791	22.06	995.92	176.60	1.27
Mudlick Creek CL	4686.55*	Max WS	11805.07	1092.36	1102.46	1102.35	1105.28	0.015142	17.69	1107.21	183.00	1.00
Mudlick Creek CL	4672.67*	Max WS	12443.88	1092.24	1102.83		1105.19	0.012165	16.50	1273.12	192.40	0.91
Mudlick Creek CL	4658.79*	Max WS	13094.93	1092.11	1103.04		1105.15	0.010287	15.93	1422.88	199.23	0.86
Mudlick Creek CL	4644.92	Max WS	13077.29	1091.99	1103.18		1104.91	0.008067	14.75	1569.95	204.99	0.78
Mudlick Creek CL	4610.97*	Max WS	13034.16	1091.77	1102.90		1104.64	0.008212	14.83	1547.24	204.25	0.79
Mudlick Creek CL	4577.02*	Max WS	12984.06	1091.54	1102.60		1104.36	0.008459	14.98	1521.91	203.79	0.80
Mudlick Creek CL	4543.08	Max WS	12928.10	1091.32	1102.30		1104.07	0.008647	15.08	1496.74	203.26	0.81
Mudlick Creek CL	4441.24	Max WS	12490.11	1090.65	1101.35		1103.08	0.008948	15.09	1418.53	203.04	0.82
Mudlick Creek CL	4407.29*	Max WS	12478.68	1090.42	1101.01		1102.77	0.009327	15.29	1389.44	203.45	0.83
Mudlick Creek CL	4373.34*	Max WS	12463.50	1090.20	1100.62		1102.46	0.009949	15.63	1354.39	203.90	0.86
Mudlick Creek CL	4339.4	Max WS	12444.57	1089.97	1100.21		1102.11	0.010648	15.97	1314.59	204.40	0.88
Mudlick Creek CL	4324.85*	Max WS	12435.33	1089.87	1100.05		1101.94	0.011040	15.85	1302.00	205.03	0.88
Mudlick Creek CL	4310.30*	Max WS	12425.50	1089.78	1099.84		1101.78	0.011569	16.10	1278.76	205.03	0.90
Mudlick Creek CL	4295.75*	Max WS	12415.32	1089.68	1099.64		1101.60	0.012161	16.05	1260.18	205.42	0.90
Mudlick Creek CL	4281.20*	Max WS	12404.95	1089.59	1099.45		1101.40	0.012615	15.90	1243.06	206.11	0.90
Mudlick Creek CL	4266.65*	Max WS	12394.07	1089.49	1099.21		1101.20	0.013513	15.97	1216.05	205.95	0.91
Mudlick Creek CL	4252.10*	Max WS	12383.07	1089.40	1098.86	1098.29	1101.01	0.015113	16.58	1166.48	204.15	0.95
Mudlick Creek CL	4237.56	Max WS	12370.28	1089.30	1098.38	1098.17	1100.79	0.018272	17.38	1091.85	200.27	1.02
Mudlick Creek CL	4192.44*	Max WS	12161.54	1088.05	1097.70	1097.36	1099.93	0.015959	16.71	1124.10	207.64	0.96
Mudlick Creek CL	4147.33*	Max WS	11728.83	1086.80	1097.28		1099.22	0.010892	15.96	1217.41	221.13	0.88
Mudlick Creek CL	4102.22*	Max WS	12035.13	1085.55	1097.35		1098.80	0.007204	13.82	1443.56	247.19	0.72
Mudlick Creek CL	4057.11*	Max WS	11968.61	1084.30	1097.47		1098.44	0.004246	11.23	1721.02	271.92	0.56
Mudlick Creek CL	4012	Max WS	11906.30	1083.05	1097.59	1094.14	1098.21	0.002701	8.46	2029.61	291.95	0.40
Mudlick Creek CL	4010	Inl Struct										
Mudlick Creek CL	4004.56	Max WS	11906.30	1083.05	1094.37	1094.36	1096.57	0.012975	16.73	1145.02	240.36	0.93



HEC-RAS Plan: Plan 45 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Chl El (ft)	W/S Elev (ft)	Crit W/S (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	3985.82*	Max WS	11755.03	1083.04	1093.76	1093.98	1096.32	0.015010	17.31	1055.24	228.14	1.00
Mudlick Creek CL	3967.09*	Max WS	11858.53	1083.04	1094.06		1095.94	0.012058	14.14	1180.74	238.41	0.81
Mudlick Creek CL	3948.36*	Max WS	11752.72	1083.03	1093.41	1093.47	1095.77	0.013662	15.75	1082.77	229.04	0.95
Mudlick Creek CL	3929.63*	Max WS	11746.51	1083.02	1093.23	1093.18	1095.50	0.013241	15.09	1095.81	230.19	0.93
Mudlick Creek CL	3910.90*	Max WS	11738.10	1083.01	1093.06	1092.93	1095.23	0.012983	14.52	1106.96	231.71	0.91
Mudlick Creek CL	3892.17*	Max WS	10800.73	1083.01	1092.94		1094.67	0.010545	12.77	1129.69	234.41	0.81
Mudlick Creek CL	3873.44*	Max WS	10792.53	1083.00	1092.87		1094.47	0.009958	12.14	1160.06	237.87	0.79
Mudlick Creek CL	3829.73*	Max WS	10764.61	1082.91	1092.83		1094.09	0.006995	10.79	1303.55	247.98	0.68
Mudlick Creek CL	3786.02*	Max WS	10741.87	1082.83	1092.82		1093.83	0.004998	9.59	1462.00	259.07	0.58
Mudlick Creek CL	3742.32	Max WS	10724.63	1082.74	1092.84		1093.64	0.003661	8.55	1631.03	270.02	0.51
Mudlick Creek CL	3611.2	Max WS	10629.54	1082.35	1092.13		1093.14	0.005122	9.73	1446.63	259.29	0.59
Mudlick Creek CL	3567.49*	Max WS	10243.20	1082.22	1091.88		1092.88	0.005090	9.77	1410.82	256.79	0.59
Mudlick Creek CL	3523.78*	Max WS	10229.05	1082.08	1091.63		1092.67	0.005410	10.13	1377.20	252.96	0.61
Mudlick Creek CL	3480.08	Max WS	10205.18	1081.95	1091.35		1092.45	0.005771	10.50	1344.58	250.03	0.63
Mudlick Creek CL	3436.37*	Max WS	10171.67	1081.82	1091.08		1092.21	0.006277	11.02	1313.89	247.32	0.66
Mudlick Creek CL	3392.66*	Max WS	9833.98	1081.70	1090.80		1091.88	0.006388	11.20	1287.12	244.31	0.67
Mudlick Creek CL	3348.96	Max WS	9828.70	1081.57	1090.52		1091.60	0.006900	11.78	1266.86	242.39	0.70
Mudlick Creek CL	3305.25*	Max WS	9814.93	1081.17	1090.19		1091.32	0.007250	12.12	1238.97	239.40	0.71
Mudlick Creek CL	3261.54*	Max WS	9790.70	1080.76	1089.83		1091.02	0.007580	12.44	1210.77	235.27	0.73
Mudlick Creek CL	3217.84	Max WS	9756.12	1080.36	1089.47		1090.70	0.007846	12.88	1184.13	229.84	0.74
Mudlick Creek CL	3174.13*	Max WS	9493.71	1079.96	1089.12		1090.33	0.007669	12.57	1162.99	225.09	0.74
Mudlick Creek CL	3130.42*	Max WS	9482.00	1079.55	1088.76		1090.01	0.007878	12.77	1144.07	220.97	0.75
Mudlick Creek CL	3086.72	Max WS	9461.16	1079.15	1088.40		1089.68	0.008075	12.96	1126.48	217.31	0.76
Mudlick Creek CL	3043.01*	Max WS	9431.28	1078.75	1088.03		1089.35	0.008268	13.13	1110.25	214.40	0.76
Mudlick Creek CL	2999.30*	Max WS	9193.24	1078.35	1087.67		1088.95	0.008049	12.99	1097.07	211.92	0.76
Mudlick Creek CL	2955.6	Max WS	9183.47	1077.95	1087.31		1088.62	0.008211	13.14	1086.07	210.13	0.76
Mudlick Creek CL	2929.37*	Max WS	9173.70	1077.71	1087.09		1088.41	0.008306	13.23	1079.53	209.10	0.77
Mudlick Creek CL	2903.15*	Max WS	9160.95	1077.47	1086.87		1088.21	0.008401	13.32	1073.30	208.32	0.77
Mudlick Creek CL	2876.92*	Max WS	9145.21	1077.22	1086.64		1088.00	0.008482	13.40	1067.77	207.73	0.78
Mudlick Creek CL	2850.70*	Max WS	8920.24	1076.98	1086.42		1087.73	0.008184	13.18	1062.32	207.31	0.76
Mudlick Creek CL	2824.48	Max WS	8918.58	1076.74	1086.21		1087.52	0.008274	13.26	1058.18	207.08	0.77
Mudlick Creek CL	2809.91*	Max WS	8916.55	1076.61	1086.08		1087.41	0.008328	13.31	1055.85	207.02	0.77
Mudlick Creek CL	2795.34*	Max WS	8913.77	1076.47	1085.96		1087.29	0.008391	13.37	1053.28	207.10	0.77
Mudlick Creek CL	2780.77*	Max WS	8910.24	1076.34	1085.84		1087.17	0.008450	13.42	1050.90	207.17	0.77
Mudlick Creek CL	2766.20*	Max WS	8905.98	1076.21	1085.71		1087.05	0.008530	13.48	1048.06	207.44	0.78
Mudlick Creek CL	2751.63*	Max WS	8900.84	1076.07	1085.58		1086.93	0.008578	13.53	1045.45	207.26	0.78
Mudlick Creek CL	2737.06*	Max WS	8894.80	1075.94	1085.46		1086.81	0.008638	13.57	1042.65	207.16	0.78
Mudlick Creek CL	2722.49*	Max WS	8888.00	1075.81	1085.33		1086.69	0.008690	13.62	1040.07	207.05	0.79
Mudlick Creek CL	2707.92*	Max WS	8880.44	1075.67	1085.20		1086.57	0.008742	13.66	1037.51	207.00	0.79
Mudlick Creek CL	2693.36	Max WS	8872.15	1075.54	1085.07		1086.45	0.008803	13.71	1034.67	206.95	0.79
Mudlick Creek CL	2562.24	Max WS	8129.14	1074.33	1083.87		1085.10	0.008116	13.12	1005.32	206.86	0.76
Mudlick Creek CL	2518.73*	Max WS	7757.74	1073.93	1083.60		1084.68	0.007086	12.35	1023.99	209.62	0.71



HEC-RAS Plan: Plan 45 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	2475.22*	Max WS	7746.90	1073.52	1083.38		1084.39	0.006571	12.04	1055.55	213.80	0.69
Mudlick Creek CL	2431.72	Max WS	7728.77	1073.12	1083.19		1084.14	0.006069	11.73	1097.22	222.73	0.66
Mudlick Creek CL	2387.81*	Max WS	7713.03	1072.32	1083.23		1083.90	0.004012	10.05	1287.08	241.84	0.54
Mudlick Creek CL	2343.90*	Max WS	7704.96	1071.51	1083.26		1083.74	0.002670	8.60	1492.45	255.66	0.45
Mudlick Creek CL	2300	Max WS	7701.79	1070.71	1083.28		1083.64	0.001822	7.42	1712.62	268.49	0.37
Mudlick Creek CL	2295.64*	Max WS	7701.20	1070.66	1083.17		1083.62	0.002328	8.36	1554.94	255.98	0.42
Mudlick Creek CL	2291.28*	Max WS	7700.18	1070.61	1083.04		1083.61	0.002959	9.39	1406.19	241.10	0.48
Mudlick Creek CL	2286.92*	Max WS	7698.82	1070.56	1082.88		1083.57	0.003467	10.12	1275.41	213.08	0.52
Mudlick Creek CL	2282.56*	Max WS	7697.18	1070.51	1082.72		1083.54	0.004089	10.93	1174.90	197.57	0.56
Mudlick Creek CL	2278.20*	Max WS	7695.36	1070.45	1082.56		1083.49	0.004532	11.44	1093.69	178.13	0.59
Mudlick Creek CL	2273.84*	Max WS	7693.48	1070.40	1082.38		1083.44	0.005134	12.10	1026.19	167.36	0.62
Mudlick Creek CL	2269.48*	Max WS	7691.53	1070.35	1082.18		1083.39	0.005754	12.71	965.76	156.98	0.66
Mudlick Creek CL	2265.12*	Max WS	7689.55	1070.30	1081.98		1083.31	0.006270	13.16	915.06	146.14	0.69
Mudlick Creek CL	2260.77	Max WS	7687.60	1070.25	1081.77		1083.23	0.006805	13.59	870.75	137.18	0.72
Mudlick Creek CL	2221.54	Max WS	7682.13	1069.79	1080.85		1083.00	0.009572	15.77	714.69	108.53	0.84
Mudlick Creek CL	2182.32	Max WS	7676.12	1069.33	1079.96		1082.65	0.011758	17.10	635.51	94.12	0.93
Mudlick Creek CL	2143.1	Max WS	7670.15	1068.87	1079.16	1078.86	1082.20	0.013291	17.86	594.65	86.94	0.99
Mudlick Creek CL	2130.02*	Max WS	7668.24	1068.72	1078.89	1078.67	1082.03	0.013788	18.07	583.84	85.21	1.00
Mudlick Creek CL	2116.95*	Max WS	7596.68	1068.56	1078.59	1078.45	1081.80	0.014187	18.18	571.62	83.61	1.02
Mudlick Creek CL	2103.88	Max WS	7596.25	1068.41	1078.14	1078.26	1081.63	0.015887	18.87	547.45	81.76	1.07
Mudlick Creek CL	2090.80*	Max WS	7663.52	1068.41	1077.90	1078.23	1081.62	0.018621	19.18	528.17	80.86	1.10
Mudlick Creek CL	2077.73*	Max WS	7662.10	1068.41	1077.64	1078.20	1081.62	0.021062	19.67	507.68	79.87	1.15
Mudlick Creek CL	2064.66	Max WS	7660.64	1068.41	1077.35	1078.14	1081.62	0.024847	20.07	484.37	78.73	1.19
Mudlick Creek CL	2055.28*	Max WS	7659.54	1068.28	1077.12	1077.90	1081.36	0.024758	19.86	486.24	79.50	1.18
Mudlick Creek CL	2045.90*	Max WS	7658.38	1068.15	1076.89	1077.65	1081.10	0.024696	19.66	487.98	80.26	1.18
Mudlick Creek CL	2036.53*	Max WS	7657.17	1068.02	1076.66	1077.41	1080.84	0.024673	19.49	489.53	81.04	1.18
Mudlick Creek CL	2027.15*	Max WS	7655.90	1067.89	1076.43	1077.16	1080.59	0.024684	19.32	490.92	81.82	1.17
Mudlick Creek CL	2017.78*	Max WS	7654.57	1067.76	1076.20	1076.93	1080.34	0.024745	19.17	491.98	82.58	1.17
Mudlick Creek CL	2008.40*	Max WS	7653.20	1067.64	1075.97	1076.70	1080.09	0.024857	19.04	492.69	83.34	1.17
Mudlick Creek CL	1999.03*	Max WS	7651.77	1067.51	1075.73	1076.47	1079.85	0.025002	18.92	493.25	84.10	1.17
Mudlick Creek CL	1989.65*	Max WS	7650.27	1067.38	1075.50	1076.25	1079.61	0.025214	18.82	493.41	84.87	1.18
Mudlick Creek CL	1980.28*	Max WS	7648.70	1067.25	1075.26	1076.02	1079.37	0.025507	18.74	493.09	85.61	1.18
Mudlick Creek CL	1970.90*	Max WS	7647.08	1067.12	1075.03	1075.80	1079.14	0.025867	18.68	492.34	86.35	1.18
Mudlick Creek CL	1961.53	Max WS	7645.39	1066.99	1074.78	1075.58	1078.92	0.026344	18.65	490.95	87.07	1.19
Mudlick Creek CL	1927.15*	Max WS	7638.23	1066.35	1073.94	1074.45	1077.48	0.022967	16.92	529.38	95.71	1.10
Mudlick Creek CL	1892.77*	Max WS	7606.29	1065.70	1073.21	1073.37	1076.17	0.019385	15.27	576.01	105.29	1.01
Mudlick Creek CL	1858.4	Max WS	7605.24	1065.06	1072.61	1072.37	1075.03	0.015847	13.70	635.39	116.21	0.91
Mudlick Creek CL	1849.02*	Max WS	7604.79	1064.97	1072.49		1074.88	0.015766	13.61	639.15	117.58	0.91
Mudlick Creek CL	1839.64*	Max WS	7604.32	1064.88	1072.37		1074.73	0.015619	13.49	643.84	119.02	0.90
Mudlick Creek CL	1830.27*	Max WS	7603.80	1064.80	1072.26		1074.59	0.015539	13.40	647.64	120.42	0.90
Mudlick Creek CL	1820.89*	Max WS	7603.19	1064.71	1072.14		1074.44	0.015470	13.30	651.30	121.81	0.90
Mudlick Creek CL	1811.52*	Max WS	7602.48	1064.62	1072.02		1074.30	0.015375	13.21	655.43	123.29	0.89

HEC-RAS Plan: Plan 45 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	1802.14*	Max WS	7601.70	1064.53	1071.91		1074.15	0.015221	13.10	660.51	124.89	0.89
Mudlick Creek CL	1792.77*	Max WS	7600.85	1064.44	1071.80		1074.01	0.015137	13.00	664.61	126.47	0.88
Mudlick Creek CL	1783.39*	Max WS	7599.94	1064.35	1071.68		1073.87	0.015082	12.92	668.37	128.07	0.88
Mudlick Creek CL	1774.02*	Max WS	7598.94	1064.27	1071.56		1073.73	0.015045	12.85	671.96	129.72	0.88
Mudlick Creek CL	1764.64*	Max WS	7597.86	1064.18	1071.45		1073.59	0.014951	12.75	676.39	131.43	0.88
Mudlick Creek CL	1755.27	Max WS	7596.69	1064.09	1071.33		1073.45	0.014913	12.68	680.13	133.20	0.87
Mudlick Creek CL	1745.89*	Max WS	7595.41	1064.00	1071.22		1073.31	0.014876	12.61	683.90	135.02	0.87
Mudlick Creek CL	1736.51*	Max WS	7594.02	1063.92	1071.10		1073.17	0.014849	12.54	687.57	136.88	0.87
Mudlick Creek CL	1727.14*	Max WS	7592.50	1063.83	1070.98		1073.03	0.014805	12.46	691.57	138.80	0.87
Mudlick Creek CL	1717.76*	Max WS	7542.82	1063.74	1070.86		1072.86	0.014618	12.32	694.88	140.70	0.86
Mudlick Creek CL	1708.39*	Max WS	7542.70	1063.65	1070.74		1072.73	0.014624	12.26	698.41	142.76	0.86
Mudlick Creek CL	1699.01*	Max WS	7542.46	1063.57	1070.63		1072.59	0.014561	12.18	703.05	144.91	0.86
Mudlick Creek CL	1689.64*	Max WS	7542.12	1063.48	1070.51		1072.45	0.014590	12.13	706.36	147.10	0.86
Mudlick Creek CL	1680.26*	Max WS	7541.70	1063.39	1070.39		1072.31	0.014613	12.08	709.76	149.29	0.86
Mudlick Creek CL	1670.89*	Max WS	7541.18	1063.30	1070.27		1072.18	0.014621	12.02	713.63	151.69	0.86
Mudlick Creek CL	1661.51*	Max WS	7540.52	1063.22	1070.15		1072.04	0.014632	11.96	717.62	154.26	0.86
Mudlick Creek CL	1652.14	Max WS	7539.73	1063.13	1070.03		1071.90	0.014643	11.91	721.77	156.94	0.85
Mudlick Creek CL	1617.76*	Max WS	7534.63	1062.81	1069.58		1071.39	0.014841	11.74	736.30	168.51	0.86
Mudlick Creek CL	1583.38*	Max WS	7527.86	1062.48	1069.06	1068.80	1070.86	0.015672	11.71	744.94	183.85	0.87
Mudlick Creek CL	1549.01	Max WS	7516.00	1062.16	1068.44	1068.41	1070.28	0.017723	11.92	741.84	204.10	0.92
Mudlick Creek CL	1514.63*	Max WS	7485.36	1061.84	1067.86	1067.93	1069.62	0.017275	11.76	760.40	220.91	0.93
Mudlick Creek CL	1480.25*	Max WS	7515.96	1061.52	1067.40		1068.86	0.016568	10.76	814.16	232.70	0.87
Mudlick Creek CL	1445.88	Max WS	7500.38	1061.20	1067.37		1068.43	0.007681	9.46	981.39	246.97	0.75
Mudlick Creek CL	1409.37*	Max WS	7485.39	1060.85	1066.98		1068.16	0.008279	9.87	937.89	239.37	0.78
Mudlick Creek CL	1372.86*	Max WS	7469.59	1060.50	1066.55		1067.86	0.009004	10.30	892.16	230.99	0.81
Mudlick Creek CL	1336.36	Max WS	7384.31	1060.15	1066.03		1067.51	0.010171	10.81	832.79	222.43	0.86
Mudlick Creek CL	1322.27*	Max WS	7384.04	1060.00	1065.88		1067.36	0.010500	10.77	826.26	218.15	0.85
Mudlick Creek CL	1308.19*	Max WS	7383.50	1059.85	1065.74		1067.20	0.010710	10.68	823.11	214.10	0.84
Mudlick Creek CL	1294.11*	Max WS	7382.72	1059.70	1065.60		1067.05	0.010883	10.58	821.70	210.90	0.83
Mudlick Creek CL	1280.02*	Max WS	7381.84	1059.54	1065.49		1066.88	0.011209	10.35	826.08	208.77	0.81
Mudlick Creek CL	1265.94*	Max WS	7380.82	1059.39	1065.34		1066.72	0.011432	10.27	824.54	206.49	0.80
Mudlick Creek CL	1251.86*	Max WS	7379.52	1059.24	1065.18		1066.55	0.011724	10.21	821.93	204.88	0.79
Mudlick Creek CL	1237.78	Max WS	7377.91	1059.09	1065.01		1066.38	0.012062	10.16	818.74	203.30	0.79
Mudlick Creek CL	1223.69*	Max WS	7375.94	1058.94	1064.82		1066.21	0.012263	10.24	811.06	201.43	0.79
Mudlick Creek CL	1209.61*	Max WS	7373.52	1058.79	1064.60		1066.04	0.012254	10.41	800.10	199.21	0.81
Mudlick Creek CL	1195.53*	Max WS	7370.66	1058.64	1064.41		1065.87	0.012431	10.47	793.89	197.97	0.82
Mudlick Creek CL	1181.44*	Max WS	7367.46	1058.49	1064.19		1065.69	0.012488	10.67	782.99	196.81	0.83
Mudlick Creek CL	1167.36*	Max WS	7364.01	1058.34	1063.98		1065.51	0.012748	10.75	776.84	196.72	0.84
Mudlick Creek CL	1153.28*	Max WS	7360.55	1058.19	1063.73		1065.33	0.013021	11.02	762.50	196.00	0.87
Mudlick Creek CL	1139.2	Max WS	7357.44	1058.04	1063.51		1065.15	0.013505	11.16	753.60	196.73	0.88
Mudlick Creek CL	1125.11*	Max WS	7355.22	1057.89	1063.28	1063.01	1064.96	0.014026	11.30	745.00	197.87	0.90
Mudlick Creek CL	1111.03*	Max WS	7302.64	1057.74	1063.04	1062.82	1064.75	0.014526	11.41	734.19	199.07	0.91

HEC-RAS Plan: Plan 45 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W/S Elev (ft)	Crtt W/S (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	1096.95*	Max WS	7301.64	1057.59	1062.80	1062.71	1064.55	0.015166	11.56	725.18	200.58	0.93
Mudlick Creek CL	1082.86*	Max WS	6266.04	1057.43	1062.59		1063.89	0.011246	9.93	724.37	202.33	0.80
Mudlick Creek CL	1068.78*	Max WS	6002.83	1057.28	1062.56		1063.64	0.009120	9.13	758.61	208.21	0.72
Mudlick Creek CL	1054.70*	Max WS	6002.70	1057.13	1062.54		1063.53	0.007992	8.74	801.72	220.20	0.68
Mudlick Creek CL	1040.62	Max WS	6254.80	1056.98	1062.55		1063.50	0.007495	8.68	858.54	240.37	0.66
Mudlick Creek CL	848.99*	Max WS	6469.45	1056.46	1062.79		1063.24	0.003257	6.48	1393.08	386.07	0.46
Mudlick Creek CL	657.36	Max WS	6450.35	1055.93	1062.93		1063.09	0.000950	3.88	2078.44	366.09	0.26
Mudlick Creek CL	513.28*	Max WS	6412.67	1054.62	1062.64		1062.95	0.001577	5.61	1611.90	311.61	0.35
Mudlick Creek CL	369.216*	Max WS	6364.88	1053.31	1061.88		1062.42	0.006315	1.20	1328.75	279.58	0.07
Mudlick Creek CL	225.12	Max WS	6314.84	1052.00	1060.20	1060.24	1061.59	0.009957	15.04	859.23	262.50	0.93

HEC-RAS Plan: Plan 44 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	6352	Max WS	1.10	1104.91	1111.11		1111.11	0.000000	0.00	486.65	143.19	0.00
Mudlick Creek CL	6054*	Max WS	28.24	1103.68	1111.13		1111.13	0.000000	0.05	594.75	126.66	0.00
Mudlick Creek CL	5776*	Max WS	38.66	1102.46	1111.14		1111.14	0.000000	0.04	855.66	141.57	0.00
Mudlick Creek CL	5488*	Max WS	44.81	1101.23	1111.14		1111.14	0.000000	0.04	1224.38	163.62	0.00
Mudlick Creek CL	5200	Max WS	49.67	1100.00	1111.14	1100.37	1111.14	0.000000	0.03	1615.89	184.96	0.00
Mudlick Creek CL	5105	Inl Struct										
Mudlick Creek CL	4977.98	Max WS	2957.61	1094.00	1101.77		1102.86	0.008400	10.04	423.85	124.89	0.70
Mudlick Creek CL	4866.96	Max WS	2912.53	1093.49	1100.72		1101.88	0.009896	10.31	401.56	117.61	0.73
Mudlick Creek CL	4844.75*	Max WS	2901.60	1093.39	1100.48		1101.66	0.010194	10.40	396.39	115.83	0.74
Mudlick Creek CL	4822.55*	Max WS	2890.66	1093.29	1100.22		1101.44	0.010621	10.53	390.12	114.32	0.76
Mudlick Creek CL	4800.34*	Max WS	2879.29	1093.19	1099.96		1101.21	0.011129	10.68	383.83	113.23	0.78
Mudlick Creek CL	4778.14*	Max WS	2866.26	1093.09	1099.65		1100.97	0.012016	10.95	373.63	111.98	0.80
Mudlick Creek CL	4755.94	Max WS	2854.35	1092.99	1098.81	1099.11	1100.77	0.020282	13.11	307.35	104.12	1.03
Mudlick Creek CL	4742.06*	Max WS	2847.80	1092.86	1098.53	1098.83	1100.49	0.020748	13.16	308.17	105.10	1.04
Mudlick Creek CL	4728.18*	Max WS	2841.73	1092.74	1098.19	1098.57	1100.22	0.022320	13.42	304.42	106.09	1.07
Mudlick Creek CL	4714.30*	Max WS	2836.53	1092.61	1097.87	1098.29	1099.93	0.023474	13.57	304.45	108.03	1.10
Mudlick Creek CL	4700.43*	Max WS	2831.09	1092.49	1097.54	1097.99	1099.62	0.024783	13.72	305.75	110.91	1.13
Mudlick Creek CL	4686.55*	Max WS	2826.09	1092.36	1097.19	1097.66	1099.28	0.026295	13.87	308.23	114.40	1.16
Mudlick Creek CL	4672.67*	Max WS	2683.58	1092.24	1097.27	1097.20	1098.64	0.016403	11.44	368.17	126.23	0.92
Mudlick Creek CL	4658.79*	Max WS	2679.02	1092.11	1097.40		1098.36	0.010682	9.88	451.09	143.98	0.77
Mudlick Creek CL	4644.92	Max WS	2676.55	1091.99	1097.49		1098.14	0.006814	8.39	549.55	152.58	0.64
Mudlick Creek CL	4610.97*	Max WS	2670.23	1091.77	1097.26		1097.91	0.006907	8.45	542.22	150.96	0.64
Mudlick Creek CL	4577.02*	Max WS	2660.12	1091.54	1097.02		1097.68	0.007066	8.53	533.66	149.33	0.65
Mudlick Creek CL	4543.08	Max WS	2646.42	1091.32	1096.78		1097.44	0.007183	8.58	524.71	147.73	0.65
Mudlick Creek CL	4441.24	Max WS	2587.69	1090.65	1096.02		1096.69	0.007618	8.74	493.63	143.12	0.67
Mudlick Creek CL	4407.29*	Max WS	2483.83	1090.42	1095.75		1096.39	0.007335	8.54	481.71	141.63	0.66
Mudlick Creek CL	4373.34*	Max WS	2482.44	1090.20	1095.48		1096.14	0.007749	8.72	469.45	140.29	0.67
Mudlick Creek CL	4339.4	Max WS	2478.91	1089.97	1095.19		1095.87	0.008223	8.91	454.95	138.74	0.69
Mudlick Creek CL	4324.85*	Max WS	2476.84	1089.87	1095.06		1095.75	0.008591	8.88	448.88	137.93	0.69
Mudlick Creek CL	4310.30*	Max WS	2474.52	1089.78	1094.92		1095.62	0.008983	9.02	440.05	136.91	0.71
Mudlick Creek CL	4295.75*	Max WS	2471.93	1089.68	1094.77		1095.49	0.009548	9.05	431.34	135.86	0.71
Mudlick Creek CL	4281.20*	Max WS	2469.18	1089.59	1094.62		1095.34	0.010138	9.05	421.31	134.71	0.72
Mudlick Creek CL	4266.65*	Max WS	2466.41	1089.49	1094.43		1095.18	0.011156	9.20	407.58	133.11	0.73
Mudlick Creek CL	4252.10*	Max WS	2463.65	1089.40	1094.20		1095.02	0.012700	9.62	387.42	130.75	0.78
Mudlick Creek CL	4237.56	Max WS	2460.61	1089.30	1093.88		1094.83	0.016010	10.26	356.83	126.89	0.85
Mudlick Creek CL	4192.44*	Max WS	2363.77	1088.05	1093.17		1094.09	0.013440	9.94	359.05	129.03	0.79
Mudlick Creek CL	4147.33*	Max WS	2205.39	1086.80	1092.83		1093.52	0.006739	8.56	412.00	139.37	0.63
Mudlick Creek CL	4102.22*	Max WS	2311.98	1085.55	1092.80		1093.28	0.003843	7.19	519.01	158.85	0.48
Mudlick Creek CL	4057.11*	Max WS	2281.00	1084.30	1092.81		1093.10	0.001953	5.61	657.01	184.58	0.35
Mudlick Creek CL	4012	Max WS	2248.04	1083.05	1092.84	1089.87	1092.99	0.001104	4.10	826.27	206.83	0.24
Mudlick Creek CL	4010	Inl Struct										
Mudlick Creek CL	4004.56	Max WS	2211.91	1083.05	1089.81	1090.03	1091.32	0.014400	11.82	285.31	126.61	0.88

## SUNNY DAY DAM BREAK

HEC-RAS Plan: Plan 44 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude #	Chl
Mudlick Creek CL	3985.82*	Max WS	2208.37	1083.04	1089.72	1089.78	1090.99	0.011908	10.55	304.65	131.04	0.81	
Mudlick Creek CL	3967.09*	Max WS	2204.22	1083.04	1089.82		1090.69	0.010100	8.68	348.35	143.38	0.67	
Mudlick Creek CL	3948.36*	Max WS	2201.58	1083.03	1089.63		1090.52	0.008869	8.61	349.69	146.40	0.69	
Mudlick Creek CL	3929.63*	Max WS	2198.59	1083.02	1089.52		1090.33	0.008535	8.13	361.51	154.22	0.67	
Mudlick Creek CL	3910.90*	Max WS	2195.87	1083.01	1089.41		1090.16	0.008562	7.80	368.83	161.94	0.67	
Mudlick Creek CL	3892.17*	Max WS	2193.02	1083.01	1089.24		1090.00	0.009346	7.72	365.02	168.58	0.69	
Mudlick Creek CL	3873.44	Max WS	2189.15	1083.00	1088.84	1088.82	1089.82	0.014225	8.61	317.39	166.95	0.82	
Mudlick Creek CL	3829.73*	Max WS	1997.11	1082.91	1088.51		1089.15	0.008354	6.97	358.39	181.18	0.65	
Mudlick Creek CL	3786.02*	Max WS	1994.50	1082.83	1088.43		1088.84	0.004662	5.66	448.34	202.56	0.50	
Mudlick Creek CL	3742.32	Max WS	1991.85	1082.74	1088.40		1088.67	0.002651	4.59	556.71	217.57	0.38	
Mudlick Creek CL	3611.2	Max WS	1965.64	1082.35	1087.69		1088.20	0.005653	6.20	408.75	201.57	0.55	
Mudlick Creek CL	3567.49*	Max WS	1899.87	1082.22	1087.43		1087.94	0.005605	6.25	394.14	187.98	0.55	
Mudlick Creek CL	3523.78*	Max WS	1896.26	1082.08	1087.17		1087.70	0.005845	6.46	384.24	176.76	0.56	
Mudlick Creek CL	3480.08	Max WS	1890.15	1081.95	1086.90		1087.45	0.006132	6.68	376.18	170.04	0.57	
Mudlick Creek CL	3436.37*	Max WS	1881.93	1081.82	1086.63		1087.19	0.006694	7.05	371.33	163.12	0.60	
Mudlick Creek CL	3392.66*	Max WS	1870.38	1081.70	1086.33		1086.89	0.007358	7.47	364.00	156.50	0.64	
Mudlick Creek CL	3348.96	Max WS	1830.12	1081.57	1086.01		1086.55	0.008029	7.93	358.93	157.02	0.67	
Mudlick Creek CL	3305.25*	Max WS	1826.46	1081.17	1085.65		1086.20	0.008191	8.05	351.97	152.42	0.67	
Mudlick Creek CL	3261.54*	Max WS	1820.15	1080.76	1085.28		1085.85	0.008387	8.17	344.54	148.07	0.68	
Mudlick Creek CL	3217.84	Max WS	1810.89	1080.36	1084.90		1085.49	0.008533	8.27	337.78	144.03	0.69	
Mudlick Creek CL	3174.13*	Max WS	1777.71	1079.96	1084.53		1085.12	0.008409	8.23	331.99	140.38	0.68	
Mudlick Creek CL	3130.42*	Max WS	1774.13	1079.55	1084.16		1084.77	0.008523	8.31	326.72	136.73	0.69	
Mudlick Creek CL	3086.72	Max WS	1767.89	1079.15	1083.78		1084.40	0.008712	8.42	320.71	133.57	0.70	
Mudlick Creek CL	3043.01*	Max WS	1730.85	1078.75	1083.40		1084.02	0.008587	8.37	314.94	130.41	0.69	
Mudlick Creek CL	2999.30*	Max WS	1729.40	1078.35	1083.02		1083.65	0.008730	8.46	310.06	127.05	0.70	
Mudlick Creek CL	2955.6	Max WS	1725.59	1077.95	1082.64		1083.28	0.008813	8.51	305.44	123.12	0.70	
Mudlick Creek CL	2929.37*	Max WS	1722.25	1077.71	1082.41		1083.06	0.008873	8.54	302.38	120.69	0.71	
Mudlick Creek CL	2903.15*	Max WS	1718.18	1077.47	1082.17		1082.83	0.008909	8.56	299.59	118.38	0.71	
Mudlick Creek CL	2876.92*	Max WS	1687.13	1077.22	1081.94		1082.58	0.008695	8.46	296.62	116.31	0.70	
Mudlick Creek CL	2850.70*	Max WS	1686.76	1076.98	1081.71		1082.36	0.008717	8.48	294.71	114.41	0.70	
Mudlick Creek CL	2824.48	Max WS	1685.74	1076.74	1081.49		1082.14	0.008762	8.51	292.66	112.84	0.70	
Mudlick Creek CL	2809.91*	Max WS	1684.87	1076.61	1081.36		1082.01	0.008798	8.53	291.31	111.86	0.70	
Mudlick Creek CL	2796.34*	Max WS	1683.80	1076.47	1081.23		1081.89	0.008821	8.54	290.04	110.89	0.70	
Mudlick Creek CL	2780.77*	Max WS	1682.53	1076.34	1081.10		1081.76	0.008860	8.56	288.86	110.19	0.70	
Mudlick Creek CL	2766.20*	Max WS	1681.06	1076.21	1080.97		1081.63	0.008887	8.57	287.56	109.22	0.71	
Mudlick Creek CL	2751.63*	Max WS	1679.39	1076.07	1080.84		1081.51	0.008917	8.59	286.09	108.21	0.71	
Mudlick Creek CL	2737.06*	Max WS	1677.53	1075.94	1080.71		1081.38	0.008945	8.60	284.75	107.25	0.71	
Mudlick Creek CL	2722.49*	Max WS	1675.48	1075.81	1080.58		1081.25	0.008986	8.61	283.42	106.48	0.71	
Mudlick Creek CL	2707.92*	Max WS	1673.26	1075.67	1080.45		1081.12	0.008996	8.62	282.16	105.49	0.71	
Mudlick Creek CL	2693.36	Max WS	1670.87	1075.54	1080.32		1081.00	0.009010	8.62	280.92	104.56	0.71	
Mudlick Creek CL	2582.24	Max WS	1644.82	1074.33	1079.13		1079.82	0.009090	8.62	269.15	95.68	0.71	
Mudlick Creek CL	2518.73*	Max WS	1642.42	1073.93	1078.70		1079.41	0.009332	8.68	263.03	91.80	0.72	

HEC-RAS Plan: Plan 44 River: Mudlick Creek CL Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	2475.22*	Max WS	1640.33	1073.52	1078.23		1078.99	0.010098	8.93	253.77	88.87	0.75
Mudlick Creek CL	2431.72	Max WS	1622.50	1073.12	1077.09	1077.09	1078.44	0.017453	10.78	207.07	82.37	0.96
Mudlick Creek CL	2387.81*	Max WS	1618.51	1072.32	1076.97		1077.79	0.011259	9.26	239.40	84.51	0.79
Mudlick Creek CL	2343.90*	Max WS	1585.82	1071.51	1076.82		1077.36	0.006384	7.63	290.74	91.99	0.60
Mudlick Creek CL	2300	Max WS	1585.65	1070.71	1076.75		1077.12	0.004066	6.63	355.10	108.31	0.49
Mudlick Creek CL	2295.64*	Max WS	1585.59	1070.66	1076.65		1077.06	0.004227	6.74	335.38	96.62	0.50
Mudlick Creek CL	2291.28*	Max WS	1585.48	1070.61	1076.56		1077.00	0.004456	6.90	320.76	90.17	0.51
Mudlick Creek CL	2286.92*	Max WS	1585.33	1070.56	1076.45		1076.94	0.005008	7.27	306.44	88.21	0.55
Mudlick Creek CL	2282.56*	Max WS	1585.12	1070.51	1076.34		1076.87	0.005422	7.52	292.67	83.72	0.57
Mudlick Creek CL	2278.20*	Max WS	1584.86	1070.45	1076.21		1076.80	0.006010	7.85	279.67	81.03	0.60
Mudlick Creek CL	2273.84*	Max WS	1584.56	1070.40	1076.06		1076.71	0.006716	8.21	266.32	78.18	0.63
Mudlick Creek CL	2269.48*	Max WS	1584.21	1070.35	1075.89		1076.62	0.007597	8.62	252.40	75.19	0.67
Mudlick Creek CL	2265.12*	Max WS	1583.83	1070.30	1075.69		1076.51	0.008804	9.11	237.33	72.20	0.71
Mudlick Creek CL	2260.77	Max WS	1583.41	1070.25	1075.45		1076.39	0.010233	9.59	221.05	67.69	0.76
Mudlick Creek CL	2221.54	Max WS	1582.06	1069.79	1074.87		1075.99	0.011773	10.23	202.73	61.37	0.82
Mudlick Creek CL	2182.32	Max WS	1580.28	1069.33	1074.36		1075.53	0.012222	10.46	199.54	61.22	0.84
Mudlick Creek CL	2143.1	Max WS	1578.05	1068.87	1074.03		1075.08	0.010503	9.94	210.68	62.50	0.78
Mudlick Creek CL	2130.02*	Max WS	1577.24	1068.72	1073.96		1074.94	0.009564	9.61	217.63	62.91	0.75
Mudlick Creek CL	2116.95*	Max WS	1576.43	1068.56	1073.90		1074.81	0.008576	9.24	225.89	63.37	0.71
Mudlick Creek CL	2103.88	Max WS	1575.61	1068.41	1073.86		1074.70	0.007637	8.86	235.04	63.88	0.67
Mudlick Creek CL	2090.80*	Max WS	1574.78	1068.41	1073.70		1074.59	0.009052	9.05	224.87	63.22	0.70
Mudlick Creek CL	2077.73*	Max WS	1573.87	1068.41	1073.45		1074.47	0.011453	9.64	208.82	62.17	0.76
Mudlick Creek CL	2064.66	Max WS	1573.10	1068.41	1072.79	1072.91	1074.34	0.022183	11.71	188.69	59.19	0.99
Mudlick Creek CL	2055.28*	Max WS	1572.66	1068.28	1072.60	1072.72	1074.13	0.022051	11.56	169.83	60.13	0.99
Mudlick Creek CL	2045.90*	Max WS	1572.20	1068.15	1072.43	1072.52	1073.92	0.021650	11.35	171.75	61.17	0.98
Mudlick Creek CL	2036.53*	Max WS	1564.75	1068.02	1072.25	1072.33	1073.71	0.021347	11.16	172.88	62.14	0.97
Mudlick Creek CL	2027.15*	Max WS	1571.29	1067.89	1072.07	1072.15	1073.52	0.021279	11.04	174.50	63.20	0.96
Mudlick Creek CL	2017.78*	Max WS	1570.80	1067.76	1071.92	1071.96	1073.32	0.020555	10.79	177.51	64.42	0.95
Mudlick Creek CL	2008.40*	Max WS	1570.22	1067.64	1071.74	1071.78	1073.12	0.020540	10.68	178.41	65.40	0.94
Mudlick Creek CL	1999.03*	Max WS	1565.13	1067.51	1071.58	1071.59	1072.92	0.020082	10.48	180.29	66.41	0.93
Mudlick Creek CL	1989.65*	Max WS	1564.95	1067.38	1071.39	1071.41	1072.73	0.020375	10.43	180.27	67.30	0.94
Mudlick Creek CL	1980.28*	Max WS	1564.81	1067.25	1071.15	1071.24	1072.54	0.021961	10.59	176.58	67.87	0.97
Mudlick Creek CL	1970.90*	Max WS	1564.73	1067.12	1070.93	1071.06	1072.36	0.023070	10.66	174.45	68.53	0.99
Mudlick Creek CL	1961.53	Max WS	1564.70	1066.99	1070.71	1070.89	1072.18	0.024273	10.74	172.08	68.83	1.01
Mudlick Creek CL	1927.15*	Max WS	1564.23	1066.35	1069.91	1070.01	1071.22	0.023180	9.94	181.09	75.99	0.97
Mudlick Creek CL	1892.77*	Max WS	1561.52	1065.70	1069.11	1069.18	1070.33	0.023358	9.43	186.81	83.17	0.96
Mudlick Creek CL	1858.4	Max WS	1563.12	1065.06	1068.93		1069.63	0.011546	7.13	245.36	95.11	0.69
Mudlick Creek CL	1849.02*	Max WS	1562.68	1064.97	1068.83		1069.52	0.011497	7.07	246.76	96.21	0.69
Mudlick Creek CL	1839.64*	Max WS	1562.20	1064.88	1068.73		1069.41	0.011408	7.02	248.43	97.38	0.68
Mudlick Creek CL	1830.27*	Max WS	1561.68	1064.80	1068.63		1069.30	0.011368	6.96	249.78	98.50	0.68
Mudlick Creek CL	1820.89*	Max WS	1561.12	1064.71	1068.54		1069.20	0.011334	6.92	251.08	99.63	0.68
Mudlick Creek CL	1811.52*	Max WS	1560.53	1064.62	1068.44		1069.09	0.011277	6.86	252.56	100.82	0.68



HEC-RAS Plan: Plan 44 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Chl El (ft)	W/S Elev (ft)	Crit W/S (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	1802.14*	Max WS	1559.90	1064.53	1068.34		1068.99	0.011188	6.81	254.27	102.00	0.67
Mudlick Creek CL	1792.77*	Max WS	1559.23	1064.44	1068.25		1068.88	0.011126	6.75	255.78	103.22	0.67
Mudlick Creek CL	1783.39*	Max WS	1558.52	1064.35	1068.15		1068.78	0.011093	6.71	257.08	104.40	0.67
Mudlick Creek CL	1774.02*	Max WS	1557.76	1064.27	1068.06		1068.68	0.011068	6.67	258.33	105.59	0.67
Mudlick Creek CL	1764.64*	Max WS	1556.97	1064.18	1067.96		1068.57	0.011001	6.62	259.89	106.85	0.66
Mudlick Creek CL	1755.27*	Max WS	1556.13	1064.09	1067.87		1068.47	0.010968	6.57	261.20	108.08	0.66
Mudlick Creek CL	1745.89*	Max WS	1555.25	1064.00	1067.77		1068.37	0.010930	6.53	262.53	109.32	0.66
Mudlick Creek CL	1736.51*	Max WS	1547.63	1063.92	1067.68		1068.26	0.010787	6.46	263.98	110.59	0.65
Mudlick Creek CL	1727.14*	Max WS	1547.60	1063.83	1067.58		1068.16	0.010744	6.41	265.49	111.93	0.65
Mudlick Creek CL	1717.76*	Max WS	1547.53	1063.74	1067.49		1068.06	0.010725	6.38	266.79	113.22	0.65
Mudlick Creek CL	1708.39*	Max WS	1547.43	1063.65	1067.40		1067.96	0.010703	6.34	268.15	114.56	0.65
Mudlick Creek CL	1699.01*	Max WS	1547.29	1063.57	1067.31		1067.87	0.010614	6.29	270.01	115.91	0.65
Mudlick Creek CL	1689.64*	Max WS	1547.12	1063.48	1067.21		1067.77	0.010601	6.26	271.30	117.28	0.64
Mudlick Creek CL	1680.26*	Max WS	1546.91	1063.39	1067.12		1067.67	0.010588	6.22	272.58	118.68	0.64
Mudlick Creek CL	1670.89*	Max WS	1546.66	1063.30	1067.03		1067.57	0.010559	6.19	274.06	120.21	0.64
Mudlick Creek CL	1661.51*	Max WS	1546.38	1063.22	1066.94		1067.47	0.010529	6.15	275.49	121.68	0.64
Mudlick Creek CL	1652.14	Max WS	1546.06	1063.13	1066.84		1067.38	0.010508	6.12	276.89	123.20	0.64
Mudlick Creek CL	1617.76*	Max WS	1544.55	1062.81	1066.51		1067.02	0.010489	6.00	281.66	129.27	0.64
Mudlick Creek CL	1583.38*	Max WS	1542.53	1062.48	1066.16		1066.66	0.010643	5.92	285.18	136.05	0.64
Mudlick Creek CL	1549.01	Max WS	1539.91	1062.16	1065.80		1066.29	0.011039	5.89	287.15	144.14	0.64
Mudlick Creek CL	1514.63*	Max WS	1536.55	1061.84	1065.42		1065.92	0.010900	5.92	288.18	155.87	0.66
Mudlick Creek CL	1480.25*	Max WS	1530.67	1061.52	1064.87		1065.47	0.016622	6.46	284.30	173.78	0.77
Mudlick Creek CL	1445.88	Max WS	1529.62	1061.20	1064.53		1065.03	0.009613	6.02	310.10	226.33	0.73
Mudlick Creek CL	1409.37*	Max WS	1527.38	1060.85	1064.06	1063.96	1064.66	0.011716	6.54	274.78	203.30	0.80
Mudlick Creek CL	1372.86*	Max WS	1524.08	1060.50	1063.64		1064.24	0.011495	6.50	270.53	183.42	0.79
Mudlick Creek CL	1336.36	Max WS	1520.04	1060.15	1063.13	1063.07	1063.79	0.013284	6.81	254.65	173.61	0.85
Mudlick Creek CL	1322.27*	Max WS	1512.69	1060.00	1062.97		1063.60	0.013118	6.66	258.56	171.48	0.82
Mudlick Creek CL	1308.19*	Max WS	1512.57	1059.85	1062.82		1063.42	0.012975	6.52	263.01	169.72	0.80
Mudlick Creek CL	1294.11*	Max WS	1512.36	1059.70	1062.66		1063.23	0.012787	6.38	267.72	168.14	0.78
Mudlick Creek CL	1280.02*	Max WS	1512.07	1059.54	1062.51		1063.05	0.013056	6.22	272.58	166.56	0.75
Mudlick Creek CL	1265.94*	Max WS	1511.70	1059.39	1062.34		1062.86	0.013164	6.14	274.78	164.48	0.74
Mudlick Creek CL	1251.86*	Max WS	1511.26	1059.24	1062.16		1062.68	0.013324	6.06	276.51	162.78	0.73
Mudlick Creek CL	1237.78	Max WS	1510.74	1059.09	1061.98		1062.49	0.013698	6.02	276.75	161.20	0.72
Mudlick Creek CL	1223.69*	Max WS	1510.14	1058.94	1061.79		1062.30	0.013905	6.05	274.93	159.59	0.73
Mudlick Creek CL	1209.61*	Max WS	1509.47	1058.79	1061.59		1062.11	0.013672	6.10	272.78	158.06	0.74
Mudlick Creek CL	1195.53*	Max WS	1508.71	1058.64	1061.40		1061.92	0.013828	6.12	271.35	156.67	0.74
Mudlick Creek CL	1181.44*	Max WS	1507.88	1058.49	1061.20		1061.73	0.013618	6.17	269.11	155.32	0.75
Mudlick Creek CL	1167.36*	Max WS	1506.97	1058.34	1061.00		1061.54	0.013773	6.19	267.71	154.08	0.75
Mudlick Creek CL	1153.28*	Max WS	1505.96	1058.19	1060.81		1061.35	0.013476	6.24	265.99	152.88	0.76
Mudlick Creek CL	1139.2	Max WS	1504.85	1058.04	1060.62		1061.16	0.013529	6.24	265.26	151.85	0.76
Mudlick Creek CL	1125.11*	Max WS	1503.60	1057.89	1060.43		1060.97	0.013549	6.23	264.73	150.86	0.76
Mudlick Creek CL	1111.03*	Max WS	1502.24	1057.74	1060.24		1060.79	0.013613	6.24	263.90	149.85	0.77



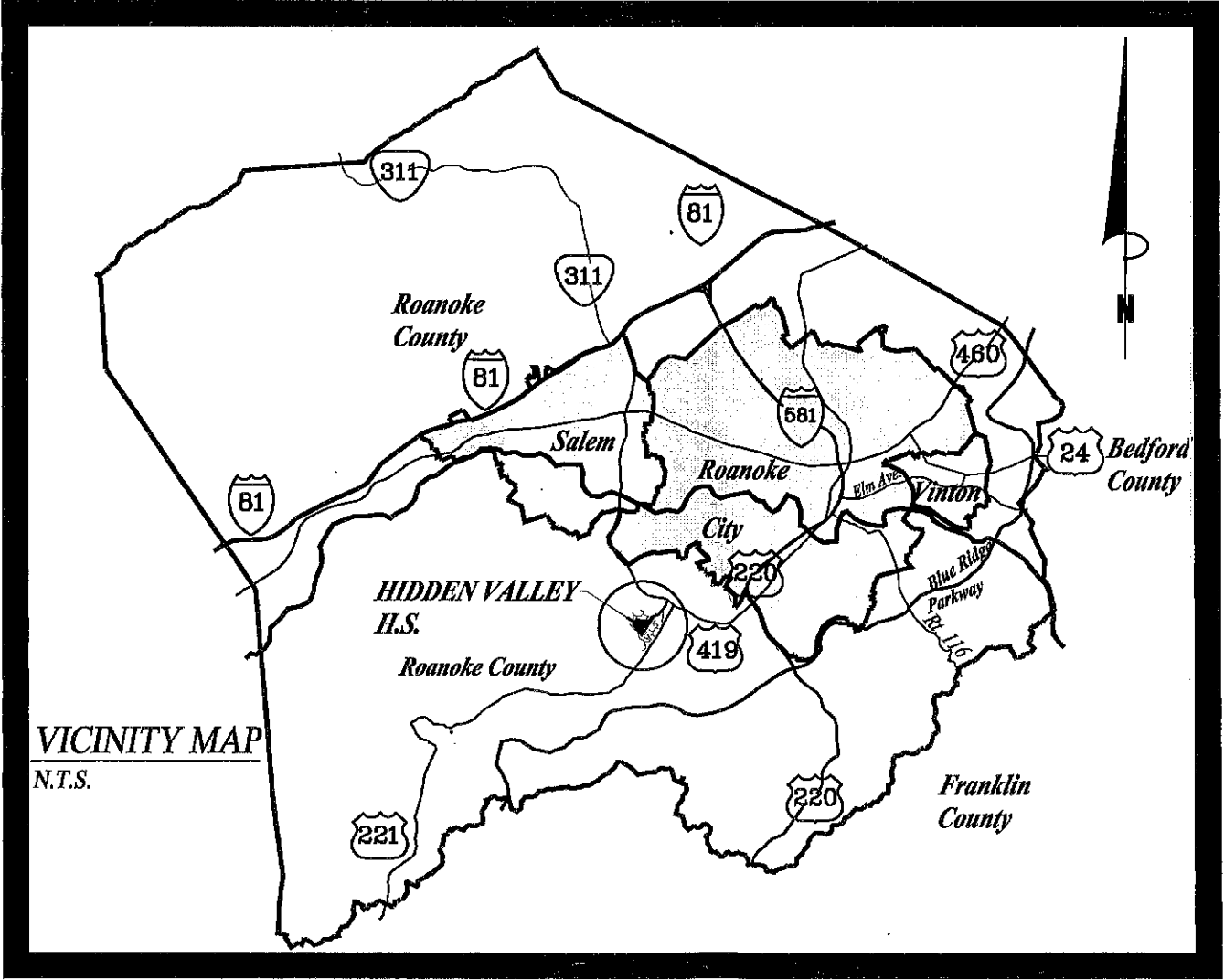
## HEC-RAS Plan: Plan 44 River: Mudlick Creek Reach: Mudlick Creek CL Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Mudlick Creek CL	1096.95*	Max WS	1496.21	1057.59	1060.05		1060.59	0.013523	6.21	263.56	149.03	0.76
Mudlick Creek CL	1082.86*	Max WS	1495.81	1057.43	1059.87		1060.41	0.013507	6.20	263.51	148.56	0.76
Mudlick Creek CL	1068.78*	Max WS	1470.84	1057.28	1059.69		1060.21	0.012839	6.06	264.94	148.31	0.74
Mudlick Creek CL	1054.70*	Max WS	1430.75	1057.13	1059.55		1060.01	0.011342	5.77	270.92	148.58	0.70
Mudlick Creek CL	1040.62	Max WS	1379.03	1056.98	1059.44		1059.84	0.009176	5.32	283.57	149.84	0.63
Mudlick Creek CL	848.99*	Max WS	1320.98	1056.46	1059.28		1059.50	0.003876	4.04	368.32	164.94	0.44
Mudlick Creek CL	657.36	Max WS	1319.91	1055.93	1059.31		1059.37	0.000894	2.31	773.88	354.25	0.22
Mudlick Creek CL	513.28*	Max WS	1309.98	1054.62	1059.17		1059.26	0.000819	2.77	644.08	230.86	0.23
Mudlick Creek CL	369.216*	Max WS	1266.23	1053.31	1058.49		1058.68	0.007824	0.96	491.06	207.95	0.07
Mudlick Creek CL	225.12	Max WS	1247.40	1052.00	1056.74	1055.97	1057.82	0.010081	10.50	195.91	92.52	0.85

# Appendix C

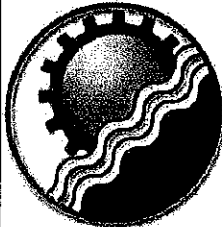
## (INUNDATION MAPS)

# WOODS END DAM BREAK ANALYSIS MUDLICK CREEK INUNDATION MAPPING ROANOKE COUNTY, VIRGINIA DAM INVENTORY # 16105



## SHEET INDEX

1. COVER SHEET
2. OVERALL INUNDATION MAP
3. INUNDATION MAP
4. INUNDATION MAP
5. PROFILES
6. FLOOD WAVE PROFILES
7. FLOOD WAVE TIMES FOR IMPACTED STRUCTURES
8. WATER DEPTH AT IMPACTED SITES



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FINCASTLE, VIRGINIA 24090  
540.473.1253 FAX: 540.473.1254

Drawn	MWL	WOODS END DAM	SCALE: NO SCALE
Designed	MWL		APRIL 16, 2013
Checked	MWL	COVER SHEET ROANOKE COUNTY, VIRGINIA	PROJECT: 12090
Approved	MWL		1 of 8

### Narrative

#### Purpose:

The Woods End Dam is a State of Virginia High Hazard regulated impounding structure and is required to have inundation mapping per the state's regulation. The guidance document is the "Working Draft Version January 14, 2010 which is in accordance with 4VAC50-20-40, 4VAC50-20-54 and 4VAC50-2-52. The inundation mapping will aid in the implementation of the Emergency Action Plan.

#### Dam Break Analysis:

The following analysis was performed for this project:

1. Sunny day dam break
2. Probable Maximum Flood with no dam break
3. Probable Maximum Flood dam failure
4. Identify impacted structures along with property owners and telephone numbers

#### Inundation Mapping:

The following is plotted on the following map sheets:

1. Sunny day dam break
2. Probable Maximum Flood dam failure
3. Probable Maximum Flood with no dam break

#### Datum (supplied by Roanoke County):

1. Virginia State Plane (South) NAD 1983 Coordinate System
2. Vertical Datum: NGVD 88

#### Hydrology Software:

1. HEC-HMS Version 3.50 (SCH UH Method)

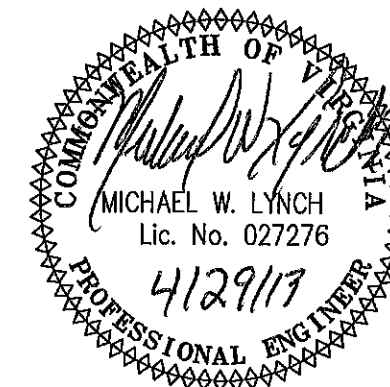
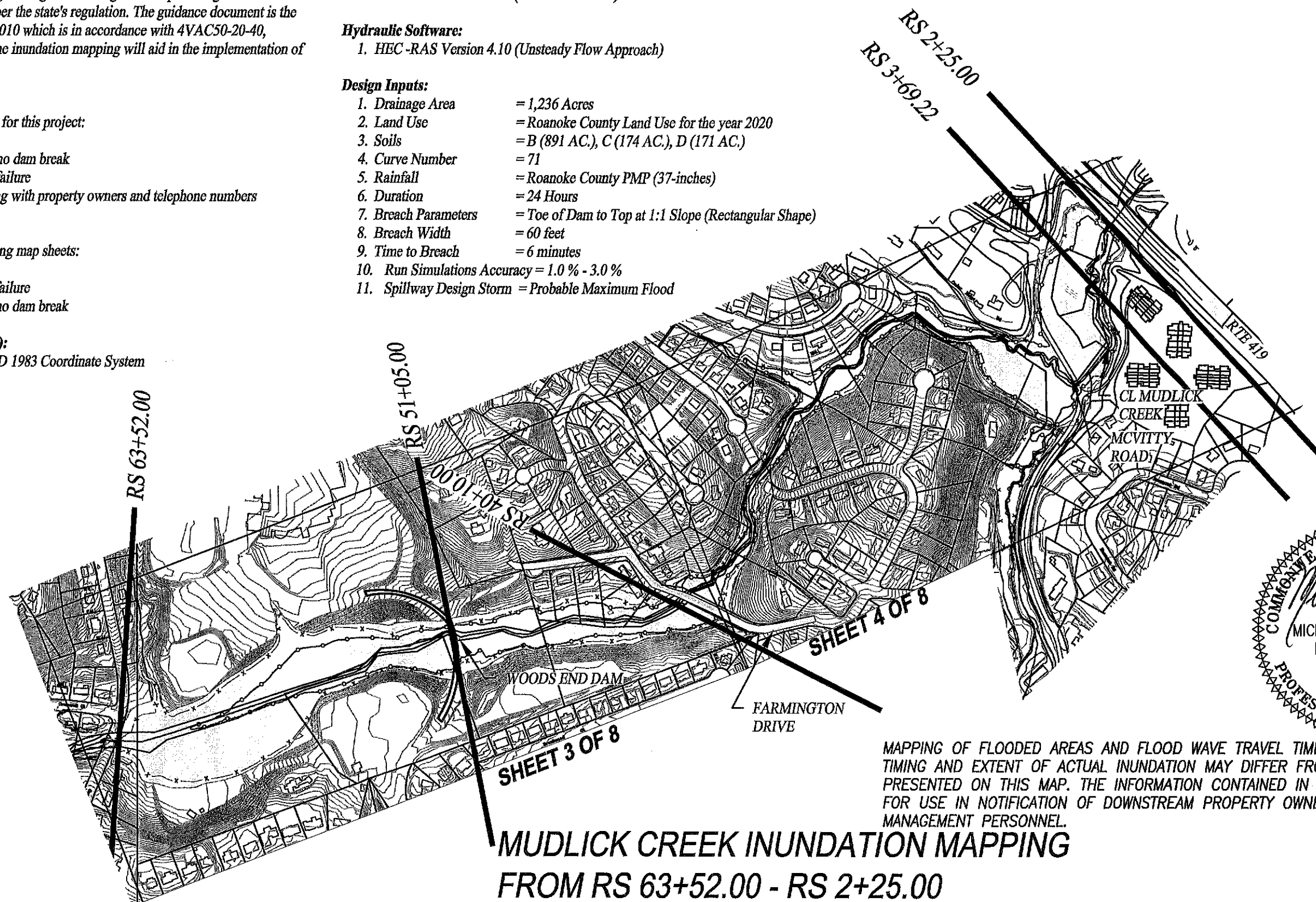
#### Hydraulic Software:

1. HEC-RAS Version 4.10 (Unsteady Flow Approach)

#### Design Inputs:

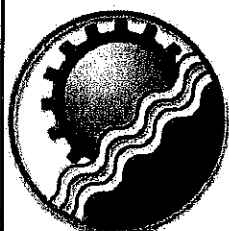
1. Drainage Area = 1,236 Acres
2. Land Use = Roanoke County Land Use for the year 2020
3. Soils = B (891 AC.), C (174 AC.), D (171 AC.)
4. Curve Number = 71
5. Rainfall = Roanoke County PMP (37-inches)
6. Duration = 24 Hours
7. Breach Parameters = Toe of Dam to Top at 1:1 Slope (Rectangular Shape)
8. Breach Width = 60 feet
9. Time to Breach = 6 minutes
10. Run Simulations Accuracy = 1.0 % - 3.0 %
11. Spillway Design Storm = Probable Maximum Flood

REFER TO SHEET NUMBER WHERE AREA IS LOCATED



MAPPING OF FLOODED AREAS AND FLOOD WAVE TRAVEL TIME ARE APPROXIMATE. TIMING AND EXTENT OF ACTUAL INUNDATION MAY DIFFER FROM THE INFORMATION PRESENTED ON THIS MAP. THE INFORMATION CONTAINED IN THIS MAP IS PREPARED FOR USE IN NOTIFICATION OF DOWNSTREAM PROPERTY OWNERS BY EMERGENCY MANAGEMENT PERSONNEL.

## MUDLICK CREEK INUNDATION MAPPING FROM RS 63+52.00 - RS 2+25.00



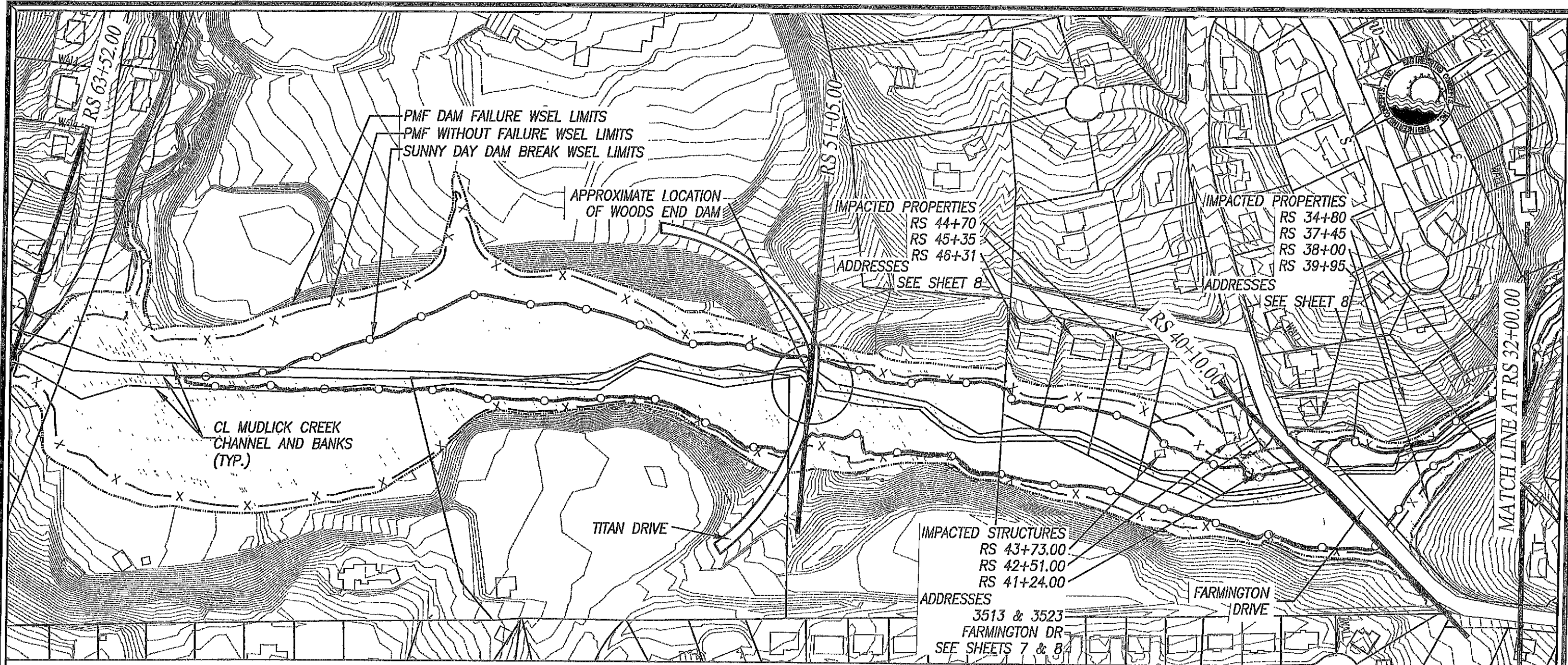
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Scale 1" = 500'

Drawn	MWL	WOODS END DAM	1"=500'
Designed	MWL		APRIL 16, 2013
Checked	MWL	OVERALL INUNDATION MAP ROANOKE COUNTY, VIRGINIA	PROJECT: 12090
Approved	MWL		2 of 8

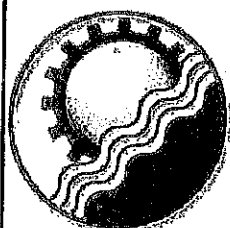
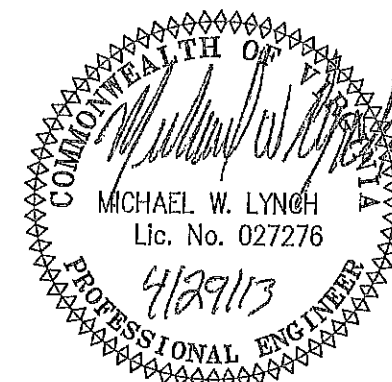


# LEGEND

PMF DAM FAILURE WSEL LIMITS  
SPILLWAY PMF WSEL LIMITS  
SUNNY DAY DAM BREAK WSEL LIMITS  
CROSS SECTION  
RS  
RIVER SECTION STATION

MAPPING OF FLOODED AREAS AND FLOOD WAVE TRAVEL TIME ARE APPROXIMATE. TIMING AND EXTENT OF ACTUAL INUNDATION MAY DIFFER FROM THE INFORMATION PRESENTED ON THIS MAP. THE INFORMATION CONTAINED IN THIS MAP IS PREPARED FOR USE IN NOTIFICATION OF DOWNSTREAM PROPERTY OWNERS BY EMERGENCY MANAGEMENT PERSONNEL.

## MUDLICK CREEK INUNDATION MAPPING FROM RS 63+52.00 - RS 32+00.00



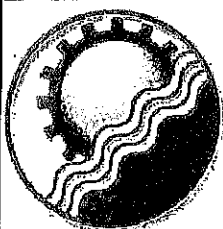
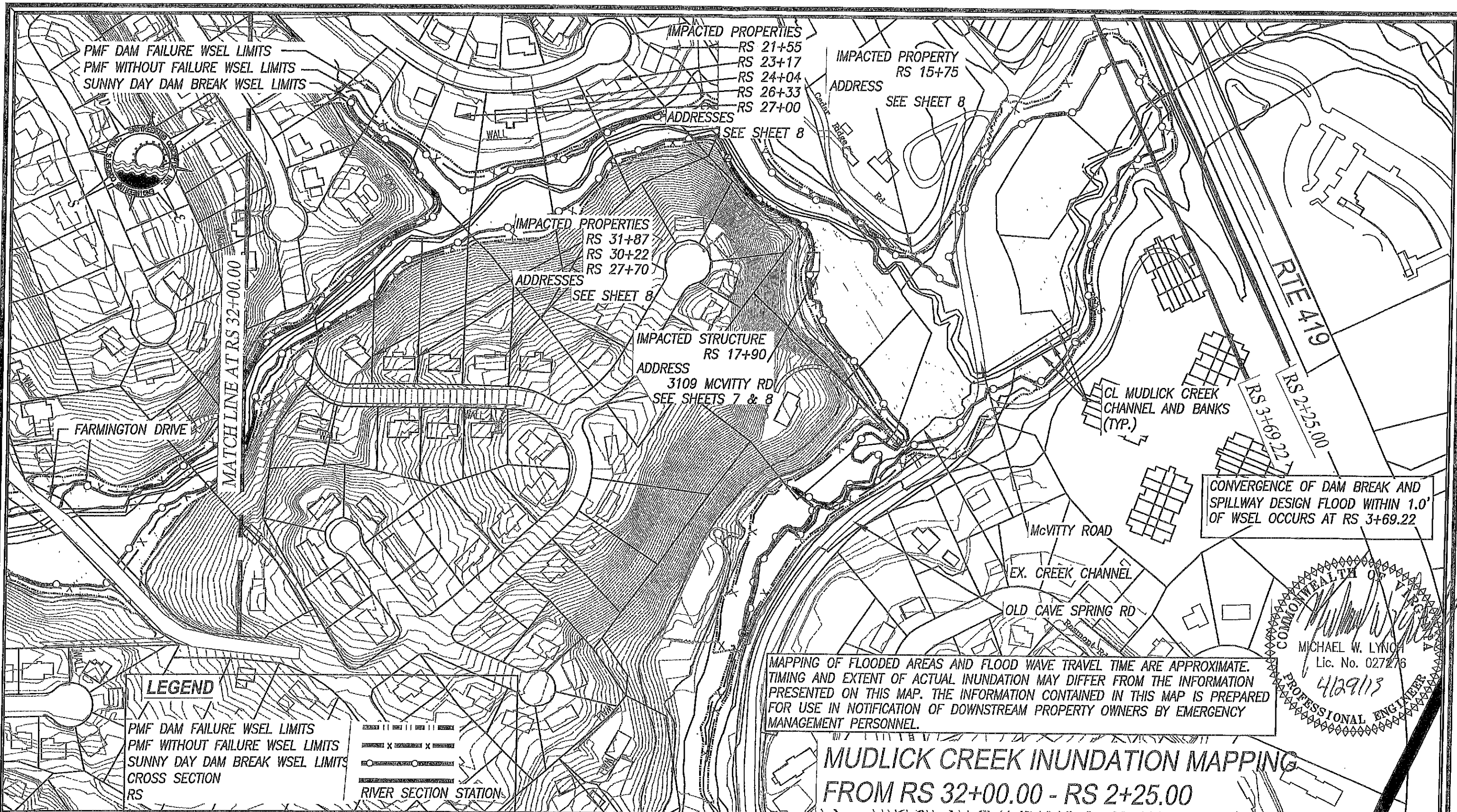
ENGINEERING CONCEPTS, INC.

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FINCASTLE, VIRGINIA 24090  
540.473.1253 FAX: 540.473.1254

200 0 200  
Scale 1" = 200'

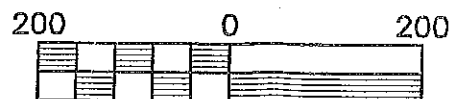
Drawn	MWL	WOODS END DAM	1"=200'
Designed	MWL		APRIL 16, 2013
Checked	MLW	INUNDATION MAP	PROJECT: 12090
Approved	MWL	ROANOKE COUNTY, VIRGINIA	3 of 8





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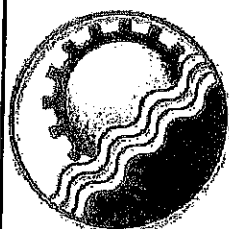
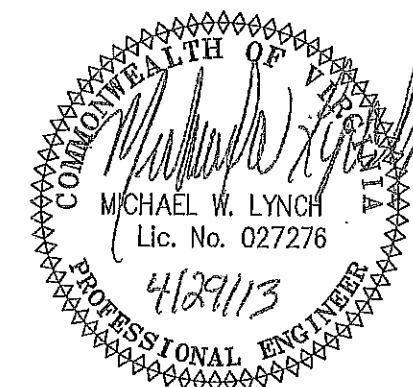
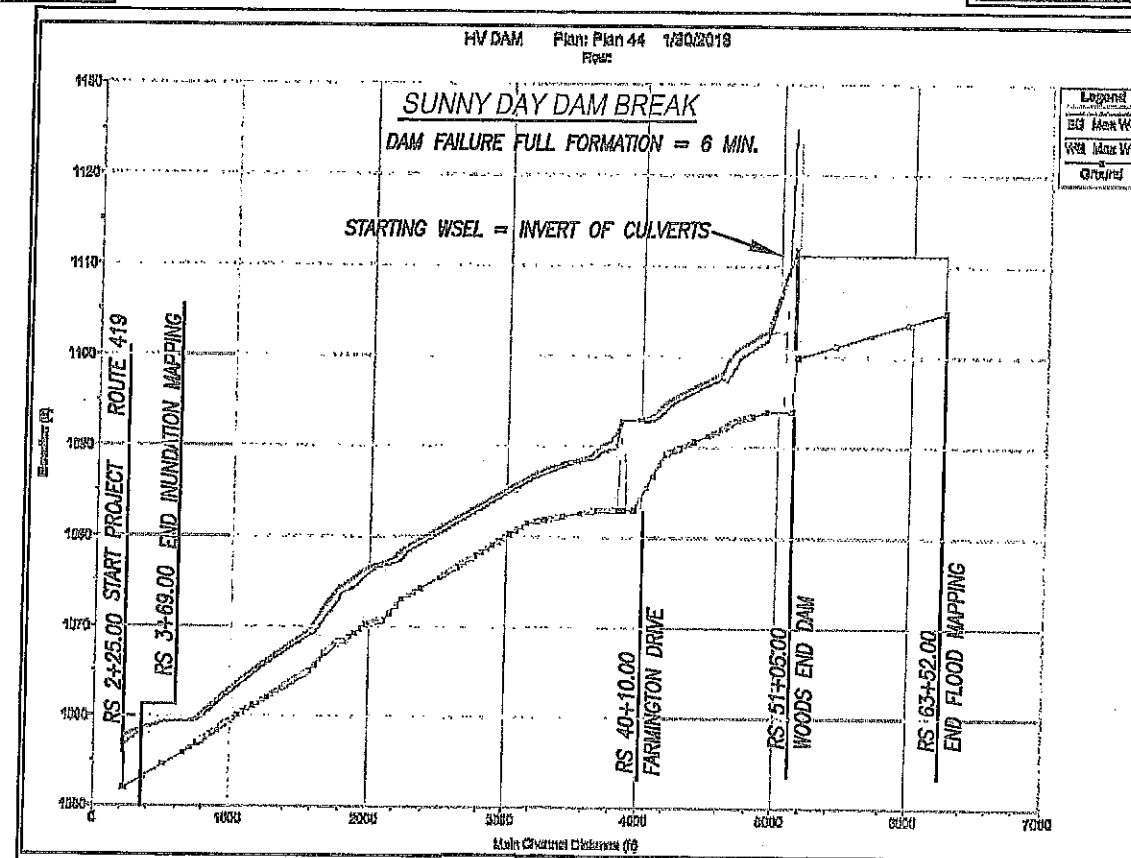
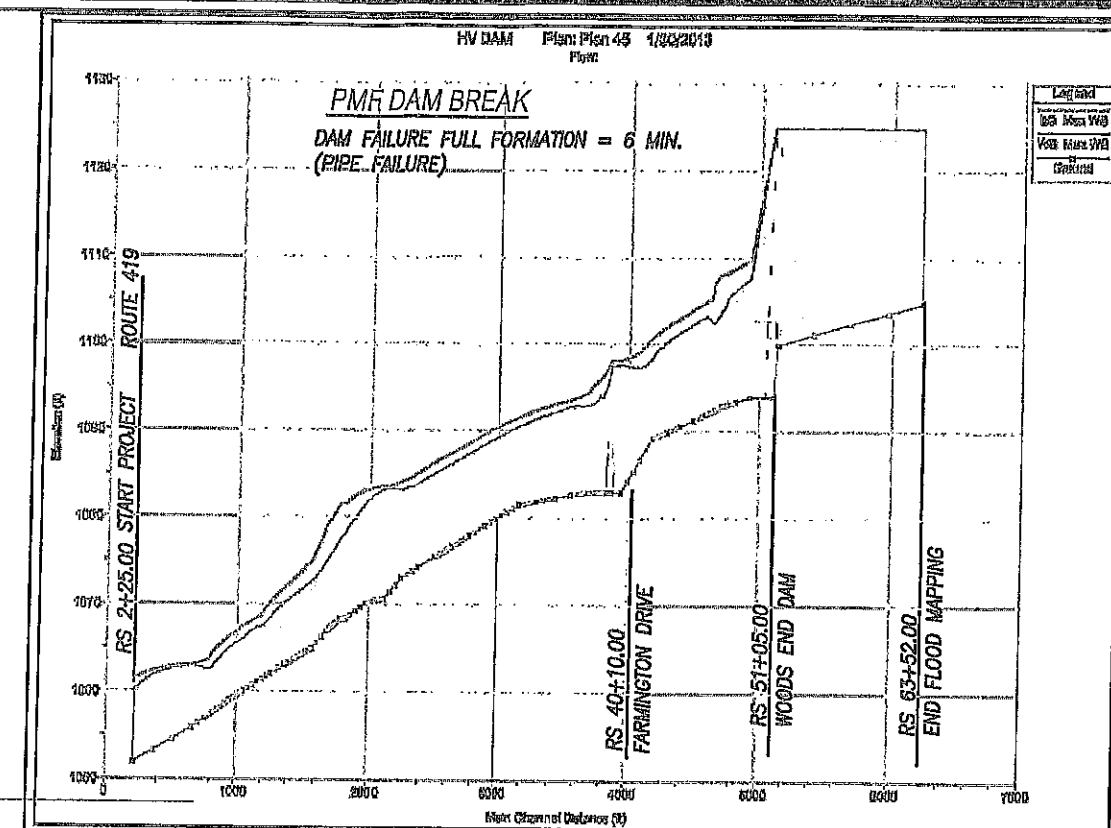
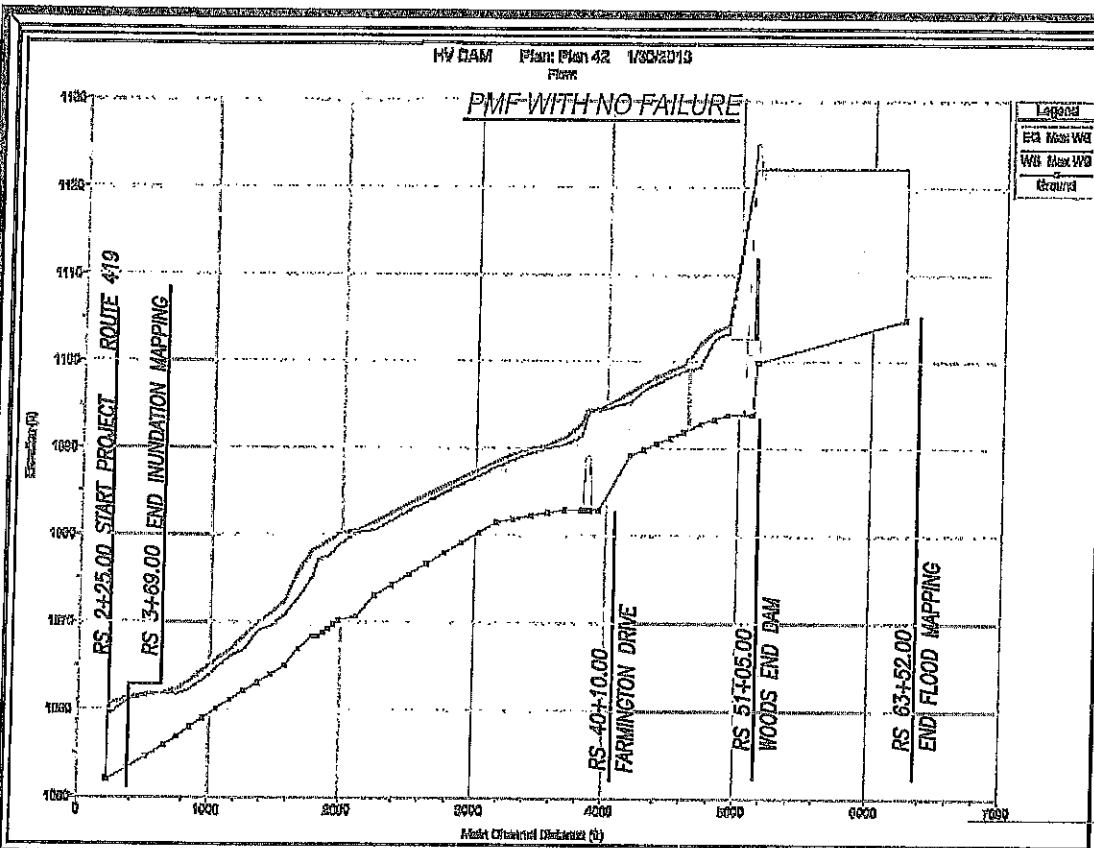
Scale 1" = 200'

Drawn MWL  
Designed MWL  
Checked MWL  
Approved MWL

**WOODS END DAM**

**INUNDATION MAP**  
**ROANOKE COUNTY, VIRGINIA**

1"=200'  
APRIL 16, 2013  
PROJECT: 12090  
4 of 8



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FOR USE IN NOTIFICATION OF DOWNSTREAM PROPERTY OWNERS BY EMERGENCY  
MANAGEMENT PERSONNEL.

Drawn	MWL
Designed	MWL
Checked	MWL
Approved	MWL

WOODS END DAM

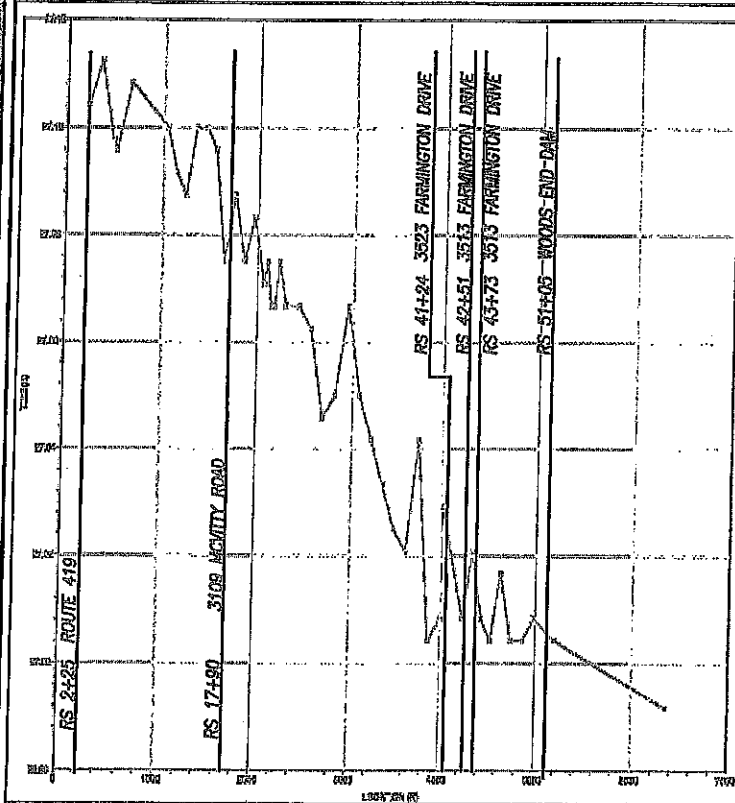
PROFILES  
ROANOKE COUNTY, VIRGINIA

SCALE: NO SCALE

APRIL 16, 2013

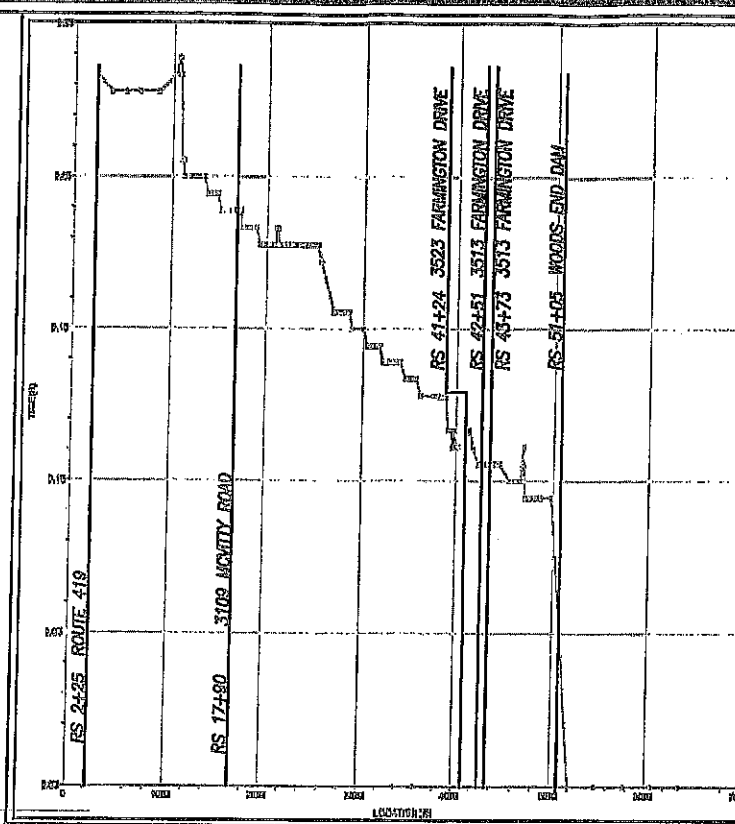
PROJECT: 12090

5 of 8



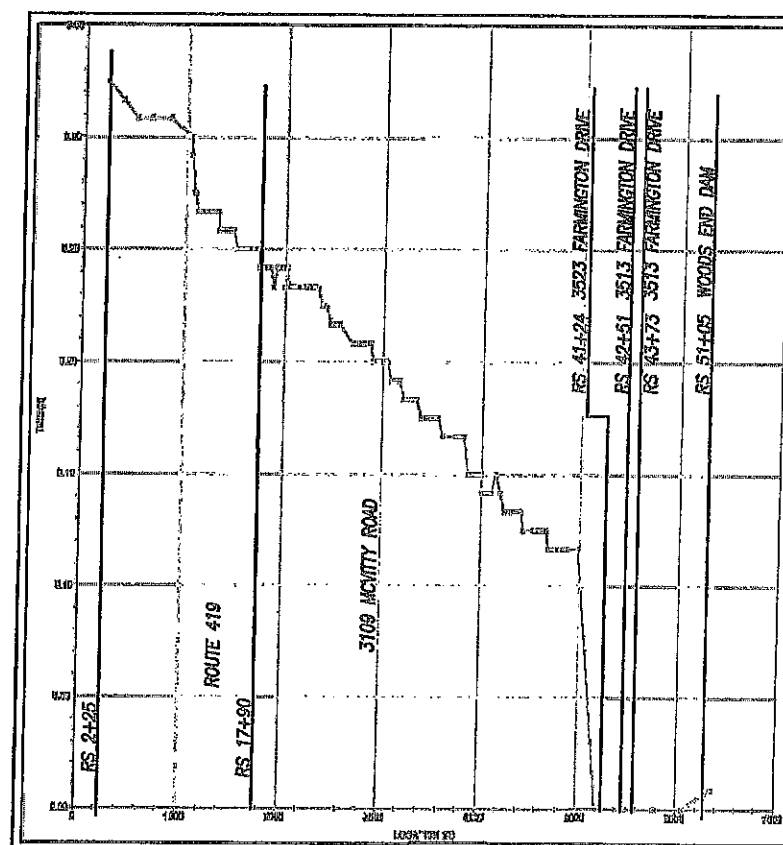
**FLOODWAVE  
TIME VS LOCATION  
PMF WITH NO  
FAILURE**

IMPACTED  
STRUCTURES  
ONLY



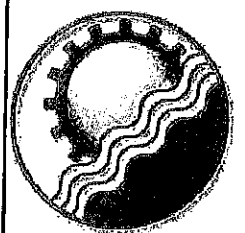
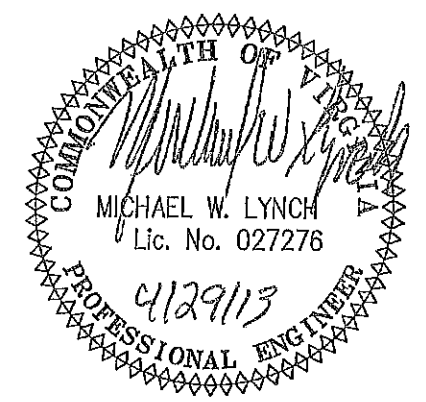
**FLOODWAVE  
TIME VS LOCATION  
PMF DAM BREAK**

IMPACTED  
STRUCTURES  
ONLY



**FLOODWAVE  
TIME VS LOCATION  
SUNNY DAY BREAK**

IMPACTED  
STRUCTURES  
ONLY



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Drawn	MWL
Designed	MWL
Checked	MWL
Approved	MWL

**WOODS END DAM**

**FLOODWAVE PROFILES**

**ROANOKE COUNTY, VIRGINIA**

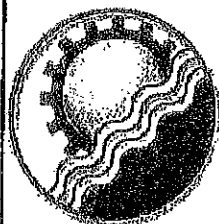
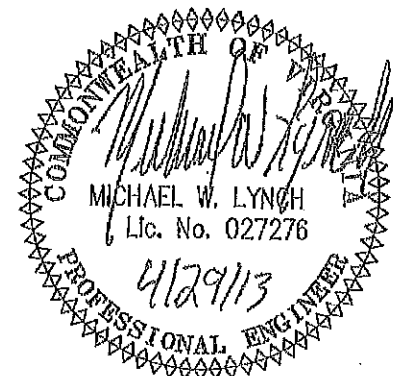
SCALE: NO SCALE
APRIL 16, 2013
PROJECT: 12090
6 of 8



VOID

FLOOD IMPACTED STRUCTURES				TIME FOR FLOOD WAVE TO REACH RIVER STATION		
RIVER STATION	ADDRESS	NAME	PHONE NUMBER	PMF NO FAILURE TIME (MIN)	SUNNY DAY BREAK TIME (MIN)	PMF DAM BREAK TIME (MIN)
2+25	Route 419			6.3	33	14
17+90	3109 MCVITT ROAD	DRISELL CHARLES G. & JOYCE G.	(767) 821-8959	5	24	10
43+73	3513 FARMINGTON DRIVE	SPANGLER RALPH N. & ESSIE S.	(540) 774-8809	< 1.0	14	7
42+51						
41+24	3523 FARMINGTON DRIVE	BOON JOHN E. SR. & BOON SHIRLEY S	(540) 989-6134	< 1.0	14	7

SEE FOLLOWING  
SHEET



## ENGINEERING CONCEPTS, INC.

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FINCASTLE, VIRGINIA 24090  
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MAPPING OF FLOODED AREAS AND FLOOD WAVE TRAVEL TIME ARE APPROXIMATE.  
TIMING AND EXTENT OF ACTUAL INUNDATION MAY DIFFER FROM THE INFORMATION  
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FOR USE IN NOTIFICATION OF DOWNSTREAM PROPERTY OWNERS BY EMERGENCY  
MANAGEMENT PERSONNEL.

Drawn	MWL	WOODS END DAM	SCALE: NO SCALE
Designed	MWL		APRIL 16, 2013
Checked	MWL	FLOOD WAVE TIMES FOR IMPACTED STRUCTURES ROANOKE COUNTY, VIRGINIA	PROJECT: 12090
Approved	MWL		7 of 8

FLOOD WAVE TIMES FOR IMPACTED STRUCTURES  
UPDATED PROPERTY OWNERS, JUNE 14, 2019

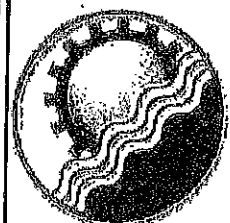
FLOOD IMPACTED STRUCTURES			TIME FOR FLOOD WAVE TO REACH RIVER STATION		
			PMF NO FAILURE	SUNNY DAY BREAK	PMF DAM BREAK
River Station	Address	Owner Name	Time (min)	Time (min)	Time (min)
2+25	VA Route 419		6.3	33	14
17+90	3109 McVitty Road	Charles G. & Joyce G. Driesell	5	24	10
43+75	3513 Farmington Drive	Elizabeth Jane Shaver Wray	less than 1	14	7
42+51	3513 Farmington Drive	Elizabeth Jane Shaver Wray	less than 1	14	7
41+24	3523 Farmington Drive	Real Estate Buy It Now LLC	less than 1	14	7

1. River Stations, Addresses, and Time for flood wave to reach river station obtained from Inundation Mapping, Sheet 7 of 8, prepared by Engineering Concepts, Inc. dated April 18, 2013
2. Owner Names updated based on Roanoke County GIS information on June 14, 2019

FLOOD IMPACTED STRUCTURES					DAM BREAK SCENARIO ANALYSIS						
RIVER STATION:	ADDRESS	NAME	STRUCT TYPE	PHONE NUMBER	PF ELE (FT)	PMF NO FAILURE		PMF FAILURE		SUNNY DAY BREAK	
						WSEL (FT)	DEPTH (FT)	WSEL (FT)	DEPTH (FT)	WSEL (FT)	DEPTH (FT)
2+25	Route 419		Road		<1080	1069.29	0	1060.2	0	1066.74	0
17+80	3109 MCVITT ROAD	DRIESELL CHARLES G & JOYCE G.	Shed	(757) 321-3959	1065	1069.95	4.95	1071.76	6.76	1068.22	3.22
43+73	3513 FARMINGTON DRIVE	SPANGLER RALPH N. & ESSIE S.	Shed	(540) 774-8209	1092	1096.9	4.9	1100.62	8.62	1095.48	3.48
42+51			Home		1097.5	1095.1	0	1098.82	1.32	1094.18	0
41+24	3523 FARMINGTON DRIVE	BOON JOHN E. SR. & SHIRLEY S.	Home	(540) 989-6154	1088.79	1094.12	6.04	1097.32	8.64	1092.81	4.03

FLOOD IMPACTED PROPERTIES					DAM BREAK SCENARIO ANALYSIS					
RIVER STATION	ADDRESS	NAME	PHONE NUMBER	*GROUND ELE (FT)	PMF NO FAILURE		PMF FAILURE		SUNNY DAY BREAK	
					WSEL (FT)	DEPTH (FT)	WSEL (FT)	DEPTH (FT)	WSEL (FT)	DEPTH (FT)
46+81	1830 HOLLAND DR	HAROLD D. & EDITH B. GREER	UNLISTED	1094	1098.81	4.81	1108.07	9.07	1097.4	3.4
45+35	3672 HOLLAND DR	CHARLES & JOYCE WAUGH	(540) 774 6268	1090	1098.15	8.15	1102.22	12.22	1096.72	6.72
44+70	3514 HOLLAND DR	WILLIAM B. JR & HILDEGARD MARTIN	(540) 989 5005	1090	1097.69	7.69	1101.64	11.64	1096.23	6.23
39+95	3514 FARMINGTON DR	RENTOR: MARY WESTERHOLD OWNER: DEWEY L. & MARY E. FOLEY	(540) 774 0519 (540) 989 4532	1090	1091.34	1.34	1094.06	4.06	1089.81	0
38+00	3584 FARMINGTON DR	JOHN M. & SARAH G. THOMAS	(540) 774 0245	1086	1090.22	4.22	1092.82	6.82	1088.46	2.46
37+45	3528 FARMINGTON DR	STEVEN T & TAMMEY BRATCHER	UNLISTED	1082	1090.08	8.08	1092.84	10.84	1088.4	6.4
34+80	5162 CAVE SPRING LN	OLIMAR THOMPSON	UNLISTED	1078	1088.69	10.69	1091.35	13.35	1086.9	8.9
31+87	5141 CAVE SPRING LN	SAMUEL F. & SONYAY GILLILAND	(540) 989 8722	1078	1086.59	8.59	1089.22	11.22	1084.64	6.64
30+22	5131 CAVE SPRING LN	MICHAEL D. & LEAH A. LEE	(540) 772 1028	1080	1085.92	5.92	1087.86	7.86	1083.22	3.22
27+70	5115 CAVE SPRING LN	BRADLEY R. & LEICHELLE MCCLURE	UNLISTED	1076	1083.37	7.37	1085.74	9.74	1081	5
26+33	5190 LAKELAND DR	BRIAN C. SMITH & KATHLEEN HUBERT	UNLISTED	1070	1082.27	12.27	1084.52	14.52	1079.77	9.77
24+04	5186 LAKELAND DR	SARAH C. BURNETT & ROBERT C. BROOKS	UNLISTED	1070	1080.44	10.44	1083.22	13.22	1077.1	7.1
23+17	5182 LAKELAND DR	RICHARD B & ANGELA K. SELLARS	(540) 772 6392	1070	1080.26	10.26	1083.27	13.27	1076.78	6.78
21+55	5178 LAKELAND DR	MARVIN JEFFREY & KATHY E. AUSTIN	(540) 725 1686	1068	1077.41	2.28	1079.4	14.4	1074.13	9.13
27+00	5194 LAKELAND DR	RANDALL D. & KIMBERLEY F. LOWEN	(540) 769 6345	1070	1082.81	12.81	1085.13	15.13	1080.38	10.38
21+10	3154 CEDAR RIDGE RD	JEANNE R. PRITCHARD	(540) 774 0816	1075	1077.2	2.2	1078.25	3.25	1073.88	0
15+75	3027 MCVITT RD	CHARLES G. & JOYCE G. DRIESELL	(757) 321-3959	1060	1067.28	7.28	1067.28	7.28	1066.07	6.07
NOTES					Lowest ground elevation on property					

COMMONWEALTH OF VIRGINIA  
MICHAEL W. LYNCH  
Lic. No. 027276  
4/29/13  
PROFESSIONAL ENGINEER



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Drawn	MWL	WOODS END DAM		SCALE: NO SCALE	
Designed	MWL			APRIL 16, 2013	
Checked	MWL	WATER DEPTH AT IMPACT SITES ROANOKE COUNTY, VIRGINIA		PROJECT: 12080	
Approved	MWL			8 of 8	

WATER DEPTH AT IMPACT S+C1:F20ITES  
UPDATED PROPERTY OWNERS, JUNE 14, 2019

FLOOD IMPACTED STRUCTURES				DAM BREAK SCENARIO ANALYSIS						
River Station	Address	Owner Name	Structure Type	Finish Floor Elev	PMF NO FAILURE		PMF FAILURE		SUNNY DAY BREAK	
					WSEL (ft)	Depth	WSEL (ft)	Depth	WSEL (ft)	Depth
2+25	Route 419		Public Road	1080	1059.29	0	1060.2	0	1056.74	0
17+90	3109 Mcvitty Road	Charles G. & Joyce G. Driesell	Shed	1065	1069.95	4.95	1071.76	6.76	1068.22	3.22
43+73	3513 Farmington Dr.	Elizabeth Jane Shaver Wray	Shed	1092	1096.93	4.93	1100.62	8.62	1095.48	3.48
42+51	3513 Farmington Dr.	Elizabeth Jane Shaver Wray	Home	1097.5	1095.5	0	1098.82	1.32	1094.18	0
41+24	3523 Farmington Dr.	Real Estate Buy It Now LLC	Home	1088.78	1094.82	6.04	1097.32	8.54	1092.81	4.03

FLOOD IMPACTED PROPERTIES				DAM BREAK SCENARIO ANALYSIS						
River Station	Address		Owner Name	Ground Elevation (ft)	PMF NO FAILURE		PMF FAILURE		SUNNY DAY BREAK	
					WSEL (ft)	Depth	WSEL (ft)	Depth	WSEL (ft)	Depth
46+31	3530 Holland Dr.		Harold D. & Edith B. Greer	1094	1098.81	4.81	1103.07	9.07	1097.4	3.4
45+35	3522 Holland Dr.		Charles & Joyce Waugh	1090	1098.15	8.15	1102.22	12.22	1096.72	6.72
44+70	3514 Holland Dr.		William B Jr. & Hildegard Martin	1090	1097.69	7.69	1101.64	11.64	1096.23	6.23
39+95	3514 Farmington Dr.		Sina Aghdasi	1090	1091.34	1.34	1094.06	4.06	1089.81	0
38+00	3584 Farmington Dr.		Barry Thomas	1086	1090.22	4.22	1092.82	6.82	1088.46	2.46
37+45	3528 Farmington Dr.		Stephen T. & Tammey Bratcher	1082	1090.08	8.08	1092.84	10.84	1088.4	6.4
34+80	5162 Cave Spring Lane		Olivia R. Thompson	1078	1088.69	10.69	1091.35	13.35	1086.9	8.9
31+87	5141 Cave Spring Lane		SonyaY. Gilliland	1078	1086.59	8.59	1089.22	11.22	1084.64	6.64
30+22	5131 Cave Spring Lane		Leah Anne Shepherd	1080	1085.32	5.32	1087.86	7.86	1083.22	3.22
27+70	5115 Cave Spring Lane		Carlene G. & Corey Lee Scott	1076	1083.37	7.37	1085.74	9.74	1081	5
26+33	5190 Lakeland Dr.		Lawrence J. Onan and Rui Rui Mu	1070	1082.27	12.27	1084.52	14.52	1079.77	9.77
24+04	5186 Lakeland Dr.		Sarah C. Burnett & Robert C. Brooks	1070	1080.44	10.44	1083.22	13.22	1077.1	7.1
23+17	5182 Lakeland Dr.		Richard B & Angela K. Sellars	1070	1080.26	10.26	1083.27	13.27	1076.78	6.78
21+55	5178 Lakeland Dr.		Marvin Jeffrey & Kathy E. Austin	1065	1077.41	12.41	1079.4	14.4	1074.13	9.13
27+00	5194 Lakeland Dr.		Raheem & Rehana Iqbal	1070	1082.81	12.81	1085.13	15.13	1080.38	10.38
21+10	3154 Cedar Ridge Rd.		Lizzie H. & David C. Barudin	1075	1077.2	2.2	1078.25	3.25	1073.88	0
15+75	3027 McVitty Rd.		Charles G. & Joyce G. Driesell	1060	1067.28	7.28	1067.28	7.28	1066.07	6.07

1. River Stations, Addresses, Ground elevations and WSELs obtained from Inundation Mapping, Sheet 8 of 8, prepared by Engineering Concepts, Inc. dated April 18, 2013  
2. Owner Names updated based on Roanoke County GIS information on June 14, 2019

## **APPENDIX B – PLANS FOR TRAINING, EXERCISING, UPDATING, AND POSTING THE EMERGENCY ACTION PLAN**

### **A. Training**

Training for the appropriate personnel named in this EAP will be performed as a part of the annual drill and periodic tabletop exercise.

### **B. Exercising**

A drill shall be conducted at least annually. A tabletop exercise shall be performed at least once during this certification period (once in 6 years).

### **C. Updating**

This Plan shall be reviewed and updated annually by the EAP Coordinator. The items that will be reviewed include:

- Changes in personnel in the Notification Flowchart.
- Changes in downstream property ownership.
- Additions or deletions of structures within the inundation zone.
- Changed conditions that could affect flood flows or flood elevations in the event of a dam failure.

If updates are needed, they will be submitted to the parties listed below. An annual notice will be submitted to DCR, by the EAP Coordinator, which documents the annual drill or tabletop exercises

### **D. Posting**

This Plan will be kept on file:

- County Engineer's office
- County's Fire and Rescue Department-County Emergency Manager
- Virginia DCR, Division of Dam Safety and Floodplain Management
- Virginia Department of Emergency Management



## APPENDIX C – SITE SPECIFIC CONCERNS

Titan Trail is a private road that crosses over the dam embankment. Titan Trail is the primary road access to Hidden Valley High School.

In the event of an emergency, this road should be closed; and students and staff should shelter in place at the high school.

Emergency access to the high school can be provided off the end of Holland Drive.

