

**OVERSIGHT HEARING ON REPEATED FLOODING
EVENTS IN ELLICOTT CITY, MD: REVIEWING
THE FEDERAL ROLE IN PREVENTING FUTURE
EVENTS**

FIELD HEARING
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION
AND INFRASTRUCTURE
OF THE
COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

AUGUST 20, 2018—ELLICOTT CITY, MD

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED FIFTEENTH CONGRESS
SECOND SESSION

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C O N T E N T S

	Page
AUGUST 20, 2018	
INTRODUCTORY STATEMENT	
Kittleman, Allan, Howard County Executive	1
OPENING STATEMENTS	
Cardin, Hon. Benjamin L., U.S. Senator from the State of Maryland	2
Van Hollen, Hon. Chris, U.S. Senator from the State of Maryland	4
WITNESSES	
Cummings, Hon. Elijah E., U.S. Representative, State of Maryland	5
Prepared statement	9
Rodrigues, Cecil, Deputy Regional Administrator for Region 3, U.S. Environmental Protection Agency	12
Prepared statement	14
Litz, Colonel John T., Commander, Baltimore District, U.S. Army Corps of Engineers	17
Prepared statement	19
DeLuca, Mark, Deputy Director and Chief of Environmental Services, Howard County Department of Public Works	30
Prepared statement	32
Weinstein, Jon, Council Member, District 1, Howard County Council	33
Prepared statement	35
Kubofcik, Grace, President, Board of Directors, Patapsco Heritage Greenway, Inc	38
Prepared statement	40
Fleming, Matthew H., President, Board of Directors, Ellicott City Partnership	43
Prepared statement	45
ADDITIONAL MATERIAL	
Response to Congressional Testimony on 20 August 2018, from the U.S. Army Corps of Engineers	55
Letters and Testimony:	
From Abigail Bardi, September 3, 2018	57
To Senators Inhofe and Cardin from Len Berkowitz and Sherry Fackler-Berkowitz, August 20, 2018	62
To Senator Cardin from Brittany Calloway	66
To Senators Inhofe and Cardin from the Historic Ellicott City Flood Work Group, August 27, 2018	68
From Gayle Killen	69
To Senator Cardin from Lori Lilly, September 3, 2018	70
From Tony McGuffin	73
From Tony McGuffin	76
To Senators Inhofe and Cardin from Melissa Metz, September 3, 2018	79
To Senators Inhofe and Cardin from Ron Peters, August 20, 2018	81
To Senators Inhofe and Cardin from Arnold Sanders, August 31, 2018	229
To Senators Inhofe and Cardin from St. John's Community Association, September 3, 2018	230

IV

	Page
—Continued	
Commentary, Bruce T. Taylor, An insider's view of rebuilding Old Ellicott City, The Daily Record, July 12, 2018	242
To Senator Cardin and Committee members from Taylor Family Properties, August 16, 2018	244
To Senators Cardin, Inhofe, and Van Hollen and Representative Cummings and Committee members from Taylor Family Properties, August 22, 2018	245
Report, The Historic Ellicott City Flood Workgroup, December 1, 2015	246
Report, 2016 Ellicott City Hydrology/Hydraulic Study and Concept Mitigation Analysis, McCormick Taylor, June 16, 2017	256
Summary of The Ellicott City Hydrology and Hydraulic Study and Concept Mitigation Analysis (response to the 2016 flood)	307
The report Urban Stormwater Management in the United States is available at Amazon.com and other sources. The Amazon link is https://amzn.to/2AlRiW6	
Summary of the USACE Report after 2016 flood: Prevention on the building level	309
Ellicott City's Watershed Master Plan	312
Concept Plan, Main Street, Ellicott City, Maryland, Alexander Design Studio .	313

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MONDAY, AUGUST 20, 2018

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Ellicott City, MD.

**INTRODUCTORY STATEMENT OF ALLAN KITTLEMAN,
HOWARD COUNTY EXECUTIVE**

Mr. KITTLEMAN. I briefly wanted to say hello and welcome you to the Banneker Room, and more than anything else, to thank our Federal representatives for being here.

Senator Cardin, thank you so much. And I know Senator Van Hollen will be here soon.

And Congressman Cummings, thank you so, so much, all.

[Applause.]

Mr. KITTLEMAN. As a lawyer, I feel like I have my back to the judge. Excuse me, please, Senator.

But I just wanted to say to everyone here, we could not have received more support from our Federal representatives than we have from Senator Cardin and Senator Van Hollen and Congressman Cummings and also previously Senator Mikulski.

They have been here multiple times. They know our community. As you all know, Congressman Cummings has an office in our community, and they have not forgotten us. And I know that's happened at other times and other places, but not here. And one of the reasons we continue to be such a strong community is because we have our Federal, State, and local support, and we work very closely together.

I've gotten to know these gentlemen very well, and Senator Mikulski as well. I knew them before the floods, but I know them a whole lot better since the floods. And I can tell you, we couldn't be better off than having them here for us. And so I say that very sincerely, and I want them to know that you being here, and the Senate holding this hearing and the Congressman being here, mean an awful lot to us.

And it's not symbolic. We know you are here because you want to help, and you're going to do whatever you can to make sure we have the help that we need to continue to have a great community here in Ellicott City.

And so for all of you who are here, thank you for being here. Thank you for being involved in our community. This is why Ellicott City is what it is. This is why we are going to continue to be a strong, safe, and smart community for many, many, many decades in the future, because of you.

And I am going to stop now, and I'm going to turn it back over to Senator Cardin.

And I want to apologize; I have another commitment. I know Counselor Weinstein will be speaking and some other folks from county government as well.

So, thank you very much for being here.

And Senator Cardin.

**OPENING STATEMENT OF HON. BENJAMIN L. CARDIN,
U.S. SENATOR FROM THE STATE OF MARYLAND**

Senator CARDIN. Thank you.

First, before the County Exec leaves—

[Applause.]

Senator CARDIN. Before the County Exec leaves, I really want to thank Allan Kittleman for his extraordinary leadership on this issue and so many others.

We talk about Team Maryland. We talk about Team Maryland responding to the priorities of our State. In regards to the floods in Ellicott City, our captain was the County Exec, and he worked very well with Governor Hogan and the State team and with our Federal congressional delegation from the beginning to see what we could get done. Only concern was the safety of the people here in Ellicott City and the future of Ellicott City.

And it was a pleasure to work with you on this issue, and Team Maryland couldn't be more proud of the manner in which we used all the resources of our State in order to deal with these horrific floods. So, thank you.

Mr. KITTLEMAN. Thank you so much. Thank you very much.

Senator CARDIN. And with that, let me call to order the Subcommittee on Transportation and Infrastructure of the Environment and Public Works Committee.

I want to first thank Senator Inhofe, who is the Chair of the Subcommittee on Transportation and Infrastructure. I am the ranking Democrat on that committee.

I also want to thank Senator Barrasso, the Chairman of the Environment and Public Works Committee, from Wyoming, and Senator Carper, the ranking Democrat on the Environment and Public Works Committee, from Delaware, for allowing us to have this field hearing.

I've talked to all three of those—of my Senators I just mentioned, and they all are interested in learning how Federal Government can be a more effective partner in dealing with the realities that we see on these more frequent floods.

So the Environment and Public Works Committee plays a very important role in that regard. And you'll hear from two of our agencies today at this hearing, the Environmental Protection Agency and the Army Corps of Engineers, because they play a particularly important role in dealing with these types of issues.

So, the purpose for today's hearing is for the U.S. Congress to have the benefit of the information that will be presented by the panel of witnesses, for us to be able to establish a record so that we can be better prepared to increase the effectiveness of the Federal Government's role in dealing with these types of events that were experienced in Ellicott City.

I think everyone knows where they were on July 30th of 2016. I remember being at a friend's house having dinner when my iPhone went off with certain warnings. That wasn't the first time I've gotten warnings through my iPhone. I didn't think too much of it, to tell you the truth.

But a few—I guess maybe a half an hour later, as I was on the streets of Baltimore County and saw the devastation in Baltimore County, I knew that this was not like a storm that we had seen before. When I got home, I had the chance of seeing the broadcast of what was happening in Ellicott City and knew that we had experienced a horrific event.

There were—over 6 inches of rain fell that evening, I think all of you know. There were two fatalities, numerous cars were destroyed, buildings were destroyed, 200 residents were displaced, and we had what is known as a once in a thousand year flood in Ellicott City.

Well, 22 months later, we experienced a second of what is known as a once in a thousand year flood, on May 27th. That occurred earlier in the day, on Sunday, a busy day for the community in Ellicott City. Six to 12 inches of rain fell, which is unprecedented. Even more devastating than the first. People literally had to be rescued, and the first responders saved numerous lives that day.

We did, unfortunately, lose the life of a National Guard Staff Sergeant, Eddison Hermond, who was seeking to help a person and got carried away by the water and lost his life. But clearly, the first responders were able to save lives.

In both of these episodes, Team Maryland did everything we could to help immediately the people that were there and to use the resources, whether it was local resources, State resources, Federal resources, private resources. It was all coordinated.

As I said a little bit earlier, I applaud the leadership of County Exec Kittleman, who was our true captain in regards to that effort.

I also thank Governor Hogan for the work the State of Maryland did. And I am particularly proud of our Federal delegation.

Our Federal delegation, we looked at FEMA coming in immediately to help. They did that without the necessary declarations. The declarations came later. The Small Business Administration was here immediately. Again, they did not wait for the declarations. They were here to help. They helped assess the situation so that the declaration process could be easier and the application processes could be easier.

The Environmental Protection Agency has a particularly important role to play, as does the Army Corps of Engineers, and we're going to talk about how we can mitigate the future risk factors that occur from such a storm. That's one of the main reasons for today's hearing.

So, we have questions. Is this really a once in a thousand year event? Obviously, it was not for our generation. What are the

causes, and how can we mitigate it? Is it development? Is development the main culprit here, when we look at increased population and more concrete rather than allowing runoff to occur in a more natural way? What impact is climate change having on what we are doing? And adaptation for the natural changes or what's happening with our climate.

So, there are a lot of questions that we want to ask as to how we can be better prepared to mitigate the risk factors in Ellicott City but also how we need to be prepared, because there will be extreme weather conditions in the future. How can we make sure that we protect life, property, and the unique nature of Historic Ellicott City?

I'm proud to have as my partner in all this Senator Van Hollen. He has been a champion on all of these issues. He serves on the Environment and Public Works Committee, so he's a member of this particular Committee as well as on the Senate Appropriations Committee. So I'm going to call on, first, Senator Van Hollen.

And then I'm extremely proud that Elijah Cummings is with us today. Senators always love having members of the House at our hearings, so we particularly appreciate Elijah being here. He's a great leader in our country and does a fabulous job of representing the people of the 7th Congressional District in the Congress of the United States.

I also want to acknowledge John Sarbanes, who has been very much engaged in these issues concerning Ellicott City and has played a very important role as well.

But first, I'm going to allow Senator Van Hollen to make an opening statement, and then we will turn immediately to Congressman Cummings.

**OPENING STATEMENT OF HON. CHRIS VAN HOLLEN,
U.S. SENATOR FROM THE STATE OF MARYLAND**

Senator VAN HOLLEN. Thank you, Senator Cardin. It's great to be here with so many members of the Ellicott City community.

And I want to thank Senator Cardin for bringing us together here at this hearing. It's a privilege to serve with him in the Senate and also very pleased to serve with him, as he indicated, on the Senate Environment and Public Works Committee. And it's under those auspices that Senator Cardin pulled together this hearing.

So, thank you, Senator, for your leadership on national issues but also very focused on the immediate concerns of community.

Also want to extend a warm welcome to our friend Elijah Cummings, who's been a leader in so many different ways. And also to Congressman Sarbanes and others in the delegation who have supported these efforts.

And I'm going to be very brief because Senator Cardin covered a lot of territory, and we want to hear from all of you.

I was here on the ground after the first awful flooding a couple years ago and had the opportunity to meet with many of you and the business owners and homeowners. And we all hoped at that time that it was just going to be an extraordinary and relatively unique event in that time scale that Senator Cardin talked about, the thousand year flood. But we know now and from our bad expe-

periences that that is not the case and certainly may not be the case going forward.

So, it's incumbent on all of us to look at why this is happening and do everything in our power to try to prevent it from happening and to mitigate the damage when it happens again.

Senator Cardin referenced climate change. Look, in my view, as a country and as a world, we should have been working much harder way back to try to put the brakes on the damages of climate change. And we're going to have to continue to try and do that at the national and international level.

But in the meantime, we cannot stand still and not do everything in our power here as a State and locally and as a Federal and State and local government and as citizens and community members to do what we can to learn about what can do locally to reduce and to prevent the damage in the first place and then mitigate it when it happens. And really, those are the lessons that we want to learn.

And I want to thank all the members of the Ellicott City community, as Senator Cardin did, for your input in this process but also for your resilience and being such amazing examples of the ability of our fellow citizens to withstand not just one major disaster but a second one, and continue to look for ways to stay together and make sure that this is a thriving city and community in years to come.

So, thank you, Senator Cardin, and I look forward to the testimony from our colleague, Congressman Cummings.

Senator CARDIN. And Senator Van Hollen, I'm glad you mentioned the people of Ellicott City. They're inspirations to—they really inspire us. The courage, the strength. We often say that Ellicott City is Main Street America. It truly is.

These are individual storeowners who have a lot of courage. On a good year with good weather it's tough to run a business. But when you have these types of floods, it really brings out the strength, and Ellicott City has that strength.

And of course I'm biased to Joanie because we went to school together, so I'm glad to see you're smiling today, Joanie. It's nice to have you here in the audience.

Elijah Cummings has been representing the 7th District for 25 years in the House of Representatives. He was born and raised in Baltimore, and the damage that was incurred in 2016 was also incurred in Baltimore. So it was not just in Ellicott City that we saw incredible damage.

He's a senior member of the House Committee on Transportation and Infrastructure, serving on both the Subcommittee on Coast Guard and Maritime Transportation and the Subcommittee on Railroads, Pipelines, and Hazardous Materials.

It's a real pleasure to have our colleague with us today, who will first testify, and then I'm going to invite him, if he wishes, as time remains, to certainly join us here.

**STATEMENT OF HON. ELIJAH E. CUMMINGS,
U.S. REPRESENTATIVE FROM THE STATE OF MARYLAND**

Representative CUMMINGS. Thank you very much.

Thank you, Senator Cardin and Senator Van Hollen. It is indeed an honor to testify before the Subcommittee on Transportation and

Infrastructure of the Senate's Committee on Environment and Public Works regarding the catastrophic flooding that has occurred in Ellicott City.

But before I go on, let me echo what you just said, Senator Cardin. When I came—I got here a little bit early, and the parking lot was empty. Hello.

[Laughter.]

And by the time I got out of my car, the parking lot was full.

And I say that to say that this is what democracy looks like. This is what it's all about: The idea that on a sunny August afternoon when you could be doing all kinds of other things, you are sitting here trying to make sure that we shape our destinies and that we do it together. And so I am truly honored.

Let me begin by thanking you, Senator Cardin, for your unwavering commitment to our constituents as they continue to rebuild after these floods.

Senator Cardin has fought tirelessly to help local residents and business owners get the assistance they need. He is also working to craft new policies to help ensure that our infrastructure programs make the investments our Nation needs to help control floods.

I also thank my good friend and colleague Senator Van Hollen for all that he has done on both the Environment and Public Works Committee and the Appropriations Committee to help secure assistance for cleanup and restoration. And I thank him for his ongoing efforts to help make the Flood Insurance Program more affordable and effective.

So I thank, finally, Howard County Executive Allan Kittleman and Governor Larry Hogan, as well as Council Member Jon Weinstein, the entire Howard County Council, and Congressman John Sarbanes, for all their continued partnership with local, State, and Federal agencies to provide relief and assistance to Ellicott City.

I also thank all of the community leaders who will testify today.

Ladies and gentlemen, I wake up every morning—as I know Senator Cardin and Senator Van Hollen do—thinking about how can we best serve our constituents and help them improve their lives. That's what this is all about. This is the reason we sought public office, and it is that passion that fuels me every day in this job.

But Senator Cardin said something that is so true: It makes a difference when you have a constituency that comes out and is supportive of your efforts. It makes a big difference because it makes you want to go out there and work even harder.

So, I'm so proud to represent Ellicott City in Congress. It is a beautiful, historic city and a thriving community that is not only a treasure for our State but a treasure for our entire Nation.

Unfortunately, it is also a community that is located on steep terrain at the confluence of several waterways in a flood prone area where topographical challenges have been worsened by the many effects of regional development.

And it is a community where extreme weather events have repeatedly unleashed devastating amounts of rainfall that have overwhelmed the city's existing infrastructure.

In 2016 and again in 2018, sudden flash floods have resulted in the loss of life and catastrophic destruction. Local residents have struggled not only with the economic devastation these storms have caused but they have also dealt with the enormous toll this destruction has taken on their lives.

Much more must be done—much more—to protect this community from flash floods, and that’s why today’s hearing is so very, very important. Significant investments are needed to ensure that flood waters can be effectively managed and directed away from Ellicott City. These improvements are all the more urgent given that climate change—yes, I did say climate change—will increase the frequency and severity of extreme weather events.

And sadly, while we’re talking about Ellicott City today, many communities throughout the United States will be at risk for the same kind of severe flooding from extreme weather, particularly if we continue to fail to act to slow or reverse climate change.

And as you, Senator Cardin, and you, Senator Van Hollen, were talking, I just want our audience to know that when there are catastrophes anywhere in this country, our delegation is always there because we realize that this is the United States of America and that we have to come to each other’s aid. And you can look at our votes, and you will see over and over again that we have done that.

Ellicott City frequently—urgently needs what our Nation needs: A coordinated, deliberate, thoughtful flood control effort that is informed by the best available science and that has adequate funding—let me repeat that—and that has adequate funding—to build the infrastructure needed to protect communities from the risks they face.

And so, as I close, I will fight, as I know Senator Cardin and Senator Van Hollen will, to help Ellicott City secure every single dollar of funding available through current programs to help it recover, formulate flood control plans, and build new infrastructure.

And as a senior member of the House Committee on Transportation and Infrastructure, I have closely monitored and voted in favor of the House’s water bill, the Water Resources Development Act, which passed the House earlier this year.

Let me also note that I strongly support the important provisions in the Senate’s Water Resources Development Bill, on which Senator Cardin and Senator Van Hollen have worked, and that would improve financing for water infrastructure.

However, I would like the size of the water bill ultimately adopted by the Congress to be significantly increased to provide more money to meet our urgent need for infrastructure to control floods, improve our ports and dams, and restore vital ecosystems.

We have a very steep backlog of authorized projects just waiting to be funded, and we can no longer afford to make our infrastructure last on the Nation’s priority list. Rather than handing out tax cuts to billionaires, we should be helping communities like Ellicott City rebuild and become more resilient before the next storm comes because, sadly, we know, ladies and gentlemen, as sure as night becomes day and day becomes night, it will come.

I am so honored to have Senator Cardin and Senator Van Hollen as my partners in this effort, along with Congressman Sarbanes,

and I thank them again as we continue to fight for the future of Ellicott City.

Thank you very much.

[Applause.]

[The prepared statement of Representative Cummings follows:]

Statement of Congressman Elijah E. Cummings

**Before the Subcommittee on Transportation and Infrastructure of the
Senate Committee on Environment and Public Works**

**“Oversight Hearing on Repeated Flooding Events in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events”**

August 20, 2018

Thank you, Chairman Inhofe, Ranking Member Cardin, and Members of the Committee.

I am honored to testify before the Subcommittee on Transportation and Infrastructure of the Senate’s Committee on Environment and Public Works regarding the catastrophic flooding that has occurred in Ellicott City.

Let me begin by thanking you, Senator Cardin, for your unwavering commitment to our constituents as they continue to rebuild after these floods. Senator Cardin has fought tirelessly to help local residents and business owners get the assistance they need. He is also working to craft new policies to help ensure that our infrastructure programs make the investments our nation needs to help control floods.

I also thank Howard County Executive Allan Kittleman and Governor Larry Hogan – as well as Councilmember Jon Weinstein, the entire Howard County Council, Senator Van Hollen and Congressman Sarbanes – for their continued partnership with local, state, and federal agencies to provide relief and assistance to Ellicott City. I also thank all of the community leaders who will testify today.

Ladies and gentlemen, I wake up every morning thinking about how I can best serve my constituents and help them improve their lives. This is the reason I sought public office and it’s the passion that fuels me in this job.

I am so proud to represent Ellicott City in the Congress. It is a beautiful, historic city and a thriving community that is a treasure to our state.

Unfortunately, it is also a community that is located on steep terrain at the confluence of several waterways in a flood-prone area where topographical challenges have been worsened by the many effects of regional development.

And it is a community where extreme weather events have repeatedly unleashed devastating amounts of rainfall that have overwhelmed the city’s existing infrastructure.

In 2016 and again in 2018, sudden flash floods have resulted in the loss of life and catastrophic destruction. Local residents have struggled not only with the economic devastation these storms have caused but also with the enormous toll this destruction has taken on their lives.

Much more must be done to protect this community from flash floods and that's why today's hearing is so important. Significant investments are needed to ensure that floodwaters can be effectively managed and directed away from Ellicott City.

These improvements are all the more urgent given that climate change will increase the frequency and severity of extreme weather events.

And sadly, while we are talking about Ellicott City today, many communities throughout the United States will be at risk for the same kind of severe flooding from extreme weather – particularly if we continue to fail to act to slow or reverse climate change.

Ellicott City urgently needs what our nation needs: a coordinated, deliberate, thoughtful flood control effort that is informed by the best available science and that has adequate funding to build the infrastructure needed to protect communities from the risks they face.

I will fight – as I know Senator Cardin will – to help Ellicott City secure every dollar of funding available through current programs to help it recover, formulate flood control plans, and build new infrastructure.

And as a senior member of the Committee on Transportation and Infrastructure, I have co-sponsored and voted in favor of the House's Water Resources Development Act, which passed the House earlier this year.

Let me also note that I strongly support the important provisions in the Senate Water Resources Development bill on which Senator Cardin has worked that would improve financing for water infrastructure.

However, I would like the size of the WRDA bill ultimately adopted by Congress to be significantly increased to provide more money to meet our urgent need for new infrastructure to control floods, improve our ports and dams, and restore vital ecosystems.

We have a very steep backlog of authorized projects just waiting for funding and we can no longer afford to make our infrastructure last on the nation's priority list.

Rather than handing out tax cuts to billionaires, we should be helping communities like Ellicott City rebuild and become more resilient before the next storm comes – because, sadly, we know it will come.

I'm so honored to have Senator Cardin as my partner in this effort and I thank him again as we continue the fight for the future of Ellicott City.

###

Senator CARDIN. Thank you, Congressman Cummings.

Just really for the benefit, the Water Resources Development Act that Congressman Cummings was referring to passed unanimously in the Environment and Public Works Committee. It's now pending on the floor of the Senate. We may bring it up as early as this week. It is looked upon as a noncontroversial bill, but it provides tremendous increased resources for water projects in our country. So we are optimistic that we will get that bill done before the end of this Congress.

I'm now going to call our first panel, which consists of our Federal partners. Cecil Rodrigues is the Deputy Regional Administrator for Region 3 at the U.S. Environmental Protection Agency. Mr. Rodrigues joined EPA in 1987 and held a variety of positions during his time with the Agency. He spent the early part of his career in Region 3's Office of Regional Counsel and served in several leadership positions. He received his B.A. in political science at Adelphi University in 1984 and his J.D. from New York Law School in 1987.

Colonel John T. Litz is the Commander and District Engineer of the U.S. Army Corps of Engineers, Baltimore District. I was at his Change of Command ceremony just a few weeks ago. You'll all, of course, know Colonel Chamberlayne and the work that he did as our District Director, and we very much look forward to the seamless leadership in our State under Colonel Litz.

Colonel Litz became the 68th Commander of the U.S. Army Corps of Engineers, Baltimore District, on July 13th of this year, where he commands a work force of more than 1,000 employees, overseeing a multibillion-dollar program that provides planning, design, engineering, construction, environment contracting, and real estate expertise throughout the Baltimore District.

And I must tell you; again, speaking for what Congress has made available to the Army Corps, the budgets this year have been more predictable and greater flexibility, so we are proud of bipartisan support for the work of the Army Corps.

I do want to acknowledge another Federal partner who I know is here, is not on our panel, is not under the jurisdiction of this Committee: Steve Umberger, who represents the Small Business Administration, the Baltimore District. I particularly want to mention him because I am the ranking Democrat on the Small Business Committee.

But this hearing is going to focus on the jurisdiction of the Environment and Public Works Committee.

And Secretary Ben Grumbles is here, who is—oh, back there—who is the comparable State head of our environmental agency and has been a tremendous resource for our Federal delegation as we've worked to deal with the Chesapeake Bay and other issues.

Ben, it's really nice to have you here, also.

We will proceed first with Mr. Rodrigues and then Colonel Litz.

By the way, for all witnesses, your entire statement will be made part of the record. We ask that you summarize in approximately 5 minutes to give time for questions and answers.

And Delegate Flanagan is also here. I acknowledge that he's here. I don't know if I have any of the other electeds that may be here, but it's a pleasure to have our Member of the House here.

STATEMENT OF CECIL RODRIGUES, DEPUTY REGIONAL ADMINISTRATOR FOR REGION 3, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. RODRIGUES. Senators Cardin and Van Hollen and Congressman Cummings, thank you for the opportunity to appear before you today to discuss EPA's role in assisting communities to reduce their risks of flooding events like those that have occurred in Ellicott City, Maryland.

Excessive stormwater runoff has serious and costly effects throughout our country. The EPA considers it one of the leading causes of water quality impairment and diminished watershed health. It can overwhelm our sewer systems, erode our stream banks, pollute our waters, and in the case of Ellicott City, devastate our towns.

The EPA works with other Federal agencies and the States to reduce stormwater runoff and build resiliency in our communities. We do that through the Clean Water Act, funding, and regulatory programs, and we do it through innovative approaches like the Clean Water Partnership and the Green Streets, Green Jobs, and Green Towns programs that I'll mention a little later.

Maryland has been a leader in addressing stormwater runoff. The Maryland Department of the Environment has set aggressive goals to control stormwater as part of a commitment to reduce pollution into local waters and the Chesapeake Bay, requiring restoration of 20 percent of untreated impervious surface areas as part of the Phase I Jurisdictions Municipal Separate Stormwater Sewer System permits.

Howard County, which includes Ellicott City, developed a county-wide implementation strategy to address the MS4 requirements, and by the end of September 2016, has restored more than 1,400 acres of impervious surfaces.

Among its other permit related activities, the county created a manual that outlines standards for design of stormwater systems in new development and redevelopment and has completed detailed assessments and maps of all the watersheds within the county.

EPA assists Maryland and States throughout the Nation in controlling stormwater through the Clean Water State Revolving Fund, or SRF, which provides low interest loans through the States to support critical water infrastructure projects. Since its inception of the SRF Program, EPA Region 3 has provided States within our region with \$145 million, which have been used to fund almost 124 projects, including 30 in Maryland for—which cost approximately \$37.4 million. The projects range from green infrastructure to stormwater sewer systems.

This Administration's focus on accelerating investment in our Nation's water infrastructure also includes the Water Infrastructure Finance and Innovation Act, also known as WIFIA. This program provides for long term loans for a diverse range of regionally and nationally significant water infrastructure projects, which can include stormwater control projects.

EPA's Water Infrastructure and Resiliency Finance Center provides technical and financial information to help local officials make informed decisions on stormwater, drinking water, and wastewater infrastructure projects.

The Center created a searchable clearinghouse for resources and funding information for EPA and other Federal agencies and State agencies, a kind of one stop shop for communities to address these issues.

In this region, we are looking beyond traditional funding sources and partner with nonprofit and the private sector to create innovative programs that offer multiple benefits of green infrastructure to capture stormwater.

For example, earlier this year the EPA and the Chesapeake Bay Trust, with the support of the city of Baltimore and the Maryland Department of Natural Resources, provided our eighth set of grants under the Green Streets, Green Jobs, Green Towns Program with nearly \$700,000, with a local match of nearly \$1 million for 21 projects. Ten of them were in Maryland. Since 2011 we have awarded \$8.4 million to 145 projects throughout the region, leveraging more than \$13.8 million in matching funds.

The G3 Program helps communities implement plans that reduce stormwater runoff and flooding, increase the number and amount of green spaces in urban areas, and improve the health of local waters and the quality of life in cities and towns, all of which can be replicated elsewhere in the Chesapeake Bay Watershed, including Ellicott City.

EPA also encourages local governments to work with us in establishing community based public-private partnerships to generate faster, cheaper, and greener controls for stormwater and provide considerable benefits for the local economy and communities. Two examples model the EPA's approach of the Clean Watershed Partnership. One is Prince George's County, and a similar one in Chester, Pennsylvania. In addition to addressing stormwater, these partnerships support local jobs, training opportunities, and assistance with small and minority owned businesses, with significant local economic impact.

We need to support innovations in project delivery and financing to enable large scale investments in green infrastructure for public health, infrastructure resilience, and neighborhood benefits. As the threat of major storms increases, so too must our resolve to help local communities protect themselves.

In conclusion, I'd like to thank you, Senators Cardin and Van Hollen and Congressman Cummings, for the opportunity to testify here before you today. EPA looks forward to building on its work with the States and our communities in our region and across the Nation to enable them to tackle the harmful effects of stormwater, which can lead to the kind of devastation we've witnessed in Ellicott City.

I would be happy to answer questions at the end.

[The prepared statement of Mr. Rodrigues follows:]

**TESTIMONY OF
CECIL RODRIGUES, DEPUTY REGIONAL ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 3**

**BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
SUBCOMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
UNITED STATES SENATE**

**Oversight Hearing on Repeated Flooding Events in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events**

August 20, 2018

Chairman Inhofe, Ranking Member Cardin and Members of the Committee. I am Cecil Rodrigues, Deputy Regional Administrator for Region 3 of the U.S. Environmental Protection Agency. Thank you for the opportunity to appear before you today to discuss the EPA's role in assisting communities to reduce their risks of flooding events like those that occurred in Ellicott City, MD.

Excessive stormwater runoff has serious and costly effects across our country. The EPA considers it one of the leading causes of water quality impairment and diminished watershed health. It can overwhelm our sewer systems, erode our stream banks, pollute our waters and, in cases such as Ellicott City, can devastate our towns.

The EPA works with other federal agencies and the states to reduce stormwater runoff and to build resiliency in our communities. We do that through Clean Water Act (CWA) funding and regulatory programs. And we do it through innovative approaches like the Clean Water Partnership and the Green Streets, Green Jobs, Green Towns (G3) program.

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restoration of 20 percent of untreated impervious surface area as part of the Phase 1 jurisdictions' Municipal Separate Storm Sewer System (MS4) permits.

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Maryland Department of Natural Resources, provided our eighth set of grants under the Green Streets-Green Jobs-Green Towns (G3) program – nearly \$700,000 with a local match of nearly \$1 million for 21 projects – 10 of which are in Maryland. Since 2011, we have awarded \$8.4 million to 145 projects throughout the region, leveraged with \$13.8 million in matching funds.

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We need to continue to support innovations in project delivery and financing to enable large scale investments in green infrastructure for public health, infrastructure resilience, and neighborhood benefits. As the threat of major storms increases, so too must our resolve to help communities protect themselves.

In conclusion, I would like to thank you, Ranking Member Cardin and Members of the Committee, for the opportunity to testify before you today. The EPA looks forward to building on its work with states in our region and across the nation to enable them to tackle the harmful effects of stormwater, which can lead to the kind of the devastation witnessed in Ellicott City. I will be happy to answer any questions you may have.

Senator CARDIN. Thank you very much.
Colonel Litz.

**STATEMENT OF COLONEL JOHN T. LITZ, COMMANDER,
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS**

Colonel LITZ. Thank you. Senator Cardin, Senator Van Hollen, Representative Cummings, I'm honored to testify before you today on the U.S. Army Corps of Engineers's role and response to the recent devastating flooding in Ellicott City, Maryland. I'm Colonel John Litz, Commander of the U.S. Army Corps of Engineers, Baltimore District.

Following the unprecedented Ellicott City flood in 2016, which equated to a flood with a 0.1 percent chance of happening during a given year, the Baltimore District provided post-flood response at the request of the Governor of Maryland to clear debris blockages in the Tiber and Hudson tributaries. This action reduced further risk of immediate flooding to the city as more rainfall was forecasted in the coming days.

This help was provided through Public Law 84-99 (33 U.S.C. 701n), which gives the Corps discretionary authority to react to various water related emergencies. The Corps provides assistance when natural disasters or other emergencies occur after State and local governments have exceeded their capabilities.

In addition to our emergency response, the Corps also leveraged the Floodplain Management Services Program, or FPMS, authorized by 206 of the Flood Control Act of 1960. The FPMS Program allows the Corps to provide general technical services and planning guidance to State, regional, and local governments without charge and within program funding limits.

Using the FPMS Program authority, an agreement was signed in September 2016 by the Baltimore District and Howard County to conduct a 12-month effort to assess the potential for nonstructural flood risk mitigation activities, such as flood proofing some or all of Ellicott City's historic structures located in the 0.2 percent floodplain, commonly known as the 500-year Floodplain. Howard County voluntarily provided the Corps \$150,000 for this effort.

The Corps reviewed information on previous floods in the area, to include the depths, velocities, warning times, and elevation surveys for 80 buildings in this 500-year Floodplain. These surveys included identification of the first floor elevation, the lowest point of entry, the lowest adjacent grade, nonstructural flood proofing assessments for 16 example structures, preliminary construction costs for recommended nonstructural measures, flood action plans needed to implement any recommendations, and a cost-benefit analysis. The Corps also participated in outreach activities within the community.

Nonstructural flood mitigation is important because it can reduce flood damages and is typically less expensive than structural solutions such as levees and floodwalls. Nonstructural flood mitigation is also customizable to individual properties and can be implemented in phases.

Examples of nonstructural measures include flood warning systems, moving valuables to higher levels, raising utilities, water-

proofing buildings by applying sealant, installing flood doors, flood-gates, and closures on doors and windows.

The Baltimore District provided Howard County with a report on their findings in January 2018, and conducted a public meeting in February 2018 to present the results.

It is important to note that nonstructural measures, including flood proofing, would not have prevented all the damages sustained during the 2016 flood or the flood earlier this year. However, certain measures may reduce flood risk during less severe floods or enhance community resilience by allowing communities to bounce back after a storm.

The Corps recognizes that implementing these options can be challenging given the estimated cost ranges and working through certain historic preservation constraints. These are all things to consider when determining the best way to reduce flood risk on individual properties.

The Baltimore District and the U.S. Army Corps of Engineers as a whole are incredibly proud to contribute to the safety and recovery of this historic and important city.

Thank you, Senator Cardin and Senator Van Hollen and Representative Cummings. This concludes my statement, and I look forward to answering any questions that you or other members may have.

[The prepared statement of Colonel Litz follows:]

**DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS**

COMPLETE STATEMENT OF

**COLONEL JOHN T. LITZ
COMMANDER, BALTIMORE DISTRICT**

BEFORE

**COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE**

**Oversight Hearing on Repeated Flooding Events in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events**

August 20, 2018

Mr. Chairman and Members of the Committee:

I am honored to testify before you today on the Corps role and response to the recent devastating flooding in Ellicott City, Maryland. I am Colonel John Litz, Commander of the U.S. Army Corps of Engineers (Corps) Baltimore District.

Following the unprecedented 2016 flood in Ellicott City, which equated to a flood with a 0.1 percent chance of happening during any given year, the Baltimore District provided post flood response at the request of the Governor of Maryland to clear debris blockages in the Tiber and Hudson Tributaries. This action reduced further risk of immediate flooding to the city as more rainfall was forecasted in the coming days.

This help was provided through Public Law 84-99, as amended (PL 84-99), 33 U.S.C. § 701n, which gives discretionary authority to the Corps to react to various water-related emergencies. The Corps provides assistance when natural disasters or other emergencies occur, and after state or local governments have exceeded their capabilities.

In addition to our emergency response, the Corps also leveraged the Flood Plain Management Services, or FPMS, Program authorized by Section 206 of the Flood Control Act of 1960, as amended. The FPMS program allows the Corps to provide general technical services and planning guidance to state, regional, and local governments without charge, within program funding limits.

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buildings in the 500-year floodplain. These surveys included: identification of the first-floor elevation; the lowest point of entry; the lowest adjacent grade; nonstructural flood-proofing assessments for 16 example structures; preliminary construction costs for recommended nonstructural measures; flood action plans needed to implement any recommendations; and a cost-benefit analysis. The Corps also participated in outreach activities with the county.

Nonstructural flood mitigation is important because it can reduce flood damages and is typically less expensive than structural solutions such as levees or floodwalls. Nonstructural flood mitigation is also customizable to individual properties and can be implemented in phases. Examples of nonstructural measures include flood warning systems, moving valuables to higher levels, raising utilities, and waterproofing buildings by applying sealant, and installing flood doors, flood gates, and closures on doors and windows. The Baltimore District provided Howard County with a report of their findings in January 2018 and conducted a public meeting in February 2018 to present the results.

It is important to note that nonstructural measures, including flood-proofing, would not have prevented all the damages sustained during the 2016 flood or the flooding earlier this year. However, certain measures may reduce flood risk during less severe floods or enhance community resilience, by allowing communities to 'bounce back' after a storm.

The Corps recognizes that implementing these options can be challenging given the cost ranges as well as working through certain historic preservation constraints, and these are all things to consider when determining the best way to reduce flood risk on individual properties.

The Baltimore District, and the U.S. Army Corps of Engineers as a whole, is incredibly proud to contribute to the safety and recovery of this historic and important city.

Thank you, Mr. Chairman and Members of this Committee. This concludes my statement and I look forward to answering any questions that you or other Members of the Committee may have.

Senator CARDIN. Well, thank you both for your testimony.

Let me first start by agreeing with Congressman Cummings as to the need for us to look at stronger ways of being able to deal with the backlog, let alone the challenges we have moving forward, in regards to our infrastructure in this country, including flood mitigation. We need to be more aggressive on that, and I really do believe there's bipartisan support.

The Chairman of the Subcommittee, Senator Inhofe, talks frequently about bipartisan support for more robust infrastructure projects. That's not a conservative—or, concern, so we should be able to do a better job there, and we're going to continue to work on it.

I want to focus on what we can do in mitigation. You talk about nonstructural measures, and I understand what you're referring to in the individual properties and the warning systems. But there's also been some recommendations or thoughts about structural changes, trying to increase the water capacity of the tributaries either by widening or redirecting or doing different measures to have a more permanent type of a change.

The realities of population growth and the impervious surfaces have made it more challenging, and of course, the weather has been more severe. So, you put that all together, without some structural changes, it's going to be difficult to see that we don't have a repeat of what happened during these last two storms.

So, can you just share with us how either the Army Corps or EPA can assist in both structural and nonstructural mitigation programs?

We know that there have been many studies—there's been several studies that have been done. We know that we're still trying to figure out where is the most cost effective place to put resources. And we also recognize that it's unlikely it'll be one funding source that'll be able to deal with solving the problems. But there are different tools available. If you could just quickly review where the Federal Government can help in regards to both structural and nonstructural?

Colonel LITZ. Senator, I'll take that question.

So, what the Corps recommends are two types of efforts: Near term and long term. And in the near term, to conduct risk communication so that those in this area understand the risks involved posed by the water and the rainfall events that have happened and could continue to occur. And also, that includes preparing for floods as well, as a community and also as individuals. And implement the flood proofing measures that the Corps has recommended.

In the long term, take a more comprehensive and collaborative approach. Two things that I will offer is to endeavor in a watershed-wide study, not just a study in the local area, in Ellicott City and close surroundings, to get the big picture and develop a holistic solution for the runoff and for the flooding in the tributaries, as so many of them converge in Ellicott City.

A second effort to—

Senator CARDIN. Do you have enough information to make that assessment today? Or do you need to do further studies as regards the water problems and runoff?

Colonel LITZ. Senator, we would need to study that. From the Corps' perspective, we would need to study that. I know that there is a study—

Senator CARDIN. What do you need from Congress in order to move that along?

Colonel LITZ. We would need an authorization and appropriation, and depending on the magnitude of that study, that would determine which service that the Corps is authorized to provide that we would trigger. If it's a small effort, say less than \$15 million, then we could look at the Corps' continuing authority's set of authorizations.

And if it's a larger effort, over \$15 million, typically what you would find a structural solution falling into the category of—we would have to have an authorization for a feasibility study and an appropriation to make good on that authorization. And then once the feasibility study is conducted, and should the project have a benefit to cost ratio that competes well nationally, we would have to have an authorization for the design, pre-engineering design work, and also construction.

Senator CARDIN. So, for structural, it appears like you would need specific authority and funding from Congress; is what you're saying?

Colonel LITZ. Yes, Senator.

Senator CARDIN. For nonstructural, you probably have enough authority?

Colonel LITZ. And we—

Senator CARDIN. You've already done so.

Colonel LITZ. Yes, Senator. We did that with the Floodplain Management Services, which is a standing authority that we have from the Flood Control Act of 1960.

Senator CARDIN. And Mr. Rodrigues, you mentioned several programs locally could qualify for funding for various aspects of flood mitigation; is that—

Mr. RODRIGUES. Sure. Yes, Senator. So we have been—for instance, we've given Howard County, through the Maryland Department of Natural Resources and the Chesapeake Bay money, \$100,000, which Maryland gave, and then \$50,000 that EPA gave through a Chesapeake Bay implementation grant to study two things. One was to look at water infrastructure assessment, green infrastructure assessments. Also, to study the—originally the flood from July 2016 to determine water measures that can be taken.

In addition, we've worked with communities to develop some public-private partnerships which fund and increase quickly—increase the use of green infrastructure projects.

The Agency also has the WIFIA grants, loans, which communities like Ellicott City, in conjunction with the State, can apply for which can give direct funding to stormwater projects.

So there are numerous sources the Agency has in the past and will continue to work with communities like Ellicott City and Howard County to apply for and determine what's the best type of funding mechanism.

Our Water Infrastructure and Resiliency Center can help finance. The Resiliency Center can help communities look at what's the best type of financing to get and what are the better projects

to spend the money on. So we have several resources that communities like Ellicott City and Howard County can partner with the Agency to do.

One other thing I'd like to mention is we have also tried to partner with our other Federal agencies, so with FEMA and the Army Corps. In Huntington, West Virginia, we've partnered with FEMA and the Army Corps to work with the community to determine its needs and then try to work as one Federal Government to direct resources. That's an opportunity that we can work with the county or—and the city to help look at alternative sources of funding that maybe they have not looked at and thought of.

Senator CARDIN. I thank you for that because we're going to have to be creative. I do point out: The WIFIA program and TIFIA are the traditional—were creations through the Environment and Public Works Committee to leverage more funds because we recognize there will never be enough funds. So we have to leverage the best we can. WIFIA does present some opportunities for us here in Ellicott City.

Senator Van Hollen.

Senator VAN HOLLEN. Thank you, Senator Cardin.

Thank both of you for your testimony here.

So, Colonel Litz, you mentioned the study that had been done by the Army Corps after the 2016 flood, focusing on the nonstructural flood proofing study. And as I understand that study, it primarily recommends to homeowners or businesses things that they might do to better protect themselves in the case they have another flood; is that right?

Colonel LITZ. Yes, Senator. That's correct.

Senator VAN HOLLEN. And the costs in those cases are borne by the homeowner or the storeowner; is that right?

Colonel LITZ. Yes, Senator.

Senator VAN HOLLEN. Do we know whether any of—I know this report didn't come until January of this year, but I know you were engaged in the study for a while. Do we know whether or not any of the homeowners or storeowners implemented any of these changes and whether that helped reduce the damage in the last flood?

Colonel LITZ. Senator, the final report came out in February of this year, so I do not know if any of the storeowners or homeowners had an opportunity to implement any of these recommendations. I think I would leave that to others to answer.

But I know that the Corps has engaged in similar studies over the past couple of decades in other places: In West Virginia, Virginia, at least. Maybe over a thousand flood proofing recommendations have been implemented successfully. In Huntington, West Virginia, there's an effort ongoing now that my colleague from the EPA mentioned earlier.

So we do know that these measures are feasible and that they can work. But as I stated in my comments, the magnitude of the events that happened in 2016 and 2018 that brought us here today, these measures would not have prevented those damages.

Senator VAN HOLLEN. Right. And so that leads me to your sort of longer term recommendations because I understand your sort of immediate term is risk communications and implementing the non-

structural proposals that you recommended. But really, as you just said, if we want to really try to limit the damage of flooding like we saw earlier this year and in 2016, we're going to have to take other measures.

I know Howard County and the community are engaged in a debate about the extent to which local development has an impact on floodwaters, and we await sort of the outcome of that discussion and are engaged in listening.

But in terms of your more permanent solutions, there was this report that was done in 2014 that was updated after 2016, and I know you're relatively new on the beat. Congratulations again on that. But there was an Ellicott City Hydrology and Hydraulic Study and Concept Mitigation Analysis where they made some specific recommendations with respect to changes that could be made that would affect the quantity of water and the flow of water.

And I don't know if you and your team have had a chance to really dig into that. If you haven't, I urge you to do it because, as Senator Cardin said, we need, obviously, to have a plan. There has been work done here, and so rather than reinvent the wheel, maybe we can find a way for everybody to take a look at that, update it if need be, and look about whether there's agreement those specific proposals would in fact reduce the damage from the flooding.

And then we have to get it done. Obviously, part of that, we have to figure out how to pay for it, and there's local funding, there's State funding, and Senator Cardin said there's Federal funding. But we've got to make sure that we come to agreement.

Have you had—do you know, have you and your team had a chance to look at that earlier study? And what do you think, if you did?

Colonel LITZ. Senator Van Hollen, I believe the study that you're referring to is the McCormick and Taylor H&H Study. And if that is the case, then yes, my team has looked at that study. They read it, they understand it, and they used it to inform their study that they—for the nonstructural flood proofing recommendations, to some extent.

So I do know that we understand this study of the district. Personally, I have not had a chance to see that study yet. But we do know the content of that study and that it makes recommendations for structural elements to protect Ellicott City and other areas. So—

Senator VAN HOLLEN. Maybe I could just ask, Senator, if you and your team could provide us any comments you've got on that study with its structural recommendations? It makes two very specific ones: Quantity management, to reduce the quantity of flow into Frederick Road and Main Street corridor, and a second, conveyance improvements. And there were some specific conveyance improvements.

So I think it would be helpful if we can all sort of be on the same page as to what needs to be done, and then we can all figure out how the funding will work to get it done.

Colonel LITZ. Yes, Senator. We can provide a follow up statement to that effect.

Senator VAN HOLLEN. Thank you.

Senator CARDIN. Congressman Cummings.

Representative CUMMINGS. I want to just pick up where both Senators left off. Whenever I come to a hearing like this, I try to put myself in the seat of the people who are sitting out there and what they're thinking and what questions that they would ask.

And if I were a business owner, or even a resident, I would ask the question: Do we know why this happened, Colonel? The flood, the situation? And the destruction? I mean it looked like—I mean—well, you saw it. It was horrible. Go ahead.

Colonel LITZ. Representative Cummings, no doubt. I saw the footage before I took command of the floodwater rushing down the streets, and I was shocked that this was happening. I was brand new to the area. I hadn't even moved here yet. And I did move to Maryland, a little bit further down south. And I have had a chance to get out and walk around in Ellicott City this weekend to get a better appreciation for the problem that this city and this community is dealing with.

Representative CUMMINGS. I appreciate you doing that. Go ahead. No, go ahead.

Colonel LITZ. Thank you, Representative.

So, as to the cause, we know that there was what the National Weather Service states is a 1,000-year rainfall event, which is an incredibly intense amount of rainfall that—I think 6 inches in less than a couple hours, maybe more. And in this area, as everyone in this room is probably well aware of, it drains to one place very quickly.

And as to the causes of that, I cannot speak to why weather patterns are occurring and what's behind that. But I can tell you it's the intense rainfall. I can't tell you—

Representative CUMMINGS. I'm talking about the flooding recurrence. I'm talking about the flooding itself.

In other words, first of all, you've been in other places. I mean, have you seen anything comparable to this?

Colonel LITZ. I know of—just because my parents are from West Virginia, and there are some places back where they're from that it's an absolute deluge at times and have been wiping communities out for years, from what I've been told.

But I have not personally, my adult life, seen this sort of flooding.

Representative CUMMINGS. I got you. But let me say what I'm trying to get to. I'm trying to figure out—I try to be practical about things. And like many of the people in this room, they want to come back. Their livelihood depends upon it. And—but on the other hand, I guess some of them are saying, "How do I—what can we do to best assure that when we come back we don't face this over and over again?" I've talked to a number of folks here, and I mean that's the key question.

So I guess I'm trying to figure out has it—have we seen something comparable? And if we have, how was that dealt with? And is that something that we can bring to this area? You following me?

Maybe Mr. Rodrigues has an answer for that; I don't know.

Mr. RODRIGUES. The heavy rains have impacted numerous cities and communities all through the—up and down the East Coast.

The Agency has seen stormwaters through sewer systems that have just been—have had to be bypassed because of the severe amount of rain and severe amount of water that's been going through the systems as far up as New York and Pennsylvania.

These are issues that we are going to have to—is not going to go away, and we're going to have to start dealing with it. And part of that is a combination of looking at structural changes, grade changes that have to be made, increasing our sewer—improving our sewer systems, but also green infrastructure. But also, rethinking and looking at, as I think the Senator mentioned before, looking at stormwater on a watershed basis to—and getting communities to work together to help address these situations.

Because this is—while we can do things on a very local basis, the answer is probably—it is going to be on a watershed basis and looking at how do we get our communities together to work together to address these because—

Representative CUMMINGS. I think we can get the communities together. I think they're already together. That's not the problem. [Applause.]

Representative CUMMINGS. I guess—maybe it's because I spent 6 months in the hospital. I have a different view of life, and that is that we only have one life to live; this is no dress rehearsal, and we may be gone tomorrow. But while we're here, this is our watch.

And I guess I'm trying to figure out how soon do you—either of you—see us being able to work this out, best case? Because that's what they want to know. I'm telling you; they may not say it, but if I were them, I would want to know.

Colonel LITZ. Congressman Cummings, so from the studying that I've done preparing for this and since I've been in command, I know that I think it was back in 1994 there was a study. There are several studies that have taken place for flooding and to address this issue, even going back to the 1970s.

And I think in the 1994 study, flood mitigation solutions were—some recommendations were made, things were studied, and I think the determination was that the locations—I think there were issues with the real estate, it's too far north, the measures weren't—it just wasn't feasible, or it wasn't economically feasible, it didn't make the benefit-cost ratio cut off to be competitive.

So I know the problem has been studied, but that doesn't mean that new methods, new technology isn't there to help. And I'm talking significant structural things that we can do. And the question is what are they, where would they go, and what would be the cost? And all of those things, in my—from the Corps' perspective, would require a deliberate study.

And there is a study authority from that very 1994 study that I just mentioned, but it hasn't been funded in a while. We would need to get reauthorized and appropriations put against it to take—to commence to another general investigation feasibility study.

Representative CUMMINGS. I see my time is up, but let me say this, and I know that Senator Cardin and Senator Van Hollen feel the same way: You will not get a delegation that will work closer and harder with you all to get this resolved and soon, as soon as we can. And we understand you don't have all the answers. But

we're here, and you've got a State Governor and certainly all of our community, residents and storeowners and shop owners. We're here.

Yes, you see them. You can look around and see them.

Thank you very much, Senator.

Senator CARDIN. Thank you, Congressman.

Let me just connect a couple dots here for my colleagues. In regards to what individual property owners can do, what the county can do within reasonable dollar amounts, we're going to take you up, Mr. Rodrigues, and take a look at all the Federal partnership programs we have under EPA and see how we can leverage that most effectively to harden as best as we can against the realities of flooding.

And we think we can do more. We can be more effective. There's good information out by the studies that have been done already. So we do have a blueprint, I think, on dealing with that area.

I think what my colleagues and I are saying, though, is that we recognize that we do need structural improvement. And yes, that's very expensive, and yes, we need to know what works and the cost-benefits of all of these issues.

So there's been conversation at the county level about changing the flow, widening the tributaries, dealing with some of the current ownership of land in order to make that more of a reality by changing use. All that has been under consideration. And as the County Exec has said, we'll consider any options. We want to do what the community wants us to do.

So we need from you, Colonel Litz, the best information we can. I think what you're telling me is that you may need—you will need additional guidance from the Congress on this issue. So my colleagues and I will go back to see how we can get you that so we can move as quickly as we possibly can in the broader watershed because that looks like what we're talking about is going to have to be done.

But we do know that there's conversations here in the county about taking those bold steps. And the community is prepared to do it, as is the leadership of this county prepared to do it. But they're going to need our help as to what makes sense, what is feasible, and they're going to need our help on partnership from the point of view of resources. So let's figure out how we can move forward on those issues.

Let me thank both of our panelists again. This is not the last time we'll be having a conversation about it. We thank you all very much.

We're going to move on to our second panel, which includes Mark DeLuca, who is the Chief of the Bureau of Environmental Services in the Howard County Department of Public Works. He has been a busy person during these last couple years, a person who we have seen quite frequently and have worked with.

Jon Weinstein represents Howard County's District 1, including Ellicott City, Elkridge, Hanover, and Columbia. He's also been a very busy person during these last 2 years. We have walked the streets together many times, talked to a lot of the neighbors about these issues, and he's been an incredible leader in trying to get us on the right path.

Grace Kubofcik is the Board President of Patapsco Heritage Greenway and has been a resident of Ellicott City for more than 49 years and has been very active in those years. She's spent her career in public service at the Social Security Administration, Maryland Department of Human Resources, and Executive Assistant to the Howard County Exec.

You've been a busy person. Thank you for your public service.

And Matt Fleming is the President of the Ellicott City Partnership, which is a 501(c)(3) nonprofit that seeks to preserve the heritage and vitality of Old Ellicott City while enhancing and creating its economic growth. Dr. Fleming has been a resident of Ellicott City since 2006.

And I've been told that Jen Terrasa is also here, a member of the County Council of Howard County. Let me just acknowledge her presence.

There she is. Thank you.

We'll start with Mr. DeLuca.

STATEMENT OF MARK DELUCA, DEPUTY DIRECTOR AND CHIEF OF ENVIRONMENTAL SERVICES, HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS

Mr. DELUCA. Thank you, Senators Cardin and Van Hollen and Congressman Cummings, for the opportunity to appear before you today.

I'd like to start by describing the Tiber-Hudson Watershed in a little bit more detail than we've gotten into so far. The watershed is very small. It's 3.7 square miles, which means that a drop of water at the top of the watershed will find its way to the Patapsco, its only drainage point, in a relatively short period of time. And those three tributaries running through it, the Hudson, the Tiber, and the New Cut Branches, all of which, as mentioned before, flow to the Patapsco.

The topography is characterized by steep slopes and has shallow bedrock which, as a result, makes the water move a lot faster; it doesn't soak into the ground, and finds its way to the Patapsco and Main Street much more quickly.

There's a history of 21 flood events in Ellicott City since 1768. Fifteen of those events were caused by the Patapsco rising. Six of the events were caused by tributaries flooding. The last three events were in 2011, 2016, and 2018. They were all tributary flooding events.

On July 30th in 2016, while the region experienced common normal thunderstorms, say 1 inch per hour, give or take a little bit, or less, Ellicott City experienced 6 inches in 2 hours. And that caused a 6- to 8-foot wall of water to travel down Main Street.

Similarly, on May 27th of this year, 2018, the region again experienced typical thunderstorms, but again, Ellicott City experienced 7.5 inches in 5 hours, with the majority of that happening over about 3 hours and another 6- to 8-foot wall of water going down Main Street.

The Weather Service described these storms as back building storms. It was something that we had never heard of in my circle—excuse me. In my circles, we had never heard of that before. And we were told that it's not something that could be predicted, when

and where they might occur. They also indicated to us the frequency and intensity of severe storms is on the rise, especially in the Northeast.

Within this context of information, we began comprehensive modeling of the watershed in 2016. Basic design principle was to minimize the water spilling out of the culverts and channels onto the street so that it posed less of a threat to property and life. The 100-year storm was modeled, in addition to the July 30th, 2016, storm.

The study identified 18 potential locations to retain stormwater as well as recommending needed conveyance improvements. The cost was estimated to be approximately \$80 million.

In August 2017 four projects were selected to move forward based on the positive impacts they would have on the community. However, even with all 18 projects, the modeling only showed modest reductions in water elevations on the upper end of the Hudson Branch and less on the lower Tiber, or the lower part of Main Street near the Patapsco River.

So we realized that structural solutions were not the end all be all, they weren't the only piece of the overall solution, and that we needed to search out other things.

We engaged with the Corps of Engineers, as you've heard, to evaluate flood proofing strategies for the town, and after the study was done, we set aside a modest pool of money for grants to kick start the flood proofing program.

And we've taken a hard look at correcting and removing pinch points in the channel conveyance, such as 90 degree bends, significant reductions in the channel size. If you've been out there, you see it. The channel goes from 50 feet to 15 feet. That might have been excellent for a mill town back in the 1800s, but it doesn't really have a purpose today other than to be detrimental to the community. And other constrictions posed by buildings that straddle the channel.

So—but our resources are strained, with the greatest challenges being funds to implement the plan. FEMA has been a lifeline, certainly a lifeline immediately after these events, to restore the infrastructure. But we ask for help in being able to maximize funds from pre-disaster mitigation and flood assistance grant programs. We need help navigating the process.

And even with this assistance, these programs may be limited in the contribution they can make. So we are asking what other programs there are that may help us bridge the funding gap that we find ourselves in.

We have much work to do to restore this community to a more resilient and sustainable form, and we can't ignore the urgency to get the work done.

So, again, thank you for this opportunity, and I look forward to answering any questions you may have.

[The prepared statement of Mr. DeLuca follows:]

**Testimony of
Mark DeLuca
Deputy Director and Chief of Environmental Services
Howard County Department of Public Works**

**Before the
Committee on Environment and Public Works
Subcommittee on Transportation and Infrastructure
United States Senate**

**Oversight Hearing on Repeated Flooding Events in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events
August 20, 2018**

Chairman Inhofe, Ranking Member Cardin, and Members of the Committee, thank you for this opportunity to testify before you today. My colleagues and I appreciate your work on the Environment and Public Works Committee and I know I also speak for them when I say we are excited to share what we have experienced and observed, as well as discuss our plans for Ellicott City.

Never in my 35-year engineering career did I ever expect to deal with emergency restoration and flood mitigation efforts for as many as three major events in less than 10 years. Those rain-soaked nights in 2011, 2016 and 2018 when I received phone calls describing significant flood conditions in Historic Ellicott City are indelibly printed on my memory.

As we picked up the pieces and moved forward to develop and implement suitable plans for flood mitigation, we have also eagerly engaged in the challenge to make the community sustainable, but it has equally shown us our limits and the strain on our resources and the necessary funds to put our plans into actions.

FEMA has been a lifeline in our effort to put the community back together again, and those programs are greatly appreciated. We also realize we must take full advantage of the pre-disaster mitigation and flood assistance grant programs as well as other opportunities if we are to ever move our flood mitigation plans further.

Again, thank you for being here today and thank you for this opportunity to speak with you. I look forward to any further information I may share or answer any questions you may have for me.

Senator CARDIN. Thank you.
Councilman Weinstein.

**STATEMENT OF JON WEINSTEIN, COUNCIL MEMBER,
DISTRICT 1, HOWARD COUNTY COUNCIL**

Mr. WEINSTEIN. Thank you, Senator. Jon Weinstein, Council Member for District 1, representing Historic Ellicott City.

Thank you very much, Senator Cardin, Senator Van Hollen, and Congressman Cummings, for being here at this very important hearing to hear representatives from our community and to help us in moving forward.

I'd like to start by thanking you, the Federal members who have been actively engaged in response to the floods in 2016 and 2018 and our recovery efforts. I'd like to recognize your partnership—as you all pointed out, it's critical to our success—and the partnership among the local, State, and Federal elected and government officials.

As it should be, natural disasters should be a time when those in public service focus on doing what's right. And I know that you all have demonstrated that, and I look forward to continuing that with you.

County Executive Kittleman and Governor Hogan, Delegate Flanagan, who's behind me as well, my colleagues on the Council, and our representatives, you have come from both major parties, yet partisanship never enters the question. We see partnership over partisanship, and that is going to be how we solve this problem.

You've heard from my friend here, Mark DeLuca. We've spent a lot of time together talking through all sorts of scenarios. You've heard from experts from the EPA and from the Army Corps. They all bring pieces of the puzzle—I'm going off script here. I know you may have my comments from before. And I do have some of the answers that you asked the previous speakers.

We've made progress, but things have changed. The frequency and severity of these floods, as Mark said, are not predictable. The National Weather Service informed us just a few weeks ago that they need help. So, on their behalf, they need funding and time to review how they look at storms, no longer looking at them in 24-hour periods but based on severity in short periods of time.

So the standards that we use in counties and localities all around the county to determine how we build, how we design stormwater facilities, it needs to be adjusted, and it needs to be reflective of our current scientifically based context of the changing climate.

We've talked about funding. That is simply the bottom line. Howard County, we're one of the wealthiest counties in the country, and we have lots of resources to bring to bear. But even we cannot bear the full cost of this recovery effort.

In Frederick County, there was a partnership between the Federal, State, and locals that basically shared a third each of a major project, a project, by the way, which took well over 20 years to execute and cost in the vicinity of \$60 million. We are talking about the same thing here.

We have opportunities to do things quicker and better because of the studies that have been done. The H&H study that's been re-

ferred to a couple times is regarded as a great blueprint, which we have been updating and revisiting since the day after the last flood just a few months ago. And we're hopeful to roll out a plan in the next week or so, if not sooner, that identifies the data driven recommendations for dramatic improvements to the conveyance of water through the town.

So we have looked at that, but funding it comes down. We are in a weird situation. The flood happened 3 days after we passed our budget, and we can't change our budget. By code and our charter, we can't just change our budget and add a whole bunch more spending to it. We have to get additional sources of revenue, which would be coming from the State and the Federal Government.

We had a great meeting with Secretary Grumbles and other Secretaries just last Friday to talk about all the various programs. But even they have a similar constraint in terms of how the dollars identified at the Federal level are spent.

There are rules that prevent our jurisdiction and jurisdictions around the country from building better replacements than what's been destroyed, which is somewhat illogical but is an outcome that we've seen as a result of other disasters like Hurricane Sandy, where the better solution is the more innovative, more technologically sound, more scientifically based solution that's grounded in today's information, not just going back and putting a pipe back in the ground that's the same size and configuration as was there before.

The huge pipe that was swept down and destroyed Ellicott Mills Drive, that intersection, which will take us many, many months to replace, we need to do something more comprehensive there, which we're working on. We have a great plan for replacing that, and the funding—we'll get some Federal funding for that. We're grateful for that. Unfortunately, that—we have to foot the bill up front. We have to pay 100 percent of it, and then we'll have to go through a process to get 75 percent of those funds back.

So, on the whole, funding remains, between the sufficiency of funds, the ease of access to those funds, and some of the local program rules. I have some solutions which are in my statement which I'd be happy to share with you during the question and answer period.

As well, just general support. I think the one thing the Federal Government can do to expedite this is to go more directly. Where you can come in, and there's a lot of scenarios where it goes to the State first, then to the counties, or some of the times the counties first. If you can go direct to the people who need the support, that would be best.

So, with that, I'll just conclude with one simple point. The solutions to these issues are possible. They're possible with comprehensive funding and support. Our county engineers and industry partners and experts in our community, in fact across the world, have come forward with recommendations that we are getting ready to put into place. We need the support to do that, and I'm looking forward to working closely with you to make sure it gets done.

Thank you very much.

[The prepared statement of Mr. Weinstein follows:]



Howard County Council

George Howard Building
3430 Court House Drive
Ellicott City, Maryland 21043-4392

Jon Weinstein
Councilmember

District 1

August 20, 2018

Testimony for the Senate Committee on Environment and Public Works' Subcommittee on Transportation and Infrastructure:

Oversight Hearing on Repeated Flooding Events in Ellicott City, MD: Reviewing the Federal Role in Preventing Future Events

Senators Inhofe and Cardin, thank you for the honor and opportunity for addressing the Senate Committee on Environment and Public Works' Subcommittee on Transportation and Infrastructure. On behalf of my constituents, Howard County's citizens, and my colleagues on the County Council, thank you for conducting this important field hearing regarding the devastating floods that have struck Ellicott City in 2016 and 2018.

I'd like to start by thanking members of the Howard County's federal delegation who have been actively engaged in the response to Ellicott City's 2016 and 2018 recovery efforts. Further, I'd like to recognize their partnership, and the partnership among local, state and federal elected and government officials. As it should be, natural disasters are a time when those in public service focus on working together to do what is right for the people; and our leaders have demonstrated this ethic. County Executive Allan Kittleman, Governor Larry Hogan, my colleagues on the Howard County Council, and our federal representatives, Senators Cardin and Van Hollen, and Congressmen Cummings and Sarbanes come from both major parties and have shown the power of bi-partisanship; something our respective constituents demand. This spirit of partnership over partisanship is a critical key to a successful and comprehensive recovery for Ellicott City.

With stark resemblance to recent flash flooding in Pennsylvania, New Jersey, New York, Colorado, Arizona, Utah and Oklahoma, people around the world have seen and heard of the devastating floods that nearly destroyed this amazing and quintessentially historic small American town. I will not recount the life changing events of July 30, 2016 and May 27, 2018. I trust that you have a sense of the unimaginable impact on the lives of those impacted by the floods, and the four lives lost as a result of them. My focus, the focus of the amazing people who live, work, and play in Ellicott City and the tremendous efforts of Howard County's dedicated public servants is on rebuilding this great town stronger, safer and smarter. We need your help to do that:

- **Funding** – The foundation of successful recovery is funding. Critical issues relating to funding include:
 - *Sufficiency of funds.* The funds local jurisdictions need often exceeds their capacity and the amounts provided by the federal government. The formulas used to determine funding levels does not consider the unique variables presented in each disaster and within specific communities. One example in the case of Howard County, is the timing of the latest flood a few days following passage of our FY 19 budget. Our county charter specifically restricts options for changing the budget after it passes. This situation combined with federal funds being disbursed as reimbursements after the expense is incurred could have the effect of delaying or otherwise inhibiting the recovery process and critical infrastructure repair efforts.
 - *Ease of access.* The alphabet soup of federal agencies and programs requires a level of knowledge, experience and access to information that local jurisdictions simply lack and do not have the resources to uncover, especially in the chaotic aftermath of a disaster.
 - *Logical program rules.* It appears that some federal monies can repair or replace damaged or destroyed infrastructure yet will not fully fund a project that will improve the old infrastructure. Why wouldn't the federal government want to encourage and support building a new asset that will improve the existing conditions and mitigate or even eliminate future devastation? This is illogical from investment, safety, and engineering perspectives.

Potential solutions to these funding issues:

- “Superfund” or block grant approach. Establish a one-stop source for managing and disbursing funds for comprehensive recovery activities that cover all aspects of a recover – public infrastructure, individual aid, private property, business support, and environmental remediation.
- Seek to fund and support innovative ways to mitigate floods and other disasters by encouraging building new infrastructure and address the impact of the changing severity and frequents of storms. Design and construction of infrastructure projects that are sensitive to environmental changes.
- Require retrofit for existing roadways with financial and engineering support for state and local infrastructure. Over the years, miles of interstate and state roads have been expanded or improved without commensurate expansion of the stormwater infrastructure or updates to outdated stormwater facilities. The federal government has both the responsibility and authority to take action on this front.

Support – The early days following a disaster consume every available resource, particularly in a small county like Howard. During this same period, the people impacted by the disaster have the greatest need to know about and access critical services. More direct support of individuals, businesses, property owners will help alleviate the burden on local governments to navigate the maze of programs and identify opportunities for assistance. Greater emphasis on grants versus

loans, particularly based on economic status of individuals, businesses, property owners. When loans are the only available vehicle, make sure the terms offer generous rates and repayment periods. Remember, few people (and some local governments) have the capacity to recover from unexpected disasters without significant disruption. Efficient and direct acquisition of destroyed properties by the federal government can simplify challenges local jurisdictions have with this process.

While I recognize that this committee does not address flood insurance, I do want to make a plea to work to improve that program to make it more affordable, hold insurance agents and companies accountable for failing to effectively disclose restrictions on coverage from flood damage (whether on their "standard" policies or flood specific policies). I would like to conclude with a simple point, the solutions to these issues are not complicated nor controversial. Our county engineers, industry partners, and experts in our community and across the world have shared their ideas and designed an array of solution options. Our challenge is funding and bureaucracy; something this body and the federal administration can do something to address. Here in Howard County, we have faced the recovery from these disasters head-on, engaging the public and our state and federal partners in identifying and designing the solutions in a bi-partisan manner. Howard County, the State of Maryland, and the United States Congress and Federal Administration have before us all, a great opportunity to turn this tragedy into a model for resiliency, and innovation. My constituents are counting on all of us to take the actions needed, as quickly as possible, and to push through any barriers to rebuilding Ellicott City safer, stronger, and smarter.

Senator CARDIN. Thank you very much for your testimony.
Ms. Kubofcik.

**STATEMENT OF GRACE KUBOFCIK, PRESIDENT, BOARD OF
DIRECTORS, PATAPSCO HERITAGE GREENWAY, INC.**

Ms. KUBOFCIK. Senator Cardin, Senator Van Hollen, and Representative Cummings, welcome. Welcome to the Patapsco Valley Heritage Area. We, the Patapsco Heritage Greenway, are the managing entity of this 24.6 square mile heritage area, the smallest of Maryland's 13 heritage areas.

Our Patapsco Valley is where people lived and worked during the 18th and 19th century on the banks of and land close to the Patapsco River. They supplied finished goods, like iron, textiles, paper, and flour, to a growing Nation and the world. From 1733, Elkridge Landing linked our valley to the Chesapeake Bay and to the world ports of Europe.

In 1772 the Ellicotts, two Quaker brothers, established the flour milling industrial village of Ellicott City, and since then, Ellicott City has stood as a well preserved 19th century mill town.

Within our heritage area are the mapped boundaries of the communities of Catonsville, Oella, Elkridge, Relay, and Ellicott City. There are 20 historic districts, 500 historic properties, which include 27 historic landmarks. One of those landmarks, the 1830 Ellicott City Baltimore and Ohio Railroad Station, the oldest surviving railroad station in America and the site of the first 13 miles of track ever constructed in America, is a National Historic Landmark.

The Patapsco Heritage Greenway rents office space on Old Columbia Pike in Ellicott City on Tonge Row, a group of buildings built by Ann Tonge in the 1840s for the residence for mill workers. Many of our partners in this audience—and there are many partners in this audience—could have been sitting at this table presenting testimony to you.

The night of July 30th, 2016, we began assisting in flood recovery. We used social media as a hub for information sharing, which continues to this day. We assisted in flood recovery efforts to ensure that all historic buildings were saved from demolition. We contacted and worked with our preservation partners, Preservation Maryland, who initiated structural engineering experts and staff reviews, and we secured building materials for stabilization efforts.

Preservation Maryland and the Howard County Department of Planning and Zoning helped property owners navigate tax credits and grants.

Our volunteer Stream Watch team members identified two major sewer leaks flowing into the Patapsco River. Our 419 volunteers removed over 13,000 pounds of flood debris from Ellicott City tributaries, Oella, the Patapsco Valley State Park, and Hammonds Ferry Road in Elkridge.

On May 27th, 2018, another major flooding catastrophe struck our valley. Again, we engaged immediately through social media. Stream Watchers were alerted. Contact was made with Preservation Maryland and the Maryland Historical Trust.

First cleanup efforts were in the Patapsco Valley State Park. The damage was breathtaking. By July we had conducted six cleanups

with 175 volunteers and removed over 3 tons of flood debris. Stream leaders were active in Oella, Catonsville, and Ellicott City tributaries. Another sewer leak was discovered and reported.

This time using our own financial resources, we gave a total of \$10,000 of flood recovery funds to Friends of Patapsco Valley State Park, the Catonsville Chamber of Commerce, and the Ellicott City Partnership. We have cleanups scheduled through September and October.

We as an organization have a very clear vision for Main Street Ellicott City. Our Main Street is a Main Street that is one of a safe, vibrant pedestrian and transit corridor. It is not one of a corridor of a reoccurring tributary created by rain and storm runoff. Our vision is a Main Street lined with historic buildings, filled with retail, arts, and restaurants, and with residents on upper floors. The Tiber and the Hudson and New Cut tributaries flow clear and safely through their natural streambeds and built channels to the Patapsco River. Upstream stormwater is contained and slowly released.

We urgently need Federal help to realize this vision. Safety is critical. Federal resources are needed to immediately construct stormwater retention facilities and water conveyance channels.

Investment in new technologies is critical.

Resources are needed to preserve and restore historic buildings.

Resources are needed to encourage the production of flood mitigation products such as waterproof doors and windows and warning systems.

Resources are needed to make flood insurance an asset, not a financial burden and liability.

And resources are needed to maintain the National Road, which is Main Street, running through Ellicott City as a transportation and pedestrian corridor.

And finally—and Senator Cardin, we know you are deeply involved with this—Federal historic tax credits are not well equipped for small Main Street-type projects. They need to be updated to reflect the needs. The tax credit should be made a transferable credit and should reduce the expansive adjusted gross requirements. Federal credit improvements should be proactive in disaster resiliency funding and planning.

And we thank you for the opportunity and for the ask to allow us to testify.

[The prepared statement of Ms. Kubofcik follows:]

PATAPSCO HERITAGE GREENWAY, INC.

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August 20, 2018

Statement to Senate Subcommittee on Transportation and Infrastructure

Chairman James M. Inhofe

Ranking Member Benjamin L. Cardin

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The Patapsco Heritage Greenway rents office space on Old Columbia Pike in Ellicott City on Tonge Row, a grouping of buildings built by Ann Tonge in 1840s as residences for mill workers. We have 2 full time staff, and 3 part time staff and a 22 member Board, comprised of Howard and Baltimore County residents.

Many of our partners could have been sitting at this table presenting testimony to you--Howard and Baltimore County Governments, the Maryland Heritage Areas Authority, Preservation Maryland, Preservation Howard County, the Ellicott City Flood Advisory Group, Howard Eco Works, Howard County Recreation and Parks, Patapsco Valley State Park, the Howard County Arts Council, Maryland Historical Trust, etc.

PATAPSCO HERITAGE GREENWAY is a 501(c)(3) non-profit organization working to preserve, protect, interpret, & restore the environment, history, and culture of the Patapsco Valley Heritage Area.

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On May 27, 2018 another major flooding catastrophe struck our Valley. Again we engaged immediately through Social media. Stream watchers were alerted. Contact was made with Preservation Maryland and the Maryland Historical Trust. First cleanup efforts were in Patapsco Valley State Park, the damage was breath taking. By July we had conducted 6 cleanups with 175 volunteers and removed over 3 tons of trash. Stream team leaders were active in Oella, Catonsville and Ellicott City tributaries. Another sewer leak was discovered and reported. This time using our own financial resources we gave \$10,000 of flood recovery funds to Friends of Patapsco Valley State Park, the Catonsville Chamber of Commerce and the Ellicott City Partnership. We have cleanups scheduled through September and October.

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We urgently need Federal help to realize this vision. Safety is critical.

Federal resources are needed to:

- immediately construct storm water retention facilities and water conveyance channels. Investment in new technologies is critical.
- preserve and restore historic buildings.

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- encourage the production of flood mitigation products such as waterproof doors and windows and warning systems
- make Flood insurance an asset not a financial burden and liability.
- maintain the “National Road-Main Street” as a transportation and pedestrian corridor.

Federal Historic Tax Credits are not well equipped for small Main Street type projects. They need to be updated to reflect the needs. The tax credit should be made a transferable credit and should reduce the expansive adjusted gross requirements. Federal credit improvements should be proactive in disaster resiliency funding and planning.

We thank you for this opportunity.

MEMBERS

Louis Diggs
Kim Egan
Paul Farragut
Chris Gallant
John Heinrichs
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Hourticolon
Pam Johnson
John McCoy
Marsha McLaughlin
David Nitkin
John O'Connor
Nancy Pickard
Mark Southerland
Steve Wachs
James Wagandt
Lisa Wingate

Sincerely,



Grace Kubofcik, President

HONORARY

James Robey

EXECUTIVE

DIRECTOR

Lindsey Baker

PATAPSCO HERITAGE GREENWAY is a 501(c)(3) non-profit organization working to preserve, protect, interpret, & restore the environment, history, and culture of the Patapsco Valley Heritage Area.

Senator CARDIN. Thank you for your testimony.
Dr. Fleming.

**STATEMENT OF MATTHEW H. FLEMING, PRESIDENT,
BOARD OF DIRECTORS, ELlicOTT CITY PARTNERSHIP**

Mr. FLEMING. Thank you very much. Senators Cardin and Van Hollen and Congressman Cummings, thank you for the privilege of coming before you to speak about flooding events in Ellicott City, Maryland.

My name is Matt Fleming. I'm the President of the Board of Directors of the Ellicott City Partnership, or ECP.

The ECP is a not-for-profit organization that serves Ellicott City's Historic District, or Old Ellicott City. Balancing the functions of a chamber of commerce and a historic preservation organization, the ECP works to preserve the heritage and vitality of Old Ellicott City while creating and enhancing economic growth. The ECP's constituents comprise businesses, property owners, residents, and visitors to Old Ellicott City.

Old Ellicott City is a place of national historic significance. As we've heard, founded in 1772, Ellicott's Mills, later renamed Ellicott City, grew to become one of the largest milling and manufacturing towns on the East Coast. Roots of the Industrial Revolution trace to Ellicott City, which served as the first terminus of commercial railroad in the United States.

Old Ellicott City is the seat of Howard County, home to some of the Nation's very best schools, most educated populous, and highest median income. The gem of the Mid-Atlantic with its celebrated Main Street, Old Ellicott city offers a unique mix of businesses, cultural and historic sites, and green spaces.

Old Ellicott City is also a place of economic significance. At full capacity, its nearly 150 businesses provide a diverse mix of retail, dining, and services. Research conducted by the University of Baltimore suggests that Old Ellicott City businesses in 2016 contributed \$197 million in business activity to the county, supported nearly \$80 million in labor and income, and generated some \$14 million in government revenues.

Old Ellicott City has historically been prone and largely resilient to overbank riverine flooding. Recently, however, Old Ellicott City has experienced destructive flash flooding. Two catastrophic flash floods have followed separate 1,000-year weather events, the first on 30 July 2016, and the second on 27 May of this year. Both flash floods have resulted in loss of life as well as considerable damage, with property and business owners suffering millions of dollars of losses.

Research suggests that the 2016 flood reduced business activity by \$67 million, labor income by \$27 million, and government revenues by more than \$1 million. And the 2018 flood was more destructive and impactful. Culverts and roadways were destroyed, along with historic buildings. And current statistics suggest that many fewer businesses are likely to return.

The ECP has sought to help its constituents following each flood event. In 2016, for example, the ECP raised and distributed \$1.8 million in flood relief; worked with county partners to provide returning businesses with various services; developed, promoted, and

delivered an array of events to bring visitors to Main Street; and convened constituent meetings to share information and emotional support to affected parties.

In 2018 the ECP has stepped up to play a similar role, though fundraising amounts trail those of 2016.

In the wake of the 2018 flood, to guide our own post-flood work plan and also to support the recovery planning of our public sector partners, the ECP conducted a needs assessment of its constituents. Constituent needs of greatest relevance to Federal Government partners include the following:

No. 1, funding and immediate completion of critical stormwater management projects. This is the most important and pressing need identified by ECP businesses and property owners, particularly the aggressive acceleration of projects to ensure that Old Ellicott City is better prepared for the next flood event.

No. 2, Federal and State funding to assist the county with purchasing properties repeatedly damaged by flooding.

No. 3, assistance with continued development and funding of an effective warning system that communicates with all parties in harm's way.

No. 4, assistance developing robust emergency preparedness plans, to include evacuation plans to the level of individual properties.

No. 5, subsidies for or other assistance with flood insurance.

No. 6, assistance with the ongoing development, funding, and delivering of a comprehensive stormwater management approach for the full watershed, and

No. 7, grants—not loans—to allow businesses and property owners to rebuild.

The ECP has worked closely with its local and State partners in Old Ellicott City's recovery. The ECP recognizes, however, that major infrastructure and related projects will be required to increase the long term safety and resilience of Old Ellicott City and that these projects will require more resources than local and State partners can reasonably allocate.

The ECP appreciates the focus of the Subcommittee and broader Committee on issues of relevance to infrastructure and flooding risks, and requests assistance meeting the needs of its constituents.

In closing, and on behalf of my ECP colleagues and constituents, I thank you, Senators Cardin and Van Hollen and Congressman Cummings, for the opportunity to speak here today and for your support of our beloved Old Ellicott City.

[The prepared statement of Mr. Fleming follows:]

**Statement of Matthew H. Fleming (Ellicott City Partnership)
to the “Oversight Hearing on Repeated Flooding Events in Ellicott City, MD: Reviewing the Federal
Role in Preventing Future Events,” for the Subcommittee on Transportation and Infrastructure of
the Senate Committee on Environment and Public Works**

Chairman Barrasso, Senators Carper, Inhofe, and Cardin, and distinguished members of the Committee and Subcommittee, thank you for the privilege of coming before you to speak about flooding events in Ellicott City, Maryland. My name is Matthew Fleming. I’m the president of the Board of Directors of the Ellicott City Partnership (“ECP”). The ECP is a 501(c)(3) not-for-profit organization that serves Ellicott City’s historic district, Old Ellicott City. Balancing the functions of a chamber of commerce and a historic preservation organization, the ECP works to preserve the heritage and vitality of Old Ellicott City while creating and enhancing economic growth (its mission). The ECP seeks a vibrant, economically sustainable, historic community (its vision). The ECP’s constituents comprise businesses, property owners, residents, and visitors to Old Ellicott City.

Old Ellicott City is a place of national historic significance. Founded in 1772, Ellicott’s Mills—later renamed Ellicott City—grew to become one of the largest milling and manufacturing towns on the East Coast. Roots of the Industrial Revolution trace to Old Ellicott City, which served as the first terminus of commercial railroad in the United States: its B&O train station is the oldest surviving railroad station in America, built in 1830 to bring goods to market. Old Ellicott City is the seat of Howard County, home to some of the nation’s very best schools, most educated populace, and highest median income. A gem of the mid-Atlantic with its celebrated Main Street, Old Ellicott City offers a unique mix of businesses, cultural and historical sites, and green spaces.

Old Ellicott City is also a place of economic significance. At full capacity, its nearly 150 businesses provide a diverse mix of retail, dining, and services. Its various festivals draw up to 5,000-8,000 visitors each. Research conducted by the Jacob France Institute of the University of Baltimore suggests that Old Ellicott City businesses (in 2016) contributed \$197 million in business activity to Howard County, supported nearly 1,400 jobs earning nearly \$80 million in labor income, and generated some \$14 million in government revenues.

Sited at the convergence of multiple tributaries to the Patapsco River, the original source of power for the mills, Old Ellicott City has historically been prone—and largely resilient—to overbank riverine flooding. Recently, however, Old Ellicott City has experienced destructive flash flooding: two catastrophic flash floods have followed separate “1,000-year” weather events, the first on 30 July 2016, the second on 27 May 2018. Both flash floods have resulted in loss of life, as well as considerable damage, with property and business owners suffering millions of dollars of losses. Research suggests that the 2016 flood reduced business activity by \$67 million, labor income by \$27 million, and government revenues by more than \$1 million. The 2018 flood was more destructive and impactful. Culverts and roadways were destroyed, along with historic buildings. And current statistics suggest that many fewer businesses are likely to return.

The ECP has sought to help its constituents following each flood event. In 2016, for example, the ECP: raised and distributed \$1.8 million in flood relief for affected business owners, property owners, and residents; worked with county partners to provide returning businesses with the services of a business consultant; developed, promoted, and delivered an array of events to attract visitors to Main Street; and convened volunteer clean-ups, community dinners, and constituent meetings to share information (and emotional support) with affected parties. In 2018, the ECP has stepped up to play a similar role, though fundraising amounts trail 2016.

In the wake of the 2018 flood, to guide its own post-flood work-plan, and also to support the recovery planning of public-sector partners, the ECP conducted a needs assessment of its constituents. Needs were identified via surveys of, and semi-structured interviews with, business and property owners, complemented by ECP knowledge of the Old Ellicott City community. Constituent needs of greatest relevance to federal government partners include the following:

- **Funding and immediate completion of critical storm-water management projects.** This is the most important and pressing need identified by ECP business and property owners, particularly the aggressive acceleration of projects to ensure that Old Ellicott City is better prepared for the next flood event.
- **Federal and state funding to assist the county with purchasing properties repeatedly damaged by flooding** so that land can be used for flood mitigation purposes.
- **Assistance with continued development and funding of an effective warning system that communicates with all parties in harm's way**—residents, owners, employees, visitors—to support timely evacuation to higher ground.
- **Assistance developing robust emergency preparedness plans** (to include evacuation plans to the level of individual properties).
- **Subsidies for (or other assistance with) flood insurance.**
- **Assistance with the ongoing development, funding, and delivery of a comprehensive storm-water management approach for the full watershed.** This would include: retrofitting older commercial/residential developments with more pervious surfaces or retention ponds to meet run-off needs; government action to manage run-off from federal/state/county properties and roads; and incentives for the public to better manage storm-water on individual residential properties (e.g., through rain gardens, native plants, stream maintenance).
- **Grants (not loans) to allow businesses and property owners to rebuild** and survive the recovery period with limited revenue. Constituents are largely unable to take on more debt, as many are still holding debt incurred to rebuild from the 2016 flood event.

The ECP has worked closely with its local and state partners in Old Ellicott City's recovery. The ECP recognizes, however, that major infrastructure (and related) projects will be required to increase the long-term safety and resilience of Old Ellicott City for its businesses, property owners, residents, and visitors—and that these projects will require more resources than local and state partners can reasonably allocate. The ECP appreciates the focus of the Subcommittee and broader Committee on issues of relevance to infrastructure and flooding risks, and requests assistance meeting the needs of its constituents.

In closing, and on behalf of my ECP colleagues and constituents, I thank you, Chairman Barrasso, Senators Carper, Inhofe, and Cardin, and other members of this distinguished Committee and Subcommittee for the opportunity to speak here today, and for your support of our beloved Old Ellicott City.

Senator CARDIN. Well, let me thank all four of you for really putting a lot behind this issue, more than just the individual properties. It's about the history, it's about the future, it's about a community. So I very much appreciate your testimonies.

Ms. Kubofcik, one of the things you said is absolutely accurate, and that is the historic tax credit issue. If there's an opportunity, probably in the next Congress, we're going to be revisiting the tax credits, and there's bipartisan support for strengthening the historic tax credits.

So, what I'm going to do is have my tax person work with the community to see whether we can establish an easier path on allocations on the historic tax credits for those properties that are at risk because of flooding. And it may give us an avenue to be able to preserve some of these historic structures in a safe manner moving forward.

So, I thank you for that recommendation because I think that's one we can move forward with, and there's great interest on the historic tax credits. So, thank you for your comments on that.

Ms. KUBOFCIK. Senator Cardin, one of our partners, which was Maryland Preservation, would love to have the opportunity to work with you on this, as would we. We think it's a tool, and we think it's a tool that can be utilized in smaller settings for small businesses, et cetera, and private property owners.

So, I'm disappointed to say it's going to be the next session. I did see bipartisan support, and thank you for reaching out to get that bipartisan support. But I think it's a tool that could be applicable throughout the United States but very important for Ellicott City.

Senator CARDIN. We were able to preserve it in this tax debate, and that wasn't a certainty.

Ms. KUBOFCIK. I know that, sir.

Senator CARDIN. And Preserve Maryland seems to be always in my office, so you have a very active partner.

Mr. DeLuca, you raised something which—I should have thought this out. But we always remember the Patapsco rising and causing flooding in Ellicott City. I'm reminded that, when I was young, I'd come out here to see the floods when the Patapsco rose up. But now, recently, these are tributary floods, as you pointed out, which is runoff problems.

So, it's a different circumstance when one thinks of the historic vulnerability of Ellicott City to flooding. It just points out one more time the need for structural considerations here, that we are dealing with a watershed problem, not so much the general flood vulnerability that Ellicott City experienced in the past. Is that fairly accurate?

Mr. DELUCA. I would agree with that. I think that my memory is relatively short, but my memory is of Agnes, and even after that, our concern was always the Patapsco rising because there's no way for Liberty Dam up the road to actually release water. It has to crest.

So we're always constantly monitoring the upstream flow to see if we will get water or where that peak water is going to be, when it will hit Ellicott City, and to kind of guess how high up Main Street it'll go.

These are different. The tributary flooding is different. It's caused more from I'd say a changing weather pattern that's dumping much more water right over this watershed. Like I said, it's a very small watershed. We wouldn't—it's a sub-watershed. It's a part of a much larger watershed. But it's—these three tributaries all drain to the same place. And so we've had some complicated storms that have come through.

And I mentioned that there were three storms that came through: 2011, 1916, and 1918. But 2011 was Tropical Storm Lee, and that had a very unique rain pattern. It's like a train of storms that just—the storms follow one another over the same area, but they're constantly moving.

These back building storms, the way they've been explained, and I'm probably oversimplifying, but they—it's like they hit a wall. Like a thunderstorm is moving—a line of thunderstorms are going through the region, but in a back building storm, it's almost like it stalls, and it starts to build up behind itself again so that it—so all the energy is going behind it, and we get this intense rain-storm over a very, very small area.

Senator CARDIN. Thank you.

Mr. WEINSTEIN. If I can add something as well because this is something that Colonel Litz brought up. We have areas within the watershed that were developed 50, 60 years ago and without any modern or even any stormwater management. The Army Corps has offered to do maybe another study. They require your support to do that.

We've done a lot of studies in terms of major projects that we can undertake. We've got a great inventory of projects we're working through now. But we can use some help in looking at a comprehensive strategic look at existing neighborhoods where there is little or no stormwater management or how can we effectively manage the storms. Because, in addition, they're at the higher elevations in the watershed as well. They're sort at the headwaters. And Mr. DeLuca and I had a meeting with constituents in that area just a few weeks ago trying to talk through that particular issue with them.

Senator CARDIN. And you had some legislation, or I believe you do, that basically says let's back up a little bit on what we do to make sure we're not doing more harm.

Mr. WEINSTEIN. Sure. Right.

Senator CARDIN. If you'd just explain that briefly?

Mr. WEINSTEIN. Sure, yes. We passed just at the end of last month a moratorium on any construction in both the Tiber Watershed and the Plumtree Watershed. So, again, it's part of the bigger watershed, but two areas which have expressly experienced devastating flooding that has either caused loss of life or threatened loss of life particularly in those two areas.

So that's a 12-month moratorium, and for the most part, there's no construction unless you're rebuilding from the damage of a flood or some other disaster.

Senator CARDIN. Dr. Fleming, you mentioned about the private conveyance properties that no longer are going to be utilized. And that's one of the reasons why I think we need more information. Because when you're looking at some of these more expensive op-

tions on structural changes, it appears to me that there's a willingness from the local community and from the county government to look at those options, but do you really have enough information to make this cost effective and provide a more permanent watershed solution?

Mr. FLEMING. Yes, so I certainly would like to start out by saying that I'm not a hydrologist. That is not my field of expertise. So what I've been trying to do is convey what we've heard from our constituents. And I think that there is a sense that we may need to recognize that some significant changes may be required to deal with, as we've heard earlier today.

We need to maintain the historic nature of this town. That's what draws all of us to it. It's what makes it such an amazing place. But there may need to be radical changes. I, nor the ECP, we are not qualified to say "We should do X or not Y," but we're hearing from our constituents that it's time to face facts that we may need to take drastic measures.

Senator CARDIN. Senator Van Hollen.

Senator VAN HOLLEN. Thank you, Senator Cardin.

Thank all of you for your testimony and your commitment to making sure Ellicott City has as bright a future as it has had a past and look forward to working with you.

I'm trying to get my arms around what we know based on the studies that have been done, and then, obviously, we've got to all figure out how to pay for it, right? And I do believe, as my colleagues do, that the Federal Government needs to play a very important role in that.

But as I understand the testimony—this is why I asked Colonel Litz if he'd reviewed it—the most recent sort of assessment was the Hydrology and Hydraulic Study that we've been talking about, which referenced, I believe, 18 projects. Is that what you said? I'm sort of asking those who are most closely following this. Eighteen projects?

Mr. DELUCA. That's correct.

Senator VAN HOLLEN. OK. And the price tag for that is \$80 million; is that right?

Mr. DELUCA. Yes, approximately \$80 million.

Senator VAN HOLLEN. OK. And is that what we're estimating the overall cost of the long term infrastructure improvements to be at this time? Is that sort of a global figure? Or are there additional costs that—other sort of initiatives that you're looking at?

Mr. DELUCA. There are other initiatives that are very specific that we've added onto the original H&H study. We're constantly updating the study and providing additional modeling. And we do have other projects that we think will help reduce or mitigate flooding in specific areas more effectively, especially in the lower part of Main Street or what I would call the mid-part of Main Street as well.

And we could share those. We could—right now, that's supplemental information. It's not part of the 2016. It is available, and we can make sure that they're included when—if the Corps would like to review those as well.

But yes, I'd say that as far as the dollar amount, \$80 million is the all around number that we've been using.

Senator VAN HOLLEN. OK. And as part of sort of piecing together the financing of that, I know you've moved forward at least on four projects, right, in the design and engineering stage; is that right?

Mr. DELUCA. That's correct.

Senator VAN HOLLEN. OK. And for those, are those budgeted already within the Howard County Government budget?

Mr. DELUCA. The design—

Senator VAN HOLLEN. The design.

Mr. DELUCA [continuing]. Or evaluation is budgeted. Two of the projects, construction dollars are available, and two of the projects, not yet.

Senator VAN HOLLEN. OK. So I just—we obviously should all keep in regular communication and put forward what we think is a realistic financing plan, figure out how much the county can reasonably invest, what the State's role is—obviously, the State's been very engaged—and then the Federal role.

So, I think there is—as I see it from the Federal perspective, there are two big pieces of this. One is, what is the Federal role in the planning and financing of the major infrastructure changes?

And then, second, as Senator Cardin and Congressman Cummings have been talking about, making sure Federal agencies are responsive to trying to meet the immediate needs of a lot of the business owners, and to the extent relevant, also homeowners in terms of the SBA, in terms of the—I know there are a number of SBA grants that are pending since the most recent flood. I don't know if any of you can give us an update on the status because we want to make sure that we're—and I have been trying to constantly push SBA to make sure that they do everything they can do as quickly as possible.

Mr. DELUCA. So, I think that a better accounting—we can provide a better accounting to make sure that everything—that we're covering everything—every line item.

Right now I think one of the issues that we're having is we just had this event. It was at the end of a budget, and we're in the position of having to forward fund even the FEMA reimbursable projects. And so we're putting out 100 percent of the cost of the restoration projects, and then we have to wait for the FEMA reimbursement, and that time lag puts a financial strain on the county as well.

So there are a lot of things at play, and there are creative ways that we have to put money and cobble funds together in order to get the contractors to do the restoration work.

And I just bring this—I just point this out as one example of many budgetary line items that we're having to deal with right now that are straining the resources of the county.

Senator VAN HOLLEN. I appreciate that. I mean the FEMA commitment to date has been—it's been over a million dollars, but you're saying that funding has been committed but not—the monies have not yet been provided; is that right?

Mr. DELUCA. Right. Correct.

Mr. WEINSTEIN. For the most recent flood, and there are still outstanding reimbursement funds from the 2016 flood. And so I've talked with jurisdictions in Colorado that have gone through that, and it's years and years before they get the final—I understand

there are pieces to that puzzle, but it's important that it comes as quickly as possible, if not—half up front would be nice.

Senator VAN HOLLEN. Yep, I hear you. OK. Thank you, thank you.

Senator CARDIN. Congressman Cummings.

Representative CUMMINGS. Just trying to figure something out here. Mr. Weinstein, you said that there are solutions—we would be better off with the more modernized solutions as opposed to doing things the same old way.

Mr. WEINSTEIN. Right.

Representative CUMMINGS. How does that play into all of this? I'm just curious. I assume that those solutions are more expensive most of the time.

Mr. WEINSTEIN. Yes. On the whole, I would imagine they are, but speaking more globally, there are probably places where a new solution is a cheaper solution, right, as well.

We were talking about one where the original—the design for the project was a pipe, but as we look at other projects that we would add to the inventory of projects we'd execute, a less expensive bridge might be better. But again, we have to make the decision if, in going that route, do we then lose the Federal funding that would pay for some or all of that project?

So if that comes out of the equation, and all we're dealing with is what funding can be given to us to do the best thing for this specific geography and geology—I mean, Mark has explained; we've got weird storms going on in Ellicott City, and we can talk about all sorts of thunder, lightning, snowstorms that we've had as well. It's dumped a bunch of snow on us, nowhere else in the county.

But that's a key thing. And I even think about it in terms of the Superfund Program, right? We have an area that is extremely sensitive to flooding that we can address if there was a commitment of a specific amount of dollars that we knew was coming and we can work with, then to leverage that money to borrow some money, to work with the private industry to create the P3 projects which the Federal Government is encouraging in some ways.

So there are ways to do it, but I think we need to start thinking about different ways. We have different weather patterns. We have different ways to address those things. We now have to find different ways to fund them as well.

Representative CUMMINGS. Mr. DeLuca, Barbara Mikulski said something to me when I first came to Congress, and I'll never forget it. She said, "When constituents come to you, make sure you do not promise results but promise best efforts, that you'll give it your best."

And I don't want people going out of here with—I want them to have a real sense of—and I think both Senator Cardin and Senator Van Hollen have said this.

I guess I'm trying to figure out what do you—what do we say to the people who are in this audience who are really trying to make some tough decisions? I mean tough decisions. These are destiny-type decisions. And we know what we have here. We have a delegation, right, fighting hard. Everybody's fighting hard. And what are you all saying to them, Mr. DeLuca? I'm just curious.

Mr. DELUCA. Well—

Representative CUMMINGS. I'm sure you get that question often.

Mr. DELUCA. Yes.

Representative CUMMINGS. In other words, what I—

Mr. DELUCA. Maybe not often enough.

Representative CUMMINGS. OK. I'm just curious. And I'm not trying to put you on the spot. I'm trying to get—be practical here because these folks are making decisions that, like I said, are destiny altering. But go ahead.

Mr. DELUCA. Well, like I said in the testimony here, that even with these 18 projects, when we looked at what difference the water elevations were, it was modest. And so, in a model, if you're getting in some areas it looks like it's dry, but in other areas we didn't get the same kind of results.

So when you're looking in the residential community, and it looks like it's a 6-inch drop in water elevation, anyone that's worked in modeling might say, "Well, that really didn't move the needle enough." So, 6 inches, if that's put out, well, you get a reduction of 6 inches. That's below my basement window; my place doesn't flood anymore.

But that's not necessarily true because the model is only as good as the information that's put in, and it's just a tool, right? So we're looking for major drops in water.

And so there are some areas—and I also said that there was less of an impact on the lower part of Main Street and the lower part of Tiber, and that's always been the case. To bring that 8 feet of water down, really, you have to do very dramatic retention, and there just aren't those opportunities in the watershed to make these gigantic levies or dams. I mean you're only going to be able to hold back so much.

So, in the upper watershed, you have some areas; if we were to do these projects, some areas would dry up a little. Maybe we could get 4 feet of water down to 2 feet of water. But a car could still move in 2 feet of water, but it would be much less damaging.

And then, on lower Main Street, if we implemented some of the plans that we kind of put forth, maybe we could go from 8 feet down to 8 feet, and 8 feet's a lot more manageable with flood proofing and some of the other techniques that have to go hand in hand with these structural solutions to—and also the warning system. It goes a much longer way.

So we're not saying we can—there's no silver bullet, and we're not promising that. I know that everyone would love to see that. I would love to see it, too. But the models haven't indicated that we're going—that a 100-year storm or a 1,000-year storm or—I tend not to talk about the 1,000-year storm or the 100-year storm. I like to talk about how many inches per hour that we're getting.

But if we get 3 inches per hour or 6 inches in over 2 hours, that we'd be able to reduce the water levels where we didn't have 8 feet of water going down Main Street. Maybe we only have half that amount. And that's much easier to, like I said, flood proof, much easier to control that.

I think that some of the other areas we need to look into, as was mentioned here, is the advanced warning system. We are working with Department of Homeland Security on a grant where they've done their proof of concept with some contractors. We have some

systems that we're deploying now, 33 sensors throughout the watershed, so that we can better map out exactly what happens in the watershed and what kind of alert system we could actually put together.

We've also talked about plans—I know our emergency operations people have talked about plans of how to evacuate.

So it's all these things all together. It's not going to just be these structural solutions. Eighty million dollars could drop out of the sky, and we would still have a threat of flooding in Ellicott City.

Representative CUMMINGS. Thank you very much.

I see my time is up.

Senator CARDIN. Well, I think my colleagues have raised very interesting questions, and your answers have been very, very helpful.

The bottom line, of course, each person must make their own decision. And some know that they can't risk their families to live in the area, and they had to move. It's happened. Certain businesses don't have the resources, and the risk factors are just too great, and they can't rebuild.

Some people saw their life flash in front of them during this most recent storm when they were rescued, didn't know if they were going to be rescued or not, didn't know whether they would survive the storm. So that's an experience that is life changing. And so you each—understand each person's going to have to make their own judgment as to their future.

What we're committed to, and I think Congressman Cummings said it best, we're going to do everything humanly possible to preserve Ellicott City. It is a treasure. It's a treasure for our country, this Main Street historic community. And the character of it is determined by the people that live and work there. These aren't chain stores. These are people from our community. And we're going to do everything we possibly can to preserve that.

And yes, the easier decisions to implement are the ones that deal with the waterproofing of your homes. And your 18 proposals, which are major changes, as you point out, won't protect against something that happened in May because it's not just the water level, it's the flow, which is something that we're not used to. As I said, historically, we saw the water flow—the rise of water and that was the risk factor, but now it's the flow of the water and the strength of that flow, what it does to buildings, what it does to cars, what it does to people.

So that's what we need to understand, and that's why I come back, as I see it, in looking at the watershed. I, quite frankly, think we don't have enough information yet. I think we do need to get a further understanding of the watershed because it's beyond just—I appreciate it's a small watershed, but it still requires us to have a better understanding how to divert and how to widen and how to impact flow so that the risk factors are better understood and can be mitigated.

And I can tell you, as both Senator Van Hollen and Congressman Cummings have said, we're going to do everything we can to get that information to implement as many of these policies as we can and to do as much transparency as possible.

One of the things I really appreciate about the leadership in this county is that it's been a very transparent process. We share the

information with you. We try to be as open as possible and as realistic as possible so that you can make your own decisions, but more importantly, we can get the community to come together on a plan. And we're committed to making sure that continues.

The Federal partnership is part of it. It's a lot more than that, as you know, the local efforts, the State efforts, the private sector efforts. But we do believe the Federal Government has a very important role to play.

So we will take back the information that we've gotten from this hearing to see whether we can strengthen the Federal Government's partnership to preserve the future of this historic community.

The record will remain open for 2 weeks, til September the 3rd, for additional comments that may be submitted or additional information that we may request.

But I thank everyone, our panelists, and I thank the people that are in this room. And as we said earlier, we admire greatly your courage, and we thank you for what you've been able to do to preserve Historic Ellicott City.

Thank you all very much. The meeting stands adjourned.

[Applause.]

[Whereupon, at 3:02 p.m. the hearing was adjourned.]

[Additional material submitted for the record follows:]

Response to Congressional Testimony on 20 August 2018**Ellicott City, MD – Flood Study Review**

Comment (Senator Chris Van Hollen): Request the U.S. Army Corps of Engineers (USACE) to provide comments on the efficacy of recommendations within the 2014 (McCormick Taylor) report.

Response: The U.S. Army Corps of Engineers, Baltimore District, can provide comments on the modeling approach used by McCormick Taylor but has not conducted a focused, thorough review of those recommendations, partly due to not having all the data and updated information beyond the original 2014 Ellicott City Flood Study and Concept Mitigation Report. In order to conduct further evaluation of this report, the Corps would also require additional federal funding in order to provide a thorough technical review including updated data and recommendations within the 2014 study and subsequent efforts.

USACE reviewed the hydrologic and hydraulic 2-D modeling completed by McCormick Taylor – as part of the 2014 study following the extreme flood event on July 30, 2016 – at the request of Howard County Stormwater Management Division, Bureau of Environmental Services. The request for technical review of the model was received in June 2017, and the review focused only on the detailed hydraulic model of the flood flows encountered along Frederick Road / Main Street in Ellicott City.

The technical review of the 2-D modeling by USACE was completed in June 2017 with minor technical comments that were addressed and resolved without issue (and also did not affect their recommendations). USACE's review only consisted of evaluating the validity and reliability of the modeling; it did not address recommended flood mitigation concepts by McCormick Taylor or outcomes of the modeling.

It is important to note that data from models developed by McCormick Taylor and reviewed by USACE showed significant flooding would still have occurred in Ellicott City during the July 30, 2016, storm even if the watershed was in a natural (i.e. all-wooded) condition. As stated in the report, "The undeveloped scenario represents significant reductions in the peak flows,

however, as storm events become larger, the existing and undeveloped discharges become closer." This implies that upstream stormwater detention alternatives will have an impact on more frequent storms but have minimal impact on less frequent, larger storms. It is the less frequent, larger storms that get out of the banks and flood buildings.

Moving forward, USACE can undertake a new feasibility study, as recommended during the field hearing, to evaluate structural, non-structural, and natural and nature-based solutions. The study would be estimated at \$3 million and cost-shared 50 percent federal / 50 percent non-federal. A Letter of Intent is required from a non-federal sponsor in order to seek Congressional study authority and subsequent funding. A sample letter and model feasibility cost sharing agreement (both included with this letter) were provided to Howard County on August 21, 2018, should they chose to proceed with further USACE study.

Furthermore, if a study recommendation is deemed feasible with a supportive benefit to cost ratio, Congressional authority and funding (if approved) would allow the design and construction of a project. This effort would still require non-federal sponsor funding.

Abigail Bardi
8672 Frederick Road
Ellicott City, MD 21043
443-538-3598
abbybardi@gmail.com
September 3, 2018

Testimony for the U.S. Senate Committee on
Environment and Public Works Subcommittee

The August 20, 2018, hearing on Ellicott City's recent flooding and possible solutions included considerable information from a variety of sources, but did not reference the plan proposed a mere three days later by Howard County Executive Allan Kittleman and County Councilman Jonathan Weinstein. That proposal has moved into the forefront of all discussion about EC and is what I wish to address here.

I have lived at the corner of Main Street and Rogers Avenue since 1999. My house is on high ground, so I was able to witness the 2011, 2016, and 2018 floods from our front porch. At our point on Main Street, the velocity of the water was already so powerful that it displayed whitecaps and hurled heavy objects down the street with great force. During the 2016 flood, the force of the water was so intense that a police boat got stuck against the guard rail.

As I witnessed these events, it seemed obvious that the powerful flooding that ended up in lower Main Street was originating in the uphill areas above the town. We observed water cascading downhill on Frederick Road and Rogers Avenue and from the hillside behind the "Old Colored School."

While I am not an expert on hydrology, I have lived in this house for two decades, and I have drawn some conclusions based on what I've seen. In the past, floods rose onto lower Main Street from the river and now they come from above the historic part of town. The most significant environmental change during that time has been a considerable amount of development uphill from Main Street on all sides. Climate change is certainly to blame for the amount and frequency of rain, but the increasingly impervious surfaces surrounding the town must certainly contribute as well.

Since both the 2016 and 2018 floods were "top-down" floods, I was frankly shocked by Mr. Kittleman's proposal to demolish buildings in the heart of the most historically significant portion of our town. The proposal includes some mitigation projects upstream as well, but I am concerned that taking a radical and irrevocable step like demolition of multiple historic buildings without first trying to mitigate flooding by taking equally dramatic measures upstream would be something later residents of our historic town would find hard to condone. Here are my concerns:

1. At best, this plan would apparently only reduce but not eliminate the water in lower Main, so there would still be a drowning risk there. Yet proponents of this proposal continually refer to their proposal as the only way of saving lives. Everyone is concerned about safety in Ellicott City, but inflammatory rhetoric is not the most helpful approach to these important issues.
2. Ellicott City has guarded its historic district carefully for as long as I've been here. To propose to tear down historic buildings in an area where people were previously prohibited from so much as using paint outside the "color wheel" seems like an enormous

change of procedure, to say the least. If demolition is indeed the only way forward, the burden of proof on those proposing it should be enormous.

3. The demolitions in lower Main Street do not appear to benefit the West End, which was very hard hit by all three floods. I am an eyewitness to the power of the floodwaters at the top of Main Street, at Rogers Ave., and it seemed quite obviously to be caused by the existing slope and the volume of water coming from above, not from conditions at the bottom of the hill (which the demolitions propose to address). I fail to see anything in the Kittleman-Weinstein plan that indicates exactly how widening the channel in lower Main Street will address water velocity in the West End. One might infer that it is the additional upstream projects, also in the plan, that will do that. Therefore, why not prioritize those other projects before demolishing the heart of the town?
4. If purchasing and demolition of structures in the community are being considered, the community contains numerous non-historic areas that could be acquired, such as the large paved area of West End Services, a logical location for mitigation that does not seem to have been considered in the proposal.
5. According to a fellow Main Street resident who is knowledgeable about storm-water management, water projects and mitigation should always begin at the top of the stream, not at the bottom. Why does this plan deviate from this normal procedure?
6. The way the plan was rolled out did not provide the community opportunity to comment in public forums before it was announced. Indeed, at the August 20 Senate hearing, there was no overt mention whatsoever of a plan that would be announced via a press conference three days later, though hindsight suggests that it was subtly alluded to. Was this plan kept from the public so it could be announced as a “done deal” before any

opposition could gather momentum? In fact, one County Council member, Calvin Ball, has written a letter to Mr. Kittleman stating publicly that he (Ball) was not informed of the impending announcement and that the plan was not discussed by, or even mentioned to, the full Council. I am told that people who knew about the plan were sworn to secrecy. This secrecy has been attributed to “privacy” concerns; however, real estate transactions and governmental actions are not subject to privacy laws. Why the lack of public input before the August 23 rollout?

7. Without speculating on the motives of the current county executive, it must be noted that we are two months away from the next election, in which Mr. Kittleman is a candidate. Mr. Weinstein was defeated in the primary and is therefore a lame duck. It is hard not to view their timing on the rollout of the plan as inappropriate and perhaps even political.
8. Finally, this plan seems suspiciously friendly to one of the town’s two major developers, who stands to gain commercially from the proposed “river walk” in town. While Mr. Kittleman’s plan is ostensibly not based on the “Alexander Plan” promoted by Bruce Taylor, whose enormous development uphill from New Cut Road appears ill-conceived in such a fragile and historic area, the “river walk” idea appears to be a component of the Alexander Plan.

To me, the plan is so flawed by its secrecy, unorthodoxy, odd timing, and haste, that even if this did turn out to be a viable solution, it would still bear considerable further scrutiny before such drastic action should be taken. In an election season, it makes sense to give the proposal a thorough vetting by all elected officials as well as candidates and above all, the public, whose input has studiously been avoided.

My recommendations:

- Work should be started immediately on upstream projects, but the discussion of demolition should be continued beyond the November election, since this election is essentially a referendum on the proposal. The results of the election could drastically change the legislative picture in EC.
- Additional public input on the proposal should continue to be solicited in multiple venues, including additional opportunities for oral and written testimony, before a decision on demolition is made.
- The county should purchase the buildings in question at market value but not demolish them, maintaining them as well as possible while upstream projects are done, additional studies and models are considered, and the public discussion on demolition is continued.
- The county should also purchase at market value any other property on Main Street, including within the West End, that the owners wish to sell.
- The current one-year moratorium on development should be extended until all flood-mitigation projects have been completed and results have been amply studied.
- Congress should take an active role in the situation to make sure that the values of the state of Maryland, historic preservation, and democracy are maintained in Ellicott City.

Thank you so much for allowing me to share my opinions. As a voter, taxpayer, and resident of Ellicott City, I truly value this opportunity.

Testimony of Len Berkowitz and Sherry Fackler-Berkowitz
Property Owners
Before the
Committee on Environment and Public Works
Subcommittee on Transportation and Infrastructure United States Senator

Oversight Hearing on Repeated Flooding in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events

August 20, 2018

The Honorable James M. Inhofe
Chair
Subcommittee on Transportation
and Infrastructure
Committee on Environment and
Public Works
United States Senate
Washington, DC 20510

The Honorable Benjamin L. Cardin
Ranking Member
Subcommittee on Transportation
and Infrastructure
Committee on Environment and
Public Works
United States Senate
Washington, DC 20510

To all concerned:

We are writing this in response to the removal of several buildings in Historic Ellicott City, and the danger the flooding of the Historic District has on property owners, business owners and visitors to town.

Myself (Sherry Fackler-Berkowitz) and my husband (Len Berkowitz) opened "Great Panes" January 1, 1980. This coming January will mark our 40th year in town.

I would like to give a little of our personal history of Ellicott City.

We opened January 1st, 1980, at 8133 Main Street Historic Ellicott City. It sits in the center of the hill in downtown Main Street. We signed a 5 year lease in that location.

In 1984, after an Ellicott City Business Meeting, a large fire broke out, in the bakery. Len and several other business owners had just left the meeting, only to turn around and go back.

The section of buildings on fire ranged from 8141 – 8173 Main Street. There were 6 businesses damaged by the fire, Iron Rail Antiques, Chateau Wine Supply, Marinos Photo Gallery, Antique Clock and Watch Repair, Leidig's Bakery and Chez Fernand. Our business was on the opposite side of the old Commercial and Farmers Bank building. Lucky for us there was no damage to our building. All of the buildings effected by the fire were bulldozed and new

more modern ones built in their place. You can see today, that section of the buildings look modern compared to the surrounding buildings.

In 1985, we moved down to our current location, 8069 Main Street. The "Historic stucco" building at the bottom of the hill. The building had 2 apartments on the top and a large retail space on the lower level.

In 1999 another fire broke out several doors up the street.

The fire started in Main Street Blues, (now Portalli's). The following business were affected, Source Unlimited, Main Street Blues, Rugs to Riches, Legends, Spring House Design, Nature Nook and Renaissance Books. The buildings affected by the fire went from Caplan's Dept Store down to Tiber Alley. Several were torn down while others had extensive fire damage and were rebuilt.

The Rosenstock Building (now known as the Shoemaker Building), was bulldozed after the fire. The building went from 8,900 sq. ft. to 11,000 sq. ft. In order for the building to have a first-floor entrance in the flood plain it needed to be built to FEMA code. It was the first and only building on Main Street built to FEMA code.

Tiber Park did not exist. It was a cinder block lot when we moved to our current building. There was a fire in 1965 in the existing building and in the 1990's it became Tiber Park.

My point is that most of buildings they are considering taking down have had so many alterations done to them, over the years that there is very little history left.

Along with this letter are documents about the buildings to be torn down.

Coming up to the current situation.

During the 2016 flood we had 7 ½ feet of water in our building.

We had carried flood insurance all the years we have been in town, except during the 2016 flood. We had received the new quote and the rate had gone up higher than we had seen in the past. We had 3 other quotes run and each one had a box that said, do you sit over or near water, the box was checked no. I contacted my insurance company along with FEMA, each said not to worry about it. We were not happy with the answer and were looking at other policy options when the flood hit. We had no insurance for the first time in 32 years and now a flood.

Due to the large amount of water that ran down the road in 2011, during Tropical Storm Lee, we had 4 ft of water in the basement. A flood claim was honored by FEMA. Whenever it rained hard I would checked in with my tenants to see if the rain was causing any flooding..

My tenants in the back apartment were the only ones there during the 2016 flood. She told me everything was ok, even though it was raining really hard for a long time. In 20 mins. she called me back to tell me the water was coming over the bridge from the Tiber River, and broke the window to the studio. She Facetimed me the Tiber River. What I saw was that as the water

came under Portalli's building the pressure of the water caused a 2 story wave to come towards my building. She asked me what to do. I told her to break down the laundry room door and go to the 3rd floor in the front apartment. I was terrified seeing that amount of water coming towards the building. I really thought it was going to wash some of the building away.

The night of the flood my tenants saved 3 people who were in Tiber Park when the rain came. All 3 worked at businesses in town. The steps to the back apartment were washed away. Everyone had to leave the building through the front apartment, once the water receded.

We gutted the building and made improvements to help us survive another flood should it happen. Remember we were told this was a 1,000-year flood. We moved our electric from the basement to the first floor. We rerouted all of the water and sewer from the back apartment to run through the studio into the basement sewer line and out the front of the building. We invested in a steel and concrete floor, because the water and debris from the Tiber River had torn a hole in our existing floor that was over the river. We put in 1" insulated tempered units in all of the windows. All of the floor boards and joists in the front of the building were replaced. We added two ADA bathrooms.

We had a huge crack in the stucco in the front of the building. We have a picture of how the building looked after the 1972 Agnes flood. There was black glass and brick on the front of the building. We were hoping to find that when the stucco was removed, but instead it was all wood framing, all the black glass and brick had been removed when the building was rebuilt in 1972.

We took a line of credit on our house, we took the state of Maryland loan for \$50,000.00, and we used money from our life insurance policies to help pay for the repairs. We spent over \$265,000.00 in repairs.

To help with the expenses we decided to rent out the front of the building to Joan Eve Collectables. Joan had been in town a long time and we thought she would be a good business to have as a tenant. We signed a 3-year lease, but due to the flood she was in our building for only one year.

When the 2018 flood hit, both Joan Eve Collectables and Great Panes Art Glass Studio had been in the rebuilt building almost 1 year.

Len and I were not in town when the storm came.

Joan called me at home and said the water was coming in the door. I told her to lock the door and go to the back apartment.

The rest is history.

After seeing the video of Joan and Gary walking across the bridge in the park during the flood, Len and I decided we no longer felt our building was safe.

Both floods we had tenants in the building, had any of those tenants drowned we would have a moment in time that would live with us forever.

Thank goodness there is an ending with none of my tenants being hurt. Three people have already lost their lives. We must make sure no one else does!

I am sending some pictures along with this letter.

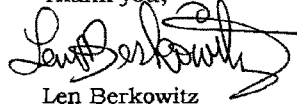
I am asking you to please move forward with plans of tearing down the buildings and making it a safe and beautiful place to live and have a business. The town cannot wait. Although we are not coming back, many of our business friends are. They need action now! They need to feel safe and so do their customers.

As for us we are looking for a new location, but without the money from the county buying our building it will be hard to move forward. Everything we own is tied up in the building and the business.

We love Ellicott City and it will always be a huge part of our life.

We are asking you to help make it safe again.

Thank you,

A handwritten signature in black ink, appearing to read "Len Berkowitz", with a stylized flourish at the end.

Len Berkowitz

A handwritten signature in black ink, appearing to read "Sherry Fackler-Berkowitz", with a stylized flourish at the end.

Sherry Fackler-Berkowitz

The Honorable Senator Cardin,

I am submitting testimony resulting from the "Oversight Hearing on Repeated Flooding Events in Ellicott City, Maryland." Thank you very much for taking the opportunity to hear from the community on this matter. I reside at 8495 Main Street in Ellicott City, and am also a small business owner in the historic district.

My family has been in Ellicott City for nearly 150 years and I've lived on Main Street for the past 2 out of 3 floods of the past decade. I have seen first-hand how these run-off events are different than historical flooding in the town. The Patapsco River did not rise causing a flood, rather the water is runoff coming from above the town. I am writing to urge that each of the projects in the proposed plan from County Executive Kittelman be voted on separately. This will allow some projects to get started on right away (which we need as time is not on our side), and others to be reviewed more closely.

The most controversial part of the proposed plan is the destruction of 19 buildings and homes (many historic). This feels like a rushed decision to tear down structures that are not causing the flooding, while at the same time hundreds of new homes are being built above our town, which are contributing to the runoff problem. While I acknowledge development isn't the only cause of the flooding, it definitely isn't helping and many of our elected officials refuse to acknowledge this. Why are we continuing to build Burgess Mills Phase 2 (and others), that sit directly above our town, filled with concrete and other impervious surface, but then rush to tear down many buildings that have been here for decades, and in some cases, centuries? While safety is my number one concern, I would be more in support with the removal of the historic sites if I knew that no more homes or businesses would be built above us in the watershed at least until we can fully solve our problem. While the one-year moratorium is a start, we will continue to flood if we keep taking away pervious land around us.

Preservation Maryland, McCormick Taylor study and Hydrology/Hydraulic study of 2016 have all proposed other options that could save the historic sites, as well as reduce the flooding on Main Street, in some cases much greater than what the county's proposed plan does. I'm under the assumption that the main reason this plan is not being considered is cost and time. As one of the wealthiest counties in the country, I believe we could pull the funding from other sources, borrow from other projects or increase developer fees in Howard County. Additionally, please consider other sites for flood mitigation projects that haven't yet been explored. One option is the West End Trucking Service property.

In summary, I'm requesting that Howard County's proposed flood mitigation plan be broken into parts to receive a vote so that some pieces can happen sooner, and that other plans that have a far greater reduction in flooding be considered before the removal of any historic buildings. Lastly, I encourage you to visit our town, and speak with residents who wouldn't normally have a voice. The same residents and business owners seem to always speak for our town due to their connection with our elected official, making the conversation one-sided.

Thank you for the opportunity to share my thoughts on this sensitive but important topic and I look forward to hearing your thoughts.

Sincerely,
Brittany Calloway

HISTORIC ELLICOTT CITY FLOOD WORK GROUP

Statement to the Subcommittee on Transportation and Infrastructure
of the Senate Committee on Environment and Public Works:
“Oversight Hearing on Repeated Flooding Events in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events”
Chairman: James M. Inhofe
Ranking Member: Benjamin L. Cardin
27 August 2018

The flash floods of 2011, 2016 and 2018 in Historic Ellicott City and the West End took four lives and destroyed homes and businesses. To minimize the danger of this happening again necessitates dramatic action. Now that we have a specific plan, your support is more important than ever.

Howard County Government formed the Historic Ellicott City Flood Work Group in the spring of 2015. It was charged with acting on initiatives to reduce flooding; evaluating priorities and schedules for mitigation/infrastructure improvements in the future; outreach to the community related to projects and initiatives; seeking community input and feedback; seeking opportunities for additional funding sources; providing community educational opportunities on reducing impact of future flooding not mitigated through the County funded projects; and work towards possible reductions in FEMA insurance rates.

The Work Group held monthly meetings, with guest speakers, field trips and public input. Eight meetings were held in 2015 and five in 2016 before the devastating flood of July 30th. Two more meetings were held that year, nine in 2017 and three in 2018 before the devastating flood of May 27th. When meetings resumed on August 11th, the venue had to be changed at the last minute from the George Howard Building to the Roger Carter Community Center to accommodate the large number of people who wanted to attend.

The Flood Work Group issued a report in December 2015 with recommendations to enhance public safety and minimize damage to properties. A copy of that report is attached here and we ask that your committee review and help implement those actions where possible.

Preserving Historic Ellicott City as a national treasure and a thriving income generator for Howard County will take a significant investment beyond the capacity of the county alone. We ask this committee to make every effort to secure the necessary funds.

The Flood Work Group continues to fulfill its mission and provides an important interface between county officials, residents, business owners and technical experts. Our members stand ready as knowledgeable locals to consult about further strategies. We appreciate the support Historic Ellicott City receives at the federal, state and local level and the work of your committee.

With respect

Debbie Slack-Katz
Chair
Historic Ellicott City Flood Work Group

Greetings,

I believe whole-heartedly that Historic Ellicott City can be preserved and protected from intense rain surges. For instance, there is major opportunity to retention at the site of West End Services Trucking Company, likely more than 100 acre-feet of storage potential. That's a huge impact for the Hudson River Branch and the community living on Main St. There's also opportunity for retention on the Sheppard Pratt site that could be a huge impact for the New Cut (Wild Cat) Branch.

Regrettably, both of these major retention opportunities are instead destined to be residential re-development.

The proposed plan includes retention projects totaling 23 acre-feet. Those projects (and others) should move forward without delay.

The proposed demolition of buildings on lower Main is hasty, I believe the decision shows a lack of belief in our ability to retain. I understand that having a developer ready to foot the bill and having a beautiful River Walk to look forward to are compelling reasons to support this plan. But I fear this plan is not aggressive enough, it still leaves 4-6' of rapid runoff on Main St and too many buildings and families still at risk.

My home is on Main St, way up above the river almost to Rogers Ave. It was built in 1809 and served as the Ice House for Ellicott City. We were devastated by several feet of rapid runoff in 2011, 2016 & 2018. My home is now rebuilt, my walls are insulated with Hempcrete and all utilities are now above the first floor. In 2016, Main Street was scoured away from my home, and runoff rapids tore through both homes of my duplex via the coal chutes. I was rebuilt in time for 2018, and while I'm still broke from recovering from 2011 & 2016, I can proudly say that my home is now flood proofed.

We can do this. Let's move retention projects forward and do all we can to retain and slow the flow. Let's make stormwater regulations ridiculously strict. Let's get right to work on projects we've known the need for since 2011.

Thanks for your time and consideration,
Gayle Killen

9/3/2018

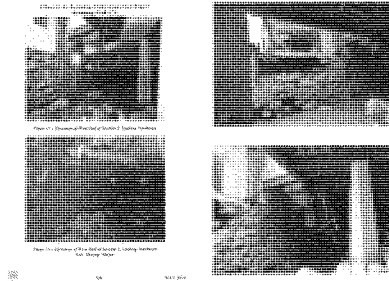
Dear Senator Cardin,

Based on the reports referenced below, being a member of the Flood Workgroup since 2014 and my own experiences trying to find solutions to flooding in Ellicott City for the past 7 years - and which I am still actively doing through my NGO (Howard EcoWorks) efforts that include the Ellicott City Soak It Up campaign, researching biochar for runoff remediation, designing a stream restoration project on the Hudson Branch and exploring projects with BG&E, I ask that you and your supporters seek federal funding that will help Ellicott City with these major flooding issues.

I also support Howard County's recently released 5-year plan that is not just a "demo plan" as many have started and it does not disregard the 2016 McCormick Taylor (McT) H&H plan. It is a mixture of upstream mitigation, conveyance improvements, floodplain expansion and planned overflows and does not mention an extensive monitoring system being put in place by the Dept. of Homeland Security, a new floodproofing grant program being launched this fall, additional culverts proposed for removal/enlargement and comprehensive storm drain improvements along Church St.

I do not believe that a 5-year plan exists that will solve this problem. People including Preservation MD are saying, "just implement the McT plan." All of those retention projects, conveyance improvements and borings will get most of the water off the street on Lower Main - but that is not a 5 year plan, that is decades and decades, and it is not a \$50MYN dollar plan, it easily hundreds and hundreds of millions for projects whose actual feasibility is unknown (just because it is a concept in the plan does not necessarily mean that it can be implemented), and then the Patapsco back-watering will still be a concern for Lower Main rendering upstream mitigation ineffective. You can look at Preservation MD's options B-D each of which are many tens to \$67MYN but those options are only addressing the 10 structures and are still not doing anything for flood mitigation.

I've walked the stream channels several times per year for years with crews pulling debris out and doing our part to prevent blockages which were definitely a contributing factor to 2016. The channel walls are failing with successive storms. The May 2016 retaining wall inspection report by KCI was alarming - and that was two floods ago. There are walls with questionable structural integrity supporting buildings in Lower Main - see the picture below - on the left is photos from KCI's report indicating a wall that is compromised in May, 2016 and on the right, of course this wall blew out from the 2016 flood. This is under Old Columbia Pike. What if one of the Lower Main walls supporting a structure were to fail when we get the next flood? Because it's not "if," it's "when" we get the next flood. It could come tomorrow. We need to be planning for tomorrow's flood, not the flood 5 years from now. We simply do not have the time.



McT's study tells us that the water cannot be contained. This watershed would flood even if it were entirely wooded. If all of the upstream mitigation projects were to be implemented (less the borings whose feasibility is unknown), there would still be water on the street on Lower Main. We can look at some other retention options, but we're not going to find the storage. It's been looked at comprehensively. The retention that is effective and takes care of some of the problem are very large in-line retention ponds with high hazard dams. Emergency action plans will need to be created to prepare for the situation if the dams should fail. That is the extent of the measures that will only partially address this problem, if they are even feasible. Do you expect that those living below the high hazard dams will be very happy about a potential failure because it helps Ellicott City? I don't know that I would be.

The structures that are proposed for removal under this 5-year plan were selected to allow the water to move the way it needs to, today, with our new high intensity storms that are becoming the norm. The floodplain expansion at the bottom of the watershed is necessary to accommodate the extremely heavy flows. The New Cut Branch is the biggest contributor of flows, and it comes in very low in the watershed behind the Caplans building. With all upstream mitigation proposed by McT put in the ground, there are still huge flows – more than 2500 cfs - coming from the New Cut. The 10' openings do not accommodate the 18' flows that were trying to get through there in 2018. You don't need to be an engineer to see that problem and if you need evidence, check out Ron Peter's video footage.

The 5-year plan needs to be put within the context of a 20-30 year plan – **and that is what we need federal funding to implement.** Because that is what it is going to take. **This is going to be ongoing through multiple administrations and continued changing climate.** Instead of figuring out how to get rid of all the water, we need to talk about how much water we can risk and are willing to live with on the streets – and on which streets. I want to see as much of the structures preserved as possible - in a different location. If calling this an emergency is what it will take to make the hard decisions, then I think we should do that. We've been waiting and advocating and fighting for projects for a long time, it's time to move forward.

- 2006 Lower Patapsco Watershed Restoration Action Strategy (Center for Watershed Protection)

- 2003 and 2008 Lower Patapsco Biological Assessments (Tetra Tech and KCI)
- 2012 Tiber Hudson Subwatershed Restoration Action Plan (Center for Watershed Protection)
- 2012 Tiber Hudson Stream Corridor Assessment (S & S Planning and Design, LLC)
- 2014 Ellicott City Flood Study and Concept Mitigation Report (McCormick Taylor)
- 2015 EC Flood Workgroup Final Report
- 2016 Ellicott City Retaining Walls Inspection Report (KCI)
- 2017 Tiber Hudson Stream Corridor Assessment (S & S Planning and Design, LLC)
- 2016 Ellicott City Hydrology / Hydraulic Study (McCormick Taylor)
- 2018 Army Corps of Engineers Nonstructural Floodproofing Study
- 2018 Howard County 5-year plan

Sincerely,

Lori Lilly
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lorililly@gmail.com

Testimony of Tony McGuffin,
 8672 Main Street, Ellicott city, MD. 21043
 phone: 443-538-3609;
 email: tonyjmcguffin@gmail.com

A lot has changed since the Congressional Field Hearing in Ellicott City on August 20th. On August 23, Howard County Executive, Allen Kittleman, and Howard County Councilman, 1st district, Jon Weinstein, announced an extreme mitigation plan which includes the demolition of buildings in the Historic district, and which had apparently been in the works for some time and had been decided upon by the time of the Congressional hearing but was not mentioned in the hearing.

As far as I can tell, this plan is not supported sufficiently by previous studies, and seems hastily put together with very little transparency, in fact, with considerable secrecy. The rollout of the plan has been clumsy, and incredibly divisive in a community which so uniquely bonded in a spirit of cooperation and support, after the 2016 flood. It is now being sharply divided and polarized by this proposal. These circumstances complicate the flood mitigation issue, which is, of course, the matter at hand.

I am not a scientist or hydrology expert, but am a 42-year resident of Ellicott City, as well as a property owner residing on Main Street for twenty years, on College Avenue for ten years prior and earlier at several Ellicott City addresses. I am also a former Main Street merchant having been proprietor of the Ellicott Theatre in the 1990's.

From my porch at 8672 Main Street, I have seen the flood waters as they enter the street, as water flowing down Rogers Avenue from the North converges with water coming down a wooded hill on the South side of the street onto the parking lot of the Historic site, "The Old Colored School." Both sources empty into the Hudson Branch causing the combined torrent to enter Main Street and then flow east toward downtown Ellicott City.

Because this is a major portion of the water that ultimately caused such destruction on lower Main Street, it would seem logical to try to mitigate that water before it gets there. The 2016 hydrology report points out a number of other sites along Main and Frederick appropriate for utilization in storm water mitigation. My understanding is that many of these mitigation points are not in the current plan, which is derived from a study by only one company, and which perhaps ignores many of the old studies, including the Army Corps of Engineers study, and also seems rushed, done in secret, announced in an authoritarian manner and supported only by political rhetoric, and misleading and inaccurate definitions of terms like "transparency" and "stakeholders."

For example, it appears that some of the water flowing down Rogers Avenue could be collected just before the junction at Main Street at a property at 8688 Main Street, an apparently abandoned structure that was *cited in the 2016 Hydrology report as a possible acquisition for the mitigation plan*. This property is adjacent to some acreage along the east side of Rogers

Ave, which St. Peter's Church owns and has indicated would be made available, and which extends up to Smith Ave. That property, as well as the 8688 property has a steep hill, for terracing. 8866 has a flat area at the top which could be used for natural water retention, and the combination of the rest of the acreage could accommodate a moderate-sized retention pond or pipe farm as outlined in the 2016 study. The adjacent intersection at Rogers and Main/Frederick is huge and somewhat unsafe, and a redesign to incorporate that space in this mitigation project at Main and Rogers would be useful.

Another flood mitigation point is on the other end of town, the most eastern part by the Railroad Station and up through the business district. That is the New Cut Branch leading into the lower end of the Historic district, and a main source of the damaging flood water. There are a number of sites along New Cut Road which could presumably be used for mitigation, a couple large areas with few structures and close to town. Apparently none of this is considered in the new plan.

The Taylor family, who are major local developers, have some property adjacent to that part of the watershed, and a number of interests in the immediate area, including a documented interest in having a "River Walk," I understand. While proponents of the plan argue that developers did not have a hand in it, it would appear that the Taylors and others, who seem accustomed to favoritism from the local government, do benefit from the proposed demolitions of a substantial portion of the Historic District.

That is the political situation we have now: County Executive Allen Kittleman and Councilman Jon Weinstein clumsily rolled out their new proclamation to follow a plan that has had little community input, and has not gone through the normal system of checks and balances, having done an end run around the Howard County Council, has a number of "stakeholders" with financial conflicts of interests, seems at odds with the previous studies, and also appears to be ***inferior in actual mitigation and in safety, to the previous studies, in particular the 2016 H&H study, which seems superior in storm water mitigation and safety, but is more expensive.***

As I mentioned earlier, Ellicott City went through a remarkable change following the 2016 flood, a unique bonding of a community with people working together, helping each other whether friend or stranger, hosting and supplying community dinners, organizing volunteer efforts, and sharing hard-earned recreation. All that seems to be suddenly torn asunder with the abrupt roll-out initiated by Kittleman and Weinstein and embraced by desperate and exasperated townspeople. If their plan has merit, why are they relying so heavily on secrecy, logical fallacies, and political rhetoric to sell it?

The lack of transparency of this plan, and the omission of mention of its very existence in front of the August 20th Congressional Hearing leads me to request a close look, if not an investigation to decide if conducting a congressional hearing without full disclosure of such critical information is a form Contempt of Congress. Our little town right now is serving as an example of exactly how government should NOT operate.

Here is a list of additional locations to consider for retention and mitigation:

- The parking lot at the afore-mentioned "Old Colored School" should be converted for some small retention pond, or at least converted to a pervious material for mitigation of run-off water.
- There are other sites to the west of Rogers along Frederick Rd, which have substantial acreage, but with few buildings. Those all combined should potentially have a substantial mitigating effect on the storm water.
- Then, most significantly, to the East, at 8600 Main Street is the huge, but seemingly largely ignored parcel, the West End Service property, which has great potential as part of the mitigation plan, and by the map appears to be a natural part of the flood plain, but is hardly mentioned in studies. Rumor has it that some of it has been recently slated for high-density development, which I hope, under the circumstances is now off the table. (West End Service, as I understand it, has been the recipient of many exemptions through the years, including having the official Historic District begin just at the end of its property, although there are historic homes, and even the Restoration project, "The Old Colored School" well to the west. The local assumption has always been that West End has gotten a lot of special leeway since the owners were the Howard County Fire Chiefs for several generations. Who knows?) But, that property is huge and located at an opportune and crucial point for mitigation between Rogers and Ellicott Mills Ave. The property is adjacent to other acreage behind 8576 and 8572 which seems a large part of the natural flood plain as well, and is largely open.
- There are a few other small parcels, and some large stretches behind dwellings on Main to the West of Ellicott Mills Drive that were mentioned in the 2016 hydrology study as well.
- Along Ellicott Mills Ave., north of Parking Lot F, is the property of the Old Roger Carter Center which was demolished several years ago. Some of it was paved to extend Parking Lot F, but in hindsight should probably have been considered for water retention as storm water flows down from Courthouse Drive through Fels Lane onto that lot. Another retention pond should be considered.

Thank you for your time and attention,

Tony McGuffin

Testimony of Tony McGuffin,
 8672 Main Street, Ellicott city, MD. 21043
 phone: 443-538-3609;
 email: tonyjmcguffin@gmail.com

A lot has changed since the Congressional Field Hearing in Ellicott City on August 20th. Howard County Executive, Allen Kittleman, and Howard County Councilman, 1st district, Jon Weinstein, announced on, August 23rd, an extreme, possibly unnecessarily destructive, mitigation plan which had apparently been in the works for some time, had even been decided upon by the time of the Congressional hearing, but was not mentioned in the hearing.

As far as I can tell, this plan is not supported sufficiently by previous studies, and seems hastily put together with very little transparency, in fact, with considerable secrecy. The rollout of the plan has been clumsy, and incredibly divisive in a community which so uniquely bonded in a spirit of cooperation and support, after the 2016 flood. It is now being sharply divided, and polarized by a shamelessly orchestrated propaganda campaign by Messrs. Kittleman and Weinstein.

All of the action described above complicates the Flood Mitigation issue, which is, of course, the matter at hand. I'll revisit the politics and comment further after addressing some of the **mitigation points**.

I am not a scientist or hydrology expert, but am a citizen and 42-year resident of Ellicott City, as well as a property owner residing on Main Street for twenty years, on College Avenue for ten years prior and earlier at several Ellicott City addresses. I am also a former Main Street merchant having been proprietor of the Ellicott Theatre in the 1990's.

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It appears that some of the water flowing down Rogers Avenue can be collected just before the junction at Main Street at a property at 8688 Main Street, an apparently abandoned structure that was *cited in the 2016 Hydrology report as a possible acquisition for the mitigation plan*. This property is adjacent to some acreage along the east side of Rogers Ave, which St. Peter's Church owns and has indicated would be made available, and which extends up to Smith Ave. That property, as well as the 8688 property has a steep hill, for terracing, the 8866 has a flat area at the top which could be used to collect water, and the combination of the rest of the acreage could accommodate a moderate-sized retention pond.

The adjacent intersection at Rogers and Main/Frederick is huge and somewhat unsafe - a redesign to incorporate that space in this mitigation project at Main and Rogers would be prudent.

Also, the parking lot at the afore-mentioned Historic site should be converted for some small retention pond, or at least converted to a pervious material for mitigation of run-off water.

I realize that small retention ponds won't completely do the trick, but there are other several sites to the west of Rogers along Frederick Rd, which have substantial acreage, but with few buildings. Those all combined should potentially have a substantial mitigating effect on the storm water.

Then, most significantly, to the East, at 8600 Main Street is the huge, but seemingly largely ignored parcel, the West End Service property, which has great potential as part of the mitigation plan, and by the map appears to be a natural part of the flood plain, but is hardly mentioned in studies. Rumor has it that some of it has been recently slated for high-density development, which I hope, under the circumstances is now off the table.

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There are a few other small parcels, and some large stretches behind dwellings on Main to the West of Ellicott Mills Drive that were mentioned in the 2016 hydrology study as well.

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The 2016 hydrology report points out a number of other sites along Main and Frederick, which I don't believe are being utilized in the current plan.

Another flood mitigation point is on the other end of town, the most eastern part by the Railroad Station and up through the business district. That is the New Cut Branch leading into the lower end of the Historic district, and a main source of the damaging flood water. There are

a number of sites along New Cut Road which could presumably be used for mitigation, a couple large areas with few structures and close to town.

The Taylor family though, who are major local developers, have some property adjacent to that part of the watershed, and a number of interests in the immediate area, including documented interest in having a "River Walk," I understand. They too seem accustomed to perhaps some favoritism from the local government which if it continues could tragically effect the historic character of the town as well as the health and safety of the townspeople.

My understanding is that many of these mitigation points are not in the current plan, which is derived from a study by only one company, and which perhaps ignores many of the old studies, such as the Army Corps of Engineers study, and also seems rushed, done in secret, announced in an authoritarian manner and supported only by political rhetoric, and misleading and inaccurate definitions of terms like "transparency" and "stakeholders."

That is the **Political situation** we have now, and that is the new factor in the discussion since County Executive Allen Kittleman and Councilman Jon Weinstein clumsily rolled out their new proclamation to follow a plan that has had little community input, and has not gone through the normal system of checks and balances, having done an end run around the Howard County Council, has a number of "stakeholders" with financial conflicts of interests, seems at odds with the previous studies, and also appears to be ***inferior in actual mitigation and in safety, to the previous studies, in particular the 2016 H&H study, which seems superior in storm water mitigation and safety, but is more expensive.***

As I mentioned earlier, Ellicott City went through a remarkable change following the 2016 flood, a unique bonding of a community with people working together, helping each other whether friend or stranger, hosting and supplying community dinners, organizing volunteer efforts, and sharing hard-earned recreation. All that seems to be suddenly torn asunder with the rhetorical attacks initiated by Kittleman and Weinstein, and picked up by desperate and exasperated townspeople. If their plan has merit, why, are they relying so heavily on logical fallacies to sell it? The political rhetoric peppered so heavily with one logical fallacy after another is ridiculous, unfair, dishonest, and now has the people of this town at each other's throats.

The secrecy of this plan, and the omission of its very existence in front of the August 20th Congressional Hearing leads me to request a close look, if not an investigation and a citation for Contempt of Congress. Our little town right now is serving as an example of exactly how government should NOT operate.

Thank you for your time and attention,

Tony McGuffin

September 3, 2018

The Honorable James M. Inhofe, Chairman
 The Honorable Benjamin L. Cardin, Ranking Member
 Subcommittee on Transportation and Infrastructure
 Committee on Environment and Public Works
 United States Senate
 Washington, D.C. 20510

Re: Oversight Hearing on Repeated Flooding Events in Ellicott City, MD

Dear Sirs,

I write as a native of Ellicott City, Maryland who grew up in this town and then returned to raise my family here, after living in different parts of the world. I urge you to do all that is in your power to make federal funding available to support flood resilience in Ellicott City.

Ellicott City is not only a treasure of Maryland, but of the nation. The oldest surviving railroad station is here – and it was just the second railroad station in the country, being the first stop outside of Baltimore on the Baltimore & Ohio Railroad. The National Road, one of the principal routes used to settle the West, passes through Ellicott City. The Patapsco River valley played an important role in the Industrial Revolution in the United States. It is a unique and lovely town, of the type that does not exist in many places anymore.

The floods of July 30, 2016 and May 27, 2018 show how vulnerable the town has become to extreme weather events, as well as the impact of increased impermeable surfaces higher up in the watershed (see McCormick & Taylor's Hydraulic and Hydrology study of Ellicott City, dated June 2017). Since 2011, three devastating floods have occurred, due to runoff from above. While Ellicott City has flooded numerous times in the past, the destruction prior to 2011 would come from the Patapsco rising. Residents and business owners made location and investment decisions based on that "normal". Now we are dealing with a new normal.

The people and government of Howard County have a responsibility to address this in several ways: 1) adjusting regulations on land development to account for the increased risk from runoff floods; 2) building infrastructure to deal with the increased runoff down the residential and commercial Main St./Frederick Rd.; 3) come together to support our neighbors and the businesses, residents, employees, property owners, and all those impacted.

I would like to ask you as representatives in Congress to do whatever you can to support this. This includes appropriating funds from any possible sources/programs that could help us meet the challenge of making Ellicott City safe and thriving. For the sake of our country's history, we cannot abandon the town. For the huge challenge ahead of us, the county cannot bear the full cost. The importance of Ellicott City to our history and as a unique place, warrants exceptional action to direct federal funds to support us. In particular, I ask that funds be directed towards 1) helping the Howard County Government implement the Five-Year Plan for flood mitigation; and

2) any possible assistance to residents, property owners, business owners, and employees who have been impacted by the floods. I am aware that the latter may be less likely, but would like to ask. The floods have had a devastating impact on individuals. Note that the floods' impacts reached not only Old Ellicott City, but also the neighborhoods of Chatham and Valley Mede (and some of these properties flooded a fourth time, in 2014).

Finally, I would also like to ask that you support any efforts to pass legislation that would help our town become more resilient in the future – regarding stormwater (quantity) management, development regulations and fees, and others. While these are mostly local issues, perhaps legislation at the federal level may also impact these areas.

Thank you very much for your attention and the opportunity to testify.

Sincerely,
Melissa

Melissa Metz
3101 Chatham Rd.
Ellicott City, MD 21042

Testimony of Ron Peters
Property Owner
Before the
Committee on Environment and Public Works
Subcommittee on Transportation and Infrastructure
United States Senate

Oversight Hearing on Repeated Flooding in Ellicott City, MD:
Reviewing the Federal Role in Preventing Future Events
August 20, 2018

The Honorable James M. Inhofe
Chairman
Subcommittee on Transportation
And Infrastructure
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

The Honorable Benjamin L. Cardin
Ranking Member
Subcommittee on Transportation
and Infrastructure
Committee on Environment and
Public Works
United States Senate
Washington, DC 20510

To all concerned:

My name is Ron Peters. I own three properties in the Historic District of Ellicott City, MD. I started coming to Ellicott City 55 years ago when I was eight. My Grandfather, John Baker, would bring me along with him as he collected rent from his many properties in the area. I grew up three miles outside of Ellicott City, where my friends and I would ride our bikes to the town of Daniels, where there was a thriving mill, a post office and a general store. That was before Hurricane Agnes in 1972. Agnes caused the Patapsco river to rise over 20 feet and overflow its banks, causing great devastation to all the communities, businesses, homes and bridges in the surrounding area. Six bridges crossing the Patapsco were destroyed. The Hollofield bridge was spared only because of its height above the river. The river did crest nearly 3 feet over the road surface.

The river flowed into Ellicott City's Main Street and rose to just past Caplan's Dept. Store. I helped my Grandfather with the clean up at his Main Street and Maryland Ave. properties. It consisted mostly of washing mud from the buildings, sidewalks and streets.

I have a scrapbook of pictures I took, along with articles from all the newspapers I could find.

There was no flooding in the upper portions of the town and no flooding in the upper watershed. I have a tenant at 8637 Frederick Road in the West End who was living there in 1972 and she tells me there was no flooding then or in 1975 when Hurricane Eloise flooded lower Main Street. In fact, she never had flooding until 2011 and she has lived there for nearly 50 years. In 2011 the flooding from the upper watershed came within six inches of entering the house. In 2016 it was 20 inches deep in the house and in 2018 it was 14 inches deep.

In 2016, the water rose so fast they didn't have time to move their cars to safety and lost both vehicles. Mrs. Lillian Shifflett had to be rescued from her car as the water submerged the hood at South Rogers and Frederick Road.

The Hudson river flows behind my house and is one of the four streams that merge and flow through the City.

You may ask yourself, how can the Patapsco River rise quickly over 20 feet, washing cars and buildings and people away in 1972 when there was no flooding caused by the New Cut, Autumn Hill, Tiber and Hudson rivers? There was no flooding in the West End, The Brewery (at that time known as Tolbert Lumber), or at the Howard House.

I will now give you my thoughts, being a member of the Ellicott City Flood Works Group since 2015 and having experienced first hand five floods. Two from the Patapsco River up and three from the watershed down.

In the 1970's when both of the floods hit, there was no storm water runoff mitigation requirements. Developments, farm fields, roads and shopping centers had no STFDA's (Slow the Flow Detention areas.) The Patapsco river would rise from all this unmitigated runoff coming from Carroll, Howard, and Baltimore counties. The river would stay muddy for days. As kids we would wait over a week for the water to clear enough to fish.

Beginning in the late 1980's and 1990's storm water mitigation requirements were put in place. Developments replaced fields along the Patapsco watershed. The Donaldson, Stirn, Bakers and Riddle farms, all in Howard County, and dozens of others have been developed with storm water mitigation (STFDA's). Carroll and Baltimore counties have seen the same type of development with added STFDA's. The Patapsco River no longer rises as fast or as high as it did in the 1970's. You can see the clarity of the water return in days instead of weeks after heavy rainfall. Trout now live in the river.

So, my observation is that when the proper size storm water retention areas are installed, flooding can be reduced and almost eliminated. I have the following thoughts on what has happened in the Tiber/Hudson watershed and the solutions I believe need to be implemented to reduce the flooding in Ellicott City.

Ellicott City is located where four small streams, the Hudson Branch, which drains 981.4 acres, starting at Route 70 and Route 29, the Tiber/Catrock branch, which drains 341.8 acres, starting west of Route 29

by St. John's Lane, the Autumn Hill branch, which drains 416.5 acres and starts at Montgomery Road and the New Cut/Wildcat branch which drains 576.4 acres and starts at the southeast portion of Montgomery Road. A total of 2370 acres. They all meet in downtown Ellicott City. The drainage is comprised of steep slopes which causes the runoff to gather very quickly. In the 1970's when the Patapsco flooded there was much less development in the EC watershed. There weren't as many shopping centers and Route 29 was one third the size that it is now. Route 40 was also only one half the size and Route 100 didn't exist. The George Howard building, Roger Carter Center and Burgess Mills I and II didn't exist. There were no worries of flooding from the above town. In fact, in 1985 the county chose to reduce the size of the West End culvert from 108 inches in diameter to 84 inches in diameter, reducing its flow capacity by over 30%. I guess the engineers who approved this figured there would never be any additional building or road development in the upper water shed. There were also no storm water management areas to capture runoff from the existing commercial properties, developments or roads. In the late 1980's and 1990's the storm water mitigation requirements did require new developments to install small detention areas. The expansion of Routes 40, 29 and 100 seemed to be exempted from storm water retention requirements. These roads, which are state and federal funded, have no storm water retention areas. Why is it that state highways, MDE, and the EPA have neglected the major runoff from these roads? They drain directly into EC with no mitigation. Some one needs to step up and fix the problem!

The existing 64 STFDA's that are in the watershed need to be inspected by an independent, unbiased engineering firm to make recommendations on how to increase the storage capacity of what already exists. I have visited many of these sites and they are in horrible condition. They are grown over with vegetation and filled with sediment. They don't drain properly. I have videos that show rain water from an office building at Ridge Road and Route 40 draining directly into the Hudson, instead of into the large STFDA located on the other side of the parking lot.

The BGE right of way is another area that consists of over 100 acres and has the best potential for installing more STFDA's in the EC watershed. There are over 600 acres above the watershed that drains through more than 2 miles of BGE right of way. There are multiple locations in that right of way that STFDA's could be installed using earth dams in alignment with some of the streams and capturing runoff from many of the acres above the right of way. There would only be water in these STFDA's for a short period of time. The following day the water will have drained out and the area would return to a water quality area, the best of both worlds. The dams would provide better access for BGE/Exelon to access the power line towers, a bonus for them as well. The BGE retention areas could also capture runoff from Routes 29,40 and 100. None of these roads have storm water detention, and all have runoff going into Ellicott City. There are areas in the watershed that could be used for STFDA's, but are located on private property. The most recent H&H Study avoids looking at private property for retention areas. We need to change our thinking on private/public partnerships to install STFDA's. or enlarge existing ones.

There are many old shopping centers, car dealerships, cemeteries and developments, built in the 1950's and 1960's that have little or no STFDA's. We have to come up with solutions on how to retrofit these areas. We could use drywells or rain gardens to capture runoff from houses and yards and underground pipe farms to store water runoff from parking lots. I've pointed out two areas near the old court house on Courthouse Drive that could be converted to STFDA's. The road would be the dam. There is already a 20" pipe under the road. We could attach a riser to the pipe, with a small flow through the pipe in the bottom of the riser. This would allow small storms to drain like it does now and a large storm would

back up and form a storage pond which would drain slowly until it was empty. Probably by the next day. This area drains about 20 acres. It would be the lowest cost detention area in the watershed, but because it involves getting permission and easements from private property owners, the H&H Study didn't consider it.

I installed 15 cameras in the Historic District of Ellicott City and have retained over 50 hours of footage showing the flood from beginning to end, starting at the EC Colored School and continuing all the way to Tiber alley on lower Main Street. The real time footage showing how quickly the flood water rose in lower Main street, from cars turning around at 4:19 PM and cars being swept away at 4:23PM and then the Miss Fit gym exploding apart at 4:35 PM. Then 6 feet of water rushing down Main Street. They also show the flooding at the intersection of South Rogers and Main Street. I shared the camera views with Howard County OEM and was starting to share with local residents and property owners the week before the last flood occurred. I had one neighbor in West End text me that she was viewing the camera near her house and saw the Hudson getting ready to crest. She grabbed her son, got in her car and left her house minutes before the road was flooded, possibly saving her and her son. I have shared the recorded flood footage with the National Weather Service, the USGS, Howard County OEM, Storm Center Communications and Maryland Public TV. I would like to offer the footage to the Army Corp of Engineers if they could use it to come up with solutions. The Corp of Engineers said they need to do another study. I would hope they could get it right once and for all. The community is tired of studies. I have hundreds of pages of studies that date back to 2010. There are flaws in the most recent study by McCormick and Taylor. They modeled the culvert in West End as 108" in diameter. When I pointed out that it was only 84", I was told that over 3300 cfs was coming down the Hudson at Court Ave. in 2016. I asked how many cfs will fit through the arched culvert under Main Street located 50 yards down stream from Court Ave. They said they didn't model that. When I asked how many cfs will fit under Maryland Ave., they hadn't modeled that either. The arched culvert under Main Street is the most restricted spot in EC. It clogged up in 2011, 2016 and 2018. This forced the water out of the channel and floods down Main Street, impacting all of the buildings and washing cars and trucks away. There is currently 3 feet of sediment under the arched bridge. I'm told that MDE won't allow dredging of the channel and it would just fill back in. If the dredging was done properly, that shouldn't happen.

I'm currently working with Dave Jones, owner of Storm Water Communications, on expanding my EC camera project so citizens could pull up a map of the EC watershed which would have the cameras pin pointed, along with the stream gauges and weather service radar. Citizens would be able to click on the camera and see a live view and the current weather conditions. Dave is currently working on a video for NOAA promoting the new JPSS weather satellite. He is planning on including some Ellicott City footage in the video.

My list of solutions include:

- 1a. The channel from the EC Colored School to the Patapsco river has to be opened up.
- 1b. Buildings, culvert pipes and parking lots covering the channel have to be removed.
2. All road crossings have to use bridges or large box culverts.
3. The channel needs to be dredged deeper where possible.
4. Dead trees and debris along the four streams in the watershed need to be removed. They acted as

2 ton battering rams in the recent storm, smashing through buildings.

5. The current 64 detention ponds need to be inspected by the Corp of Engineers and improved to Maximum efficiency through clean out, enlargement and re-directing building and parking lot runoff into them.
6. Bio-Char test project needs to be funded. Lori Lilly will provide testimony on Bio-Char.
7. The 18 identified projects by McCormick Taylor should be re-evaluated for cost benefits. I believe There are less expensive STFDA's that could be built using earth dams instead of expensive and Inefficient pipe farms. Earth dams STFDA's offer retention and quality potential.
8. Every homeowner could be offered a tax credit for putting in retention on their property. For Example: drywells, rain gardens and rain barrels.
9. The Federal and State governments and Exelon should meet to come up with a solution for runoff Retention for Routes 29,40 and 100, and the BGE right of way.
10. Commercial properties with no storm water retention need to be given incentives to install SWM on Their properties.
11. Federal funding is needed in addition to funding provided by the State and County.
12. Funding for better warning systems to alert citizens. Such as, stream gauges and better access to the Watershed cameras shown on interactive geo-collaborative map.

My great uncle Franklin Baker once told me, "Ron, watch your pennies and your dollars will take care of themselves." I feel if we watch our gallons of runoff, our acre feet of storage will take care of itself. It has to be a Federal, State, County and Community effort to fix this flooding problem.

Thank you Senator Cardin, Senator Van Hollen and Congressman Cummings for coming to Ellicott City and offering your help looking for solutions to mitigate the on going flooding in Ellicott City.

Please feel free to contact me with any questions about my suggestions.

Ron Peters

rpeters@peters-bodyshop.com

443-802-6681

Supporting documents

Section one

- 1) 9 camera view on May19,2018 before the flood
- 2) 9 camera view on May27,2018 4.55 pm during the flood
- 3) 6 camera view on May 27,2018 5.03 pm during the flood
- 4) Tiber-Hudson year built, homes and buildings, dark green shows
No storm water mitigation, this includes rte29,rte40,and rte 100
- 5) Rainfall totals for Ellicott City Md. May27, 2018, shows 3 inches
Between 3.20 and 5.00 pm
- 6) Tiber Hudson watershed map, BGE right of way
- 7) Proposed Homeland Security stream gage locations
- 8) May 2, 2018 storm map
- 9) May 27,2018 rainfall intensity map
 - 10) Tiber/Hudson/Newcut topographic map
 - 11) National Weather Service report for May 27, 2019

Section two

- 1) Individual Camera views approximate, 15 minute intervals
 - 1) Rogers and Main Street at Ellicott City Colored School
 - 2) 108/84 pipe in 8600 block main street
 - 3) Court ave at Main Street, 8300 block
 - 4) Lot D behind Lapalapa, Tiber Hudson intersection
 - 5) Tiber-Newcut west behind ECpops
 - 6) EC POPS , Main street east, 8143 main street
 - 7) Portali's East, 8085 Main street
 - 8) Tiber Alley, Tea on the Tiber, Great Panes , 8069 main street

Section three

- 1) Tiber Hudson Stream Channel improvement recommendations
 - 1) Tiber-Newcut after flood behind EC Pops 8143 main street
 - 2) Arched culvert at 8300 main street
 - 3) 108-84 culvert in the Westend , 8600 block
 - 4) Logs and debris lodged in Caplan's
 - 5) Tiber culvert in lot D
 - 6) Ellicott Mills drive
 - 7) Log jams along the Autumn Hill branch
 - 8) 64 current SWM facilities need inspections

Section four

- 1) BGE right of way SWM recommendations
 - 1) There are many areas shown on the maps in the BGE right of way
 - 2) Examples of STFDA's that could be installed in the BGE right of way
 - A) Lyons Mill road, Owings Mills, Md
 - B) Uniontown Road , Westminster

Section five

- 1) EC Strong Volunteers doing flood cleanup
 - A) EC Pops building -9ft of mud & water in basement full of inventory, 5 ft on first floor , took over 4 weeks to clean out ,one bucket at a time
 - B) Seventeen Seventy Two,the old bank building, 8 ft of mud and water in the basement , 3 feet of dirt and mud on first floor, water was 8 feet high on first floor , three weeks to clean out
 - C) A-Diva, 8 feet in the basement , six feet on first floor , shop owner tied herself to the sprinkler pipes while standing on the front counter and waited one hour to be rescued
 - D) Great Panes glass shop had 8ft in basement, 9 feet on first floor , 3 feet of dirt and mud
 - E) Joan Eve antiques, 9 feet of water, 3 feet of dirt and mud, Shop owner Joan Eve and friend Gary had to escape the building by breaking a window, it took them over 25 minutes to reach safety holding onto a fence as they made their way to higher ground , the water up to their chest. If they had waited a few minutes longer the outcome may have been different
 - F) Portali's restaurant complete demo, basement full, first floor gutted, all equipment ,fixtures, flooring destroyed.
 - G) 8637-8639 main street in the Westend , both units gutted of furniture, flooring , kitchens , drywall , tenants relocated for repairs.

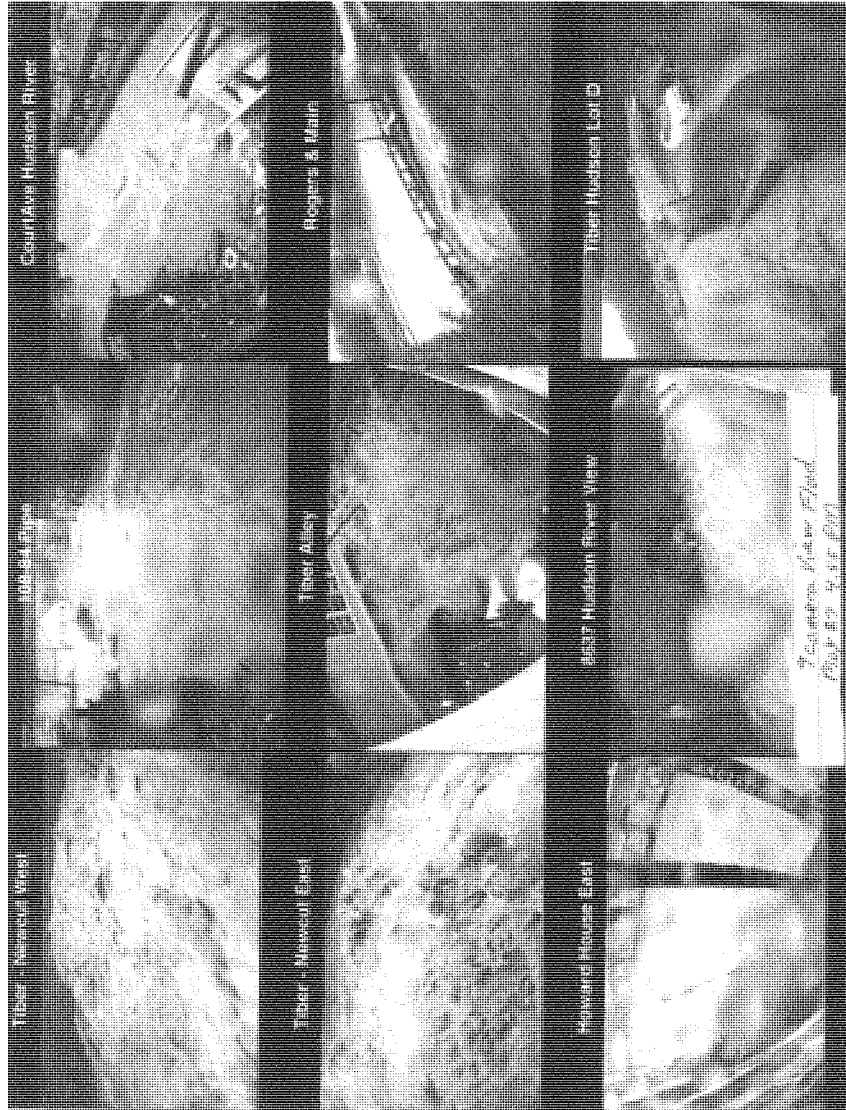
This is the second time in 22 months that all the above locations have gone thru this along with dozens of others .

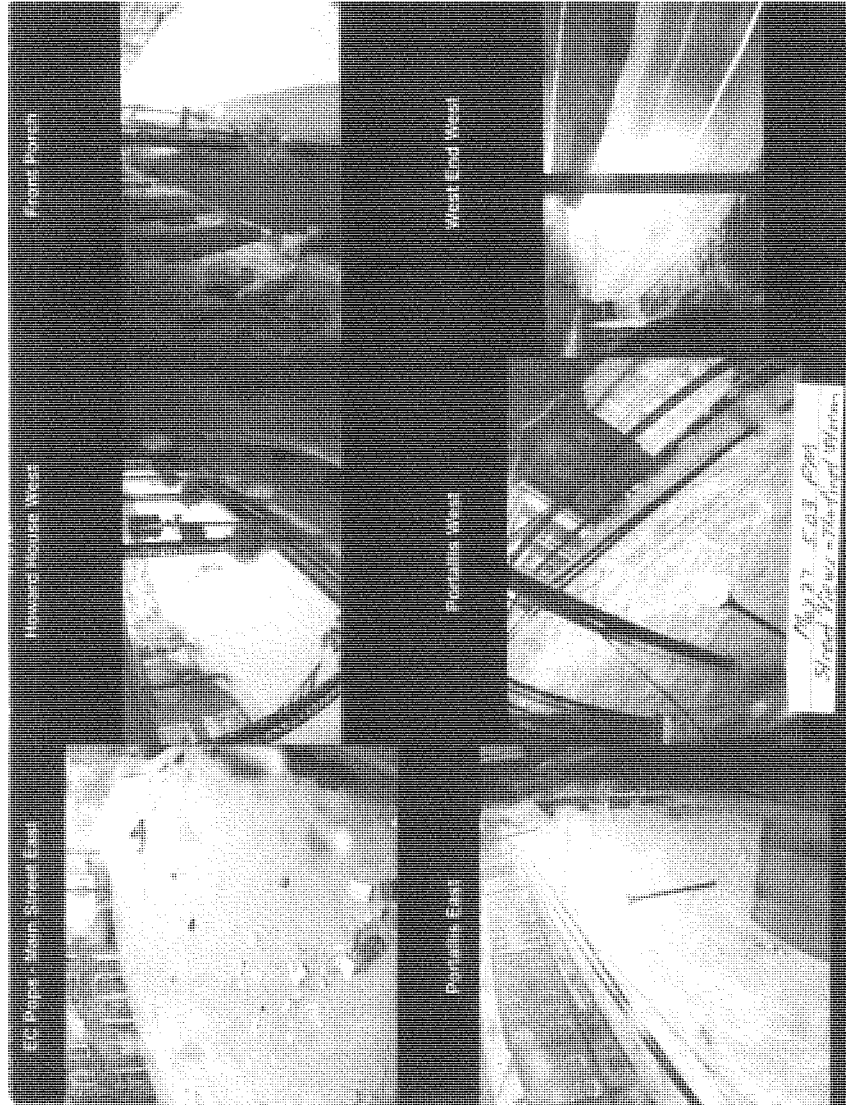
We have to look at improving our current SWM locations
Now! We don't need a study to do that!

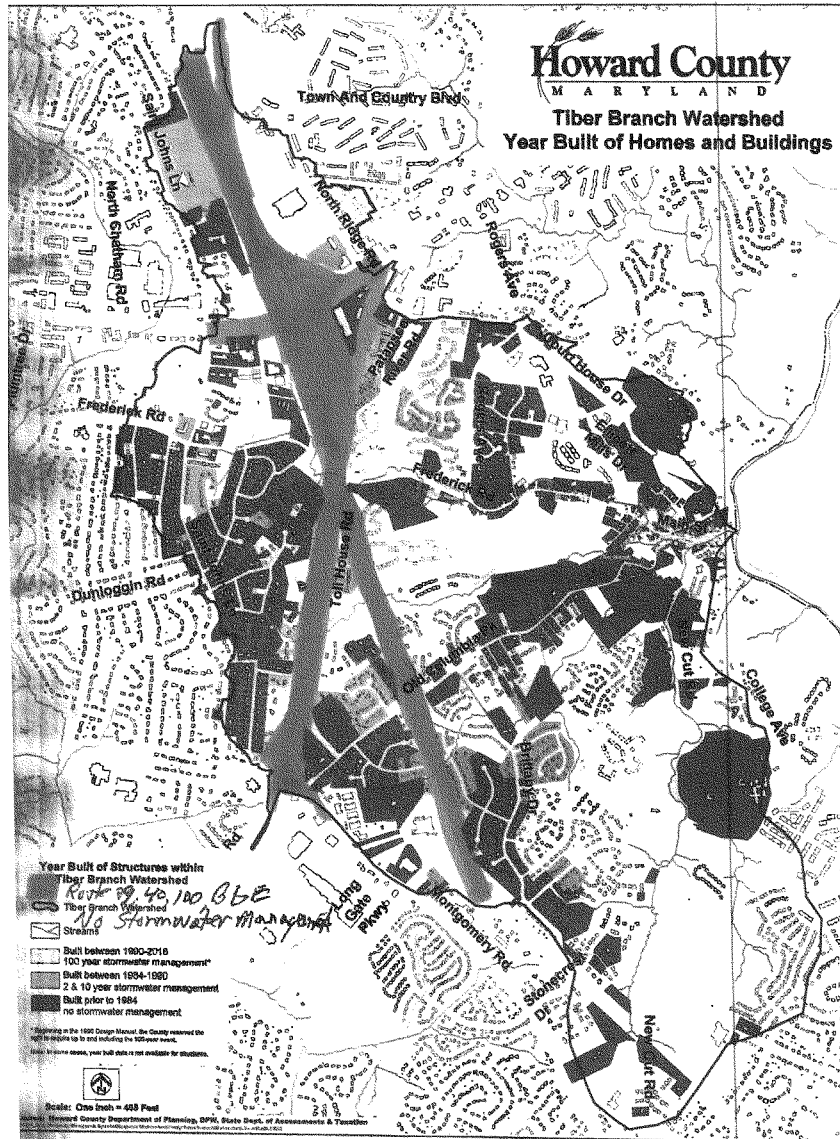
We have to improve the flow capacities of the channels now!
We don't need a study to do that!

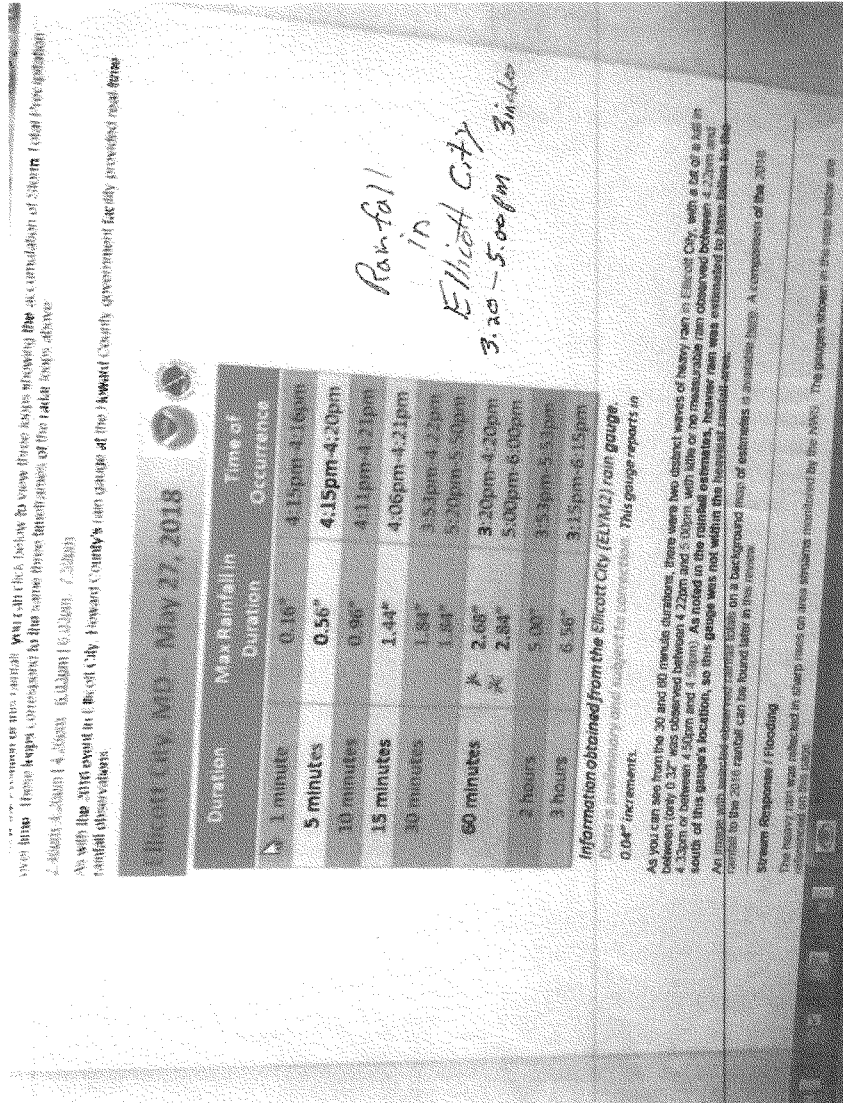
We need to add new detention areas as soon as possible !
We don't need to study that!
Studies are a way for prolonging doing Nothing!
We have done enough studies over the last 8 years!

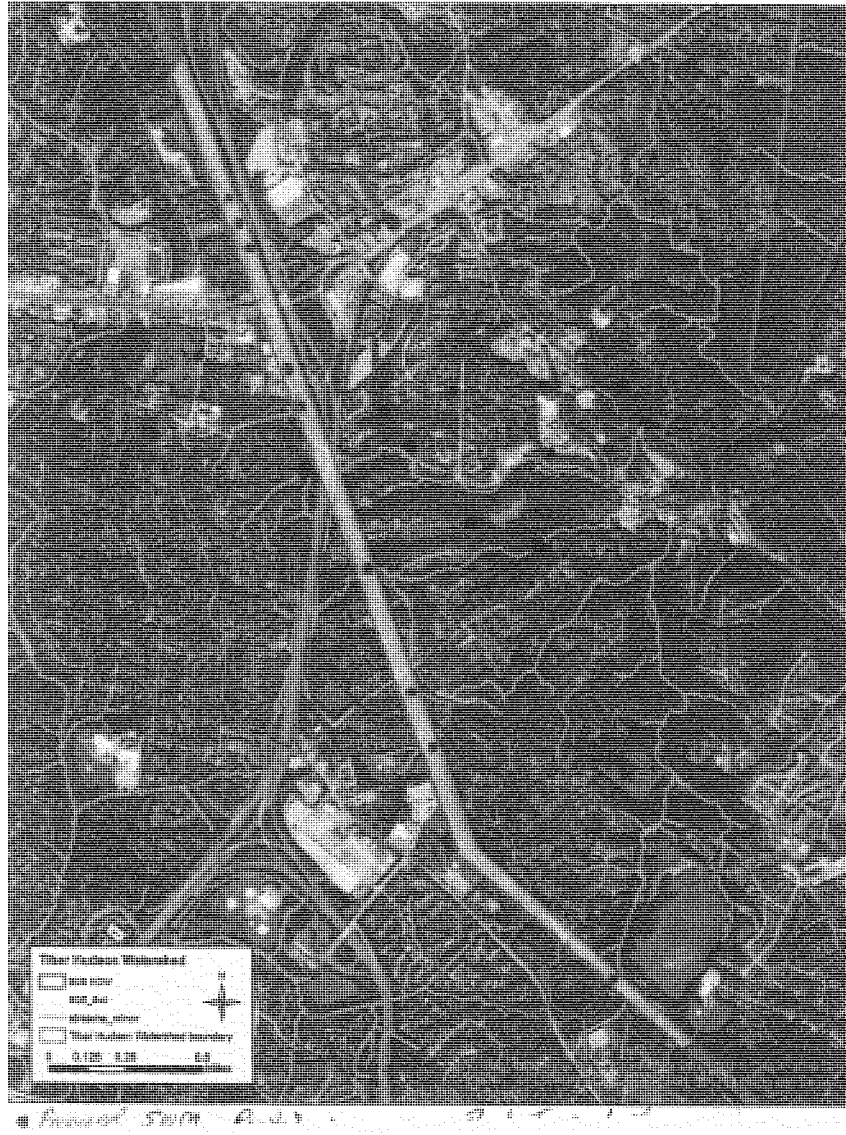


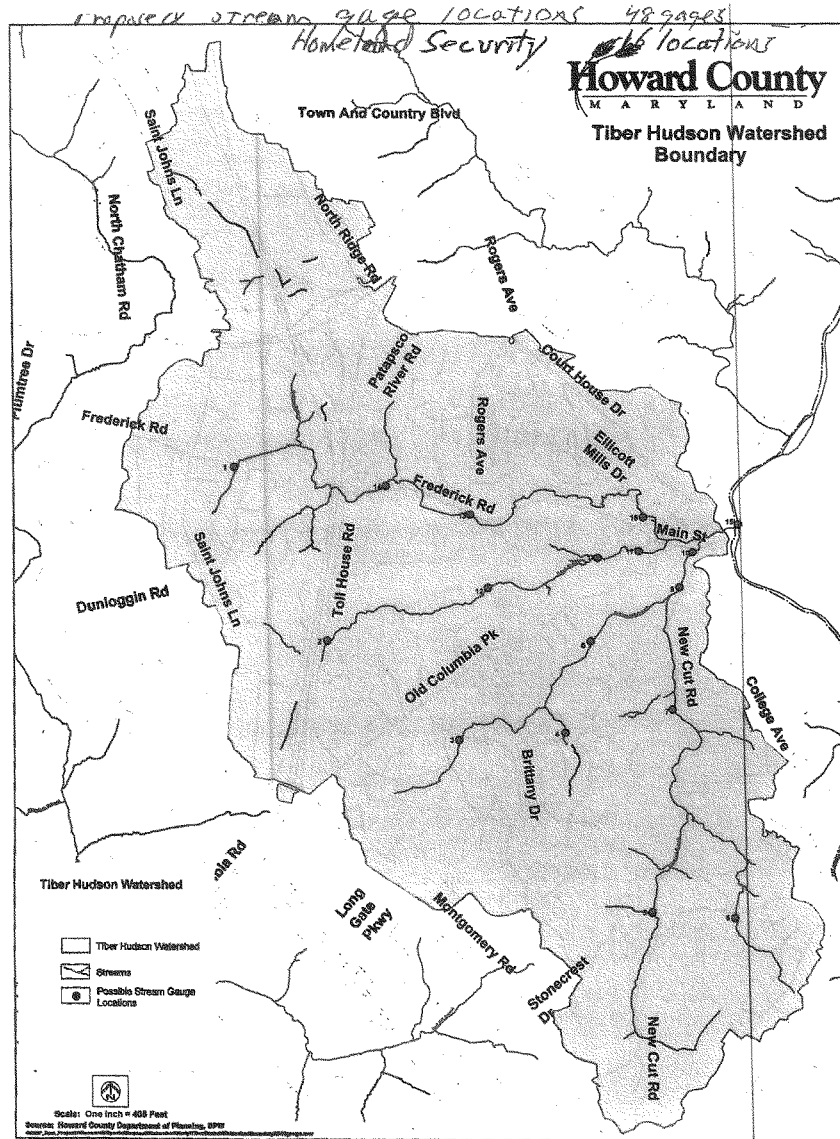


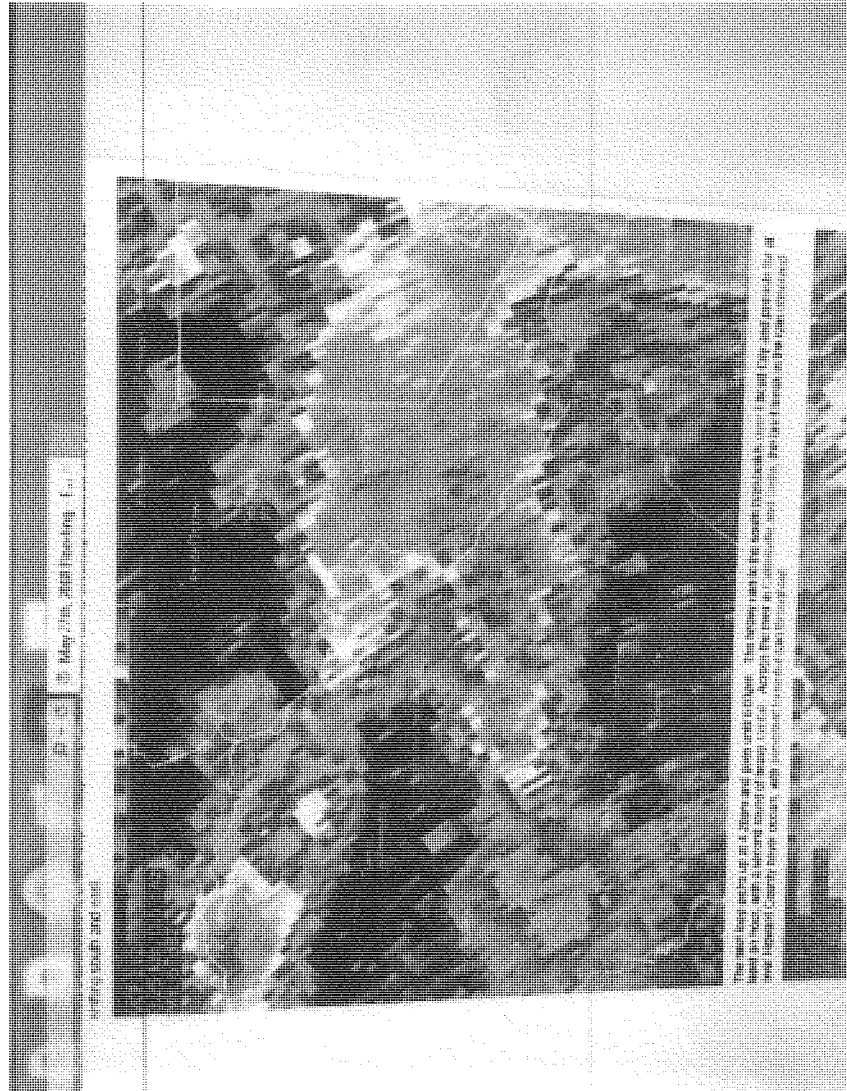










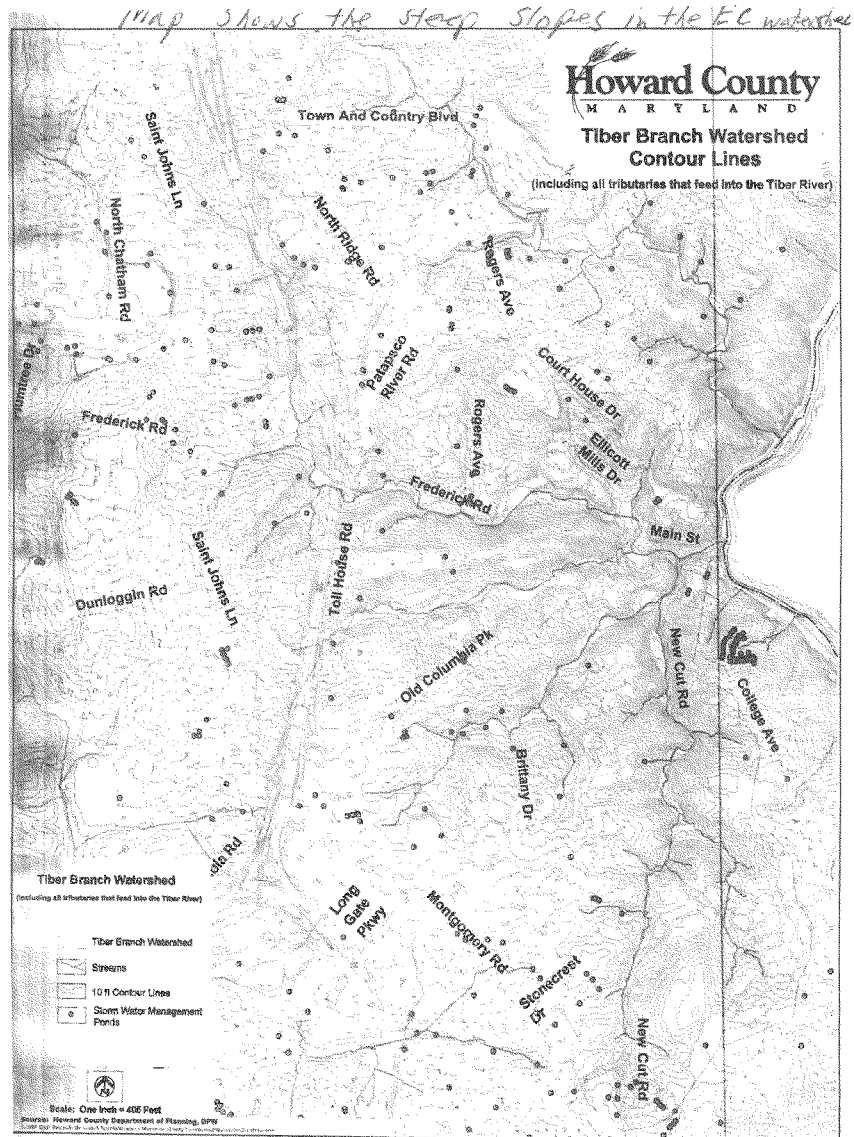


LOCAL FLOODING

The maps below show radar rainfall estimates from the entire event. Radar estimates are usually large areas which received 4.5 inches or more, as indicated by the yellow, red, and white colors in the maps. Areas colored in red were estimated to have received 8.5 inches or more, and the white areas were estimated to have received 12 inches or more. The maps show the area around the city of San Francisco, California, including the surrounding Bay Area.



The above maps show the radar rainfall estimates from the entire event. The maps show the area around the city of San Francisco, California, including the surrounding Bay Area.



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Ellicott City & Catonsville, Maryland -- Heavy Rain and Flash Flooding of May 27th, 2018
(Last updated 8/28/2018)

Quantization

Overview

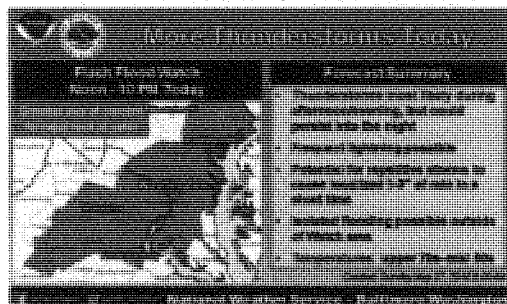
For the second time in just 22 months, torrential rain fell in the Ellicott City and Catonsville areas of Howard and Baltimore Counties. The heavy rainfall, between 5 and 12 inches in the heaviest band, caused catastrophic damage, especially in Historic Ellicott City where nearly 30-year old historic buildings were badly trying to help a woman who was swimming assistance from the first floor waves. Many homes were damaged or destroyed, dozens of vehicles were swept away by flood waters. Hundreds of people were addressed by first responders during the event, with around 1100 separate 911 calls reported in to Howard County. Some roads were washed out and land erosion and localized landslides were reported.

Thesauri

The National Weather Service (NWS) began highlighting the potential for flooding in the Hazardous Weather Outlook (link) beginning on Friday morning, May 25th.

Thunderstorms capable of producing locally heavy rain may lead to isolated incidents of flooding on Saturday and Sunday.

On Sunday morning, May 27th, a Flash Flood Watch was issued for the Baltimore/Washington corridor, highlighting the potential for showers and thunderstorms capable of producing heavy rain during the afternoon and evening.

[illegible]

Just as the rain began, a [Flood Warning](#) was issued at 3:15pm for portions of Howard County, Baltimore County, and Baltimore City including Ellicott City, Catonsville, Dundalk, and Baltimore City, all of which experienced significant flooding during this event. This initial rain pushed south of Ellicott City after causing an estimated 1.5 to 2 inches of rain, but by 4:00pm, had built back over both Ellicott City and Catonsville. At 4:00pm, video footage showed a small amount of flowing water near the curbs on Main Street in Ellicott City, with rain increasing in intensity. Video shows Main Street was still passable until around 4:20pm.

Between 4:00pm and 4:30pm, the heavy rain persisted, quickly dropping an estimated two inches of rain in a band just south of Elliott City to near Catonsville. This heavy rain caused a major rise in the New Cut Branch ([click here](#) for an annotated map of the watershed), and the added water pushed the Tiber River out of its banks at 4:10pm near Tiber Alley. Two minutes later, at 4:20pm, the water level in the Tiber further increased, exceeding the capacity of the channel in the 8100 block of Main Street and near Tiber Alley, sending water both into nearby structures and down the Alley onto Main Street.

As initial reports of this more significant water came in to the Medford Weather Service, the Flood Warning was upgraded to a **Flood Warning**, at 4:20pm. Remarkably, conditions continued to worsen throughout the Ellicott City area between 4:30pm and 5:00pm as the rain shifted just south of the city, with overland flooding occurring in West End as well as even more significant water coming down the Tiber and through both Tiber Alley and the buildings on the south side of Main Street. The highest water – up to the top of the first floor of buildings – was observed between 4:40pm and 5:00pm, then water levels began to recede somewhat.

At the time of this highest water (4:40pm), a **Flood Emergency** was declared by the National Weather Service, in coordination with Howard County Emergency Management, due to the ongoing catastrophic flooding, and the heaviest rain was still falling at the point. Total rainfall estimates reached six inches by 5:15pm just south of Old Town Elkton City, and in the Oella and Catonsville areas.

A second round of heavy rain pushed across Ellicott City between 5:00pm and 8:00pm, with the heaviest rain occurring between 5:20pm and 6:30pm. This second round was of nearly equal intensity to the first, and had equal or greater impacts. This second round of heavy rain prompted even stronger statements in the Flash Flood Emergency.

HEAVY RAIN HAS MOVED BACK INTO THIS AREA. THOSE CURRENTLY RESPONDING TO EARLIER FLASH FLOODING MUST SEEK HIGHER GROUND IMMEDIATELY AS A NEW ROUND OF FLOODING IS IMMINENT! THIS NEW FLOODING COULD BE MORE SIGNIFICANT THAN THE INITIAL ROUND! YOU MUST GO TO THE HIGHEST POSSIBLE LOCATION IMMEDIATELY AND STAY AWAY FROM ANYWHERE WHERE THERE IS WATER OR COULD BE WATER!!!

On the Hudson Branch, water levels were higher than the first round by 5:35pm, going over a deck near Court Street by 5:40pm. Water levels on the Hudson Branch peaked at 5:53pm at a level almost equal to the 2015 flood. Downstream at Tiber Alley, the relative full ended around 5:40pm as well, with floodwaters rising back up to the top of the first floor of buildings for about half an hour, until 6:10pm.

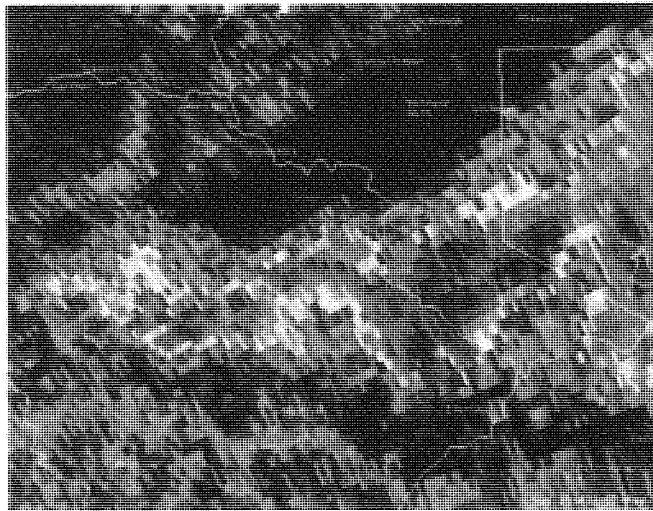
The second round of rainfall shifted south by 6:00pm, but another round of heavy rain, which caused flash flooding in the Sykesville area, was moving toward the affected region. Luckily, it weakened as it approached Ellicott City, sparing the area from a third flood wave. Therefore, all the small streams in the Tiber-Hudson basin were back within their banks by around 6:45pm.

Radar

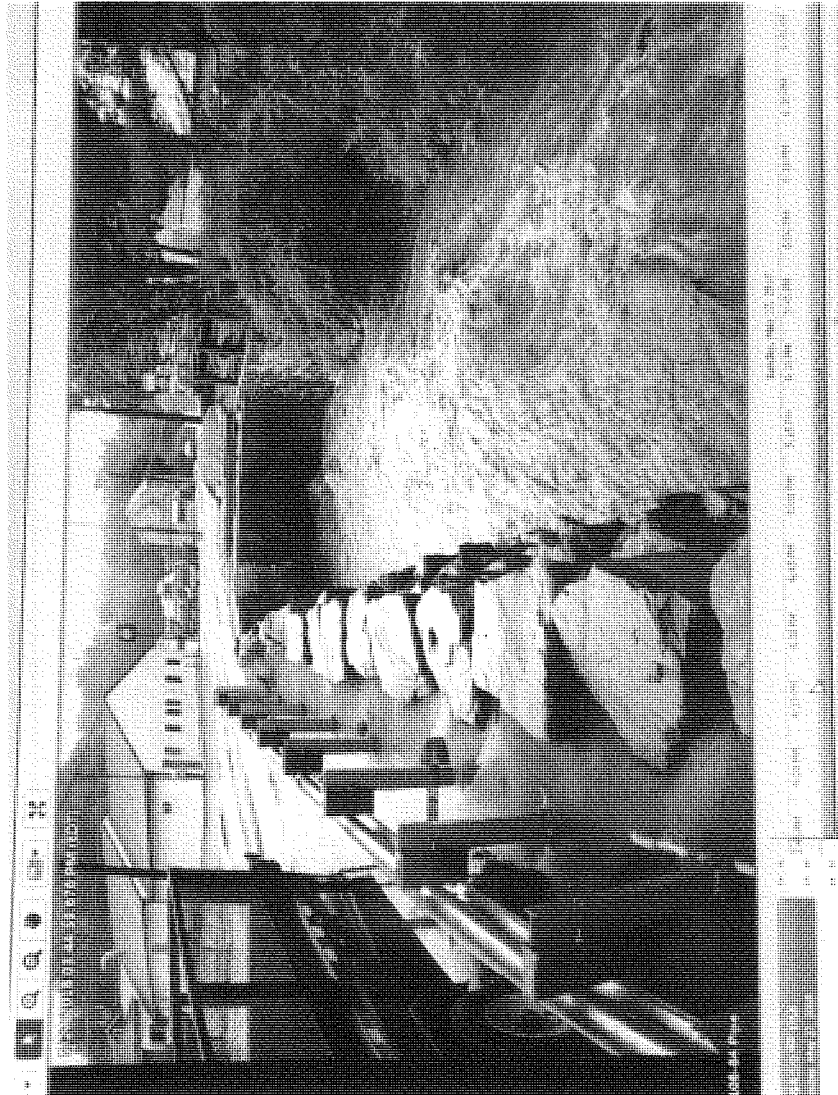
This [radar loop](#) of the full event (Warning: Very large file!) shows conditions from approximately 2:00pm to 7:00pm on Sunday. Multiple low-level boundaries (moving blue lines to the west) can be seen which aided in forming new showers and storms to move over the same areas repeatedly.

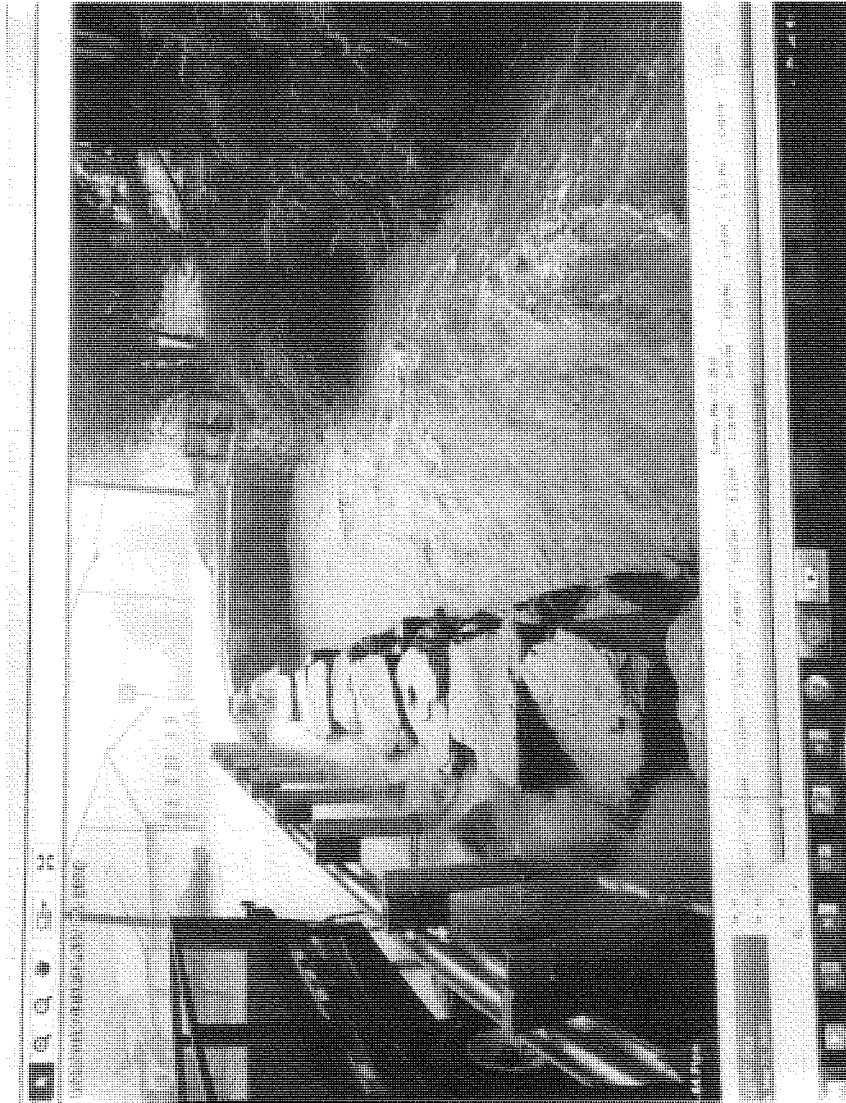
Zoomed Radar Loops

The first loop shows the time period from 2:40pm to 4:25pm. The initial rain shown caused minor street flooding between 3pm and 4pm. The heavier rain toward the end of the loop sparked the more significant flooding which began around the time this loop ends. Note that at the end of the loop -- 4:25pm -- a lull in the heavy rain is occurring in Ellicott City proper, with much of the rain area shifting south and east.



The next loop picks up at 4:25pm and goes until 6:03pm. The heavy rain to the south backbuilds over Ellicott City and persists for at least an hour, with a second round of heavy rainfall. Across the river in Catonsville and Owles, the brief break in the rain observed over Howard County never occurs, with persistent torrential rain throughout.





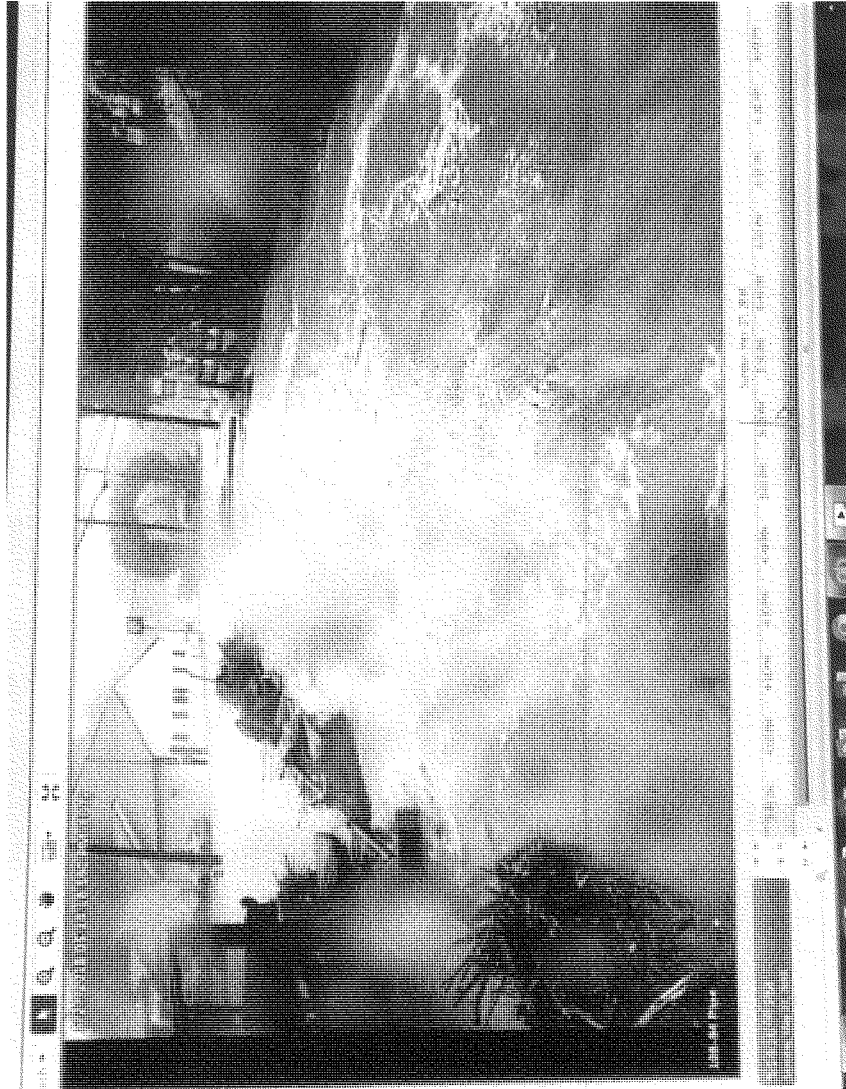








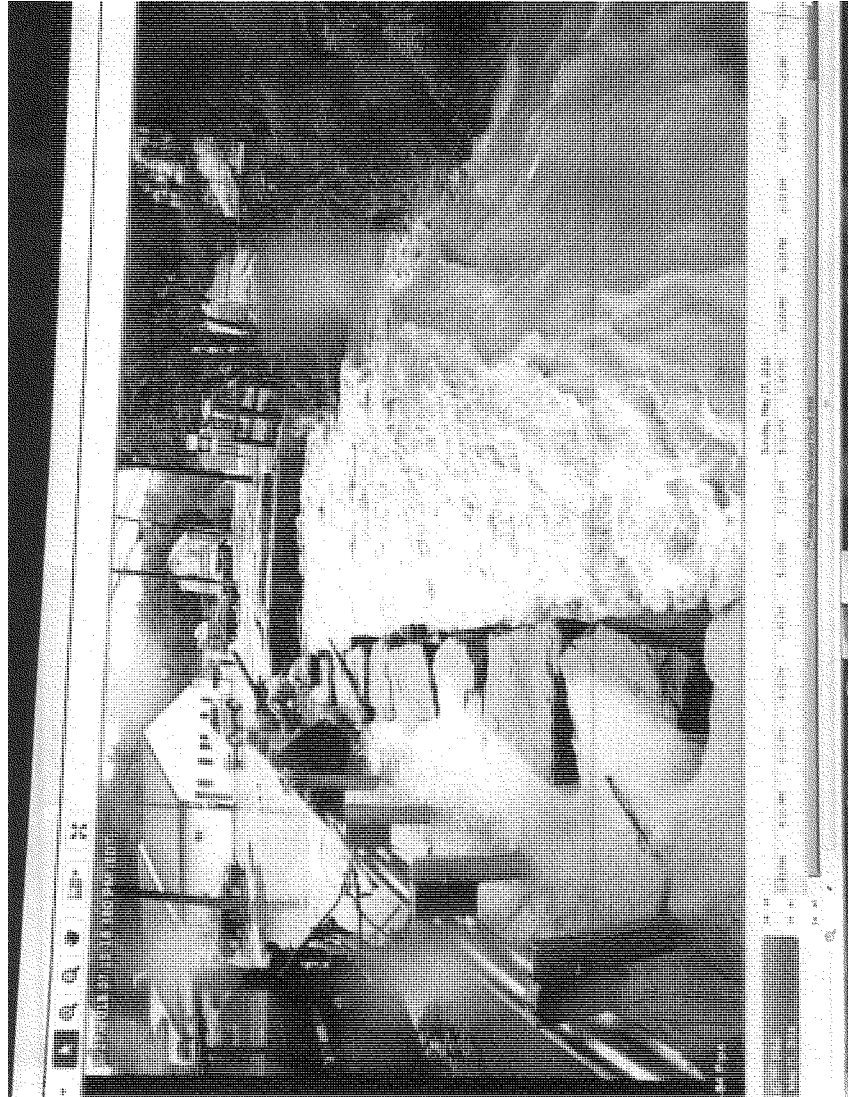




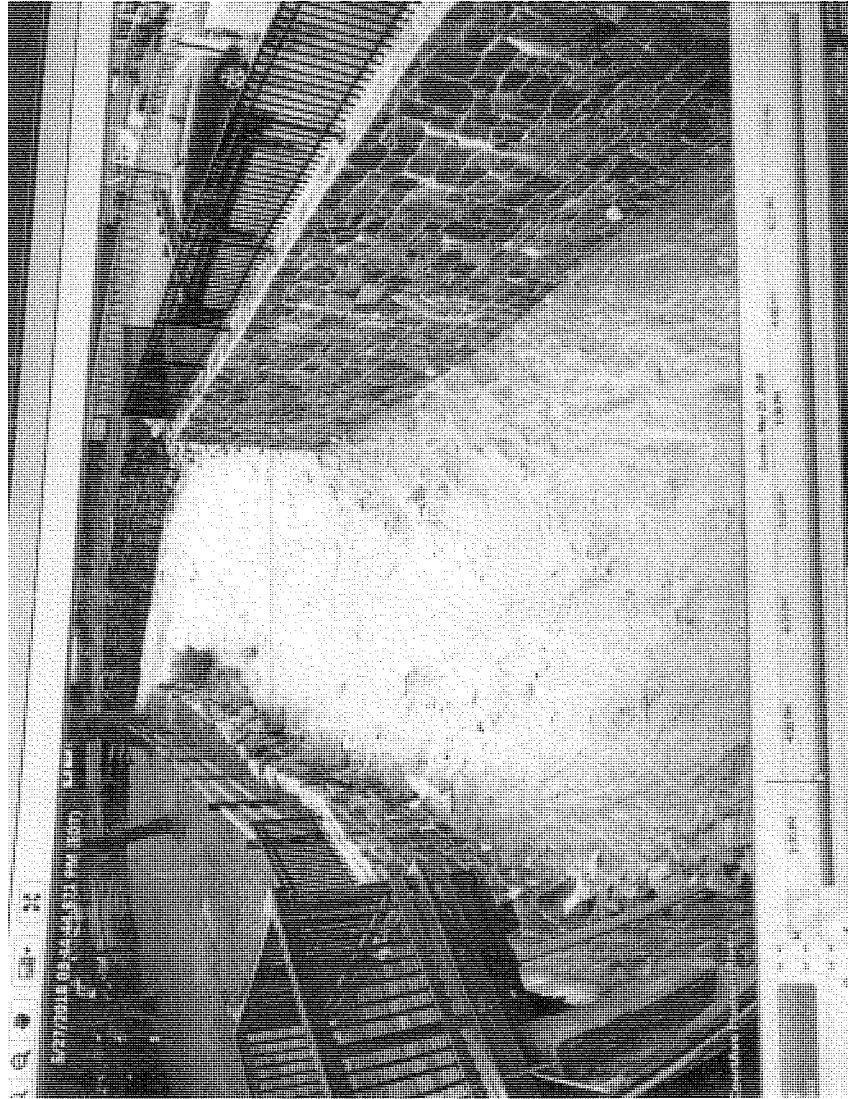




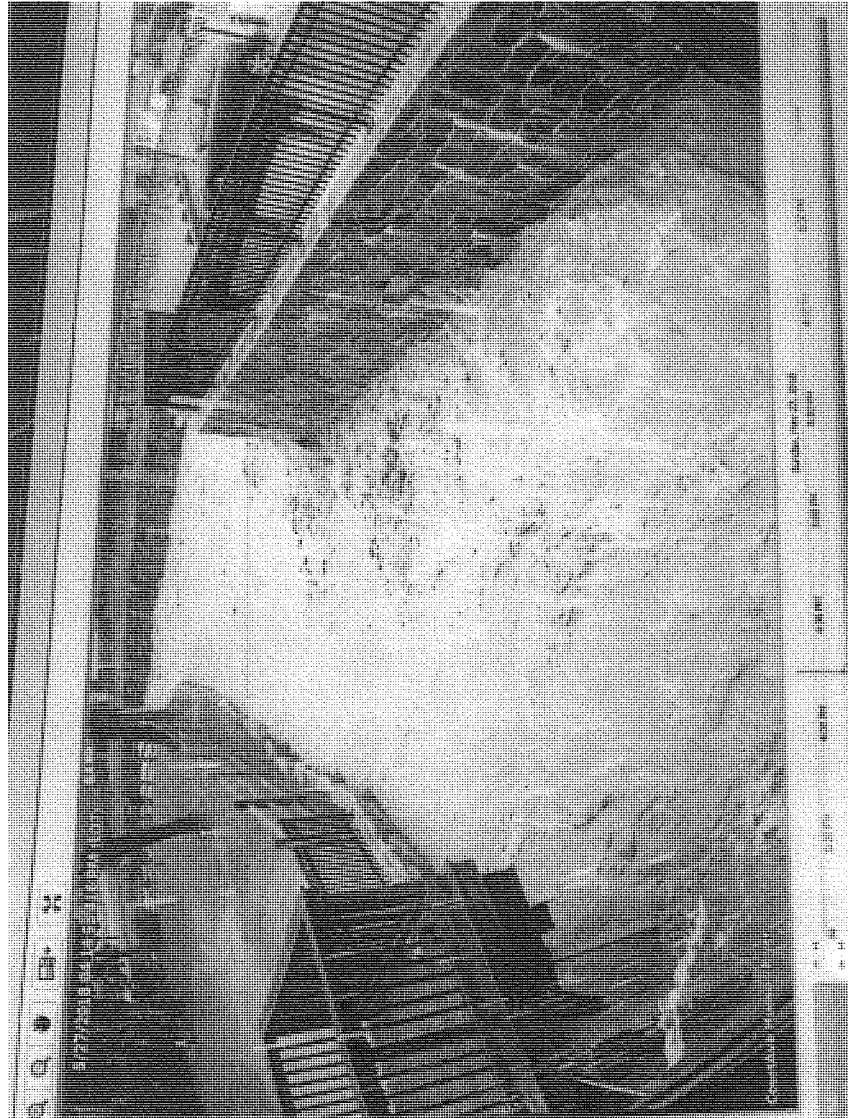


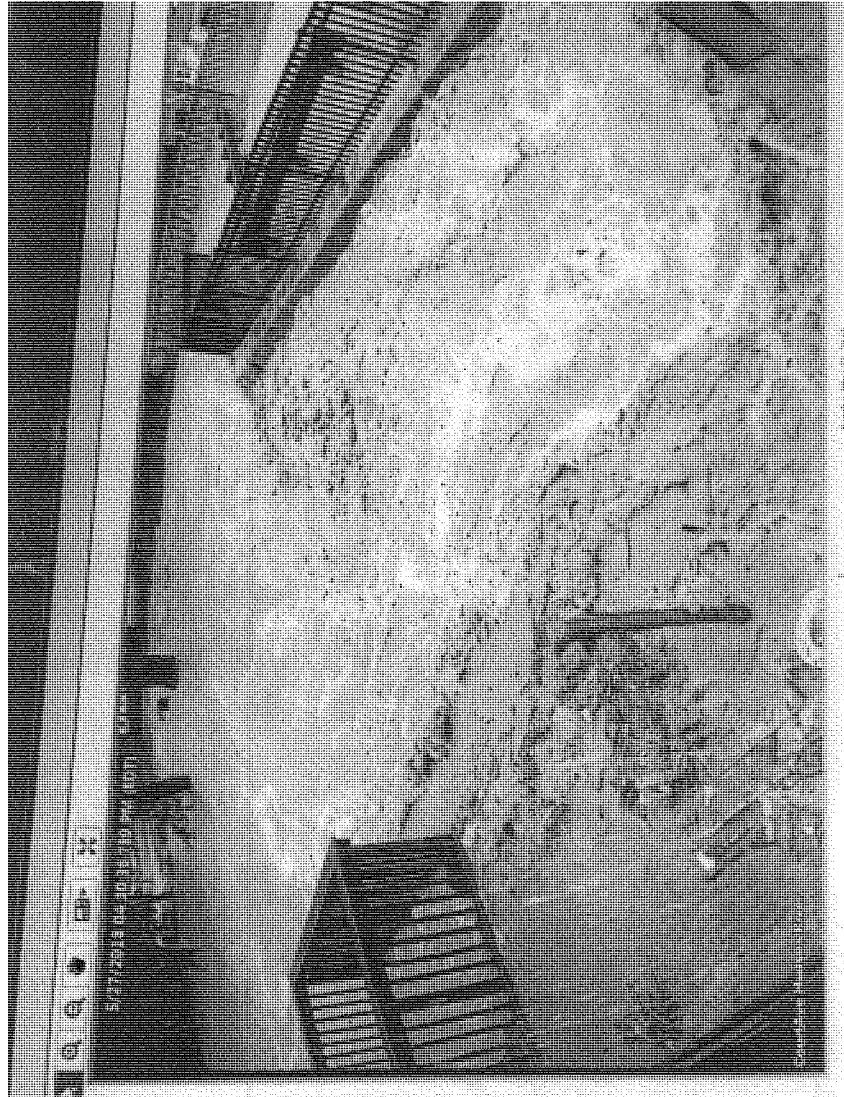


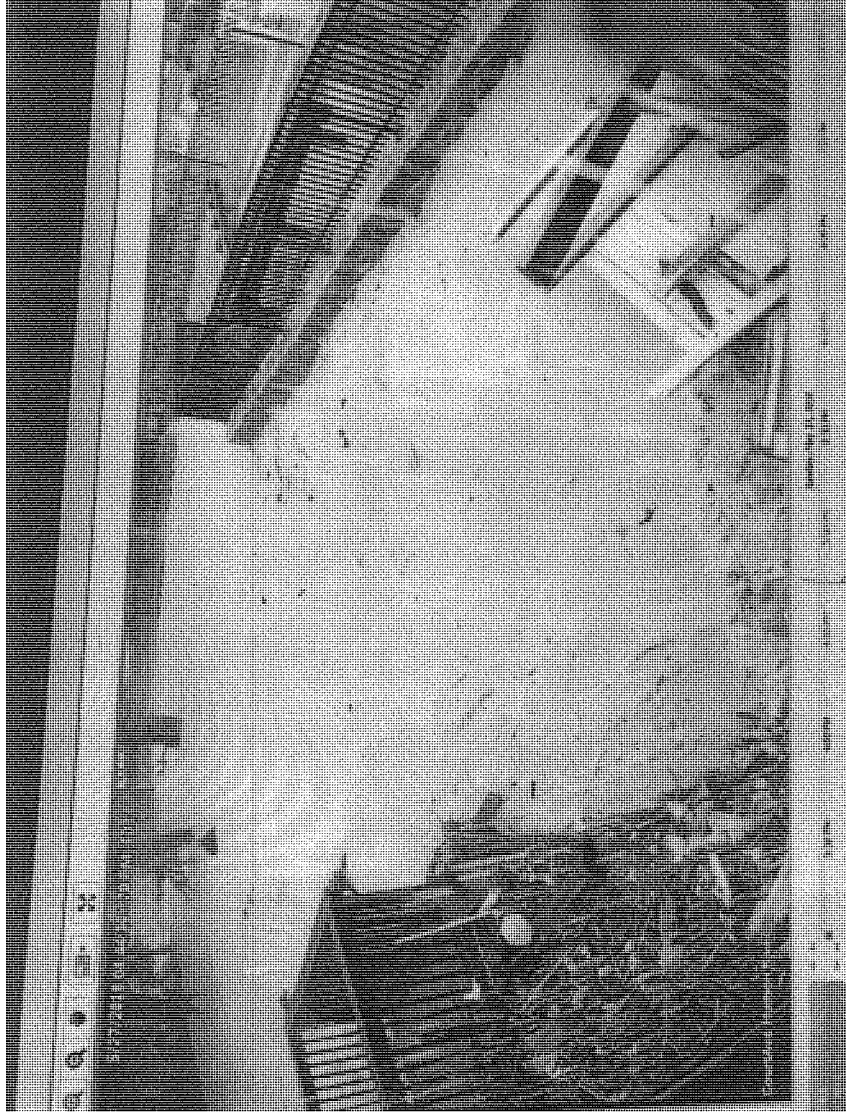




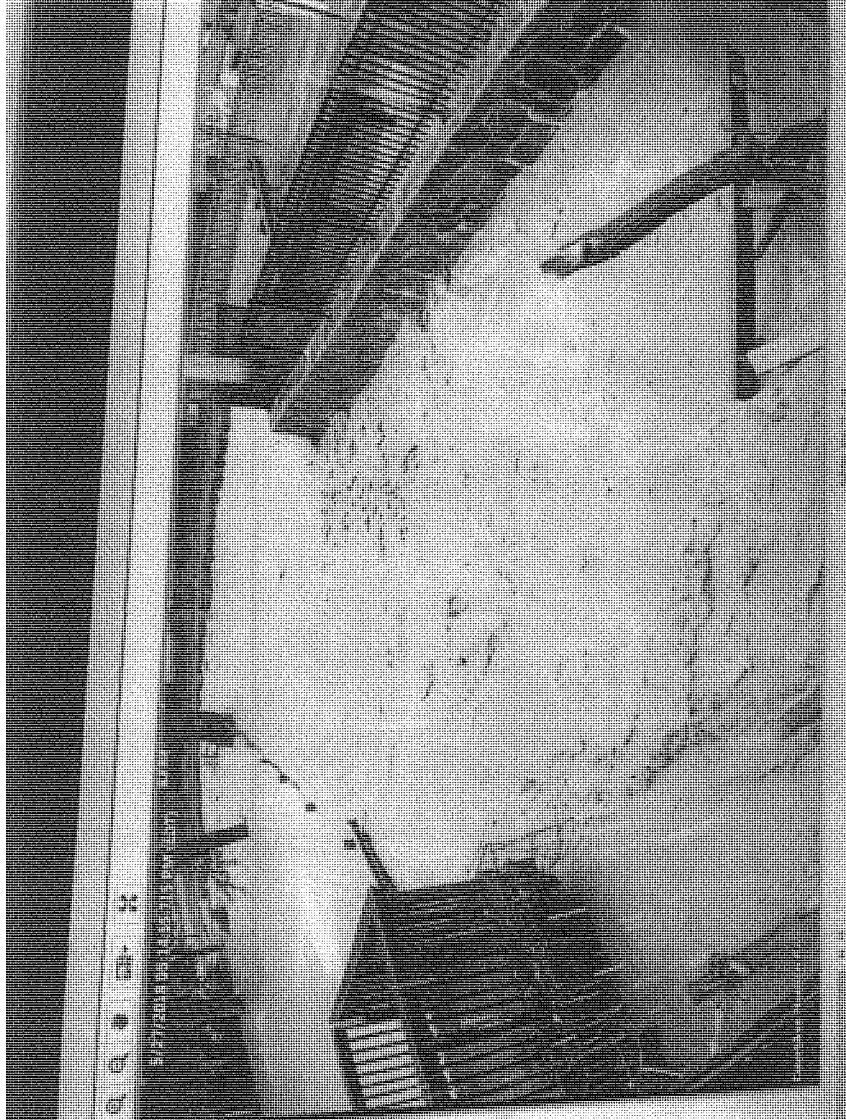










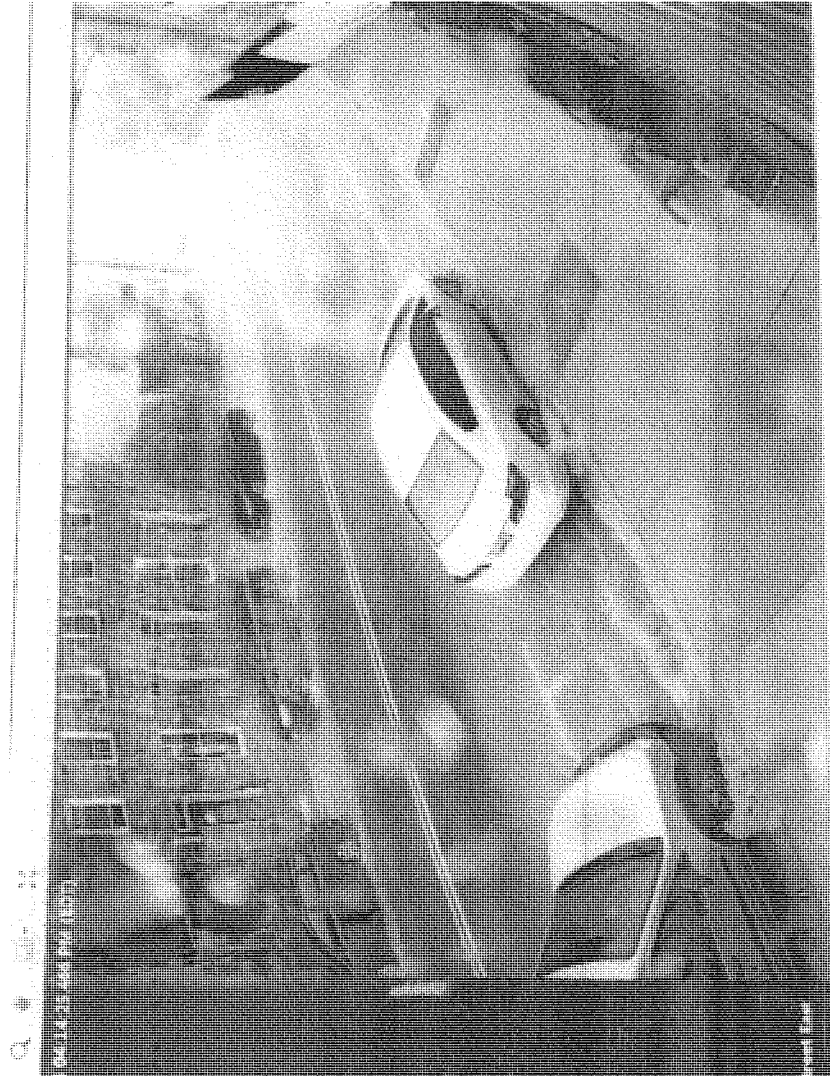












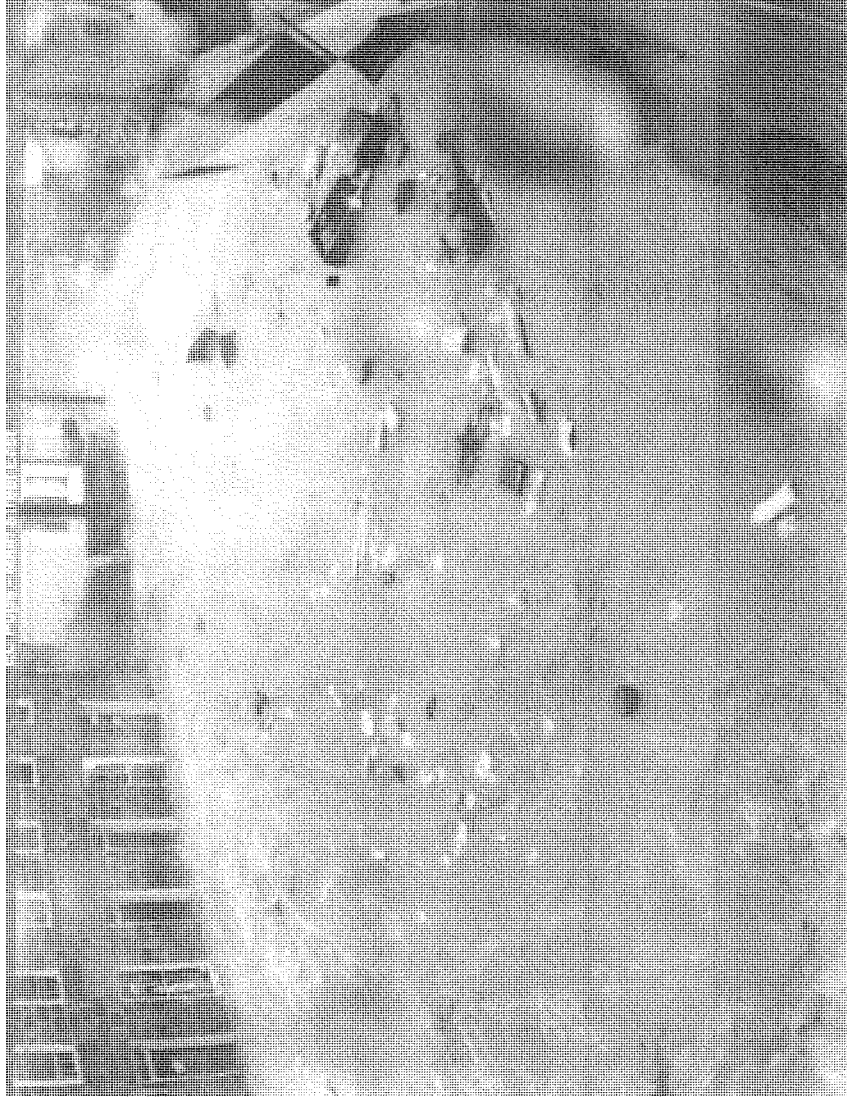










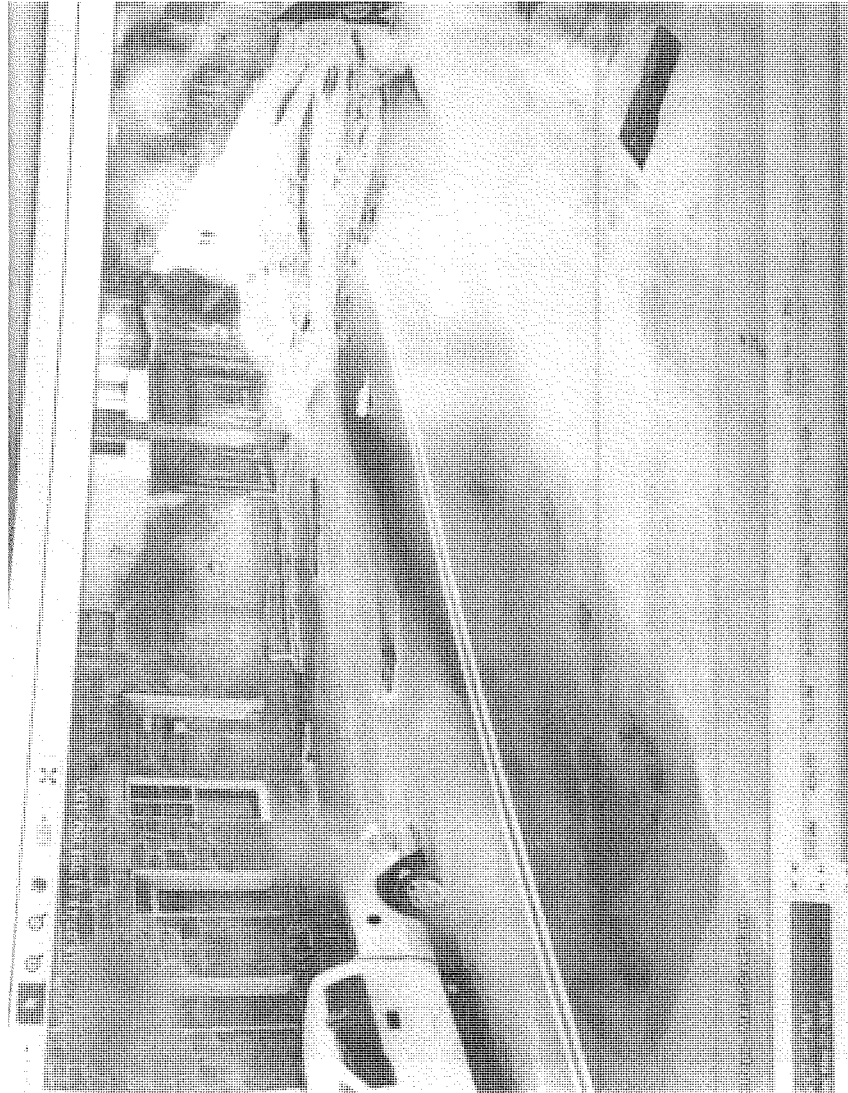








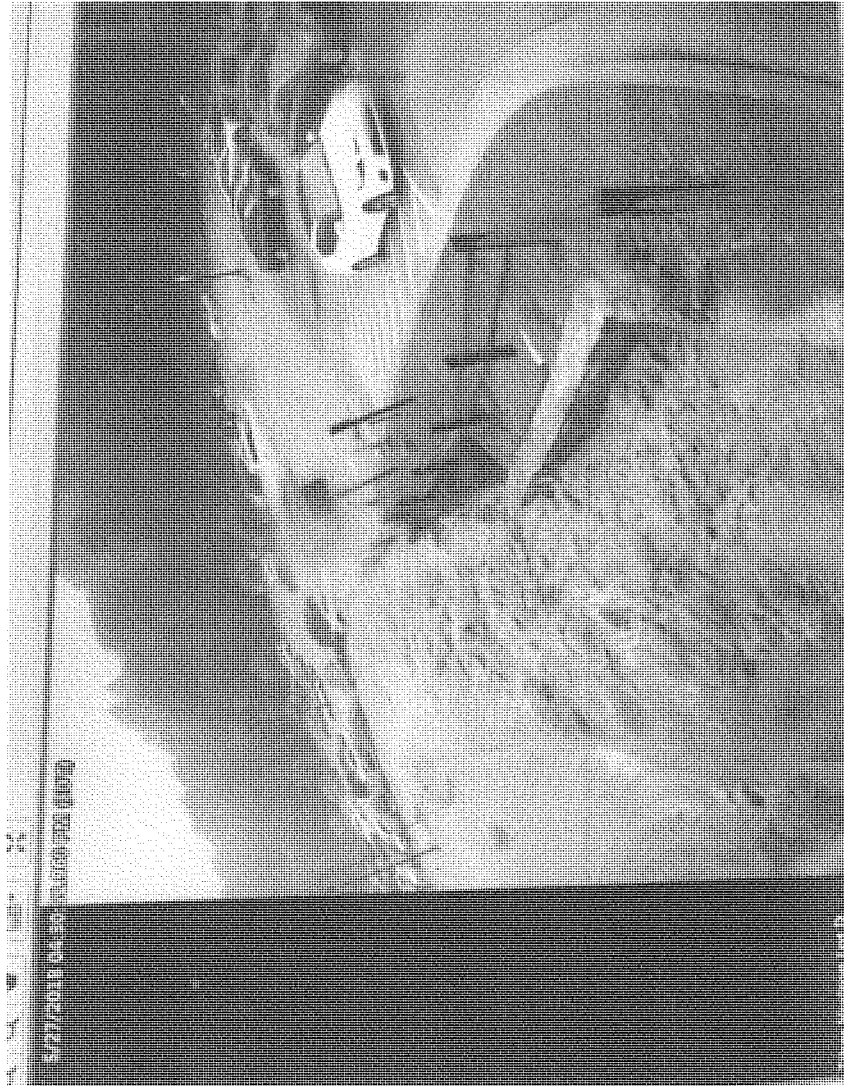


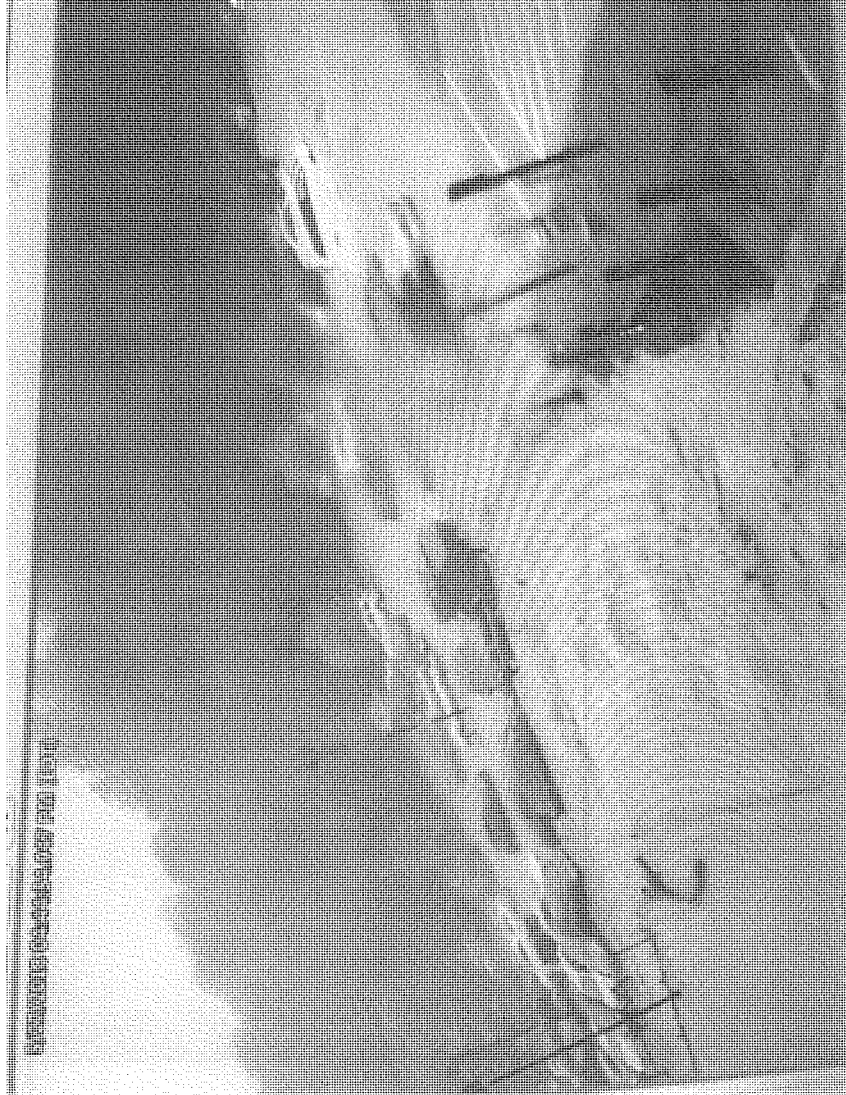




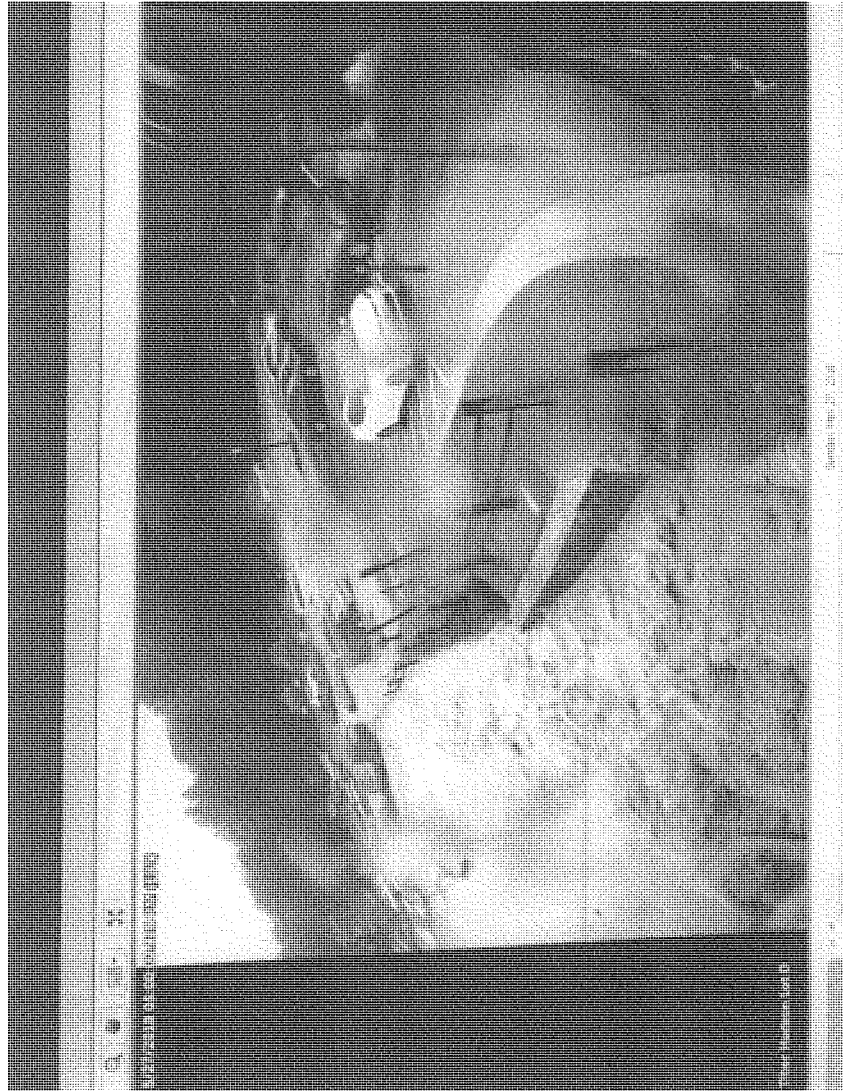




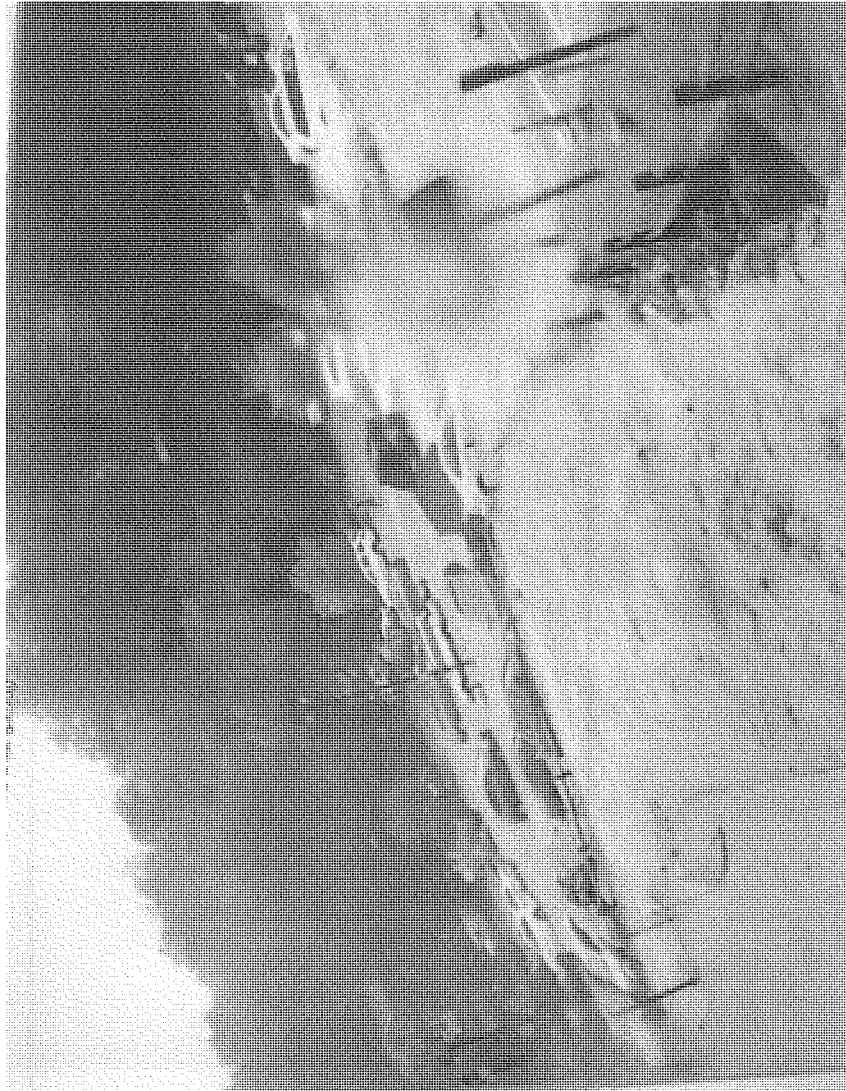




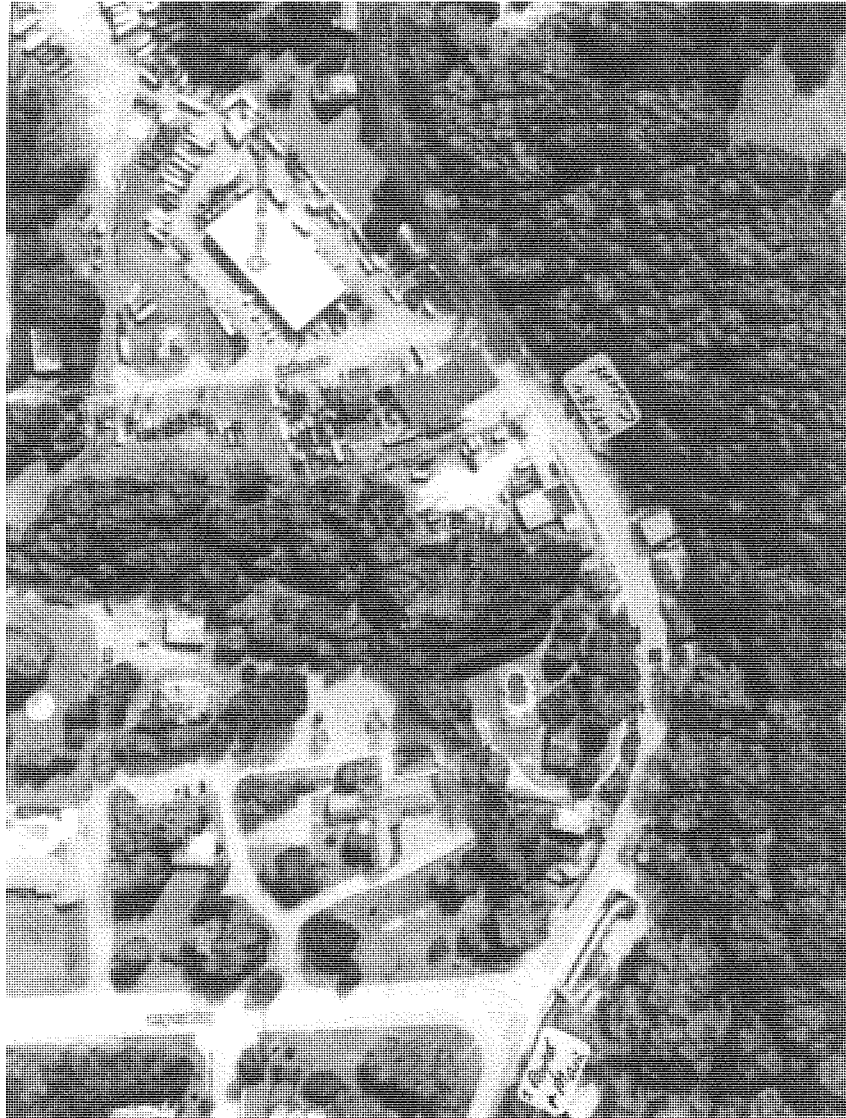




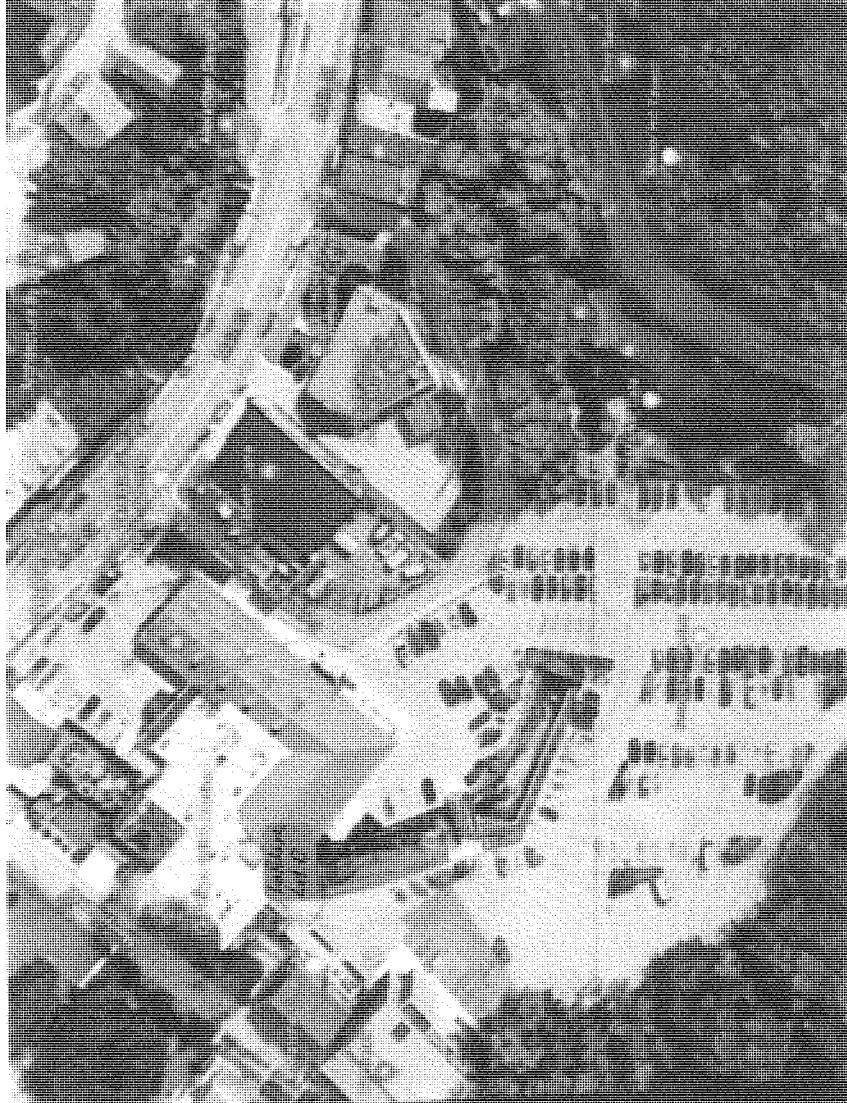


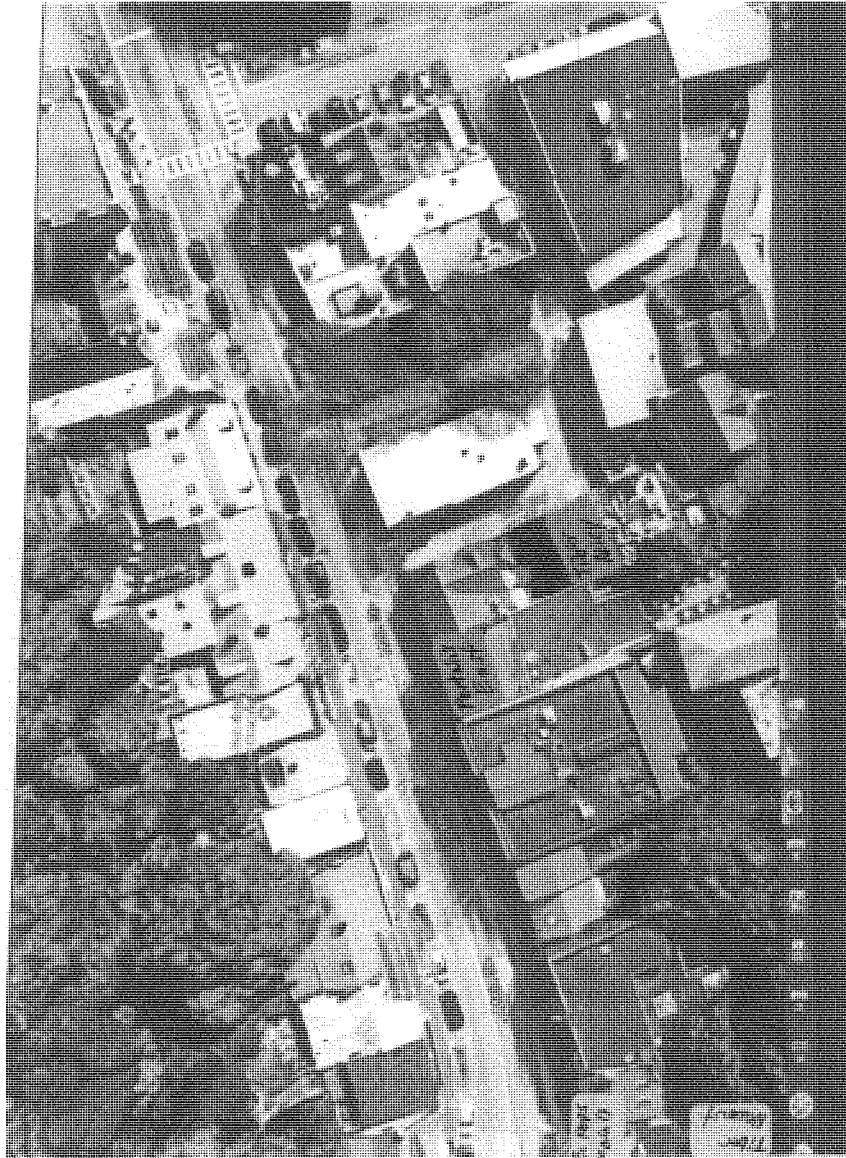


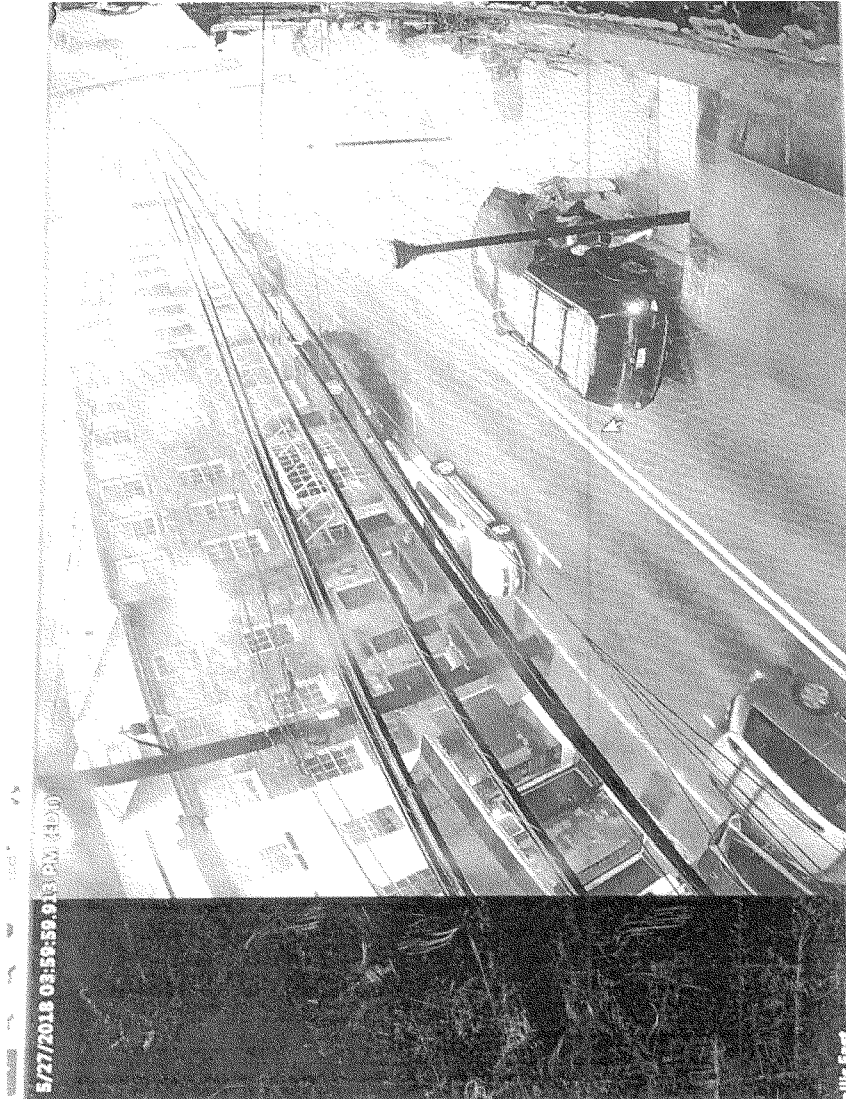




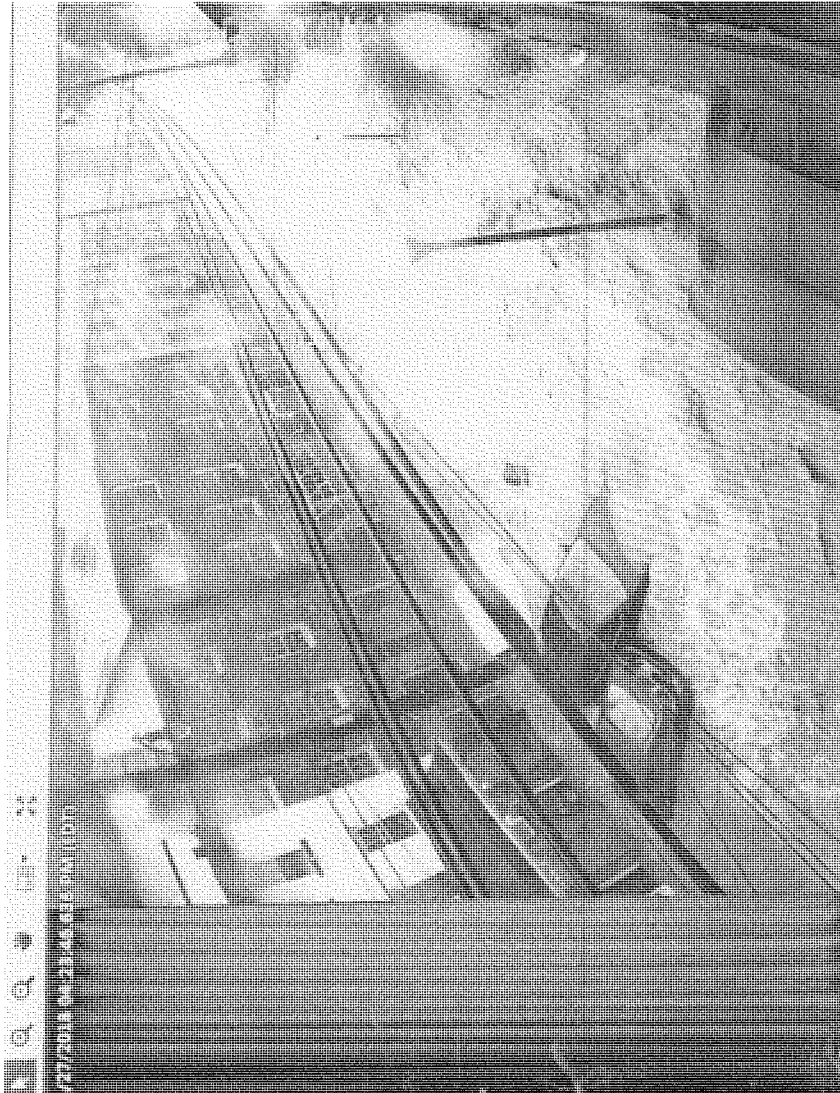


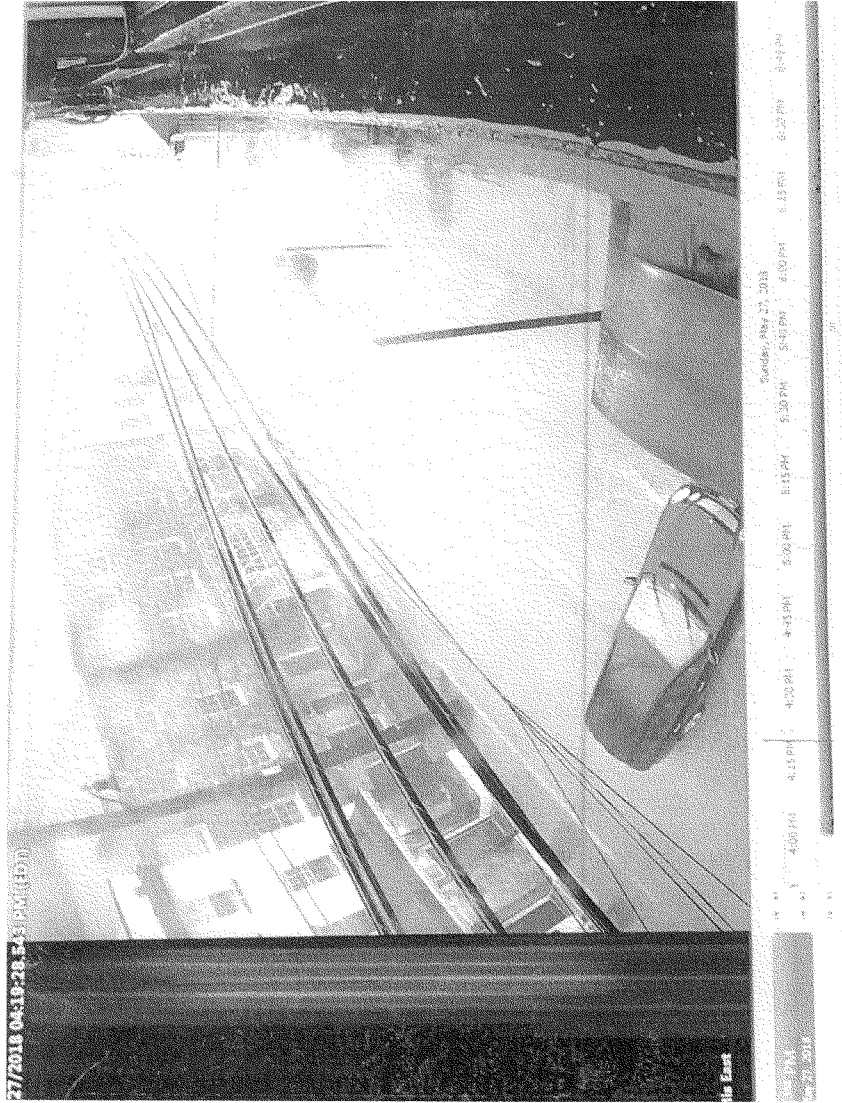






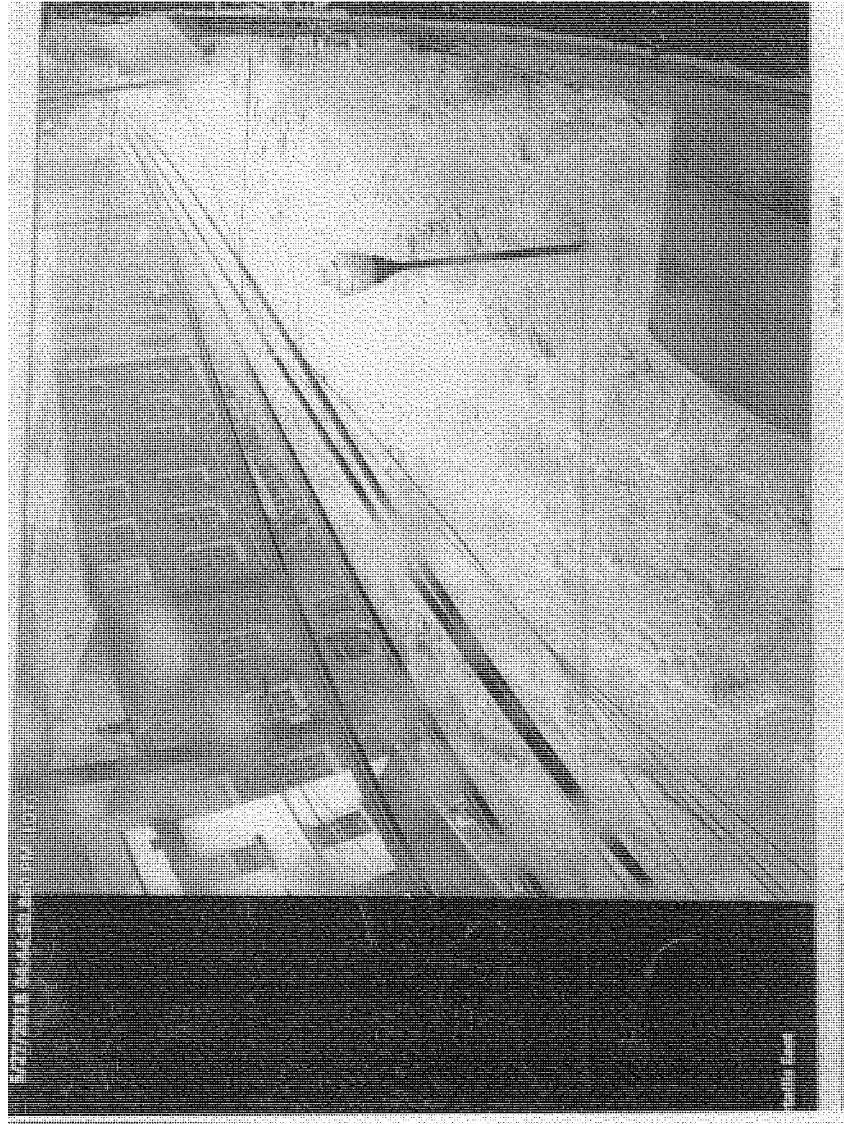


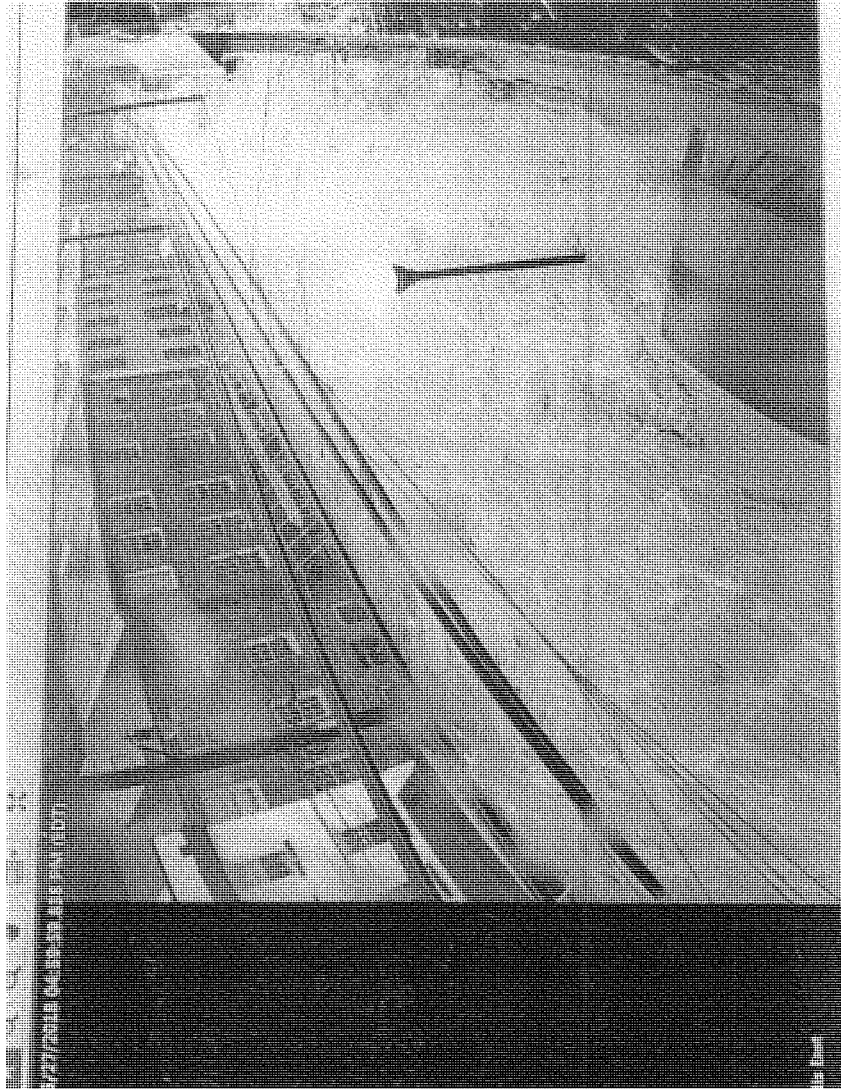


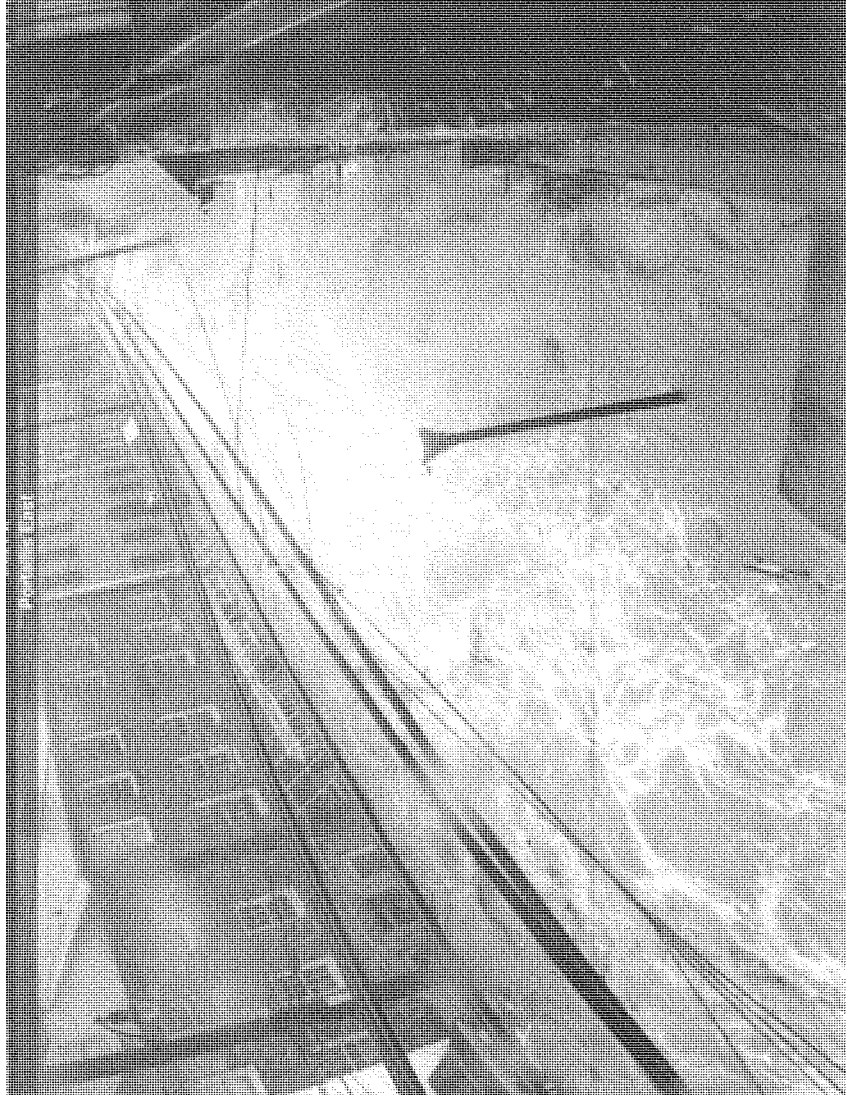


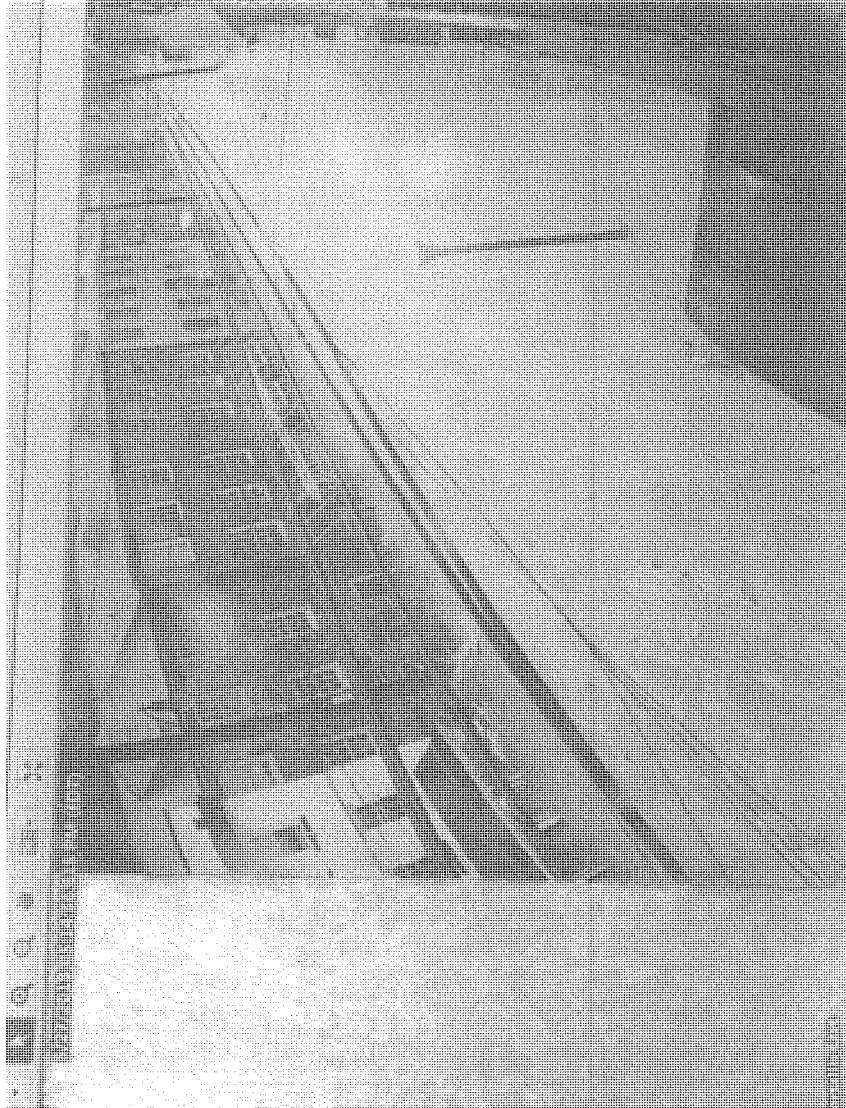


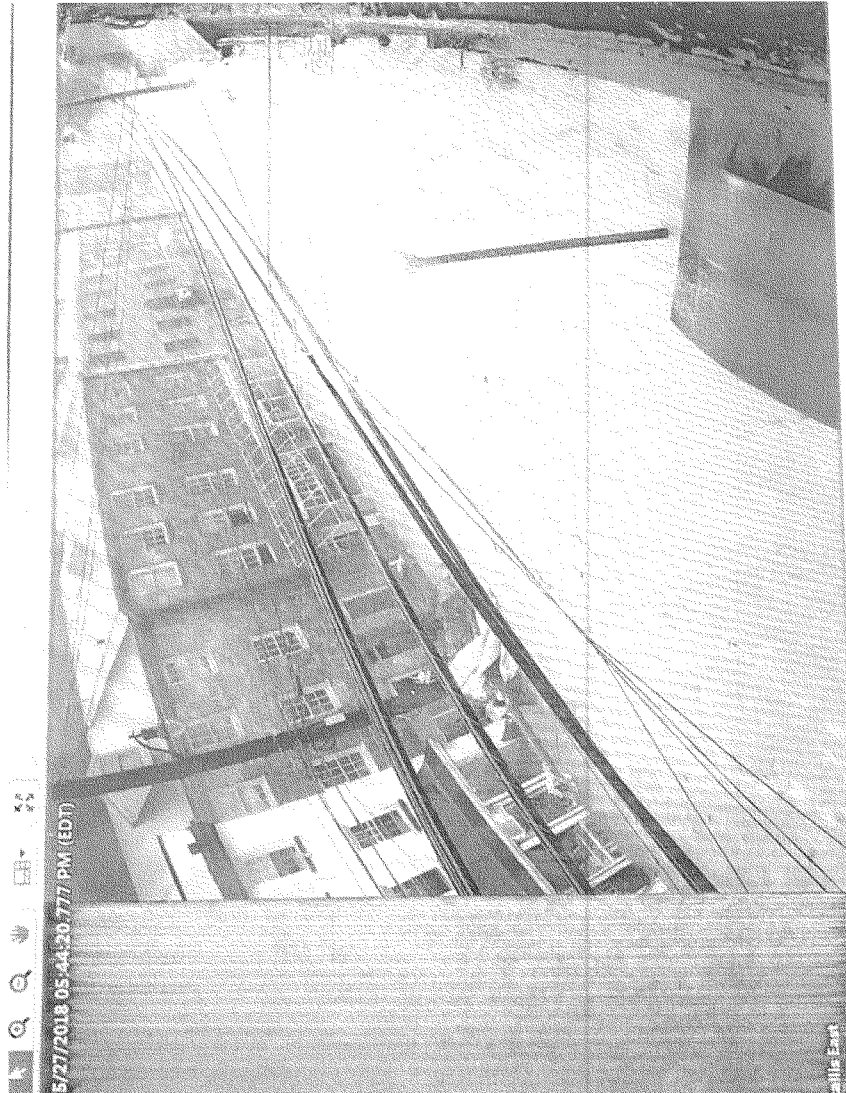


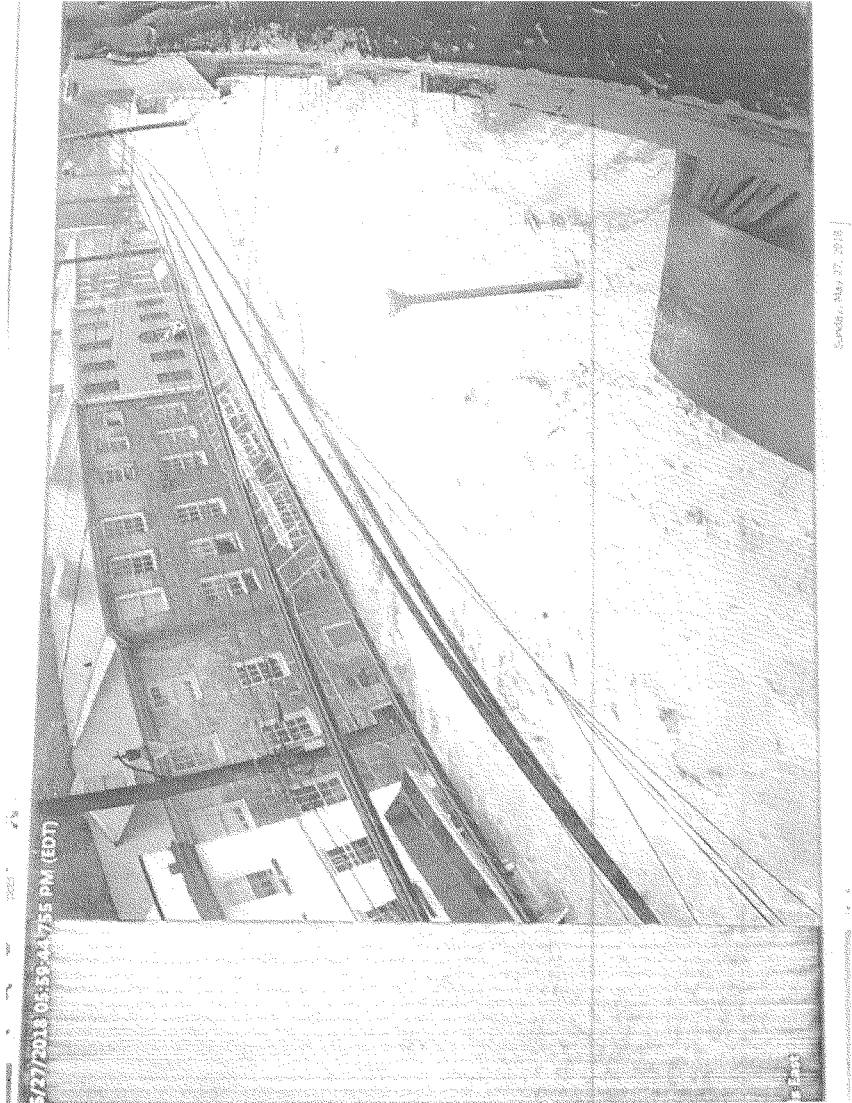


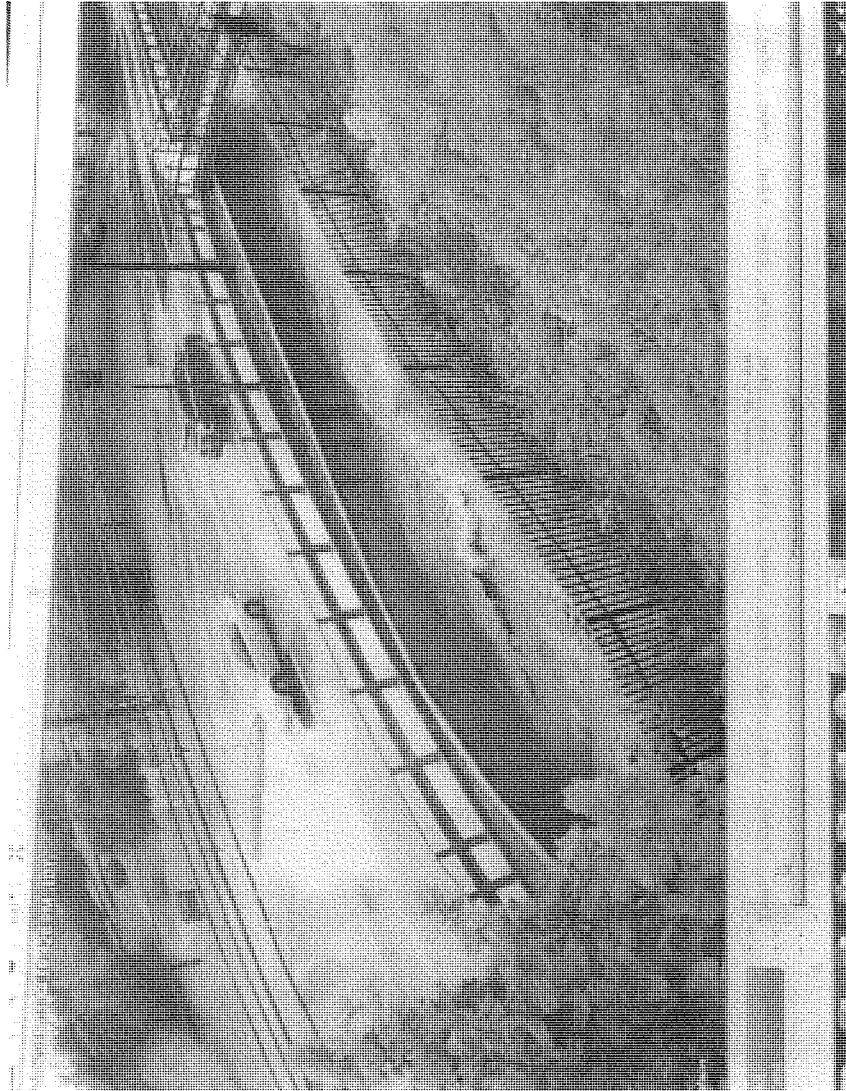


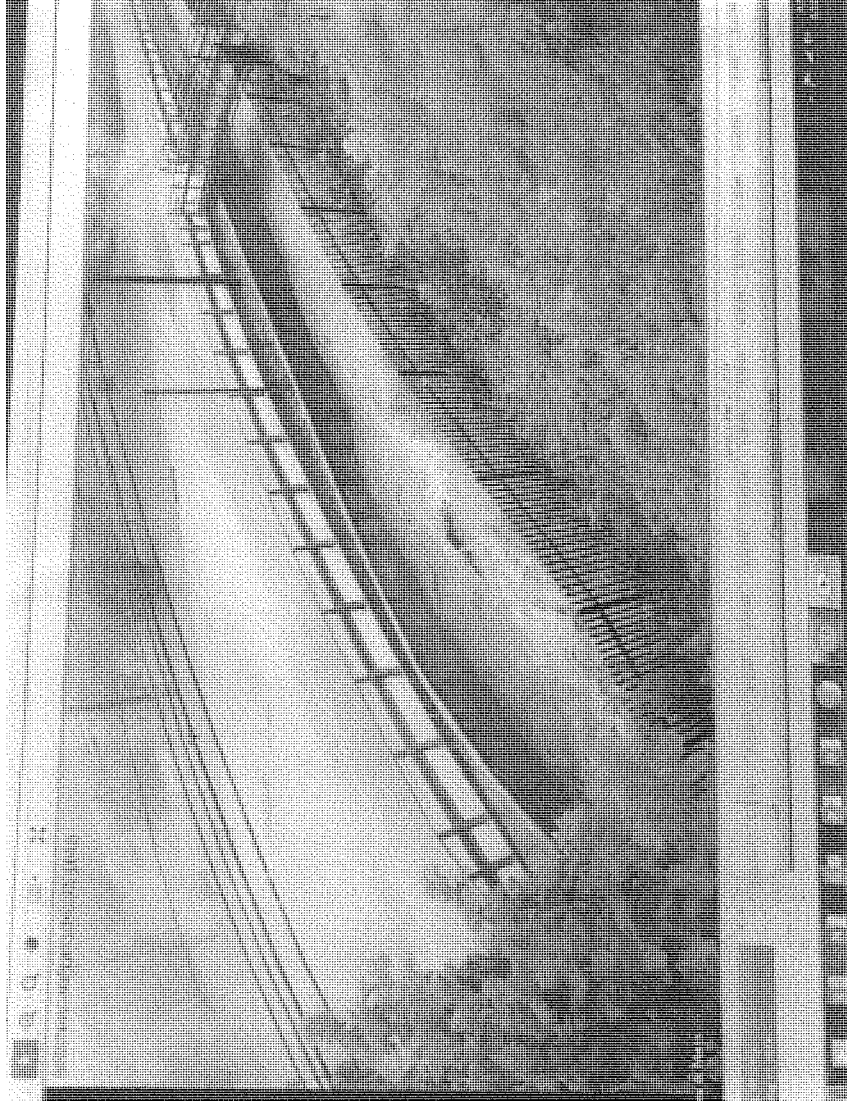


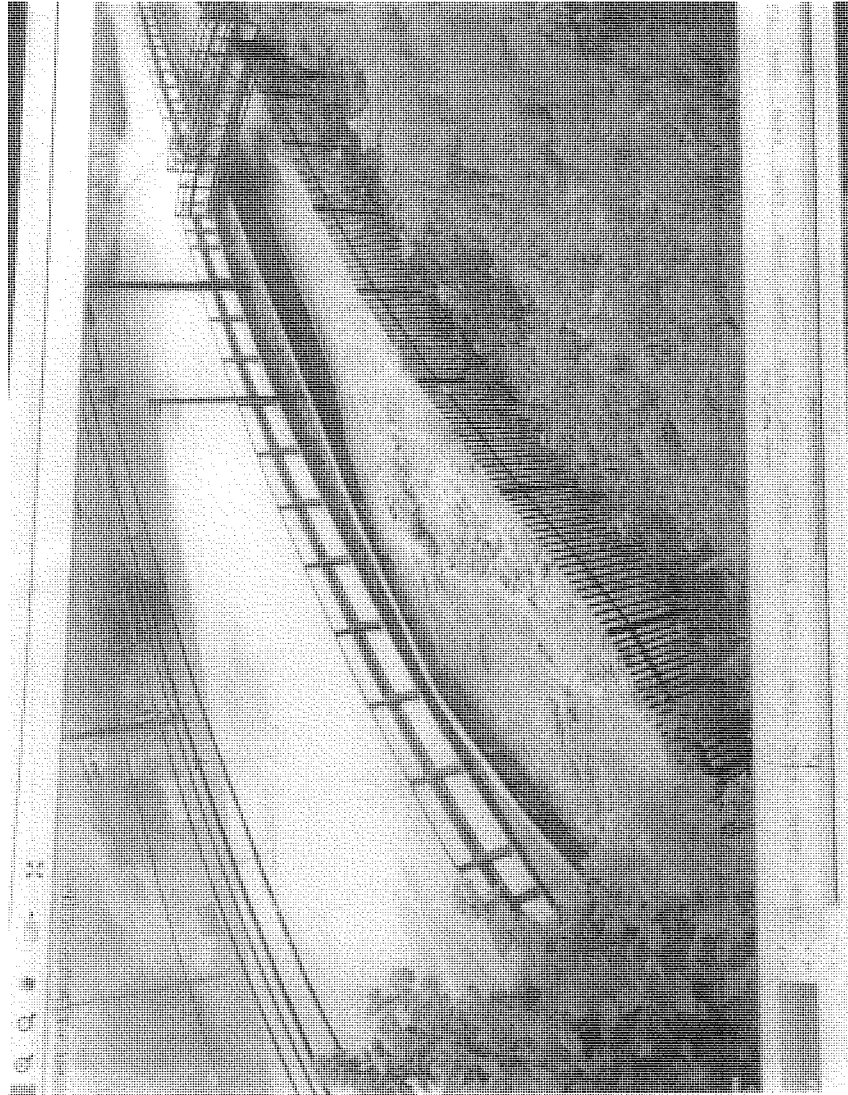


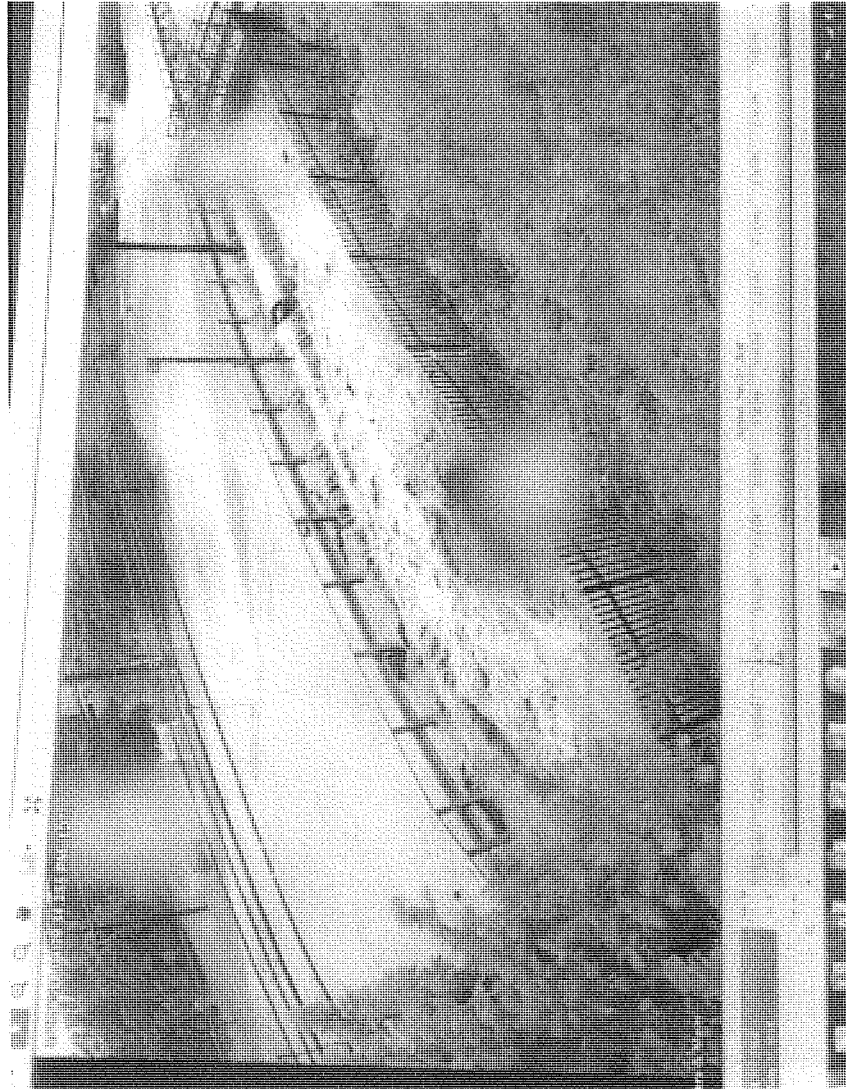




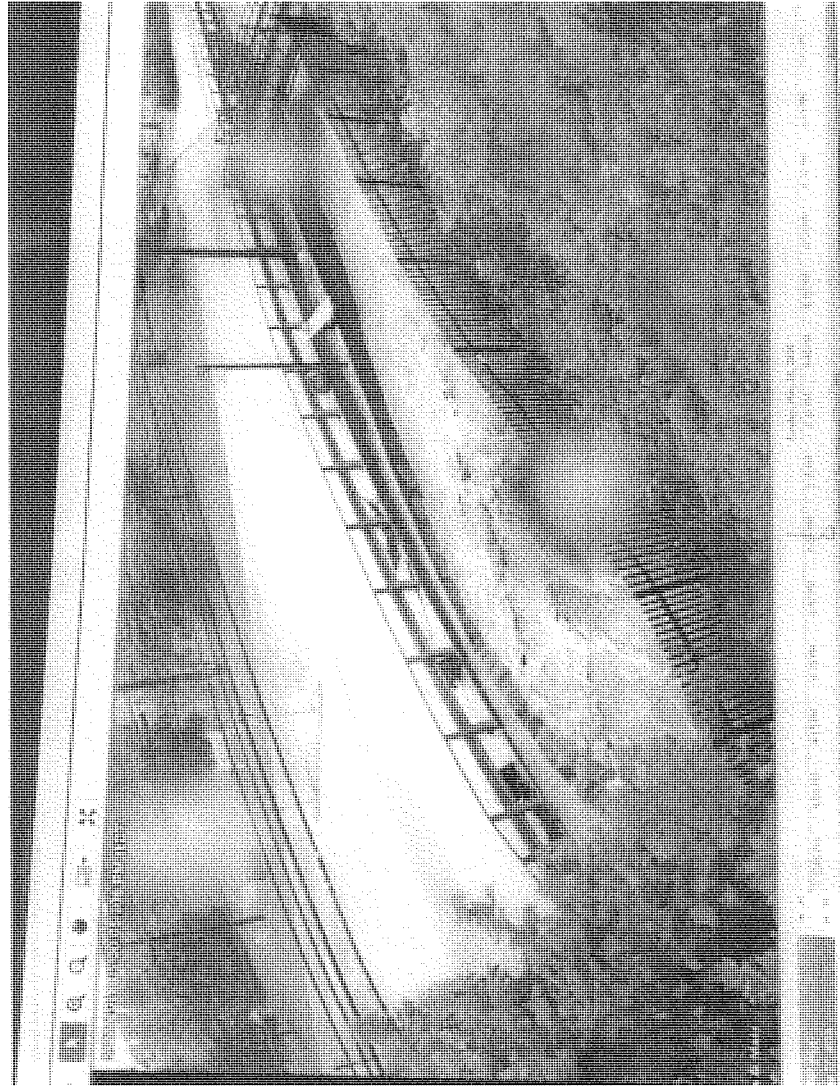


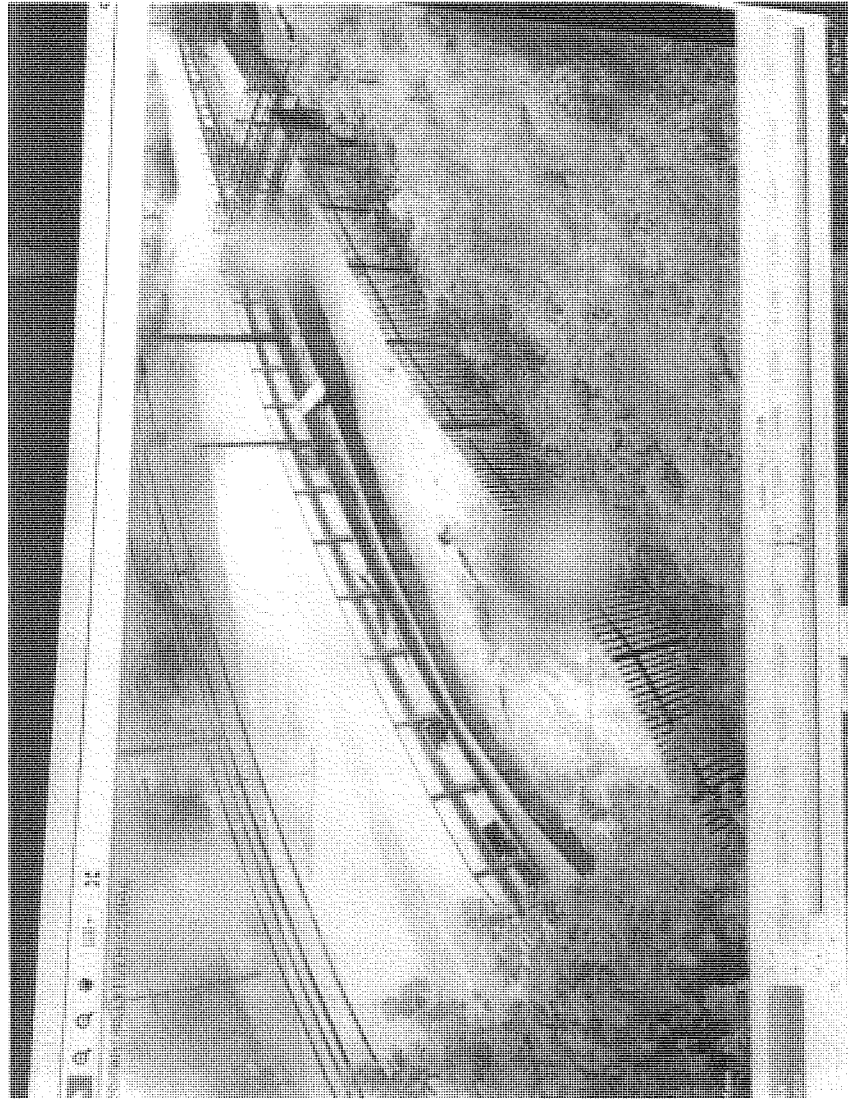


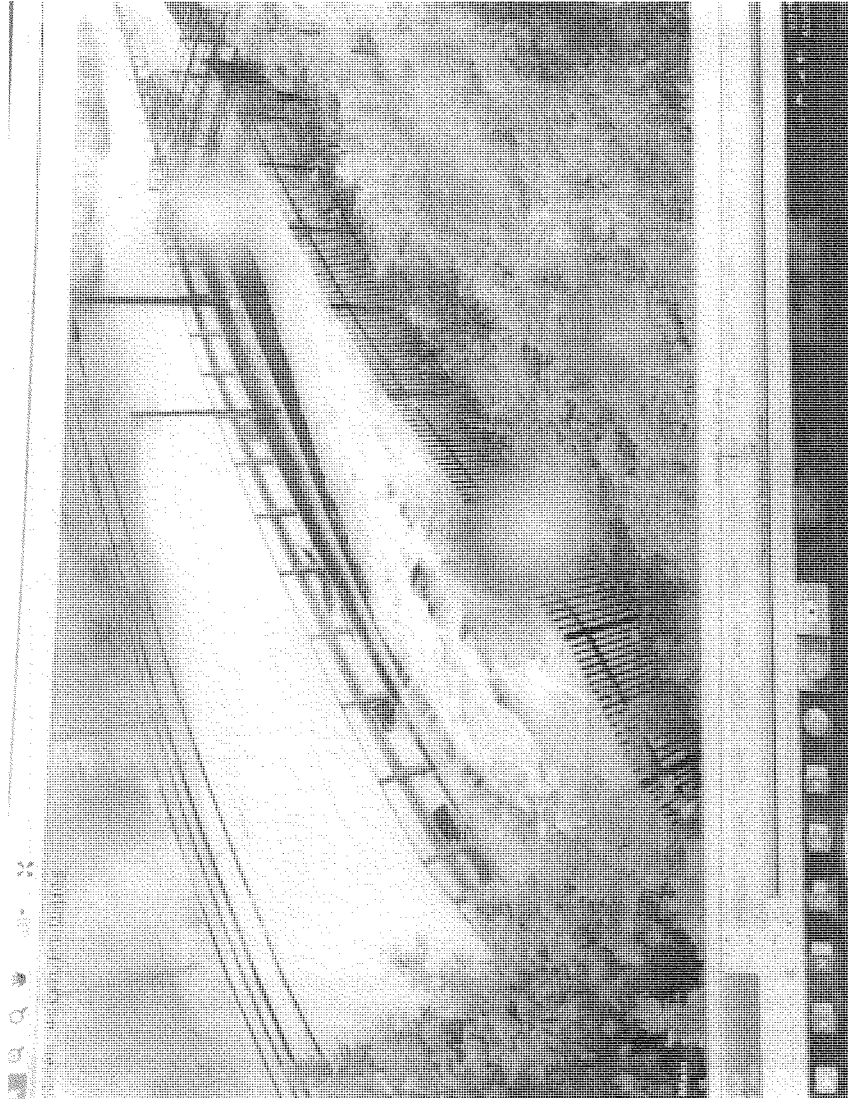


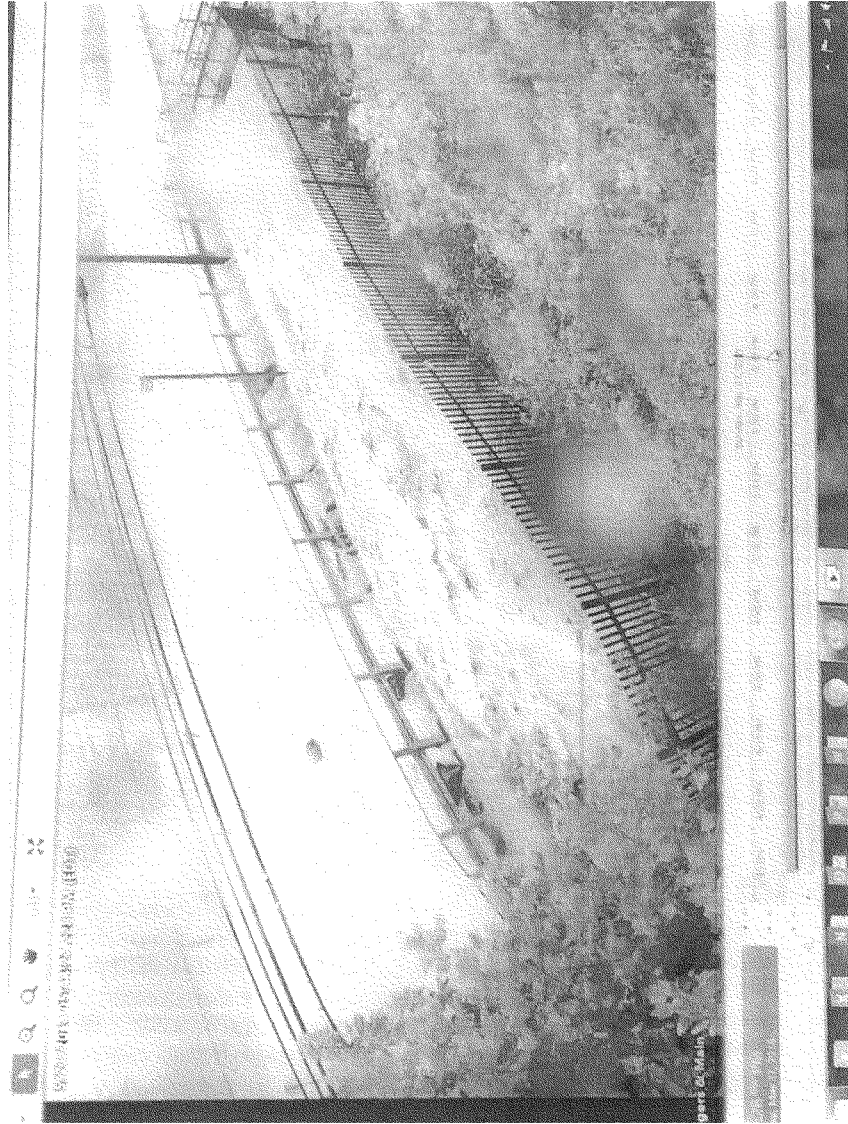


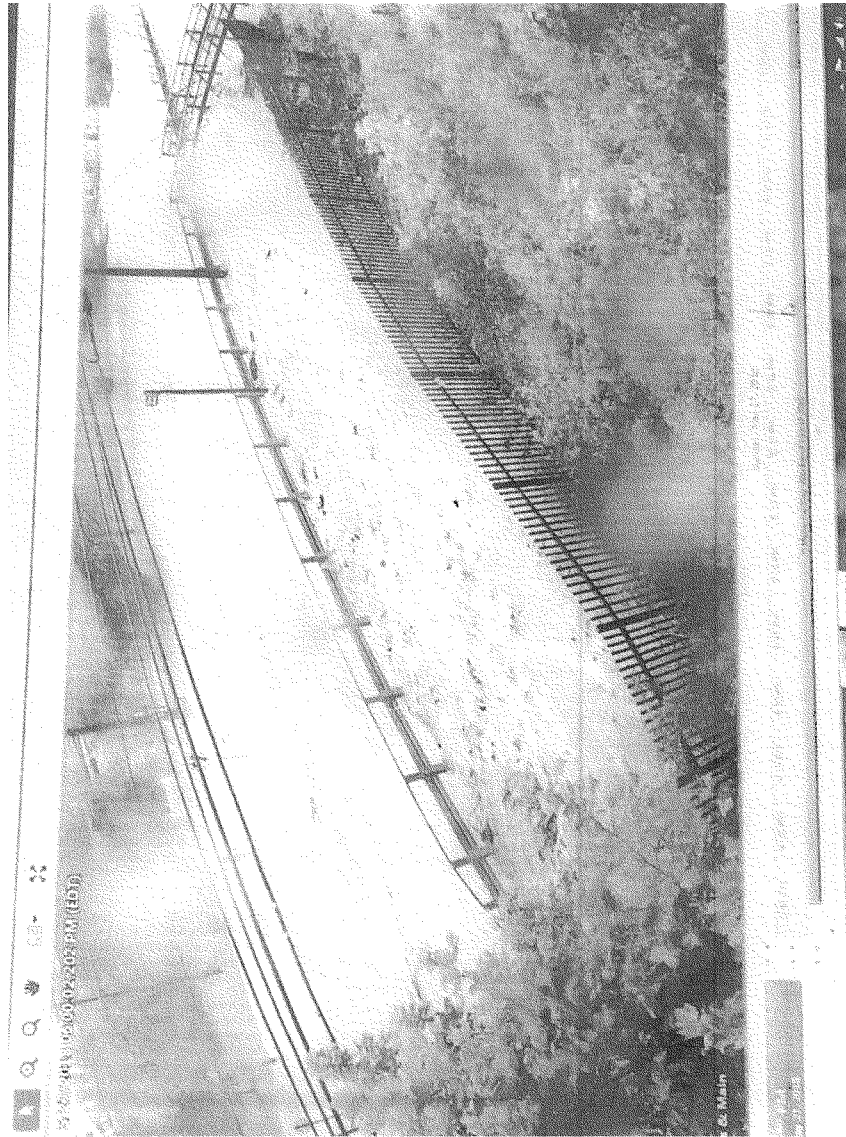


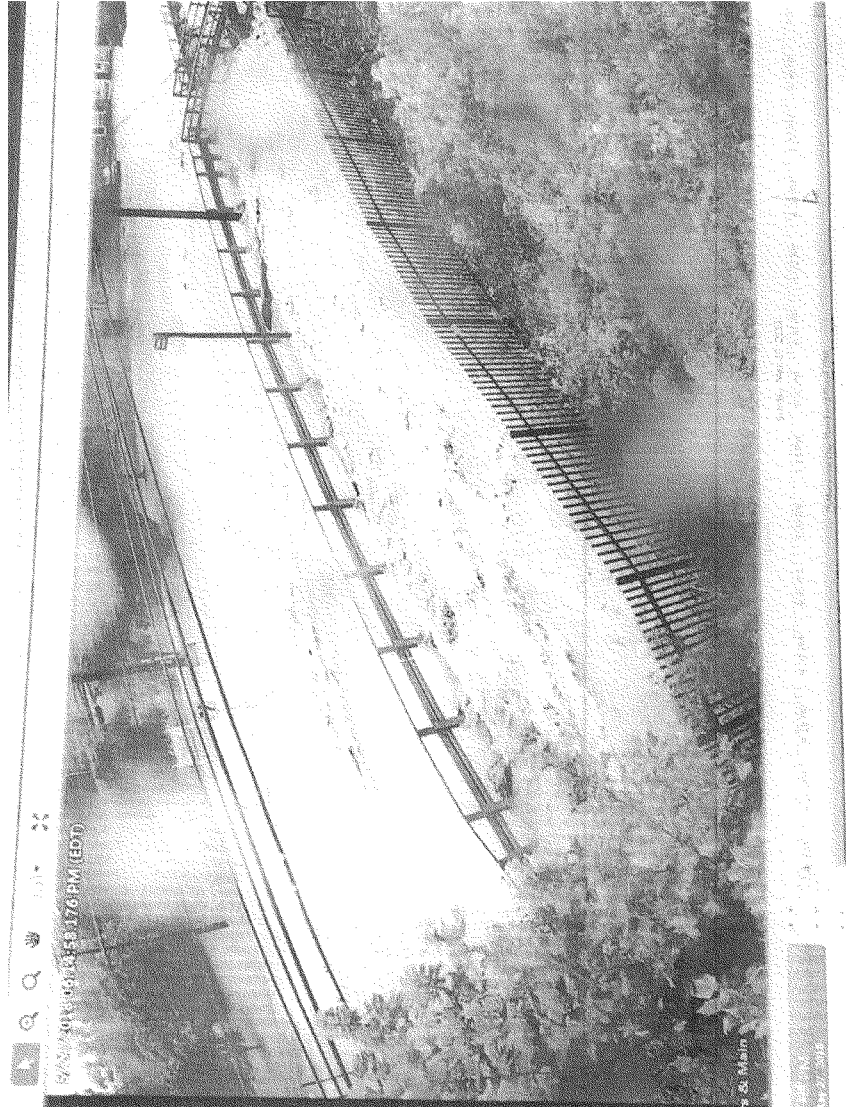


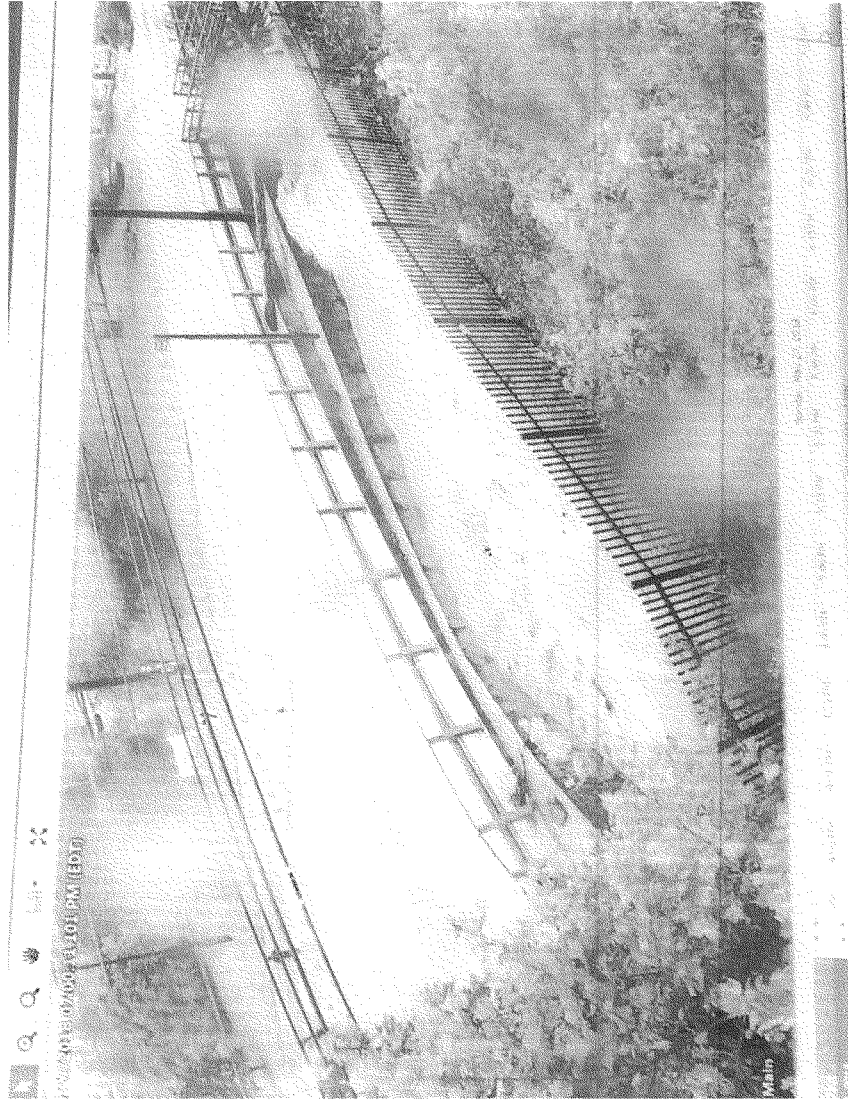




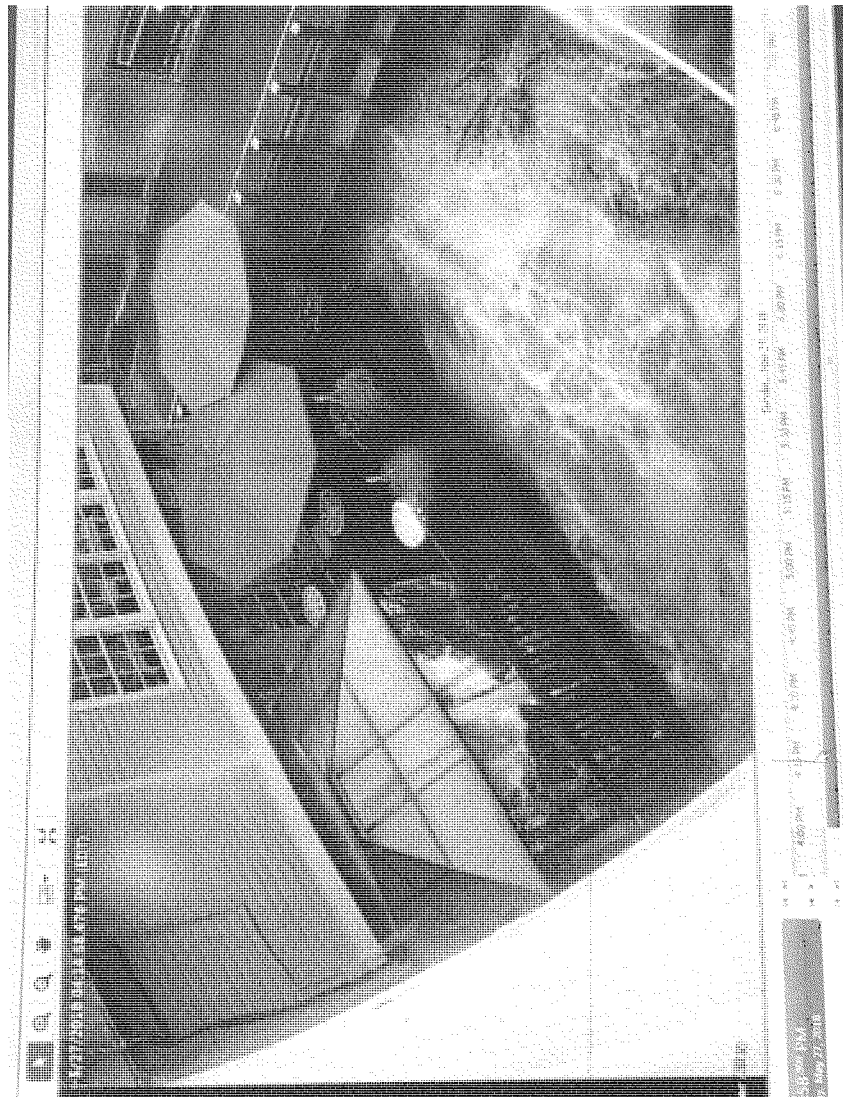


















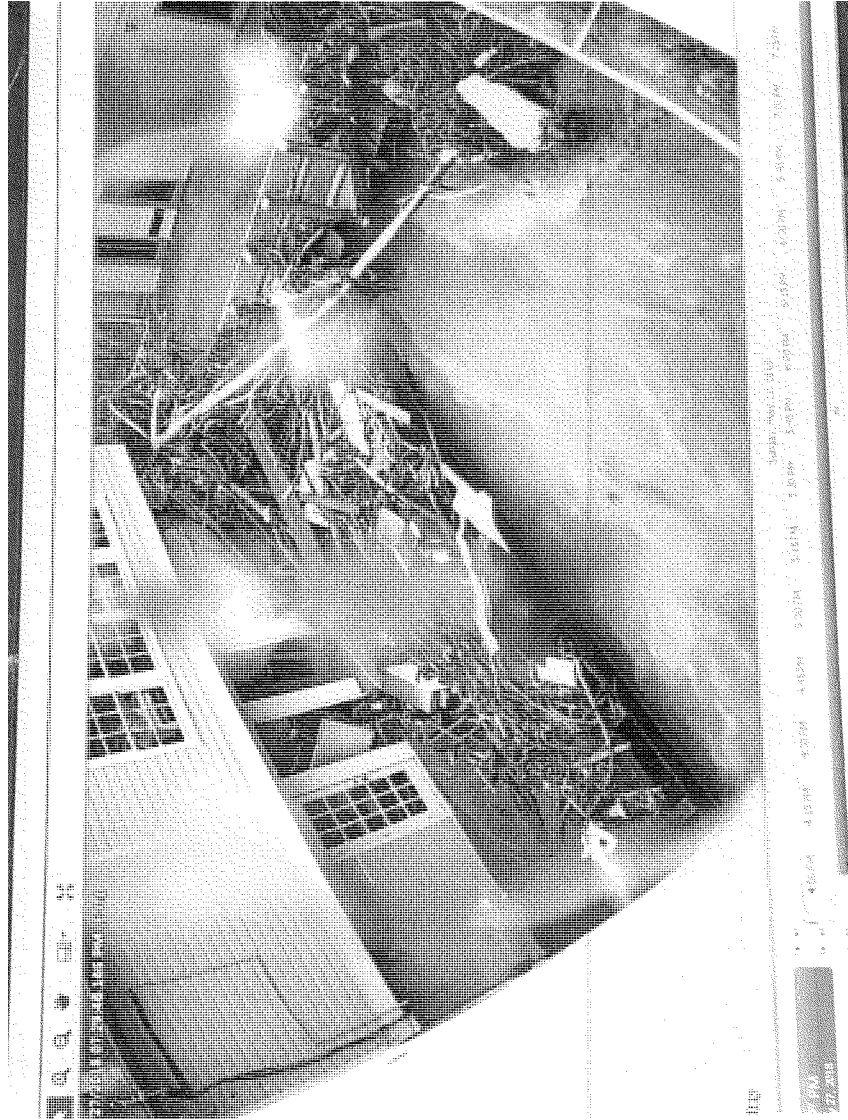




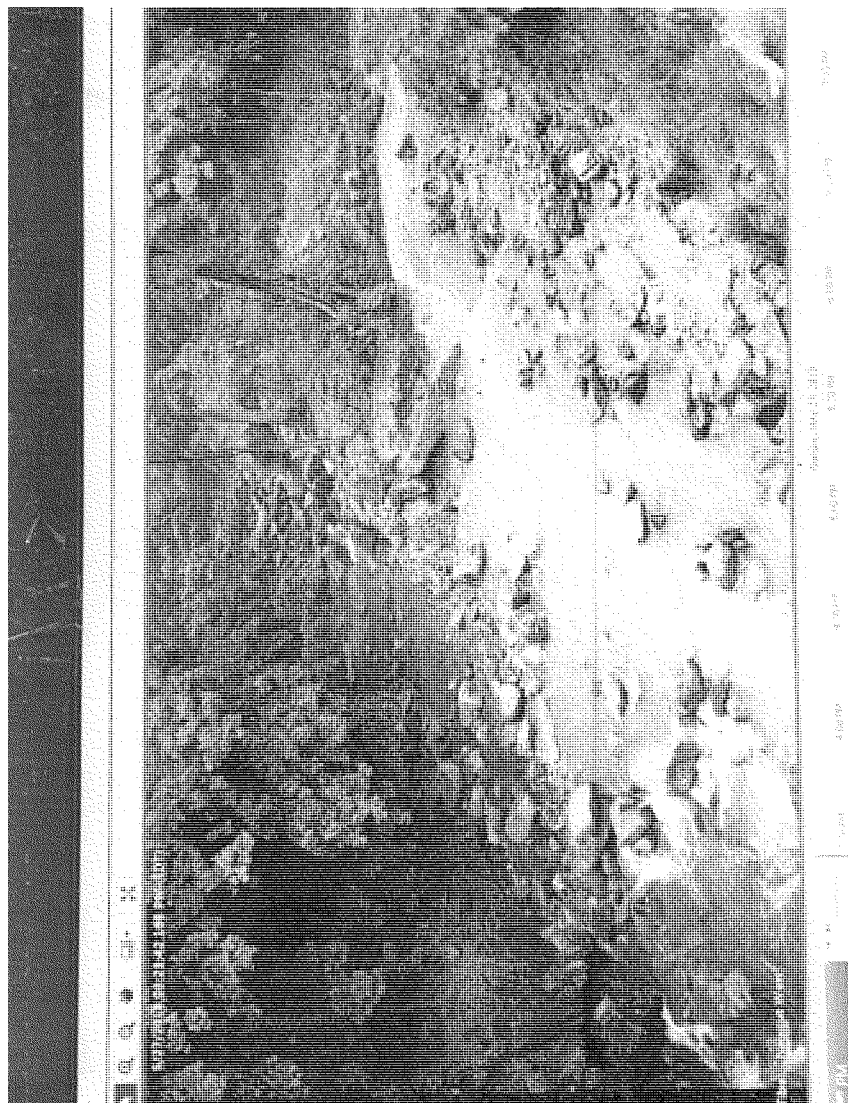


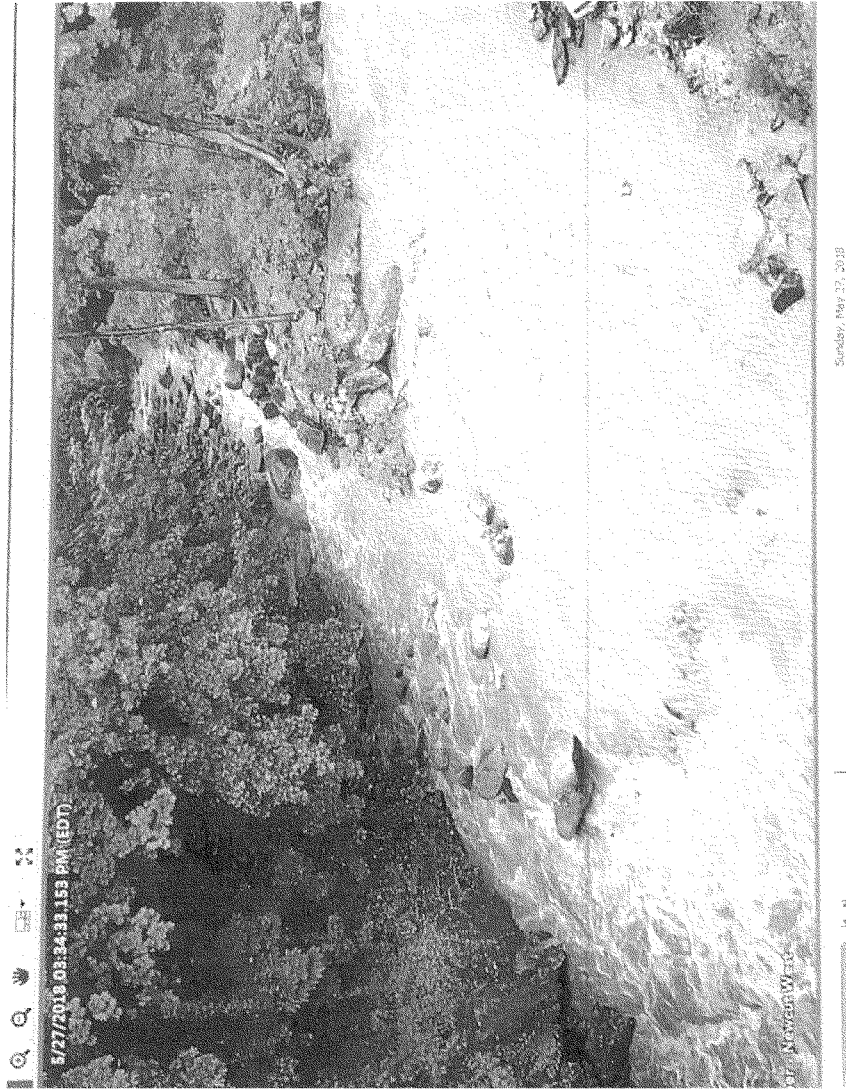


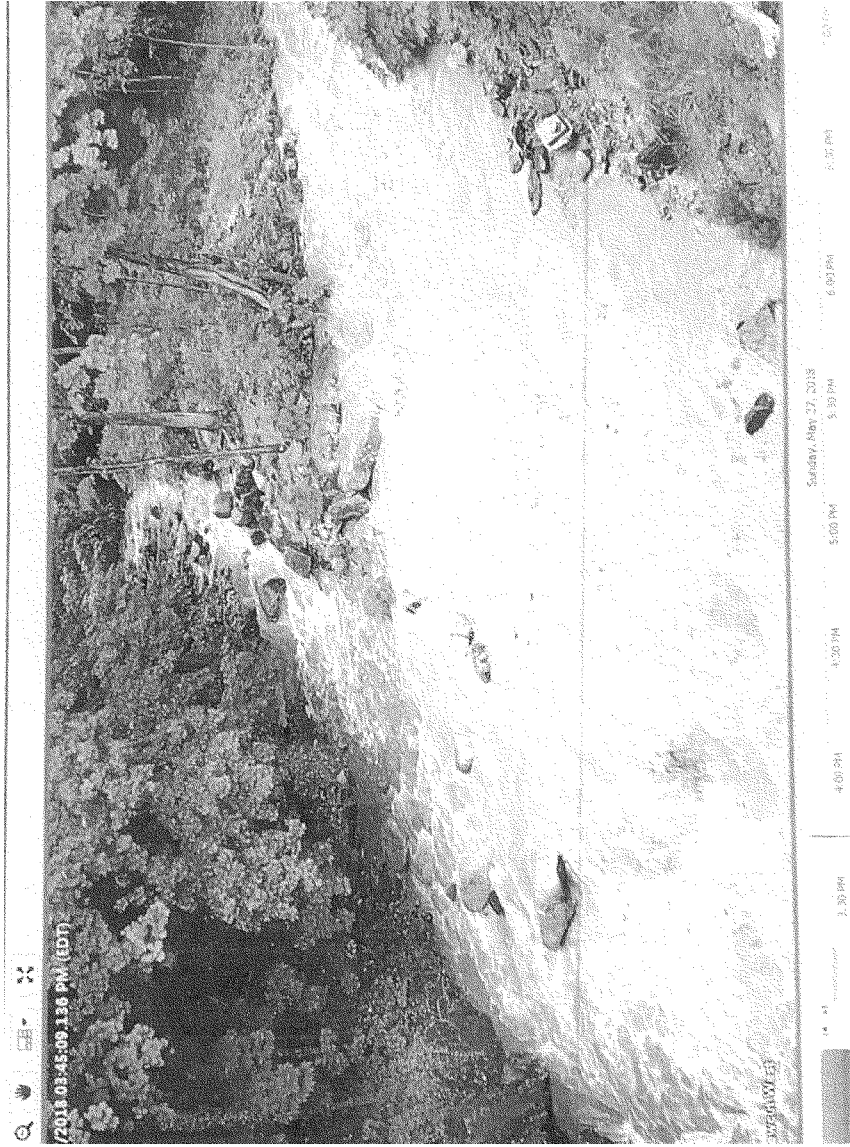




















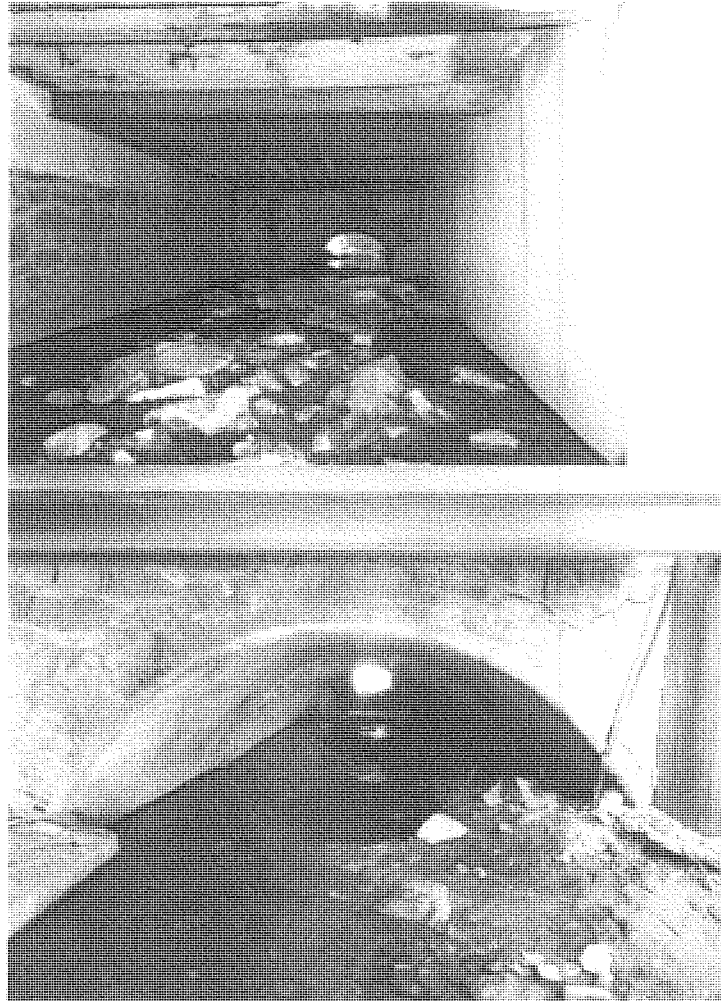








This shows the rock debris field that was left after the 2018 flood, 50 yards upstream from Caplan's. This whole channel from the river up to the New cut and on up to Ellicott Mills drive needs to be dredged and cleaned out



This is the channel and Arched culvert under main street. The culvert restricts the volume of water flowing thru the Hudson channel , it clogs

up with debris and causes extreme flooding starting at Court Ave and rushing down main street taking vehicles with it and is the main cause of flooding into the buildings in this area . This needs to be removed and the channel day lighted and dredged to deepen the channel , there is more than 3 feet of sediment under the culvert now , along with rocks and bricks , it all needs to be cleaned out for maximum flow



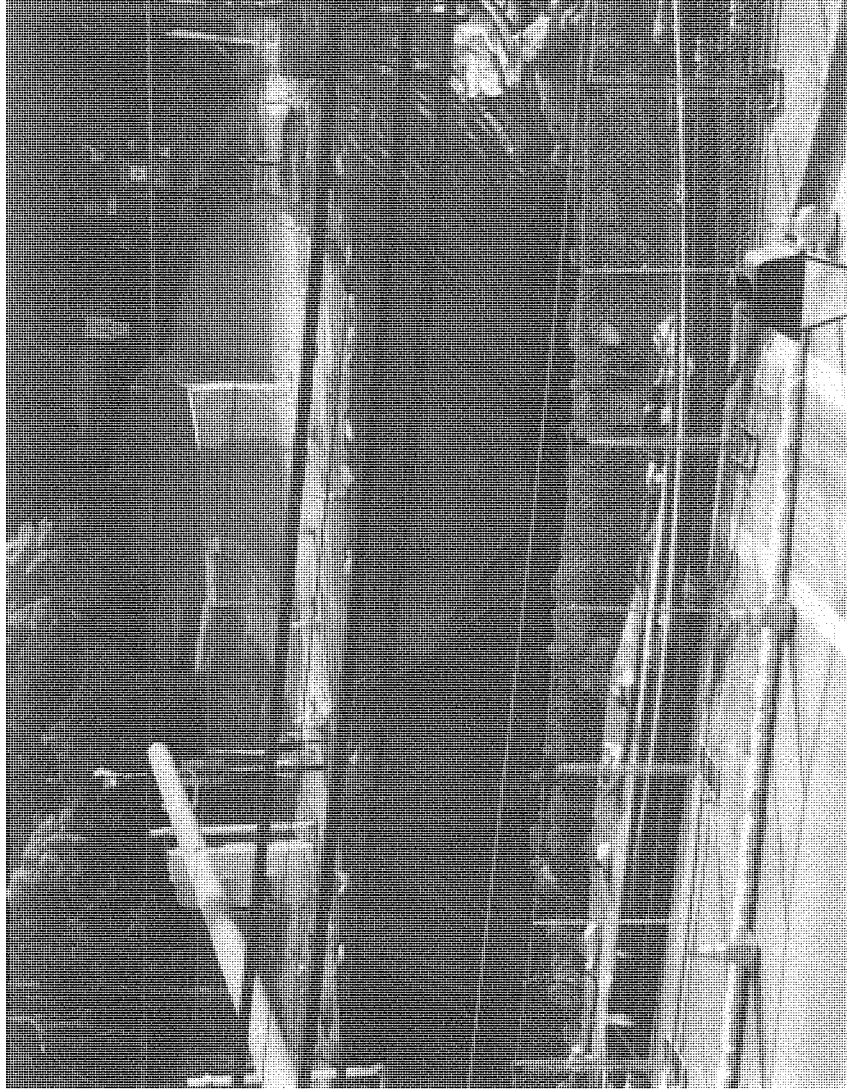
This is the 108-84 culvert , once 108 inches in diameter it was reduced in size in 1985, to 84 inches , it will not handle the current runoff volume , which includes the extreme amounts of UNMITIGATED water coming off of route 40 and routes 29 , these roads have been enlarged and widen several times with no SWM added by the State. All that runoff floods into Ellicott City. This is located in the 8600 block of Westend. It is scheduled for removal starting late next year and replaced with a bridge, and the lower 500 feet of culvert removed and the channel day lighted . There is a camera viewing this area and shows how severe the flooding was in 2018



This photo shows the logs and trees that broke thru Caplans wall , the water level was at the top of the windows of the old bank building , about 20 feet deep . This is the beginning of where the Tiber goes under the buildings on lower mainstreet. The County has recommended taking these 10 buildings down to open the channel and improve the flow of the Tiber to the Patapsco river, this would also remove several hundred people from harms way when the next flood happens . The flood happened on Sunday, if it had been Saturday, MS Fit would have had a class of women exercising in this building, while children were being watched in the provided day care. This could have been a horrible tragedy. The removal of these buildings is necessary of which only one is historic and could be taken down and rebuilt .



This is where the Tiber Branch joins the Hudson in parking lot D behind Lapalapa. The culvert is too small to handle the large runoff volume coming from route 29, tollgate road and part of the BGE right away, all which is unmitigated . This culvert needs to be removed , replaced with a day lighted channel that is wider and deeper with an open grated bridge for building and pedestrian access .



66

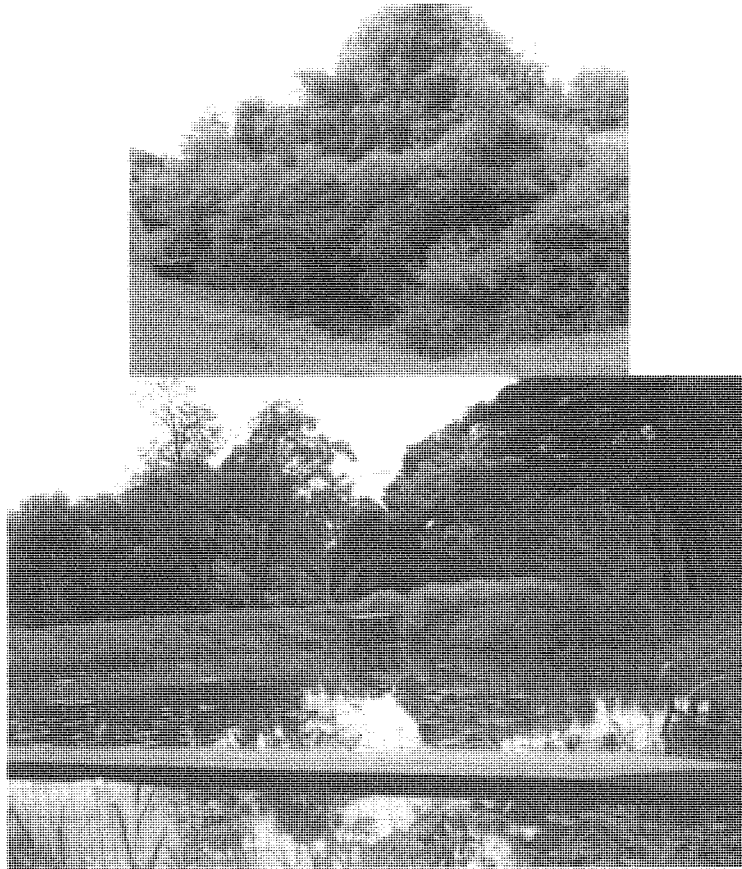


This is a log jam along the Autumn hill branch about 400 yards above the New Cut branch , these are the type of debris that took out the upstream wall at Caplans. They need to be removed , photo taken Aug 12,2018

Photo 1



This is another example of fallen trees and logs in the Autumn hill branch
That needs to be cleaned up. 8-12-2018



The above photos show two SWM facilities in the Hudson watershed , one is full , not working properly and the other is located 100 yards away and is hard to locate and not maintained properly . The 64 current SWM facilities need to be inspected and recommendations given to improve their function



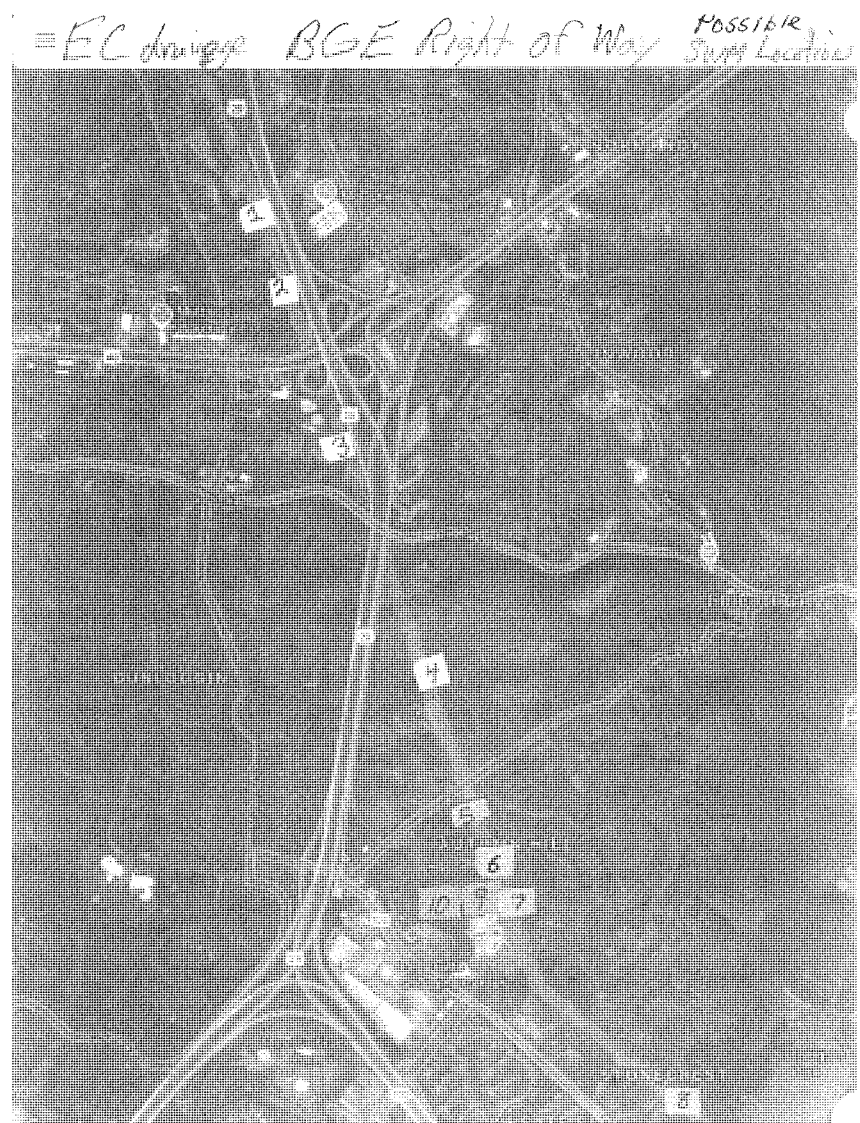
The Ellicott City water shed has about 2400 acres , most has been developed , either with commercial properties built in the sixties and seventies or housing developments also built in the sixties and seventies before SWM laws came about . There are very few of the 64 current SWM facilities that are sized to the current SWM 100 year regulations. With the increased size of rte29, rte40 and rte100 and connecting merge lanes all of which have no mitigation , Ellicott City becomes overrun with flood water with a little over 3 inches of rain in one hour. There are only a few places where I'm told new detention ponds can be built. The BGE/EXELON right away which has over 100 acres in the EC Water shed and has over 640 acres of watershed draining thru it has the best locations in the watershed to add new storm water detention areas. Many SWM could be added in their right of way, they could be built as dry detention areas , being wet during extreme rain events. In some locations the damn for the detention area would give BGE better access to their towers. They already have water running under their wires everyday, there would be no change , except for a few days a year. I took a photo today showing a tower which has two legs on one side of the creek and two legs on the other side and has been that way for over 50 years with no adverse effects. Help from BGE/EXELON is the only way we can get enough SWM to minimize the flooding in Ellicott City. I hope our federal partners can reach out to Exelon and bring them on board with the Federal government, the State of Md. Howard County, and the citizens of Ellicott City to come up with solutions . We need your help.

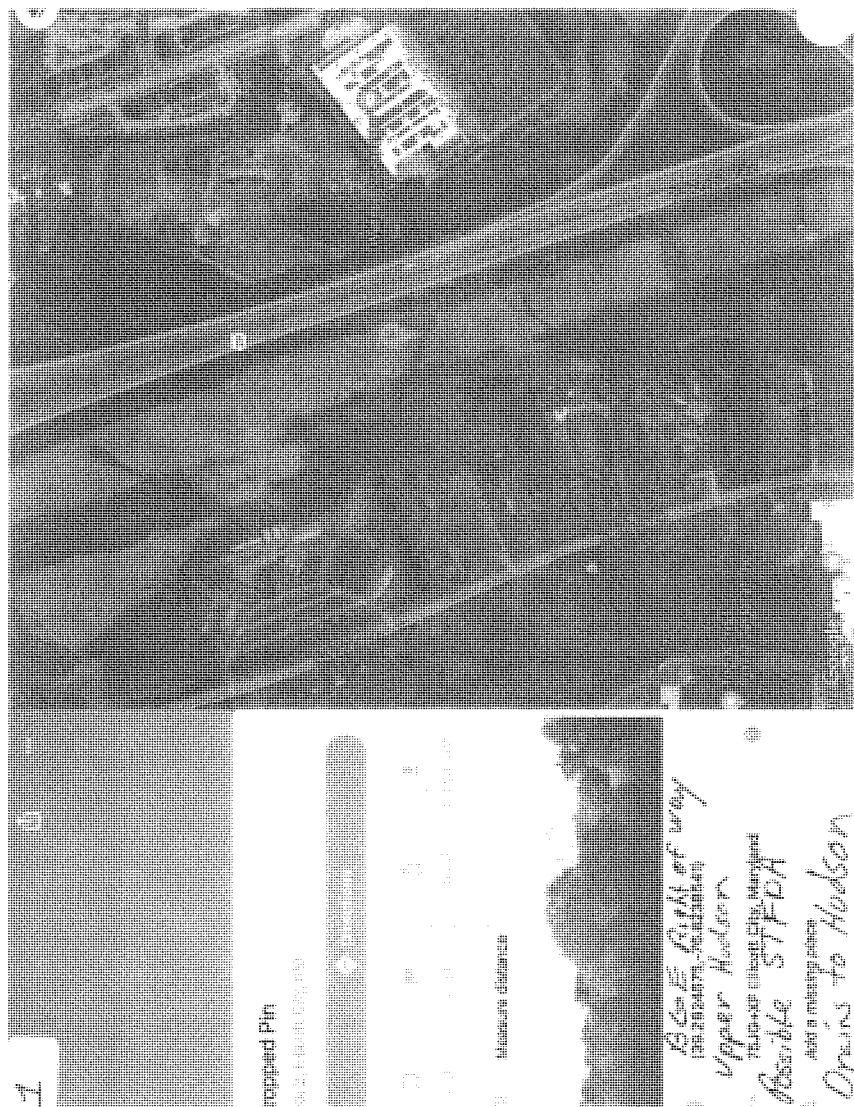


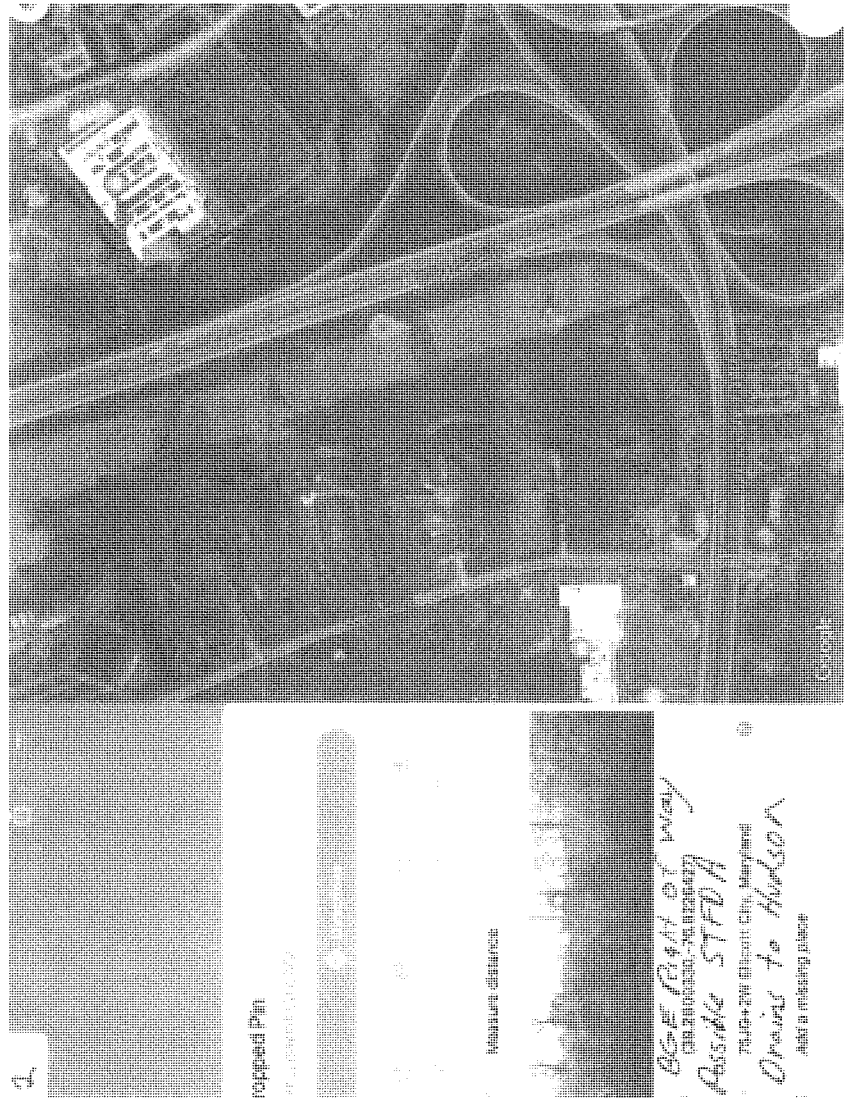
The above two pictures show dry temporary detention areas that could be built in the BGE right of way. The top one is on Union town road, a three acre mowed field, the road is the dam, the riser is in the middle left, 12 acre feet of storage, efficient and inexpensive compared to the ones I've seen in the Hydrology study. The bottom is in front of Lyons Mill elementary in Owings Mills, both only become wet in heavy rain, hours later they are dry.

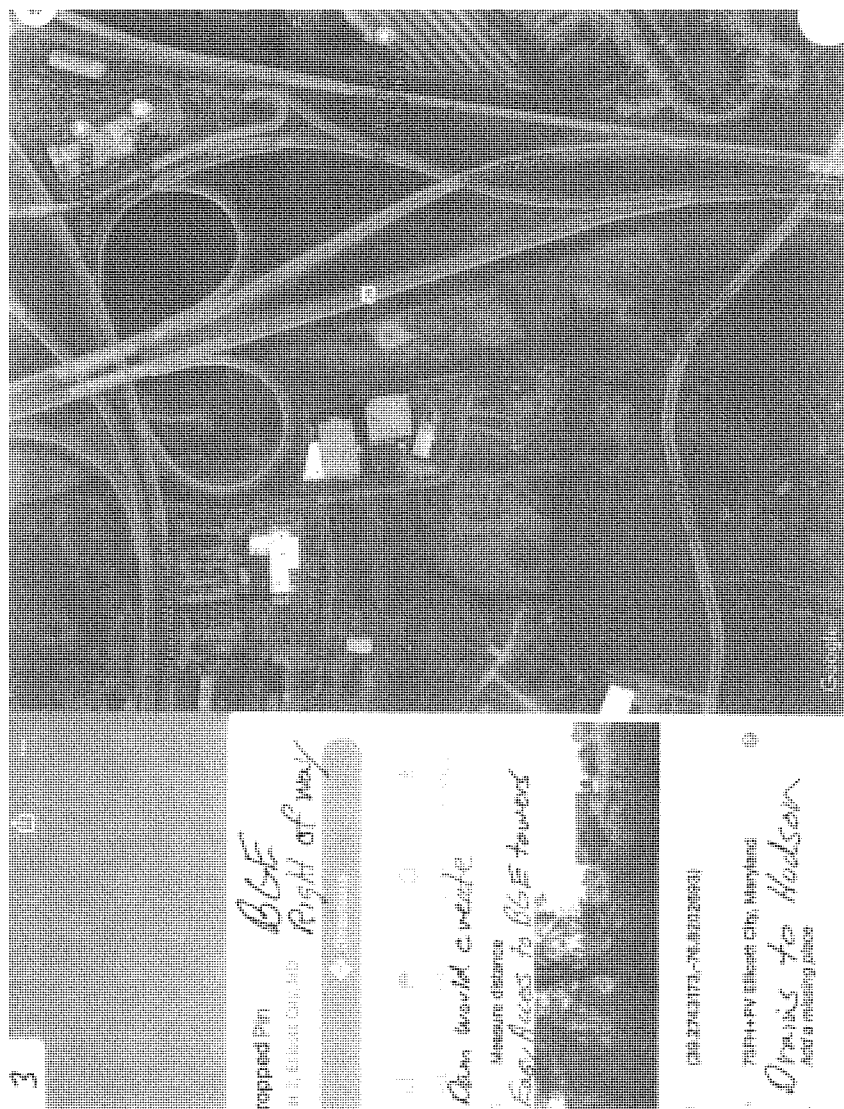


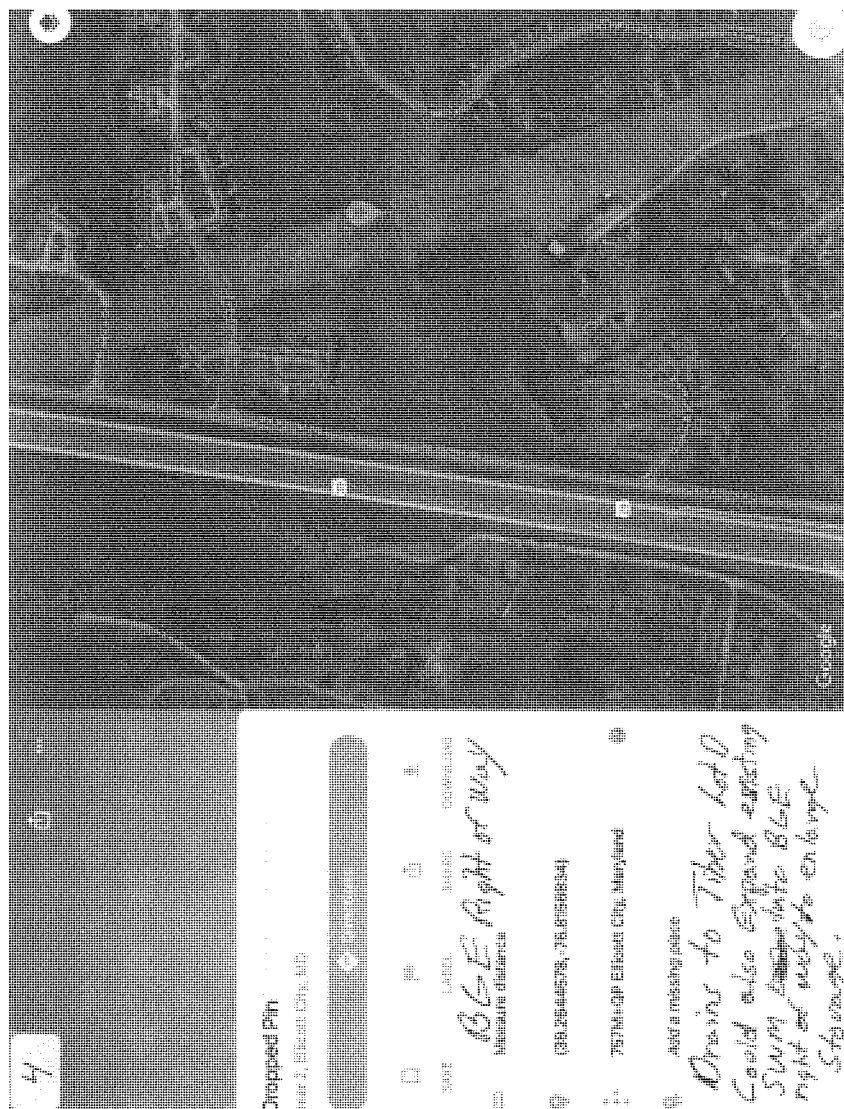
This shows the dry SWM on Lyons Mill road working during a very rainy day

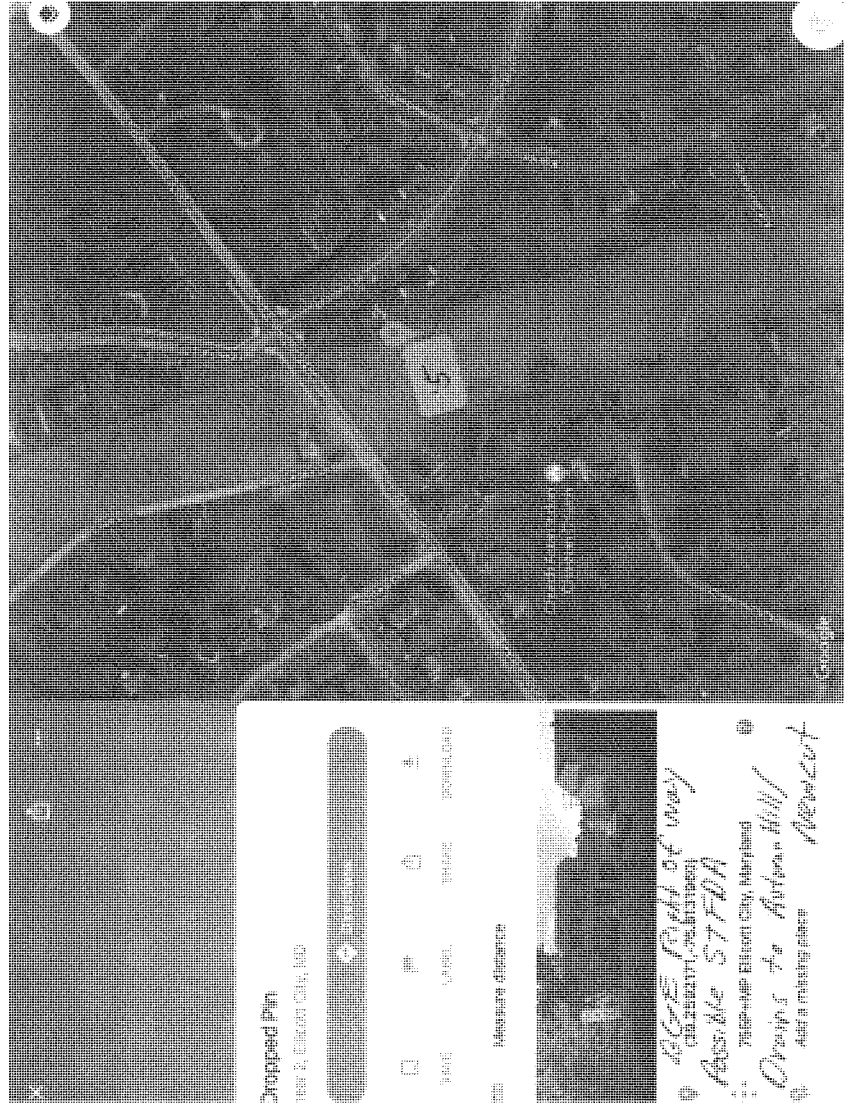


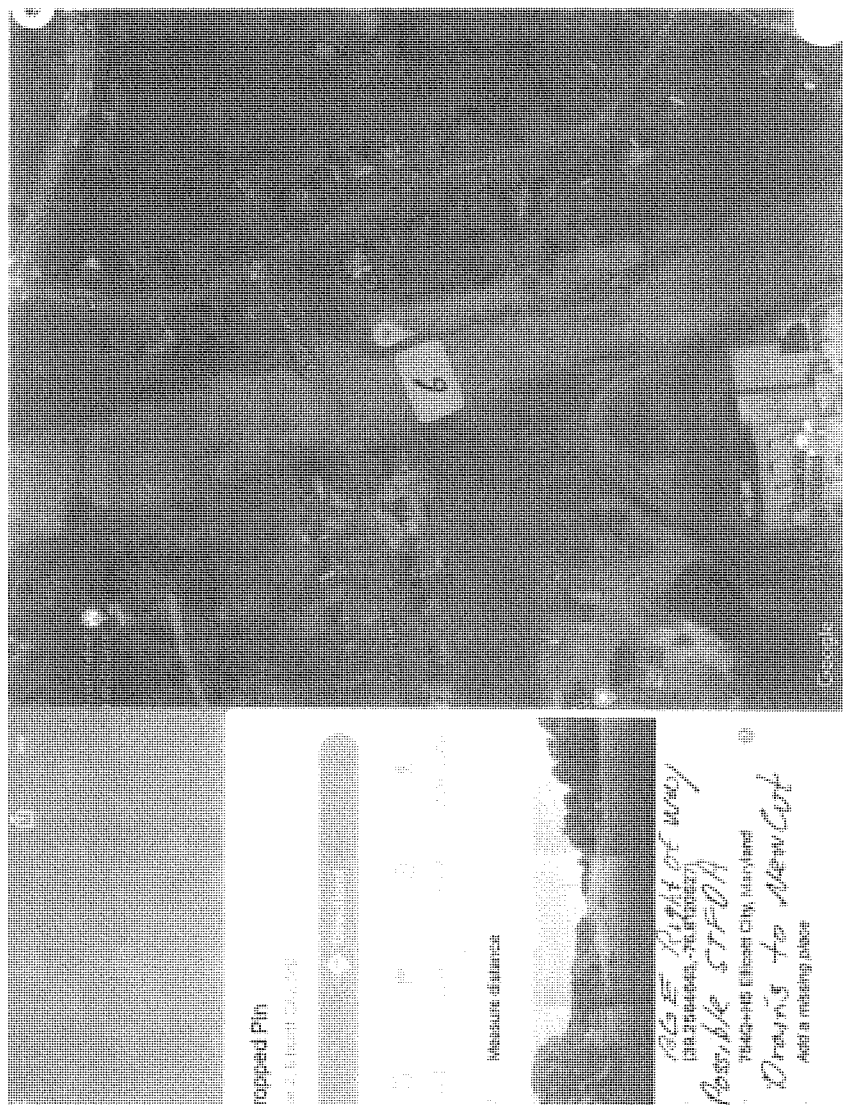




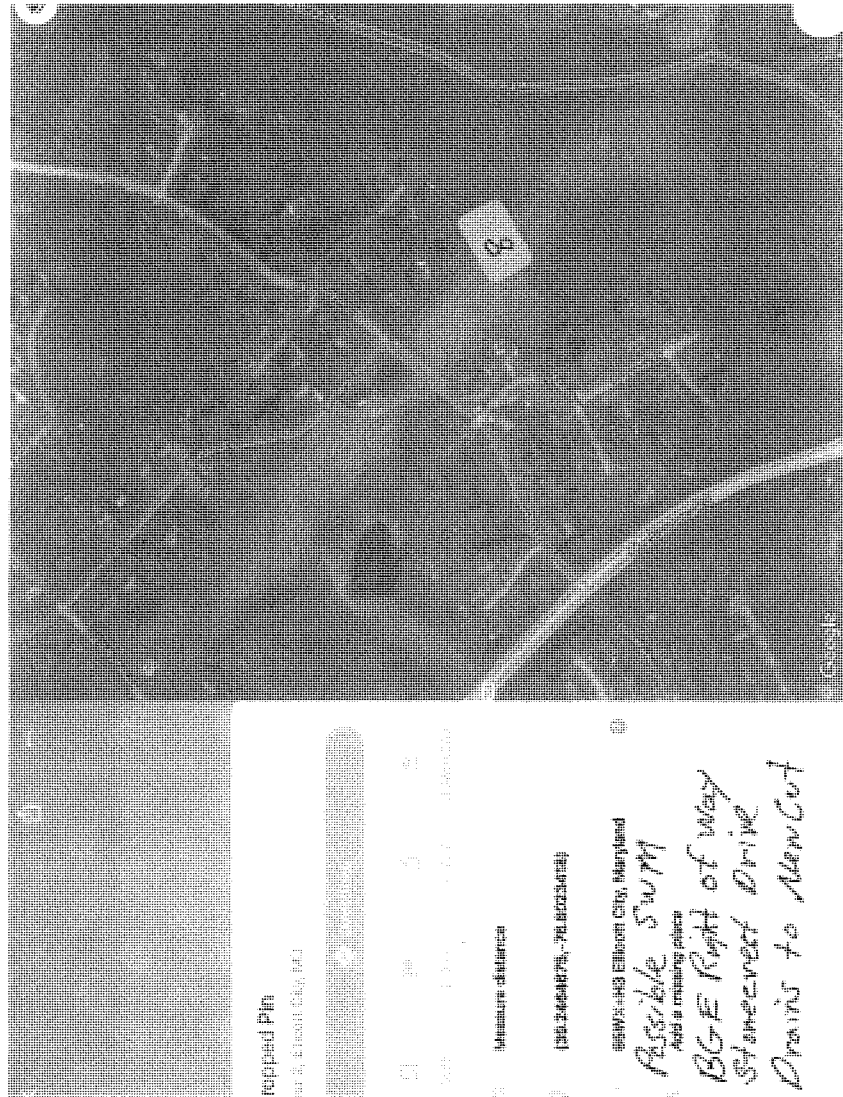


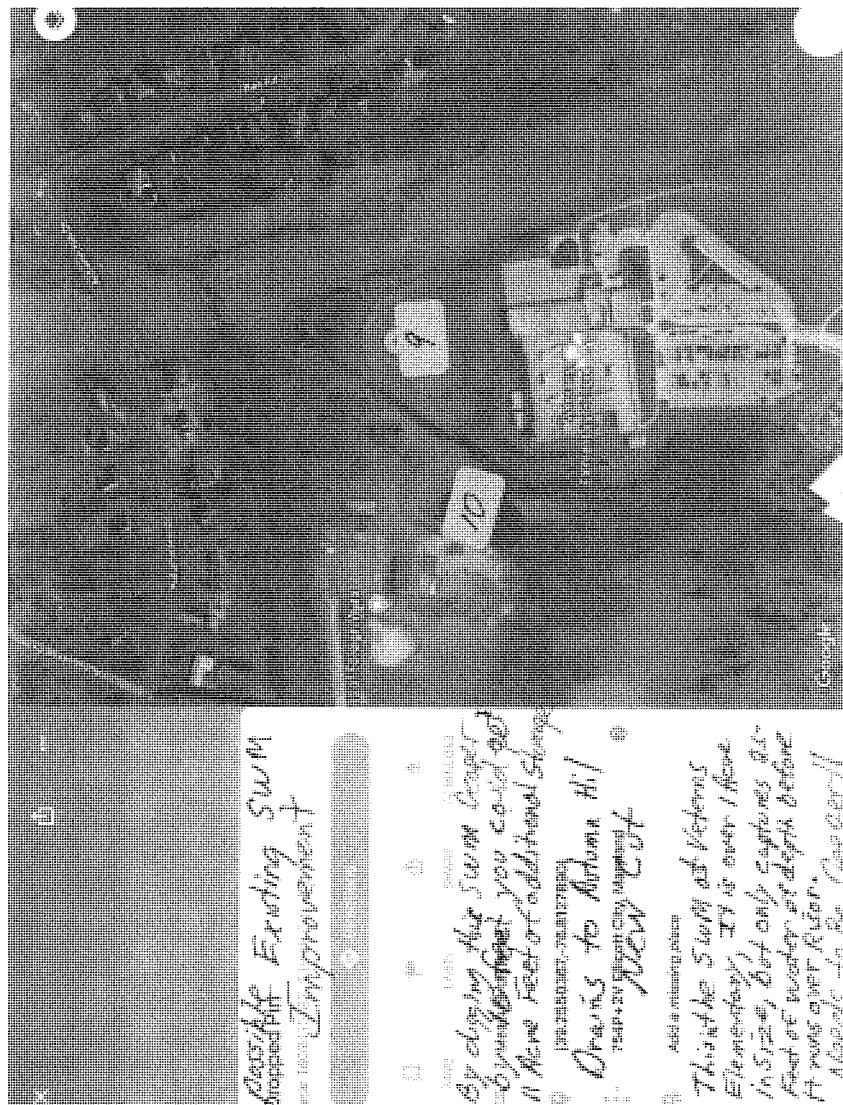












Volunteers spending many ,many hours doing cleanup





Volunteers working thousands of hours on the cleanup, in some of the worst conditions I have ever worked in , the basement of EC POPS took over a month to clean out , wet, muddy inventory one bucket at a time .















31 August 2018

To Chairman The Honorable James. M. Inhoffe, and Ranking Member The Honorable Benjamin L. Cardin,

Please take two minutes to watch this video:

<https://www.facebook.com/marvianne.medeiros.5/videos/1307784549250703/>

It was shot from Salon Marielle on Main Street, looking at the retaining wall by the Fire Station Museum at the foot of Church Road. The date was June 21, 2016, a bit more than a month before the July 2016 flood. The storm was nothing special, but as usual the runoff from the Circuit Court parking lots and upper Church Road turned Church Road and Emory Streets into the Church and Emory "Rivers." My wife and I have lived on the corner of Church and Emory since 1989, and we have seen the runoff levels increase every time new construction brought more parking lots above us. Each time it takes less and less rain to produce the effect. First the Circuit Court parking lots' runoff fills Emory from gutter to gutter. Then it meets a similarly over-burdened Church Road "River," and together they plunge down into backyards of Main Street buildings and over the Fire House Museum retaining wall into what becomes the Main Street "River." A 4:30 PM on May 27 of this year, I watched from my front porch as the combined flow formed standing waves like floods at Great Falls on the Potomac.

This problem will not be corrected by knocking down buildings on lower Main Street, or by deepening the channel of the Tiber. The flooding has already begun above the level of the river. You must take seriously the overbuilding of the watershed immediately above these paved "urban arroyos." This includes the Circuit Court parking lot, but also the parking lots of the Howard County Office Campus where last week's hearing was held. If you return there, just walk around its perimeter to get a sense of its acreage and look down Ellicott Mills Drive where all of that pavement drains when that road becomes a river, too. To reduce this runoff and thereby prevent it being a major contributor to flooding of the region below will require us to strip the asphalt and cement from those parking lots, all of them, and lay down water-permeable paving with water retention ponds near the worst stormwater collection points. Upper Church Road stormwater runoff already has chosen its preferred direct course to the Patapsco by cutting through the downhill curb of Church Road below Sarah's Lane. The water should be given its way to the river, not restrained by paving to channel it down to Main Street.

Treating the Main Street flooding problem by deepening the Tiber channel recalls the disastrous lesson learned from the Army Corps of Engineers when they attempted to control the Mississippi River flooding by dredging the river channel and building up the levees. The river ran faster and higher. When a failure occurred somewhere along the bank, as it eventually would, the catastrophe was magnified by the greater pressure and volume of water available to pass through the breach. Unless you reduce the amount of water going into the Tiber and the water going down Main Street without even entering the Tiber, you will have made the problem worse, again by deepening the channel. The previous deeper channeling of the Tiber between 2016 and 2018 led directly to the explosion of water from beneath the stores instead of their windows being driven in by water on the outside. The "deeper, faster Tiber" response to the 2016 flood report fed the flood of 2018 and made it worse. Please do not repeat the mistake.

Sincerely,

Arnold Sanders

3794 Church Road, Ellicott City, MD 21043

443-852-1869



St. John's Community Association
Serving the Dunloggin Neighborhood for 50 Years

September 3, 2018

Kathryn B. Held
9282 Frederick Road
Ellicott City, MD 21042

The Honorable James M. Inhofe	The Honorable Benjamin L. Cardin
Chairman	Ranking Member
Subcommittee on Transportation and Infrastructure	Subcommittee on Transportation and Infrastructure
Committee on Environment and Public Works	Committee on Environment and Public Works
United States Senate	United States Senate
Washington, DC 20510	Washington, DC 20510

Subcommittee Chairman Inhofe and Ranking Member Cardin:

I request this letter be added as written testimony for the record of the Oversight Hearing on Repeated Flooding Events in Ellicott City MD: Reviewing the Federal Role in Preventing Future Events, held on August 20, 2018.

My name is Kathryn Held, and I reside at 9282 Frederick Road in Ellicott City, Maryland. I am president of the Saint John's Community Association (SJCA), which serves the community of Dunloggin in Ellicott City.

I submit this testimony to support a conclusion that overdevelopment and poorly planned development without sufficient regard for drainage have contributed to problems with stormwater and flooding in our neighborhood.

Dunloggin was one of two Howard County neighborhoods outside of historic Old Ellicott City with heaviest damage from the May 27, 2018 storm that flooded Old Ellicott City. Our neighborhood is located north and south of the original National Road, now called Frederick Road, less than two miles west of the center of the historic district. Frederick Road becomes Main Street in the historic area. Housing development began in Dunloggin in the mid 1950s, and the SJCA was founded over fifty years

ago. We still have some original homeowners. Today there are over one thousand households in our community. An attached map shows the boundaries of the Dunloggin neighborhood served by the SJCA.

In the week after the May 27, 2018 storm, I asked neighborhood residents to send me photographs and videos they had taken during the storm. Some residents also had photos of stormwater from other heavy but less devastating rains. In all, residents submitted more than one hundred fifty photographs. Only three photos are included with this testimony, but I can provide the entire collection if requested.

The flooding in some Dunloggin houses was catastrophic. In one, the basement flooded to the ceiling and up into the first floor within a matter of minutes. The new resident had been moving in and spending a lot of time in the basement. She or her children could have been in the basement as the water rushed in. Our streets became rivers, washing out trees and damaging cars. One block floods up to the level of mailboxes during even more common heavy rains. Our drainage infrastructure was damaged extensively by the May 27 storm.

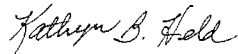
As we had been told the flood of July 30, 2016 was a "1000-year rain storm," most homeowners did not have flood insurance at the time of the May 27, 2018 storm. In most cases, homeowners insurance has denied coverage, because the damage came primarily from rising water overflowing the Plumtree stream branch of the Tiber River rather than rain.

A few long-term residents related to me how stormwater drainage has changed over time. Many correlated drainage problems with increased housing density and placement of new houses without regard for drainage issues either for the new construction or for surrounding existing houses. I therefore put a query on social media asking long-term residents to describe in writing their observations of stormwater drainage over the years. At the June 13, 2018, SJCA meeting, these statements were shared with visiting representative from the Stormwater Management Division of the Howard County Bureau of Environmental Services.

I now submit these statements as written testimony to the Senate Oversight Hearing on Repeated Flooding Events in Ellicott City MD.

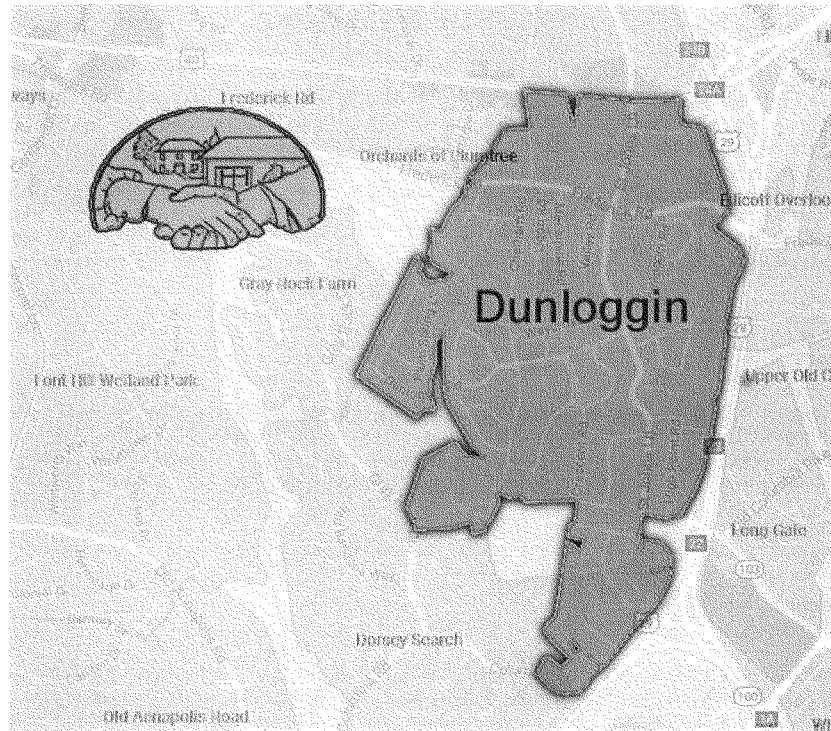
Thank you for your time and for considering my testimony on behalf of the Saint John's Community Association and the community of Dunloggin in Ellicott City.

Sincerely,



Kathryn B. Held, MBA, PhD
President, Saint John's Community Association

Boundaries of the Dunloggin neighborhood served by the Saint John's Community Association:



Statements from Dunloggin community members regarding changes in stormwater drainage

Angie Boyter
3914 Macalpine Rd
Ellicott City, MD 21042

When we first moved onto MacAlpine Road in 1967 there MIGHT be a LITTLE water in the median once or twice a year. Now it is once or twice a month, and it gets much deeper than it ever did. Plus our front yard gets puddles that stay for days and days. That NEVER happened in the earlier days. We have photos of today's runoff problems, but who takes pictures of LACK of a problem? All we can say is it [rainwater filling the median drainage ditch] did not happen.

Jane Hartlove
3708 Spring Meadow Dr
Ellicott City, MD 21042

My parents have lived on Spring Meadow Drive for almost 45 years and have never had flooding issues until recently. Their yard backs up to the stream, which would previously rise to the top but not overflow, during heavy rain. In recent years, after the construction of the new library, Miller's Grant etc, the water frequently floods the entire backyard, almost reaching the house.

Anonymous resident
Crescent Rd

I don't have any pictures to share (too busy bailing out my basement), but I was just curious **why the county doesn't check the open ditch areas that are part of the county easement**. Two years ago I replaced the pipe going under my driveway because the county said it was collapsed and impeding water flow. I paid for the work to be done, which honestly did help. My question is **why doesn't the county grade the land in these open swales to direct the water properly to the pipe? The swales are on what is considered their right of way. Maybe if the water flowed towards my drain pipe and not down my driveway, I would [not] get as much water in my garage.**

Carolyn Stansky
3826 Plnm Meadow Dr
Ellicott City, MD 21042

Memory jog for folks: Hurricane Isabel hit 9/18/03 and closed schools. We had torrential rain 6/25/06 (right after the hole was dug for our addition!). But I don't remember Main Street flooding then, at least not from the "wall of water". Hurricane Lee 9/7/11 caused first "river" on Main St. (check out YouTube video from EC Brewing [Ellicott Mills Brewery]) and saturated soil caused the stone wall to collapse on cars beneath St. Paul's church (across from train station); I also remember significant flooding at Rt 40/North Chatham from Lee, which closely followed Hurricane Irene 8/27/11. Still, 5/27/18 was the worst we've seen our yard in 28 years here.

Jeanne Whittington
4022 Chatham Rd
Ellicott City, MD 21042

I have lived in Dunloggin for 50 years next to the woods at the end of Chatham. The flooding has gotten more frequent and much worse than when we first moved in.

Sara Siemers
9106 Northfield Rd
Ellicott City, MD 21042

Those of us at lower "elevations" in the neighborhood are doomed to water slides, even in moderate rains. It definitely has gotten worse throughout the years-we have been here on Northfield Rd for 12 years. Also we feel it got much worse when the redid the road, which heightened the road and now the ditch becomes a river.

Craig Garfield
3757 Spring Meadow Dr
Ellicott City MD 21042

We have been in Dunloggin since early 1973. Downtown flooded from the Patapsco rising, not the Tiber and Hudson running down main street. That is new from development like the townhomes on the old Papillion property.

On Spring Meadow, my basement was flooded, as was my neighbor's next door. This is due to there now being 7 houses behind me instead of the 2 that were there before the R-20 change, and this was long before Kittleman BTW. I will be working down in the basement tonight trying to sort out what gets thrown out and what I can salvage. The remediation company has already disposed of some very expensive furniture and removed the walls and insulation waist high. I have to have most of my work done before the rebuild construction starts. Even with insurance, it will cost me quite a bit. Forget climate change, it has been rampant development.

Debbie Baronas
4014 Macalpine Rd
Ellicott City MD 21042

I am on MacAlpine and it [the water] seems to be coming from Chatham Rd and Crownwood Rd, through our yard and into the culvert across the street that runs along the bottom half of MacAlpine.

Judith Kilroy
3930 St. John's Lane
Ellicott City, MD 21042

TO: St. John's Community Association

I will be unable to attend the meeting scheduled for June 13, 2018. However, I wanted to offer my observations about the current state of stormwater management in the Dunloggin neighborhood.

I have lived on St. John's Lane since 1993. Over the past three to four years, I have noticed that stormwater is draining far more slowly than it had previously done. On some days, after a steady rainfall, I have noticed that the ground on my lot and other lots near me is like a full sponge, and it persists through the next day. I walk daily throughout our neighborhood, and have seen this on my street, Hawthorne Drive, MacAlpine, Crescent and Woodley. (After all of the rainfall we have had since Memorial day weekend, the ground is still like this, and with water standing above the grass) I cannot remember seeing this before 2013 or 2014.

Why are our existing stormwater management systems seemingly so overtaxed and unable to handle even average rainfall? In our zeal to promote smart growth, with density concentrations, we seem to have lost an enormous amount of permeable surface. I'm all for "Smart Growth" but do our Planning and Development regulations include adequate provisions for SWM that need to accompany such plans?

None of us expected a repeat of the 2016 rainfall, which was said to be a 1,000 year event. And here we are again. I will say that I had never before seen St. John's Lane flood out, so that traffic could not pass. The storm drains along the road simply stopped working. Relief drains in my backyard stopped flowing

because the opening were so far underwater. I think that Hawthorne and MacAlpine were even worse. The damage to the SWM structures on MacAlpine is clearly evident.

If the frequency of such events is increasing, how do you propose to manage the water flow? Clearly the existing provisions are not adequate. I do wonder if they would be adequate if the newer development around us were less dense? Or if the SWM permitted for these developments had been up to the task of managing the run-off?

As a long-time resident of Dunloggin, I look forward to hearing from you regarding the changes you will make to the development standards to accommodate any new development, and how the County plans on remediating the flooding issues in existing development.

Peter and Ann Green
9117 Northfield Road
Ellicott City, MD 21042

Stormwater: A Retrospective Over 42 Years: We bought our house in 1976, being the third owners. The previous owners bought it around 1964. It was built in 1961 and is a typical Dunloggin Awalt house with one level and a basement. Square footage on the main level is a bit over 1500. About ¾ of the basement is finished and was when we arrived.

Quizzing the previous owners, they said they had no water problems, even in Hurricane Agnes in 1972, and there were no indications of any such problems. It has a French drain system and a large, bronze sump pump.

We had some work done to deal with seepage in the unfinished basement problem during hard rains. This was about 1995 and cured the problem. We had some outside work done to keep a basement window well on the west side from filling in hard rains, and generally spent a fair amount of money getting water away from the house.

Our lot slopes gently from the back-property line to the rear of the house (about 90 feet). On the other side of the rear boundary, the land of the adjacent infill development lot slopes very steeply away from the boundary. We own the highest local point of land. Our house sits at about the same level as the house on one side, and above the house on the other side.

We had no stormwater problems over at least two, and maybe more, hurricanes.

That all changed in September 2011 when there were very hard rainfalls at a very high rate (3 inches per hour at one point). Water sheeted over the ground and filled up two basement window wells on the east side. Water seeped around the basement windows, ruined the drywall below the windows and soaked part of the basement carpet (which had been there since the early 90s). To remedy this, we had the carpet taken up, the drywall replaced, and a drain system put under the two window wells which goes,

via 4-inch plastic pipe, out to the front of our lot. The trench for the drain pipe probably fatally disturbed the roots of the large maple in our front lawn, which began to die, so we had it removed and replaced with a pin oak. The two window wells had concrete floors put into them and roof drains installed. Roof drains are built to avoid clogging with leaves and debris. We also had covers built for the two window wells. We have had no more problems with these two window wells. The floor in the finished part of the basement was replaced with porcelain tile, from which water can be easily vacuumed or sponge mopped.

We had no water problems during the July 2016 rain and flood event.

During the May 2018 rain and flood event, rain was falling at such a rate, and running into the sump at such a rate, that the sump pump, though running continuously, was unable to keep up and the water began to rise in the sump. We augmented the sump pump with a manual bilge pump, the suction of which went into the sump and the discharge of which went into a downstairs bathtub. We took turns working this bilge pump for an hour and a half until the rain slackened and the water level in the sump began to drop. Had we not been home, or had the electricity gone off, likely the basement would have flooded.

YouTube video of Main Street in Old Ellicott City from the September 7, 2011, flood following Hurricane Lee. This video clearly shows the floodwater coming from the Tiber River and flowing toward the Patapsco River rather than swelling from the Patapsco.
https://www.youtube.com/watch?v=BKCGqvvy_cU

Diane Butler
4056 Saint John's Lane
Ellicott City, MD 21042
politicodiane@msn.com
410-461-0066

Where I live there were originally 6 homes. There will now be 14, in the same space. (Three are waiting for APFO closed schools). We are in the watershed. My home was bought sight unseen when I moved from California to Howard County. When I got here, I realized that I had purchased an infill house. Due to water problems in my yard, I did a little research. It turns out that when the front house on Saint John's Lane (I am the second house built in the backyard), originally built their house THEY WERE ORDERED BY THE COUNTY to install a drain field as this was the natural waterway for drainage in the area. The owner complied, and he and the neighboring house had their storm water brought down the hill, underground, in terra cotta pipes, to a county drain near the next street over (Woodley). This was 40 years ago.

When the county, in their infinite wisdom, 20 years later allowed the new owner to split the property and add not one house, but two, to the backyard of the property, they conveniently forgot about the county mandated drain field, and it was torn up to build the new houses. This not only left very wet lots for the builder to deal with, but also started flooding out the basement of the original house on Saint John's Lane, AND the house above it that also had their storm water running into these drains.

The developer put a French drain all around my house, but I dare not add an addition, or do any digging close to my house as if this is disturbed, I will have the same water problems as the front two houses. This limits my rights as a homeowner. The builder also paid a "fee in lieu of" installing the rain gardens that were supposed to be put in, on my property. How is a "fee" supposed to drain the water away?

As each year progresses, my lot gets wetter and wetter as the water builds up with nowhere to go. Plus, more and more houses have been built, paving over all of the land that used to be for the storm water to get to the county drain, downhill. The county has allowed a new house to be built in between each house and two more, in each backyard (I wonder where all of these kids will go to school?). Hence 6 houses to 14 with no added storm water management, and actually the removal of the county mandated drain field. How does this happen?

Every time it rains, my yard becomes a rushing river. I have pictures of my daughter and her boat on a string, from years ago playing in the river. Now, the river is so bad that you would not dare to go out there for fear of being swept away. The river has now widened to almost thirty feet. It is very hard for me to keep any grass or plantings as they are always washed out. My yard never dries now, and that has ruined the carpet in my house, and the value of my home. I bought a house with a yard, not a temporary river, every time it rains.

The county has come out twice to try and do something about the water for the houses affected, but the plans that they came up were so egregious that all of the home owners would not sign off on it. They wanted 20 foot easements around all of our properties, and they wanted to dig up my driveway, for piping, **at my expense**. Storm water management needs to be installed in this older neighborhood, and be done properly, and be well planned, not just as an afterthought. NOTHING else should be built here until this is done. Once your house is wet, it is never the same!

Before they built the house below me, we actually had a pond fill up with ducks and cattails before the developer bulldozed it to put in another home. This is where the water was supposed to drain through for this area, yet the county overbuilt and allowed homes to be put in the storm water drainage area. Nothing should be built on land that will not "perc", whether we have public sewer and water, or not. When the original Dunloggin plan was done, this area was to be left open for storm water. That is why the county installed a big drain on the property below mine. Why were houses allowed to be built here, under these circumstances, WITH NO STORM WATER plans. If the "green" thing to do, to protect the Chesapeake Bay, is to let the water drain over the land, you cannot build and pave over all of the land, especially in a watershed.

I sat at the [Inhoff/Cardin Senate] hearing the other day and listened to everyone blame the weather for all of the flooding in Ellicott City. Not once, did I hear anything about the overbuilding (without installing proper storm water management). Or, about the building on the tops of the ridges, and on the steep slopes, and overbuilding in the watershed. This is short sighted. I did hear Jon [Weinstein]

mention his bill for a year moratorium on building permits, and I think it was Ben who mentioned a little bit about looking at storm water management in the older neighborhoods. Other than that, all I heard was about back building storms, and climate change. Frankly, I think, that it is way more feasible that this is being caused by over building and poor planning. Just my opinion as my studies were in GeoPhysics.

Some of the areas off of MacAlpine actually caved in due to old, unmaintained storm drains, years back. When the road finally caved in, something was done about it. I noticed the road by the culvert wall is caving in again, and cones have been put out. This is about storm water management, not climate change. The studies that you suggested need to be done for the entire watershed, and funding needs to be allocated soon. This area cannot take another storm, and this 1,000 year storm modeling is nonsense. We have only been keeping records since 1880. That is 138 years.

I am including a picture of my "backyard" when it rains. It has gotten much worse as more houses have been built adjacent to mine, and I no longer have a yard. The state even lowered my taxes due to the damage. I need this problem fixed.

My poor, immediate neighbor, not only lost his store for the second time, but his house flooded also. He is on Woodley. We need your help in a timely manner.



Alex Bateson
3909 Macalpine
Ellicott City, MD 21042

Basement with floodwater pouring in 5-27-2018



**Southernmost block of Chatham Road
Ellicott City, MD 21042**

Front yard and mailbox *after a heavy rain but not one of the major floods*. High water like this is common on the southern end of Chatham Road.





An insider's view of rebuilding Old Ellicott City

1 By: Commentary: Bruce T. Taylor July 12, 2018

The two recent floods of Old Ellicott City (OEC) have caused significant damage, business and financial losses, disruptions and tragic deaths. Careful analysis indicates that to prevent or reduce future problems we cannot simply keep putting the town back together the way it was and expect a different result the next time; after all, it is in a flood zone, collecting water from over 2,000 acres. Flooding will happen again, most likely sooner than later due to more dramatic weather events brought on by climate change.

Is development the problem? Surprisingly, not much: engineers hired by Howard County found that, had the same rains occurred before the development in the OEC watershed, the resulting floods would have been only about 20 percent less and that completing the development of the watershed will also make little difference. So stopping development is not the answer based on scientific data.



Bruce T. Taylor

In fact, stopping development projects will make things worse for OEC. New communities and redevelopment of old sites under our current regulations will improve the situation by providing quality, quantity and 100-year flood controls to reduce runoff to OEC from places where there is little-to-no stormwater control now. To help reduce flooding in OEC, these new projects need to be fast-tracked, not slowed down. These projects alone will help, but not stop the flooding. To mitigate the flooding, we need to make infrastructure changes above and in OEC, as recommended by the county-hired engineers, and changes to Main Street itself.

A concept to revitalize OEC and significantly reduce flooding for lower Main Street has been put forward privately by an architectural and planning team from OEC experienced in flood measures for historic structures in the similarly flood prone Jones Falls Valley. The concept plan should provide significant flood relief for lower Main Street while also improving vehicular and pedestrian flow. Further study and development of this plan along with the implementation of the flood warning system and suggestions from the McCormick Taylor study should make a significant difference.

In summary, this plan would divert most or all of the water from the New Cut streams that normally flow into the Tiber River midway down Main Street. A diversion structure with a new road on top would send the water under Saint Paul Street to carry it safely to the Patapsco without impacting Main Street. This would prevent perhaps as much as 41 percent of the water during a flood event from reaching Main Street.

Embracing heritage

As proposed in previous concepts, this plan would remove the buildings which bridge and constrict the Tiber at the bottom of Main Street, allowing the Tiber to be daylighted and appropriately dredged, giving its channel greater carrying capacity. A park setting will be created that makes the river an attractive asset to OEC instead of being its enemy. After all, it is because of the confluence of rivers here that the town was built in the first place. To preserve most of the town, we need to sacrifice a few of its buildings, or at least the parts that restrict flow and access to the river.

In addition, the plan would connect Saint Paul Street to Old Columbia Pike by creating a new link, connecting across the diversion structure to Saint Paul Street. Some of the buildings proposed to be removed are owned by my family and associates. With fair compensation to owners, this plan can be a key part of the solution. This concept has the added benefit of allowing Main Street to be one way going west to Old Columbia with the St. Paul extension going

one way east, creating a giant traffic circle. The traffic lights at Maryland Avenue and Old Columbia could be removed, the sidewalks widened and angle parking instituted. Re-zoning parts of OEC will provide an opportunity for new businesses and buildings on higher ground to maintain a critical mass of shops and restaurants, reinforcing the vibrancy of lower Main Street.

Additional projects which would help prevent flooding damages include: substantial steel fences around the parking lots and dumpster enclosures to prevent clogging the rivers; stabilizing and cleaning stream embankments; rebuilding our sidewalks out of concrete to protect infrastructure and foundations; and creating public private partnerships to build new retail, offices and apartments with stormwater management and structured, free public parking.

Contact your elected officials and let them know a revitalized Ellicott City that embraces its river heritage is possible now, that new development with modern stormwater management must be permitted to proceed to help protect OEC and that the projects recommended by these studies should be funded as soon as possible to preserve the history, charm and beauty of OEC.

Bruce T. Taylor, M.D., is a psychiatrist and developer who owns property both in Old Ellicott City and above the city. He is not related to the firm McCormick Taylor. He can be reached at btaylor@taylorservice.com.

Tagged with: [ELLCOTT CITY](#) [FLOODING](#) [REDEVELOPMENT](#)



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Honorable Senator Ben Cardin and Committee Members
Senate Oversight Hearing on Repeated Flooding Events in Ellicott City, MD
By Email courtesy of Heather Campbell, Heather_Campbell@cardin.senate.gov
Re: Written Testimony of Bruce T. Taylor, M.D., property owner and developer

Dear Committee Members,

August 16, 2018

Thank you for considering this written testimony since it is unlikely I will have an opportunity to testify at the above hearing, although I plan to attend and be ready to speak.

My great grandmother, Rachel Caplan came to Ellicott City in the 1890s and established the iconic Caplan's Department store and building at 8125 Main Street shortly after that. My grandfather Isaac Taylor established the Taylor's Furniture Store and the Ellicott Theater. I have come to own with my family over the last 100 years over two dozen properties in historic Ellicott City that have been affected by the floods over the years, including 10 on lower Main Street. I am also the principal behind the development of over 1000 homes in Taylor Village at the top of College Avenue above Ellicott City, where another 1000 homes are planned on the 65 acre hospital property over the next decade or so. Much of this property was developed before modern storm water management and drains to historic Ellicott City.

In summary, I am vested at both the top and bottom of the hill and am quite concerned to facilitate a re-vitalization of the town. So much so that I got together with another owner/developer, Don Reuwer, and local architect, Charles Alexander to develop and present to Howard County and the community what I will call the Alexander Plan to mitigate flooding, traffic and parking concerns in the historic town. This plan is attached along with an Op-Ed published in the Daily Record that explains the details of removing buildings that obstruct the flow of the Tiber River and diverting the water from the New Cut branches that feed the Tiber, while improving the traffic flow, pedestrian access and parking. New buildings can be built with an historic flare to replace those that must be removed. This plan is based in part on the guiding principles that the town is worth saving from an historic and economic perspective and that we cannot simply keep re-building everything as it was in the face of significant changes in weather patterns which have caused supposed "1,000 year" floods to occur at 22 month intervals. I have rebuilt after three major and several minor floods since Agnes in 1972. Facing this fact I advised the County that at least two of my major buildings, 8095 and 8129 Main Street would not be re-built after the May 27, 2018 flood as they cross the Tiber and will simply be destroyed again in the next event. Unfortunately, it seems highly likely the next flood will be sooner than later, perhaps in as little as a year or so. We must all make changes quickly.

Howard County commissioned a detailed hydrology study completed in 2017 by McCormick Taylor (no relation) to evaluate what can be done in Ellicott City. In part the study revealed that even if the entire 2300+ acre water shed were forested and undeveloped, 80% of the flooding would still have occurred, and that even if all the remaining land in the watershed were developed, it would not make a significant increase in the flooding since so much is already built out. In other words, of the approximately 10 feet of water that came through town in the last flood, two feet is the result of development. Most of the development was before modern stormwater practices of quality and quantity control. Development in the watershed now requires "100 year" flood water control of 8.5 inches of rain in 24 hours. This is significant and will help reduce flooding better than leaving the land as it is, particularly where the areas are re-developing land that now has little to no storm water management. Development and re-development are important economic engines vital to the survival of Ellicott City and the County economy. More people and more housing, out of flooding reach, are needed to support a vibrant town.

Federal assistance would be especially helpful in the following ways:

1. Assist in funding the acquisition of properties needed to mitigate flooding.
2. Assist in funding over \$100,000,000 needed in infrastructure improvements to reduce flooding as identified in the McCormick Taylor Study and Alexander Plan.
3. Facilitate the necessary environmental approvals needed to clear the rivers and streams and stabilize their banks to keep debris from damaging property and taking lives in the future.
4. Support public-private partnerships which will create new housing, shopping, offices and parking to help revitalize Ellicott City in a safe manner.

I look forward to being part of the solution to solve the flooding crisis in Ellicott City and deeply appreciate your interest in and our government's support of the process.

Sincerely,
Bruce T. Taylor, M.D.

Bruce T. Taylor, M.D.



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Honorable Senator Benjamin Cardin
Honorable Senator James M. Inhofe
Honorable Senator Chris Van Hollen
Honorable Representative Elijah E. Cummings
and Committee Members
Senate Oversight Hearing on Repeated Flooding Events in Ellicott City, MD
By Email courtesy of Shannon_Frede@cardin.senate.gov

Re: Additional Written Testimony of Bruce T. Taylor, M.D., property owner and developer

Dear Committee Members,

August 22, 2018

Thank you for considering this second written testimony and for your time and interest in historic Ellicott City. In addition to my written testimony provided by email letter of August 18, 2018, I appreciate the opportunity to put in the record the plans and considerations as noted below.

When Howard County commissioned the detailed hydrology study completed in 2017 by McCormick Taylor to evaluate what can be done about the flooding in Ellicott City, they constrained the engineers, telling them all the existing buildings need to be preserved. This left in place all the buildings crossing the lower portion of the Tiber River, all of which were severely damaged in the 2016 and 2018 floods. Several of the property owners, including myself for Historic Ellicott Properties, Inc., have advised the County we will not be rebuilding our buildings and we have requested that the government acquire them. This is because it is not going to be feasible, at any cost, to flood proof them to a height of ten feet needed to prevent future damage by similar floods. Additionally, since there will be considerable delay in putting in place the infrastructure improvements which can reduce flooding to two to four feet, it also makes no economic sense to repair the structures again since they will likely be destroyed by another flood event before long.

The County has appraised these ten structures from 8125 (Caplan's) to Maryland Avenue, and offered to purchase them from the owners. So far eight of ten owners have agreed. This coincides with the first phase of the Alexander Plan sent on August 18th, setting the stage to demolish these structures, create parkland, opening up, widening and deepening the Tiber channel so it can carry more water out of town in future storms. The County I am sure will welcome future Federal assistance to reimburse the County for these emergency, unplanned purchases and subsequent work.

In addition, the McCormick Taylor Study recommended two major large tunnels be bored through Ellicott City to carry water collected from the New Cut Branch and from the Hudson Branch to the Patapsco, bypassing Ellicott City. The New Cut Branch supplies approximately 40% of the water entering Ellicott City, and diverting this flow is the second major phase of the Alexander Plan I sent on August 18th. We need funding and the assistance of the Army Corps, EPA and others to further model and evaluate these plans to see the benefits and costs to accomplish these changes along with the removal of the structures spanning and restricting the Tiber. While McCormick Taylor noted that the 13' x 1300' long tunnel for the Hudson waters and the 15' x 790' would be quite effective, they did not further explore them due to the difficulties anticipated in constructing them. However, I believe if indeed they are through rock, that although this will make drilling them harder, it should reduce the additional shoring if any required, likely offsetting some of this cost. The total of approximately 2100' of tunneling is not that much when you think of the underground roadways and subways which have been built elsewhere. This should be given some priority to re-evaluate these solutions which can make a major difference to preserving property, lives and the heritage of Ellicott City. Furthermore, as these solutions are evaluated, a better understanding of the cost and benefits of the other solutions recommended can then be assessed. Each method of reducing and controlling the waters to reach the town is going to be beneficial.

I look forward to working with County, State and Federal officials and agencies to solve the problems of Ellicott City's flooding. I deeply appreciate your interest in and our government's support of the process.

Sincerely,



Bruce T. Taylor, M.D.

CC: Governor Larry Hogan
County Executive Alan Kittleman
Mark DeLuca, Chief of Environmental Services, Howard County
Valdis Lazdins, Director of Planning and Zoning, Howard County
Jim Irvin, Director of Public Works, Howard County



The Historic Ellicott City Flood Workgroup

Report

12/01/2015

I. Introduction

Flooding is a major problem in the Patapsco River and Hudson/Tiber Watershed Tributaries, causing significant property damage and personal loss. There have been numerous incidents of flooding, including several recent major events.

The Howard County Flood Mitigation Plan identifies Historic Ellicott City as an area of flood vulnerability, stating: “The (Old) Ellicott City area will potentially be one of the most impacted during a 100-year flood event on the Patapsco River...Nearly all structures in the area may suffer flooding damage to their buildings and contents. Many are likely to be impacted significantly or severely. In addition to flooding from the Patapsco River, the (Old) Ellicott City area is also impacted by the Tiber Hudson Branch, Cat Rock Run, Autumn Hill Branch, and New Cut Branch. There are many businesses in the (Old) Ellicott City area, making both the buildings and their valuable contents vulnerable to flooding.”¹ The Howard County Executive funded approximately \$2,500,000 in Fiscal Year 2016 for a first phase (Phase I) of flood mitigation projects in the Historic Ellicott City area. In conjunction with that effort, the Howard County Executive created the Historic Ellicott City Flood Workgroup through **Executive Order 2015-06**. While the Workgroup will not oversee Phase I efforts, it is tasked with recommending flood mitigation solutions to be included in future efforts (Phase II). The Workgroup is specifically charged with:

1. Acting on initiatives to reduce flooding.
2. Evaluating priorities for mitigation/infrastructure improvements in the future.
3. Outreach to the community related to projects and initiatives.
4. Seeking community input and feedback.
5. Seeking opportunities for additional funding sources.
6. Providing community educational opportunities on reducing impact of future flooding.
7. Work towards possible reductions in Federal Emergency Management Agency (FEMA) insurance rates.

¹ *Flood Mitigation Plan - Howard County, Maryland; September 6, 2010;*
http://www.howardcountymd.gov/uploadedfiles/home/environment/environmental_services/finalhowardcountymfp.pdf

The Workgroup consists of the following individuals:

- Kevin Bloom
- Frank Durantaye
- Debra Korb
- Lori Lilly
- Jason McMillan
- Ken McNaughton
- Dave Myers
- Ron Peters
- Bruno Reich
- Debbie Slack Katz (Chair)

The Workgroup is supported by the following Howard County Departments/Offices:

- Office of Community Sustainability
- Office of Emergency Management
- Department of Inspections, Licenses & Permits
- Department of Planning & Zoning
- Department of Public Works
- Howard County Council (District 1)

II. Workplan

The Flood Workgroup met on a monthly basis from June – September 2015. The Flood Workgroup then met on a bi-monthly basis from October – December 2015.

➤ June 15, 2015 -

- Logistics – A discussion on:
 - When and where the group will meet.
 - Mission and member responsibilities.
 - Setting meeting procedures.
- Deliverables – A discussion on requirements:
 - Outreach – At least one public hearing to receive community input.
 - Education – Campaign to educate community on flooding and how to help mitigate impacts.
 - Insurance – Work on reducing FEMA insurance rates. **The Workgroup did not explore FEMA insurance rates further based on the fact that the insurance rate had recently been reduced and that it would be difficult to reduce it farther.*
 - Continuation – Recommendation by October 1, 2016 on whether to continue work.
 - Public testimony targeted for 2016.

➤ July 13, 2015

- Current Work – Discussion of what County Government is currently doing to mitigate flooding. Potential Phase I projects were shared:

Proj #	Project Description	Amt	Unit	Estimate Unit Price	Total Estimated	Year 1	Years 2-5	Years 6-10
					Cost	FY16	FY17-20	FY21-25
1	Stream Wall Inspections and Prioritization	1	Ea	\$50,000	\$50,000	\$50,000	\$0	\$0
2	Stream Wall Design and Construction (assume 750 lf per year)	7500	LF	\$2,000	\$15,000,000	\$1,500,000	\$6,000,000	\$7,500,000
3	Comprehensive Floodproofing Study for Historic Ellicott City	1	Ea	\$75,000	\$75,000	\$75,000	\$0	\$0
4	Historic Ellicott City Floodproofing	50	Ea	\$10,000	\$500,000	\$250,000	\$250,000	\$0
5	READY – annual channel clean up (\$20k/year)	10	Year	\$20,000	\$200,000	\$20,000	\$80,000	\$100,000
6	Annual County Stream Channel Maintenance (larger projects)	10	Year	\$100,000	\$1,000,000	\$100,000	\$400,000	\$500,000
7	S&S Site 1 – Re-form channel under Tiber Park Bridge	300	LF	\$300	\$90,000			\$90,000
8	S&S Site 4 – Replace cinder block wall next to apartment complex	400	LF	\$2,000	\$800,000	\$0	\$800,000	\$0
9	S&S Site 5 – Repair erosion above culvert and do planting	1	Ea	\$50,000	\$50,000	\$50,000	\$0	\$0
10	S&S Site 6 – Replace sandbag wall	200	LF	\$2,000	\$400,000	\$400,000	\$0	\$0
	TOTAL ESTIMATED COSTS				\$18,165,000	\$2,445,000	\$7,530,000	\$8,190,000

- Historical Overview – Discussion of what have been the past impacts of flooding and what could happen in the future.
- Education – Discussion of what has already been done to address flooding. **All technical reports prepared over the last 20-years were reviewed.*
- Next Steps – Discussion of how the workgroup will work moving forward

➤ **August 17, 2015**

- The Workgroup took a tour of the watershed to visualize flooding impacts and better understand potential mitigation efforts:

Stop	Location	Topic Speaker	Themes / Discussion
1 (5:05-5:20)	Courthouse gully	Lori Lilly	• Unmanaged impervious cover, effects on stream channel, relation to flooding
2 (5:25-5:40)	EC staircase	Jim Caldwell / Mark DeLuca	• Stormwater management in downtown EC • Project design / function
3 (5:45-6:05)	8454 Frederick Rd (Nathan Sowers)	Mark DeLuca / Lori Lilly	• Channel walls • Private vs public improvements • Routine maintenance • Constrictions
4 (6:10-6:25)	EC Historic Colored School	Mark DeLuca / Lori Lilly	• Impacts from Lee • S & S Study • Stream restoration • Channel walls
5 (6:30-6:45)	Rusty Rim pond	Center for Watershed Protection	• Outdated stormwater management facilities • Proposed project site
6 (6:50-7:00)	CR Daniels / Lott Plaza	Jim Caldwell	• Unmanaged, large lot impervious cover • Private commercial property • County incentive programs for stormwater management
7 (7:05-7:15)	End at EOC	Ryan Miller	• Emergency operation center • Response and communication during Lee/emergency events

➤ **September 14, 2015**

- Discussion on the relation of Phase I flood mitigation efforts (“short-term” goals) vs. the Workgroup’s Phase II flood mitigation efforts (“long-term” goals).

➤ **October 19, 2015**

- This meeting isolated the focus of the report. Each Workgroup member presented 5-10 points they want to see covered in the report. The Workgroup worked through those proposals to establish the focus of the report.

➤ **October 26, 2015**

- The Workgroup confirmed the objective of the report due to the County Executive and County Council. A framework for the report was developed to capture all the items needed to fulfill the executive order establishing the Workgroup.

➤ **November 16, 2015**

- Workgroup members worked on the content of each section of the report. The workgroup then reviewed all the sections as a whole, refined the content, and concluded the meeting with a preliminary draft of the report.

➤ **November 23, 2015**

- The Workgroup finalized the flood mitigation report.

III. Recommendations

The Historic Ellicott City Flooding Workgroup is making the following recommendations to the Howard County Executive and County Council with the goal of protecting the Ellicott City Historic District by enhancing public safety and minimizing damage to properties.

A. Structural

The Flood Workgroup has identified short and long range structural improvements to the stormwater management systems in the Ellicott City drainage area to mitigate and possibly eliminate property damage. Some of these ideas are in response to the changing character of recent floods and could be accomplished in the near future. Others are long range ideas that could enhance the urban design of Ellicott City, create tourist attractions and capture the imagination of the wider population. Other ideas are possible long range projects to handle maximum water quantities with no damage to property. Many small projects such as repairing of the channel walls on private property may be accomplished by cooperatives, grants, or other programs to allow them to be completed faster or at lower cost. Other projects may be accomplished by public funding or public/private ventures. The following recommendations should be considered for future mitigation efforts:

1. Continue funding Phase I and fund Phase II mitigation projects.
2. Repair existing stormwater system including:
 - a. Channel walls
 - b. Structures supporting buildings spanning the channels
3. Increase capacity of the existing stormwater system including:
 - a. Increase number and/or size of underground stormwater pipes
 - b. Create spillways
 - c. Create underground storage such as below Parking Lots F and D
 - d. Increase size of existing stormwater management ponds and add new ponds

4. Implement flood proofing projects on private property
5. Create new funding/implementation models including:
 - a. A technical assistance program on the local level modeled after FEMA
 - b. State and federal grants
 - c. Tax incentives
 - d. Cooperative programs
6. Create projects that combine increased stormwater capacity and urban design such as:
 - a. Widen and deepen beds and develop recreation areas
 - b. Create step ponds
 - c. Partner with Baltimore Gas and Electric (BGE) on flood mitigation projects in its corridor.
 - d. Creation of a park/city attraction that doubles as stormwater storage
 - e. Creation of a rock quarry that doubles as a stormwater storage
7. Create an access point in the lower downtown watershed for maintenance, monitoring and post storm surveys.

B. Maintenance/Monitoring

The purpose of this section is to emphasize the importance of channel maintenance and monitoring in flood control. The following recommendations should be considered for future mitigation efforts:

1. **Maintenance:** The County should implement an ongoing plan to minimize the amount of debris that accumulates within the stream channels of the Tiber and Hudson tributaries, as well as the drainage channels that empty into the Tiber and Hudson. This would include all naturally occurring debris from rain, wind, snow or ice storms and any other debris that ends up in the channels.
2. **Monitoring:** The county should monitor the Tiber and Hudson channels along with the tributaries that empty into the Tiber and Hudson on a scheduled basis of four times per year. This would include monitoring for any blockages, side wall failures or potential side wall failures that could cause future problems. In addition to the scheduled inspections the stream channels should be inspected after every significant storm event for any accumulated debris. A significant storm event can be defined by heavy snowfall over 6 inches, heavy rain over 2 inches in an 8 hour period, wind gusts of over 30mph and any accumulating freezing rain. In addition to the county monitoring, it would be

beneficial for local residents whose property adjoins the stream channels to also monitor for debris and report any concerns to the Department of Public Works. The portion of the Patapsco River from the Route 144 bridge to Oella should also be monitored for any fallen trees or logs that could cause blockages at the bridge. The inspections, debris removal and any blockages should be photographed and GPS coordinates recorded for future reference. Real time monitoring of waters levels and flow rates in the Tiber and Hudson along with adjoining streams would be beneficial for analysis and archiving. The flow station on the Hudson located at the Ellicott City Colored School should have an audible and visual alarm added. In addition to this alarm station, a second alarm station should be added where the Tiber and Hudson merge behind the Visitors Center. A third station behind the old bakery on Main Street would provide valuable comparative data on the less developed watershed of the Autumn Hill Branch and New Cut Road. The use of drone technology to help with the monitoring may be an option in the future.

C. Education

In a world where climate changes are somewhat unpredictable and building developments can change the flow of stormwater in Historic Ellicott City, Howard County should reach out to developers, commercial interests, business owners and residents with the latest information about techniques to control and mitigate floodwater. The following recommendations should be considered for future mitigation efforts:

1. Maintain the current web page for all information related to Historic Ellicott City flooding. This would include flood mitigation preparedness techniques, technical resources, grant programs and videos about past floods and flood preparedness.
2. Reach out to longtime Historic Ellicott City homeowners to share their knowledge of past flood events and educate new property owners and tenants about flood risk.
3. Support the Flood Workgroup in its effort to hold at least one public hearing in 2016.
4. Consider holding a Water Day in Historic Ellicott City. Invitations could be extended for representatives and presentations from the National Incident Management System, as practiced by the Emergency Management Division in South Carolina; the Maryland Emergency Management Agency; the Federal Emergency Management Agency; the Red Cross; and Southwest Airlines. The event would include a host of water-related items to attract public attention and would be held in conjunction with other relevant

groups in Howard County (e.g. the Watershed Stewards Academy and the University of Maryland Extension).

5. Initiate community-level planning for emergency preparedness. This would include information about sand bags, monitoring and disseminating information from stream gages, dedicated communications and recovery efforts.
6. Promote awareness of stormwater quantity and quality. Stencil storm drains in Historic Ellicott City with “Drains to Patapsco River” and “Nothing down the drain but rain.” Encourage the use of rain gardens, rain barrels and bio-retention areas. Investigate involving the Boy Scouts and local High Schools.
7. Partner with relevant volunteer groups such as the Patapsco Heritage Greenway, Ellicott City Partnership, etc.

D. Programmatic/Capacity

In order to mitigate flooding in Ellicott City, the Flood Workgroup feels that consistent and dedicated resources need to be applied to the flooding issue until measurable improvements are seen. Until the recent appointment of the Flood Workgroup, a venue for discussion did not exist. The Flood Workgroup has since vetted many potential solutions and paths forward in its meetings and determined that comprehensive solutions will require resources beyond those that currently exist with regards to funding, staff and programs. The Flood Workgroup therefore recommends that flood mitigation capacity be increased through the following mechanisms:

1. **Dedicated Staff.** The County should have dedicated staff to oversee and coordinate flood mitigation efforts. This staff person would have the ability to effectively work across departments to achieve specified objectives. The staff person would be responsible for submitting grants, coordinating with other departments on grant submittals, communicating progress to the community, providing or coordinating provision of technical resources to the community, and generally ensuring and spearheading forward momentum on flood mitigation efforts.
2. **Provision of Flood Mitigation Programs.** The Flood Workgroup recommends that existing programs be supported or enhanced and new programs be developed and implemented. The Flood Workgroup recommends that 1) Restoring the Environment and Developing Youth (READY), Patapsco Heritage Greenway, and other groups

continue to be supported; 2) Tax incentives are offered to homeowner associations, businesses, and other groups to implement infrastructure remediation; 3) public / private partnerships are sought for funding infrastructure improvements and increasing awareness of flood issues; and 4) a new program be created to identify and implement floodproofing projects with incentives provided as needed.

E. Other

The Historic Ellicott City Flood Workgroup suggests that Howard County consider the following items, which do not conveniently fit under any of the previous headings in this report. The following recommendations should be considered for future mitigation efforts:

1. In the Lower Patapsco watershed, the Tiber-Hudson subwatershed had 27.7% impervious cover in 2006, which made it the second most impervious of the eleven subwatersheds.² While on-site flood plain controls are currently in effect for development in the watershed, in-lieu fees for offsite improvements should also be considered. The fees could be used for the design, construction, or modification of flood management projects throughout the watershed. Efforts should be made to return developed space to the natural environment where possible. Efforts should be made to protect and preserve the existing green and forested areas in the watershed. Where development must take place, it should be under the requirement of making no adverse impact on the environment. The Flood Workgroup is available to review and comment on any new development site plans.
2. The County should work for equitable solutions with homeowners whose properties have been adversely affected by increased flood exposure over a period of new development and possible climate change. When considering purchasing properties in high risk flood zones the County Government should negotiate fairly and equitably with all homeowners in that area.
3. The County should make clear how its funds are divided between managing the *quantity* of stormwater and the *quality* of stormwater that enters the Patapsco River.

² 2005 Lower Patapsco Watershed Restoration Action Strategy; <http://www.howardcountymd.gov/DisplayPrimary.aspx?id=375>

IV. Conclusion

Damaging floods have been recorded in Historic Ellicott City ever since the town was founded in 1772. Recent events such as Tropical Storm Lee in 2011 have reminded us that more needs to be done to mitigate the danger to life and property. Following the Ellicott City Flood Study and Concept Mitigation Report of 3 April 2014 Phase I steps were outlined for fiscal year 2016 and following years.

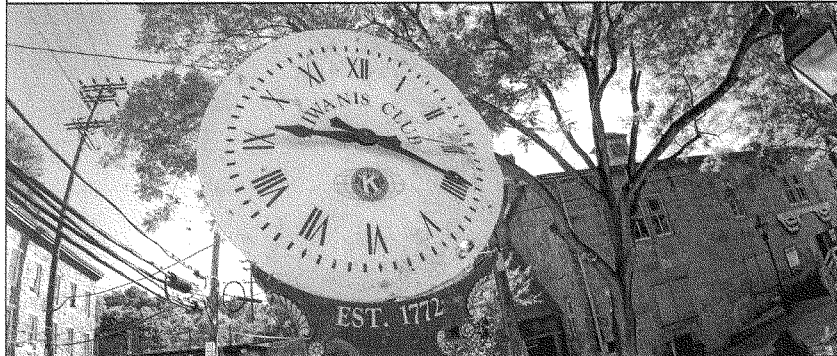
Climate change could make future flooding more frequent and larger in scope. Development in the watershed has contributed to the flooding danger and this needs to be considered if proposals for new development occur. We hope this report will help prevent loss of life and damage to property in the place where we live, work and recreate, Historic Ellicott City.

2016 Ellicott City Hydrology/Hydraulic Study and Concept Mitigation Analysis



McCormick Taylor Project No. 5519-93
June 16, 2017

Prepared for:
Howard County Government
Storm Water Management Division
Bureau of Environmental Services
6751 Columbia Gateway Drive, Suite 514
Columbia, Maryland 21046-3143



Prepared by



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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Project Location	2
1.3 Project Goals	2
2.0 HYDROLOGIC ANALYSIS	4
2.1 Initial TR-20 Analysis	4
2.2 USGS Estimates Calibration	7
2.3 Analysis With Existing Stormwater Management	8
2.3.1 Methodology	9
2.3.2 Results with Existing SWM	9
2.3.3 Woods In Good Condition (Undeveloped)	10
2.3.4 July 30, 2016 Hydrology	11
3.0 HYDRAULIC MODELING	12
3.1 TUFLOW 2-D Modeling	12
3.1.1 Inflow Hydrographs	12
3.1.2 Topographic data	13
3.1.3 Manning's ("n") Roughness Values	14
3.1.4 Existing Structures	14
3.1.5 Boundary Conditions and Time Step	15
3.2 Model Calibration	15
3.2.1 Available Data from July 30, 2016 Event	15
3.2.2 Correlation With Models	16
3.3 Existing Conditions Results	20
3.3.1 Area 1 – US 29 to Rogers Ave	20
3.3.2 Area 2 – Rogers Ave. Through West End to Ellicott Mills Dr.	21
3.3.3 Area 3 – Ellicott Mills Dr. to Old Columbia Pk.	22
3.3.4 Area 4 – Old Columbia Pk. to Patapsco River Confluence	23
4.0 CONCEPTUAL IMPROVEMENTS	24
4.1 Tiber Branch	26
4.2 New Cut Branch	26
4.3 Hudson Branch	27
4.3.1 Stormwater Ponds	27
4.3.2 Underground SWM	27

4.4	Conveyance Improvements	29
4.5	Examination of Retrofit of Existing SWM Facilities	31
4.6	Flow Reduction From SWM Improvements	32
4.7	Modeling Results of Proposed Improvements	34
4.7.1	Area 1 – US 29 to Rogers Ave.....	34
4.7.2	Area 2 – Rogers Ave. Through West End to Ellicott Mills Dr.....	36
4.7.3	Area 3 – Ellicott Mills Dr. to Old Columbia Pk.	37
4.7.4	Area 4 – Old Columbia Pk. to Patapsco River Confluence	38
4.7.5	Tunnel Bore Improvements.....	39
4.8	Reduction in Property Impacts.....	41
5.0	CONCLUSIONS AND RECOMMENDATIONS	42
6.0	REFERENCES	43

LIST OF TABLES

Table 2.1 – Hudson Branch Hydrologic Soils Distribution	5
Table 2.2 – Tiber Branch/New Cut Hydrologic Soils Distribution.....	5
Table 2.3 – Hudson Branch Land Use Information	6
Table 2.4 – Tiber-New Cut Branches Land Use Information.....	6
Table 2.5 – NOAA Standard Rainfall Data	7
Table 2.6 – TR-20 Calculated Discharges for Standard Storm Events	7
Table 2.7 – TR-20 Generated Hydrology for July 30, 2016 Event compared to USGS Estimates	8
Table 2.8–Hudson Branch Subdivided Hydrology and Existing Management Results	9
Table 2.9 – Undeveloped “Woods in Good Condition” Discharges compared to the Existing Conditions Discharges	10
Table 4.1: Peak Flow Reduction Per Facility and Combined, Tiber Branch and New Cut Branch Watersheds	28
Table 4.2: Peak Flow Reduction Per Facility and Combined, Hudson Branch Watershed.....	29
Table 4.3 – TR-20 Simulated Peak Flowrate to Hudson Branch Watershed Outlet for Existing Conditions and the Proposed Stormwater Management Concept.....	32
Table 4.4 – TR-20 Simulated Peak Flowrate to Tiber Branch Watershed Outlet for Existing Conditions and the Proposed Stormwater Management Concept	33
Table 4.5 – TR-20 Simulated Peak Flowrate to New Cut Watershed Outlet for Existing Conditions and the Proposed Stormwater Management Concept	33
Table 4.6 – TR-20 Simulated Peak Flowrate to Hudson-Tiber-New Cut (Tiber- Hudson Branch) Outlet for Existing Conditions and the Proposed Stormwater Management Concept.....	33
Table 4.7 – Number of Buildings within the Floodplain under Existing Conditions and the Proposed Stormwater Management Concept.....	41

LIST OF FIGURES

Figure 1.1: Vicinity Map of the Ellicott City Flood Study Area.....	3
Figure 2.1: Location of Ellicott City Gauges used in the study	11
Figure 3.1: Schematic of Key Elements Used to Define the Hydrologic and Hydraulic Characteristics of the TUFLOW Simulations.	13

Figure 3.2: Digital elevation model (DEM) used to define topography of the TUFLOW simulations	14
Figure 3.3: Hydraulic Model depth output compared to recorded gauge depths from the July 30, 2016 storm event	18
Figure 3.4: Location and Flood Depth Map of Area 1	20
Figure 3.5: Location and Flood Area Map of Area 2	21
Figure 3.6: Location and Flood Area Map of Area 3	22
Figure 3.7: Location and Flood Area Map of Area 4	23
Figure 4.1: Peak Flow and Volume, 10- and 100-Year Storm	25
Figure 4.2: Peak Flow and Volume, 10- and 100-Year Storm	25
Figure 4.3: Reduction in Peak By Storage, Above and Below Ground SWM ..	26
Figure 4.4: Supplemental Cross Culvert Locations	30
Figure 4.5: Supplemental Bypass Culvert Locations	31
Figure 4.6: Existing Retrofit Comparison to Conceptual Improvements	32
Figure 4.7: Location and Flood Depth Maps of Area 1: Existing, w/ SWM Improvements and w/ SWM+Conveyance (<i>top to bottom</i>)	35
Figure 4.8: Location and Flood Area Maps of Area 2: Existing; w/ SWM Improvements; w/ SWM + Conveyance (<i>top, bottom, next page</i>)	36
Figure 4.9: Location and Flood Area Maps of Area 3: Existing; w/ SWM Improvements (<i>below, next page</i>)	37
Figure 4.10: Location and Flood Area Maps of Area 4: Existing; w/ SWM Improvements (<i>below, next page</i>)	38
Figure 4.11: Location of Conceptual Tunnel Bores to Divert Flow around Main St.	40
Figure 4.12: Flood Area Maps of Area 3 (below) and 4 (next page) w/ Tunnel Bores	40

TABLE OF APPENDICES

Appendix A Existing Hydrology and Hydraulics

Appendix B Concept Designs

Appendix C Proposed Hydrology and Hydraulics

Appendix D 2-D Hydraulic Modeling (TUFLOW)

Appendix E Select Concept Alternatives Modeling

EXECUTIVE SUMMARY

This study was expanded from the original 2014 Ellicott City Flood Study and Concept Mitigation Report at the request of Howard County Bureau of Environmental Services for the purposes of extending a detailed hydraulic model of the flood flows encountered along Frederick Rd./ Main St. in Ellicott City, Howard County, Maryland, and using that model to examine the effect of additional proposed conceptual improvements on flooding conditions. Several hydrologic models of the Hudson Branch, Tiber Branch and New Cut Branch subwatersheds of the Tiber-Hudson Branch were created to calibrate a baseline hydrologic model which included the effects of existing stormwater quantity management within the watershed. The hydrology of the flooding event of July 30, 2016 was also synthesized to calibrate the hydraulic model against observed flooding conditions during the event. National Weather Service (NWS) estimates were used as part of the hydrologic calibration of this storm synthesis.

Updates to the original hydraulic floodplain model along Main St. included expanding of the limits of 2-D (TUFLOW) models from the channel confluence with the Patapsco River upstream to the US 29 crossing, and to include small segments of the Tiber Branch and New Cut Branch in the vicinity of the Main St. corridor. Once developed and calibrated, this revised model served as a baseline for the comparison of a new set of flood mitigation concepts, including additional stormwater quantity management in the three tributary watersheds and additional storm drain and culvert conveyance systems through portions of Frederick Rd.

Flood mitigation approaches in the report focused on a goal of reducing the 100-year event flows as close as possible to the 10-year event flows, effectively reducing peak flow below the undeveloped "woods, in good condition" runoff scenario, which represents runoff potential assuming a woods land cover over the entire watershed, but does not change the existing channel or infrastructure along Main St. In the interest of achieving this reduction with as few discrete project sites as possible (i.e. cost-benefit efficiency) stormwater quantity management opportunities focused on larger facilities in-line with existing stream channels, particularly in the Tiber Branch and New Cut Branch subwatersheds. In the Hudson Branch subwatershed, where space was not available for sufficient in-line storage management with traditional ponds, alternatives also included underground management, and conveyance improvements to minimize roadway flooding.

The combined effects of the conceptual improvements noted above were run through the expanded 2-D hydraulic model to demonstrate the resulting reduction in flooding elevations relative to existing conditions. Proposed conditions analyses were run for the 10-, 25-, and 100-year events, as well as the synthesized July 30, 2016 event. These results are represented by color flood flow depth mapping, and described in detail within the report. The 100-year event also considered a subset of mitigation options to examine an incremental improvement condition below the full suite of recommended management

options. The report notes that the improvements are independent of an event that creates backwater flooding of lower Main St. from the Patapsco River at its 100-year flood stage; backwater flooding from such an event (Tropical Storm Agnes, 1972) is not significantly impacted by improvements in the Tiber-Hudson watershed because the Patapsco River has a substantially (80X the Tiber-Hudson) larger watershed, which is responsive to a less-localized, general heavy rainfall across the majority of the watershed.

1.0 INTRODUCTION

1.1 BACKGROUND

Hudson Branch, a tributary of the Tiber-Hudson Branch, itself a tributary to the Patapsco River, winds along Main St. in Ellicott City, Howard County, Maryland. Runoff from the 1.55 square mile watershed of the Hudson Branch, the upland boundaries of which extend north and west of the US 40 / US 29 interchange, flows through a confined channel and occasional storm culverts along both the north and south sides of Main St. before meeting its confluence with the 0.54 square mile watershed of the Tiber Branch in a parking lot south of Main St. (Parking Lot 'D'). The Tiber-Hudson Branch continues eastward from Parking Lot 'D' in a confined channel where it meets its confluence with the 1.55 square mile watershed of the New Cut Branch. The combined flow of this total 3.7 square mile watershed (the remaining 0.06 sq. mi runs to the combined channel at the downstream end) continues through a confined channel under several historic buildings before meeting its ultimate confluence with the Patapsco River.

The confined nature of the channel, due in part to the steep topography surrounding Main St., as well as the historic buildings which line or straddle its immediate banks, contributes to the dramatic flooding experienced in the Main St. corridor during certain intense rainfall events. The development within the watershed, built over time beginning with Ellicott City's founding in 1772, some of which is managed for quantity control to varying degrees, also plays a role. The severe flooding experienced on Main St. and surrounding areas during the intense July 30, 2016 event, where over 6" of rain fell in about 2 hours, was an extreme example with a recurrence probability of 0.1% based on 3-hour National Oceanic and Atmospheric Administration (NOAA) Precipitation Data for the region. The storm caused widespread flooding of the Main St. community and its surrounding homes and businesses with flooding in excess of 6' feet deep in places. Several buildings along the channel experienced significant damage, and dozens of cars were washed downstream into the Patapsco River, resulting in two fatalities. This damage extended up Main St. from the historic district to the West End area just east of US 29.

Following up on the 2014 study performed for the Main St. commercial/residential district to analyze the effects of Tropical Storm Lee in 2011, the 2-D hydraulic model was extended from the Patapsco River downstream, to the US 29 crossing upstream for the Hudson Branch, with the confluence areas of the Tiber Branch and New Cut Branch also represented in the model. This analysis, performed using TUFLOW 2-D hydraulic modeling software along with detailed topographic survey, attempts to create a more accurate representation of typical Main St. flooding by considering the 2-D flow vectors resulting from floodwaters over this highly varied landscape. The further establishment of this baseline flooding condition allows for a more accurate representation of the effect on flood elevations resulting from the various conceptual improvements examined within this study, which have been expanded well beyond the limitations of the previous study.

1.2 PROJECT LOCATION

This study focused on the historic section of Ellicott City, Maryland and areas to the west along Frederick Rd./Main St. (a.k.a Maryland 144) from the Patapsco River upstream to US 29. Short sections of the Tiber Branch upstream of Parking Lot 'D' and the New Cut Branch along New Cut Rd. were also included in the hydraulic model. The model was analyzed using TUFLOW to establish a 2-D floodplain surface. Proposed mitigation concepts, including stormwater quantity management and conveyance improvements, were identified for locations throughout the Tiber-Hudson Branch watershed. The location of the project and the subject watershed can be seen in *Figure 1.1*.

1.3 PROJECT GOALS

The goals of this study include the following:

- Develop hydrology* for the Tiber Branch, New Cut Branch and Hudson Branch watersheds, combined with the previously developed and updated hydrologic model for the Hudson Branch that considers the effect of existing stormwater quantity management as a baseline for analysis. This hydrology includes a synthesis of the July 30, 2016 event.
- Develop a 2-D hydraulic** floodplain model through the area affected by the Main St. flooding during the July 30, 2016 event and calibrate the model based on observed conditions that day.
- Develop potential improvements to the hydrology of the Hudson Branch, Tiber Branch and New Cut Branch (additional management of stormwater quantity) and the hydraulics of the conveyance network through the town (improvements to channels, culverts and storm drain systems to increase conveyance through this area), and define limitations of the existing network.
- Quantify the potential positive impacts to flood elevation and frequency as a result of the conceptual improvements noted in the report, using the baseline hydrologic and hydraulic models developed for existing conditions as a means of comparison.

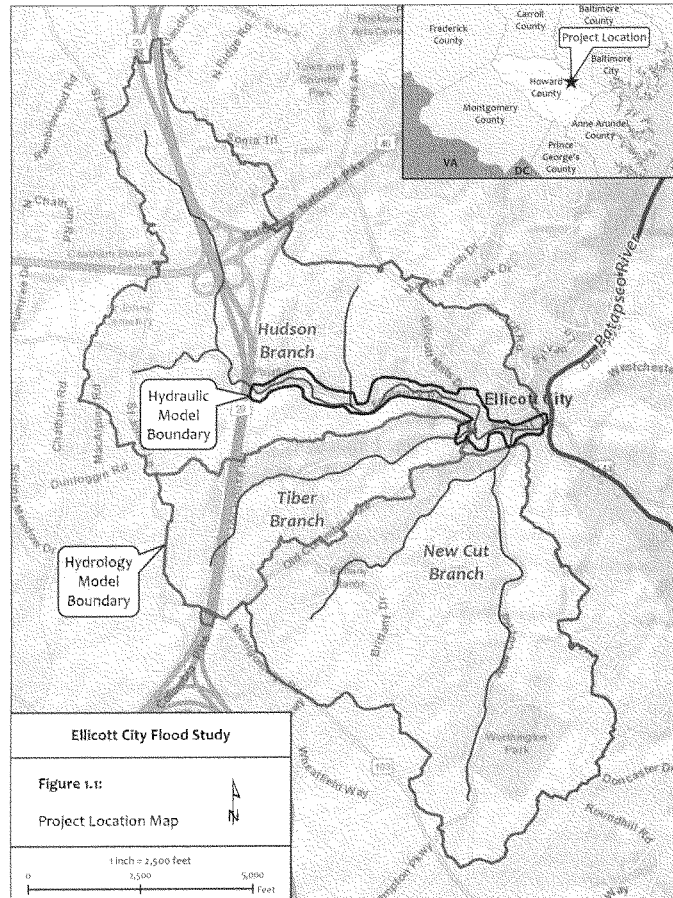
In addition to the goals defined above, this effort will generate a baseline model that can be used to examine various combinations of mitigation measures outside of the alternatives summarized in this report, such that the model can be a tool in the long term master planning effort for Ellicott City[†].

*Hydrology is the study of how much runoff will be generated within a watershed.

**Hydraulics is the study of how water will behave when flowing through and around topography or structures.

[†] May 31, 2017 Public Presentation can be found online at: <https://www.howardcountymd.gov/Departments/Planning-and-Zoning/Community-Planning/Community-Plans/EC-Master-Plan>

Figure 1.1: Vicinity Map of the Ellicott City Flood Study Area



2.0 HYDROLOGIC ANALYSIS

In order to determine the proper hydrologic flow quantities for use in the study, several steps were employed. Two distinct TR-20 hydrologic models were developed; one representing the Hudson Branch watershed and one representing flows from the Tiber and New Cut Branches.

Subsequent TR-20 models were developed for the two large watersheds to represent different levels of subarea detail and the effects of stormwater management. The drainage area (DA) for the Hudson Branch was analyzed using TR-20 for a single drainage area (detail level 1), with seven (7) sub drainage areas (detail level 2), and with thirty-five (35) sub drainage areas (detail level 3). A combined drainage area for the Tiber- New Cut Branches was analyzed using TR-20 for a single drainage area (detail level 1), with eight (8) sub drainage areas (detail level 2) and with twenty-seven (27) sub drainage areas (detail level 3).

The level 2 TR-20 models were subdivided into the level 3 models in order to consider the effect of existing and proposed stormwater management within the hydrologic model, which required distinct subareas for each existing stormwater facility.

Once the architecture of the TR-20 model was set, rain gage data from the July 30, 2016 event was used to create a rain table for use in the TR-20 model that would mimic the precipitation from that event. The flow data generated through the TR-20 hydrologic model were compared to USGS discharge estimates from the event. The flow data (in the form of hydrographs) was then used as input for hydraulic models, which were calibrated using anecdotal information (witness account reports, video) about local water surface elevations during the July 2016 flood event. The hydrologic details of this sequential analysis are described below.

2.1 INITIAL TR-20 ANALYSIS

Hydrologic modeling was used to generate recurrence interval discharges for the study site based on existing land use and soil conditions. Though data from the initial 2014 study was used for a portion of the Hudson Branch watershed, the runoff curve number (CN) data was updated based on revised regulatory guidance regarding the soil classification (and resulting CN) associated with certain soil types present in the watershed. As a result, the runoff values are close but do not perfectly match those generated in the 2014 report. In addition to the existing conditions, current Howard County zoning data was utilized to examine ultimate conditions that reflect a full developed build out of the watershed, as a point of comparison to existing conditions. The existing conditions were quite close to the ultimate zoning results since few undeveloped sites remain in the watershed. In the interest of preserving the model for comparison with any future development conditions, and to be consistent with

conditions on July 30, 2016, existing land use conditions were used for the analyses detailed below.

USDA Soil Conservation Service (SCS) TR-55 and TR-20 computer programs were used to determine runoff from the watershed area. The downstream study point used to determine the drainage area for the overall study was where the Tiber-Hudson Branch meets its confluence with the Patapsco River. This includes the subareas for the Hudson Branch, Tiber Branch (a.k.a. Cat Rock Run) and New Cut Branch. The New Cut Branch also includes the Autumn Hill tributary; for the purposes of this study, the Autumn Hill tributary is considered to be included in the discussions of the New Cut Branch.

The initial analysis (detail level 1) did not subdivide the Tiber-New Cut and Hudson Branch watersheds. The second analysis (detail level 2) subdivided the Hudson Branch drainage area into 7 subwatersheds; the Tiber-New Cut watershed was subdivided into 8 subwatersheds. The subwatershed boundaries were based on their configuration within the watershed and/or significant changes in the predominant land use type. For the subdivided analysis, reach routing section tables used in the TR-20 model were developed in the GIS Hydro Program environment or from GIS contour data and Flowmaster analysis.

The overall drainage area for the Hudson Branch consists of a mix of residential (low, medium and higher density) and commercial/urban areas, the interchange of US 29 and US 40, and some undeveloped open/wooded space in the northern portion of the watershed and the hillier terrain along the southern and eastern perimeter. For the Tiber, there are significant steep, wooded areas as well as residential land use. For the New Cut, the watershed is primarily developed residential areas with some steep and moderate woodland areas. Soil types include B, C and D Hydrologic Soil Groups, with the percentages are as noted below.

Table 2.1 – Hudson Branch Hydrologic Soils Distribution

<i>Hydrologic Soil Group</i>	<i>% of Drainage Area</i>
A	12%
B	27%
C	39%
D	22%

Table 2.2 – Tiber Branch/New Cut Hydrologic Soils Distribution

<i>Hydrologic Soil Group</i>	<i>% of Drainage Area</i>
A	9%
B	20%
C	60%
D	11%

Table 2.3 – Hudson Branch Land Use Information

<i>Land Use</i>	<i>Percent of Watershed</i>
Brush / woods	18.1 %
Pasture / open space / Agricultural	8.9 %
Impervious (roads, parking not incl. below)	5.8 %
Residential - 1 ac.	15.5 %
Residential – 1/4 to 1/8 ac.	27.8 %
Urban Commercial	15.7 %
Urban Industrial	8.2 %

Table 2.4 – Tiber-New Cut Branches Land Use Information

<i>Land Use</i>	<i>Percent of Watershed</i>
Brush / woods	27.6 %
Pasture / open space/ Agricultural	8.0 %
Impervious (roads, parking not incl. below)	0.6 %
Residential - 1 ac.	12.6 %
Residential – 1/2 ac.	2.7 %
Residential – 1/4 to 1/8 ac.	40.2 %
Urban Commercial	8.2 %
Urban Industrial	<0.1 %

Land use was derived from County GIS data and aerial photography, and the breakdown is noted above in *Tables 2.3 and 2.4*. Soils information for the project was obtained from the Web Soil Survey developed by NRCS (<http://websoilsurvey.nrcs.usda.gov/>). This data was used to determine curve number values for each study point using TR-55 methodology. See *Appendix A* for CN computations, Hydrologic Soils Maps as well as Land Use and Drainage Area Maps.

TR-55 methodology was also used for time of concentration calculations. The Hudson Branch model has a total time of concentration of 1.136 hours, or 68.2 minutes, and the Tiber/New Cut Branch watershed has a total time of concentration of 0.619 hours, or 37.2 minutes. An analysis of the overall drainage area indicated a total time of concentration of 1.18 hours, or 71 minutes, to the downstream study point at the confluence with the Patapsco River. See *Appendix A* for time of concentration computations.

The rainfall depths for the 24 hour duration storms were obtained from WinTR55 and represent NOAA Atlas 14 rainfall depths for Howard County.

Table 2.5 – NOAA Standard Rainfall Data

<i>Return Period (years)</i>	<i>Rainfall Depth w/ areal reduction (inches)</i>
2	3.19
10	4.91
25	6.14
50	7.23
100	8.47

Discharges were calculated for the 2-, 10-, 25-, 50- and 100-year recurrence intervals. The 24-hour NOAA_C rainfall distribution was used for all analyses except where shown in *Section 2.3.4* below, as this is the standard for stormwater management analysis in Maryland. The results of the TR-20 analysis for the two watershed models analyzed as single DAs (Level 1) and with large sub drainage areas (Level 2) shown in the section below in *Table 2.6*.

Table 2.6 – TR-20 Calculated Discharges for Standard Storm Events

	<i>Return Period (yr)</i>	<i>TR-20 Simulation (Level 1) (cfs)</i>	<i>TR-20 Simulation (Level 2) (cfs)</i>
<i>Hudson Branch</i>	<i>10-yr</i>	1208	1296
	<i>25-yr</i>	1682	1815
	<i>50-yr</i>	2121	2259
	<i>100-yr</i>	2618	2764
<i>Tiber Branch</i>	<i>10-yr</i>	--	453
	<i>25-yr</i>	--	664
	<i>50-yr</i>	--	855
	<i>100-yr</i>	--	1075
<i>New Cut Branch</i>	<i>10-yr</i>	--	1750
	<i>25-yr</i>	--	2450
	<i>50-yr</i>	--	3091
	<i>100-yr</i>	--	3771

2.2 USGS ESTIMATES CALIBRATION

As part of the July 30, 2016 post-storm analysis, representatives from USGS performed an estimate of flow in three separate channels, one in each of the

three major subwatersheds (Hudson, Tiber and New Cut Branches), based on cross-section, estimated channel roughness and high water marks. This data was compared to the values estimated in the synthesized July 30, 2016 storm event TR-20 (Section 2.3.4 below) as a calibration. The Hudson Branch and New Cut Branch watershed discharge estimates were within the relative error window when compared to the USGS data (which was provided with a stated relative error of +/- 25%) and the Tiber Branch subwatershed was below the calibration window when compared to the USGS data. The hydrology parameters were examined for calibration based on the MD Hydrology Panel (2016) guidance and minor adjustments to time of concentration were made to calibrate flows for the Tiber Branch watershed. Given the small size (0.55 square mile) of the Tiber Branch watershed, potential error in the USGS post-storm measurement and the distributed variation of flow estimates in the overall Tiber-Hudson-New Cut Branches watershed, it was determined that further adjustment of hydrologic parameters of the Tiber Branch was not justified.

Table 2.7 – TR-20 Generated Hydrology for July 30, 2016 Event compared to USGS Estimates

	<i>TR-20 Simulation (Level 3) (cfs)</i>	<i>USGS Estimate (cfs)</i>	<i>USGS Estimate Range (+25%) (cfs)</i>
<i>Hudson Branch*</i>	3115	2750	2062 - 3438
<i>Tiber Branch</i>	1169	2100	1575 - 2625
<i>New Cut Branch</i>	3967	3320	2490 - 4150

*Estimate of flow at gauge location near Rogers Ave./Frederick Rd. intersection.

2.3 ANALYSIS WITH EXISTING STORMWATER MANAGEMENT

The drainage area features many communities and commercial sites with existing stormwater management, which varies from just water quality and/or 2- and 10-year management to full 100-year management. There are County records of 64 SWM quantity management facilities within the watershed, some of which have detailed design computations and records and others where the as built data is sporadic. Also, some of the ponds are small enough relative to the watershed size that their impact on overall watershed hydrology is questionable. In order to consider both of these factors, and come up with a reasonable approach to approximating the management effects of small facilities (<6 ac. Drainage Areas in Hudson Branch; <9 ac. in the other two subwatersheds), smaller SWM ponds were considered using a curve number reduction methodology in lieu of pond routing calculations, which were often not available for these smaller ponds. A detailed analysis of the validity of this approach can be found in the previous 2014 study (McCormick Taylor, 2014).

2.3.1 METHODOLOGY

The 18 largest, existing facilities in the watershed were represented as structures in the TR20 model and routed accordingly to model their effects on management. This included 8 facilities in the Hudson Branch watershed model and 10 facilities in the Tiber/New Cut Branches watershed model. From as-built drawings and computations, storage-discharge tables were developed to model the effects of each of these storage structures. Runoff from upstream was routed through the structures, then added (ADDHYD) to other runoff areas within the model. Refer to the drainage area map located in *Appendix A* that details the subareas and SWM described below.

The 46 smaller SWM facilities each have drainage areas less than 9 acres. To approximate the effect of their management, these facilities were incorporated into the TR-20 model by reducing the CN of the drainage area to reflect runoff conditions under a "woods in good condition" land use. The CN of each SWM facility drainage area was added to the CN of the surrounding subarea to create a weighted average CN that reflects reduction in runoff resulting from small SWM facilities.

2.3.2 RESULTS WITH EXISTING SWM

Using the methods described above, the hydrologic results for the various recurrence intervals using the 24-hour NOAA_C storm event are noted in *Table 2.8* below. For the additional subdivision of drainage areas, in order to reflect timing differences in the hydrologic routing, reach routing was performed for drainage area routing lengths greater than 1000', however in most instances the routing was not significant enough to alter the results.

Table 2.8—Hudson Branch Subdivided Hydrology and Existing Management Results

	Return Period (yr)	TR-20 Simulation (Level 3), No Large SWM (cfs)	TR-20 Simulation (Level 3), With Large Existing SWM (cfs)
Hudson Branch	10-yr	1388	1203
	25-yr	2007	1768
	50-yr	2509	2313
	100-yr	3133	2907
Tiber Branch	10-yr	525	497
	25-yr	761	734
	50-yr	931	905
	100-yr	1057	1078
New Cut Branch	10-yr	1881	1640
	25-yr	2644	2330
	50-yr	3341	2988
	100-yr	3911	3581

Ultimately, the models incorporating all quantity SWM facilities (highlighted in Table 2.8, above) were used as the most representative scenario for the watershed; these models served as the comparison baseline for evaluation of future concept improvements.

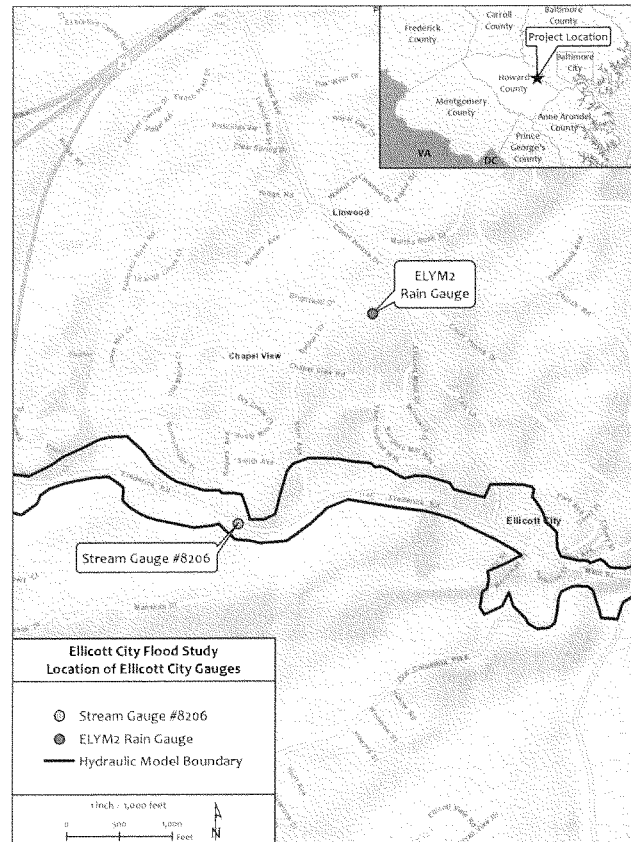
2.3.3 WOODS IN GOOD CONDITION (UNDEVELOPED)

As a basic comparison of discharges if the entire watershed was managed to an "undeveloped" condition, a "Woods in Good Condition" TR-20 simulation was created. Under this scenario, the "woods in good condition" land use was assumed for the entire watershed, meaning the potential of the existing watershed to generate runoff was the same as if the area was entirely covered with woods. This scenario did not change the time of concentration for the watershed for several reasons: significant assumptions about the original channel geometry would be needed to replace the existing conveyance infrastructure; the existing infrastructure is unlikely to be completely removed and replaced with natural channel; and also, changing existing SWM infrastructure to natural channels would likely have negligible effect on the time of concentration, as the overall channel slope from top of the watershed to the outlet would be identical to the current conditions.

The results of the "woods in good condition" simulations are provided below and compared to the Level 3 discharges that include existing stormwater management. The undeveloped scenario represents significant reductions in the peak flows, however, as storm events become larger, the existing and undeveloped discharges become closer.

Table 2.9 – Undeveloped "Woods in Good Condition" Discharges compared to the Existing Conditions Discharges

	Return Period (yr)	Existing Conditions Discharge (cfs)	Woods In Good Condition Discharge (cfs)	% Difference (cfs)
Hudson Branch	10-yr	1203	629	-48%
	25-yr	1768	1064	-40%
	50-yr	2313	1507	-35%
	100-yr	2907	2075	-29%
Tiber Branch	10-yr	497	290	-42%
	25-yr	734	467	-36%
	50-yr	905	638	-30%
	100-yr	1078	842	-22%
New Cut Branch	10-yr	1640	1048	-36%
	25-yr	2330	1657	-29%
	50-yr	2988	2255	-25%
	100-yr	3581	2964	-17%

Figure 2.1: Location of Ellicott City Gauges used in the study**2.3.4 JULY 30, 2016 HYDROLOGY**

In order to calibrate the hydraulic model to the conditions that were observed and recorded during the July 30, 2016 event, it was necessary to use rainfall data from that actual event, rather than a standard 24-hour Type II storm and rainfall

table, as the precipitation that day fell predominantly in a much shorter timeframe (the majority in just over two hours) and did not necessarily mimic the curve of the standard hyetograph. To accomplish this, a custom rainfall table was created and used within TR-20 to mimic the precipitation and runoff from that storm.

The National Weather Service (NWS) provided precipitation data collected from a tipping-bucket style rain gauge (ELYM2) located along Court Ave. near the George Howard Building (*Figure 2.1, above*). This rain gauge data was normalized to provide a dimensionless rainfall distribution estimating rainfall at three minute intervals for the duration of the storm event. Cumulative rainfall for the storm was 6.6 inches and total duration of the event was 3.4 hours. Additional information on the details of the precipitation from this event can be found in a published study from NWS (NWS, 2016). The discharges simulated for the July 30, 2016 event are provided in *Table 2.7*.

3.0 HYDRAULIC MODELING

The study utilized 2-D modeling tools to develop the floodplain analysis through the study area. Detailed survey was collected for the surface of the entire area shown outlined in *Figure 3.1*, from the downstream side of US 29 to the confluence of the Tiber-Hudson Branches with the Patapsco River.

3.1 TUFLOW 2-D MODELING

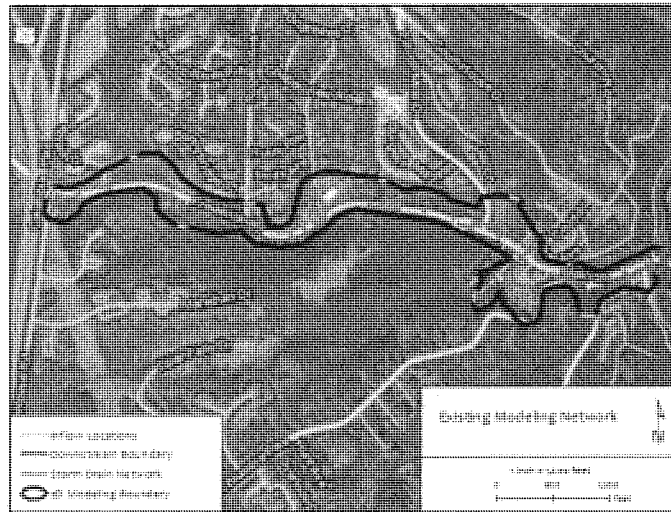
The TUFLOW simulation software provides computations for flood analysis using both 1-dimensional and 2-D solutions. The complexity of the drainage network and topography of the downtown area necessitated the use of a 1D/2D simulation program, such as TUFLOW, to best represent flood conditions.

The TUFLOW simulation program requires several key inputs to drive the simulation computations (See *Figure 3.1*). Inputs into the TUFLOW model were generated using the Surface-water Modeling System (SMS) (Aquaveo, 2016) software to create spatially oriented data layers and develop input files for the TUFLOW simulation program.

3.1.1 INFLOW HYDROGRAPHS

To represent the flow of water into the modeled region, it was necessary to define 10 different inflow hydrographs for each model scenario. Inflow hydrographs were generated using the TR-20 hydrologic models of the drainage area. The hydrographs at these inflow locations, including where the Tiber and New Cut branches entered the Tiber-Hudson main branch, were defined by specific cross sections within the TR-20 models. Runoff resulting from rainfall within the hydraulic model area was conservatively added to the closest upstream hydraulic model inflow. Hydrographs to seven inflow points were generated from the hydrologic model of the Hudson Branch and three inflow points were generated from the Tiber-New Cut Branches hydrologic model.

Figure 3.1: Schematic of Key Elements Used to Define the Hydrologic and Hydraulic Characteristics of the TUFLOW Simulations.



To reduce the simulation time for the TUFLOW models, the inflow hydrographs were abbreviated in duration to capture the peak discharges from each inflow location, while neglecting low flows at the beginning and end of the storm. The inflow hydrographs for the July 30, 2016 storm begin at time equal to 10 hour and have a duration of 5 hours, replicating the flows from approximately 6:10pm to 11:10pm on July 30, 2016. The standard storm events (10-, 25-, 50-, and 100-yr) were modeled with inflows beginning at time equal to 10.02 hours with a four hour inflow duration. The duration of each simulation was enough to calculate flood outputs for all significant flooding from each storm event. See *Appendix D* for inflow hydrographs.

3.1.2 TOPOGRAPHIC DATA

Another basic input requirement of TUFLOW models is topographic data to represent the ground surface within the model. Topographic data for the 2-D modeling area was acquired through aerial surveys supplemented with detailed field survey which produced digital terrain models (DTM) representing the surface of the ground. The DTM was interpolated to assign elevations to 5 foot square grid cells necessary for the TUFLOW simulation. A grid size of 5 feet was chosen based on the size of the modeling region, the size of the stream channel,

and the desired level modeling detail. The smaller the grid, the more detailed the topographic data; however, a smaller grid also presents issues such as long simulation times and greater flow instabilities. The 5 foot grid size yielded a reasonable simulation time of roughly two hours, while providing enough detail to sufficiently represent regional topography.

Figure 3.2: Digital elevation model (DEM) used to define topography of the TUFLOW simulations.



3.1.3 MANNING'S ("N") ROUGHNESS VALUES

The Manning's roughness coefficient, 'n', is an estimate of the resistance to flow for a given area. Factors which may affect the roughness include bed material, vegetation, channel irregularities, and obstructions to flow. The Manning's roughness values were assigned based on field investigations, aerial imagery, and topographic survey data. Given the diverse landscape of the modeled area, a wide range of roughness values were defined, representing 19 different material types, with roughness values ranging from 0.02 for smooth pavement to 3.0 for solid buildings with minimal flooding.

3.1.4 EXISTING STRUCTURES

The TUFLOW simulations also required information detailing the inlet, storm drain, culvert and bridge network inside the 2-D modeling region. A conveyance structure network describing the inlets, storm drains and culverts was embedded as a 1-D network inside the 2-D modeling region. Boundary conditions connecting the 1-D and 2-D areas completed the addition of these structures into the model. Bridge structures were represented as shapes within the 2-D modeling region. Most buildings in the model were represented with elevated topography and high roughness values.

3.1.5 BOUNDARY CONDITIONS AND TIME STEP

Boundary conditions define how flows enter and exit the modeled area. All inflow boundary conditions were defined as flow versus time boundaries, allowing inflows to be represented by time dependent hydrographs. The downstream boundary condition was represented as a model computed water surface elevation versus flow boundary, based on the water surface slope. A starting water surface elevation at the downstream boundary of 113 feet was input for every model, to improve the computational stability of the simulations. Each model utilized a computational time step of 0.25 seconds.

Other various elements were added to the model to further describe the 2-D simulation region. As discussed in Section 3.3, several of these parameters were adjusted throughout the modeling process to better represent the anecdotal evidence of the flooding conditions resulting from the July 30, 2016 event. Once these parameters were finalized for each storm event, parameters were not changed, ensuring consistent comparisons between existing and proposed modeling scenarios.

Simulation outputs were generated at 5 minute intervals for each simulation, although further discussion focuses on the maximum outputs generated at each grid cell. The outputs generated by the TUFLOW model were post-processed using the SMS software to analyze outputs and generate graphics. A variety of output results can be generated to view variables such as flow, velocity, shear stress and water level at various times and locations throughout the modeled region. *Appendix D* contains maps that show maximum flood depths calculated during each simulation.

3.2 MODEL CALIBRATION

In order to assure the model was accurately depicting depth and direction of flow through the terrain in the modeled area, anecdotal data was used as a point of comparison to the hydraulic model for the simulated July 30, 2016 storm event. The water surface elevations calculated with the July 30, 2016 event model were compared to measurements and visual indicators, and the model was adjusted as necessary in an attempt to recreate those conditions as closely as possible. Additionally, the simulation of large culverts in the TUFLOW model was compared to simulations of the culverts using alternative hydraulic modeling software published by the Federal Highway Administration, HY-8. These model calibration practices will assure, to the greatest extent possible given the available information and the resolution of the data, that the model will represent typical storm events in a manner that would represent the actual flooding conditions during such a storm.

3.2.1 AVAILABLE DATA FROM JULY 30, 2016 EVENT

A significant amount of anecdotal evidence from Ellicott City during the night of July 30, 2016 has been gathered through various sources on the web and through information or videos provided by the local citizens. Videos uploaded to YouTube and videos from security footage, in many cases provided time stamps

that can be used to visually correlate the depth of water relative to existing structures within the study area such as buildings, curbs, channel crossings and the like. Below are some of the videos used for this purpose:

- Approximate Address: 8344 Main St. to Parking Lot 'D'; Post-storm along lower Main St.
 - Evaluated flow directions and depth at 8344, extent of flooding in Parking Lot 'D'
 - Evaluated post storm damage along lower Main St.
 - <https://www.youtube.com/watch?v=ktHzzfPKlv8>
- Approximate Address: 8125 Main St. to 8059
 - Evaluated flow directions, depth and velocities
 - <https://www.youtube.com/watch?v=T4JMYuieFc>
- Approximate Address: 8059 Main St. to 8049
 - Evaluated flow directions, depth and velocities
 - <https://www.youtube.com/watch?v=9-KmdQLEBKY>
- Approximate Address: 8059 Main St. to 8049
 - Evaluated flow directions, depth and velocities
 - <https://www.youtube.com/watch?v=k-shmNbxAgS>
- Approximate Address: 8190 Main St.
 - Evaluated flow directions, depth, velocities and flow timing
 - Security camera footage;
 - <https://www.youtube.com/watch?v=nrGBtQhAvo8>

A Howard County stage gauge (Gauge #8206) is located along the Hudson Branch in the concrete channel near the intersection of Frederick Rd. and Rogers Ave. The depth and time relationship recorded from this gauge was used as a measure of simulated model depth and flow timing to observed conditions.

A draft report prepared for Howard County, "Case Study- 2016 Ellicott City Flood Event" (Smith, 2017) was provided for this use as well, as it contains records of over 70 interviews with residents recounting their recollection of the event, including the depth and direction of flood waters on their property. Some of the anecdotal data referenced was still being vetted at the time of publishing of this report, however, this data was considered in conjunction with all other anecdotal evidence available as an additional data point for model evaluation.

3.2.2 CORRELATION WITH MODELS

The TUFLOW simulation model was compared to anecdotal evidence from the July 30, 2016 event, using generated outputs showing the extent of the

floodplain, maximum depth of flooding, maximum shear stress, and velocity (direction, magnitude) of flow. The timing of the flooding was also examined. Generally speaking, the results of the calibration models correlated with the anecdotal data, within the expected tolerances for this type of analysis.

A perfect match between simulated outputs and anecdotal evidence provided in the case study or found in online videos was not anticipated due to the precision of both the model resolution and anecdotal evidence, but the simulations were expected to yield results that generally represented the behavior of the flooding. Because topography within the models was represented with an interpolated 5-foot grid, locations with steep banks or severe topographic changes were not expected to simulate flood depths that matched precisely with anecdotal evidence. Model tolerance related to depth of flooding was also high because of potential conflict/error associated with personal accounts and non-scientific evidence of flood depths. Instead, model performance based on flooding behavior was largely evaluated by comparing simulated and real-world evidence through the overall extent of flooding and direction of flow paths.

The overall maximum floodplain was evaluated first to determine if modeled flooding occurred in the same locations shown in anecdotal evidence. Next, flow depths, directions, and velocities were compared. For initial modeling iterations, model characteristics that were augmented to calibrate the model included material roughness, 1-D culvert form loss coefficients, model topography, 1D/2D boundary conditions, and inflow locations.

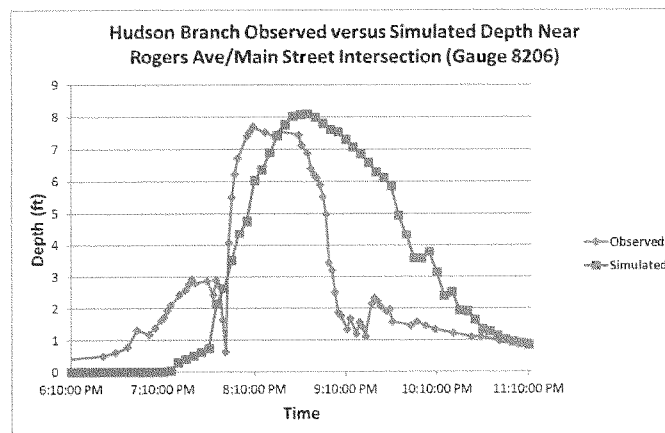
It is important to note, that the extent and depth of flooding in the model is intended to reflect flooding of the main branches of the Tiber-Hudson watershed and major inflows, and that localized, minor flooding resulting from smaller and less concentrated inflows is not shown. For example, anecdotal evidence indicates that properties along the north side of lower Main St. experienced flooding resulting from runoff coming down the steep, rocky hillside immediately to the north; this type of un-concentrated runoff was not the focus of this study. Additionally, the modeling assumes no change in model parameters during the simulation, which means it does not attempt to simulate variation in flows resulting from transient obstructions, like floating vehicles, and from events such as the embankment failure of a local sand filter.

The upstream portion of the TUFLOW modeling area (approximately 8879 Frederick Rd. to 8683 Frederick Rd.) contained a significant amount of flooding along the stream and some flow in the roadway. This area is less densely populated than the downtown area, and thus less anecdotal evidence was available. Reports from the Smith Planning Case Study report (Smith, 2017) indicated flow running down Frederick Rd. as a result of overtopping at each of the three main stream crossings in this area. Significant erosion was observed along the north side of Frederick Rd. just east of Papillon Dr.; the erosion in this area was simulated by the model as a location where flow from the roadway was reentering the channel and significant shear stresses were simulated along this stream bank.

The modeled area from Rogers Ave. east to Ellicott Mills Dr. was calibrated by adjusting the location of the inflows. Anecdotal evidence suggested the stormwater junction box on the northeast side of the Rogers Ave./Frederick Rd. intersection surcharged and that significant rates of flow were observed coming down Rogers Ave. onto Frederick Rd. The initial hydraulic model was adjusted to simulate flow surcharging the storm drain network and flowing down Rogers Ave. This split flow was simulated by having two inflow points; an inflow along the concrete channel was capped at a maximum discharge rate equal to the maximum capacity of the storm drain leading from the junction box, while flow rates greater than that capacity were injected onto Rogers Ave. Flow proportioning of this inflow provided an improved representation of the flows onto Frederick Rd. downstream of Rogers Ave.

The gauge data collected near the intersection of Rogers Ave. and Frederick Rd. was compared to model outputs to provide a measure of the model's ability to predict depth and storm timing.

Figure 3.3: Hydraulic Model depth output compared to recorded gauge depths from the July 30, 2016 storm event



Simulated depth and timing of the flows at the gauge correlated well with the gauge data and within the expected tolerances when considering the relative error associated with the hydrologic inputs and hydraulic variables at the site. Simulated flows were slightly delayed compared to observed data, but maximum flooding depth, and the relationship between depth and time indicated by the

shape of the curve, are similar, indicating simulated depths for the Hudson Branch are fairly well represented by the model.

The hydraulic model parameters along the majority of the area between Ellicott Mills Dr. and the Tiber Branch confluence in Parking Lot 'D' remained the same as the parameters developed under the original 2014 flood study (McCormick Taylor, 2014). Buildings and the roadway in much of this area experienced severe flooding. The culvert from 8611 to 8580 Main St. was adjusted to reflect existing conditions, which includes the upstream 1/4 of the culvert length being 88" diameter and the downstream 3/4 of the culvert being 108" diameter. Model correlation with anecdotal observations was satisfactory for much of this reach, with only minor edits to stream topography for model calibration. The simulated extent of flooding in Parking Lot 'D' appeared consistent with flooded areas shown in videos online.

In lower Main St., significant flows were reported coming down Church Rd. The storm drain network from Church Rd. was assumed to be overwhelmed by the flows from large storm events, thus all flows originating in the drainage area uphill of Church Rd. were introduced into the street just north of the Church Rd. intersection with Main St. This inflow simulated runoff on Main St. that was observed during the earlier part of the storm event, before overtopping of the main stream channel. As previously noted, runoff identified coming from the north hillside behind the 8100 and 8000 Main St. blocks was not simulated, but some of those flows were included in the inflow on Church Rd.

Building footprints throughout most of the model areas were represented with high elevations and high Manning's roughness values, as flood attenuation and conveyance through the buildings was generally negligible compared to other parts of the floodplain and anecdotal evidence specifying amount of flow through the buildings was variable; however, in the buildings from 8125 to 8077 Main St. along the south side of Main St., significant flow rates were observed through the buildings. These flows were supported by significant anecdotal and post-storm evidence; thus the initial model parameters were adjusted to allow simulation of flow through these specific buildings once it could no longer be contained within the stream. This adjustment results in significantly greater flows onto Main St. and more accurate flow behavior in the lower Main St. area.

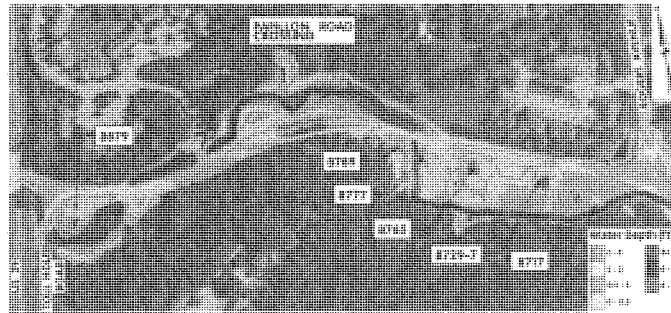
Other indicators of model performance in this downtown area were flow velocity and shear stress. Flow velocities between 10 and 15 ft/s were simulated in much of the area between 8250 and 8000 Main St.; these velocities are similar to velocities of floating debris observed in online videos of the event. Additionally, buildings and the roadway in this area experienced significant damage, which was predicted by the model simulation with shear stresses between 5 and 15 lb/sf along the roadway and within the buildings above the stream from 8125 to 8085 Main St.

3.3 EXISTING CONDITIONS RESULTS

The results of the existing model simulations were evaluated through extent of flooding, flow depth, and flow velocity (magnitude and direction for 2-D model). For discussion purposes, the behavior of flooding under the various modeling scenarios is broken out into four different areas. The discussion below focuses on the benchmark 100-year, 24-hour storm event flood depths, a standard for floodplain determination and regulatory flood control permitting, which will be the point of comparison for improvement concepts. Note that the July 30, 2016 event flood elevations were on the order of 4"-6" higher in the problematic flooding locations, relative to the 100-year event. All house numbers noted below refer to Frederick Rd. (Main St.) unless otherwise noted. Results mapping of the 2-D models for various storm events including the 10- and 100-year, as well as the July 30, 2016 storm may be found in *Appendix D*.

3.3.1 AREA 1 – US 29 TO ROGERS AVE.

Figure 3.4: Location and Flood Depth Map of Area 1.



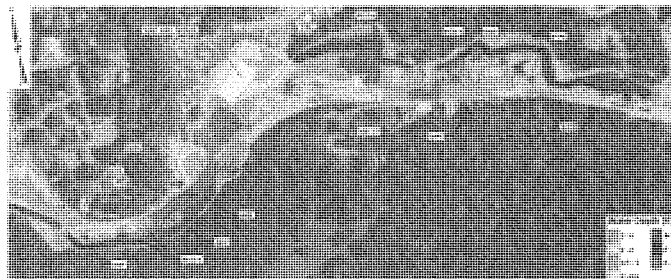
The model indicates the first instance of significant roadway flooding at the first point the stream crosses Frederick Rd. just east of Toll House Rd. in the 8800 Block where it shows as 1'+ deep, increasing to 2'+ deep at the second crossing of the stream under Papillion Dr. At its deepest point where a local sump in the roadway occurs near here, the roadway may flood up to 3' deep. As the roadway grade ascends heading eastward the flooding depth decreases back to zero.

At the next stream crossing, southward under Frederick Rd. near 8789-77, there is 1'-2' of roadway flooding due to insufficient culvert capacity. Flooding of the residential areas on the south side of the roadway occurs from 8777 east to the Rogers Ave. intersection, and is worst (2'+) from 8729 to 8717 where there is minimal floodplain availability for the stream between the adjacent hillside and roadway. This flooding of 2'+ continues into the roadway approaching Rogers

Ave. due to the confluence of storm drains carrying the runoff south into the channel, and the channel up against the roadway with no available floodplain.

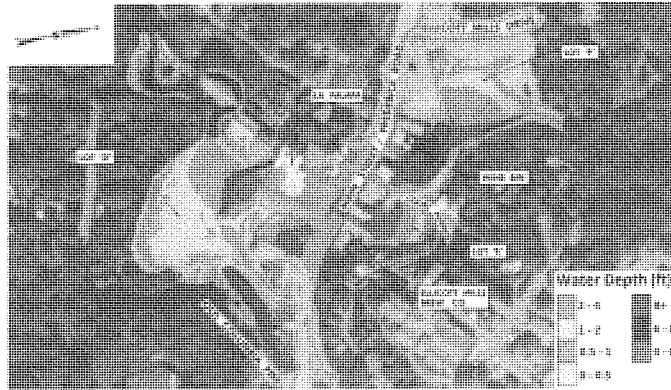
3.3.2 AREA 2 – ROGERS AVE. THROUGH WEST END TO ELLICOTT MILLS DR.

Figure 3.5: Location and Flood Area Map of Area 2.



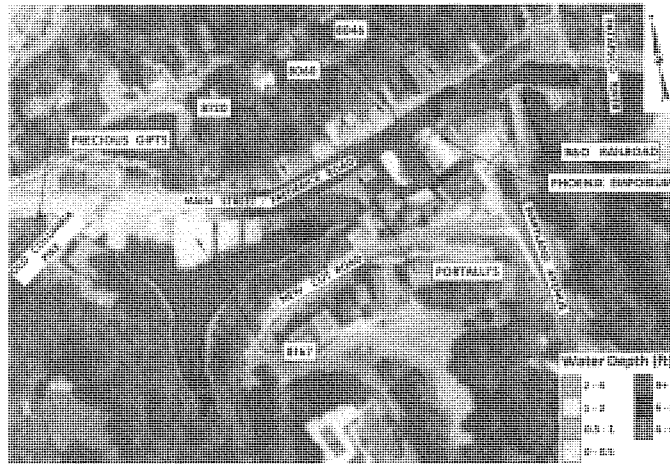
The 2'+ roadway flooding extends past Rogers Ave. to 8672, where the stream goes under a bridge adjacent to the roadway. The flood depth lessens slightly in the roadway then increases dramatically as it approaches the culvert entrance across from West End Service. Residential and roadway flooding in excess of 4' is indicated from 8643 on the south side, through the lower half of the West End Service property. The culvert that carries the stream was originally a 108" CMP culvert that was lined and reduced in diameter to an 88" culvert for part of its length. The interior of the culvert also has several projecting culverts that enter perpendicular to the length of the pipe from the north side, carrying runoff from West End Service and areas above. In total, this storm drain system appears inadequate to convey Hudson Branch for the 10-year storm and above, leading to the significant flooding in this area.

Beyond the West End Service property, the culvert outlets in a channel behind the residential buildings on the north side of the street, with 2'-5' of flooding in the area behind 8560-48. The flow approaches a 96" culvert behind the structure at 8522-26. This constriction, and the lack of available floodplain to the north of the channel results in flow being pushed out into the roadway, where flooding of 2'-4'+ occurs, with the worst of it between 8527 and 8511 in the roadway and between 8522 and 8500 through the residences on the north side. Beyond 8470, the roadway flooding is relatively minor (<1') as the channel becomes significantly deeper/larger as it approaches the culvert under Ellicott Mills Dr. The flow appears to overtop Ellicott Mills Dr. in the 100-year model by a foot or more, as it did during the July 30, 2016 event.

3.3.3 AREA 3 – ELLICOTT MILLS DR. TO OLD COLUMBIA PK.**Figure 3.6: Location and Flood Area Map of Area 3.**

The water that overtopped Ellicott Mills Dr. combined with the water outfalling from the 114" x 192" arch culvert carrying the channel under the roadway and adjacent to Parking Lot 'F', and with a small tributary from the north, to backwater in the southeast corner of the lot to a depth of 2'+. The channel floodplain between the stream and the buildings along Frederick Rd. was flooded in excess of 6-8' in places, with that floodwater impacting the rear of the buildings from the Wine Bin to Court Ave. (8390-8340). The 15' wide x 9' high bridge under Court Ave., and confined downstream channel that runs along the south end of Parking Lot 'E' before turning south at 8316, create a constriction that pushes 2'-4' of flooding out into the roadway from 8360 down to Church Rd., where the steeper roadway grade lessens the depth but increases the flood velocity on Main St. The deepest roadway flooding of 4'+ occurs in Lot 'E' and in front of the Ellicott Mills Brewing Company.

The channel flowing south under Main St. is also constricted further by a 63" x 171" arch culvert under the roadway, that opens up into a 16.5' wide x 14' high box culvert flowing under the La Palapa Restaurant before outfalling into a channel in Lot 'D' just upstream of the confluence with the Tiber Branch. The confluence which re-enters a bridge/box culvert that flows under the lot results in flooding ranging from 1'-2' in lower Lot 'D' to 2'-4'+ in upper (western) Lot 'D' just downstream of the restaurant. The water flowing through the lot eventually re-enters a deep, confined channel downstream of the lot that flows towards Old Columbia Pk. This flow remains separate from the flow down Main St. which left the channel in the Court Ave. vicinity as noted above.

3.3.4 AREA 4 – OLD COLUMBIA PK. TO PATAPSCO RIVER CONFLUENCE**Figure 3.7: Location and Flood Area Map of Area 4.**

The channel flow downstream of Lot 'D' continued east under a set of buildings including the Precious Gifts store and under Old Columbia Pk., emerging back into an open channel near the confluence with the New Cut Branch behind 8167 Main St. The channel flow, lacking a floodplain due to steep slopes on the south side and buildings on the north side, flows under several buildings including the Caplan's and Portalli's Restaurant buildings, with the only relief for high water to be found pushing between the buildings onto Main St. or, in the case of the July 30, 2016 flood, through the first floor of the buildings onto Main St. The model was adjusted to reflect this possible flow path due to the results of that flood; without that relief water will backwater in the channel higher than the model above indicates. It remains to be seen in a similar event whether the reconstructed first floor walls and floor of the building above the channel will withstand the tremendous pressure of the flood and raise the back water, or sustain damage allowing the flood to flow through as it did on July 30, 2016. The current model presumes the latter for the purposes of this analysis.

The parallel flow down Main St. accelerates in the steep area from Church Rd. past Old Columbia Pk., flowing 1'-2' deep in excess of 12 feet/second (fps) and increasing the possibility of roadway scour and additional damage from the shear stresses in excess of 10 pounds/square foot (psf), as was witnessed in the July 30, 2016 event. Eventually this accelerated flow enters a relatively flat local low point of the roadway, which, combined with the channel flow pushing through the

buildings as noted above, results in 6'-8'+ of flooding through this stretch between Caplan's and the Phoenix Emporium (8137 to 8049). Video at the peak of the July 30, 2016 storm indicated flows nearly touching the bottom of the store awnings in this area, supporting the calculations of the model.

As the flow of the combined three subwatersheds continues in the channel beneath buildings, through Tiber Park, and under the B&O Railroad Bridge, as well as down Main St., the inundation of the two flow paths reconnects them through this last stretch prior to combining with the Patapsco River. In looking at the subsequent improvement strategies for conveyance and stormwater management, this area will prove to be the most challenging to return to a manageable depth for the 100-year and similar storm events due to the flat grade, full watershed contribution and lack of a floodplain in the confined channel under several structures.

4.0 CONCEPTUAL IMPROVEMENTS

This study focused on two main types of conceptual improvements, stormwater quantity management (SWM) to reduce the quantity of flow into the Frederick Rd./Main St. corridor, and conveyance improvements that would upgrade or supplement the storm drains and channels through the flooded area to carry more water at a lower elevation for a given event. The structure of the model created for this study allows for any variation on, or combination of, improvements to be run through the model as part of a larger long-term planning effort, however for the sake of keeping the large amount of data manageable, the focus of this study looks at a progressively cumulative improvement using four types of approaches in total, and subsequently examines an incremental improvement considering selected individual improvements as defined below. The alternative of retrofitting the existing SWM facilities in the watershed is also examined relative to the other options presented below.

The approach to determining how much SWM storage is necessary to effectively reduce flood elevations and the probability of damaging flooding was based on attempting to store as much of the volume as possible that makes up the difference between the 10- and 100-year events, in order to reduce the peak flow of the 100-year event down to that of the 10-year event. This required temporary storage in the form of ponds as well as underground SWM. The effectiveness of each in reducing peak flow can be seen in *Figures 4.1* through *4.3* below.

For the SWM ponds, all in-line ponds assumed allowance for the 5-year storm event to pass through before accumulating meaningful storage. This is based on the premise that the downstream channels can accommodate this storm event, and that the meaningful storage could then be reserved for the higher storm events. This is also allows for the branches to maintain their existing base flows, and not changing the appearance of the stream running through downtown. Volume was maximized based on available undeveloped area with emergency

spillways routing the higher storm events where necessary. During the large storm events, excess runoff would be temporarily stored within the facilities and let out at a controlled rate. At the time of this report, the County has initiated preliminary discussions with the Maryland Department of the Environment (MDE) regarding the in-line nature of the ponds as well as the likelihood of high hazard dams that will require Emergency Action Plans for downstream areas.

Figure 4.1: Peak Flow and Volume, 10- and 100-Year Storm.

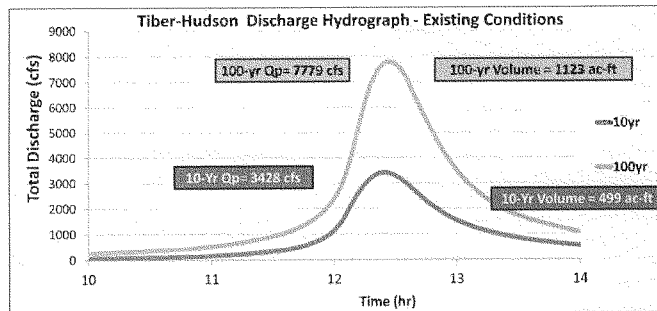


Figure 4.2: Peak Flow and Volume, 10- and 100-Year Storm.

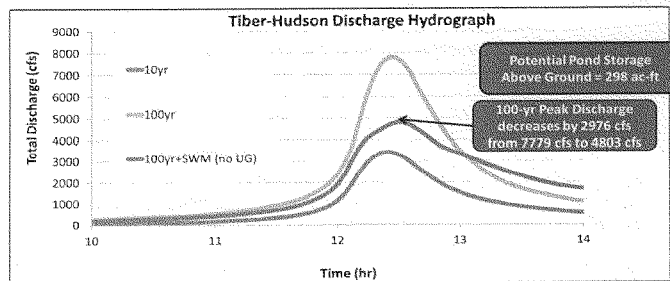
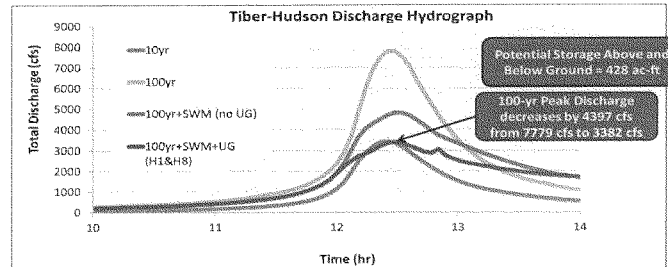


Figure 4.3: Reduction in Peak By Storage, Above and Below Ground SWM

For underground SWM areas, two approaches were considered: underground pipe storage, aka 'pipe farms' which would exist offline, storing diverted flow up to maximum capacity and outletting metered flow by gravity; and underground vaults, which are concrete storage spaces that store diverted excess flow from the channel and drain utilizing pumps over the course of 2-3 days following the storm event. All SWM facility conceptual layouts and grading maps can be found in *Appendix B*.

Capacity improvements examined include supplemental cross culverts where the Hudson Branch crosses the roadway, which are generally only effective at reducing flooding in their local vicinity; bypass culverts which supplement existing culverts carrying Hudson Branch and have effectiveness in reducing flooding in portions of the West End; and tunnels bored through existing rock under adjacent highlands and buildings to carry excess flow underground and divert it away from Lower Main St. Maps of conceptual conveyance improvements are found in *Appendix B*.

4.1 TIBER BRANCH

Improvements in the Tiber Branch focused on a single, large in-line SWM pond (T1), approximately 70 acre-feet in storage size. This was chosen as it was feasible within a wider, undeveloped area of the floodplain without excessive excavation relative to the volume of storage; and also because its size in this smaller subwatershed makes it particularly effective at reducing the peak flows out of this subwatershed. This would likely be a high-hazard dam. Additional details are noted in *Table 4.1*.

4.2 NEW CUT BRANCH

Improvements in this subwatershed included the examination of several in-line SWM ponds which attempted to maximize available undeveloped floodplain area

for storage. From that initial set, there was a notable drop off in the effectiveness of the sites below a certain volume threshold of about 12 acre-feet, so going forward the four largest, most effective ponds were chosen for the concept modeling. Three of these ponds (NC1-NC3) were in-line within the Autumn Hill tributary, with the upstream-most pond being the most effective when examined individually. The downstream-most pond of the three, because of its location, which does not have an emergency spillway location, would likely need to be constructed as a concrete dam. All three ponds would likely be high-hazard dams. The fourth (NC-4) is near the headwaters of New Cut in the southeast corner of the watershed, and is the smallest and least effective of the four when examined individually.

4.3 HUDSON BRANCH

The Hudson Branch subwatershed was the most challenging one to find locations for the large in-line SWM ponds that were so effective in reducing peaks within the other two subwatersheds, largely because of the development adjacent to the floodplain, which is denser and more commercial than the other subwatersheds, and also because this branch is very much intertwined with Frederick Rd./Main St. in its lower reaches. Because all of the meaningful flooding takes place within this branch, before and after its confluences, this is where the majority of the improvements are conceptually proposed and examined.

4.3.1 STORMWATER PONDS

Conceptual improvements include three SWM ponds in-line and off-line within the US 40 / US 29 interchange (H5-H7), which is owned by Maryland State Highway Administration (MSHA) as well as three additional ponds adjacent to or within the Hudson Branch (H2-H4), with all but one (H2) upstream of US 29 at Frederick Rd. The pond in the NW loop ramp of the interchange (H7) which is online, is the most effective in this subwatershed when examined individually; the pond in the opposite NE loop ramp (H6) which is offline, the least effective of the six.

4.3.2 UNDERGROUND SWM

Conceptual Improvements include pipe farms and vaults as defined above. The pipe farm in the old Roger Carter Center property above Lot 'F' on Ellicott Mills Dr. (H8-UG1) includes ~4600 LF of 10' diameter pipe. The additional 3 sites (H8-UG2-4) are located west of US 29 in the undeveloped strip of land currently owned by BGE for their high tension power lines. These pipe farms would comprise ~3.3 miles of 10' diameter pipe located near but not in the footprint of the current towers. The total storage of these 4 sites is approximately 40 acre-feet. At the time of this report, BGE has not been contacted by the County to discuss specific locations for use of their Right-of-Way.

There are three concrete vault locations (H1-UG1-3) along the Hudson Branch east of US 29 which combined offer up to 90 acre-feet of storage, and, when used in conjunction with the pipe farm facilities (H8) are effective in significantly reducing the peak flows in this subwatershed. The locations are at Lot 'F', the current West End Service site and the areas between residential structures at 8777-8729 Frederick Rd. These sites represent conceptual storage of volume divided up based on footprint, but in fact their relative sizes and locations could vary depending on subsurface conditions (which may allow easier, deeper excavation, at one site vs another) with their overall effectiveness varying little, so long as the quantity of storage remains the same.

Table 4.1 and 4.2 indicate the volume and reduction in flow resulting from each of the individual SWM alternatives, as well as combined for the subwatersheds.

Table 4.1: Peak Flow Reduction Per Facility and Combined, Tiber Branch and New Cut Branch Watersheds

Tiber Proposed SWM				
	Total Without Concept Management		Total With Concept Management	
	Q10	Q100	Q10	Q100
T1 (Tiber)	497	1078	168	334

Tiber Concept Ponds Treatment Summary	
	Tiber
	T1
Storage	70.0 ac-ft
Emb. Height	24 ft
Change to Q100 - Total Tiber 100YR	-69%

New Cut Proposed SWM				
	Total Without Concept Management		Total With Concept Management	
	Q10	Q100	Q10	Q100
NC1 (New Cut)	1640	3581	1630	3053
NC2 (New Cut)	1640	3581	1396	3052
NC3 (New Cut)	1640	3581	1241	2876
NC4 (New Cut)	1640	3581	1462	3420
Total Combined	1640	3581	965	2464

New Cut Concept Ponds Treatment Summary					
	New Cut				Combined New Cut Concepts
	NC1	NC2	NC3	NC4	
Storage	34.0 ac-ft	42.0 ac-ft	63.0 ac-ft	14.4 ac-ft	153.4 ac-ft
Emb. Height	28 ft	18 ft	21 ft	11 ft	
Change to Q100 - Total New Cut 100Y	-15%	-15%	-20%	-4%	-31%

Table 4.2: Peak Flow Reduction Per Facility and Combined, Hudson Branch Watershed

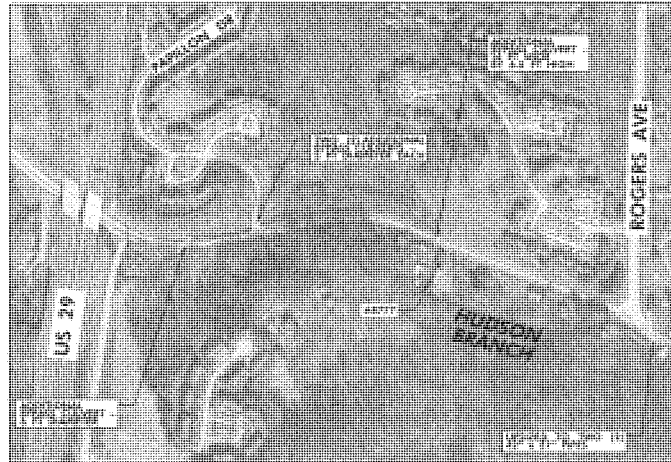
	Hudson Proposed SWM			
	Total Without Concept Management		Total With Concept Management	
	Q10	Q100	Q10	Q100
H1 - UG (Hudson)	1203	2907	734	2613
H2 (Hudson)	1203	2907	1124	2821
H3 (Hudson)	1203	2907	1162	2864
H4 (Hudson)	1203	2907	955	2663
H5 (Hudson)	1203	2907	1128	2798
H6 (Hudson)	1203	2907	1161	2823
H7 (Hudson)	1203	2907	1129	2598
H8 (Hudson) BGE/RGR CTR	1203	2907	903	2459
Total Combined	1203	2907	669	752

Hudson Concept Ponds Treatment Summary									
	Hudson Branch								Combined Hudson Concepts
	H1-UG 1-3	H2	H3	H4	H5	H6	H7	H8-UG 1-4	
Storage	82.4 ac-ft	15.0 ac-ft	7.7 ac-ft	15.6 ac-ft	11.5 ac-ft	12.0 ac-ft	12.8 ac-ft	40.0 ac-ft	197.0 ac-ft
Emb. Height	N/A	15 ft	11 ft	9 ft	12 ft	14 ft	12 ft		
Change to Q100 - Total Hudson 100YR	-10%	-3%	-1%	-8%	-8%	-3%	-11%	-11%	-74%

4.4 CONVEYANCE IMPROVEMENTS

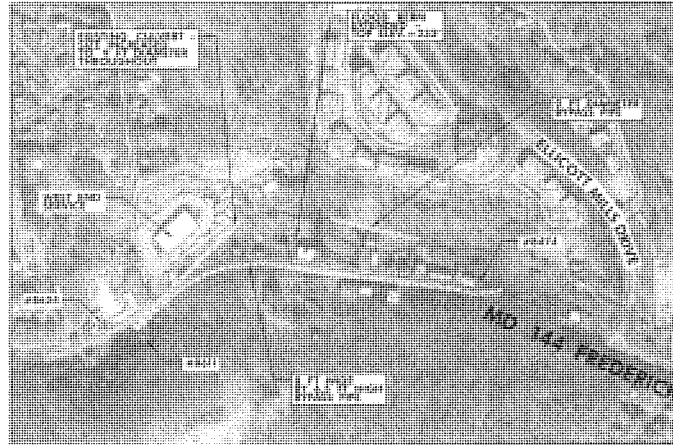
Conceptual improvements to the capacity of pipe and culvert systems along Frederick Rd./Main St. include supplemental cross culverts added to the model in the following locations:

- 8800 Frederick Rd. – Additional 6' culvert
- Papillon Dr. – 2 Additional 5' culverts
- 8777 Frederick Rd. – Additional 6.5' x 14' box culvert
- 8680 Frederick Rd. @ Rogers Ave. - 2 – 42" x 27" pipes – This carries flow from Rogers Ave. across the road into channel

Figure 4.4: Supplemental Cross Culvert Locations

To address the capacity issue at the existing 108"/88" culvert at 8611 Frederick Rd., the model includes the following conceptual improvements:

- Restore the existing culvert to 108" diameter throughout and add a supplemental 6' x 8.5' culvert along the roadway to carry additional flow to an outfall into the channel downstream of 8470
- 8532/34 Frederick Rd.: add a 9' bypass culvert to carry flow behind the houses at 8532 where constricted by the existing culvert, and combine with a flood berm from spanning from 8572 to 8534 to protect adjacent houses from floodplain flow.

Figure 4.5: Supplemental Bypass Culvert Locations

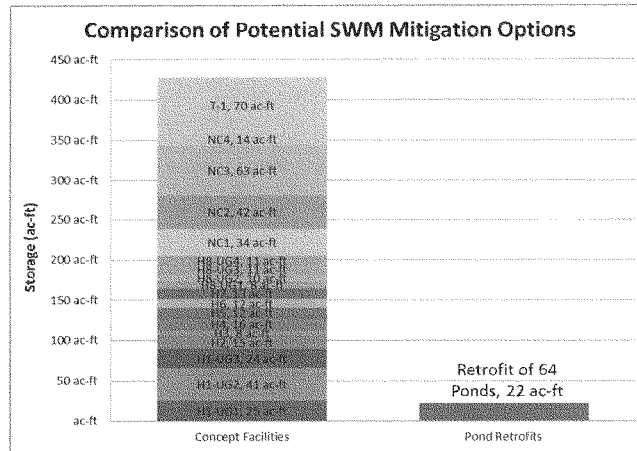
The effects of the capacity improvements on the hydraulic models are shown in more detail and discussed in Section 4.7 below. Larger maps of the options can be found in *Appendix B*; modeling in *Appendix D*.

4.5 EXAMINATION OF RETROFIT OF EXISTING SWM FACILITIES

The analysis considered what the impacts would be on retrofitting the existing 64 SWM facilities throughout the watershed relative to the larger scale SWM improvements noted above. The existing ponds account for about 85 acre-feet of available dry storage combined. Considering a rough assumption that, based on constrictions of adjacent development, right-of-way, natural resources, etc., each facility could be increased by about 25% on average, that would yield approximately 22 additional acre-feet storage.

Relative to the changes observed from the creation of 18 new facilities for 428 acre-feet of additional storage, the approach of retrofitting all 64 existing SWM facilities did not warrant further modeling based on the effective change per each of the 64 individual projects (~1/3 acre-foot per site, on average). A relative scale of this option can be seen in *Figure 4.6*, below.

Figure 4.6: Existing Retrofit Comparison to Conceptual Improvements



4.6 FLOW REDUCTION FROM SWM IMPROVEMENTS

As discussed, the stormwater management improvements both above and below ground, provide substantial attenuation of the peak flows, resulting in reduced peak discharges into the 2-D hydraulic model. Provided below is a summary of SWM simulated changes in peak flows from the three subwatersheds (*Tables 4.3-4.5*) as well as change in peak flow at the outlet of the 2-D hydraulic model. The discharges summarized for the three subwatersheds were pulled directly from the hydrograph output by the TR-20 hydrologic model. The peak flows in *Table 4.6* reflect the combined peak of all inflow hydrographs for the hydraulic model, assuming all conceptual improvements are constructed.

Table 4.3 – TR-20 Simulated Peak Flowrate to Hudson Branch Watershed Outlet for Existing Conditions and the Proposed Stormwater Management Concept

Storm Event	Peak Flowrate (cfs)				
	Existing Conditions	Proposed Above Ground SWM Concepts	Percent Change	Proposed Above & Below Ground SWM Concepts	Percent Change
10-yr	1203	743	-38%	699	-42%
25-yr	1768	1116	-37%	730	-59%
100-yr	2907	2010	-31%	752	-74%
July 30, 2016	3549	2517	-29%	1396	-61%

Table 4.4 – TR-20 Simulated Peak Flowrate to Tiber Branch Watershed Outlet for Existing Conditions and the Proposed Stormwater Management Concept

Storm Event	Peak Flowrate (cfs)		
	Existing Conditions	Proposed Above Ground SWM Concepts	Percent Change
10-yr	497	168	-66%
25-yr	734	212	-71%
100-yr	1078	334	-69%
July 30, 2016	1169	438	-63%

Table 4.5 – TR-20 Simulated Peak Flowrate to New Cut Watershed Outlet for Existing Conditions and the Proposed Stormwater Management Concept

Storm Event	Peak Flowrate (cfs)		
	Existing Conditions	Proposed Above Ground SWM Concepts	Percent Change
10-yr	1640	965	-41%
25-yr	2330	1411	-39%
100-yr	3581	2464	-31%
July 30, 2016	3967	2519	-37%

Table 4.6 – TR-20 Simulated Peak Flowrate to Hudson-Tiber-New Cut (Tiber-Hudson Branch) Outlet for Existing Conditions and the Proposed Stormwater Management Concept

Storm Event	Peak Flowrate (cfs)				
	Existing Conditions	Proposed Above Ground SWM Concepts	Percent Change	Proposed Above & Below Ground SWM Concepts	Percent Change
10-yr	3428	1828	-47%	1801	-47%
25-yr	4947	2716	-45%	2511	-49%
100-yr	7779	4804	-38%	3382	-57%
July 30, 2016	8669	5503	-37%	3455	-60%

The reduced flowrates under the proposed scenario resulted in decreased water surface elevations, flow velocities and the extent of the floodplain; the magnitude of the changes to these variables is dependent on the unique topographic features at any specific cross section in the modeled area. *It is important to note that percent peak flowrate reductions do not necessarily represent equivalent reductions in water surface elevation, flow velocity, or flood extent.*

4.7 MODELING RESULTS OF PROPOSED IMPROVEMENTS

Water surface elevations, and extent of flooding, are reduced incrementally as stormwater management and conveyance improvements are progressively introduced. Below is a summary of the effect of the 428 acre-feet of SWM storage, and subsequently the addition of conveyance improvements, to the existing conditions models detailed above. Additional, larger graphics, which also include a breakdown of flood modeling results between above and below ground SWM improvements, may be found in *Appendix D*.

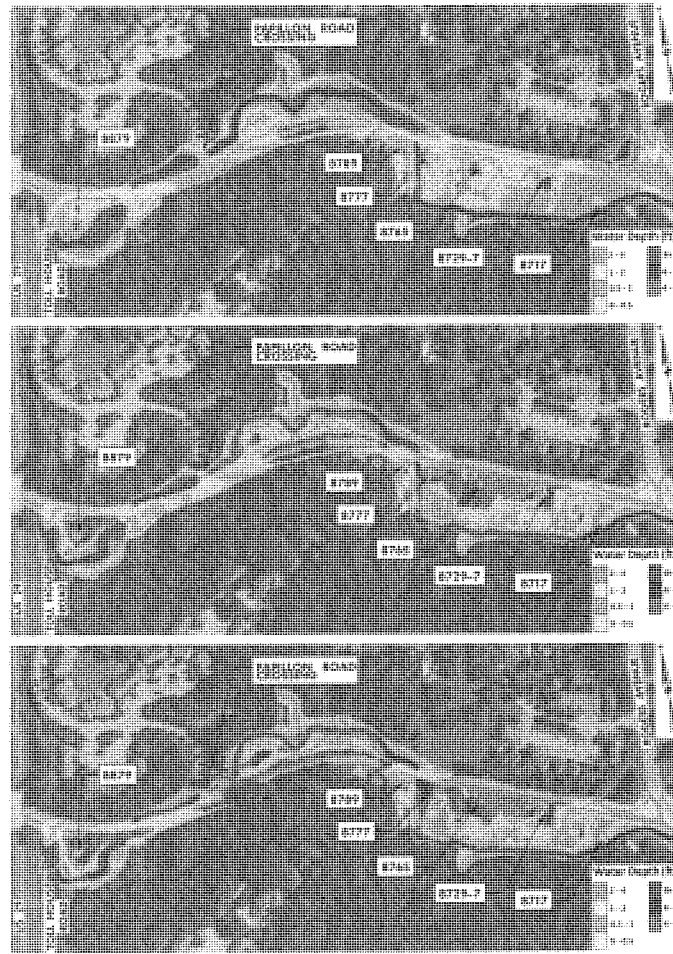
It's important to note that where the model graphics below represent "no flooding" (no color) on the roadway or adjacent areas, that this is indicative of a *lack of flooding resulting from water overflowing out of the channel or overburdened pipe structures only*. This does NOT mean there would be no flow or water depth in the area during this storm event, but rather that the model does not account for all runoff initiated in the immediate vicinity. The model considers the flow directed to the channel from the 10 hydrograph input points within the model and the handling of the major flow 'through' the Frederick Rd./Main St. community. It does not consider the hyper-local runoff between those points that may result in additional minor, local flooding.

4.7.1 AREA 1 – US 29 TO ROGERS AVE.

The roadway flooding at the first point the stream crosses Frederick Rd. just east of Toll House Rd. in the 8800 Block is reduced to under 1' deep, and down below 2' deep at the second crossing of the stream under Papillion Drive. This is a decrease of 1'+. The addition of the supplemental cross culverts at these first two locations further reduces the roadway flooding to about 6" deep.

At the next stream crossing, southward under Frederick Rd. near 8789-77, flooding is reduced below 1' under both scenarios. Flooding of the residential areas on the south side of the roadway is also reduced from 8777 east to the Rogers Ave. intersection, with areas of 2'-4' of flooding now reduced in extent, and in depth down to 0.5'-2', though there are some localized increases at the outlet of the supplemental culvert at 8777. At this culvert it appears either the conveyance or SWM improvement will result in these improvements, but combined they do not provide a significant additional benefit in the immediate vicinity. This is similar with the flooding of the roadway approaching Rogers Ave., which is reduced from 2'+ down to 0.5' to 1' near the roadway edges.

Figure 4.7: Location and Flood Depth Maps of Area 1: Existing, w/ SWM Improvements and w/ SWM+Conveyance (top to bottom)

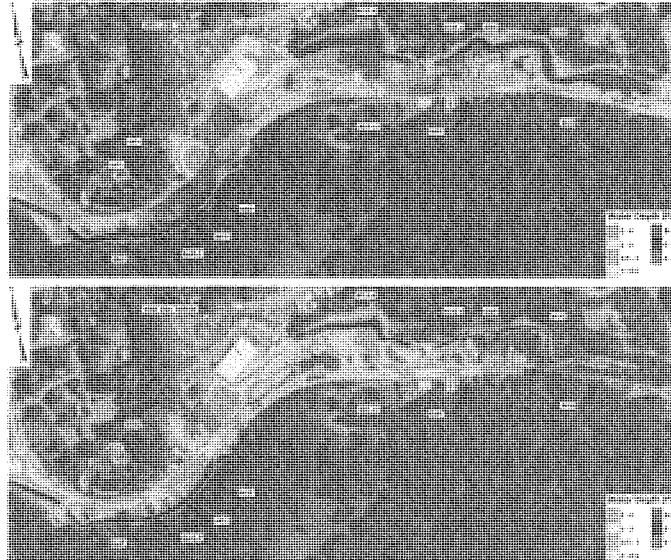


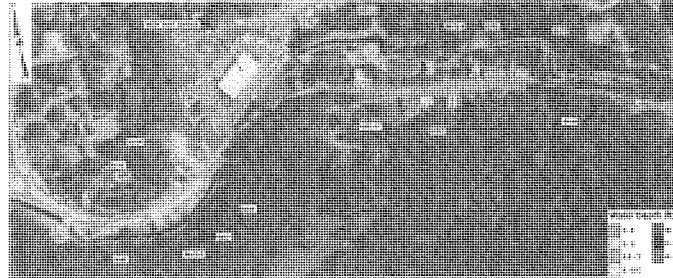
4.7.2 AREA 2 – ROGERS AVE. THROUGH WEST END TO ELLICOTT MILLS DR.

The 2'+ roadway flooding past Rogers Ave. to 8672 is now reduced by about 1', where the stream goes under a bridge adjacent to the roadway. The significant flooding at the culvert entrance across from West End Service is reduced by 2'+ by the SWM alternatives, and an additional 1' by adding the bypass culvert. Residential and roadway flooding from 8643 to 8629 on the south side is similarly reduced. Through the West End Service property, the flooding is reduced by SWM and eliminated by the additional bypass culvert.

Beyond the West End Service property, the 2'-5' of flooding in the area behind 8560-48 is reduced to 1'-3' and kept away from the residences and roadway entirely the bypass culvert/berm alternative. The flow no longer overtops Ellicott Mills Dr. in the 100-year model under both modeled improvement scenarios.

Figure 4.8: Location and Flood Area Maps of Area 2: Existing; w/ SWM Improvements; w/ SWM + Conveyance (top, bottom, next page).

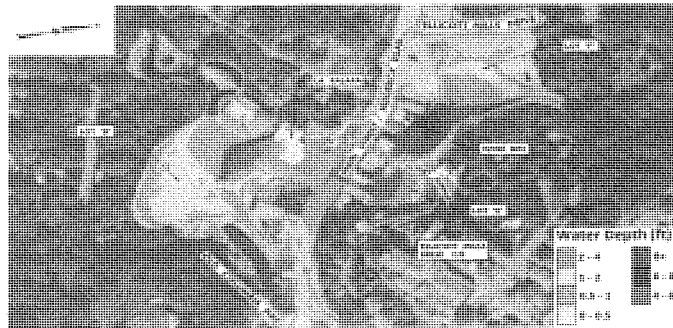


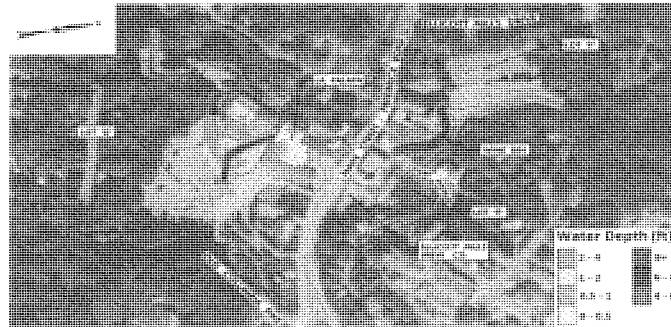


4.7.3 AREA 3 – ELLICOTT MILLS DR. TO OLD COLUMBIA PK.

The conceptual underground management at Lot 'F' stores a large portion of the water that is not already managed upstream, resulting in very little flooding at the lot when modeled. Iterative modeling has demonstrated that the underground management at this site is most effective when combined with the pipe farm storage upstream. The flood depth between the stream and the buildings along Frederick Rd. from the Wine Bin to Court Ave. (8390-8340) is reduced by up to 4'. Similar reductions of 2'-4' are seen along the south end of Parking Lot 'E' and in front of the Ellicott Mills Brewing Company. Flooding in Lot 'D' behind La Palapa is reduced by 2'-3'+. The flow down Main St. resulting from channel overflow is about 6", which is roughly a 1' reduction under the SWM concept improvements. As the conveyance improvements are upstream of this area, the effects on the model are negligible and not shown.

Figure 4.9: Location and Flood Area Maps of Area 3: Existing; w/ SWM Improvements (below, next page).

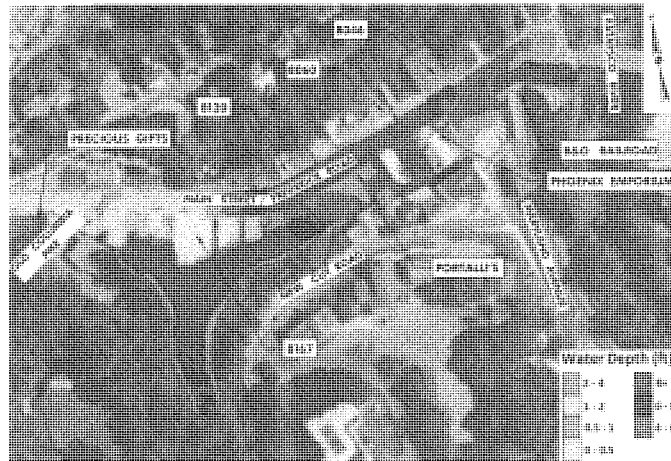


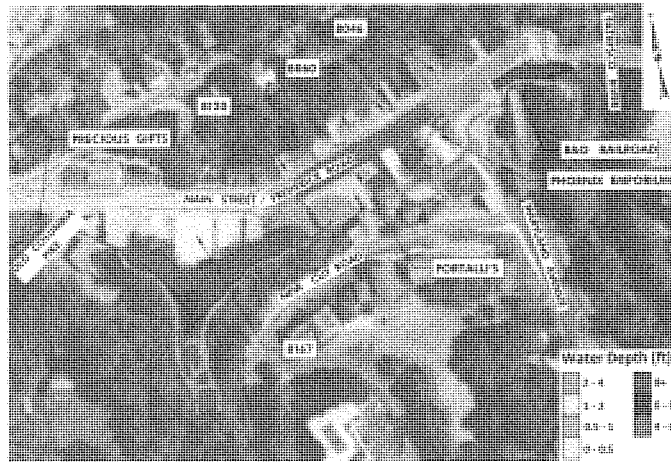


4.7.4 AREA 4 – OLD COLUMBIA PK. TO PATAPSCO RIVER CONFLUENCE

The flow down the steeper section of Main St. past Church Rd. is substantially reduced in depth and destructive force, as compared to existing conditions. Through the flat local sump areas, the SWM concepts reduce depth

Figure 4.10: Location and Flood Area Maps of Area 4: Existing; w/ SWM Improvements (below, next page).





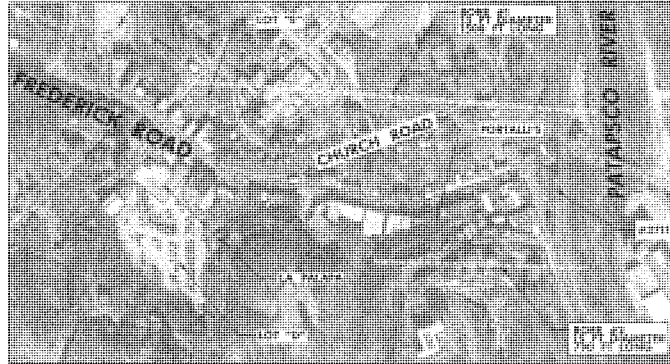
for this storm event by 2'-3'+ however, there is still a section of 4'-6' deep water that is not fully managed through this block. This area still showing over 1' of flooding also coincides with the 100-year flood backwater (elevation 133') from the Patapsco River. It is notable that this model considers flood events that generate from intense rainfall within the Tiber-Hudson watershed (3.7 mi.² which is 1.3% of the 294 mi.² Patapsco River watershed). In the event of a Patapsco River backwater flooding event (similar to T.S. Agnes in 1972) the proposed concepts will not be effective in reducing flooding from the backwater in this area, though areas upstream of the backwater will experience the reductions modeled here.

4.7.5 TUNNEL BORE IMPROVEMENTS

In order to consider a conceptual option that would provide full flood relief for the lower Main St. section for a 100-year event with all of the other SWM conceptual improvements in place, and to address requests made at the inception of this study from the community, the hydraulic analysis examined the concept of tunnels that would bore through the bedrock of Ellicott City in two locations to divert excess flood flows around the Main St. commercial district. Both were located in areas where the terrain goes up very steeply such that the bore would go well beneath any existing structures in the community. The first tunnel would begin upstream of Lot 'E' and would divert flood flows to the Patapsco River approximately 1300' away with a 13' diameter circular bore. The second tunnel, a 15' diameter circular bore, would capture flood flows from the New Cut Branch

just upstream of its confluence with Tiber-Hudson and divert through the adjacent hillside to the Patapsco River approximately 790' away.

Figure 4.11: Location of Conceptual Tunnel Bores to Divert Flow around Main St.



The tunnel bores were sized to convey adequate flood flows such that the channel that runs under the buildings on the south side of Main St. would not overflow and flood the adjacent buildings and roadway. The resulting change in the 100-year flooding from channel capacity can be seen for Areas 3 and 4, in Figure 4.12. The implementation of such a system would have several challenges relative to the construction, permitting and funding of the tunnels.

Figure 4.12: Flood Area Maps of Area 3 (below) and 4 (next page) w/ Tunnel Bores

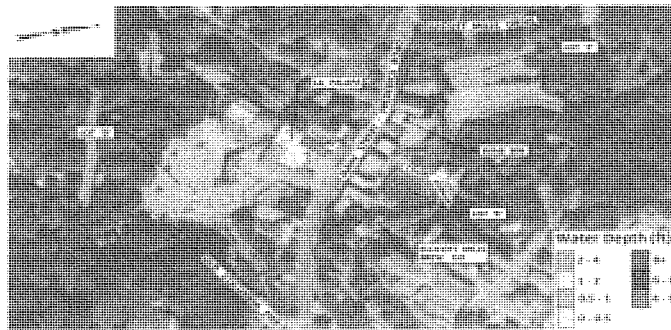




Table 4.7 – Number of Buildings within the Floodplain under Existing Conditions and the Proposed Stormwater Management Concept



**McCORMICK
TAYLOR**

5.0 CONCLUSIONS AND RECOMMENDATIONS

The creation of a comprehensive hydrologic and 2-D hydraulic model of the Tiber-Hudson Branch along Frederick Rd. / Main St. east of US 29 provides Howard County with an interactive tool for long term planning and execution of strategies to reduce the probability and severity of flooding in Ellicott City. The results of this study demonstrate that construction of stormwater storage facilities throughout the watershed, combined with stormwater conveyance infrastructure improvements, can make an appreciable difference in the severity of flooding from a 100-year or other similar storm event. However, the nature and scope of such improvements is significant in scope, impact and cost. It will require a long term planning and implementation effort, supplemental to the Master Plan process, to prioritize, design and construct improvements based on the concepts represented in this report. In the shorter term, flood proofing and insurance of buildings and their contents within the floodplain should be a consideration throughout the study area.

In the interest of representing what a subset of selected improvements, of the type that would hypothetically represent the first stage of a multi-stage plan, would result in, the analysis included modeling of a subset of improvements. These SWM improvements were chosen for the subset based on their having the greatest individual impact on their respective subwatersheds in terms of peak flow reduction (see *Sections 4.1-4.3* and *Tables 4.1, 4.2*) and included T1, NC3 and H7 (ponds) and additionally H8 (Underground Pipe Farms) along with the proposed conveyance improvements (not including the tunnel bores). The mapping demonstrating the flooding reductions associated with this subset of improvements may be found in *Appendix E*.

It should be noted that these concepts, particularly those representing stormwater management and storage, are broad-brush representations of practices that can significantly vary in their final detail and location while still achieving the same improvements. The dynamic nature of the model will allow for the continued analysis of chosen alternatives as they are refined in the planning and design of future improvements associated with Ellicott City flood mitigation.

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Summary of The Ellicott City Hydrology and Hydraulic Study and Concept Mitigation Analysis (response to the 2016 flood):

The Ellicott City Hydrology and Hydraulic Study and Concept Mitigation Analysis is an expansion of the 2014 Ellicott City Flood study and Concept Mitigation Report, done at the request of the Howard County Bureau of Environmental Services. This report utilizes updated models to examine the effect of conceptual flood mitigation improvements along Frederick Road and Main Street in Ellicott City. The topography surrounding Ellicott City's Main Street and area development have contributed to the recent flooding of the Main St. corridor. This study proposes concepts to mitigate the flooding of Ellicott City, specifically stormwater quantity management and conveyance improvements. This analysis demonstrated that proposed efforts can result in reduced flooding.

This study developed a hydrology for the Tiber Branch, New Cut Branch, and Hudson Branch watersheds. These models were used as representations of the watershed area and serve as a comparison baseline for the evaluation of future conceptual improvements, even beyond the ones proposed here. Hydrologic analysis was then done with the 64 stormwater management (SWM) facilities as they currently exist. This initial analysis shows that as the storm event intensifies, water discharges increase. Data from these models was then put into the hydraulic models.

The hydraulic models were 2-D floodplain models of the Main St. flooding area during the July 30, 2016 event. The study utilized TUFLOW simulation software, which allows for variable input for the floodplain analysis. To assure the model was accurately depicting the water flow through the area, the study used actual data from July 30, 2016. These model calibration practices assure that the model represents typical storm events comparable to actual flooding conditions. The simulated model showed the extent of the floodplain, depth of flooding, and velocity of the flow. The results of these calibration models correlated with the actual data.

The initial hydraulic model simulations show the result of intense rain on existing conditions. Specifically, these simulations evaluated the extent of flooding, flow depth, and flow velocity. The study used the hydraulic model simulations on four areas: US 29 to Rogers Ave., Rogers Ave. through West End up to Ellicott Mills Dr., Ellicott Mills Dr. to Old Columbia Pk., and Old Columbia Pk. to Patapsco river confluence. In general, the model simulations of existing conditions found *insufficient culvert capacity, inadequate storm drain systems, constricted flow paths, and lack of water relief* resulting in general flooding and the flooding of buildings.

Based on the above analysis, this study proposes two main types of conceptual improvements to Ellicott City's current flood mitigation approaches. The first is improvements to stormwater quantity management (SWM) to reduce the quantity of flow into Frederick Rd. / Main St. Corridor. The second is conveyance improvements that would upgrade or supplement the storm drains and channels through the flooded area to carry more water at a lower elevation.

The ultimate goal of these improvements is to reduce peak flood flows from that of a 100-year event down to that of a 10-year event. This requires the temporary storage of water in the form of ponds and underground SWM. During storm events, excess runoff would be temporarily stored within these facilities and then let out at a controlled rate. In addition, Howard County has

initiated discussions with the Maryland Department of the Environment regarding the ponds and the likelihood of high hazard dams that will require emergency action plans.

For underground SWM areas, this study took two approaches. The first is underground pipe storage, which store diverted flow up to maximum capacity and release the water by gravity. The second is underground vaults, which are concrete storage spaces that store diverted excess flow and drain it through pumps over the course of several days.

For capacity improvements, the study took three approaches. The first is supplemental cross culverts where Hudson Branch crosses the roadway, which is effective in reducing local flooding. The second is bypass culverts, which supplement existing culverts carrying Hudson Branch and are effective in reducing flooding of the West End. The third approach is tunnels through existing rock to carry excess flow underground and divert it away from lower Main St.

These approaches were applied along the Tiber Branch, New Cut Branch, and Hudson Branch. The Hudson Branch is where the most significant flooding, being the most dense and commercial area. The majority of the conceptual improvements are proposed in this area. Analysis of these models show stormwater management improvements both above and below ground provide substantial reductions in peak water discharges. Under the proposed scenarios, flow rates were reduced. These reduced flow rates in turn resulted in decreased water surface elevations, flow velocities, and the extent of the floodplain. These improvements were applied to the earlier model of the four aforementioned areas. In general, the improvement simulations showed a reduction in flooding due to supplemental cross culverts, SWM improvements, and additional bypass culverts.

The simulated results of the proposed improvements show that as stormwater management and conveyance improvements are introduced, there is incremental reduction in water elevations and extent of flooding. This study also examined tunnel bore improvements, a conceptual option requested by the Howard County community. This option would divert excess flood flows around the Main St. commercial district. However, the implementation of such a system would have challenges in terms of its construction, permitting, and funding.

The study's final analysis had these conclusions and recommendations: The comprehensive modeling developed for the purposes of this study provides for an interactive tool for long-term planning and execution of strategies to reduce the probability of another event of severe flooding in Ellicott City. The construction of stormwater storage facilities throughout the watershed in combination with stormwater conveyance infrastructure improvements is significant in scope, impact, and cost. The conceptual improvements outlined here, and the general flood mitigation efforts, require long-term planning and implementation efforts, supplemental to the master plan process. In the short term, it is necessary to flood proof and insure buildings and their contents within the floodplain area of Ellicott City. The nature of the models developed here allow for continued analysis of the area and alternative improvements to Ellicott City flood mitigation efforts.

Summary of the USACE Report after 2016 flood: Prevention on the building level

After the 2016 flood, Howard County, MD requested that the U.S. Army Corps of Engineers, Baltimore District (USACE) investigate potential nonstructural flood proofing measures to provide a level of flood risk management (FRM) for residential, public, and commercial buildings from floodwaters.

Nonstructural flood proofing measures are physical and nonphysical measures that reduce flood risk by modifying the characteristics of structures or modifying the behavior of people living in or near floodplains. Nonstructural measures differ from more traditional structural measures, such as floodwalls and levees, which reduce the risk of flood waters making contact with buildings. Generally, nonstructural FRMs don't modify the depth or velocity of floods nor do they induce development in a flood plain that is inconsistent with reducing flood risk. Physical nonstructural FRM measures include dry flood proofing, wet flood proofing, elevation of buildings, and relocation of structures. Nonphysical nonstructural FRM measures include flood preparedness plans, flood insurance, and land use changes.

Ellicott City's hilly nature as well as its proximity to the Patapsco River make it a significant flood risk. Nonstructural flood proofing measures would not have thwarted the storm of 2016 but it could minimize damage from future storms and floods.

To conduct the study, USACE inspected structures to determine what type of FRM measure is most appropriate for that particular building based on its condition, construction type, location, etc. According to the applicable building codes in Ellicott City, nonstructural flood proofing measures must be designed to reduce risk at the base flood elevation plus two feet of freeboard (BFE+2). Freeboard is the vertical distance from the normal water surface to the top of the confining wall. USACE performed building surveys on several structures within the study area to determine first floor elevation, low opening/first point of entry elevation, and lowest adjacent grade. USACE used hydraulic and hydrologic technology to create models representing Ellicott City's floodplains.

16 properties in the study area were investigated and selected by USACE to be representative of Ellicott City in terms of structure types, occupancy types and flood risk characteristics. This included three public buildings, three residential buildings, and ten commercial buildings, all in the National Historic District. Observations and measurements taken during site visits were combined with field survey data and were used to develop final recommendations for each structure and to develop estimated construction costs.

The goal of the assessment was to provide a tool for Ellicott City property owners to consider the applicability and feasibility of implementation of nonstructural flood proofing measures to their own buildings, based on similar structural features or flood characteristics to one or more of the 16 sample structures.

Initial screening of potential nonstructural FRM measures, which included input from relevant historic preservation organizations, identified dry flood proofing, wet flood proofing and structural elevation as the primary physical measures applicable in Ellicott City. Nonstructural

flood proofing measures have been employed in similar situations across the country and have proven successful in reducing flood damage. Nonstructural measures are effective for short and long-term flood risk and flood damage and can be cost effective when compared to larger structural measures. Nonstructural measures can be broken into two types: passive and active. Passive measures require minimal pre-flood actions and include flood doors/windows such as dry flood proofing and structural elevation. Active measures require more action before a flood and include temporary flood barriers.

Dry flood proofing consists of waterproofing the exterior of a structure up to a determined height (usually 3-4 feet) to reduce the probability of flooding of the building interior starting on the first floor. The challenges are limited warning time to close barriers, keeping historic aesthetic of structures, and sometimes a limited level of FRM. Flood proof doors can be purchased to reduce pre-flood actions but these doors are costly.

Wet flood proofing is the process of modifying a building to allow flood waters to enter and inundate a portion of the building to minimize the risk of structural damage. The selected area is usually a sub-grade basement or crawlspace. If ceiling height allows, the interior first floor can be raised to allow flood water to enter while causing minimum structural damage. It's an effective option for a relatively small number of cases where structure type and first floor occupancy allow for it. Implementation would require significant changes to building layout and functionality and clean-up after a flood may also be costly.

Elevation of structures is another option and consists of raising flood prone buildings in place so that the lowest floor is above the BFE. The building is raised on temporary framing and set on new foundation walls, extended foundation walls, or structural fill above the BFE. Basements and crawl spaces can be filled with suitable fill material and storage space can be added in higher level to compensate for the lost space. The risk of flooding up to the new low opening elevation is eliminated with minimal need for any pre/post flood mitigation with this plan and flood insurance premiums would decrease. However, residents/tenants would need to be relocated during construction and it would be difficult to coordinate among owners of buildings sharing a wall for simultaneous elevation of adjacent structures.

Another option is relocation of buildings to an area outside of the floodplain. This removes the possibility of loss or damage from high flood events. Howard County requested that USACE assess relocation of buildings as a last possible option because of historic preservation and community cohesion concerns. The relocation process could be lengthy and disruptive to property owners as well.

In Ellicott City, there is often very little warning before a flood event. Therefore, the passive option is the primary recommendation in most cases because it does not require the action of property owners. Unfortunately, this option is not always possible because of the nature of the structures, the topography, and the historical value of many of the buildings in Ellicott City. Final recommendations included: passive dry flooding, active dry flood proofing, and wet flood proofing as favorable options for certain buildings because high vulnerability of flooding throughout the study area led to high damage estimates. Active dry flood proofing is cheaper

than passive dry flood proofing and can be effective at reducing flood damages when applicable. Structural elevation was found to be an unfavorable option.

Prevention on the watershed level: stormwater management at the EPA

To protect communities and our aquatic resources, communities, construction companies, industries, and others, use stormwater controls, known as best management practices (BMPs). These BMPs filter out pollutants and/or prevent pollution by controlling it at its source.

The NPDES stormwater program regulates some stormwater discharges from three potential sources: municipal separate storm sewer systems (MS4s), construction activities, and industrial activities. Operators of these sources might be required to obtain an NPDES permit before they can discharge stormwater. This permitting mechanism is designed to prevent stormwater runoff from washing harmful pollutants into local surface waters.

Most states, including Maryland, are authorized to implement the stormwater NPDES permitting program. EPA remains the permitting authority in a few states, territories, and on most land in Indian Country.

Population growth and the development of urban/urbanized areas are major contributors to the amount of pollutants in the runoff as well as the volume and rate of runoff from impervious surfaces. Together, they can cause changes in hydrology and water quality that result in increased flooding, habitat modification and loss, decreased aquatic biological diversity, and increased sedimentation and erosion. The benefits of effective stormwater runoff management can include; flood control, protection of public health, improved quality of receiving waterbodies, protection of wetlands and aquatic ecosystems, and conservation of water resources.

Ellicott City's Watershed Master Plan

As a result of the 2018 flood, the finalization and publication of Howard County's *Ellicott City Watershed Rebuilding Master Plan*, initiated after the 2016 flood, has been delayed. The Master Plan is being written by a combination of national experts in flooding and stormwater management and historical preservation, as well as an extensive community outreach effort, which has included workshops, online surveys, and advisory councils of community and business leaders.

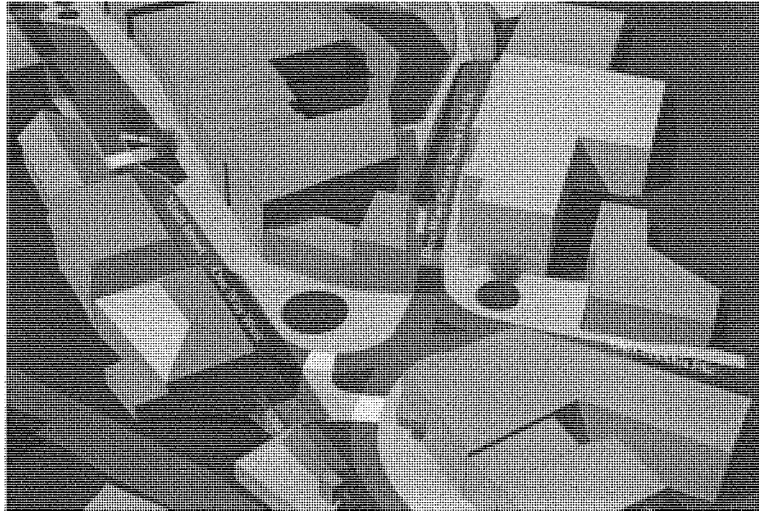
The four main goals of the *Ellicott City Watershed Rebuilding Master Plan* are:

- to emphasize resilience and place making while rebuilding,
- to protect the environment,
- to preserve the city's heritage, and
- to revitalize the downtown economy.

Ellicott City, without its own natural floodplain and with steep rocky topography and unchecked development exacerbating runoff, sits at the bottom of an essential funnel where four tributaries empty into Patapsco. Ellicott City itself, built before today's regulations preventing construction in 100-year flood plains, has also over-channelized and literally built over streams. By creating constrictions and pinch points in the water network, the system is overwhelmed by even 10-year storms. Lower Main Street is the most susceptible area but much of Ellicott City is in 500-year and 100-year flood plains.

A Hydrology and Hydraulic (H&H) Study has been conducted on the entire Tiber-Hudson watershed, running storm scenarios and seeking solutions. It identified 18 projects, costing around \$80 million, which would improve capacity for storm water. This includes 425-acre feet of storage both underground and above ground. The initial phase, 4 projects costing \$18 million, is in the design and engineering stage.

Howard County needs to fundamentally change the land use around streams and in the flood plain. This will include public open space expansion, pedestrian network enhancement, new storm water retention facilities, strengthened wetlands, and improved flood proofing in buildings. The main effort will be channel and floodplain expansion, which includes many of the aforementioned efforts, but will involve acquisition and removal of structures to extend and construct channels and culverts. The biggest changes could involve open channels through Main Street. Lower Main culverts present the largest challenge, as major construction risks major business disruption, possibly for years.

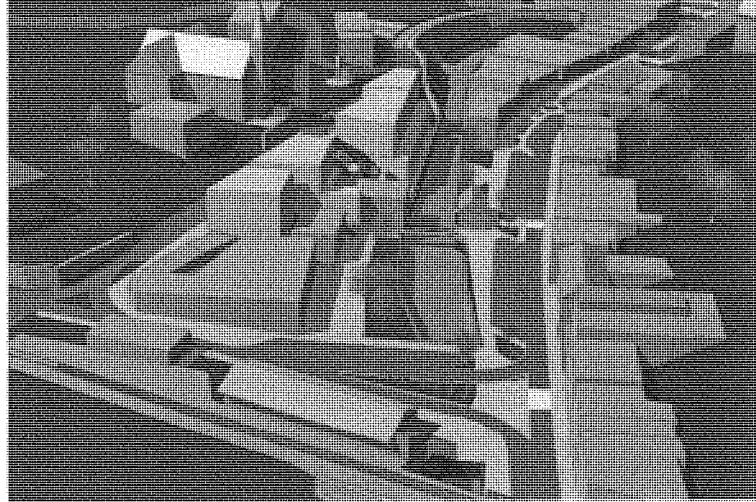


CONCEPT PLAN

① Aerial of Columbia Pike Intersection

Alexander Design Studio

8212 Man Street, Ellicott City, Maryland 21043 | 410-965-6207

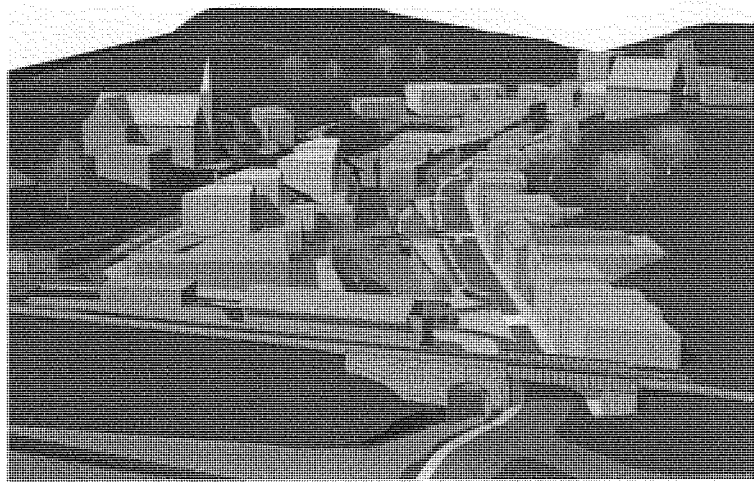


CONCEPT PLAN

① Aerial of Lower Main

Alexander Design Studio

8712 Main Street, Ellicott City, Maryland 21043 | 410 865 8267

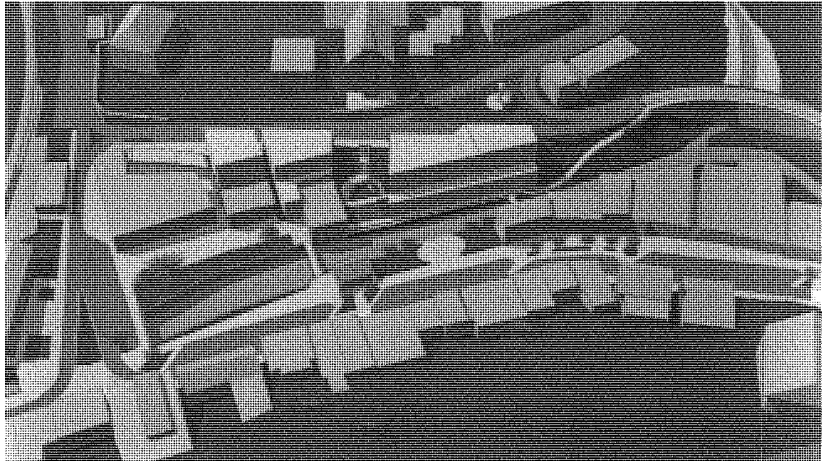


CONCEPT PLAN

Alexander Design Studio

① View Up Tiber

6212 Main Street, Ellicott City, Maryland 21043 | 410.495.8207



CONCEPT PLAN

① Aerial of Lower Main From East

Alexander Design Studio

8212 Main Street, Everett City, Maryland 21041 | 410-483-8207