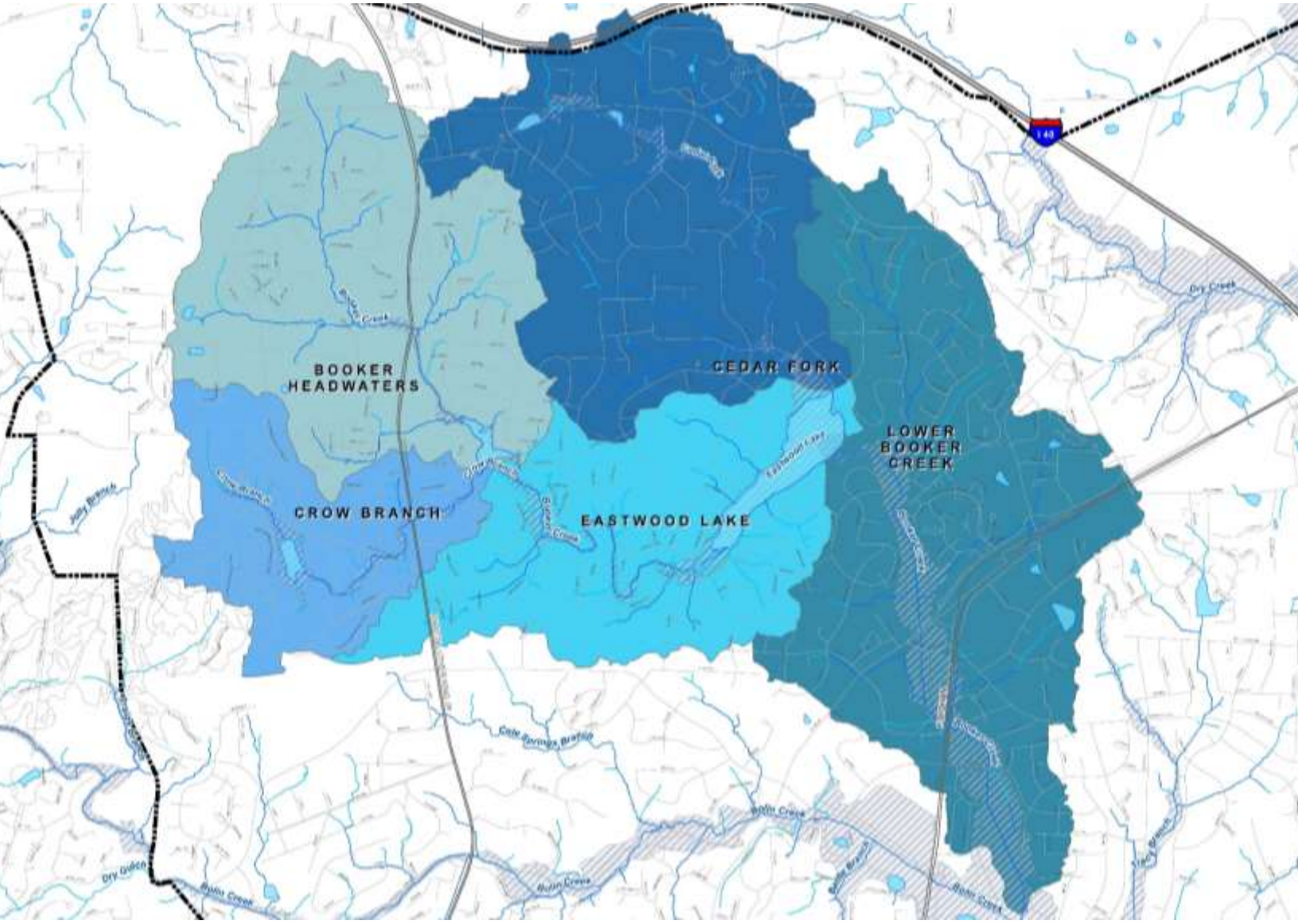
Booker Creek Watershed Working Group



Recommendation Report

May 2023

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Cover image: Booker Creek Watershed Map. Courtesy of Town of Chapel Hill (https://www.townofchapelhill.org)

1.0 MESSAGE FROM THE WORKING GROUP

To Chapel Hill Mayor Hemminger, Members of the Town Council, and the Chapel Hill Community:

The Booker Creek Working Group is pleased to submit the attached report for your consideration as you make decisions about the future direction of the Town's stormwater program. Our assignment began when community concern arose in the summer and fall of 2021 about a number of flood water storage basins that the Town staff had recommended to be constructed to deal with flooding problems in the Booker Creek watershed. Following the September 13, 2021 public forum designed to hear questions, concerns and ideas from the community, the Town Council adopted a resolution unanimously rescinding approval for the six unbuilt flood water storage projects on September 22, 2021.

> "WHEREAS; The Council recognizes the importance to the environmental health of the town and quality of life for our community of expanding the scope and goals of the Town's sub-watershed evaluations to take into consideration the broader ecological context of Chapel Hill and the goals of the newly adopted Chapel Hill Climate Action Plan; and
>
> WHEREAS: the council also wishes to have a greater understanding of the financial and (environmental/ecological) costs and benefits of the solutions being considered.
>
> NOW, THEREFORE, BE IT RESOLVED by the Council of the Town of Chapel Hill that the Council withdraws approval of the following stormwater storage basin projects: Piney Mountain, Red Bud, Daley Road, New Parkside, MLK and Willow.
>
> BE IT FURTHER RESOLVED that the Council approve creation of a Working Group on Stormwater Management in the Booker Creek Watershed consisting of experts, community members and staff to bring back recommendations to the Council based on the charge provide by the Mayor and Manager."

The Working Group approached our assignment by looking for stormwater programs in other North Carolina communities that had developed proven, successful solutions to the points in the Mayor's charge. Several representatives from other communities generously joined us at our meetings and shared their experiences with us.

In our report you will learn more about the recommendations we are making to shift the Town's stormwater goal from preventing flooding to incorporating this goal within a broader goal of reducing flood damages to homes and businesses.

Our small group of volunteers has not had the resources or the time to recommend complete program plans with detailed budgets and staffing needs. What we have been able to do is to produce a series of recommended directions that will improve stormwater management in Chapel Hill. **These recommendations are not academic: they have all been proven in practice in North Carolina**

communities. We invite the Council to evaluate these concepts and carry them forward to implementation, providing opportunities for public review and engagement in the process.

We have appreciated our opportunity to work together on these recommendations and thank the Town staff for their essential help in organizing our zoom meetings, creating the valuable website to make our records available to us and to the public, and for providing us with an experienced facilitator. We thank Council Member Amy Ryan for taking an interest in this issue and serving as the Council liaison throughout the process.

Sincerely,

John Morris
John Morris, Co-chair

Pamela Schultz
Pamela Schultz, Co-chair

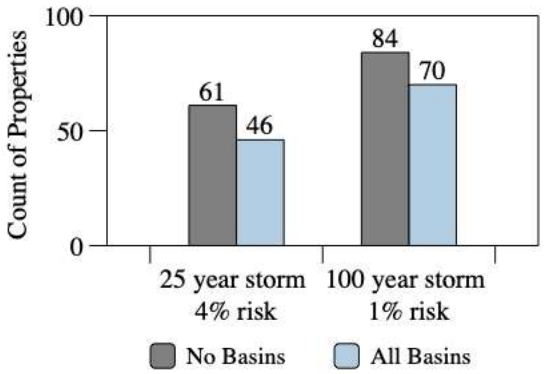
Jeanette Bench
Jeanette Bench, Vice-chair

1.1 EXECUTIVE SUMMARY

We live in a town where flooding is a significant concern for many residents. Ideally, we would stop flooding from occurring, but the reality is that we can't eliminate flooding. In the past, the town allowed structures and businesses in floodplains and floodways. Currently, we are adding more development in our watersheds, and "as the amount of impervious surface area increases due to development in local watersheds, streams may flow at increasingly higher levels following storm events ..." [1]. Thus, our community has flood risk from nearby streams but also increased risk due to urban flooding.

The Town of Chapel Hill formed our working group in September of 2021 to provide recommendations to find better solutions to flooding problems during significant storm events. Our working group collaborated for over a year, gathering advice from other communities in North Carolina. During our meetings, we had impressive presentations from members of different communities, our own Working group members, and town staff. We found one key difference between the approach Chapel Hill has taken compared to other communities, is that we have focused on reducing flooding, while we found other communities have focused on the broader goal of reducing flood damages.

During the months our group was active, members further analyzed data from the Town sponsored W.K. Dickson Study, which identified seven proposed flood water storage basin projects. The Study estimated flood elevation data for properties in the Lower Booker Creek Watershed under future conditions without the basins compared to future conditions with the construction of all seven flood storage basins. [2]



Using these data, we counted the number of properties at risk of flooding with and without all the projects being built. The included bar graph summarizes the results, showing that most of the properties are still at risk of flooding, even with all the projects built. This result concerned our group, as significant damage can occur in the first few inches of flooding.

While preventing floods altogether is impossible, we have identified ten recommendations to improve our stormwater management practices and reduce risks to homes and businesses. Table E1 provides a summary of all the recommendations based on the order the Working Group approved them in draft form. On September 12, 2022, the Working Group approved this complete list of recommendations.

[1] Town of Chapel Hill Stormwater Management, Website, DRAINAGE ASSISTANCE, Accessed May 6, 2023. https://www.townofchapelhill.org/government/departments-services/public-works/stormwater-management/faqs/drainage-assistance.

[2] Town of Chapel Hill Lower Booker Creek Subwatershed Study, Prepared by W. K. Dickson & Co, Volume II: Appendices, Lower Booker Creek Subwatershed Study: APPENDIX B HYDRAULIC ANALYSIS, At-Risk Properties/Structures.

Table E1. Recommendations of the Booker Creek Working Group

Date	Recommendation		Key Points
3/14/22	1	Advancement of Green Stormwater Infrastructure	• Support and empower homeowners to pursue stormwater and flood resilience-related improvements. • Create a Targeted Decentralized System of Green Stormwater Infrastructure in Chapel Hill. •Target neighborhoods are identified in the Dickson Report.
	2	Streambank Stabilization Project Assistance	• Provide community members with resources to repair and protect streambanks using stabilization techniques. • The Dickson Report identified sites that need streambank stabilization.
4/4/22	3	Cost Effective Flood Damage Reduction	• A data-driven program to reduce flood damage by identifying structures & tracking risk reductions over time, using the most cost-effective methods. • Exemplified by Charlotte-Mecklenburg's Flood Risk Reduction Program.
4/25/22	4	Preserving and Protecting Bottomland Forests and Natural Stream Corridors	• Forested bottomlands and riparian areas naturally mitigate flooding by intercepting floodwaters and reducing velocity after storms.
6/6/22	5	Modification to the Land Use Management Ordinance (LUMO) to Address the 100-Year Storm Event	• Update the Land Use Management Ordinance to address the 100-year storm event. • Follows other local communities, such as Cary.
	6	Community and Staff Engagement in Stormwater Policy Improvement	• The Town of Cary provided an example of how this engagement effort can be effective. • Chapel Hill could choose to follow their example as adapted to meet our needs.
6/27/22	7	Standards for Approving Major Stormwater Projects	• Town stormwater projects should meet the following standards: Cost Effectiveness, Environmental Assessment, & Equity. • These evaluations should be presented to the Council before a decision on project approval and funding.
9/12/22	8	Enter the FEMA Community Rating System (CRS)	• The program incentivizes improved floodplain management. • Reduces flood insurance premiums for the community.

	9	Set Funding Priorities for the Maintenance of Existing Stormwater Facilities	• Make maintenance of existing stormwater structures a funding priority. •As exemplified by the Town of Cary, development approvals should require Evergreen Letters of Credit to ensure that new developments maintain their structures.
	10	Utilizing Existing Water Bodies for Flood Water Storage	• Utilize existing water bodies for flood mitigation projects such as Lake Ellen (7-acre) & Eastwood Lake (50-acre). • Per the WK Dickson report, Eastwood Lake is the "largest potential floodplain storage facility in the Booker Creek watershed".[3]

The Booker Creek Working Group considers it important to recognize that a transversal dimension across these recommendations is equity, diversity, and environmental justice since acts of nature, here flooding, impacts communities of color and of low income on a different level. The Working Group also considers other-than-human entities not just as ecosystem services but as an integral part of the living systems and identity of Chapel Hill.

[3] Town of Chapel Hill Lower Booker Creek Subwatershed Study, Prepared by W. K. Dickson & Co, Volume I: Report, SECTION 4: FLOOD MITIGATION ALTERNATIVES. September 2018, Page 4-3.

2.0 ACKNOWLEDGEMENTS

Working Group Membership

- Jeanette Bench ** - (Vice Chair) CH Parks, Rec. & Greenway Commission
    - CH Adopt A Trail – Booker Creek Habitat Restoration Project 2018-present
- Michael Dupree - Expert Content Resource
    - MS with Certifications in Surface Water Identification, Stormwater Control Measure Construction & Inspection, NC Stormwater Nitrogen & Phosphorus (SNAP) Tool Certification.
- Doug Frederick - Forester
    - PhD Professor Emeritus NC State University College of Natural Resources
- John Morris *- Water Resources
    - Former Director of the NC Division of Water Resources, Chair of the Interstate Council on Water Policy, and Chair of the NC Water Resources Association. Managed flood damage reduction projects funded by North Carolina and state participation in Corps of Engineers projects for this purpose.
- Chad Pickens – Business Manager in the Booker Creek watershed with flooding property
    - (Co-Chair) Stormwater Management Utility Advisory Board
- Louie Rivers – Environmental Justice
    - PhD NC State Department of Forestry and Environmental Resources. Research focuses on the examination of risk and decision process in minority and marginalized communities.
- Pamela Schultz * - (Co-Chair) Stormwater Management Utility Advisory Board
    - PhD Environmental Engineer
- Antonia Sebastian- Hydrologist
    - PhD UNC Assistant Professor Earth, Marine, and Environmental Sciences. Research focuses on flood risk in urban areas.
- Miguel Rojas Sotelo – Homeowner in Booker Creek watershed with flooding property
    - PhD Duke University. Nicholas School of the Environment, Center for Latin American and Caribbean Studies.
- Shugong Wang – Stormwater Management Utility Advisory Board
    - PhD Civil Engineering focusing on Hydrology and Water Resources
- ESAB Representative -

*Co-chair; **Vice-chair

Non-Voting Support

- Loryn Clark – Deputy Town Manager
- Lance Norris – Public Works Director
- Chris Roberts – Manager of Engineering & Infrastructure
- Sue Burke – Senior Engineer

- Ernest Odei-Larbi – Senior Engineer
- Alisha Goldstein – Engineer III
- Allison Weakley – Stormwater Analyst
- Sammy Bauer – Community Education Coordinator
- Morgan Flynt – Stormwater Outreach Intern

Town Council Liaison

- Amy Ryan

Facilitator

- Maggie Chotas, Dispute Settlement Center (DSC)

3.0 BACKGROUND - STORMWATER PLANNING IN THE BOOKER CREEK WATERSHED AND THE CREATION OF THE BOOKER CREEK WORKING GROUP

The Town of Chapel Hill adopted a Stormwater Master Plan in 2014. This plan outlined goals and strategies to reduce flooding in Chapel Hill, to improve stormwater quality, and to protect and restore natural stream corridors. One of the initiatives identified to reach these goals is the development of plans for subwatersheds in Chapel Hill to provide detailed assessments of problems and specific recommended solutions.

The Town engaged the WK Dickson (Dickson) consulting firm to complete plans for the Booker Creek subwatersheds. Dickson worked with Town staff to produce a number of reports on Booker Creek between 2016 and 2020. the Dickson study contained diverse recommendations to work toward all three of the goals mentioned above.

The Dickson report proposed seven flood water storage basins, which involved clearing forests and excavating topsoil on floodplain sites that were owned or partially owned by the Town. The additional floodplain volume created by this excavation could then temporarily store flood waters and reduce downstream peak flood elevations to some extent. Although Dickson and the Town staff had done some public consultation on the watershed plans, many residents and Council Members did not understand the full environmental ramifications, cost, and benefits of the recommendations.

The Town Council approved proceeding with the design and construction of several of these projects on January 18, 2017 and approved funding them from stormwater bonds in September 2017. The highest priority project, the Elliott Road Storage Basin, was constructed between June 2020 and February 2021. The Elliott Road Storage Basin, also known now as the Booker Creek Basin Park, is located in the very visible area between Elliott Road and Eastgate Crossing. This project attracted public attention and drew attention to the plans for the other six basins that were not yet built.

When the Town Council approved the Dickson report for Booker Creek on May 5, 2021, including authorizing construction of the other six storage projects, many more Town residents became aware of the projects and started to look for information about them. In the summer and fall of 2021, the public began to ask more and more questions about the flood water storage projects. The Town held a special public information meeting on September 13, 2021, at which many speakers expressed detailed concerns about the projects.

Most of the public concern centered on two points. First, the removal of floodplain forests and the extensive excavation and removal of topsoil from the floodplain eliminated the climate moderation and carbon absorption benefits of these mature forests and eliminated extensive aquatic and riparian wildlife habitat. The quality of this habitat depends on the whole assemblage of the riparian forested habitat, which provides shade, cover, and food sources, together with the adjacent stream aquatic habitat. This type of habitat, which is rich in both riparian and aquatic species, is represented in most of

the proposed storage basin sites and is increasingly scarce in Chapel Hill. These environmental impacts were not documented and evaluated in the Dickson report and were given no weight in the priority setting process for recommended projects.

Second, the purpose of the flood water storage projects is to reduce flooding in terms of reducing flood damages to houses, businesses, and public infrastructure. These are the benefits that reduce the losses and suffering of individuals affected by flooding, but the Dickson report does not identify and quantify these most important benefits. In most studies of flood damage reduction projects carried out by public agencies, the costs of the recommended flood damage reduction measures are compared to the quantitative benefits of the projects in terms of reduced flood damages to determine whether proposed projects are economically justified. The storage projects are the costliest of the Dickson report recommendations, but Dickson did not determine whether the cost of the projects was justified as a public expenditure.

Public comments on the proposed flood water storage basins included these examples:

- The Dickson report included a long list of street addresses of structures potentially subject to flood damage in a 25-year flood, showing flood elevations under current conditions and how much they would be reduced if all the recommended flood water storage projects were built. However, this data is based on the lowest adjacent grade of each structure, which is the ground elevation adjacent to each structure as determined by remote sensing (lidar). This approach is much less useful than data on the lowest finished floor elevation when determining flood risk. The Dickson report does not allow us to determine whether these structures experience flood damages or not, the cost of the damages, or how much the construction of all the proposed projects would reduce the amount of the damages.
- The proposed Willow Drive project is the most expensive of the seven proposed flood water storage basins at $4.6 million. This project also has a big environmental impact with the loss of 15 acres of forest and associated climate, habitat, and water quality benefits. The report states that of the 26 structures now in the 25-year floodplain, only three would no longer be in the floodplain as a result of the project. This is a very small benefit for such an expensive project. Due to the less useful kind of data used in the Dickson report, we do not know how many of the 26 structures have actually experienced flood damages or how much these damages would be reduced by the project.
- Reducing hazardous flooding of streets is another goal of stormwater management. Modeling done by Dickson indicates that North Lakeshore Drive near the upper end of Eastwood Lake is flooded to a depth of 0.51 feet in a 25-year storm. Three of the proposed storage projects are upstream of this point: New Parkside Drive, Martin Luther King Jr. Boulevard, and Piney Mountain Road, with a total estimated cost of $9,817,000. The projects would also cause the loss of the habitat, climate, and water quality benefits of 16 acres of forest. The three projects would only reduce 25-year street flooding on North Lakeshore Drive by 0.11 feet, leaving the street still flooded at a depth of 0.4 feet and still hazardous. This small reduction in flood levels

does not justify the expenditure of almost $10 million and the significant loss of valuable environmental services.

- Dickson recommended the seven flood water storage projects based on a reconnaissance of the Booker Creek watershed, not on a detailed evaluation. Certain costs such as land rights and design work were left out of the estimates. The cost of the Elliott basin, the only one yet constructed, increased by 230 percent over the estimate in the Dickson report, not counting the additional costs related to recreational features. The Dickson report itself points out that for some of the basins land rights and major utility relocations may greatly increase costs over the estimated amounts. The strong probability that the costs of the recommended projects will more than double if constructed makes it even more doubtful that they are economically justified as public expenditures.

After considering the public comments on the flood water storage projects, the Town Council, at its September 22, 2021, meeting, reviewed the six unbuilt projects and withdrew their earlier approval. The Council resolution stated that the Town wanted to expand the scope of the watershed studies to consider the broader ecological context of Chapel Hill and the goals of the new Climate Action Plan, and to get a better understanding of the financial and environmental costs and benefits of the report recommendations. The Council approved the creation of a Working Group to be named by the Mayor to review the plans for stormwater management in the Booker Creek basin and to bring back recommendations for potential new directions.

Mayor Hemminger appointed ten residents to the Working Group who brought diverse experience and knowledge of the issues involved to the assignment. The Mayor gave the Working Group a charge, consisting of questions to address, which are stated in the next section of the report.

The Town assisted the Working Group in organizing virtual meetings as necessitated by the COVID pandemic, created an excellent website to make the record of Working Group meetings available to the public, and provided the services of an experienced facilitator. The Working Group held its first meeting on October 7, 2021. After adopting ground rules for its discussions and electing leaders, the Working Group took the lead on setting its agenda and beginning the investigation of potential new directions in stormwater management.

4.0 WORKING GROUP PROCESS

The Working Group started its deliberations by reviewing the Mayor's charge to us:

1. Where is it flooding in our community and by how much? (in layman's terms - 6 inches, etc.) How many homes, streets & businesses?
2. What ideas can help reduce flooding during big storm events - and by how much?
3. How to get the community engaged on their own properties with stormwater reduction?
4. How long do you think it will take to come back with short-term & long-term ideas?
5. Who is not at the table and what expertise are you still needing?
6. What role do our existing bottomland forests play in mitigating large stormwater events?

Throughout our meetings, we have explored the Mayor's questions and educated ourselves about what other communities in North Carolina have implemented. Brief summaries of our responses to the Mayor's questions follow:

Where is flooding happening in our community and how many homes, streets, and businesses are affected?

This question led us to the realization that the Dickson report did not identify specific structures that have experienced flood damages and how much these damages would be reduced by the recommended flood water storage basins. This kind of information on project benefits is normally included in studies of community flood problems and is a significant omission here. We are recommending that the Town's flood damage reduction programs be targeted toward quantitative reductions in damages to structures and public infrastructure to ensure cost-effective results, rather than simply building structures to retain more flood water.

What ideas can reduce flooding?

The Working Group reinterpreted this question from "reduce flooding" to "reduce flood damages" to focus Town programs on reducing specific losses and suffering experienced by residents and businesses. Our recommendations will target Town programs toward identifying and reducing these specific losses more effectively and expand their scope to include a wide array of measures to reduce damages.

How can we get the community engaged with stormwater reduction on their own properties?

Our recommendation regarding providing assistance to residents with small green stormwater infrastructure projects addresses this issue. Green stormwater infrastructure projects can improve stormwater quality, a high priority for the Town's stormwater program, and can cumulatively reduce flood peaks downstream.

What is the role of bottomland forests in mitigating flooding?

Bottomland forests provide significant benefits in slowing and reducing stormwater runoff and also important climate and wildlife habitat benefits. Bottomland forests are natural features that mitigate

flooding with no construction or maintenance cost. The Working Group proposes protection for these valuable and increasingly scarce resources in Chapel Hill.

4.1 HOW DID THE WORKING GROUP APPROACH THE MAYOR'S CHARGE?

The strategy of the Working Group was guided by several conclusions, some of which we reached right away while others developed as we went along.

Members of the Working Group brought a variety of knowledge and experience to our assignment, but none of us had experience working in a local government stormwater program. To respond to our charge, we decided to search for constructive program ideas that were already functioning successfully in other North Carolina jurisdictions. Many local government representatives generously attended our meetings and shared their experiences with us. As a result, the recommendations of the Working Group are not theoretical proposals but are based on programs that have been adopted by other local governments and have been proved effective in practice.

We recommend that the Town Council and staff, with review and contributions from the public, evaluate our recommendations and give them more detailed study to determine which recommendations can be integrated into Chapel Hill's stormwater programs.

Several Chapel Hill stormwater staff members came to our meetings and reviewed their existing programs for us. We came to understand and appreciate the key role of Town review and regulation of new development projects in reducing future flood damages. As stated in the Dickson Report,

> "*Based on the existing flooding in the watershed, it is highly recommended the Town strongly review any rezoning requests that will increase the impervious area and determine if additional stormwater measures are required. It is also highly recommended that the Town require green infrastructure and low impact development to the extent possible for both new development and redevelopment to promote infiltration and minimize increases to peak flow and volumes."*[4]

The working group's understanding of stormwater issues developed as we went along. As we heard from more communities about their experiences, we identified new subjects for investigation. Because we knew that each new issue we approached might shape the whole of our recommendations, we adopted a policy of giving tentative approval to recommendations as we went along, with the whole list of recommendations to be reviewed by the Working Group toward the end of our work.

The Town has created an excellent webpage[5] to gather materials to assist us in our work and to collect the record of each of our meetings. We invite those interested to visit the site to get more information on specific recommendations. Because this information about our meetings and the information we

[4] Town of Chapel Hill – Lower Booker Creek Subwatershed Study, WK Dickson & Co., Inc., Pages ES-12.
[5] https://www.townofchapelhill.org/government/departments-services/public-works/stormwater-management/know-your-watersheds/booker-creek-studies-and-projects

received is so conveniently available, we will not summarize our meetings in this report, but instead give the sources of some of our main recommendations.

At the end of our investigation, the Working Group reached the following understanding of the most effective way to manage community flooding problems:

Effective programs to reduce flood damages to homes, businesses, and public infrastructure have been in place in some jurisdictions for many years. There is extensive professional literature explaining how using this four-part strategy is the best way to reduce flood damages. The best community programs combine the four strategies, selected in the best mix for each specific location:

1. **Regulate new development to reduce stormwater runoff from the site to the minimum amount feasible.**
2. **Manage the floodplain to reduce vulnerability to flood damage. Examples include floodplain zoning to prevent building in flood hazard areas and acquisition of flood-prone land for open space and parks.**
3. **Mitigate the damages of flooding. Examples include floodproofing, elevation of structures, and buyouts of structures in the floodplain.**
4. **Control flood waters. Examples include dams, levees, flood water detention facilities, and stream conveyance improvements.**

4.2 SOURCES OF KEY WORKING GROUP RECOMMENDATIONS

As the Working Group proceeded, we sought recommendations that would strengthen the strategies that needed more emphasis and get the four strategies in the right balance.

A Mecklenburg County representative described their effective program to reduce flood damages, based primarily on the third strategy. This program identifies structures subject to flood damage and determines which mitigation measures are most cost-effective in each case. The County is able to report to residents yearly the cumulative benefits of this program in terms of reduced damage potential. Antonia Sebastian, a member of the Working Group, explained how to use modeling to develop a depth-damage curve, which can quantify the benefits of flood damage reduction programs. The Mecklenburg information led to our recommendation on cost-effective flood damage reduction, which responds to the Mayor's charge to the group to identify where flood damages are occurring and how they can be reduced. This recommendation strengthens the third strategy to mitigate flood damages.

Another charge to us was to find ways to get the community engaged in improving stormwater management on their own properties. Michael Dupree, a member of the Working Group, described a well-established program in Durham to give assistance to homeowners to make small scale improvements to reduce erosion, slow down stormwater runoff, and restore a more natural floodplain. These measures can improve stormwater quality and collectively reduce flood peaks. The Durham program and another good example of a similar program in Mecklenburg County led to our recommendation on green stormwater infrastructure.

Related to green stormwater infrastructure, a representative from NC State explained inexpensive but effective ways to use natural plant materials to reduce streambank erosion, which improves water quality and also protects houses and lots from damage by bank recession. We have recommended a demonstration project along Booker Creek to build interest and understanding in using this approach throughout the watershed.

The Town of Cary has recently made fundamental and far-reaching improvements in its stormwater programs. Cary has reduced flood vulnerability by buying land and/or structures in the floodplain to both reduce damages and provide more park and open space lands. Cary is also entering the FEMA Community Rating System, which requires strengthened floodplain management. These measures strengthen the second flood damage reduction strategy, to manage the floodplain.

The most innovative aspect of Cary's reform program is their robust effort to develop improved policies by setting up committees made up of stakeholders and Town staff members from several departments. Having the staff work directly with interested parties built up mutual understanding and resulted in implementable recommendations. We have recommended a similar approach to that adopted by the Town of Cary that Chapel Hill can use to evaluate and further develop our recommendations, through a partnership effort between staff and stakeholders.

Chapel Hill has only a limited amount of bottomland forests, which provide habitat for many land and aquatic species. The riparian land and the adjacent stream together provide the cover, shade, and food sources for many land and aquatic species. These forests also capture carbon and mitigate climate change. Bottomland forests help reduce flooding by allowing water to seep into the ground and by spreading out and slowing down the speed of floodwaters, which results in lower flood levels downstream. These combined benefits led us to recommend protective measures to keep Town-owned bottomland forests in their natural state. This recommendation responds to the mayor's charge to identify the function of bottomland forests in stormwater management.

4.3 OBLIGATION TO WEIGH THE BENEFITS AND COSTS OF MAJOR EXPENDITURES

The Town Council rescinded approval of the six unbuilt flood water storage projects for two main reasons. First, the environmental costs of project construction, including loss of mature forests and associated climate benefits and loss of valuable riparian and aquatic habitat were substantial, and were not documented and reported to the Council to help in their decision making. The prioritization process used by the Town and Dickson for recommended projects gave no weight to environmental factors. Second, the Dickson Report does not quantify the past flood damages to specific homes and businesses and show how much these damages would be reduced by the proposed projects. In addition, some of the cost elements of the proposed flood water storage projects were not included in the estimates given to the Council when the projects were approved. The Dickson cost estimates are only rough estimates and do not include the cost of purchasing land, relocating utilities, and other items. The cost of the Elliott project, the only one that has been built, was 230 percent over the cost provided to the Council,

not counting the additional costs for recreational features. These deficiencies prevented the Council from balancing the costs of the projects against their benefits to determine whether they were economically justified.

The Working Group recommends new standards for large stormwater projects that will ensure that the Council has reasonably accurate estimates of project benefits and costs, including environmental costs, before making decisions on future projects.

This recommendation responds to the Council resolution rescinding approval of the six unbuilt flood water storage projects, which expressed the need for more information about the costs and benefits and the environmental impacts of projects of this scale.

4.4 A POTENTIAL BENEFIT FOR OWNERS OF PROPERTY WITH FLOOD RISK

The Federal Emergency Management Agency manages the National Flood Insurance program, which allows homeowners to insure themselves against flood damages. (Standard home insurance policies do not cover flood damages.) FEMA is moving to adopt actuarial rates for flood insurance, which will mean big rate increases for many homeowners. FEMA encourages communities to join the Community Rating System, which requires stronger floodplain management policies to reduce future vulnerability to flood damages. In return, communities who join the program get lower flood insurance rates. We are recommending that Chapel Hill join this program, which will not only give residents a financial benefit, but will also strengthen the "manage the floodplain" aspect of flood damage reduction.

4.5 TWO KEY ISSUES REQUIRING TOWN COUNCIL CONSIDERATION

During our Working Group meetings two issues came up that we realized were important, but which were not either within our mandate or exceeded the time and resources we had to pursue them. The first one was whether we should make recommendations for the whole Town or just for the Booker Creek watershed. The language in the Mayor's charge seems to apply Town-wide, but we were created in response to specific issues at Booker Creek. Most of our members thought that our recommendations could apply Town-wide, since there are similar flooding and stormwater issues in all parts of Town. In addition, some of our recommendations are by necessity Town-wide, such as entry into the FEMA Community Rating System. But we also felt that most of the public consultation related to our project had focused on the Dickson reports on Booker Creek, and that there should be extensive public consultation Town-wide as our recommendations are evaluated and acted on by the Council. So, the resolution of this issue is passed on to the Town Council.

Second, we wanted to evaluate the effect of our recommendations on low-cost housing. This was more difficult to do because the Dickson study and the Town have not identified specific residential structures that have experienced flood damages and the amount of damage that has occurred. One thing is clear,

that any new affordable housing built in Chapel Hill should not be located where flood damage is likely. Low-income families are more vulnerable to the economic losses caused by flooding and should not be exposed to this danger. For existing low-cost housing, the Town should do what it can to help residents vulnerable to flood damages to reduce these risks. We believe that our recommendation on Cost-Effective Flood Damage Reduction is the best way to provide this relief, by targeting specific structures and evaluating a broad range of measures to reduce this vulnerability, thereby enabling the selection of the best approach for each case.

4.6 PUTTING THE RECOMENDATIONS IN CONTEXT

We are constantly seeing media reports from all over our country and all over the world of record-breaking floods caused by greater and greater weather extremes. We must understand that the projects we plan today to reduce flood damages may not provide the amount of security we are counting on.

After suffering from extensive flood damages from three hurricanes in recent years, the State of North Carolina has created an Office of Recovery and Resiliency to work systematically to reduce vulnerability to flood damages in the state. This Office carried out detailed studies of the Lumber, Tar, and Neuse River basins where flood damages had been the greatest. These studies considered a wide range of methods to reduce flood damages, including constructing dams and stormwater detention facilities, channel modification, levees, widening highway bridges to avoid backing up flood waters, and elevating structures or moving them out of the floodplain. The studies did preliminary plans for each of these methods and estimated the cost effectiveness of each strategy. The conclusion of these studies was:

> *Based on analysis performed as part of this effort, the Elevation, Acquisition, Relocation option is the most effective flood mitigation strategy based on time frame to implement, scalability of funding allocation, ability to target most vulnerable structures and communities, benefit/cost ratio and potential positive environmental impact.*[6]

The Working Groups recommendations are consistent with the policy direction set by this major recent state study.

[6] NC Division of Emergency Management and NC Department of Transportation, Neuse River Basin Flood Analysis and Mitigation Strategies Study, May 1, 2018, https://www.rebuild.nc.gov/documents/files/neuse-mitigation-report/open.

5.0 WORKING GROUP RECOMMENDATIONS

Recommendation 1: Advancement of Green Stormwater Infrastructure

Recommendation 2: Streambank Stabilization Project Assistance

Recommendation 3: Cost Effective Flood Damage Reduction

Recommendation 4: Preserving and Protecting Bottomland Forests and Natural Stream Corridors in Chapel Hill

Recommendation 5: Modification to the Land Use Management Ordinance (LUMO) to Address the 100-Year Storm Event in Chapel Hill

Recommendation 6: Community and Staff Engagement in Stormwater Policy Improvement

Recommendation 7: Standards for Approving Major Stormwater Projects

Recommendation 8: Chapel Hill entry into the FEMA Community Rating System (CRS)

Recommendation 9: Setting Funding Priorities for the Maintenance of Existing Stormwater Facilities in Chapel Hill

Recommendation 10: Utilizing Existing Water Bodies for Flood Water Storage

RECOMMENDATION 1: ADVANCEMENT OF GREEN STORMWATER INFRASTRUCTURE

This recommendation responds to the Mayor's framing question 3: How to get the community engaged on their own properties with stormwater reduction?

1. Summary

A new program to deliver residential green stormwater infrastructure and flood resilience assessment and installation services to interested residents. "Green stormwater infrastructure" does not have a precise definition, but the term refers to stormwater management measures that typically have lower costs and lower environmental impacts than measures involving significant construction such as earth moving, concrete structures, etc. The goal of the program is to support and empower homeowners to pursue stormwater and flood resilience-related improvements to their homes or lots. These objectives are accomplished by providing technical assistance and cost share agreements to assist landowners with the cost of the installation of green stormwater infrastructure on private property. A small percentage of the stormwater utility fee could be allocated to provide these new services.

2. Program Operation and Benefits

Green stormwater infrastructure has been an effective tool to reduce stormwater runoff in municipalities around the country. Green stormwater infrastructure improves water quality, protects property values by reducing erosion, protects streams by reducing sediment delivery, and can reduce flood peaks in streams during storm events by providing retention and detention of stormwater runoff on site. https://www.epa.gov/green-infrastructure/benefits-green-infrastructure

All green stormwater infrastructure practices would be designed and installed according to the NC Department of Environmental Quality (NCDEQ) Minimum Design Criteria listed in this reference: Stormwater Design Manual | NC DEQ

In October of 2021, The Booker Creek Neighborhood Protection Alliance (BCNPA) recommended 29 stormwater practices that are currently being used in municipalities around the country. Some of these practices are recommended in the North Carolina Stormwater Manual. A few of the practices that Chapel Hill residents have expressed an interest in installing include:

- Down Spout Disconnection/Disconnect Impervious Surface https://deq.nc.gov/media/17544/download
- Cisterns and Rainwater Harvesting https://deq.nc.gov/media/17541/download
- Rain Gardens and Bioretention Cells https://deq.nc.gov/media/17536/download

The Orange County Soil & Water Conservation District (OCS&WD) has a program to provide technical assistance and cost-share funding opportunities to assist landowners with the cost of green stormwater

infrastructure on private property: https://www.orangecountync.gov/727/Soil-Water-Conservation-District. The OCS&WCD offers these services for non-agricultural related properties (from their website):

- Non-Agricultural Related Services
- Closure of Abandoned Wells
- Community Conservation Assistance Program (CCAP) for existing residential, commercial, public, and private buildings
- Educational Programs for Youth and Adults
- Riparian Restoration Along Streams
- Urban Erosion Control and Storm Water Controls

The Town should consider how much of the need for green stormwater infrastructure projects in Chapel Hill is being currently met by the Orange County Soil and Water Conservation District program. The Town should supplement this County program as needed to meet Town needs and extend it to include types of beneficial projects that Town residents need which are not provided by the County program.

The Dickson Booker Creek subwatershed studies identified green stormwater infrastructure retrofits in some neighborhoods that would improve water quality and estimated the cumulative benefits if these projects were installed on several properties. This recommendation includes funding for some of these projects that have already been identified.

3. Differences from Current Chapel Hill Approach

The Town does not have a program to provide technical assistance and cost share services to assist with green stormwater infrastructure installation on private property. This project will further expand the level of service that Town staff have been able to provide and more broadly be an important component of efforts to create a more flood resilient community and to be a better steward of the Jordan Lake regional water resource.

4. Who benefits? Who bears the cost?

Green stormwater infrastructure practices benefit the landowner and the community.

Community Benefits: Green stormwater infrastructure improves water quality, reduces sediment and nutrient delivery to streams, protects stream biodiversity, and provides retention and detention of stormwater, which can reduce flood peaks in the stream during storm events.

Most often the lowest income people in the community are located where they suffer the consequences of stormwater runoff as a result of the lack of management of runoff upstream. The installation of green stormwater infrastructure that is concentrated in sub-watersheds upstream of areas that have flooding can have a positive impact on the quality of life of those individuals downstream.

Several local governments in North Carolina offer cost share assistance to landowners to install green stormwater infrastructure. These programs offer 75% to 100% of the cost of the installation of the

practices. In Raleigh, the Rainwater Rewards program will cover 90% of the cost of practices. In Durham County, the Impaired Stream Improvement Program will cover 100% of the cost of practice installation for landowners who self-certify that they have income below the poverty level. In Mecklenburg County, practices are cost shared at 75%. Some of these programs are supported by USDA funding and some by general revenues.

5. Sources

There are multiple programs that are being implemented in the state of North Carolina.

- City of Charlotte/Urban Cost Share Program
  - https://conserve.mecknc.gov/resources/urban-cost-share-program
- City of Raleigh/ Rainwater Rewards Program
  - https://raleighnc.gov/stormwater/services/apply-raleigh-rainwater-rewards
- North Carolina Division of Soil & Water/Community Conservation Assistance Program
  - http://www.ncagr.gov/SWC/costshareprograms/CCAP/index.html
- Environmental Quality (NCDEQ) Minimum Design Criteria
  - https://www.deq.nc.gov/about/divisions/energy-mineral-and-land-resources/stormwater

RECOMMENDATION 2: STREAMBANK STABILIZATION PROJECT ASSISTANCE

This recommendation responds to the Mayor's framing questions 2 & 3. 2) What ideas can help reduce flooding [flood damages] during big storm events - and by how much? 3) How to get the community engaged on their own properties with stormwater reduction?

1. Summary

The Lower Booker Creek Subwatershed Study report prepared by Dickson identified sites that need streambank stabilization. The recommendation is to provide private landowners with funding to repair and protect streambanks using streambank stabilization techniques developed by the North Carolina Division of Soil and Water Conservation, Charlotte Mecklenburg Stormwater, and the North Carolina Cooperative Extension Service. Links to these design tools are in section 5 below.

2. Program Operation and Benefits

Streambank stabilization is the use of vegetation to stabilize and protect banks of streams, lakes, estuaries or excavated channels against scour and erosion. This practice should be used to prevent the loss of land or damage to utilities, roads, buildings, or other facilities adjacent to the banks, to maintain the capacity of the channel, to control channel meander that would adversely affect downstream facilities, to reduce sediment load causing downstream damages and pollution and to improve the stream for recreation and fish and wildlife habitat.

This practice is very cost-effective, requiring minimal design and permitting requirements from state and federal agencies. This practice does not disturb or alter the stream channel and focuses on streambank reshaping and revegetation.

3. Differences from Current Chapel Hill Approach

This practice would be one of the green stormwater infrastructure tools that are part of Recommendation 1: Advancement of Green Stormwater Infrastructure. By stabilizing the banks of streams, the Town of Chapel Hill will save money on cleanup efforts after major storm events. Stormwater delivers sediment and organic materials downstream, clogging infrastructure which can cause flood damage by backing up water. Streambank erosion is the number one source of sediment during a storm.

Properly designed, streambank stabilization substantially increases the capacity of the stream channel thereby reducing downstream peak flows. This is the most economical practice that increases flood resiliency for downstream landowners as well as reducing the amount of sediment and debris during a storm.

The Orange County Soil and Water Conservation District offers technical, financial, and educational advice to Orange County property owners. The Town of Chapel Hill should determine how it can advise and encourage property owners to take advantage of this County program, to what extent the County can meet Chapel Hill's need for this kind of service, and to whether the Town should supplement County assistance with its own resources.

4. Who benefits? Who bears the cost?

Landowners that have streams that cross their property soon discover that it is against the law for an individual to impede or alter the natural flow of water. Streams are regulated by government agencies. The stream bed is regulated by a federal agency, the United States Army Corps of Engineers; the streambank is regulated by a state agency, the NC Division of Water Resources.

Often the streams that are impacted the most by streambank erosion are in older neighborhoods, often affecting lower-income households. These individuals are less likely to have the financial resources necessary to improve or repair the stream. In Durham County, the County created the Impaired Stream Improvement Program to address this inequity. The landowner applies for streambank stabilization funding and the County staff hires an environmental contractor to provide bank reshaping and revegetation practices as defined in the state manual.

It is in the Town's best interest to stabilize streambanks by environmentally sound methods which will reduce sediment delivery downstream, reduce the cost of cleanup efforts by public works staff after storm events, and reduce the damage to utilities and infrastructure near the stream.

5. Sources

- **North Carolina Division of Soil & Water Conservation**
  https://www.ncagr.gov/SWC/costshareprograms/CCAP/documents/Chapter11StreambankandShorelineProtection.pdf
- **Charlotte Mecklenburg Stormwater Services**
  https://www.charlottenc.gov/Services/Stormwater/Surface-Water-Quality
- **North Carolina Cooperative Extension**
  https://www.bae.ncsu.edu/workshops-conferences/wp-content/uploads/sites/3/2017/07/Small-scale-Solutions-to-Eroding-Streambanks.pdf
- **For more information on what practices are funded by CCAP and administered through OCS&WCD**
  https://www.ncagr.gov/SWC/costshareprograms/CCAP/BMPs.html

RECOMMENDATION 3: COST-EFFECTIVE FLOOD DAMAGE REDUCTION

This recommendation responds to the Mayor's framing questions 1 & 2: 1) Where is it flooding in our community and by how much? (in layman's terms - 6 inches, etc.) how many homes, streets & businesses? 2) What ideas can help reduce flooding [flooding damages] during big storm events – and by how much?

1. Summary

A program to reduce flood damages to structures by identifying specific structures with flood risk, assigning a quantitative risk factor to each, evaluating a wide range of mitigation measures to determine which is most cost-effective in each case, and setting a priority list for capital budgeting based on selecting the most cost-effective projects to implement with available funds.

2. Program Operation and Benefits

This program will directly address reducing flood damages to homes and businesses by a systematic, quantitative method so that program expenditures can be evaluated for cost-effectiveness. Specific structures at risk of flood damage will be identified and given a quantitative risk rating. For each structure, a wide range of damage mitigation measures will be evaluated. These measures, successfully used and proven in practice around the country, include property acquisition and demolition, property acquisition and relocation, elevation of structures, abandonment of basements, dry and wet floodproofing, small floodwalls to protect one or more structures, elevating HVAC equipment, and others. The next step is to determine the most cost-effective mitigation measure for each structure, then to set priorities considering both cost-effectiveness and community factors such as public safety. The mitigation measures are then selected in priority order for the government unit's capital budget. Town staff can then report to the Town Council how much quantitative reduction in potential flood damages has been achieved by public expenditures each year.

3. Differences from Current Chapel Hill Approach

The recommended new approach will shift the Town's goal from preventing flooding to the broader and more beneficial goal of preventing flood damages. Chapel Hill now relies mainly on controlling flood waters, partly through regulation of new development and increasingly on flood water detention in the proposed flood water storage projects. The Town Council rescinded approval of the six unbuilt flood water storage projects in order to have a greater understanding of the financial and environmental/ecological costs and benefits of the solutions being considered.. A better approach to protecting structures from flood damage is to focus on structures at risk and to consider a wide range of mitigation measures to choose the most cost-effective one for each structure. The result will be a more targeted reduction in flood damages with less cost and less environmental damage. Unlike the proposed flood water storage projects, the benefits of public expenditures will be clearly quantified.

The Town has made some steps toward the direction of this recommendation, such as requiring new structures in the floodplain to be elevated two feet above the base flood elevation, mandating floodproofing in certain cases, and buying out properties subject to flooding. We are recommending that a broader range of flood damage mitigation measures be considered and that this approach be intensified and made the center of Town policy for this purpose.

4. Who benefits? Who bears the cost?

All Town taxpayers and stormwater fee payers will benefit by having their funding targeted to the most cost-effective methods to reduce flood damages to identified structures. Home and business owners vulnerable to flood damage will receive effective assistance in reducing this danger. With flood damages reduced, property values will increase.

The cost of flood damage mitigation will be shared by the property owners and the Town under policies set by the Town. The Town's contribution will come from some combination of general revenues and stormwater fees.

5. Sources

The most fully developed and proven program in North Carolina for reducing flood damages is in Mecklenburg County. Here is David Kroening's presentation to the working group on the Mecklenburg program:

- David Kroening: Charlotte-Mecklenburg Storm Water Services
- Consultant report for Mecklenburg on flood damage reduction:
- https://stormwaterservices.mecknc.gov/flood-management-risk-tools-and-flood-sensors

RECOMMENDATION 4: PRESERVING AND PROTECTING BOTTOMLAND FORESTS AND NATURAL STREAM CORRIDORS IN CHAPEL HILL

This recommendation addresses the Mayor's framing question 6: What role do our existing bottomland forests play in mitigating large stormwater events?

1. Summary

Recognizing the bottomland forest ecosystem's contribution to reducing the impact of climate change, protecting clean drinking water in Jordan Lake, providing aquatic and wildlife habitat, and enhancing biodiversity, and moderating peak stream flows we recommend permanently protecting and expanding valuable bottomland forests and aquatic ecosystems in Chapel Hill.

2. Program Operation and Benefits

This recommendation would protect existing Town-owned bottomlands, streams, and other aquatic ecosystems by placing a conservation easement on the properties and by acquiring additional flood plain properties with the goal of creating unbroken forested corridors. In addition to easements and land purchases, protection of targeted bottomlands can be supported by land use planning and appropriate rules to limit development that would encroach on these areas. These recommendations will have the following benefits:

- **Mitigation of Stormwater and Flooding:** The value of bottomland forests and stream corridors cannot be over emphasized. Forested bottomlands and riparian areas naturally mitigate flooding by intercepting floodwaters and reducing velocity after storms. The forests' irregular natural topography, presence of organic debris and pervious soils impede and absorb floodwaters. Bottomland forests are effective stormwater and flooding mitigation systems, and they operate for free. For this reason alone, they should be protected and expanded as a high priority for Chapel Hill.
- **Ecosystem Services:** Bottomland forest and natural stream corridors have many other functions and values that are noteworthy, including carbon sequestration, wildlife habitat and travel corridors, cool microclimates compared to open areas, habitat for fish, amphibians and reptiles and places for human meditation and escape from the developed world. These "Ecosystem Services" are critical to life itself since they include production of oxygen through photosynthesis and protection of clean water.
- **Increased Opportunities for Recreation:** Acquisition of more land in these forested bottomland corridors can have the added benefit to the Town by providing green space, walking trails, wildlife observation opportunities, improved aesthetics, and other social benefits. Increasing protected forested green space will have long-term benefits for Chapel Hill. Chapel Hill currently has below average percentage of lands in this category compared to other towns of similar size. Our recommendations could change this condition for the long-term benefit of the Town.

3. Differences from Current Chapel Hill Approach

Chapel Hill does not currently have a plan to permanently protect the Town-owned bottomland forest from being removed. We are losing our forests and the percentage of land in natural forests compared to non-forested areas is rapidly declining. We need to permanently protect our bottomland forests as well as the land in the flood zones.

Many of the bottomland forests and stream corridors are located along greenway trails. The preservation of these mature forests along the trails will ensure that heat islands are not created. In a time of extended periods of high temperature due to climate change the trees reduce the cost of cooling in the homes and apartments that surround them. Some of the existing forests along stream corridors are located near more affordable housing. Many families from all walks of life play in the steam corridors and use them for transportation during the very hot summer days.

When prioritizing the preservation of the forests, the Town should take into consideration the accessibility of the property to housing that is more affordable and ensure that the forests are accessible to all residents.

4. Who benefits? Who bears the cost?

The taxpayers will bear the relatively low cost of preserving the forests. Grants could be applied for to offset the cost.

5. Sources

- Emerging EPA guidelines recognize the importance of targeted pollutant reduction: “Traditional stormwater management approaches that rely on peak flow storage have generally not targeted pollutant reduction and can exacerbate problems associated with changes in hydrology and hydraulics.” The benefits of effective stormwater runoff management can include protection of wetlands and aquatic ecosystems.
- Will Harman – Hierarchy of Stream Functions and Restoration

RECOMMENDATION 5: MODIFICATION TO THE LAND USE MANAGEMENT ORDINANCE (LUMO) TO ADDRESS THE 100-YEAR STORM EVENT IN CHAPEL HILL

This recommendation addresses the Mayor's framing question 2: What ideas can help reduce flooding [flood damage] during big storm events - and by how much?

1. Summary

Chapel Hill's current stormwater management ordinances are designed to address a 25-year storm event. However, with increasing impermeable land due to development and climate change leading to stronger, longer, and more frequent storms, Chapel Hill should consider updating its Land Use Management Ordinance (LUMO) to consider the 100-year storm event. The Town should evaluate the benefit of updating the stormwater ordinance to incorporate level of service requirements relative to storm frequency (25-yr vs 100-yr) for example. This would include implementing new stormwater ordinances that improve drainage infrastructure and updating land management requirements for stormwater retention practices.

2. Program Operation and Benefits

The Town of Chapel Hill is working on a rewrite of the LUMO which will be a multiyear process. It is not necessary to wait for the entire LUMO to be updated to implement this change. The Town Council can implement this change to the existing LUMO with a public hearing and a vote. Implementing this change quickly will improve the mitigation of stormwater and flooding as we continue to build in Chapel Hill.

3. Differences from Current Chapel Hill Approach

Chapel Hill currently has stormwater management ordinances to address a 25-year storm event.

4. Who benefits? Who bears the cost?

As Chapel Hill continues to build and the storms continue to intensify, more residents will experience flooding. Making sure that new development does not add to the existing problem will be critical, especially to residents who are not able to afford remediation and to the roads that everyone must use. The cost of this program will primarily be an incremental cost to the developer of the property. Affordable housing developments could request funding from the stormwater fund to help cover the extra expenses of building to meet the 100-year storm level requirements for controlling run-off.

5. Sources

- https://nrcsolutions.org/mapping-planning-regulation-regulatory-and-policy-approaches-to-address-hazards/

RECOMMENDATION 6: COMMUNITY AND STAFF ENGAGEMENT IN STORMWATER POLICY IMPROVEMENT

This recommendation addresses the Mayor's framing question 5: Who is not at the table and what expertise are you still needing? A broader range of expertise and stakeholder representation will be needed to develop detailed program plans from the policy recommendations made by the Working Group and to integrate them with existing Town stormwater programs.

1. Summary

After receiving the Working Group recommendations, the Town can carry the effort further by assigning responsibility for stormwater program improvement leadership within the Town staff and engaging a wide range of stakeholders to work directly with Town staff members to develop detailed program changes and action plans. The Town of Cary has provided an example of how this broader effort can be very effective. Chapel Hill could choose to follow their example as adapted to meet our needs.

2. Program Operation and Benefits

We can learn from the successful initiation and operation of community engagement efforts by neighboring towns. The Cary initiative, for example, began with strong leadership by the Town Manager. The Town established three objectives for stormwater management improvements: restoration of open space, flood mitigation, and reduction of flood losses. To pursue these objectives, the Town established six committees:

- Steering Committee
- Stakeholders
- Basin Modeling
- Town Ordinances
- Open Space
- Maintenance

On most of these committees Town staff members from several departments worked closely with such stakeholders as home and business owners and developers. Having staff members work directly with stakeholders built mutual understanding and led to recommendations that had consensus support.

The Committee recommendations have led to many specific policy and program improvements. Some examples are:

- Changing Town ordinances to require mitigation of the 100-year flood and making grants to help developers meet this standard.
- Developing a dynamic flood model to allow flood damages to individual structures to be evaluated. Consideration of a range of measures determined the most cost-effective method to

reduce damages in each case. In some cases, the Town has bought structures with repeated flood damages and converted the sites to open space.

- Setting priorities for acquiring Town-owned open space to meet both recreation and flood damage reduction purposes.
- Higher standards for floodplain management to reduce future flood losses and to give residents lower rates on flood insurance through entry into the FEMA Community Rating System.
- An innovative program that can pay developers to install stormwater management improvements with significant public benefits as a part of their own construction contracts. The Town benefits by getting quicker construction and lower costs.

3. Differences from the Current Chapel Hill Approach

Chapel Hill's current stormwater program uses several means of community engagement, primarily surveys and public information meetings. This recommendation calls for a more intensive cooperation between the Town and stakeholders.

Under this recommendation, the Town staff would work directly with stakeholders and outside experts in committees with specific assignments, such as improving Town ordinances and using basin models to find the most cost-effective flood damage reduction measures. Collaboration between the staff and stakeholders would build mutual respect and understanding and produce consensus recommendations with a good chance of adoption. Leadership by the Town Manager would guide follow up and implementation.

4. Who benefits? Who bears the cost?

Town residents would benefit from better targeted and more effective stormwater programs resulting from a close partnership between Town staff and key stakeholders. This partnership would bring together the knowledge and experience needed to find solutions to problems.

The cost of Town participation in this joint effort would be covered by Town general revenues.

5. Sources

- Cary's Adaptive Stormwater Journey
- Adaptive Stormwater 5.1.18
- The Path to the Community Rating System

RECOMMENDATION 7: STANDARDS FOR APPROVING MAJOR STORMWATER PROJECTS

This recommendation responds to the Town Council resolution of September 22, 2021, rescinding approval of the six unbuilt flood water storage projects and expressing a need for greater understanding of the financial and environmental costs and benefits of solutions being considered for stormwater management.

1. Summary

The mission statement developed by the Booker Creek Working Group appointed by Mayor Hemminger sets out principles and standards to assure that our recommendations meet a high standard of cost effectiveness, minimization of environmental damage, and equity. The Working Group recommends that significant Town stormwater management projects meet these same standards.

2. Program Operation and Benefits

Town stormwater projects of significant cost and potential environmental impacts should meet the following standards:

- Costs should be estimated by including all foreseeable types of cost and using the best available data. Benefits should be estimated for specific types of results, such as avoiding street flooding during storms of specified frequency or reducing property damages to houses and businesses. In the case of structural flood damage, an estimated depth damage curve should be developed to determine estimated monetary benefits. Benefits should exceed costs for any project to be approved. If project costs increase greatly above amounts approved by the Council during project design, the project should be resubmitted to the Council for review and reconsideration.
- Environmental damages related to a proposed project should be described using available quantitative data. All negative impacts such as loss of forest stands and associated climate benefits, damage to riparian and aquatic habitat, and loss of wetlands should be considered.
- Projects should be reviewed for equity considering all income and demographic groups in the project area.
- A summary of project benefits and costs, environmental impacts, and equity considerations should be presented to the Council before a decision on project approval and funding.

3. Differences from the Current Chapel Hill Approach

The seven proposed flood water storage projects can be used as an example. The Dickson study and other Town materials do not estimate the benefits of the projects in terms of reduced flood damages to houses and businesses. The Town did not do an additional modeling step that would allow depth damages curves to be estimated. A long table in the Dickson report shows potential reductions in flood

elevations at many different addresses in the Booker Creek watershed. But the Town used remote sensing data to estimate the depth of flooding based on the lowest adjacent grade, which does not have the usefulness of data on the lowest finished floor elevation. The Town did not determine whether flood damage was actually occurring at these addresses or whether the proposed projects would significantly reduce damages. Therefore, project benefits cannot be compared to project costs.

On the cost side, the cost of the Elliott Road flood water storage project increased from $1,140,000 to $2,645,000 after consideration and approval by the Council (not counting additional funds added for recreation features). As a result of these deficiencies in both cost and benefit information, the Council was not able to make an informed judgment about whether the proposed projects were economically justified.

The Dickson report did not include an environmental assessment documenting the loss of mature forests and associated climate benefits or the significant loss of wildlife and aquatic habitat that would result from the clearing of riparian forests and the excavation of floodplain topsoil. This information was therefore not available to be weighed by the Council when the projects were approved.

4. Who benefits? Who bears the cost?

The Town Council would benefit by having the information needed to make good decisions on major stormwater projects. The Council could weigh estimated costs against benefits to determine if the expenditure of public funds is justified. The Council would be able to weigh the environmental costs of approving projects. Town residents would benefit by having their taxes spent more responsibly.

The cost of the additional data gathering to support better decisions would be covered by Town general revenues or stormwater fees.

5. Sources

The most fully developed and proven program in North Carolina for reducing flood damages is in Mecklenburg County. Here is David Kroening's presentation to the working group on the Mecklenburg program:

- David Kroening: Charlotte-Mecklenburg Storm Water Services
- Consultant report for Mecklenburg on flood damage reduction: https://stormwaterservices.mecknc.gov/flood-management-risk-tools-and-flood-sensors

RECOMMENDATION 8: CHAPEL HILL ENTRY INTO THE FEMA COMMUNITY RATING SYSTEM (CRS)

This recommendation responds to the Mayor's framing question 2: What ideas can help reduce flooding [flood damages] during big storm events – and by how much?

1. Summary

The Community Rating System provides incentives to a community to implement new floodplain management standards and policies. These higher standards will reduce future flood damages and provide reduced flood insurance premiums for the community's property owners.

There are four areas in the CRS program – Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness – containing 19 activities for which a local government can accrue points toward a reduction in flood insurance premiums.

2. Program Operation and Benefits

- Reduction of Flood Premium rates for property owners. Rate reduction for high hazard areas from 5 to 45%. Rate reduction for low hazard areas from 5 to 10%
- Increased public information concerning flooding, including real estate disclosure to prospective buyers.
- Mapping and Regulations including guaranteeing that currently open public or private floodplain parcels will be kept free from development.
- Flood Damage Reduction to existing development including a flood hazard mitigation plan, floodproofing, elevating, acquisition, and drainage system maintenance.
- Flood preparedness, including a system for recognizing the threat of dam failure, practicing emergency responses, and coordinating with operators of critical facilities.

3. Differences from the Current Chapel Hill Approach

Chapel Hill currently practices many of the activities outlined by this program. The activities need to be documented and enhanced to participate in the program and receive reduced flood insurance rates.

Reduced rates will benefit homeowners, businesses, UNC, and all Town-owned properties. Additional benefits include enhanced public knowledge of flood hazards, flood preparedness, and less property damage.

4. Who benefits? Who bears the cost?

The FEMA requirements include real estate disclosures. Chapel Hill should enhance the notification requirement to include all landlords of residences and businesses. When a property that floods is rented

or changes ownership, the new residents should be informed about the flood risks they take on. New residents should also be made aware of the Orange County OC Alerts Program to get flood warnings.

Many residents who have flood insurance policies will benefit by getting lower premiums on their policies.

5. Sources

- A short FEMA document that describes the program: https://www.fema.gov/floodplain-management/community-rating-system
- Link to the Booker Creek Working Group's April 25, 2022 presentation that was given by the Stormwater Staff in Cary: https://chapelhill.granicus.com/MediaPlayer.php?clip_id=5656
- FEMA's new methodology (Risk 2.0) for determining flood insurance rates which results in higher rates for high-risk properties: https://www.fema.gov/flood-insurance/riskrating

RECOMMENDATION 9: SETTING FUNDING PRIORITIES FOR THE MAINTENANCE OF EXISTING STORMWATER FACILITIES IN CHAPEL HILL

1. Summary

A recommendation to set and fund priorities and report annually to the Town Council on the maintenance of existing stormwater facilities, including stormwater basins. Reporting to include the status of Town-owned facilities, DOT-owned facilities, and facilities that were built on private property as part of the development approval.

Ongoing maintenance is critical to the performance of every stormwater system. Without regular maintenance, the system will eventually fail due to sediment buildup and structural issues. Routine upkeep can prevent costly rehabilitative and restorative repairs. Maintenance plans should include inspection of all structures, removal of trash and debris, sediment control, structural maintenance (stabilizing poor soil coverage and erosion), and vegetation management (mowing grass, removing nuisance or invasive growth, managing beneficial species).

2. Program Operation and Benefits

- Culverts that have filled in with silt and debris cause urban flooding. A maintenance plan which includes annual reporting to the council will prioritize maintenance within the stormwater department.
- The culverts that are under DOT-maintained roads are currently not maintained by Town staff. Failing to maintain these culverts can lead to flooding of the Town's major artery roads and the surrounding area. Town staff needs to ensure that the DOT road culverts remain free of silt and debris either by following up with the DOT to complete the work or completing the work within the department.
- The new Elliot Road Storage Basin (Booker Creek Basin Park) does not have a maintenance plan. Creating and funding a plan to remove invasive growth and ensure that the replacement trees survive is critical to the functioning of the basin and to its use as a park.
- New developments are responsible for maintaining their stormwater infrastructure. Requirements for annual reporting and the issuing of an Evergreen Letter of Credit for maintenance security should be instituted. See below for an example of this program in Cary.

3. Differences from the Current Chapel Hill Approach

- The Town does not require Evergreen Letters of Credit from private developers or on public projects.
- The new Elliott Road Storage Basin does not have an ongoing maintenance plan.
    - The invasive species in the wetland area were not removed when the basin was created. There is no plan (other than a one-year warranty to replace plantings) to ensure that the

replacement trees will survive. The loss of native vegetation will impact water quality and increase the water flow rate. The Town needs to follow the maintenance practice that is required of private residents. When the Lake Forest Association created a forebay for Eastwood Lake, they were required by the permit to have a five-year maintenance plan on the section of the creek that they restored as a tradeoff for being permitted to create the forebay. This included an annual review by Town stormwater staff and replanting all plants that did not survive. A formal report was created and executed for five years.

- As stated in the Dickson study, all basins require ongoing maintenance for them to be effective.

4. Who benefits? Who bears the cost?

Chapel Hill is currently in the process of expanding its housing supply. The Evergreen Letters of Credit would cost the developers as well as allocating staff time to oversee the program. Ensuring that the stormwater facilities continue to perform as designed will benefit the residents of the housing as well as the Town as a whole in terms of mitigating the flooding of roads and residences.

5. Sources

- The Town of Cary's program to ensure maintenance of stormwater facilities on new developments, including the Evergreen Letter of Credit for maintenance security.
- https://www.carync.gov/services-publications/water-sewer-stormwater/stormwater/watershed-protection-and-nitrogen-control/stormwater-control-measure-paperwork
- Town of Chapel Hill Lower Booker Creek Subwatershed Study, Prepared by W. K. Dickson & Co, Volume I: Report, Draft Report Comments 01/13/2017, Pages 22 and 24
- Community input from Paul Jansen on 11/15/2016:

Restoration and Maintenance: From experience, the construction is easy compared to the restoration and maintenance required to keep these detention basins functional. Plantings have to be timed in very tight planting windows and then irrigated to make sure they take. Once the protective canopy and forest root system are removed, storms will wash away soil and plants before they root and take. Invasive plants and weeds need to be removed on a regular basis and replacements made for new plants that don't survive. These public detention areas are routinely neglected. By contrast, the natural wetland system that currently exists appears to be working in the New Parkside and ML King areas.

RECOMMENDATION 10: UTILIZING EXISTING WATER BODIES FOR FLOOD WATER STORAGE

1. Summary

This recommendation supports the use of existing water bodies for flood mitigation projects. The two primary projects of interest are Lake Ellen and Eastwood Lake. Lake Ellen is a 7-acre lake in the Booker Creek headwaters. Eastwood Lake is a 50-acre lake further down in the watershed. Both are privately owned lakes that are formed by dams on Booker Creek. These lakes were built for recreation and aesthetic reasons and were not designed for flood management. We recommend the Town form private-public partnerships to utilize existing water bodies for flood mitigation.

Both lakes have a tremendous benefit in that they are already existing water storage facilities. **As stated in the Booker Creek report, Eastwood Lake is the "largest potential floodplain storage facility in the Booker Creek watershed."**

2. Program Operation and Benefits

Using existing water bodies for flood water storage can be achieved by lowering the permanent water level below the current level maintained by the dams. The difference between the current water level and the lowered level would provide flood water storage. This may require modification to existing structures (dams), as well as some stabilization of the shoreline. A permanent lowering has the benefit of providing flood water storage whenever it is needed. Another possible source of flood water storage is to lower the water level seasonally or in anticipation of a storm. These approaches require more active management than the permanent lowering of the water level but may also provide additional storage and be more acceptable to adjacent residents.

3. Differences from the Current Chapel Hill Approach

The Town of Chapel Hill has already been pursuing Lake Ellen as a possible flood water storage project and we support the Town continuing to pursue this project.

Eastwood lake was not identified as a possible flood water storage project in the past; however, members of the Eastwood Lake community have shown recent interest in working with local officials to explore how the lake could be useful for both recreation and flood water storage.

4. Who benefits? Who bears the cost?

These projects have the potential to be a significant win-win-win. There are benefits to the residents at these private facilities to have the support of the Town in maintaining the water bodies' infrastructure. There is a benefit to downstream residents to increase the flood water storage capacity of the watershed. The final win is for the environment, as these projects utilize existing water bodies, thereby limiting environmental impact.

Private-Public partnerships can be challenging to negotiate; however, based on the significant benefits of these projects we support the Town working with these communities to make the most of the existing Town infrastructure. This could require seeking grants or consulting mediators with experience in negotiating similar agreements. The Town can serve as the government partner needed to leverage state funding for these projects.

5. Sources

Town of Chapel Hill Lower Booker Creek Subwatershed Study, Prepared by W. K. Dickson & Co, Volume I: Report, SECTION 4: FLOOD MITIGATION ALTERNATIVES. September 2018, Page 4-3.

Eastwood Lake is owned by The Lake Forest Association.

Lake Ellen is owned by the Lake Ellen Homeowners Association.

6.0 ADDITIONAL RESOURCES

The Resource Institute is a 501 C based out of Winston Salem that manages water related projects including applying for state grant funding: https://www.resourceinstituteinc.org/.

Many resources are included in the source section of individual recommendations.

7.0 WORKING GROUP DETAILS

Mayor's Framing Questions

1. Where is it flooding in our community and by how much? (in layman's terms - 6 inches, etc.) how many homes, streets & businesses?
2. What ideas can help reduce flooding during big storm events - and by how much?
3. How to get the community engaged on their own properties with stormwater reduction
4. How long do you think it will take to come back with short-term & long-term ideas?
5. Who is not at the table and what expertise are you still needing?
6. What role do our existing bottomland forests play in mitigating large stormwater events?

Working Group Norms

To promote a productive and effective group culture, the group agrees to the following norms:

- Begin and adjourn on time
- One speaker at a time
- Listen for understanding
- Say what you need to say while making room for others to say what they need to say
- Embrace a learning mindset
- Be mindful of assumptions & ask questions
- It is OK to disagree…please do so respectfully
- Share your own story and respect the stories of others
- Be goal-oriented and clarify objectives for each meeting
- Engage with staff for context & details
- Work toward consensus. If consensus can't be reached, decisions will be made with a significant majority of at least ¾ quorum – with a minimum of 6 present
- Notice will be given to group members for critical votes and deferrals will be made to the next meeting as relevant. Critical votes are defined as any specific recommendation that would go to the Town Council, including the final report
- Attendance rules will be guided by the standards of the Town's committees

Working Group Guiding Questions

- What ideas are promising and worth further consideration for our recommendations?
- What additional information do we need to help us develop our recommendations?
- How can we improve and evolve the organization of our meetings to help us be successful?