CARRBORO
RESIDENTIAL ASSESSMENT
PILOT PROJECT

PROJECT SUMMARY REPORT

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Executive Summary

The following document was prepared by Michael G. Dupree DBA Feather Village Farms & Services here after known as the Contractor. The information in this executive summary is a concise statement of the services provided to the Town of Carrboro and its residents for the Residential Assessment Pilot Project. The findings and recommendations section of this document is solely the opinion of the Contractor.

Background

The Town of Carrboro conducted a pilot project to deliver residential green stormwater infrastructure and flood resilience assessment services to interested residents. An independent Contractor was hired to evaluate 50 sites. The goal of the project was to evaluate each site and make recommendations to correct drainage and runoff away from structures (including homes), provide homeowners with technical assistance and green infrastructure designs that if implemented would better manage runoff and improve water quality, and provide vegetation recommendations to reduce erosion.

The project contract had three tasks to complete:

Task I: Pilot Project Planning and Development

The contractor collaborated with Town staff by thoroughly reviewing project background and related materials, including but not limited to the previously completed *RainReady* study, documents provided by staff, the Town's website, and other resources; made recommendations regarding project delivery materials, including the web page creation, intake form, and resource materials for residents; produced project delivery materials which included drainage and small scale/non engineered Stormwater Control Measures information handouts.

Task II: Assessments

This phase comprised the delivery of 50 site assessments to Carrboro residents. Town staff collected and processed applications for site review and tracked the application implementation progress on Teams.

Task III: Reporting

This Task summarized the findings from site assessments to both residents and Town staff on an individual basis and included summary reports and presentations to staff and the Stormwater Advisory Commission. There were 50 individual Site Reports with proposed improvements and improvement descriptions. A final report was also included, stating the number of potential site improvements/SCMs that would improve community water quality and assist the Town with compliance with Jordan Lake Nutrient Management Reduction Strategies.

Project Implementation

Scheduling

The contractor received applications that were approved by Town staff through Teams. An introductory email was sent to the landowner within two weeks of receiving the application. In order to accommodate residents varying schedules, weekend site visits were made available for landowners resulting in nine of the 50 site visits that were conducted on Saturdays. Landowners received the written report in less than two weeks from the initial site visit.

Assessments & Site Visits

Assessments involved utilizing professional, technical expertise regarding the suitability of green stormwater infrastructure improvements, alterations to structures or landscaping to improve flood resilience, and the potential for stream channel and riparian buffer improvements. Each site visit included the following:

A. A consultation with the landowner reviewing the *North Carolina Building Codes Chapter 4 Foundations* and the *EPA Moisture Control Guidance for Building Design, Construction and Maintenance.* Each landowner received an onsite evaluation and written guidance on how to protect the structure and improve indoor air quality by reducing moisture under the home.

https://codes.iccsafe.org/content/NCRC2018/chapter-4-foundations

https://www.epa.gov/sites/default/files/2014-08/documents/moisture-control.pdf

B. A site survey was conducted on each site using a laser level. The landowner was able to interact with the contractor and review the drainage pattern and grade of the parcel. This experience allowed each homeowner to better understand the importance of drainage swales, and how the placement of new infrastructure and landscape features may impede the flow of stormwater away from the home, and to better understand how the runoff may be affecting the neighboring property. Each resident was able to understand the relationship of the NC Building codes on drainage and how to maintain the structure and prevent foundation failure. During the visit the contractor recorded elevations including: crawl space door (bottom); HVAC pad; base of vent wells; slope around foundation, the management of vegetation and organic material around the structure. If the parcel had a waterway the contractor conducted a stream cross section survey, and recorded stream elevations such as the thalweg, bench level, the flood prone width and the top of the bank in relationship to the survey data regarding the elevations of the structure listed above.

C. The landowners were provided technical assistance regarding potential small scale Stormwater Control Measures that could be implemented on site. The discussion included the size and type of practices, installation processes and feasibility, maintenance requirements and benefits to the landowner and potential impact to their down-stream neighbors. During the site visit, the contractor photo documented potential locations for SCMs and recorded area calculations for future use for the volumetric design of the practices.

D. Each landowner was provided a consultation regarding the existing vegetation and potential landscape management practices to control erosion and reduce nutrient delivery during rain events. The landowners were provided verbal recommendations and written guidance that listed links to resources in the individualized report.

Reports

The contractor engaged with GeoDecisions, a Pennsylvania based software design company, to create a custom PracticeKeeper ESRI-based geospatial platform for the project. This is a conservation management software that simplifies tracking best management practices (BMPs/SCMs). PracticeKeeper's Conservation Planning module was utilized to create, map, administer and evaluate conservation plans with designed SCM practices for each site. By using this conservation management software, the contractor was able to analyze landowner data and automatically populate critical information via spatial queries in order to assist Town of Carrboro Stormwater staff with a method to track the design and potential installation of SCMs. This electronic mapping and design software leads to sustainable management of soil, water, and related natural resources within the municipality and also documents efforts to reduce nutrient delivery to the Jordan Lake Reservoir. Furthermore, the Town staff can access all design data and review spatial mapping of designed practices in order to pursue grants or to submit to state agencies as part of the annual reporting process.

In addition to the benefits to the Town staff, this environmental tracking software allowed each resident to receive a spatially mapped Conservation Plan and a written report with sized SCM recommendations to manage stormwater runoff on their property. These reports provided definitions of each practice as well as links to state agencies' websites for additional information. These reports provide the necessary volumetric calculations and spatial location necessary for qualified environmental contractors to provide the landowner with detailed quotes for the installation of the designed SCMs.

Eligible Practices & Design Standards

The contractor met with Town of Carrboro staff and created a list of SCM practices to be utilized in the custom Conservation Planning module. The practices included a practice definition and were mapped geospatially as a point, line or a polygon. The size of the practices were designed based on volumetric calculations of the runoff being treated on each site. The State of North Carolina Department of Environmental Quality provides a Stormwater manual for SCM design standards. In this project, the NCDEQ Minimum Design Criteria (MDC) for the practices were utilized for those practices listed in the manual. Other practices were designed using practice standards for the North Carolina Division of Soil & Water Conservation Districts Community Conservation Assistance Program.
The table below summarizes some of the practices designed for the residents on the 50 sites.

Load reductions

All of the practices recommended and designed in this project have estimated reductions associated with each practice. In most cases, the practices would have a 10-year life span with associated nutrient reductions provided they are properly maintained during that time. In the appendices section there are several tables listing the practices that have been designed in PracticeKeeper during this project and the associated estimated reductions.

Table 1. Summary of Design Practices

SCM Type	Number of designs	Storage volume gal. per 1" rain	Soil loss tons per year	Soil loss lbs. per year	Total area treated sq. ft.
Rain Garden	31	23,226.84		183.458	136,708
Cistern	27	9960		75.324	11,990
Critical Area Planting	19			89.5951	80,892
Streambank Stabilization	5		118.3		
Grass Swale	34			145.72859	197,377
Impervious Surface Conversion	1	57.37		6.36	9.71
Permeable Pavement	1	310		5.24	496
Wetland	1	1809.60		7.29	17,509
Disconnected Impervious Surface	1			4.028	667
Total	120	35,363.81	118.3	517.02369	445,648.71

Findings & Recommendations

A survey was sent to all project participants by Town staff, with results presented in the separate Town report. The survey data collected suggested that with few exceptions that the landowners were satisfied with the information they received during the site visit and in their customized report. Below are some findings and recommendations to improve the program.

1. Prior to the site visits, it would have been a good idea to have met with a group of contractors who have experience working in Carrboro and have them add their names to the Town's contractor list. It would have been a great benefit to have a list of qualified contractors prior to the meetings with landowners and to be able to share the list with landowners. The search for the list and the process of trying to contact contractors was a source of frustration for landowners.
2. Some landowners need the additional one-on-one time on site to review the recommendations and to discuss the reasons why they should implement the recommended strategies to protect their home. It would be better in the future to have a follow up meeting to review the report in person with the landowner to answer any questions or respond to additional information requests not covered in the first meeting.
3. The landowners wanted detailed plant recommendations. They did receive resources such as links to the types of vegetation that would be best suited to the sites but most of the landowners wanted detailed vegetation plans and detailed drawings of the plant recommendations. This service was not part of the pilot program.
4. In a few instances during site visits the landowners had renovations or additions that were not on the latest tax parcel imagery. In all cases, the new additions to the structures did not have an adequate final grade according to the North Carolina Building Codes Chapter 4-Foundations. The final grade was

observed to be the primary reason for the standing water, ponding and excess water in the crawl spaces. The Contractor does not know if this was because grading was done after the final certificate of occupancy was issued or if it is not currently part of the final inspections process. It would be best in general and specifically for building projects permitted by the Town for the landowner to be advised, preferably in writing, of the importance of establishing and maintaining the grade according to the NC Building code. This is in their and future owners best interest.

5. It is recommended that the staff continue to use the PracticeKeeper software. The package has been customized for the Carrboro community and the annual fee per licensed user is nominal.. The staff will find this tool to be invaluable in future work.
6. During site visits, residents indicated that a cost share program would be important in order to install SCMs. All SCMs have a community benefit and landowners often asked the contractor if there were financial resources or incentives available for SCM installation. The survey data showed that the amount of cost share required depends on the landowners. The Town of Carrboro could create a Cost Share program to assist landowners with SCM installation mimicking other municipal programs in the state. Some examples of programs that utilize the storm water utility fee to assist landowners with the installation of SCMs on private property include the City of Durham, the City of Raleigh, and the City of Charlotte.
    i. City of Raleigh Rain Water Rewards. This program is managed by staff which approves applications for SCM installation. The program will cost share 75%, 90% or 100% depending on the watershed. Additional information can be found here. https://raleighnc.gov/stormwater/apply-raleigh-rainwater-rewards
    ii. City of Durham established a Rain Catchers program to help install SCM practices. For more information https://www.durhamnc.gov/949/Rain-Catchers
    iii. The City of Durham also provides Non-Profit organizations with funding to install SCM practices within the city limits. The funding supports the organization and covers part of the cost of the installation of the green infrastructure. In this model the City negotiates a contract with the organization to install practices. The design and liability of the installations is the responsibility of the contracted organization and not City of Durham staff. An example and additional information can be found here. https://www.durhamnc.gov/1619/Green-Infrastructure
    iv. The City of Charlotte and Mecklenburg County have developed Memorandum of Understanding with the Mecklenburg Soil & Water Conservation District. The municipal governments allocate funding annually to support the Conservation District staff and the District Urban Cost Share Program. Additional information can be found here. https://conserve.mecknc.gov/resources/urban-cost-share-program

In conclusion, the Town of Carrboro Residential Assessment Pilot Project was a logical next step as the Town continues to grow the program to meet the community's responsibility to reduce its nutrient and sediment delivery to the Jordan Lake Reservoir. Nonpoint source pollution from urban runoff in existing development is the largest source of excess sediment, nitrogen and phosphorus delivery to our aquatic systems. The Town of Carrboro is playing an important role in creating community resilience, pursuing watershed restoration work, and the protection of the Jordan Lake Reservoir and it was a pleasure to work with the Stormwater staff and landowners, and witness the strong desire to be excellent community and environmental stewards.

Appendix 1 SCM Practices Tables
Table 1 Rain Garden Designs (31)

HUC Code	N Reduction	P Reductio	Parcel Id	SCM Type	Soil Loss lbs. per year	Storage Volume Cu. Ft.	Treated Area Sq.Ft.
030300020603	0.18	0.02	9779528320	Rain Garde	8.33	217.25	2391
030300020603	0.16	0.01	9778777012	Rain Garde	8.04	96.33	2581
030300020603	0.1	0.02	9779533135	Rain Garde	4.183	71.26	3170
030300020603	0.37	0.07	9870519636	Rain Garde	15.2	351	37170
030300020603	0.09	0.01	9779502993	Rain Garde	3.78	59.71	1911
030300020603	0.05	0.01	9779424501	Rain Garde	2.373	36.58	1075
030300020603	0.09	0.01	9779424501	Rain Garde	3.845	59.19	1732
030300020603	0.22	0.02	9860804513	Rain Garde	10.854	140.25	2809
030300020603	0.17	0.01	9778496954	Rain Garde	8.217	105.48	2167
030300020603	0.1	0.02	9860813462	Rain Garde	4.185	73.18	3720
030300020603	0.15	0.02	9779625559	Rain Garde	7.45	83.87	1841
030300020603	0.12	0.01	9779627099	Rain Garde	5.47	128.07	3665
030300020603	0.1	0.01	9779627099	Rain Garde	4.38	67.95	2555
030300020603	0.13	0.01	9778584605	Rain Garden	5.95	84.85	1932
030300020603	0.08	0.01	9778584687	Rain Garde	3.485	62.62	3760
030300020603	0.12	0.01	9778980589	Rain Garde	5.274	79.83	2203
030300020603	0.1	0.02	9778980589	Rain Garde	3.994	74.52	5753
030300020603	0.07	0.01	9778980589	Rain Garden	3.445	38.71	489
030300020603	0.34	0.04	9778983968	Rain Garde	16.21	211.85	5665
030300020603	0.13	0.02	9778981650	Rain Garden	6.54	81.48	1952
030300020603	0.05	0.01	9778981650	Rain Garden	2.179	37.31	1701
030300020607	0.08	0.01	9778851370	Rain Garden	3.244	55.43	2502
030300020607	0.15	0.03	9778395601	Rain Garden	6.14	117.67	12040
030300020607	0.18	0.03	9778395601	Rain Garden	7.232	136.03	11192
030300020607	0.16	0.03	9779124995	Rain Garden	6.78	123	8934
030300020607	0.06	0.01	9779205543	Rain Garde	2.42	41.16	1796
030300020607	0.1	0.01	9779202871	Rain Garden	4.83	63.97	1187
030300020607	0.02	0.01	9778859482	Rain Garden	2.14	15.07	1241
030300020607	0.14	0.03	9779314179	Rain Garden	6.01	94.02	2909
030300020607	0.14	0.02	9779206931	Rain Garden	6.16	91.73	2395
030300020607	0.11	0.01	9778766795	Rain Garden	5.118	78.46	2270
Total	4.06	.56			183.458	2977.83	136,708

Table 2 Cistern Designs (27)

HUC Code	N Reduction	P Reduction	Parcel Id	SCM Type	Soil Loss lbs. per year	Storage Volume Cu. Ft.	Treated Area Sq.Ft.
030300020603	0.09	0.01	9870112925	Cisterns	4.798	550	681
030300020603	0.07	0.01	9778763854	Cisterns	3.48	500	495
030300020603	0.12	0.01	9870503603	Cisterns	2.79	600	694
030300020603	0.1	0.01	9779527388	Cisterns	2.26	305	262
030300020603	0.02	0.01	9779516030	Cisterns	2.13	305	398
030300020603	0.12	0.01	9778777012	Cisterns	1.936	305	481
030300020603	0.04	0.01	9779235395	Cisterns	2.14	305	289
030300020603	0.04	0.01	9779235395	Cisterns	2.14	305	305
030300020603	0.06	0.01	9779249392	Cisterns	3.328	550	551
030300020603	0.02	0.01	9779502993	Cisterns	2.52	305	313
030300020603	0.06	0.01	9778496954	Cisterns	2.86	305	406
030300020603	0.13	0.01	9778496954	Cisterns	6.807	610	966
030300020603	0.12	0.01	9779625559	Cisterns	5.03	550	625
030300020603	0.02	0.01	9778584687	Cisterns	2.14	305	514
030300020603	0.2	0.01	9778983968	Cisterns	2.4	305	229
030300020603	0.02	0.01	9778981650	Cisterns	2.4	305	407
030300020607	0.02	0.01	9778849009	Cisterns	2.52	305	316
030300020607	0.05	0.01	9778851370	Cisterns	2.39	305	297
030300020607	0.05	0.01	9779124995	Cisterns	2.684	305	381
030300020607	0.02	0.01	9779202871	Cisterns	2.91	305	421
030300020607	0.04	0.01	9778397166	Cisterns	2.14	305	337
030300020607	0.04	0.01	9778398542	Cisterns	2.14	305	336
030300020607	0.04	0.01	9778859482	Cisterns	0.08	305	327
030300020607	0.07	0.01	9779314179	Cisterns	3.841	500	636
030300020607	0.08	0.01	9779206931	Cisterns	2.35	305	413
030300020607	0.02	0.01	9778295797	Cisterns	2.71	305	450
030300020607	0.12	0.01	9778766795	Cisterns	2.4	305	460
Total	1.78	0.27			75.324	9960	11,990

Table 3 Streambank Stabilization Designs (5)

HUC Code	**N Reduction**	**P Reduction**	**Parcel Id**	**SCM Type**	**Soil Loss Tons per year**	**Storage Volume Cu. Ft.**	**Treated Area Sq.Ft.**
030300020603			9779611185	Streambank Protection and Repair	49.3		
030300020603			9779533046	Streambank Protection and Repair	19.7		
030300020607			9779205543	Streambank Protection and Repair	8.1		
030300020607			9778397166	Streambank Protection and Repair	23.9		
030300020607			9779203880	Streambank Protection and Repair	17.3		
Total					**118.3**		

Table 4 Critical Area Planting/Erosion Control Designs (19)

HUC Code	N Reduction	P Reduction	Parcel Id	SCM Type	Soil Loss lbs. per	Storage Volume Cu. Ft.	Treated Area Sq.Ft.
030300020603	0.07	0.01	9779502993	Critical-Area Planting/Erosion Control	3.096		1215
030300020603	0.12	0.01	9779528320	Critical-Area Planting/Erosion Control	6.372		1055
030300020603	0.12	0.02	9779527388	Critical-Area Planting/Erosion Control	7.549		1870
030300020603	0.27	0.03	9779527485	Critical-Area Planting/Erosion Control	12.71		5223
030300020603	0.13	0.02	9779611185	Critical-Area Planting/Erosion Control	5.67		5460
030300020603	0.21	0.03	9779533135	Critical-Area Planting/Erosion Control	9.357		6273
030300020603	0.03	0.01	9779235395	Critical-Area Planting/Erosion Control	1.45		1805
030300020603	0.16	0.01	9779235395	Critical-Area Planting/Erosion Control	8.765		1465
030300020603	0.24	0.03	9779249392	Critical-Area Planting/Erosion Control	11.135		5429
030300020603	0.01	0.01	9779424501	Critical-Area Planting/Erosion Control	0.259		1490
030300020603	0.01	0.01	9779625559	Critical-Area Planting/Erosion Control	0.125		778
030300020603	0.02	0.01	9779625559	Critical-Area Planting/Erosion Control	0.3833		2200
030300020603	0.09	0.01	9778983968	Critical-Area Planting/Erosion Control	4.03		3556
030300020603	0.01	0.01	9778981650	Critical-Area Planting/Erosion Control	0.226		800
030300020607	0.09	0.01	9778399309	Critical-Area Planting/Erosion Control	3.373		3938
030300020607	0.18	0.03	9779215458	Critical-Area Planting/Erosion Control	8.07		5305
030300020607	0.19	0.02	9779006871	Critical-Area Planting/Erosion Control	4.55		7875
030300020607	0.05	0.01	9778391426	Critical-Area Planting/Erosion Control	0.3448		12928
030300020607	0.01	0.01	9778295797	Critical-Area Planting/Erosion Control	2.13		12227
Total	2.01	0.3			89.5951		80,892

Table 5 Grass Swale Designs (34)

HUC Code	N Reduction	P Reduction	Parcel Id	SCM Type	Soil Loss lbs. per	Storage Volume Cu. Ft.	Treated Area Sq.Ft.
030300020603	0.2	0.03	9860813353	Swale/Regenerative Conveyance	8.882		2837
030300020603	0.18	0.03	9870112925	Swale/Regenerative Conveyance	7.149		17605
030300020603	0.12	0.02	9778418381	Swale/Regenerative Conveyance	4.912		12556
030300020603	0.04	0.01	9870503603	Swale/Regenerative Conveyance	1.638		1626
030300020603	0.18	0.02	9779527485	Swale/Regenerative Conveyance	8.47		5223
030300020603	0.07	0.01	9779501775	Swale/Regenerative Conveyance	3.05		2847
030300020603	0.06	0.01	9779501775	Swale/Regenerative Conveyance	2.871		1685
030300020603	0.13	0.01	9779516030	Swale/Regenerative Conveyance	6.128		3099
030300020603	0.27	0.05	9870518635	Swale/Regenerative Conveyance	10.85		37170
030300020603	0.16	0.02	9779249392	Swale/Regenerative Conveyance	1.823		16214
030300020603	0.01	0.01	9779424458	Swale/Regenerative Conveyance	1.73		1049
030300020603	0.2	0.02	9860804513	Swale/Regenerative Conveyance	9.786		5390
030300020603	0.02	0.01	9860813462	Swale/Regenerative Conveyance	0.34279		8532
030300020603	0.22	0.02	9779625559	Swale/Regenerative Conveyance	11.292		2186
030300020603	0.02	0.01	9779627099	Swale/Regenerative Conveyance	0.25		2161
030300020603	0.04	0.01	9778584605	Swale/Regenerative Conveyance	1.61		1422
030300020603	0.05	0.01	9778584687	Swale/Regenerative Conveyance	1.988		3760
030300020603	0.01	0.01	9778980589	Swale/Regenerative Conveyance	0.14		1261
030300020603	0.02	0.01	9778983968	Swale/Regenerative Conveyance	0.884		3369
030300020603	0.03	0.01	9778981650	Swale/Regenerative Conveyance	1.488		1969
030300020607	0.04	0.01	9778849009	Swale/Regenerative Conveyance	1.96		346
030300020607	0.04	0.01	9778851370	Swale/Regenerative Conveyance	1.85		2502
030300020607	0.09	0.02	9778395601	Swale/Regenerative Conveyance	3.51		12040
030300020607	0.09	0.02	9779124995	Swale/Regenerative Conveyance	3.81		8934
030300020607	0.01	0.001	9778766689	Swale/Regenerative Conveyance	0.0278		1240
030300020607	0.1	0.01	9778396744	Swale/Regenerative Conveyance	4.69		2497
030300020607	0.12	0.01	9778398542	Swale/Regenerative Conveyance	5.66		2696
030300020607	0.01	0.01	9778859482	Swale/Regenerative Conveyance	0.45		1241
030300020607	0.1	0.02	9779112107	Swale/Regenerative Conveyance	4.379		6259
030300020607	0.06	0.01	9778399309	Swale/Regenerative Conveyance	2.489		4645
030300020607	0.08	0.01	9779314179	Swale/Regenerative Conveyance	3.73		2909
030300020607	0.08	0.01	9779206931	Swale/Regenerative Conveyance	3.52		2395
030300020607	0.03	0.01	9778391426	Swale/Regenerative Conveyance	1.384		709
030300020607	0.11	0.01	9778766795	Swale/Regenerative Conveyance	4.92		2669
030300020607	0.2	0.8	9778295797	Swale/Regenerative Conveyance	8.684		6367
	0.21	0.03	9778763854	Swale/Regenerative Conveyance	9.435		7967
Total	3.4	1.321			145.78259		197,377

Appendix 2 - Sample Plans

Conservation Plan	Homeowner name and address have been removed.
Objective(s)	**Improve drainage to protect the residential structure, maintain proper indoor air quality by reducing crawl space moisture and reducing stormwater runoff and the associated pollutant delivery downstream.**

Urban

Standard Statement:

To assist residential landowners with the following: moisture control guidance that focuses on drainage issues for preventative building maintenance; the design of conservation practices that reduce stormwater runoff; recommendations regarding vegetation to control erosion.

Keep Your Crawl Space Dry

1. Maintain your gutters. Improperly maintained gutters lead to over-topping which drops water along your foundation. This water can splash soil on the siding or create stress on the foundation. Excessive moisture at the foundation can lead to cracks in the foundation requiring expensive repairs.
2. Pipe your gutters away from the foundation until the water flows away from the house. North Carolina Building code requires a minimum of five feet of piping attached to gutter downspouts. It is better to use smooth wall pipe. Smooth wall pipe can be regularly cleaned with a plumber's snake/drain cleaning tool. Corrugated pipe maybe damaged when using this type of cleaning technique. It is best to use 4" inside diameter pipe. Some examples include 4" PVC schedule 40 pipe or NDS double wall 4".
3. Maintain your drainage swale. It is recommended to have a 5% slope away from the foundation (6" of fall over 10'). When adding new plants or extending a deck or patio be sure not to put obstructions in the path of the water as it flows away from your foundation. Obstructing the flow of water away from the foundation will lead to ponding and excessive moisture around the home. Maintain at least a 2% slope in the swale to make sure there is no ponding or standing water around the foundation.

0. **Maintain a 6"-8" inch air space between the bottom board of your siding or the crawl space vents.** Do not allow leaves, mulch or organic matter to build up on your siding. This may cause moisture wicking in the walls or allow rain to enter into crawl space vents. You may want to use decorative gravel 12" around the perimeter of the home to protect it from insects and excess moisture.

https://www.epa.gov/sites/default/files/2014-08/documents/moisture-control.pdf

Reduce the height of the garden bed to reduce splashing and possible soil and water from entering the crawl space.
A cistern on the back corner would collect 344 gallons of water in a one-inch rain event. The roof water is currently piped to the edge of the stream.

Cisterns
01: Cisterns are above- or below-ground storage tanks that harvest rainwater. This collected rainwater can then be made available for irrigation and potentially other uses. They are also intended to reduce stormwater runoff and reduce the use of potable water. A cistern is much larger than a rain barrel which is only able to capture a small percentage of rooftop runoff.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Wade	1.0 Quantity	2	2023		
Total:	1.00 Quantity				

Rainwater harvesting and collection of rainfall from roofs into large cisterns sized to capture the first one inch of a rain event has numerous benefits to the homeowner and the community. The water can be used for watering gardens/ landscapes, or for other non-potable uses (toilet flushing, vehicle washing, etc.). Use of rainwater for landscape irrigation has benefits relative to treated potable water by reducing the demand during the peak use (usually in the summer and early mornings) and may reduce the cost of potable water due to the demand during peak use times.

Harvesting your roof runoff helps the community by detaining water and reduce the amount of water in the streams during a storm. This detention of water will help reduce damage to property and the stream ecosystem.

This practice can increase the available water supply, reduce the cost of potable water, reduce energy use, improve air quality, and reduce atmospheric CO2.

Resources

https://www.ncagr.gov/SWC/costshareprograms/CCAP/documents/Chapter7-CisternDesign.pdf

https://content.ces.ncsu.edu/rainwater-harvesting-guidance-for-homeowners

Critical-Area Planting/Erosion Control
01: This practice is useful on erodible areas that are difficult to stabilize. It consists of the establishment of a durable and appropriate vegetative cover. Benefits include reduced soil erosion and sedimentation and improved water quality. For some eroding areas, additional steps beyond planting may be needed to stabilize the area.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Wade	3199.99 Square Feet	2	2023		
Total:	3199.99 Square Feet				

Critical Area Planting/Planting in Shade

This practice is used to replace lawns techniques in shady areas to maintain vegetative cover. Bare soils will erode during rains. **It is best to have 80% or more of the soil covered in vegetation to prevent erosion**. The planting of perennial native plants along with the removal the of invasive plant species or lawn practices in shade areas has numerous benefits. Native plants under a tree canopy increase the root zone which increase infiltration of stormwater runoff and simultaneously reduce erosion. These plantings will diffuse and slow down runoff and provide additional habitat for wildlife.

https://ncwildflower.org/recommended-native-species/

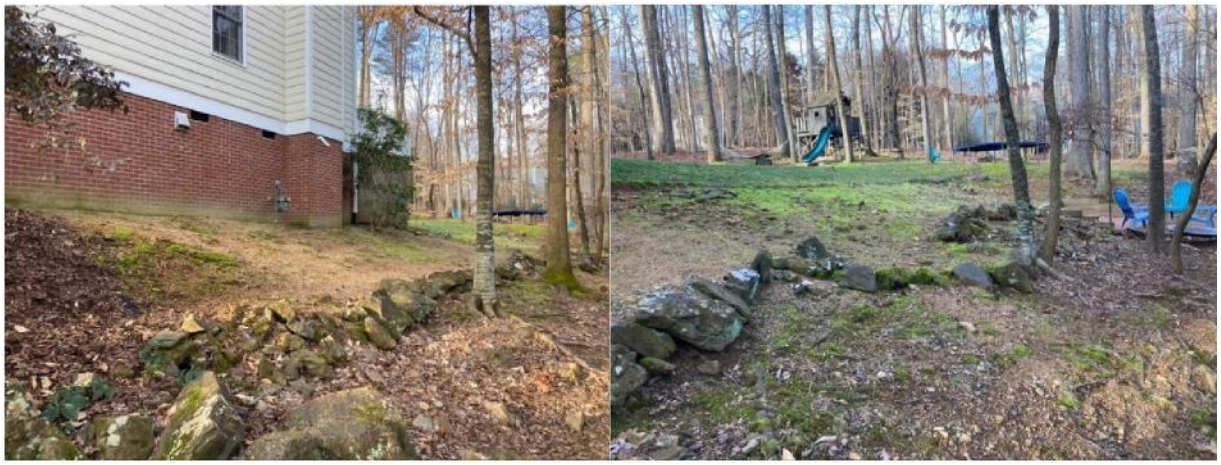
https://www.trianglegardener.com/colorful-natives-for-shady-places/

https://caldwell.ces.ncsu.edu/2021/10/what-can-i-plant-instead-of-grass/

Natives seed mixes for sale in North Carolina.

https://garrettseed.com

https://mellowmarshfarm.com/native-seed-mixes/



Swale/Regenerative Conveyance

01: A swale is a channel that is shaped and graded to required and uniform dimensions and established with suitable vegetation (ex. perennial plants, grass). A regenerative conveyance is similar but has less uniformity in its shape and more natural stream channel features such as sinuosity, pools and riffles, and native vegetation. Benefits include reductions in runoff, soil erosion, sedimentation, and pollution transport and improvements in water quality.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Wade	1094.44 Square Feet	2	2023		
Total:	1094.44 Square Feet				

Grasses Swales are a stormwater conveyance that transports water away from foundations and delivers it to other treatment areas. It should be designed to carry the calculated stormwater volume and the slope should be between 2 and 4 percent. This will slow water and allow some filtration/infiltration before reaching a secondary treatment.

Resources

https://www.ncagr.gov/SWC/costshareprograms/CCAP/documents/Chapter8-VegetatedSwales.pdf

Lawn Care

A lawn can provide numerous benefits to the homeowner and to the environment. When turf management is the preferred land use strategy it is recommended to follow the guidelines for establishment and maintenance of turf in the Carolina Lawn Manual. This can be found here:

https://content.ces.ncsu.edu/carolina-lawns

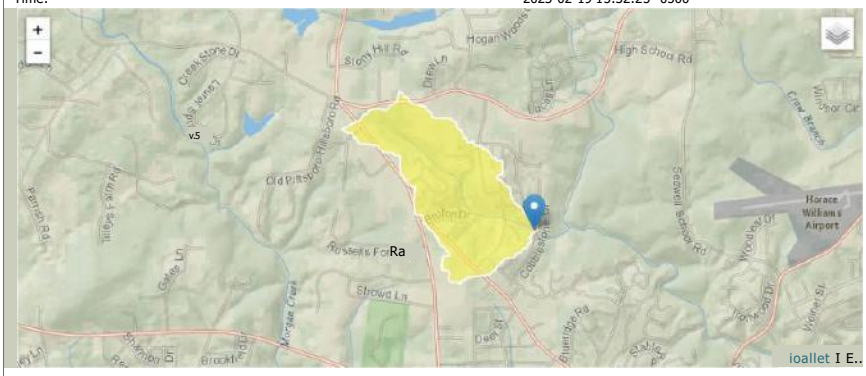
State and local regulated buffers on this parcel

Flood map and USGS Stream Stats

https://www.usgs.gov/streamstats

StreamStats Report

Region ID:	NC
Workspace ID:	NC20230219203205257000
Clicked Point (Latitude, Longitude):	35.93267, -79.09090
Time:	2023-02-19 15:32:25 -0500



0 Collapse All

> Basin Characteristics

Parameter Code	Parameter Description	Value Unit
DRNAREA	Area that drains to a point on a stream	0.45 square miles
LCO6IMP	Percentage of Impervious area determined from NLCD 2006 impervious dataset	10.27 percent

> Urban Peak-Flow Statistics

Urban Peak-Flow Statistics Parameters [Region 1 Piedmont Urban under 3 sqmi 2014 5030]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.45	square miles	0.1	3
LCO6IMP	Percent Impervious NLCD2006	10.27	percent	0	47.9

Urban Peak-Flow Statistics Flow Report [Region 1 Piedmont Urban under 3 sqmi 2014 5030]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	ASEp
Urban 50-percent AEP flood	127	ft"3/s	68.9	234	31.9
Urban 20-Percent AEP flood	198	ft"3/s	121	325	25.4
Urban 10-percent AEP flood	250	ft"3/s	156	401	25
Urban 4-percent AEP flood	316	ft"3/s	188	531	27
Urban 2-percent AEP flood	367	ft"3/s	210	643	29.3
Urban 1-percent AEP flood	419	ft"3/s	226	776	32.1
Urban 0.5-percent AEP flood	472	ft"3/s	242	921	35.1
Urban 0.2-percent AEP flood	545	ft"3/s	266	1120	37.5

Urban Peak-Flow Statistics Citations

Feaster, T.D., Gotvald, A.J., and Weaver, J.C.,2014, Methods for estimating the magnitude and frequency of floods for urban and small, rural streams in Georgia, South Carolina, and North Carolina, 2011 (ver. 1.1, March 2014): U.S. Geological Survey Scientific Investigations Report 2014-5030, 104 p.

CERTIFICATION OF PARTICIPANTS

Customer name removed DATE

Map Legend

Business Data

BMP Points
Cisterns

BMP Polygons
Critical-Area Planting/Erosion Control

Land Units

Land Unit Labels

BMP Points
Cisterns

BMP Polygons
Critical-Area Planting/Erosion Control

Reference Layers

SWInlets

OWASAGravityMain

SWPipe

Parcels

Parcels

Parcel Dimensions

County Boundaries

County Boundary

Municipal Boundaries

Voting Precincts

Conservation Plan Report

Homeowner and address removed.

Objective(s)

Improve drainage to protect the residential structure, maintain proper indoor air quality by reducing crawl space moisture and reducing stormwater runoff and the associated pollutant delivery downstream.

Urban

Standard Statement:

To assist residential landowners with the following: moisture control guidance that focuses on drainage issues for preventative building maintenance; the design of conservation practices that reduce stormwater runoff; recommendations regarding vegetation to control erosion.

Keep Your Crawl Space Dry

1. Maintain your gutters. Improperly maintained gutters lead to over-topping which drops water along your foundation. This water can splash soil on the siding or create stress on the foundation. Excessive moisture at the foundation can lead to cracks in the foundation requiring expensive repairs.
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native vegetation. Benefits include reductions in runoff, soil erosion, sedimentation, and pollution transport and improvements in water quality.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Alder	449.48 Square Feet	2	2023		
Total:	449.48 Square Feet				

Grassed Swales

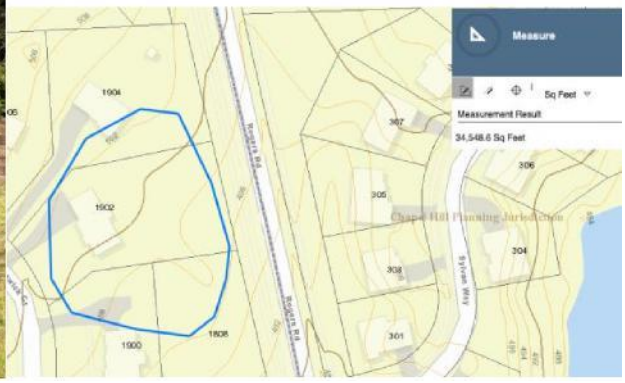
Grasses Swales are a stormwater conveyance that transports water away from foundations and delivers it to other treatment areas. It should be designed to carry the calculated stormwater volume and the slope should be between 2 and 4 percent. This will slow water and allow some filtration/infiltration before reaching a secondary treatment.

Resources

https://www.ncagr.gov/SWC/costshareprograms/CCAP/documents/Chapter8-VegetatedSwales.pdf

Field review and estimates indicate approximately 34,548 sq ft of area drain to the back yard.

A new swale would divert the runoff away from the deck and foundation to a rain garden.



Backyard Rain Garden

01: A shallow depression in the ground that captures runoff from a driveway, roof, or lawn. This temporary storage slows down the runoff and allows it to soak into the ground, thereby preventing or reducing erosion, pollutant transport, and impacts to adjacent properties and downstream waterbodies. The word backyard has come into common use for this practice, but unless restricted in some way, these can be located elsewhere on the property.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Alder	560.35 Square Feet	2	2023		
Total:	560.35 Square Feet				

Rain gardens are shallow depressions that collect rainwater from a roof or driveway. They are designed to capture water during a rain, and they have a ponding depth of 3, 6, 9 or 12 inches depending on the soils. If there is poor drainage, then the garden can be excavated and filled with a porous soil media that allow water to infiltrate. Other benefits are that plants use the water (evapotranspiration) and have deep roots that increase soil infiltration and use the nitrogen from the impervious runoff to grow.

This practice will slow down and reduce runoff; improve water quality through physical/chemical and biological processes. It increases groundwater recharge, increases available water supply, improves air quality, reduces atmospheric CO2, reduces urban heat island effect, improves aesthetics, improves habitat, reduces noise pollution, improves community cohesion.

Resources & Design Information

https://www.ncagr.gov/SWC/costshareprograms/CCAP/documents/Chapter5-BackyardRainGardenDesign.pdf

Rain garden plants

https://www.ncagr.gov/SWC/costshareprograms/CCAP/Tools.html

https://extensiongardener.ces.ncsu.edu/extgardener-rain-garden-plant-list/

The rain garden would start at the end of the swale and would be linear paralleling the two cherry trees. This rain garden was sized using the North Carolina CCAP cost share BMP Water Quality spreadsheet. This size is based on the volume of area draining to the proposed garden. Soil infiltration test would need to be conducted to see if a rain garden is suitable. If the soils do not perc it would be best to continue the grass swale to convey the water away from the home.

Watershed Details

(1) Type of Land Cover	(2) Catchment Area (sf)	(3) Catchment Acreage (ac)	(4) S.M. Formula (0.46 + 8.3I)	(5) Average EMC of TN (mg/L)	(6) Column (2) * (3) * (4)	(7) Average EMC of TP (mg/L)	(8) Column (2) * (3) * (6)	(9) Average EMC of TSS (mg/L)	(10) Column (2) * (7) * (8)
Transportation impervious	1964	0.05	1.85	1.60	0.12	0.19	0.01	150	7.08
Roof impervious	658	0.02	1.85	1.95	0.03	0.11	0.00	100	1.58
Managed pervious	34548	0.79	1.85	1.42	1.18	0.28	0.23	55	45.64
Wooded pervious		0.00	1.85	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP		0.00	1.85	1.95	0.00	0.11	0.00	100	0.00
Fraction Impervious (i) =		0.07		Pre-BMP TN Load (lb/yr) =	1.33	Pre-BMP TP Load (lb/yr) =	0.24	Pre-BMP TSS Load (lb/yr) =	54.29207339
Total Area of Development =		0.85		Pre-BMP TN Export (lb/ac/yr) =	1.56	Pre-BMP TP Export (lb/ac/yr) =	0.28	Pre-BMP TSS Export (lb/ac/yr) =	63.62557754

Simple Method for Calculating Volume

I (%)	7
Rv	0.133
A (ft2)	37170.0
P (in) (water quality depth)	1
Volume (ft3)	351.53
Ponding Depth (in)	6
Recommended BMP Size:	703.05

Runoff Conveyance

01: This practice uses drainage materials and devices to direct stormwater runoff away from a direct discharge point and divert it to another practice or naturally vegetated area capable of storing water and removing pollutants. This may be accomplished by grading and implementing practices such as curb cuts, french drains, dry stream beds, earthen berms, and check dams.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Alder	85.23 Square Feet	2	2023		
Total:	85.23 Square Feet				

This practice would be at the end of the rain garden to carry water to the vegetated area on the edge of the lawn.

Utility Location

CERTIFICATION OF PARTICIPANTS

Customer name removed DATE

Conservation Plan Map

Date: 3/12/2023

Plan ID: CP-FV-00049

Customer:	Homeowner name removed	Field Office:	Carrboro
District:	Feather Village Farms & Services	Agency:	Stormwater Department
Approx Acres:	0.35	Assisted By:	Mike Dupree
Tract(s):	Parcel number removed		

Conservation Plan - CCAP Report

Homeowner name and address removed

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Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Dumas	94.22 Square Feet	3	2023		
Dumas	157.04 Square Feet	3	2023		
Dumas	240.05 Square Feet	3	2023		
Total:	491.31 Square Feet				

The first garden in the chart would treat the front left down spout and is in the same location as the existing rain garden. The current size is about the right size for the roof area.

The second garden in the chart would be in the front yard to treat the two down spouts on the west side of the house.

The third garden in the chart is in the back yard to treat the four down spouts off of the back roof and east side back.

Rain gardens are shallow depressions that collect rainwater from a roof or driveway. They are designed to capture water during a rain, and they have a ponding depth of 3, 6, 9 or 12 inches depending on the soils. If there is poor drainage, then the garden can be excavated and filled with a porous soil media that allow water to infiltrate. Other benefits are that plants use the water (evapotranspiration) and have deep roots that increase soil infiltration and use the nitrogen from the impervious runoff to grow.

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Resources & Design Information

https://www.ncagr.gov/SWC/costshareprograms/CCAP/documents/Chapter5-BackyardRainGardenDesign.pdf

Impervious to Pervious Surface Conversion

01: Impervious surfaces such as asphalt, concrete, brick, and stone prevent infiltration. Replacement of impervious materials with permeable pavement or vegetation increases infiltration and therefore reduces stormwater runoff and pollutant transport.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Dumas	651.89 Square Feet	3	2023		
Total:	651.89 Square Feet				

Removal of driveway and installation of a grass swale along the east side of the house.

Permeable Pavement

01: Permeable pavement is an alternative to conventional concrete and asphalt paving materials that allows rapid infiltration of stormwater. Stormwater infiltrates into a porous paving material that temporarily stores water until the water infiltrates into underlying permeable soils or through an underground drain system. This practice is intended to reduce pollution transport and stormwater runoff rate and volume.

Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Dumas	496.71 Square Feet	3	2023		
Total:	496.71 Square Feet				

This would be the removal of the parking area and replacing it with a turf stone product. There are concrete turf pavers and plastic turf paving products on the market.

Plastic grid example produced by NDS a company out of Garner, NC

https://www.ndspro.com/products/permeable-pavers/ez-roll-gravel-pavers.html

Concrete paver example. Adams Products has a concrete plant in Morrisville, NC that produces this product sold at retail outlets. These can be purchased wholesale by contractors.

https://www.lowes.com/pd/Turfstone-Gray-Concrete-Paver-Common-24-in-x-16-in-Actual-24-in-x-16-in/3764691

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Field	Planned Amount	Planned Month	Planned Year	Applied Amount	Date
Dumas	218.5 Square Feet	3	2023		
Total:	218.50 Square Feet				

Grassed Swales along the west side of the house to reestablish a flow of water away from the house to the front rain garden.

Grasses Swales are a stormwater conveyance that transports water away from foundations and delivers it to other treatment areas. It should be designed to carry the calculated stormwater volume and the slope should be between 2 and 4 percent. This will slow water and allow some filtration/infiltration before reaching a secondary treatment.

Resources

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CERTIFICATION OF PARTICIPANTS

Customer name	DATE