Beaufort County Stormwater Management Utility Board (SWMU Board)
Meeting Minutes

May 7, 2014 at 2:00 p.m. in Beaufort Industrial Village Building #2 Conference Room

Board Members		Ex-Officio Members	
Present	**Absent**	**Present**	**Absent**
Don Smith	William Bruggeman	Andy Kinghorn	Van Willis
Patrick Mitchell	Allyn Schneider	Scott Liggett	
James Fargher		Kimberly Jones	

Beaufort County Staff
Eric Larson
Eddie Bellamy
Danny Polk
Carolyn Wallace
Josh Gruber

Visitors
Lamar Taylor, City of Beaufort
Bryan McIlwee, Town of Hilton Head Island
Paul Moore, Ward Edwards
Reed Armstrong, Coastal Conservation League
Tony Maglione, ATM

1. Meeting called to order – Don Smith

- **A.** Agenda – Item (3) "Executive Session" was removed from the agenda because there was no quorum. Item (5A) "MS4 Permit Submittal" was also removed from the agenda.
- **B.** April 2, 2014 Minutes – Mr. Eric Larson mentioned that most recent draft copy of the March SWIC Minutes were included in the packet for the meeting.

2. Introductions – Completed.

3. Executive Session – Removed from agenda.

4. Public Comment(s) – Mr. Larson congratulated Mr. Andy Kinghorn on his reappointment to the Board.

5. Reports – Mr. Larson submitted his written report in advance (please see attachment).

- **A.** Removed from agenda.
- **B. Monitoring Update** – Mr. Eric Larson
  USCB Lab – The last piece of equipment arrived the week of April 14th.
  Monitoring Plan near Shellfish Station 15-25 – Mr. Larson and Mr Danny Polk met with representatives with the Town of Port Royal to work on expanding the monitoring plan.
- **C. Utility Update –** Eric Larson
  DHEC and MS4 Update – He continues to develop a plan for implementation of the MS4 program. His presentation to the Natural Resources Committee was pulled from the meeting's agenda for May and is part of the reason he requested the special presentation on the "MS4 Permit Submittal" be postponed for now.
  Budget for FY15 – Mr. Larson and Mrs. Carolyn Wallace and working on revisions and may be presenting a second draft to the board next month.
- **D. Stormwater Implementation Committee Report –** Eric Larson
  April 3rd, 2014 SWIC Meeting - The topic was Public Education.

Public Education Branding – The SWIC has recommended the shared use of the Town Of Bluffton's "Neighbors for Clean Water" slogan for all public education efforts county wide. Our County Administration concurs.

E. Stormwater Related Projects – Eric Larson

Proposed Carolina Jellyball processing facility in Lobeco and unloading facility on Golden Dock Road on St. Helena Island – The Golden Dock site went before DRT the week of April 7th, 2014. Mr. Larson offered comments to the Planning staff. Mr. James Fargher said that the state is following up on some of the citizens concerns and asked the facility to test their wastewater for toxicity. The jellyfish is toxic to fish and the preliminary results of one test, suggests it is toxic to shellfish.

Bluffton Gateway Development Agreement – County Council has had its third and final reading and the development agreement is approved. The county hired ATM to critique the county's findings and their review is in the packet.

F. Upcoming Professional Contracts Report – Eric Larson

US 278 retrofit ponds – Bid due date is June 5, 2014. The addendum with the new plans are published. Permit modifications with DHEC and the County DRT are complete.

County Admin. Complex Retrofit Project – The project received no bids. We are evaluating the reasons behind the lack of response and we are discussing options to negotiate a contract with interested contractors.

Consultant procurement for the Carolina Jellyball application for the Lobeco site - on hold pending a submittal from the applicant.

RFP for a stormwater consultant to assist with the setup of the MS4 Program - on hold pending development of a MS4 implementation strategy.

Water Budget Study – The county has received the draft of the final report. Dr. Badr will be presenting the findings to the Board at the June Board meeting.

Okatie East BMP Monitoring – They have started the preliminary stage of the monitoring program. First step is to gather data and establish the Standard Operation Procedure (SOP). Mr. Paul Moore said there is historical fecal data but no historical flow data.

Trask Parkway Overtopping Study – The consultant's Andrews and Burgess are waiting on the original modeling data from the 2006 Stormwater Management Master Plan.

Paige Pointe Overtopping Study – This study is complete. Report from Andrews and Burgess confirmed the overtopping issue and provided sizing and construction cost options. This project will be added to our list of CIP needs.

G. Regional Coordination - Eric Larson

Battery Creek Pond – Mr. Paul Moore said they are still waiting on the surveyor who is a one-man crew. Mr. Lamar Taylor with the City of Beaufort said the city has approved additional help for the surveyor if needed.

Stoney Creek – Ms. Kimberly Jones said the Town of Bluffton is working through the RFQ procurement process and they will be going to the town council next week to see if they can negotiate with the first and second responders.

Salinity Study - On going. Nothing new to report. Mr. Larson noticed on the agenda for the annual SESWA conference in October, that SCDNR are on the agenda to present the salinity study findings.

Sea Level Rise and future planning – On going. Nothing new to report.

Okatie 319 Grant – The final report was accepted by DHEC.

H. Financial Report - Copies of the March financials were provided.

6. Unfinished Business – Eric Larson

A. *10 Percent Effective Impervious Area discussion and application of the rule to the Bluffton Gateway Development Agreement* – Eric Larson and Tony Maglione

Mr. Larson opened the floor for discussion. Discussion ensued. Mr. Kinghorn and Mr. Patrick Mitchell expressed their agreement with Mr. Larson's analysis of the Bluffton gateway project and how the ordinance was interpreted for this project. Mr. Larson said the ordinance is clear that you have to meet volume, peak flow and water quality and this development meet these three parameters. Imperviousness is an alternative method to reach the goal. Mr. Don Smith said he always considered the 10 percent effective impervious as a safety mechanism and it is useful for planning. Mr. Smith said if the county goes back to review the BMP Manual, he would like the 10 percent effective imperviousness revisited and strengthened. He would prefer to err on the side of caution and he referred to Mr. Tony Maglione report. Mr. Maglione said they investigated the 10 percent rule and could not find definitive data. He suggested if the county is going to use this as a comparison then it needs to be researched.

Mr. Reed Armstrong said that the developer had it memorialized in the agreement that they would be allowed to exceed the 10 percent. But the report provided by Mr. Larson indicated that it was not necessary. He said the developer has removed the language. Mr. Armstrong said this was a good educational opportunity for the elected officials and the public of how we try to approach water quality protection in our county.

The form-based code is going through the planning commission for final adoption. Mr. Larson provided a copy of his submission of the draft form-based codes for stormwater to the planning commission (please see attachment). He has asked them to add some additional detail back in to the code for clarification. Mr. Larson ended the discussion stating the need to revisit the ordinances and BMP Manual in light of pending MS4 permit requirements, would provide the opportunity to revisit the intent of the effective imperviousness guidance and how they may need to be modified.

7. New Business – None.

8. Public Comment – None.

9. Next Meeting Agenda – "Executive Session" will be added to the June Board meeting.

10. Meeting Adjourned.

BEAUFORT COUNTY STORMWATER UTILITY
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May 7, 2014

Stormwater Manager's report for the Stormwater Utility Board Meeting

Utility Update

1. DHEC and MS4 update – We continue to develop a plan for implementation of the MS4 program. I have been interviewing other MS4 programs across the state to learn how others are implementing their programs and how they are sharing tasks between multiple jurisdictions. I will be addressing the Natural Resources Committee in May to provide an overview of the MS4 program and the status of our County Stormwater program.
2. Budget for FY15 – Submitted in early March. We are awaiting feedback from the County Administrator's office.
3. Public Education Effort / Dog Waste Education at Earth Day events – We partnered with the Solid Waste / Recycling Division and the Friends of the Bluffton Dog Parks to distribute dog waste baggie dispensers and brochures during the Farmer's Market opening and Carb Festival in Port Royal on April 19th and the May River Clean-Up and Earth Day Celebration on April 26th. We distributed approx. 500 dispensers and 3,000 brochures at the Port Royal Event. At the Bluffton event, we distributed approx. 175 dispensers and 400 brochures.
4. Larson, C. Wallace, and E. Miller attended the SESWA spring conference on April 8 and 9, 2014. Notable "take-aways" are included in the attached memo. (backup)
5. Larson attended the American Planning Association's National Conference last week in Atlanta, GA. Larson was a presenter on the topic of Green Infrastructure. Beaufort County's program was part of the presentation.
6. May River Watershed signs by the Town of Bluffton and Beaufort County – The Town of Bluffton Stormwater Program is making watershed entry signs, similar to what the Port Royal Sound Foundation did, at select locations within the watershed. The County has agreed to partner with the Town on the cost of future signs.

Monitoring Update

1. USCB Lab – The last piece of equipment arrived the week of April 14th. Training on this equipment will occur May or June. Other monitoring activities are on-going.
2. D. Polk and I met with representatives with the Town of Port Royal to revisit the monitoring plan for the area near shellfish station 15-25. It is located in the Dowlingwood Tributary of Battery Creek. It is the only site impaired within the watersheds within the limits of the Town of Port Royal. As we move forward, we will try to identify sources of fecal contamination and develop potential project concepts.

Stormwater Implementation Committee (SWIC) report

1. The SWIC met on April 3rd, 2014. The topic was Public Education. (See attached draft minutes)
2. Public Education Branding – The SWIC has recommended the shared use of the Town Of Bluffton's "Neighbors for Clean Water" slogan for all public education efforts county wide. Our County Administration concurs. I recommend the Board's support of the joint branding effort.

Stormwater related Projects

1. Proposed Carolina Jellyball processing facility in Lobeco and unloading facility on Golden Dock Road in St. Helena Island – The Golden Dock site went before DRT the week of April 7th, 2014. I offered comments to Planning staff. The added concrete pad was below the threshold of our requirements for a stormwater plan. However, I did offer advice on requirements that could be included in an environmental study that would cover the process water and potential spills of the water, by-products, or other industrial use related to the site.
2. Drainage issue on H.E. McCracken Circle in Bluffton – Nothing new to report since last month.
3. Bluffton Gateway Development Agreement – I provided my review to the Natural Resources Sub-Committee April 4th, 2014. (See attached report). I presented to the sub-committee again on April 24th. (See attached presentation). ATM was hired to review our BMP Manual and present an opinion on my review. (See attached memo). The topic is continuing to be discussed.
4. US 278 at Kitty's Crossing Overtopping issue – The Bluffton Gateway project design highlighted the overtopping issue first mentioned in the 2006 Master Plan. Like the Forby Tract site last month, I am looking into the issue, the need for upsizing, and alternative solutions that can be incorporated into the changes proposed by the Bluffton Gateway site.
5. Infrastructure crew performed on-going maintenance needs. Nothing significant to report.

Professional Contracts Report

1. US 278 retrofit ponds – Bid due date is June 5, 2014. A Second pre-bid meeting was held on April 24th to go over the changes to the project. The addendum with the new plans was published. Permit modifications with DHEC and the County DRT are complete.
2. County Admin. Complex Retrofit Project – The project received no bids. We are evaluating the reasons behind the lack of response and we are discussing options to negotiate a contract with interested contractors.
3. Consultant procurement for the Carolina Jellyball application for the Lobeco site is still on hold pending a submittal from the applicant.
4. A RFP for a stormwater consultant to assist with the setup of the MS4 program is also on hold pending development of a MS4 implementation strategy.
5. Water Budget Study – Dr. Badr will be presenting the findings to the Board at the June Board meeting.

6. Okatie East BMP monitoring – D. Polk and I met with Ward Edwards to kick-off the monitoring project.
7. Trask Parkway Overtopping study – Results pending.
8. Paige Pointe Overtopping study – Report from Andrews and Burgess confirmed the overtopping issue and provided sizing and construction cost options. This project will be added to our list of CIP needs.

Regional Coordination

1. Battery Creek Pond – Still in design phase. (Lamar Taylor may report)
2. Stoney Creek – RFP for consultant currently is being advertised. (Kim Jones may report)
3. Salinity Study - On going. Nothing new to report.
4. Sea Level Rise and future planning – On going. Nothing new to report.
5. Okatie 391 Grant – The final report was accepted by DHEC.

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I N T E R O F F I C E M E M O R A N D U M

TO: **Rob McFee, Director of Engineering and Infrastructure**

FROM: **Eric W. Larson, Stormwater Manager**

SUBJECT: **Re-Cap of the spring 2014 SESWA Seminar in Atlanta, GA on April 8-9, 2014**

DATE: **April 21, 2014**

Carolyn Wallace, Ezekial Miller, and I attended the SESWA spring seminar in Atlanta, GA on April 8 and 9, 2014.

Noteworthy discussions from EPA representatives revolved around three central topics: 1) Stormwater Rulemaking and permit changes, 2) monitoring programs, and 3) audits/inspections of MS4 programs. EPA has withdrawn its proposal for a revised stormwater rule and is focusing on strengthen permit programs through integrated planning with water and wastewater, promoting LID, and creating a community based incentive program similar to a LEED certification but for a "green community". They also stated that going forward EPA will be focusing on "three pillars of sustainability" including the environment, social, and economics, which to me means they are aware of the pressures of the development community and the cost of stormwater regulations on development.

Strengthen the MS4 permits going forward has many components. Audits of program have found deficiencies in inspection by unqualified staff, failure to perform adequate biological assessment, not performing dry weather screening, and lack of quality assurance in monitoring programs. New permit language will have specific performance standards for BMPs and monitoring. They intend to stress improving programs by utilizing incentive programs to encourage LID and volume control. These were key components of the new stormwater rule they have now withdrawn.

One incentive mentioned that is of particular interest to us is the EPA Campus Rainworks Challenge competitions on college campuses. Since we have the WQ lab, maybe USCB may be interested in forming teams to compete. County could assist in selecting judges and providing prizes. This would be a public education & outreach opportunity and the projects would demo green infrastructure designs.

The City of Chattanooga has a credit program based on volume reduction, not a percentage based on deploying certain BMPs. Part of their credit program includes an annual design challenge to promote LID use. They also have a LID Excellence award, which is a financial award to development for using LID. A program such as this, providing competitive grants to local rate payers interested in retrofitting their site for volume control, could be an opportunity for Beaufort County.

An awareness program mentioned by EPA were project signs highlighting water quality enhancement projects. We could use these signs during and after construction to educate the public on what is being done and demonstrating the use of Utility Fees.

Steve Leo with Gwinnett County, GA spoke on asset management. He stressed the importance of mapping and assessing the system to find maintenance needs and identify capital projects. I agree with that approach and intend to implement an asset management program in FY 2015.

DRAFT Minutes - SWIC Meeting April 3, 2014 - BJWSA Community Room 1:30 pm - 3pm

1. Introductions
    a. Attendees: Kim Jones, Beth Lewis, Bryan McIlwee, Lamar Taylor, Eric Larson, Tony Maglione
2. Minutes from March 12, 2014 - approved by common consent
3. Public Education and Involvement
    a. Message(s)
        i. Pet waste
        ii. Septic
        iii. Construction erosion
        iv. Stormwater 101 (as done previously by ATM) for general audience
        v. Stormwater Utility credit program
        vi. Wildlife – "don't feed wildlife"
        vii. Agricultural / silviculture activities (erosion control)
        viii. Pesticide and herbicide on AG property, golf courses, residential and commercial applications
        ix. IDDE - used oil, detergents, straight pipe of washers
        x. Stormwater pond maintenance
    b. Audience(s)
        i. Greater Island Committee
        ii. Neighbors for Clean Water
        iii. Friends of Port Royal Sound Foundation
        iv. SC Coastal Conservation League
        v. Beaufort County Schools - ToB does all 3rd and 7th grade classes (in Bluffton only) annually
        vi. Home Builders Associations
        vii. POA / management companies
        viii. Golf course managers
        ix. Festivals throughout the year
        x. Local Audubon Foundation
    c. Methods
        i. It was decided to have the agencies propose back to us on how to best deliver the message rather than dictate how to do it.
        ii. Possible ideas (not discussed during this meeting but mentioned in past meetings
            1. Hard copy mailers, stuffers
            2. Video and Audio ads for TV, County Channel, Radio
            3. River Clean Up days
            4. Public Meetings
            5. School Curriculum
    d. Partners
        i. Internal Resources
            1. ToHHI has Sally Krebs but OK using something like Carolina Clear to assist.
            2. ToB has Beth Lewis. Due to small cost, will likely join the cost share and OK with using outside consultant.
        ii. Carolina Clear

1. Overwhelming support by the SWIC on the past efforts of the Carolina Clear program and recommended their continued use.
2. It was noted the scope from past contract was acceptable to all. Carolina Clear knows the MS4 program and what is needed to satisfy DHEC reporting.
3. Tony suggested that perhaps Carolina Clear is used to organize efforts and reporting and utilize local organizations to do the work.
4. It was noted that the last contract had a requirement to utilize local groups (Port Royal Sound Foundation, Low Country Institute, etc.)

iii. USCB-might be useful for student involvement as part of course work.
iv. Technical College of the Low Country - same as USCB but likely to lesser degree due to courses offered.
v. Friends of Port Royal Sound / Port Royal Sound Foundation - no one is sure what they're doing.
vi. SC Coastal Conservation League - No. Advocacy group, not educators.
vii. Sea Grant Consortium - would be good for content, but probably wouldn't do administrative effort of the education program. They do have grant funding and could probably help with funding. Contacts are Rick DeVoe and April Turner.
viii. Low Country Institute - Chris Marsh's group. Could be a local contributor but likely not an administrator of the reporting.
ix. Together for Beaufort – No. Committee of others, not a stand alone group.
x. Neighbors for Clean Water - simply branding of ToB stormwater education program.
xi. Beaufort Soil and Conservation District (Denise Parsick) - would be a good option. Kim pointed out they have the skills but not sure about the reporting aspect.
xii. Others
    1. Tony suggested Waccamaw SW Consortium. Supported by Coastal Carolina University and Dr. Susan Libes.
    2. Hillary at Town of Mount Pleasant was also mentioned as a reference and advice. Danny Polk stated she ran their education program.
    3. It was suggested to ask Cary Gaffney with ToHHI. He has past knowledge of County educational efforts.

4. Procurement
    a. Eric should get the past Carolina Clear contract and see how it was laid out.
    b. Scope should define measurable goals to determine success.
    c. Would it be possible to sole source someone without going through the RFP process? Eric will ask County Purchasing.
5. Cost Sharing and Collaboration
    a. To get CoB and ToPR to buy in, Rob McFee needs to work with Scott Dadson and Van Willis to explain why the contract with Carolina Clear was canceled and why they should voluntarily participate again.
6. Other issues
    a. Bryan says we need a consortium name to identify effort, such as Neighbors for Clean Water. Kim says ToB willing to expand the effort and name to all. Kim will look into the ability to expand the use of the name to all.
7. Next Meeting - May 14, 2015. Topic: MS4 Data Management

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INTEROFFICE MEMORANDUM

TO: **Beaufort County Administration**
Natural Resources Sub-Committee on the Bluffton Gateway Development Agreement
County Council

FROM: **Eric W. Larson, Stormwater Manager**

SUBJECT: **Bluffton Gateway Development Project – Stormwater Design review**

DATE: **April 4, 2014**

Summary

This report includes a review of the Kimley-Horn and Associates stormwater plan for the proposed site. Review included verification that the plan meets the requirements found in the Beaufort a County BMP Manual for stormwater run-off peak flow rate for the 25 year, 24 hour storm event, pollutant removal criteria for Phosphorus, Nitrogen, and Fecal Coliform Bacteria, and volume reduction for the 95th percentile storm event volume of 1.95". Effective impervious area calculations were reviewed as part of the volume reduction criteria. Sizing of the cross drains for the proposed Connector Road was also reviewed. Additional issues, including the inclusion of the Connector Road in volume and water quality design calculations and the impacts of the required Brownfield mitigation, were considered.

The stormwater design has met the BMP Manual requirements for peak run-off flow rate reduction, pollutant removal, and volume reduction through the use of various BMPs including a wet detention pond, water capture and re-use through irrigation, porous pavement, and bio-retention cells. The effective impervious area calculations indicate that the design of the BMPs has met the criteria of "Maximum Extent Practicable" at an effective impervious rate of 14.4%. The proposed plan appears to meet the "spirit" of the BMP manual through the use of multiple BMPs although the effective impervious area calculation does not demonstrate achieving the target of 10% effective impervious area. The design parameters for irrigation storage and reuse are reasonable, however more information will be needed during the design submittal the Technical Review Team to assure the design will achieve the proper results.

Additional review is needed concerning the cross drains proposed for the proposed Connector Road to assure upstream flooding of structures and diversion of waters into adjacent watersheds does not occur.

Introduction

I have completed a review of the Kimley–Horn and Associates (KH) submittal received March 26, 2014 and subsequent submittals made April 1, 2, and 3 in response to preliminary review comments I made to KH. The following is a summary of my review and recommendations concerning the report.

My review was intended to assure compliance with our current requirements for stormwater design, found in the Beaufort County Manual for Stormwater Best Management and Design Practices (BMP Manual). Review was three parts:

1. Peak Run-off rate reduction for the 25 year – 24 hour storm event
2. Pollutant removal for Phosphorus, Nitrogen, and Fecal Coliform Bacteria, and
3. Volume reduction for the 95th percentile storm event, or the 1.95" volume.

Included in the volume reduction analysis, I reviewed the effective impervious area calculations. This requirement is in the BMP Manual and compliments the review of the 95th percentile storm volume reduction.

Peak runoff rate analysis

Our BMP Manual requires the analysis of the discharge rates from a detention basin for the 25 year - 24 hour storm event. KH provided analysis for the 2, 10, 25, 50 and 100 year - 24 hour events to satisfy County requirements as well as those of the USCAE, DHEC and SCDOT. With the exception of the 100 year storm event, which we do not regulate, the post-development rate of discharge from the site is below pre-development conditions. Therefore, this criterion has been met.

Storm Events	Pre Development Discharge (cfs)	Post Development Discharge (cfs)
2-Year, 24-Hour	18.45	16.04
10-Year, 24-Hour	42.39	41.98
25-Year, 24-Hour	66.91	61.12
50-Year, 24-Hour	92.68	92.10
100-Year, 24-Hour	122.02	138.04

Pollutant Removal

KH has provided pollutant removal efficiency calculations for a series of effective imperviousness scenarios as part of a cost - benefit analysis (see more discussion below). In the 10%, 14.4%, 15.2% and 19.8% effective imperviousness analysis, removal requirements for Phosphorus, Nitrogen, and Fecal Coliform Bacteria have been met. Nitrogen removal requirements were not met in the 24.5% effective imperviousness analysis. Therefore, any level of effective imperviousness at or below 19.8% will meet this criterion.

Volume Reduction

Our BMP Manual requires that the post-development run-off volume not exceed that of pre-development. The run-off volume is calculated based on the 95th percentile rain event. For this area, it is generally accepted as 1.95" of rainfall and is defined within the manual as the standard. Based on the development of the site, KH has calculated a post-development volume of 67,631 cf, or an increase of 43,442 cf from the pre-development condition.

Volume Reduction is met through a combination of pervious BMPs implementation and water capture and re-use through irrigation. The wet detention pond has a permanent irrigation pool with a volume of 156,233 cf; therefore the BMP for irrigation re-use has the potential to store all runoff, not just the increase from pre-development. The irrigation re-use volume is based on capturing 4" of rainfall from

approximately 10 acres of roof tops and impervious pavements on the site. This equates to a volume of 145,200 cf, which exceeds the post-development runoff volume and is contained within the irrigation basin.

In order to assure that the capture and re-use volume is appropriate, I requested an analysis of the application of the irrigation water and drawdown of the irrigation pond. KH has quoted 2013 weather data of approx. 52" of annual rainfall, which is consistent with the generally accepted 50"/yr., 20 year average for the area. They are recommending an application rate of 1.5"/week over approx. 8.2 acres. It is also generally accepted that irrigation rates of 1" - 2" / week are acceptable for the area, therefore the recommendation is reasonable. Based on an analysis of pump drawdown and horizontal infiltration into the soil, KH has estimated that the 4" volume within the irrigation pool could be drained dry within 15 days. Given the average annual rainfall of approx. 48"-52" and a 95th percentile event of 1.95", the area averages a design storm event every 14 days. Therefore, it is a reasonable assumption that the basin will have adequate capacity to store most storm events.

The Design Review Team may choose an additional step to assure compliance with the volume reduction proposed by the applicant. In similar irrigation re-use BMPs in the County, the issuance of stormwater fee credits to several residential developments has included the condition of annual reporting to verify the minimum irrigation volume was collected and re-used over the previous year. This would give the County the opportunity to revisit the design approval should the BMP fail to function as designed.

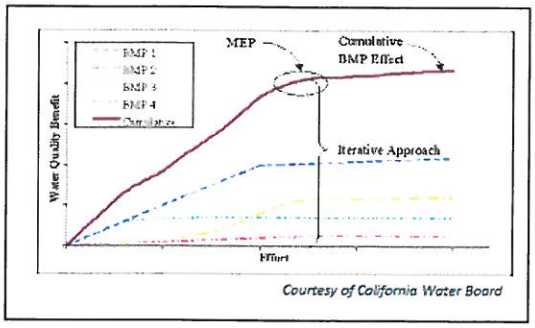
The method of irrigation pool filling has not been clearly defined. The plan seems to indicate that the basin will fill during a 25 year design storm event through gravity flow and will be captured and prevented from release via a berm within the wet detention pond. To be effective in volume reduction as proposed, the basin will need to be designed so that the irrigation pool is filled during every storm event either by gravity or pumping from the water quality portion of the basin.

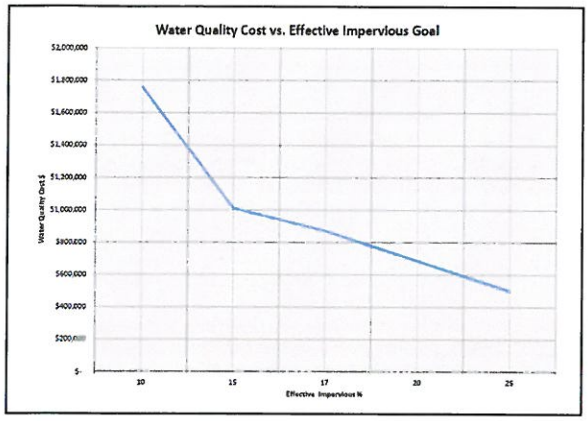
Effective Impervious Area

KH has provided a series of effective impervious area calculations. 10%, 14.4%, 15.2%, 19.8%, and 24.5% effective imperviousness site designs are considered. With each analysis, a summary of the BMP practices to be used and the incremental cost of construction were provided. As stated above, any scenario with an effective imperviousness at approx. 20% would meet pollutant removal criteria. However, throughout Section 3 of the manual, the use of primary and secondary BMPs is outlined to reduce stormwater run-off volume to achieve a volume control target of 10% effective impervious area for the site. (Section 3.1, pg. 3-22). Further, the states that a post development site that reduces impervious surface runoff so that it is equivalent to the pre-development surface runoff would have an effective imperviousness of 0%. (Section 3.1, pg. 3.6). Therefore, based on the Volume Reduction discussion above, it could be assumed the effective impervious area for this site is 0%.

Through my review of the BMP Manual, I have concluded that the "spirit" of the BMP Manual is to promote Low Impact Development, or Green Infrastructure, to minimize our impact to the environment. The BMP Manual states that BMPs should be used to the Maximum Extent Technically Feasible (METF) to achieve the 10% effective impervious area target. I interpret that to mean that the extensive use of a variety of different BMPs in a treatment train should be utilized to achieve the target. To varying degrees, the five scenarios proposed by KH do this. KH has included the following BMPs within the scenarios: run-off reduction through irrigation reuse, bio-retention (rain garden), wet detention, and porous pavement.

Another important definition used in regulation by the US EPA and SC-DHEC is Maximum Extent Practicable (MEP) (EPA Stormwater Phase II Final Rule - 64 Federal Register 68722 & SC NPDES General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems, January 1, 2014). Recently at a South Carolina Association of Stormwater Managers meeting (3/19/14), representatives from DHEC defined MEP as "if a permittee employs all applicable BMPs, except those which are not technically feasible for the location and whose cost would exceed the benefit of implementation, MEP has likely been met. If a permittee only selects a few, low cost and /or ineffective BMPs, MEP has likely not been met."





KH has provided a cost-benefit analysis for the 10%, 14.4%, 15.2%, 19.8%, and 24.5% effective impervious area scenarios. On a chart comparing cost to effective impervious area, there is a notable change in the slope of the curve at approx. 15% effective impervious area, meaning cost increases at a higher rate than the decrease in impervious area. Based on the definition of MEP, it can be applied that MEP is met at this inflection point along the slope. Given that the 14.4% scenario provided by KH includes the use of porous pavement, and the 15.2% scenario does not, I suggest that the 14.4% scenario should be considered MEP.

However, MEP, as defined by KH, does not meet the target of 10% effective impervious area. Therefore, I decided to explore the establishment of this threshold. The BMP Manual notes research by (Tom) Schueler that suggests that a relatively low percentage of impervious cover (10-15%) can induce adverse and irreversible changes in stream water quality. It is the continued discussion within the BMP Manual concerning pollutant loading as it relates to run-off volume that apparently established the 10% target (Appendix A, Section A.7). I read the article titled "The Importance of Imperviousness" authored by Schueler that this cite was apparently based on. In this article, it clarifies that the range of 10-15% impervious cover is that within a watershed that produces run-off volumes that being to degrade the receiving stream by destabilizing the stream bank through erosion (due to increased volume and velocity over a longer period of time). Ironically, the end of the article it cautions that "while the research on impervious cover and stream quality is compelling, it is doubtful whether it can serve as the sole foundation for legally defensible zoning and regulatory actions." Therefore, the KH scenario of 14.4% effective impervious area appears to meet the "spirit" of the BMP Manual.

Due to the lesser amount of pervious surfaces being utilized for infiltration and irrigation water absorption, and the extensive use of stormwater reuse by irrigation, the calculation of effective impervious area is skewed so that the criteria for volume control and pollutant reduction can be met without having to employ additional BMPs to reach the 10% target.

Connector Road Culvert Analysis

The stormwater design also includes the sizing of cross drains under the proposed Connector Road to convey upstream off-site water through the wetlands and downstream to the 2 existing 42" RCP culvert crossings under US 278. This location along US 278 is identified in the 2006 Beaufort County Master Plan as an insufficient pipe size that will result in an overtopping situation during a 100 year flood event.

Modeling by KH of the existing culverts under US 278 indicates that the impoundment of stormwater during the 50 year event (as required by SCDOT) at an elevation of 21.42 ft. Review of County GIS data shows the impoundment extending south towards the Bluffton Parkway and the May River watershed. Two notable issues currently exist - (1) the apparent watershed boundary between the Colleton River and the May River is above 22 ft., and (2) at least one structure is located in the flood impoundment area. Review via Pictometry suggests it is non-residential in nature, however I have not made any further review of the use or finished floor elevation.

KH has proposed two 4'x6' box culverts under the proposed Connector Road. KH modeling of the proposed culverts indicates the 25 year storm event will impound flood waters to an elevation of 22.32 ft. (The BMP manual only requires the evaluation of the 25 year storm event.). According to the KH report, it is the tailwater condition on the proposed culvert, a result of the undersized pipes under US 278, which hinders the proposed culverts to convey the flood waters without an increase in headwater (flood) elevation. Without more information, I am unable to determine if the increased flood elevation will cause additional impact to existing structures or result in flow of stormwater into adjacent watersheds.

Inclusion of the proposed Connector Road in the stormwater design

The impervious area of the new road has been included in the calculations for peak run-off rate reduction, pollutant removal, and volume reduction for the 95th percentile storm event. However, for the calculation of the effective impervious area, the impervious areas within the future County right-of-way were not included. As explained by KH, these areas were not included since they are not part of the developed site.

Impervious encapsulation for the Brownfield mitigation plan

The KH plan proposes several bio-retention cells within the area identified for encapsulation. According to an email provided by the environmental consultant for the mitigation plan, "installation of a few shallow rain gardens in the areas of contaminated ground water should not have an adverse effect on the environmental situation." Therefore, the need to create an approx. 5 acre impervious area on the site is not an issue for determining the effective impervious area.

Conclusion and Recommendation

The stormwater design prepared by Kimley-Horn and Associates has met the BMP Manual requirements for peak run-off flow rate reduction, pollutant removal, and volume reduction through the use of various BMPs including a wet detention pond, water capture and re-use through irrigation, porous pavement, and bio-retention cells. The proposed plan appears to meet the "spirit" of the BMP manual through the use of multiple BMPs although the effective impervious area calculation does not demonstrate achieving the target of 10% effective impervious area. The design parameters for irrigation storage and reuse are reasonable, however more information will be needed during the design submittal the Technical Review Team to assure the design will achieve the proper results.

Additional review is needed concerning the cross drains proposed for the proposed Connector Road to assure upstream flooding of structures and diversion of waters into adjacent watersheds does not occur.

Beaufort County Stormwater Design

Explanation of the review process and its application on the Bluffton Gateway Development Plan

The Regulation

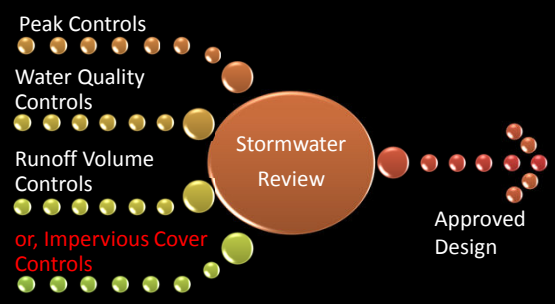
- Code of Ordinances
  - Chapter 106 – Z.D.S.O.
    - Article XIII – Sub'd & Land Development Stds.
      - Division 4 – Stormwater Mgt. Stds.
        - » Section 106-2856. Purpose

(c) All development and redevelopment shall provide adequate stormwater runoff water treatment and volume control in accordance with the **latest version of the county's manual for Stormwater Best Management Practices (BMPs).**

The Regulation, cont.

(d) To the maximum extent technically feasible, **no development or redevelopment shall cause post-development stormwater rates, quality or volume to increase above predevelopment levels** or to cause an adverse increase in the surface runoff reaching adjacent or surrounding property or receiving waters. Surface runoff rate and volume shall be dissipated by detention or retention on the development parcel, percolation into the soil, evaporation, transpiration, reuse or by transport by natural or manmade drainageway or conduit (protected by legal easement) to a county-approved point of discharge.

BMP Manual Principles



Note on Bluffton Gateway Design

- The site design prepared by Kimley – Horn includes the buildings, parking areas, outparcels, and the proposed Connector Road to be built and dedicated to the County
- The stormwater design routes all runoff from the site and the road through the primary BMP, a Wet Detention Pond
- Therefore, County Road and outparcels runoff **are** accounted for in the Peak, Water Quality, and Volume Reduction Controls
- However, the County Road and outparcel surface area **are not** included in the Impervious Cover Control analysis

BMP Manual Guidelines

- Peak Controls
  - BMP Manual Section 2.3.4 (2) – Peak discharge for post-development design storm **shall not exceed** the peak discharge of the pre-development or existing conditions (for the 25-year, 24-hour design storm event).

Bluffton Gateway - Peak Control

- Ordinance requires the 25-year, 24-hour event to be considered
- Kimley – Horn Design exceeds our requirements

Storm Events	Pre Development Discharge (cfs)	Post Development Discharge (cfs)
2-Year, 24-Hour	18.45	16.04
10-Year, 24-Hour	42.39	41.98
25-Year, 24-Hour	66.91	61.12
50-Year, 24-Hour	92.68	92.10
100-Year, 24-Hour	122.02	138.04

BMP Manual Guidelines

- Water Quality Controls
  - BMP Manual Section 3.2, supported by Appendix A.7 (paraphrased) – "Antidegradation" **goal** for total phosphorus and total nitrogen is based on annual average loads expected to be generated by land uses with an overall imperviousness of approximately 10%. The load **target** for fecal coliform bacteria should be based on an overall imperviousness of 5%. BMPs are selected based on removal efficiencies.

Bluffton Gateway - Water Quality Control

- Kimley – Horn Design utilizes a Wet Detention Pond as primary BMP for nutrient and bacteria removal
- This analysis considers % impervious cover
- Kimley-Horn submitted analyses for 10%, 14.4%, 15.2%, 19.8%, 24.5% effective impervious area
- Any level of effective impervious at or below 19.8% meet this criterion

BMP Manual Guidelines

- Runoff Volume Controls
  - BMP Manual Section 2.3.4 (4) – Facility design will control and retain total volume by retention and other methods so stormwater runoff levels **will not exceed** pre-development levels (for the design storm event).

Bluffton Gateway - Runoff Volume Control

- Based on the 95th percentile design storm event, Kimley – Horn determined:
  - Pre-Development Volume = 24,189 CF
  - Post-Development Volume = 67,631 CF
  - Increase = 43,442 CF
- Irrigation capture and reuse BMP provides 156,233 CF storage
- Therefore, 100% of site runoff volume is captured

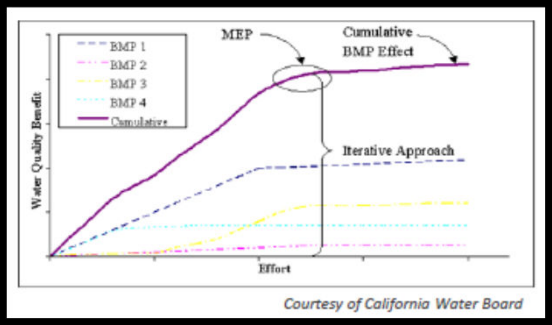
BMP Manual Guidelines

- Impervious Cover Controls
  - BMP Manual Section 3.1, supported by Appendix A.6 (paraphrased) – Volume control **target** is a threshold of 10% effective impervious area. It is consistent with the water quality framework in Appendix A.7 and consistent with the ordinance that requires post-development stormwater volume to be controlled for storm events up to the 95th percentile event, or daily rainfall of 1.95".

Bluffton Gateway - Impervious Cover Control

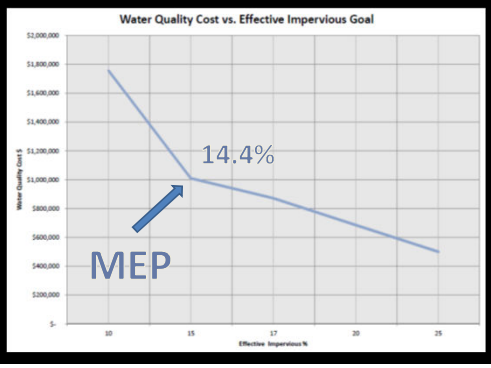
- Kimley-Horn submitted analyses for 10%, 14.4%, 15.2%, 19.8%, 24.5% effective impervious area
- Design utilizes these BMPs:
  - Wet Detention Pond
  - Bio-swales / Rain Gardens
  - Runoff capture and reuse for irrigation
  - Porous Pavement
- The range of values was intended to demonstrate Maximum Extent Practicable (MEP)

MEP defined



Provided by: SC-DHEC

MEP on Bluffton Gateway site



The Logic of the "10% Rule"

- …runoff volume controls (are) a different way to handle stormwater runoff and **not an additional set of controls**.
- …by utilizing volume controls, most water quality and some of the peak shaving requirements are also addressed.
- …in addressing a runoff volume requirement, volume quantity and quality **requirements can be integrated by utilization** of Equivalent (effective) Impervious Cover (method).

- D. Ahern, R. Wagner, R. Klink (2012)

Conclusion

- 4 separate analyses, but
- Impervious Cover Control review has basis as an alternate approach to review the other three main components and applies a performance standard in those three components.
- The BMP Manual allows compliance with the three main components yet not meet the Impervious Cover Control approach.
- Section 3.1 Volume Control – "if post – development impervious surface runoff is equal or less than pre-development pervious surface runoff, then the effective impervious area is 0%.

Conclusion cont.

- The BMP Manual **does not** mandate the use of specific BMPs. Instead, it offers a variety of BMP alternatives that can be used on a project that have found to be effective in reducing volume and pollutants.
- All BMPs are engineered solutions that require maintenance to remain effective in reducing volume and pollutants.
- The BMP Manual **does not** prohibit the use of "engineered solutions" for BMPs.

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Technical Memorandum

To: Eric Larson, PE Stormwater Manager

From: Tony Maglione

Date: April 11, 20014

Re: Application of 10% Effective Impervious Concept
Gateway Development, Beaufort County, SC

Introduction:

ATM was requested to review the information prepared by the County Stormwater Staff related to the stormwater management system design for the Gateway development. Concerns have be raised by various parties as to whether or not the site should or could meet the 10% Effective Impervious Area concepts outlined in the County's Manual for Stormwater Best Management Practices. ATM has reviewed:

- Mr. Larson's *Bluffton Gateway Development Project – Stormwater Design review"* dated April 4, 2011
- Section 106-2856 of the County ZDSO Stormwater Management Standards
- Section 106-2860 of the County ZDSO General Planning and Design Requirements
- Section 3 of the Stormwater Best Management Practices

Part of the stormwater design computations is preparation of a worksheet that computes the percentage of Effective Impervious Area. One major concern that has been raised is what percentage of Effective Impervious area that can be achieved on this site? Many believe that the project must demonstrate that it can achieve an Effective Impervious Area of 10%. However, the ZDSO does not address Effective Impervious Area. The Effective Impervious Area is only referred to the Stormwater Best Management Practices Manual. The Stormwater Best Management Practices Manual Section 1, 1.1 Background states "*The recommended goal set for new developments is 10% effective impervious." (Emphasis added).* Thus an Effective Impervious area of 10% is not a requirement but is a goal to be strived for with the understanding, that because of nature of the computations used in the Stormwater Best Management Practices Manual, that not all sites will be capable of achieving the 10% Effective Impervious Area even if they meet all the other requirements for stormwater pollutant removal and discharge volume controls.

The Gateway project appears to be one such project. In reviewing Mr. Larson's analysis of the proposed project site contains some unique site conditions that may impact results of the Effective Impervious Area worksheet computations. In addition, based upon Mr. Larson's review, the calculations demonstrate that the site will meet the requirements for fecal coliform and nutrient removal as well as stormwater volumetric controls. However, the

worksheets for Effective Impervious Area contained in the Stormwater Best Management Practices Manual does not allow for adjustments for unique site conditions.

Recommendations:

The inability of the Gateway project to achieve the 10% Effective Impervious goal is a result of the mathematical calculations used to compute this value. As the Gateway project appears to meet all other critical stormwater pollutant and volume controls stipulated in the Stormwater Best Management Manual, it should not be forced to meet the 10% Effective Impervious Area goal simply because of a mathematical anomaly. We concur with Mr. Larson's review that the proposed stormwater system design is protective.

ATM was heavily involved with the development of the Stormwater Volume Control Ordinance but was not involved in the development of the Effective Impervious Area goals nor the changes to the Stormwater Best Management Practices that implemented the same. We believe that the 10% Effective Impervious Area concept is not supported in sound science and should have been studied more thoroughly before implementation. The computations presented in the Stormwater Best Management Practices Manual used to determine if a project can meet this goal leave no room for interpretation and, such as in the case of the Gateway project, creates unnecessary burdens on development that have no measurable benefits.

The Effective Impervious Area concept was developed after the Stormwater Volume Control ordinance was developed and was created by County staff who are no longer with the County. As there are a number of technical issues surrounding the practical application of the Effective Impervious Area process and given the complexity of the concept as presented in the Stormwater Best Management Practices Manual, we would strongly recommend that the County have an outside third party engineering firm revisit the Effective Impervious Area process, the 10% goal to determine if it is based on sound science, identify anomalies in the process and make recommendations to the County as to how best to modify this process so it can be properly applied, clearly understood and conflicts, such as the one surrounding the Gateway project, can be avoided in the future.

Division 5.12: Stormwater Standards

Sections:

5.12.10 Purpose

The purpose of these standards is to protect the County's water resources by ensuring that development and redevelopment, including highways, shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the pre-development hydrology of the property with regard to the temperature, rate, volume, quality and duration of the water flow.[1]

5.12.20 Applicability

A. **Exemptions**. The standards established in this Division shall apply to all proposed development within the County, except for the following exemptions:

1. Any maintenance, alteration, renewal use or improvement to an existing drainage structure as approved by the County Engineer which does not create adverse environmental or water quality impacts and does not increase the temperature, rate, quality, or volume or location of stormwater runoff discharge;
2. Development where adequate drainage exists of fewer than four residential dwelling units that are not part of a phase of a larger development, not involving a main drainage canal;
3. Site work on existing one-acre sites or less where impervious area is increased by less than two percent;
4. Site work on existing one-acre sites or less where impervious area is increased by less than two percent, and any earthwork that does not increase runoff and/ or eliminate detention/retention facilities and/or stormwater storage or alter stormwater flow rates or discharge location(s);
5. Agricultural activity not involving relocation of drainage canals; or
6. Work by agencies or property owners required to mitigate emergency flooding conditions. If possible, emergency work should be approved by the duly appointed officials in charge of emergency preparedness or emergency relief. Property owners performing emergency work will be responsible for any damage or injury to persons or property caused by their unauthorized actions. Property owners will restore the site of the emergency work to its approximate pre-emergency condition within a period of 60 days following the end of the emergency period.
7. Golf courses are required to comply with the latest version of the County's Manual for Stormwater BMPs and all site runoff volume and water quality control and drainage planning and design requirements. However, both golf courses and private lagoons shall be exempt from the flood control requirements of BMP manual Control Design, subject to clear demonstration by the design engineer that no damaging flooding will

Summary of Comments on Division 5-12 Stormwater 1-27_14 with ewl comments 05052014.pdf

Page: 1

Number: 1 Author: elarson Subject: Highlight Date: 5/5/2014 1:41:13 PM

Add the following sentence:

No development or redevelopment shall cause postdevelopment stormwater rates, quality, or volume to increase above predevelopment levels or to cause an adverse increase in the surface runoff reaching adjacent or surrounding property or receiving waters.

occur during the 100-year/24-hour storm and that all other safety concerns are addressed.

B. **Private Drainage Systems Not County Responsibility**. Where private drainage systems and easements have been previously approved as private facilities, prior to 4/26/1999, as well as all new development and redevelopment, and have not been accepted by the County, such facilities shall not become County responsibility, and are to be so noted on any new subdivision plat or land development plan, as well as in the respective covenants and agreements which control or follow the property.

C. **On-Lot Volume Control**. If single-family homes are not covered by an approved development volume control, the Building Permit will require controls as specified in the current edition of the County's Stormwater BMP manual.

5.12.30 Stormwater Standards

A. All development and redevelopment require both stormwater runoff volume control and runoff pollution load control as well as peak runoff rate controls. Standards for volume and runoff pollution load control are based on anti-degradation goals tied to "effective imperviousness" values. Current standards are as follows:

Table 5.12.30.A Effective Imperviousness Values

Loads	Equivalent Effective Imperviousness
Runoff Volume Control	10%
Phosphorus and Nitrogen Loads	10%
Bacteria	5%

B. Standards for peak runoff rate control are that peak post-development flows for the 25 year design storm is less than or equal to the peak pre-development flow for the same design storm. Currently the 24 hour/ 25 year design storm is 8.0 inches. All these standards are to be achieved in accordance with the latest version of the County's Manual for Stormwater Best Management and Design Practices (BMP), which is incorporated herein by reference.

C. All development and redevelopment shall utilize and integrate Stormwater BMPs which are appropriate to their location and environment, and contribute to the overall character of a proposal. BMPs implemented at the development scale shall be integrated into civic and open space networks to the maximum extent 1ossible in accordance with the standards found in Division 2.8, Civic and Open Space Types. Stormwater BMPs should be selected in keeping with the applicable transect zone or conventional zone, as indicated in Table 5.12.30.C. BMPs may be designed as a singular practice or as part of various supplemental pre-treatment BMPs in series to achieve the 2ffective imperviousness goals.

E. Planning for stormwater should commence at project inception. As the requirements set forth above and elsewhere in BMP manual will require stormwater management to become a vital aspect of all development and redevelopment projects within the County, planning for stormwater management, in accordance with this Section shall commence at the time of initial project inception and presentation to the Director. Review of stormwater management for development and redevelopment projects will be undertaken during all phases of the development review process.

5.12.40 Enforcement

The County has the right to enter, enforce maintenance and/or cause maintenance of any stormwater management facility, either privately or publicly owned.

Page: 2

Number: 1 Author: elarson Subject: Highlight Date: 5/5/2014 1:36:51 PM
Replace with:
technically feasible

Number: 2 Author: elarson Subject: Highlight Date: 5/5/2014 1:43:39 PM
I recommend changing these three words as follows:
runoff volume, runoff pollution load, and peak runoff rate control standards.

Table 5.12.30.C: Stormwater BMP Type Standards		
	Stormwater BMP Type	**Allowed In**
	**Vegetated Swales** are shallow drainage ways that employ landscaping to provide water quality treatment via biofiltration. They are designed to remove silt and sediment associated pollutants before discharging to storm sewers and to reduce volume if soils allow for infiltration. The treatment area can be planted in a variety of grasses, sedges and rushes, while the side slopes can be planted with shrubs and groundcover. Check dams are added to aid infiltration.	T1 T2 T3 T4 C3 C4 C5 S1
	**Green Roofs** are a way of managing stormwater in urban areas with limited space for more land intensive BMPs. Green roofs are able to store stormwater in the soil medium during rain events, helping to detain runoff. Some of the stormwater will be taken up by the roots of the plants and some will be evaporated from the soil medium, reducing the amount of runoff from the roof.	T1 T2 T3 T4 C3 C4 C5 S1
	**Pervious Paving Systems** allow water to pass freely through the interstitial space ingrained throughout the paving matrix, thereby transforming traditionally impervious surfaces. Several examples are pervious concrete and asphalt, interlocking pavers, and reinforced gravel and grass paving.	T1 T2 T3 T4 C3 C4 C5 S1
	**Rain Gardens** are flat-bottomed landscaped depressions that can be built to any size or shape. Also known as 'bioretention cells', they are designed to allow water to settle and infiltrate into the soil. They reduce the peak discharge rate from a site via detention. Water quality improvements are achieved through particle settling, nutrient uptake, and filtration as water soaks into the ground.	T1 T2 T3 T4 C3 C4 C5 S1
	**Disconnected Downspouts**. In lower density residential areas downspouts should be disconnected from storm drain systems and directed towards landscaped areas or other BMP devices. This reduces the burden on the storm drain network and allows runoff to slow and infiltrate before overflowing to storm drains.	T1 T2 T3 T4 C3 C4 C5 S1
	**Wet Detention Ponds.** The pond consists of a permanent pool of water into which storm water runoff from each rain event is detained and treated in the pond until it is displaced by runoff from the next storm. Sedimentation processes remove particulates, organic matter, and metals, while dissolved metals and nutrients are removed through biological uptake.	T1 T2 T3 T4 C3 C4 C5 S1

General Note: Images on this page are illustrative, not regulatory.

Key T# Allowed T# Not Allowed

Table 5.12.30.C: Stormwater BMP Type Standards (continued)

Stormwater BMP Type	Allowed In
 **Vegetated Flood Plains** can be integrated with parks, playing fields, or unmanaged landscapes. Frequent storm events can be detained by smaller decentralized means, while larger storm events should be directed to non-priority vegetated landscapes for temporary detention.	T1 T2 T3 T4 C3 C4 C5 S1
 **Urban Flood Plain.** Urban hardscapes can be used for temporary storage of large storm events. Smaller events should be mitigated by decentralized means, while the larger events can be directed toward non-priority spaces which are planned and designed for the temporary storage of stormwater flows.	T1 T2 T3 T4 C3 C4 C5 S1
 **Riffle Pools.** Connected landscapes provide retention of runoff by integrating intermittent vertical drops and damming in a watercourse. The retained runoff is then allowed to infiltrate into the groundwater table or conveyed for further treatment.	T1 T2 T3 T4 C3 C4 C5 S1
 **Flow-through Planters** are landscape features that also provide stormwater runoff control and treatment. Flow-through planters are sealed on all sides and fitted with an underdrain. They only absorb as much water as soil and plants in the planter can accommodate. Once the planter is at capacity, water is then discharged through the underdrain. They are ideal for receiving roof runoff from downspouts and can be incorporated into foundation walls.	T1 T2 T3 T4 C3 C4 C5 S1
 **Infiltration Trenches** are subsurface facilities designed to provide on-site stormwater retention in areas of good infiltration by collecting and recharging stormwater runoff into the ground. Trenches filter pollutants to improve water quality and contribute towards groundwater recharge. They are relatively low maintenance and can be easily retrofitted into existing sidewalk areas and medians.	T1 T2 T3 T4 C3 C4 C5 S1
 **A Natural Channel** is a meandering, vegetated watercourse with natural banks. It is buffered from development zones by large uncultivated landscape.	T1 T2 T3 T4 C3 C4 C5 S1

General Note: Images on this page are illustrative, not regulatory.

Key T# Allowed T# Not Allowed

Table 5.12.30.C: Stormwater BMP Type Standards (continued)		
	Stormwater BMP Type	**Allowed In**
	**Tree Box Filters** are containers filled with a soil mixture, a mulch layer, under-drain system and a shrub or tree similar to flow through planters. The compact size of tree box filters allow volume and water quality control to be tailored to specific site characteristics and are well suited to urban areas. Tree box filters provide the added value of aesthetics while making efficient use of available land for stormwater management.	T1 T2 T3 T4 C3 C4 C5 S1
	**Urban Channels** are narrow vegetated or stone lined conveyances framed by vertical stone or concrete banks abutting cultivated landscapes or hardscapes.	T1 T2 T3 T4 C3 C4 C5 S1
	**Level Spreaders** are structures that are designed to uniformly distribute concentrated flow over a large area to mimic natural sheet flow. Concentrated flow enters the spreader through a pipe, ditch or swale; the flow is retarded, energy is dissipated; the flow is distributed throughout a long linear shallow trench or behind a low berm; water then flows over the berm/ditch uniformly (in theory) along the entire length.	T1 T2 T3 T4 C3 C4 C5 S1
	**Rain Barrels** are connected directly to downspouts to capture and store runoff for future use. Stormwater discharge is slowed down and water can be reused for irrigation. Fifty gallons of storage is suggested as a minimum. Barrels must also have a cover to prevent insect and debris collection.	T1 T2 T3 T4 C3 C4 C5 S1
	**Cisterns** function similar to rain barrels by collected stormwater and storing it for reuse, but on a much larger scale. Cisterns can be stored above ground, buried below ground, or located inside of buildings. They typically store rainwater for reuse in irrigation, mechanical uses, toilet flushing, and fire prevention.	T1 T2 T3 T4 C3 C4 C5 S1
	**Dry detention ponds** are basins whose outlets have been designed to detain stormwater runoff for some minimum time (e.g., 24 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool of water. However, they are often designed with small pools at the inlet and outlet of the basin. They can also be used to provide flood control by including additional flood detention storage.	T1 T2 T3 T4 C3 C4 C5 S1
General Note: Images on this page are illustrative, not regulatory.		
Key	T# Allowed	T# Not Allowed