PUBLIC WORKS AND UTILITIES COMMITTEE
AGENDA

There will be a meeting of the Public Works and Utilities Committee on Monday, September 23, 2019 to begin at 4:00 pm., first floor conference room at City Hall. The following items will be heard:

A. Invocation

None

B. Approval of Public Works and Utilities Committee Minutes

August 19, 2019 - Deferred

September 9, 2019 – Deferred

C. Request to Set a Public Hearing

None

D. Acceptance and Dedication of Rights-of-Way and Easements

1. Quit Claim a portion of Hanover Street (.06 of a mile between Romney and Center Streets)
   a. Quit claim deed

2. Quit Claim a portion of Nassau Street (.007 of a mile between Romney and Center Streets)
   a. Quit claim deed

3. Quit Claim a portion of Romney Street (.06 of a mile between Nassau and Hanover Streets)
   a. Quit claim deed
4. Acceptance and Dedication of Daniel Island, Parcel S, Tract 2- a portion of Farr Street (50' R/W, 1679 LF)
   a. Title to Real Estate
   b. Affidavit for Taxable or Exempt Transfers
   c. Exclusive Stormwater Drainage Easement Agreement
   d. Plat

E. Temporary Encroachments Approved by The Department of Public Service
(For information only)

1. **122 Spring St. – 124 Spring, LLC** – Installing 40" X 18" right angled sign above the public right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

2. **45 1/2 Spring St. – Warehouse** – Installing 36" X 12" right angled sign above the public right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

3. **457 Spring Hollow Dr.** – Installing driveway encroaching into City drainage easement. This encroachment is temporary. **Approved September 20, 2019.**

4. **544 Yellow Tower** – Installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

5. **967 Foliage Ln.** – Installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

6. **1167 Elliotts Cut Dr.** - Installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

7. **1519 Charming Nancy Rd.** – Installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

8. **1659 Emmets Rd.** – Installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**
10. **1954 Bellona St.** – Installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

11. **1608 Juliana St.** – Transfer installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

12. **1620 Juliana St.** – Transfer installing irrigation encroaching into City right-of-way. This encroachment is temporary. **Approved September 20, 2019.**

13. **2556 Daniel Island Dr.** – Transfer installing 6ft wood fence and drain basin encroaching into City drainage easement. This encroachment is temporary. **Approved September 20, 2019.**

**F. Stormwater Management Department Update**

1. Stormwater Fee – Assistance Program Discussion
2. Stormwater Design Standard Manual Update Discussion
3. Dupont Wappoo Project Area Recommendations Discussion
4. An ordinance amending Chapter 27, Stormwater Management and Flood Control, of the Code of the City of Charleston, by amending the definitions in the Flood Hazard Prevention and Control Requirements in Article II, Division 3, Section 27-103 to add a new definition for “market value” for the purpose of making final determinations of substantial damage and substantial improvement under this Division allowing the appraised value of a structure to be used in place of the assessed value. **(AS AMENDED)** *(Requested by Councilmember Perry K. Waring)*
5. Church Creek Task Force Discussion
6. Project Update
7. Floodplain Management Update
8. Update on Spring/Fishburne and Low Battery STIB grant applications
Council member Keith Waring, Chairperson

In accordance with the Americans with Disabilities Act, people who need alternative formats, ASL (American Sign Language) interpretation or other accommodation please contact Janet Schumacher at (843) 577-1389 or email to schumacherj@charleston-sc.gov three business days prior to the meeting.
STATE OF SOUTH CAROLINA

COUNTY OF CHARLESTON

QUITCLAIM DEED

WHEREAS, pursuant to Section 57-5-340, Code of Laws of South Carolina, 1976, as amended, the South Carolina Department of Transportation has authority to dispose of the premises hereinbelow described, which premises are no longer required for purposes of the South Carolina Department of Transportation; Now Therefore,

KNOW ALL MEN BY THESE PRESENTS, that the South Carolina Department of Transportation ("Grantor"), for and in consideration of the sum of Five and no/100 Dollars ($5.00) to it in hand paid, receipt of which is hereby acknowledged, does hereby remise, release and quitclaim unto the City of Charleston ("Grantee"), all its right, title, interest in or to the following described property:

All that certain piece, parcel, or tract of land, situate, lying, and being, a portion of Road S-488 in the City of Charleston in Charleston County, State of South Carolina, containing approximately 0.06 of a mile of road right of way, and all improvements thereon, as shown on Exhibit A, attached hereto and made a part hereof, and being shown on the South Carolina Department of Transportation Plans for Road S-488, File 10.383, sheet 9, and being further described as follows:

Approximately 0.06 of a mile of road right of way and all improvements thereon, having a total width of approximately 40 feet of right of way, being approximately 20 on each side of the survey centerline of Road S-488, extending from the present right of way line of Road S-126 (Romney St. f/k/a Road S-493) in a southerly direction to S-219 (Conroy St., f/k/a/ Center St.), as being shown on Exhibit A, LESS AND EXCEPTING any possible interest of the Atlantic Coast Line Railroad Company in the above described property between approximate survey stations 6+54.9 and 9+81 of Road S-488.

A portion of Road S-488 was removed from the SC State Highway System by approval of the Highway Commission on January 17, 2019.

This being a portion the right of way acquired by the South Carolina Department of Transportation from the City of Charleston by Letter of Dedication dated February 25, 1953, by and being filed in the South Carolina Department of Transportation Deed Vault in Columbia, South Carolina under Road S-488, File 10.383.

Grantee’s Address: P.O. Box 652
Charleston, SC 29402

This conveyance is being made subject to any and all existing public utility rights of user, reservations, easements, rights of way, control of access, zoning ordinances and restrictions or protective covenants that may appear on record or on the premises, other than those hereby released.
TOGETHER with all and singular, the rights, members, hereditaments and appurtenances to the said premises belonging, or in anywise incident or appertaining.

TO HAVE AND TO HOLD, all and singular, the said premises before mentioned unto City of Charleston, its successors and assigns, forever.

WITNESS the hand and seal of the South Carolina Department of Transportation this 31st day of May, in the year of our Lord Two Thousand Nineteen.

Signed, sealed and delivered in the presence of:

Mae A. Jefferson-Young

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

By: ______________________ (L.S.)

Christy A. Hall, P.E., Secretary of Transportation

By: ______________________ (L.S.)

Justin P Powell, Deputy Secretary for Finance and Administration

THE STATE OF SOUTH CAROLINA )
COUNTY OF RICHLAND )

ACKNOWLEDGEMENT

Personally appeared before me the above named Grantors on behalf of South Carolina Department of Transportation and acknowledged the due execution of the foregoing instrument.

Witness my hand and seal this 31st day of May, 2019.

Notary Signature

Printed Name of Notary

NOTARY PUBLIC FOR THE STATE OF SOUTH CAROLINA
My Commission Expires: 2/18/26
(Affix Seal if outside SC)
STATE OF SOUTH CAROLINA  )
COUNTY OF Charleston  )

AFFIDAVIT FOR EXEMPT TRANSFERS

PERSONALLY appeared before me the undersigned, who being duly sworn, deposes and says:

1. I have read the information on the back of this affidavit and I understand such information.

2. The property being transferred is located at Road S-488
   bearing Charleston County Tax Map Number N/A
   the South Carolina Department of Transportation was transferred by
   to City of Charleston
   on May 21, 2019.

3. The deed is exempt from the deed recording fee because (See Instructions section of affidavit): #2

   If exempt under Exemption #14 as described in the Information section of this affidavit, did the
   agent and principal relationship exist at the time of the original sale and was the purpose of this relationship to
   purchase the realty? Check Yes ☐ or No ☑

4. As required by Code Section 12-24-70, I state that I am a responsible person who was connected with the
   transaction as: the Property Management Manager of the South Carolina Department of Transportation

5. I understand that a person required to furnish this affidavit who wilfully furnishes a false or fraudulent affidavit
   is guilty of a misdemeanor and, upon conviction, must be fined not more than one thousand dollars or
   imprisonment not more than one year, or both.

Kathryn E. Copeland
Print or Type Name Here

SWORN to before me this 21st day of May, 2019

Jean C. Barnes
Notary Public for South Carolina

Printed Name of Notary
My Commission Expires: 11/18/24
STATE OF SOUTH CAROLINA

COUNTY OF CHARLESTON

QUITCLAIM DEED

WHEREAS, pursuant to Section 57-5-340, Code of Laws of South Carolina, 1976, as amended, the South Carolina Department of Transportation has authority to dispose of the premises hereinbelow described, which premises are no longer required for purposes of the South Carolina Department of Transportation; Now Therefore,

KNOW ALL MEN BY THESE PRESENTS, that the South Carolina Department of Transportation ("Grantor"), for and in consideration of the sum of Five and no/100 Dollars ($5.00) to it in hand paid, receipt of which is hereby acknowledged, does hereby remise, release and quitclaim unto the City of Charleston ("Grantee"), all its right, title, interest in or to the following described property:

All that certain piece, parcel, or tract of land, situate, lying, and being a portion of Road S-119 (N. Nassau St.) in the City of Charleston in Charleston County, State of South Carolina, containing approximately 0.07 of a mile of road right of way, and all improvements thereon, as shown on Exhibit A, attached hereto and made a part hereof, and being shown on the South Carolina Department of Transportation Plans for Road S-119, File 10.500, sheet 18, and being further described as follows:

Approximately 0.07 of a mile of road right of way and all improvements thereon, having a total width of approximately 40 feet of right of way, being approximately 20 on each side of the survey centerline of Road S-119, extending from the present right of way line of Road S-126 (Romney St.) in a Southerly direction for a distance of 0.07 of a mile to the present right of way line of Road S-219 (Conroy St. D/b/a Center St.), as being shown on Exhibit A, attached hereto and made a part hereof.

A portion of road S-119 was removed from the SC State Highway System by approval of the Highway Commission on January 17, 2019.

This being a portion of the right of way acquired by the South Carolina Department of Transportation from the City of Charleston by Letter of Dedication dated July 16, 1961, and being filed in the South Carolina Department of Transportation Deed Vault in Columbia, South Carolina under Road S-119, File 10.500.

Grantee’s Address: Post Office Box 304
Charleston, SC 29402

This conveyance is being made subject to any and all existing public utility rights of user, reservations, easements, rights of way, control of access, zoning ordinances and restrictions or protective covenants that may appear on record or on the premises, other than those hereby released.
TOGETHER with all and singular, the rights, members, hereditaments and appurtenances to the said premises belonging, or in anywise incident or appertaining.

TO HAVE AND TO HOLD, all and singular, the said premises before mentioned unto City of Charleston, its successors and assigns, forever.

WITNESS the hand and seal of the South Carolina Department of Transportation this 1st day of May, in the year of our Lord Two Thousand Nineteen.

Signed, sealed and delivered in the presence of

[Signature]

Catherine L. Brooks

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
By: Christy A. Hall, P.E., Secretary of Transportation
By: Justin P. Pudwell, Deputy Secretary for Finance and Administration

THE STATE OF SOUTH CAROLINA
COUNTY OF RICHLAND

Personally appeared before me the above named Grantors on behalf of South Carolina Department of Transportation and acknowledged the due execution of the foregoing instrument.

Witness my hand and seal this 1st day of May, 2019.

[Signature]

Catherine L. Brooks
Notary Signature

Catherine L. Brooks
Printed Name of Notary

NOTARY PUBLIC FOR THE STATE OF SOUTH CAROLINA
My Commission Expires: 2/8/26
(Affix Seal if outside SC)
STATE OF SOUTH CAROLINA  
COUNTY OF Charleston  

AFFIDAVIT FOR EXEMPT TRANSFERS

PERSONALLY appeared before me the undersigned, who being duly sworn, deposes and says:

1. I have read the information on the back of this affidavit and I understand such information.

2. The property being transferred is located at Road S-119, Charleston, SC, bearing Charleston County Tax Map Number N/A, was transferred by the South Carolina Department of Transportation to City of Charleston on May 1, 2019.

3. The deed is exempt from the deed recording fee because (See Instructions section of affidavit): 

   If exempt under Exemption #14 as described as described in the Information section of this affidavit, did the agent and principal relationship exist at the time of the original sale and was the purpose of this relationship to purchase the realty? Check Yes [ ] or No [ X ]

4. As required by Code Section 12-24-70, I state that I am a responsible person who was connected with the transaction as: Property Management Manager of the South Carolina Department of Transportation.

5. I understand that a person required to furnish this affidavit who wilfully furnishes a false or fraudulent affidavit is guilty of a misdemeanor and, upon conviction, must be fined not more than one thousand dollars or imprisonment not more than one year, or both.

   Kathryn E. Copeland
   Responsible Person Connected with the Transaction

SWORN to before me this 1st day of May, 2019

   Jean C. Barnes
   Notary Public for South Carolina

   Printed Name of Notary
   My Commission Expires: 11/18/24
STATE OF SOUTH CAROLINA  
COUNTY OF CHARLESTON  

QUITCLAIM DEED

WHEREAS, pursuant to Section 57-5-340, Code of Laws of South Carolina, 1976, as amended, the South Carolina Department of Transportation has authority to dispose of the premises hereinbelow described, which premises are no longer required for purposes of the South Carolina Department of Transportation; Now Therefore,

KNOW ALL MEN BY THESE PRESENTS, that the South Carolina Department of Transportation ("Grantor"), for and in consideration of the sum of Five and no/100 Dollars ($5.00) to it in hand paid, receipt of which is hereby acknowledged, does hereby remise, release and quitclaim unto the City of Charleston ("Grantee"), all its right, title, interest in or to the following described property:

All that certain piece, parcel, or tract of land, situate, lying, and being a portion of Road S-126 (formerly known as S-493) in the City of Charleston in Charleston County, State of South Carolina, containing approximately 0.06 of a mile of road right of way, and all improvements thereon, as shown on Exhibit A, attached hereto and made a part hereof, and being shown on the South Carolina Department of Transportation Plans for Road S-493 (now known as S-126), File 10.383, sheet 9, and being further described as follows:

Approximately 0.06 of a mile of road right of way and all improvements thereon, having a total width of approximately 50 feet of road right of way, being approximately 25 feet on each side of the survey centerline of Road S-126 (ℓ/k/a S-493), extending from the present right of way line of Road S-119 in a Easterly direction to Road S-488, as being shown on Exhibit A, attached hereto and made a part hereof.

A portion of Road S-126 (ℓ/k/a as S-493) was removed from the SC State Highway System by approval of the Highway Commission on January 17, 2019.

This being a portion the right of way acquired by the South Carolina Department of Transportation from the City of Charleston by Letter of Dedication dated February 25, 1953, and being filed in the South Carolina Department of Transportation Deed Vault in Columbia, South Carolina under Road S-493 (n/k/a as S-126), File 10.383.

Grantee's Address:  Post Office Box 652  
Charleston, SC 29402

This conveyance is being made subject to any and all existing public utility rights of user, reservations, easements, rights of way, control of access, zoning ordinances and restrictions or protective covenants that may appear on record or on the premises, other than those hereby released.
TOGETHER with all and singular, the rights, members, hereditaments and appurtenances to the said premises belonging, or in anywise incident or appertaining.

TO HAVE AND TO HOLD, all and singular, the said premises before mentioned unto City of Charleston, its successors and assigns, forever.

WITNESS the hand and seal of the South Carolina Department of Transportation this 8th day of May, in the year of our Lord Two Thousand Nineteen.

Signed, sealed and delivered in the presence of

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

By: (L.S.)
Christy A. Hall, P.E., Secretary of Transportation

By: (L.S.)
Justin P. Powell, Deputy Secretary for Finance and Administration

THE STATE OF SOUTH CAROLINA
COUNTY OF RICHLAND

Personally appeared before me the above named Grantors on behalf of South Carolina Department of Transportation and acknowledged the due execution of the foregoing instrument.

Witness my hand and seal this 8th day of May, 2019.

Notary Signature

Printed Name of Notary

NOTARY PUBLIC FOR THE STATE OF SOUTH CAROLINA
My Commission Expires:
(Affix Seal if outside SC)
STATE OF SOUTH CAROLINA

COUNTY OF Charleston

AFFIDAVIT FOR EXEMPT TRANSFERS

PERSONALLY appeared before me the undersigned, who being duly sworn, deposes and says:

1. I have read the information on the back of this affidavit and I understand such information.

2. The property being transferred is located at Road S-126 formerly known as S-493, bearing Charleston County Tax Map Number N/A, was transferred by the South Carolina Department of Transportation to City of Charleston on May 8, 2019.

3. The deed is exempt from the deed recording fee because (See Instructions section of affidavit): __________
   #2 __________

   If exempt under Exemption #14 as described as described in the Information section of this affidavit, did the agent and principal relationship exist at the time of the original sale and was the purpose of this relationship to purchase the realty? Check Yes [ ] or No [x]

4. As required by Code Section 12-24-70, I state that I am a responsible person who was connected with the transaction as: the Property Management Manager of the South Carolina Department of Transportation

5. I understand that a person required to furnish this affidavit who wilfully furnishes a false or fraudulent affidavit is guilty of a misdemeanor and, upon conviction, must be fined not more than one thousand dollars or imprisonment not more than one year, or both.

Kathryn E. Copeland

Responsible Person Connected with the Transaction

Kathryn E. Copeland

Print or Type Name Here

SWORN to before me this 8th day of May, 2019

Jean C. Barnes

Notary Public for South Carolina

Printed Name of Notary

My Commission Expires: 11/18/24
STATE OF SOUTH CAROLINA )
COUNTY OF BERKELEY )

KNOW ALL MEN BY THESE PRESENTS, that CRP-GREP Overture Daniel Island Owner, L.L.C. ("Grantor") in the state aforesaid, for and in consideration of the sum of ONE AND 00/100 DOLLAR ($1.00), being the true consideration to it in hand paid at and before the sealing of these presents by the CITY OF CHARLESTON, the receipt whereof is hereby acknowledged, has granted, bargained, sold and released, and by these presents does grant, bargain, sell and release unto the said CITY OF CHARLESTON ("Grantee"), its successors and assigns, forever, the following described property which is granted, bargained, sold and released for the use of the public forever:

All of the property underneath, above, and containing those certain streets, roads, drives, and cul-de-sacs situate, lying and being in the City of Charleston, County of Berkeley State of South Carolina, identified as (list street names) "Farr Street (Extension)"

as shown and designated on a plat entitled "Final Subdivision Plat of Parcel S. Tract 2 Containing 8.60 Ac to Create Parcel S. Tract 2 (6.66 Ac) & New Variable Width Public Right-Of-Way, Farr Street Extension (1.94 Ac) & Easements"

prepared by by Phillip P. Gerard P.L.S. No. 26596 of Thomas & Hutton ________________, dated January 14, 2019, revised n/a ________________, and recorded on ________________ in Plat Book _____ at Page _____ in the _____ Office for Berkeley County. Said property butting and bounding, measuring and containing, and having such courses and distances as are shown on said plat. Reference being had to the aforesaid plat for a full and complete description, being all of the said dimensions, a little more or a little less.

This being a portion of the property conveyed to Grantee herein by deed of the The Daniel Island Company, Inc., ________________ dated December 8, 2017 and recorded December 15, 2017 in Book 2634 at Page 837 in the ROD Office for Berkeley County, South Carolina.

Grantee's Mailing Address: City of Charleston
Department of Public Service
Engineering Division
2 George Street
Suite 2100
Charleston, South Carolina 29401

Portion of TMS No.: 275-00-00-286
TOGETHER with all and singular, the rights, members, hereditaments and appurtenances to the said premises belonging, or in anywise incident or appertaining.

TO HAVE AND TO HOLD, all and singular, the said premises before mentioned unto the CITY OF CHARLESTON, its successors and assigns forever.

AND Grantor does hereby bind itself and its heirs, executors and administrators, to warrant and forever defend, all and singular, the said premises unto the said City of Charleston, heirs and assigns, against Grantor and its heirs, and all persons whomsoever lawfully claiming, or to claim the same or any part thereof.

WITNESS our Hand(s) and Seal(s) this 11th day of July 2019.

SIGNED, SEALED AND DELIVERED IN THE PRESENCE OF:

[Signature]

Witness Number One

Robert Morgan

Printed Name

[Signature]

Witness Number Two

Leidy Cole

Printed Name

************

STATE OF SOUTH CAROLINA )
COUNTY OF Charleston )

This foregoing instrument was acknowledged before me (the undersigned notary) by

[Signature]

Ben Liedertau, the Vice President of CPE Group Overseas Daniel Brannan, a Division of Charleston LLC, on behalf of the Grantor on the 11th day of July 2019.

Signature of Notary:

Print Name of Notary:

Notary Public for South Carolina

My Commission Expires: 09/13/2023

SEAL OF NOTARY
STATE OF SOUTH CAROLINA
COUNTY OF BERKELEY

AFFIDAVIT FOR TAXABLE OR EXEMPT TRANSFERS

PERSONALLY appeared before me the undersigned, who being duly sworn, deposes and says:

1. I have read the information on this affidavit and I understand such information.

2. The property was transferred by The Daniel Island Company, Inc., to CRP-GREP Overture Daniel Island Owner, L.L.C., on December 8, 2017.

3. Check one of the following: The deed is

   (A) ______ subject to the deed recording fee as a transfer for consideration paid or to be paid in money or money’s worth.

   (B) ______ subject to the deed recording fee as a transfer between a corporation, a partnership, or other entity and a stockholder, partner, or owner of the entity, or is a transfer to a trust or as distribution to a trust beneficiary.

   (C) ______ exempt from the deed recording fee because (See Information section of affidavit): transferring to City of Charleston ___ (explanation required)

If exempt under exemption #14 as described in the Information section of this affidavit, did the agent and principal relationship exist at the time of the original sale and was the purpose of this relationship to purchase the realty?
Check Yes ____ or No ____

4. Check one of the following if either item 3(a) or 3(b) above has been checked. (See Information section of this affidavit):

   (A) ______ The fee is computed on the consideration paid or to be paid in money or money’s worth in the amount of ____________________________

   (B) ______ The fee is computed on the fair market value of the realty which is ____________________________.

   (C) ______ The fee is computed on the fair market value of the realty as established for property tax purposes which is ____________________________.

5. Check YES ____ or NO ____ to the following: A lien or encumbrance existed on the land, tenement, or realty before the transfer and remained on the land, tenement, or realty after the transfer. If “YES,” the amount of the outstanding balance of this lien or encumbrance is ____________________________.

6. The deed recording fee is computed as follows:

   (A) ______ Place the amount listed in item 4 above here: ____________________________

   (B) ______ Place the amount listed in item 5 above here: ____________________________

   (If no amount is listed, place zero here.)

   (C) ______ Subtract Line 6(b) from Line 6(a) and place the result here: ____________________________
7. The deed recording fee is based on the amount listed on Line 6(c) above and the deed recording fee due is ________________________________.

8. As required by Code Section 12-24-70, I state that I am a responsible person who was connected with the transaction as ________________________________.

9. I understand that a person required to furnish this affidavit who willfully furnishes a false or fraudulent affidavit is guilty of a misdemeanor and, upon conviction, must be fined not more than one thousand dollars or imprisoned not more than one year, or both.

______________________________
Responsible Person Connected with the Transaction

______________________________
Print or Type Name Here

______________________________
Sworn this ___ day of ____ 2019

______________________________
Notary Public for South Carolina
My Commission Expires: ____________________________

ATET4-2013
STATE OF SOUTH CAROLINA  )   EXCLUSIVE STORM
 ) WATER DRAINAGE
 ) EASEMENTS
COUNTY OF BERKELEY     ) CITY OF CHARLESTON

This Agreement is made and entered into this ____ day of _______________ 2019, by and between the City of Charleston, a Municipal Corporation organized and existing pursuant to the laws of the State of South Carolina (herein the "City"), and CRP-GREP Overture Daniel Island Owner, L.L.C. ___________ (herein the "Owner").

WHEREAS, THE CITY OF CHARLESTON, is desirous of maintaining storm water drainage ditches and appurtenances ("Storm Water System") across a portion of ____ property identified by and designated as Berkeley ________ County tax map number 275-00-00-286 ________ and to accomplish this objective, the City must obtain certain easements from the Owner permitting the maintenance of the Storm Water System through the referenced portion of ____ the Owner’s property as hereinafter described; and

WHEREAS, the undersigned Owner of the property is desirous of cooperating with the City and is minded to grant unto it certain permanent and exclusive storm water drainage easements in and to the property necessary therefor.

NOW, THEREFORE, in consideration of the foregoing and the benefits to be derived by the drainage improvements to the property, the Owner has granted, bargained, sold, released and conveyed by these present and does grant, bargain, sell, release and convey unto the City of Charleston all of those certain New City of Charleston Drainage Easements (or D.E.) as such are identified on the above referenced portion of ____ property and which are more fully shown on that certain plat entitled;

" Final Subdivision Plat of Parcel 5, Tract 2 Containing 8.60 Ac to Create Parcel S, Tract 2 (6.66 Ac) & New Variable Width Public Right-Of-Way, Farr Street Extension (1.94 Ac) & Easements

Prepared and executed by by Phillip P. Gerard P.L.S. No. 26596 ____________ dated January 4, 2019 ____________, revised on n/a ________________, and recorded on ___________________________ in Plat
Book ____ at Page _____ in the _____ Office for Berkeley ____________, South Carolina (herein the "Plat").

A copy of said plat is attached heretofore as "Exhibit A" and incorporated herein.

Said EXCLUSIVE STORM WATER DRAINAGE EASEMENTS having such size, shape, location, and butting
and bounding as shown on said Plat, reference to which is hereby made for a more complete description.

The City shall at all times have the right of ingress and egress to the land affected by the said Exclusive and Permanent Storm Water Drainage Easements for purposes of periodic inspection, maintenance, repair and replacement of the Storm Water System. These Exclusive and Permanent Storm Water Drainage Easements shall be commercial in nature and shall run with the land.

The City has no obligation to repair, replace or to compensate the Owner for trees, plants, grass, shrubs or other elements damaged or destroyed within the confines of these Exclusive and Permanent Storm Water Drainage Easements during the conduct of its allowable activities as described above.

TO HAVE AND TO HOLD, all and singular, the said before mentioned unto the said CITY OF CHARLESTON, its successors and assigns, against Owner and its heirs and assigns, and all persons whomsoever lawfully claiming or to claim the same or any part thereof.
IN WITNESS WHEREOF, the parties have set the Hands and Seals the day and year above written.

WITNESSES:

Witness #1

Witness #2

CITY OF CHARLESTON

By: Laura Cabiness
Its: Public Service Director

STATE OF SOUTH CAROLINA )

ACKNOWLEDGEMENT

COUNTY OF CHARLESTON )

The foregoing instrument was acknowledged before me (the undersigned notary) by

________________________

of the City of Charleston, a Municipal Corporation organized and existing pursuant to the laws of the State of South Carolina, on _________________.

Signature: ____________________________

Print Name of Notary: ____________________________

Notary Public for ____________________________

My Commission Expires: ____________________________

SEAL OF NOTARY

WITNESSES:

Witness #1

Witness #2

STATE OF _____________ )

ACKNOWLEDGEMENT

COUNTY OF _____________ )

The foregoing instrument was acknowledged before me (the undersigned notary) by

________________________

of _____________, a _____________, on behalf of the Owner on _________________.

Signature: ____________________________

Print Name of Notary: ____________________________

Notary Public for _____________

My Commission Expires: ____________________________

SEAL OF NOTARY

ESWDE8-2016

Page 2 of 2
STATE OF SOUTH CAROLINA

COUNTY OF BERKELEY

EXCLUSIVE STORM WATER DRAINAGE EASEMENTS

CITY OF CHARLESTON

This Agreement is made and entered into this _____ day of ________________ 2019, by and between the City of Charleston, a Municipal Corporation organized and existing pursuant to the laws of the State of South Carolina (herein the “City”), and The Daniel Island Company, Inc. (herein the “Owner”).

WHEREAS, THE CITY OF CHARLESTON, is desirous of maintaining storm water drainage ditches and appurtenances (“Storm Water System”) across a portion of _____ property identified by and designated as Berkeley _______ County tax map number 275-00-00-287 and to accomplish this objective, the City must obtain certain easements from the Owner permitting the maintenance of the Storm Water System through the referenced portion of _____ the Owner’s property as hereinafter described; and

WHEREAS, the undersigned Owner of the property is desirous of cooperating with the City and is minded to grant unto it certain permanent and exclusive storm water drainage easements in and to the property necessary therefor.

NOW, THEREFORE, in consideration of the foregoing and the benefits to be derived by the drainage improvements to the property, the Owner has granted, bargained, sold, released and conveyed by these present and does grant, bargain, sell, release and convey unto the City of Charleston all of those certain New City of Charleston Drainage Easements (or D.E.) as such are identified on the above referenced portion of _____ property and which are more fully shown on that certain plat entitled;

“Final Subdivision Plat of Parcel S, Tract 2 Containing 8.60 Ac to Create Parcel S, Tract 2 (6.66 Ac) & New Variable Width Public Right-Of-Way, Farr Street Extension (1.94 Ac) & Easements

Prepared and executed by by Phillip P. Gerard P.L.S. No. 26596 dated January 4, 2019, revised on n/a, and recorded on in Plat Book _____ at Page _____ in the Office for Berkeley. South Carolina (herein the “Plat”).

A copy of said plat is attached hereto as “Exhibit A” and incorporated herein.

SAID EXCLUSIVE STORM WATER DRAINAGE EASEMENTS having such size, shape, location, and butting and bounding as shown on said Plat, reference to which is hereby made for a more complete description.

The City shall at all times have the right of ingress and egress to the land affected by the said Exclusive and Permanent Storm Water Drainage Easements for purposes of periodic inspection, maintenance, repair and replacement of the Storm Water System. These Exclusive and Permanent Storm Water Drainage Easements shall be commercial in nature and shall run with the land.

The City has no obligation to repair, replace or to compensate the Owner for trees, plants, grass, shrubs or other elements damaged or destroyed within the confines of these Exclusive and Permanent Storm Water Drainage Easements during the conduct of its allowable activities as described above.

TO HAVE AND TO HOLD, all and singular, the said before mentioned unto the said CITY OF CHARLESTON, its successors and assigns, against Owner and its heirs and assigns, and all persons whomsoever lawfully claiming or to claim the same or any part thereof.
IN WITNESS WHEREOF, the parties have set the Hands and Seals the day and year above written.

WITNESSES:

Witness #1

Witness #2

STATE OF SOUTH CAROLINA )
) COUNTY OF CHARLESTON )

ACKNOWLEDGEMENT

The foregoing instrument was acknowledged before me (the undersigned notary) by  

of the City of Charleston, a Municipal Corporation organized and existing pursuant to the laws of the State of South Carolina, on _________________.

Signature: ____________________________________________

Print Name of Notary: ________________________________

Notary Public for: __________________________________

My Commission Expires: _____________________________

SEAL OF NOTARY

WITNESSES:

Witness #1

Witness #2

STATE OF South Carolina )
) COUNTY OF Berkeley )

ACKNOWLEDGEMENT

The foregoing instrument was acknowledged before me (the undersigned notary) by  

of the City of Charleston, a Municipal Corporation organized and existing pursuant to the laws of the State of South Carolina, on _________________.

Signature: ____________________________________________

Print Name of Notary: ________________________________

Notary Public for: __________________________________

My Commission Expires: _____________________________

SEAL OF NOTARY

OWNER: The Daniel Island Company, Inc.

Name: Matthew R. Sloan

Its President

Acknowledged by: Matthew R. Sloan, a SC corporation, on behalf of the Owner on July 11th, 2019.
STATE OF SOUTH CAROLINA
COUNTY OF BERKELEY

EXCLUSIVE STORM WATER DRAINAGE EASEMENTS

CITY OF CHARLESTON

WHEREAS, THE CITY OF CHARLESTON, is desirous of maintaining storm water drainage ditches and appurtenances ("Storm Water System") across a portion of property identified by and designated as Berkeley County map number 275-00-00-118 and to accomplish this objective, the City must obtain certain easements from the Owner permitting the maintenance of the Storm Water System through the referenced portion of the Owner’s property as hereinafter described; and

WHEREAS, the undersigned Owner of the property is desirous of cooperating with the City and is minded to grant unto it certain permanent and exclusive storm water drainage easements in and to the property necessary therefor.

NOW, THEREFORE, in consideration of the foregoing and the benefits to be derived by the drainage improvements to the property, the Owner has granted, bargained, sold, released and conveyed by these present and does grant, bargain, sell, release and convey unto the City of Charleston all of those certain New City of Charleston Drainage Easements (or D.E.) as such are identified on the above referenced property and which are more fully shown on that certain plat entitled; "Final Subdivision Plat of Parcel S, Tract 2 Containing 8.60 Ac to Create Parcel S, Tract 2 (6.66 Ac) & New Variable Width Public Right-Of-Way, Farr Street Extension (1.94 Ac) & Easements"

Prepared and executed by Phillip P. Gerard P.L.S. No. 26596, dated January 4, 2019, revised on n/a, and recorded on in Plat Book at Page in the Office for Berkeley, South Carolina (herein the "Plat"). A copy of said plat is attached heretofore as “Exhibit A” and incorporated herein.

SAID EXCLUSIVE STORM WATER DRAINAGE EASEMENTS having such size, shape, location, and butting and bounding as shown on said Plat, reference to which is hereby made for a more complete description.

The City shall at all times have the right of ingress and egress to the land affected by the said Exclusive and Permanent Storm Water Drainage Easements for purposes of periodic inspection, maintenance, repair and replacement of the Storm Water System. These Exclusive and Permanent Storm Water Drainage Easements shall be commercial in nature and shall run with the land.

The City has no obligation to repair, replace or to compensate the Owner for trees, plants, grass, shrubs or other elements damaged or destroyed within the confines of these Exclusive and Permanent Storm Water Drainage Easements during the conduct of its allowable activities as described above.

TO HAVE AND TO HOLD, all and singular, the said before mentioned unto the said CITY OF CHARLESTON, its successors and assigns, against Owner and its heirs and assigns, and all persons whomsoever lawfully claiming or to claim the same or any part thereof.
IN WITNESS WHEREOF, the parties have set the Hands and Seals the day and year above written.

WITNESSES:                                            CITY OF CHARLESTON

Witness #1                                                                                                    By: Laura Cabiness-Tom O'Brien

Witness #2                                                                                                    Its: Public Service Director

STATE OF SOUTH CAROLINA                               ACKNOWLEDGEMENT

COUNTY OF CHARLESTON

The foregoing instrument was acknowledged before me (the undersigned notary) by

of the City of Charleston, a Municipal Corporation organized and existing pursuant to the laws of the State of

South Carolina, on ___________________.

Signature:________________________________________
Print Name of Notary:________________________________________
Notary Public for:________________________________________
My Commission Expires:________________________________________

SEAL OF NOTARY

WITNESSES:                                            OWNER: Daniel Island Town Association, Inc.

Witness #1                                                                                                    Name: Matthew R. Sloan

Witness #2                                                                                                    Its: President

STATE OF South Carolina                               ACKNOWLEDGEMENT

COUNTY OF Berkeley

The foregoing instrument was acknowledged before me (the undersigned notary) by

Matthew R. Sloan, the President of Daniel Island Town Association, Inc., a SC nonprofit corporation, on behalf of the Owner on July 11th, 2019

Signature:________________________________________
Print Name of Notary: Maggie R. Durbiber
Notary Public for: South Carolina
My Commission Expires: 10/16/24

SEAL OF NOTARY
City of Charleston Signature Page

I hereby certify that I have examined this Stormwater Design Standards Manual and, being familiar with the South Carolina Department of Health and Environmental Control (SCDHEC) National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Regulated Small Municipal Separate Storm Sewer Systems (MS4s) and the City of Charleston Department of Stormwater Management, attest that this Manual has been prepared in accordance with the applicable MS4 permit requirements. My signature below constitutes authorization for the commitment of resources necessary for implementation of the Manual.

_____________________________
Director, Department of Stormwater Management

_____________________________
Date
## Contacts

<table>
<thead>
<tr>
<th>Service</th>
<th>Phone Number</th>
<th>Address</th>
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<tr>
<td>General Stormwater Questions</td>
<td>(843) 724-3754</td>
<td>2 George Street</td>
</tr>
<tr>
<td></td>
<td>Fax: (843) 973-7261</td>
<td>Suite 2100</td>
</tr>
<tr>
<td></td>
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<td>Charleston, SC 29401</td>
</tr>
<tr>
<td>Stormwater Technical/Design</td>
<td>(843) 724-3754</td>
<td>2 George Street</td>
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<tr>
<td>Questions</td>
<td>Fax: (843) 973-7261</td>
<td>Suite 2100</td>
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<td>Charleston, SC 29401</td>
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<tr>
<td>Stormwater Permitting</td>
<td>(843) 724-3761</td>
<td>2 George Street</td>
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<tr>
<td>Building Inspections: Administration &amp; Plan Review Services</td>
<td>(843) 577-1685</td>
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<td>(843) 724-7441</td>
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<tr>
<td>Building Inspections: Permit Center</td>
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Record of Revisions

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This manual is intended to be a dynamic document. As design technology and criteria evolve and change or it becomes evident that additional measures are needed to ensure the public general welfare, this manual shall be amended with City Council's approval. This manual can also be found on the City of Charleston's website at https://www.charleston-sc.gov/. 
Acknowledgements

The development of the Stormwater Design Standards Manual represents the culmination of a cooperative, collaborative effort among the City of Charleston, the Stormwater Design Standards Task Force, and AECOM.

The Stormwater Design Standards Task Force provided guidance and feedback on the content of this document, reviewed drafts, developed and participated in workshops, and engaged stakeholders. We would like to thank them for their enthusiasm, knowledge, experience, and commitment to the process.

City of Charleston

Mayor John Tecklenburg 14 Kinsey Holton
Council Member Peter 15 Matt Blackwell
Shahid 16 Stephen J ulka
Council Member Gary White 17 Steve Kirk
Council Member Carol 18 Chris Morgan
Jackson 19 Katie McKain
Matthew Fountain 20 Tracy McKee
Tom O’Brien 21 Frank Newham

Dianne Aghapour, Citizen at Large
Jared T. Bramblett, Davis & Floyd
Andrew Todd Burke, HLA, Inc.
Abraham Champagne, Clemson University
Stuart Coleman, CC&T
Kelsey Gagnon, Berkeley County
J eannie Lewis, SCDHEC OCRM
Bill McKenzie, Daniel Island Associates, LLC
Betty Niemann, Seamon, Whiteside & Associates
Kirk Richards, SCDOT
Jack Smith, Nelson Mullins
Lisa Vandiver, Johns Island Community Association, NOAA
Guinn Wallover, Clemson Extension, Ashley Cooper Stormwater Education Consortium
Chris Wannamaker, Charleston County
James L. Ward, College of Charleston
Patrick Arnold, Charleston Homebuilder’s Association
Josh Dix, Charleston Trident Association of Realtors
# Table of Contents

1  City of Charleston Signature Page .......................................................................................................................................................... i
2  Contacts ........................................................................................................................................................................................... ii
3  Record of Revisions ........................................................................................................................................................................ iii
4  Acknowledgements .......................................................................................................................................................................... iv
5  Table of Contents ........................................................................................................................................................................... v
6  Acronyms and Abbreviations ......................................................................................................................................................... vi
7  Definitions ......................................................................................................................................................................................... ix
8  Executive Summary .......................................................................................................................................................................... xxiii
### Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>No.</th>
<th>Acronym</th>
<th>Description</th>
</tr>
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<td>Waters of the United States</td>
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Definitions

Words used in this manual shall have their customary meanings as determined by the standard dictionary definition except for the following specific words and terms that are herein defined or are otherwise defined in the City of Charleston’s Stormwater Management Ordinance, City Code, authorizing regulations listed in Section 1.5, or in applicable Federal Emergency Management Agency (FEMA) regulations. The Department of Stormwater Management shall have the right to define or interpret any other word or term contained within this manual.

Accommodate: water elevation not exceeding the crown of the pipe or culvert crossing under a roadway; coming within 12 inches of the top of the ditch or channel for the design storm; or encroaching on more than one-third of a travel lane for street drainage, curbs, and gutters for the design storm event.

Algal Bloom: the rapid increase in the population of algae in an aquatic system.

Applicant: a person, firm, governmental agency, partnership, limited liability company, or any other entity who seeks to obtain approval under the requirements of Chapter 27 in the City of Charleston Stormwater Ordinance and who, in addition to the property owner or operator, will be responsible for the land disturbing activity(ies) and related maintenance thereof. The Applicant executes the necessary forms to obtain approval for a permit for a land disturbing activity.

Appropriate Plan Approval Authority: SCDHEC, local government, or conservation district that is responsible in a jurisdiction for review and approval of Stormwater Management and Erosion Prevention and Sediment Control Plans. This function shall be carried out by the City of Charleston.

Bankfull Events: the flow condition where the highest stresses are applied to streambanks, causing streambank erosion and channel enlargement.

Best Management Practice (BMP): any structural or non-structural measure or drainage facility used for the control of stormwater runoff, be it for quantity or quality control. BMPs also include schedules of activities, prohibitions of practices, maintenance procedures, treatment requirements, operating procedures, and other management practices to control site runoff, spillage or leaks, sludge or waste disposal, drainage from raw material storage, or measures that otherwise prevent or reduce the pollutant loading of receiving water(s).

Brownfield: a formal industrial or commercial site where future use is affected by environmental contamination.

Building: any structure built for support, shelter, or enclosure for any occupancy or storage.
Certified Erosion Prevention and Sediment Control Inspector (CEPSCI): a person with the responsibility for conducting inspections during construction and maintenance inspections after the land disturbing activity is completed as certified by SCDHEC.

Certified Stormwater Plan Reviewer (CSPR): a person with the responsibility for reviewing Stormwater Management and Erosion Prevention and Sediment Control Plans for the City as certified by SCDHEC.

Channel: a stormwater conveyance open to the atmosphere flowing under the influence of gravity, including, but not limited to, natural waterways, canals, ditches, swales, and flumes.

City of Charleston Ordinance: stormwater regulations set forth in the Stormwater Management and Flood Control Ordinance, specifically Chapter 27, Article 1, of the City of Charleston Code of Ordinances; in addition to applicable sections of Chapter 54, Zoning Ordinance.

Clean Water Act (CWA): the federal Water Pollution Control Act (33 U.S.C. section 1251 et seq.) and any subsequent amendments thereto.

Construction or Construction Activity: an activity involving clearing, grading, transporting, filling, or any other activity that causes land to be exposed to the danger of erosion, or that might create an alteration to an existing drainage way or other component of the City’s stormwater management system or drainage facility.

Construction Activity Application: the set of drawings, specifications, design calculations, Stormwater Pollution Prevention Plan (SWPPP), and other documents necessary to apply for a construction activity permit.

Contour: representative line on a topographic map connecting points of equal elevation.

Covenants: the Covenants for Permanent Maintenance of Stormwater Facilities (CPMSF), which is a permanent maintenance agreement between the property Owner and the City of Charleston, for maintenance of permanent stormwater BMPs described in construction plans approved by the City, and any other permanent stormwater BMPs thereafter constructed on the Owner’s property.

Conveyance System: private and public drainage facilities other than sanitary sewers within the City’s MS4 by which stormwater runoff may be conveyed to receiving waters, and includes but is not limited to roads, streets, constructed channels, storm drains, pipes, street gutters, inlets to storm drains or pipes, or catch basins.

Culvert: an enclosed symmetrical channel of comparatively short length installed to convey water from one side of an embankment to the other, typically under a roadway, and mainly used to divert stream or rainfall runoff to prevent erosion or flooding on roadways.
Detention: the collection and storage of stormwater runoff in a surface or subsurface facility for subsequent controlled discharge to a conveyance system or receiving water.

Detention Structure: a permanent stormwater management structure whose primary purpose is to temporarily store stormwater runoff and release the stored runoff at controlled rates.

Development: any of the following actions undertaken by a person, a firm, a governmental agency, a partnership, a limited liability company, or any other individual or entity, without limitation:

- Division or subdivision of a lot, tract, parcel, or other divisions by plat or deed;
- Construction, installation, or alteration of land, a structure, impervious surface, or drainage facility;
- Clearing, scraping, grubbing, or otherwise significantly disturbing the soil, vegetation, mud, sand, or rock of a site; or
- Adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging, or otherwise disturbing the soil, vegetation, mud, sand, or rock of a site.

Discharge: when used without a qualifier, refers to “discharge of a pollutant” as defined at South Carolina Water Pollution Control Permits Regulation 61-9, section 122.2.

Ditch: a drainage channel in the earth created by natural or artificial means to convey surface and/or subsurface water, flowing continuously or intermittently. Ditches are generally smaller than those conveyances referred to as channels.

Drainage: a general term applied to the removal of surface or subsurface water from a given area either by gravity via natural means or by systems constructed to remove water, and is commonly applied herein to surface water.

Drainage Area: an area contributing stormwater runoff to a single point.

Drainage Easement: the right of access of stormwater runoff from adjacent drainage basins into the drainage way within the defined easement as defined by Section 54-1051(i) Ord. No. 2018-031 § 11, 4-10-18.

Drainage Facility: any component of the drainage system.

Drainage System: the surface and/or subsurface system that collects and conveys stormwater and surface water, and includes watercourses, waterbodies, receiving waters, and wetlands.

Easement: an authorization by a property owner to the general public, a corporation, or a certain person or persons for the use of any designated part of his property for a specific purpose, as defined by Ord. No. 2007-158, § 2, 8-21-07; Ord. No. 2017-110, § 1, 9-13-17). An easement is also defined in the Zoning Ordinance as the right of use for
access granted on, above, under, or across a tract of land by the landowner to another
person or entity (Section 54-1051(i) Ord. No. 2018-031 § 11, 4-10-18).

**Elevation**: height in feet above a given known datum, such as NGVD29.

**Embankment** or **Fill**: a deposit of soil, rock, or other material placed by man.

**Erosion**: the general process by which soils or rock fragments are detached and moved by the
action of wind, water, ice, and gravity.

**Erosion Prevention**: measures employed to prevent erosion including soil stabilization
practices, limited grading, mulch, temporary or permanent cover, compost application,
and construction phasing.

**Eutrophication**: the process by which a body of water becomes enriched in nutrients that
stimulate growth of aquatic plant life, usually resulting in the depletion of dissolved
oxygen.

**Evapotranspiration**: the process by which water is transferred from the land to the
atmosphere by evaporation from the soil and other surfaces and by transpiration from
plants.

**Final Stabilization**: having 70% or more of the entire site with permanent coverage in good
condition.

**Flood** or **Flooding**: a temporary rise in the level of water that results in the inundation of areas
not ordinarily covered by water. The types of flood events that occur in the City of
Charleston are:

- **Coastal (Tidal) Flooding**: occurs during high tides and is not dependent on weather
  conditions. Frequency of tidal flooding increases with effects of sea level rise and moon
  phases.

- **Extreme Event (Flash) Flooding**: occurs when intense rainfall makes water rise quickly and
  flow at a high speed for a short amount of time.

- **Fluvial (Riverine) Flooding**: occurs when the capacity of a river’s channel is exceeded as a
  result of intense or sustained rainfall across the catchment.

- **Groundwater Flooding**: occurs when the water table rises up to the surface during a
  prolonged wet period. Low lying areas, areas near aquifers, and properties with cellars or
  basements are more likely to experience groundwater flooding.

- **Surface Flooding**: occurs when the volume of rainfall is unable to drain away through the
  drainage systems or infiltrate into the land, and instead flows over land.

**Floodplain**: an area of low-lying ground that may be submerged by floodwaters.

**Grading**: the excavating, filling (including hydraulic fill), or stockpiling of earth material, or any
combination thereof, including the land in its excavated or filled condition.
Green Infrastructure: an adaptable term used to describe an array of materials, technologies, and practices that use natural systems or engineered systems that mimic natural processes to enhance overall environmental quality and provide utility services. As a general principal, green infrastructure techniques use soils and vegetation to infiltrate, evapotranspirate, and/or recycle stormwater runoff. Examples of green infrastructure include green roofs, porous pavement, rain gardens, and vegetated swales.

Green Spaces: an area of grass, trees, or other vegetation set apart for recreational or aesthetic purposes in an otherwise urban environment.

Hydrologic Soil Group: a classification of soils based on the soil's runoff potential used by the Natural Resource Conservation Service.

Illicit Discharge or Illegal Discharge: any activity that results in a discharge to the City of Charleston stormwater management system or drainage facility or receiving waters that is not composed entirely of stormwater except:

- Discharge pursuant to a NPDES permit (other than the NPDES permit for discharges from the City of Charleston MS4) and
- Discharges resulting from fire-fighting activities.

Impaired Waters: water bodies with pollutant load exceeding the Total Maximum Daily Load level established by the State in which it is located and approved by the Environmental Protection Agency.

Impervious surface: a surface that has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water, including conventionally surfaced streets, roofs, sidewalks, parking lots, and other similar structures.

Infiltration: the passage or movement of water through the soil profile.

King Tide: the highest seasonal tides that occur each year.

Land Disturbing Activity: any use of the land by any person that results in a change in the natural cover or topography that may cause erosion and contribute to sediment and alter the quality and quantity of stormwater runoff.

Larger Common Plan (LCP): broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot. A common plan for development or sale identifies a site where multiple separate and distinct construction activities (areas of disturbance) are occurring on contiguous areas. Such sites may have one operator or owner or several operators and owners. Construction activities may take place at different times on different schedules, in separate stages, and/or in separate phases, and/or in
combination with other construction activities. Each Developer, Operator, or Owner for each Site or Project determined to be a part of an LCP are subject to permitting requirements as defined by Chapter 27 in the City of Charleston Ordinance and the City of Charleston Stormwater Design Standards Manual.

**Level Spreader:** structure that is designed to uniformly distribute concentrated stormwater runoff over a large area. Level spreaders come in many forms, depending on the peak rate of inflow, the duration of use, the type of pollutant, and the site conditions. All designs follow the same principle:

1) Concentrated flow enters the spreader through a pipe, ditch, or swale.

2) The flow is retarded, energy is dissipated.

3) The flow is distributed throughout a long linear shallow trench or behind a low berm.

4) Water then flows over the berm/ ditch, theoretically, uniformly along the entire length.

**Low Impact Development (LID):** a set of principles and design components used to manage stormwater runoff by mimicking natural conditions and limiting pollutant transport through source control.

**Maintenance:** any action necessary to preserve stormwater system components, including conveyances, facilities, and BMPs in proper working condition, in order to serve the intended purposes and to prevent structural failure of such components.

**Maximum Extent Practicable (MEP):** a technology-based control standard used in the municipal stormwater program against which SCDHEC Bureau of Water and permittees assess whether an adequate level of control has been proposed in the SWMP.

**Municipal Separate Storm Sewer System (MS4):** conveyances or system of conveyances (including roads with drainage systems, highways, rights-of-way, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, storm drains, detention ponds, and other stormwater facilities) that receives, transports, stores, or treats stormwater runoff and that is:

- Owned or operated by the City of Charleston;
- Designed or used for collecting or conveying stormwater;
- Not a combined sewer system; and
- Not a part of a publicly owned treatment works (POTW).

**National Pollutant Discharge Elimination System (NPDES) Permit:** NPDES permit for stormwater discharges issued by SCDHEC pursuant to the CWA and the federal stormwater discharge regulations (40 C.F.R. 122.26) that allows for restricting pollutant loads as necessary to meet water quality standards.
Navigable Waters: According to the EPA, a water body qualifies as a “navigable water of the United States” if it meets any of the tests set forth in 33 C.F.R. Part 329 (e.g., the water body is (a) subject to the ebb and flow of the tide, and/or (b) the water body is presently used, or has been used in the past, or may be susceptible for use [with or without reasonable improvements] to transport interstate or foreign commerce.

Non-erodible: a material (e.g., natural rock, riprap, concrete, plastic, etc.,) that will not experience surface wear due to natural forces of wind, water, ice, gravity, or a combination of those forces.

Nonpoint Source Pollution: pollution contained in stormwater runoff from ill-defined, diffuse sources.

Non-stormwater Discharge: any discharge to the stormwater system or Waters of the State that is not composed entirely of stormwater.

Operator: the person who is operating the property, the operator's agent, or any other person who acts in the operator's behalf.

Outlet Facility: stormwater management facility designed to regulate the elevation, rate, and volume of stormwater discharge from detention facilities.

Owner: the legal property owner, the owner's agent, or any other person who acts in the owner's behalf.

Oxygen Demand: the amount of oxygen needed by aerobic organisms to break down organic material present in water.

Person: any and all persons, natural or artificial and includes any individual, association, firm, corporation, limited liability company, business trust, estate, trust, partnership, two or more persons having a joint or common interest, or an agent or employee thereof, or any other legal entity.

Person Responsible for Land Disturbing Activity:
- Person who has or represents having financial or operational control over the land disturbing activity; and/or
- Landowner or person in possession or control of the land who directly or indirectly allowed the land disturbing activity or has benefited from it or who has failed to comply with any provision of this ordinance.

pH: a quantitative measure of the acidity or basicity of aqueous or other liquid solutions. The scale ranges from 0 to 14 where low pH indicates the solution is acidic, high pH indicates the solution is basic/alkaline, and a pH of 7 indicates the solution is neutral.

Pollutant: anything that may cause or contribute to exceedances of water quality standards, including but not limited to sediment, bacteria, nutrients, dredged spoil, solid waste,
incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, soil, and industrial, municipal, and agricultural waste discharged into receiving waters.

**Pollutant Load:** a numeric value representing an estimate of the mass of a given pollutant entering a stormwater system or receiving water.

**Post-Development:** the conditions that exist following the completion of the land disturbing activity in terms of topography, vegetation, land use and rate, volume, quality, and direction of stormwater runoff.

**Pre-Development:** the conditions that existed prior to the initiation of the land disturbing activity, or at the time of Application, whichever is earlier, in terms of topography, vegetation, land use and rate, volume, quality, and direction of stormwater runoff.

**Qualified Individual:** a licensed professional (as defined by the South Carolina Construction General Permit) who is authorized to prepare, amend, certify, and stamp a construction SWPPP. The Qualified Individual is knowledgeable in the principles and practices of erosion prevention and sediment controls and possesses the skills to assess conditions at the construction site that could impact stormwater quality and to assess the effectiveness of any EPSC measures selected to control the quality of stormwater discharges from the construction activity.

**Project:** improvements and structures proposed by the applicant to be built on a defined site as part of a common plan of construction, development, or re-development.

**Public Infrastructure:** Infrastructure that is owned by the public, represented by the government, for public use. Includes public water, sewer and stormwater facilities, electric lines, gas lines, telephone or cable television lines, curbs, and sidewalks located within the public right-of-way, and other public improvements.

**Rate:** volume of water passing a point per unit of time, generally expressed in cubic feet per second (cfs).

**Receiving Water(s) or Waters of the State:** refers to any lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial limits of the State of South Carolina, and all other bodies of surface or underground water, natural or artificial, public or private, inland or coastal, fresh or salt.

**Redevelopment:** development on a previously developed site where the impervious surface on the developed site is equal to or greater than 20 percent of the total site and where any repair, reconstruction, or improvement to an existing site and/or to any structures located on that site such that the cumulative costs of repairs, over a five-year period
equals or exceeds 50 percent of the fair market value of the property and the structures located on that property; but excludes ordinary maintenance activities, remodeling of existing building interiors, resurfacing of paved areas, and exterior building changes or improvements that do not materially increase or concentrate stormwater runoff, or cause additional nonpoint source pollution.

**Regulation:** any regulation, rule, or requirement prepared by and/or adopted by the City of Charleston, the state, and federal regulatory agency(ies).

**Retention:** the collection and storage of stormwater runoff without subsequent discharge to surface waters.

**Retention Structure:** a permanent structure whose primary purpose is to permanently store a given volume of stormwater runoff. Release of the given volume is by infiltration, reuse, and/or evaporation.

**Retrofit:** the process of altering an existing drainage system to function properly or more efficiently than currently exists.

**Sediment:** solid particulate matter, both mineral and organic, that has been or is being transported by water, air, ice, or gravity from its site of origin.

**Sediment Control:** the control of solid material, both mineral and organic, during a land disturbing activity to prevent its transport out of the disturbed area by means of air, water, gravity, or ice.

**Sedimentation:** the process that operates at or near the surface of the ground, which deposits soils, debris, and other materials either on other ground surfaces or in the waterbody.

**Sedimentation Facility:** any structure or area which is designed to retain suspended sediments from collected stormwater runoff, including sediment basins, and allows the sediment to settle out of the stormwater.

**SEDPRO:** Computer software program for modeling the hydrology and erosivity of a land development site and the sediment transfer and trapping efficiency of specific management practices.

**Sensitive Waters:** any waters with approved or established TMDLs; any waters included in the most recent SCDHEC Bureau of Water CWA Section 303(d) list; and/or any waters pursuant to South Carolina's Classification & Standards (R.61-68) and Classified Waters (R.61-69) regulations that are classified as either Outstanding National Resource Waters, Outstanding Resource Waters, Trout Waters, or Shellfish Harvesting Waters; and/or in Source Water Protection Areas.

**Single-Family Residence-Separately Built:** a noncommercial dwelling that is occupied exclusively by one family and not part of a residential and subdivision development.
Site: the land or water area where any development is physically located or conducted including adjacent land used in connection with the development, and borrow and spoil locations associated with the development.

Small Municipal Separate Storm Sewer (SMS4 or as referenced herein MS4): Defined in South Carolina Water Pollution Control Permits Regulation 61-9, section 122.26(b)(16) and refers to all small separate storm sewer systems that are owned or operated by the United States, a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States, but is not defined as “large” or “medium” municipal separate storm sewer system. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

Special Stormwater Management Area: areas within the City of Charleston that require some additional stormwater management controls due to existing concerns.

Stabilization: the installation of vegetative or structural measures to establish a soil cover to reduce soil erosion by stormwater runoff, wind, ice, and gravity.

Storm Frequency: the probability of recurrence of a storm event.

- Two-Year Frequency Storm: a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in two years. It may also be expressed as an exceedance probability with a 50 percent chance of being equaled or exceeded in any given year.

- Five-Year Frequency Storm: a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in five years. It may also be expressed as an exceedance probability with a 20 percent chance of being equaled or exceeded in any given year.

- Ten-Year Frequency Storm: a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in 10 years. It may also be expressed as an exceedance probability with a 10 percent chance of being equaled or exceeded in any given year.

- Twenty-Five-Year Frequency Storm: a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in twenty-five (25) years. It may also be expressed as an exceedance probability with a four (4) percent chance of being equaled or exceeded in any given year.
- **Fifty-Year Frequency Storm**: a storm that is capable of producing rainfall expected to be equaled or exceeded on the average once in 50 years. It may also be expressed as an exceedance probability with a 2 percent chance of being equaled or exceeded in any given year.

- **One Hundred Year Frequency Storm**: a storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in 100 years. It may also be expressed as an exceedance probability with a 1 percent chance of being equaled or exceeded in any given year.

**Storm Surge**: rising sea levels as a result of atmospheric pressure changes and wind associated with a storm.

**Stormwater**: runoff or excess water caused by precipitation.

**Stormwater Management**:
- Quantitative control, a system of vegetative or structural measures, or both, that ensure no increase in volume and rate of stormwater runoff caused by man-made changes to the land
- Qualitative control, a system of vegetative, structural, or other measures that reduce or eliminate pollutants that might otherwise be carried by stormwater runoff.

**Stormwater Management and Sediment Control Plan**: a set of drawings, other documents, and supporting calculations submitted as a prerequisite to obtaining a permit to undertake a land disturbing activity, which contains all the information and specifications required by the City of Charleston. This plan is considered to be a part of the SWPPP.

**Stormwater Management Program (SWMP)**: the City of Charleston’s Stormwater Management Program, which describes the components to be used by the City of Charleston to control stormwater discharges, address flooding, and meet water quality standards. SWMP may also refer to the City of Charleston’s Stormwater Management Plan developed to implement the Stormwater Management Program.

**Stormwater Management System(s) and Drainage Facility(ies)**: natural and man-made channels, swales, ditches, swamps, rivers, streams, creeks, branches, reservoirs, ponds, drainage ways, inlets, catch basins, pipes, head walls, storm sewers, lakes and other physical works, properties, and improvements which transfer, control, convey, or otherwise influence the movement of stormwater runoff, be it for quantity or quality control.

**Stormwater Pollution Prevention Plan (SWPPP)**: a site-specific written document that
- Identifies potential sources of stormwater pollution;
- Describes stormwater control measures to reduce or eliminate pollutants in stormwater discharges; and
• Identifies procedures the operator will implement to comply with the terms and conditions of a permit.

The SWPPP includes site map(s), drawings and plans, other documents, and supporting calculations, and identification of activities that could cause pollutants in the stormwater, and a description of measures or practices to control these pollutants. A SWPPP may be prepared for construction sites, municipal facilities, or industrial facilities.

**Stormwater Runoff or Runoff:** the direct response of a watershed to precipitation and includes the surface and subsurface runoff that enters a ditch, stream, storm sewer or other concentrated flow during and following the precipitation. The part of rainfall that is not absorbed into the site but flows over the site as surface waters.

**Structure:** anything constructed or erected, the use of which requires a location on the ground, or attached to something having a location on the ground, including, but not limited to, tennis courts, swimming pools, fences, and buildings.

**Subdivision:** The division of a tract of land or of a parcel of land into two or more lots, building sites, or other divisions, for the purpose, whether immediate or future, of sale, legacy, or building developments, which includes any of the following:

- Creation of a new City road or the alteration of an existing road
- Need for drainage, sedimentation, or flood control measures,
- Installation of a water delivery system, or
- Installation of a sanitary sewerage system.

Subdivision shall not include the division of a tract of land wherein each lot created meets the standards of the City of Charleston Department of Public Service regarding the use of individual wells and septic tanks and does not involve any of the activities referenced in items (1) through (4) above. When appropriate to the context, the term subdivision relates to the process of subdividing or to the land area subdivided.

**Subsurface:** relating to or situated in an area beneath a surface or body of water.

**Swale:** a vegetated open channel for the purposes of conveying stormwater with side slopes no steeper than 3H:1V. The cross-sectional shape may be triangular or trapezoidal.

**Tailwater:** the water depth downstream of a hydraulic structure that restricts the flow of water from the structure.

**Total Maximum Daily Load (TMDL):** a calculation of the maximum amount of a specific pollutant that a waterbody can receive and still meet water quality standards. It is the sum of the allowable loads or allocations of a given pollutant from all contributing point and nonpoint sources. It also incorporates a margin of safety and consideration of
seasonal variation. For impaired waters, the TMDL document specifies the level of pollutant reductions needed for waterbody use attainment.

**Undeveloped Land:** property not altered from its natural state by construction or installation of improvements such as roads, drainage improvements, buildings, structures, or other impervious surfaces, or which has less than 20 percent of its property covered by impervious surfaces.

**Variance:** the modification of the minimum stormwater management requirements contained in Chapter 27 of the City of Charleston’s Stormwater and Flood Ordinance and the SWMP for specific circumstances where strict adherence to the requirements would result in unnecessary hardship and not fulfill the intent of Chapter 27 of the City of Charleston’s Stormwater and Flood Ordinance.

**Violator:** a person who violates any provision of Chapter 27 of the City of Charleston’s Stormwater and Flood Control Ordinance, the SWMP, the Stormwater Design Standards Manual, or any permit or authorization issued by the City of Charleston pursuant to the ordinance, SWMP, or SWDSM.

**Vegetation:** all plant growth, especially trees, shrubs, mosses, and grasses.

**Waiver:** the relinquishment from certain EPSC and stormwater management requirements by the Appropriate Plan Approval Authority for a specific land disturbing activity on a case-by-case review basis.

**Water Quality:** characteristics of stormwater runoff or receiving waters that relate to the physical, chemical, biological, or radiological integrity of water.

**Water Quantity:** characteristics of stormwater runoff that relate to the rate, duration, and volume of the stormwater runoff including characteristics of receiving waters.

**Watercourse:** any natural or man-made conveyance used to transport runoff from one location to the next.

**Waters of South Carolina, or Waters of the State:** defined as lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial limits of the State, and all other bodies of surface or underground water, natural or artificial, public or private, inland or coastal, fresh or salt, which are wholly or partially within or bordering the State or within its jurisdiction and all waters of the United States within the political boundaries of the State of South Carolina. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA, are not waters of South Carolina. This exclusion applies only to man-made bodies of water that neither were originally created
in waters of South Carolina (such as disposal areas in wetlands) nor resulted from the
impoundment of waters of South Carolina.

**Waters of the United States, or Waters of the U.S. (WOTUS):**

- All waters that are currently used, were used in the past, or may be susceptible to use in
  interstate or foreign commerce, including all waters that are subject to the ebb and flow of
  the tide;
- All interstate waters, including interstate “wetlands”;
- All other waters such as interstate lakes, rivers, streams (including intermittent streams),
mudflats, sandflats, wetlands, sloughs, wet meadows, or natural ponds the use, degradation,
or destruction of which would affect or could affect interstate or foreign commerce including
  any such waters:
  - That are or could be used by interstate or foreign travelers for recreational or other
    purposes;
  - From which fish or shellfish are or could be taken and sold in interstate or foreign
    commerce; or
  - That are used or could be used for industrial purposes by industries in interstate
    commerce;
- All impoundments of waters otherwise defined as waters of South Carolina under this
  definition;
- Tributaries of waters identified in paragraphs (a) through (d) of this definition;
- The territorial sea; and
- Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in
  paragraphs (a) through (f) of this definition.

**Watershed:** the drainage area contributing stormwater runoff to a single point.

**Wetlands:** Those areas that are inundated or saturated by surface or groundwater at a
frequency and duration sufficient to support, and that under normal circumstances do
support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
Wetlands generally include swamps, marshes, bogs, and similar areas. Wetland areas
typically fall under the jurisdiction of one or more of the following agencies: OCRM or the
United States Army Corps of Engineers (USACE).
Executive Summary

The objective of the City of Charleston Stormwater Design Standards Manual is to provide guidance on the design process during all phases of construction and the latest and best permanent construction stormwater management practices available to minimize the negative impacts of increasing stormwater runoff and its associated pollutants. Building on the previous version, this updated manual will help the City of Charleston take a comprehensive approach to stormwater management that integrates drainage design, stormwater quantity, and water quality considerations. The goal is to provide an effective tool for the City of Charleston and the development community to reduce both stormwater quality and quantity impacts and protect downstream areas and receiving waters.

Stormwater management has entered a new era, and the City of Charleston recognizes the need for more innovative policies and practices. The requirements for NPDES municipal and industrial permits, TMDLs, and watershed assessments and the desire to protect human life, property, aquatic habitats, and the quality of life in the City of Charleston, have brought home the pressing need to manage both stormwater quality and quantity from developed and developing areas. To enhance its utility and ease of use, this manual has been divided into eight chapters. Each section provides information that supports the implementation of an integrated, green infrastructure-based approach to natural resource protection, stormwater management, and site design that can be used to protect the City of Charleston’s and coastal South Carolina’s valuable natural resources from the negative impacts of land development and nonpoint source pollution. The eight chapters presented in the document include:

- **Chapter 1 - Introduction and Legal Authority:** Chapter 1 provides an introduction to the Stormwater Design Standards Manual and summarizes the legal authority the City of Charleston has been authorized to review and approve stormwater construction permits through federal, state, and local laws, regulations, and ordinances.

- **Chapter 2 - Conceptual Overview:** Chapter 2 provides a conceptual overview of stormwater concepts, water quality and quantity, management and planning, LID design, various types of development, BMPs, and sea level rise.

- **Chapter 3 - Design Requirements:** Chapter 3 provides information necessary to develop adequate systems that will control the rate, volume, and pollutants released from construction, development, and re-development projects. Chapter 3 also includes requirements for Special Stormwater Management Areas, sea level rise, landscape design, and additional design considerations.

- **Chapter 4 - Development Permitting:** Chapter 4 provides information on the permitting process prior to any land disturbing activity. The chapter includes roles and responsibilities, types of projects and permits, approvals of applications, and any changes made after project approval, fees, and exemptions and exceptions.
• **Chapter 5 - Construction Phase:** Chapter 5 provides requirements during the land disturbing phase of the construction process. The chapter includes implementation of temporary BMPs, requirements for changes to approved designs and approved stormwater pollution prevention plans, inspections by the construction applicant, owner, and/or operator during construction, and erosion prevention and sediment controls.

• **Chapter 6 - Post-Construction:** Chapter 6 provides requirements for closeout operations during the post-construction phase. The chapter includes information on final stabilization of the site, inspections, and in situ testing by the construction applicant, owner, and/or operator, stormwater record drawings, city roadways inventory, final plats, stormwater GIS, maintenance plans and covenants, and stormwater facility warranties.

• **Chapter 7 - Inspections and Enforcement:** Chapter 7 provides requirements for inspections and enforcement actions conducted by the City of Charleston. The inspection section of Chapter 7 includes duties and responsibilities for the City of Charleston, inspector qualifications, associated fees, and inspection reports. The enforcement section of Chapter 7 includes information about common violations, correction orders, notices of violations, stop work orders, penalties, and uniform ordinance summons.

• **Chapter 8 - References:** Chapter 8 provides a singular location for all references in this manual. It includes references to laws, regulations, standards, ordinances, manuals, permits, studies, and websites.

This manual is intended to provide guidance for the City of Charleston’s government officials and staff on implementing stormwater management programs. Developers planning land disturbance activities in the City of Charleston will use this manual for the minimum requirements needed throughout the design process from the beginning of the project to closeout.

Other interested parties and the general public may also find this manual helpful because it describes how managing stormwater improves water quality and quantity, helps protect the City of Charleston’s valuable natural resources, and contributes to other social and economic benefits. Adoption of new comprehensive management strategies using LID concepts, such as green infrastructure, will reduce the negative impacts of stormwater runoff. These LID concepts help reduce runoff from new and re-development sites by using BMPs that encourage infiltration, evaporation, harvest, and use of stormwater runoff onsite.
Chapter 1. Introduction and Legal Authority ......................................................... 1-1
  1.1 Purpose .............................................................................................................. 1-1
  1.2 Scope .................................................................................................................. 1-1
  1.3 Legal Authority .................................................................................................. 1-1
  1.4 Authorization ..................................................................................................... 1-2
  1.5 Stormwater Related Laws, Regulations, and Permits ........................................ 1-2
    1.5.1 Federal Clean Water Laws ........................................................................... 1-3
    1.5.2 Required Federal Permits ............................................................................ 1-4
    1.5.3 South Carolina Water Laws ......................................................................... 1-4
    1.5.4 South Carolina Stormwater Related Regulations ........................................ 1-5
    1.5.5 Required South Carolina Permits ............................................................... 1-6
  1.6 Section 303(d) Listed Waters and TMDLs ......................................................... 1-7
  1.7 City of Charleston Ordinances, Regulations, and Standards .............................. 1-7
    1.7.1 Qualifying Local Program .......................................................................... 1-7
    1.7.2 1984 Master Drainage Plan ......................................................................... 1-8
    1.7.3 Level of Service for Maintenance ............................................................... 1-8
  1.8 Easements .......................................................................................................... 1-8
  1.9 Standards Superseded ....................................................................................... 1-9
  1.10 Other Standards Sought .................................................................................. 1-9
  1.11 Duty to Comply ............................................................................................... 1-9
# Table of Contents

1.12 Engineering Design Accountability ......................................................................................... 1-9
1.13 Severability ............................................................................................................................................. 1-10
1.14 Language and Interpretation of Text .......................................................................................... 1-10
1.15 Disclaimer ............................................................................................................................................... 1-11

## Chapter 2. Conceptual Overview ................................................................. 2-1

2.1 Introduction ............................................................................................................................... 2-1
2.2 Stormwater and Watersheds ........................................................................................................ 2-1
  2.2.1 Introduction to Stormwater ................................................................. 2-1
  2.2.2 What is a Watershed? ............................................................................. 2-3
  2.2.3 Changes from Natural Conditions to Development ...................... 2-4
  2.2.4 Effects of Development ............................................................................ 2-5

2.3 Introduction to Soils .............................................................................................................................. 2-6

2.4 Water Quality ............................................................................................................................... 2-8
  2.4.1 Suspended Solids ........................................................................................ 2-10
  2.4.2 Oxygen Demanding Matter and Bacteria ............................................. 2-10
  2.4.3 Nutrients ...................................................................................................... 2-10
  2.4.4 Illicit Discharge Detection and Elimination ........................................... 2-11

2.5 Water Quantity ............................................................................................................................... 2-12
  2.5.1 Coastal and Tidal Flooding .................................................................... 2-13
  2.5.2 Extreme Event (Flash) Flooding .............................................................. 2-14
  2.5.3 Fluvial (Riverine) Flooding .................................................................. 2-14
  2.5.4 Groundwater Flooding .......................................................................... 2-15
  2.5.5 Surface Flooding ..................................................................................... 2-16

2.6 Principles of Floodplain Management ...................................................................................... 2-17

2.7 Master Planning for Stormwater ............................................................................................ 2-18

2.8 Principles of Stormwater Management ..................................................................................... 2-18
  2.8.1 Introduction to Stormwater Management ........................................... 2-19
  2.8.2 Innovative Design .................................................................................. 2-19
  2.8.3 Site Planning ............................................................................................ 2-19

2.9 Types of Development .................................................................................................................. 2-22
  2.9.1 New Development .................................................................................. 2-22
Chapter 3. Design Requirements 3-1

3.1 Introduction 3-6
3.2 Determination of Construction Activity 3-6
3.3 Design Approach 3-6
3.4 Stormwater Hydrology and Routing 3-8
  3.4.1 Introduction to Hydrologic Requirements 3-8
  3.4.2 Rainfall and Design Storms 3-9
  3.4.3 Recommended Methods and Design Procedures 3-10
  3.4.4 Collection and Conveyance Requirements 3-12
  3.4.5 Roadway Drainage Design 3-19
  3.4.6 Green Infrastructure 3-22
3.5 Special Stormwater Management Areas 3-22
  3.5.1 Areas Associated With Flooding 3-23
  3.5.2 Areas Discharging to TMDLs and Impaired Waters 3-24
  3.5.3 Church Creek Drainage Basin Requirements 3-26
3.6 Sea Level Rise 3-27
3.7 Soils and Geotechnical Information - Germantown 3-27
3.8 Permanent Stormwater Design 3-28
  3.8.1 Introduction to Permanent Stormwater Design Requirements 3-28
  3.8.2 Design Volumes 3-29
  3.8.3 Recommended Methods and Design Procedures 3-30
3.9 Detention, Retention, and Infiltration Requirements 3-34
  3.9.1 Detention and Retention Requirements 3-34
  3.9.2 Detention Specific Requirements 3-35
  3.9.3 Retention Specific Requirements 3-35
  3.9.4 Infiltration Requirements 3-36
3.10 Equalization Pipes and Submerged Systems 3-37
3.11 Accepted Permanent Structural and Non-Structural BMPs .............................................. 3-38
  3.11.1 Stormwater Quantity BMPs .................................................................................................. 3-44
  3.11.2 Stormwater Quality BMPs ..................................................................................................... 3-50
3.12 Site Grading Requirements .............................................................................................................. 3-51
3.13 Erosion Prevention and Sediment Control................................................................................ 3-52
  3.13.1 Introduction to EPSC Requirements ................................................................................. 3-52
  3.13.2 Rainfall, Design Storms, and Design Volumes .............................................................. 3-52
  3.13.3 Recommended Methods and Design Procedures ..................................................... 3-53
  3.13.4 Accepted EPSC BMPs ............................................................................................................ 3-53
  3.13.5 EPSC BMP Design Requirements ...................................................................................... 3-57
3.14 Landscape Design ............................................................................................................................... 3-60
  3.14.1 BMP Soils and Compaction .................................................................................................. 3-61
  3.14.2 Plant Selection ........................................................................................................................... 3-61
  3.14.3 Fertilizer, Pesticides, Irrigation, and Mulch .................................................................... 3-63
3.15 Maintenance Access and Easements ......................................................................................... 3-66
  3.15.1 Stormwater Pipe ........................................................................................................................ 3-66
  3.15.2 Open Conveyances ................................................................................................................. 3-66
  3.15.3 Detention and Retention Ponds ......................................................................................... 3-67
  3.15.4 Other Stormwater Facilities and BMPs ............................................................................ 3-67
  3.15.5 Offsite Easements .................................................................................................................... 3-67
3.16 Additional Design Considerations ................................................................................................ 3-67
  3.16.1 Safety ............................................................................................................................................. 3-68
  3.16.2 Signage and Stenciling ........................................................................................................... 3-68

Chapter 4. Development Permitting ................................................................................................... 4-1
4.1 Overview of Application/Approval Process ................................................................................ 4-2
4.2 Roles and Responsibilities ........................................................................................................... 4-2
  4.2.1 City of Charleston Stormwater Management ............................................................... 4-2
  4.2.2 Applicant, Owner/Operator (Permittee) .......................................................................... 4-2
  4.2.3 Engineer-of-Record ................................................................................................................. 4-3
4.3 Permanent Structural Stormwater Facility Ownership ........................................................... 4-3
  4.3.1 Residential ................................................................................................................................. 4-3
4.3.2 Non-Residential ......................................................................................................................... 4-3
4.3.3 Easements ............................................................................................................................... 4-4
4.4 Construction Activity Applications ................................................................................................. 4-4
  4.4.1 Who Must Submit an Application .......................................................................................... 4-5
4.5 Types of Applications ..................................................................................................................... 4-5
  4.5.1 Single Family Residence Applications .................................................................................. 4-6
  4.5.2 Small Construction Activity Applications (Type I) .............................................................. 4-6
  4.5.3 Medium Construction Activity Applications (Type II) ........................................................ 4-6
  4.5.4 Large Construction Activity Applications (Type III) .......................................................... 4-13
  4.5.5 Linear/Utility Applications .................................................................................................. 4-15
4.6 Additional Permits and Approvals ................................................................................................. 4-15
  4.6.1 South Carolina Department of Transportation Encroachment Permits ............................. 4-16
  4.6.2 US Army Corps of Engineers Permits ............................................................................... 4-16
  4.6.3 SC DHEC OCRM Coastal Zone Consistency Certification .................................................. 4-16
4.7 Approval of Applications .............................................................................................................. 4-17
4.8 Changes After Project Approval .................................................................................................. 4-17
  4.8.1 Changes to Approved Applications ...................................................................................... 4-17
  4.8.2 Transfer of Responsibility (Change of Owner) .................................................................... 4-17
  4.8.3 Expiration of City Approval .................................................................................................. 4-18
4.9 Fees ............................................................................................................................................. 4-18
  4.9.1 Construction Activity Fee ...................................................................................................... 4-18
  4.9.2 Major Modification ............................................................................................................... 4-19
4.10 Exemptions and Design Exceptions ......................................................................................... 4-19

Chapter 5. Construction Phase ............................................................................................................. 5-1

5.1 Roles and Responsibilities ............................................................................................................. 5-2
  5.1.1 City of Charleston Stormwater Management ...................................................................... 5-2
  5.1.2 Applicant, Owner/Operator (Permittee) ................................................................................ 5-2
  5.1.3 Inspector ............................................................................................................................... 5-2
5.2 Pre-Construction Requirements .................................................................................................. 5-2
  5.2.1 Pre-Construction Activities .................................................................................................. 5-3
  5.2.2 Inspection Fees ...................................................................................................................... 5-3
5.2.3 Other Planning Considerations ........................................................................ 5-3
5.2.4 Pre-Construction Meeting ............................................................................. 5-4

5.3 Construction Requirements .............................................................................. 5-5
  5.3.1 Implement and Maintain EPSC BMPs ............................................................... 5-5
  5.3.2 Conduct Inspections ......................................................................................... 5-5
  5.3.3 Maintain Stormwater Documents On-Site ....................................................... 5-7
  5.3.4 Spills and Illicit Discharge Detection and Elimination .................................. 5-7

5.4 Changes During Construction ........................................................................... 5-7
  5.4.1 Changes to Approved Design ......................................................................... 5-8
  5.4.2 Changes to Approved SWPPP ......................................................................... 5-8
  5.4.3 Qualifications .................................................................................................... 5-9
  5.4.4 Transfer of Responsibility (Change of Owner) ................................................ 5-9
  5.4.5 Expiration of City Approval ............................................................................ 5-10
  5.4.6 Notifications .................................................................................................... 5-10

Chapter 6 - Post-Construction ............................................................................. 6-1
6.1. Overview of Project Closeout Requirements .................................................... 6-4
6.2. Final Stabilization and Project Closeout .............................................................. 6-4
  6.2.1. Single-Family Residential (SFR) ................................................................. 6-4
  6.2.2. Site Plan (Commercial, multi-family) Projects ................................................. 6-4
  6.2.3. Subdivision/Road Construction Plan Projects ............................................... 6-5
  6.2.4. Utility Projects ............................................................................................... 6-5
6.3. Stormwater Record Drawings (As-Builts) ........................................................... 6-5
  6.3.1. Piped Drainage Systems ............................................................................... 6-6
  6.3.2. Open Channel Drainage Systems ................................................................. 6-6
  6.3.3. Stormwater Management Pond or Basin ......................................................... 6-6
  6.3.4. Project Datum ............................................................................................... 6-7
  6.3.5. Certifications Statement ................................................................................. 6-7
6.4. Maintenance Plan and Covenants ................................................................. 6-7
6.5. Final Plat ............................................................................................................ 6-8
6.6. Stormwater Video Inspection ........................................................................ 6-8
6.7. Stormwater Facility Warranty ...................................................................... 6-9
6.9. In-Situ Testing of BMPs ........................................................................... 6-12
6.10. City Roadways Inventory/Stormwater GIS ........................................... 6-16

Chapter 7. City Inspection and Enforcement................................................. 7-1

7.1 Stormwater Management Inspections...................................................... 7-1
  7.1.1 City Inspection Duties and Responsibilities ...................................... 7-1
  7.1.2 Inspector Qualifications ................................................................. 7-2
  7.1.3 Inspection Reports ......................................................................... 7-2

7.2 Enforcement ............................................................................................ 7-2
  7.2.1 Administrative Order ...................................................................... 7-3
  7.2.2 Notice of Violation ......................................................................... 7-5
  7.2.3 Uniform Ordinance Summons ....................................................... 7-6
  7.2.4 Civil and Criminal Penalties .......................................................... 7-6

Chapter 8. References .................................................................................. 8-1
CHAPTER 1. INTRODUCTION AND LEGAL AUTHORITY

1.1 Purpose

Stormwater management is extremely important, particularly in coastal cities, such as the City of Charleston (City). With sea level rise, king tides, and the increase in population density, the City has and will continue to implement high standards in regard to public infrastructure, development, and redevelopment projects. The purpose of the Stormwater Design Standards Manual (SWDSM) is to provide guidance on the design of the City's stormwater system. The SWDSM addresses issues related to pre-construction and permitting, construction, and post-construction for public infrastructure, development, and redevelopment projects within the City. The SWDSM describes the policies and procedures that shall be used by the City's Department of Stormwater Management to implement the City's ordinances related to stormwater. The SWDSM provides:

- Application submittal requirements and approval process.
- Technical design standards, to include standards that address flow rates, runoff volume, and pollutant load/concentration, as well as standards applicable during construction, and post construction performance.
- General information on measures to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts due to construction activity, development, and redevelopment.
- Other protection provisions related to stormwater discharges such as wetlands and watercourse conservation.

1.2 Scope

The SWDSM is intended to be a resource for City officials, staff, designers, and developers on the stormwater design requirements approved by the City's Department of Stormwater Management. Additionally, the SWDSM provides information to the interested citizen regarding the City's approach to stormwater management.

1.3 Legal Authority

Federal regulatory agencies delegate authority to the states, providing that state requirements meet or exceed federal requirements. The United States Environmental Protection Agency (EPA) delegates authority for the Clean Water Act (CWA) and other environmental laws to the state of South Carolina. In turn, South Carolina Department of Health and Environmental

AECOM
Control (SCDHEC) is the regulating and permitting agency of the state. SCDHEC has the authority to delegate authority to local stormwater management programs, if said programs meet or exceed federal and state requirements. The City has combined federal, state, and local laws, regulations, and ordinances for stormwater into the SWDSM.

The SWDSM incorporates design standards that are required by the regulatory agencies. The City requires any construction activity to incorporate the standards stated in the manual, or enforcement and correct actions will be taken. The strict adherence the City takes with the SWDSM and future construction activities will improve flood control, water quality, and infrastructure integrity.

1.4 Authorization

The SWDSM has been prepared under the direction of the Department of Stormwater Management, which has been granted the authority by the City Council to develop engineering design standards and enact programs and policies to ensure compliance with state and federal laws for the purposes previously described. A detailed description of the laws, regulations, and assigned authorizations to the City is provided below.

1.5 Stormwater Related Laws, Regulations, and Permits

Any construction activity is required by law to regulate water quality and quantity to protect the waters of the State and waters of the United States (WOTUS). Federal laws and regulations provide the overarching guidelines for the United States. South Carolina laws include Federal laws, and require other regulations specific to the state. This section contains the Federal and State laws, regulations, and permits that are included and required by the City’s Stormwater Ordinance and are encompassed in the SWDSM (Figure 1).
1.5.1 Federal Clean Water Laws

1.5.1.1 Clean Water Act

The Federal Water Pollution Act, as amended by the Clean Water Act (CWA) requires the reduction of water pollution and gives EPA the congressional authority to develop programs to improve the health of navigable waters. EPA developed regulations that created a program of discharge permits as part of the National Pollutant Discharge Elimination System (NPDES) to regulate point sources from a variety of discharges. The 1987 amendments to the CWA extended NPDES permits to industrial discharges, including stormwater runoff associated with land disturbing activity. The 1987 CWA Amendments also require NPDES permitting for stormwater runoff from urbanized areas. A Municipal Separate Storm Sewer System (MS4) NPDES permit is required based on population. Authority to administer the NPDES permit program was delegated to state agencies, such as SCDHEC, by EPA.
1.5.1.2 Federal Coastal Zone Management Act of 1972

The United States Congress recognized the fragile balance between economic growth and preservation of the environment and passed the Coastal Zone Management Act (CZMA) in 1972. The goal of CZMA is to “preserve, protect, develop, and where possible, to restore or enhance the resources of the nation’s coastal zone.” CZMA is administered by the National Oceanic and Atmospheric Administration (NOAA) and provides for the management of the nation’s coastal resources. Coordination between Federal and State jurisdictions is a requirement, and allows flexibility to local programs to address their specific needs.

1.5.2 Required Federal Permits

1.5.2.1 United States Army Corps of Engineers 404 Permit

Under the CWA Section 404(b)(1) Guidelines, EPA established regulations and guidelines for discharges of dredged or fill materials into the WOTUS, including wetlands. The United States Army Corps of Engineers (USACE) are charged with evaluating applications of the 404 Permit under a public interest review, CWA, and additional regulations promulgated by EPA. The basis of the 404 Permit is to show that steps have been taken to avoid discharges of dredged or fill material into WOTUS, potential impacts have been minimized, and compensation will be provided for all remaining unavoidable impacts. Activities requiring a 404 Permit include but are not limited to fill for development, water resources projects (e.g., dams and levees), infrastructure development (e.g., highways and airports), and mining activities.

1.5.3 South Carolina Water Laws

1.5.3.1 South Carolina Pollution Control Act

The South Carolina Pollution Control Act (PCA) was originally enacted in 1950 and was last amended in 1970 during the initial stages of the environmental movement. It was written very broadly and is applicable to essentially any activity that could negatively impact the environment by requiring attainment of a permit and implementation of measures to mitigate potential negative impacts.

1.5.3.2 South Carolina Stormwater Management and Sediment Reduction Act

The South Carolina Stormwater Management and Sediment Reduction Act of 1991 (SMSRA) S.C. Code Ann. §§ 48-14-10 et seq. was enacted to address the increase in stormwater runoff rate and quantity, the decrease of rainwater infiltration, and the increase in erosion associated
with the extensive urban development occurring throughout the state. SMSRA gave legislative authority to SCDHEC to enact programs to meet its purpose.

1.5.3.3 South Carolina Coastal Zone Management Act

CZMA provides grants to states that develop and implement federally approved coastal zone management plans. The Office of Ocean and Coastal Resource Management (OCRM), a division of SCDHEC, implements this management plan for the state’s eight coastal counties as established by the Coastal Zone Management Act of 1976. Within the coastal zone, the program provides authority to review any project requiring a state permit (certification), a federal permit or license (including NPDES), federal funding, as well as direct federal activities to determine whether the project is consistent with the policies and procedures of the South Carolina Coastal Zone Management Program.

1.5.4 South Carolina Stormwater Related Regulations

South Carolina became the permitting authority over the NPDES Stormwater Program through SMSRA in 1991. SCDHEC has the responsibility of enforcing the stormwater regulations. These regulations provide information about stormwater standards and the regulatory process. Below is a list of regulations from SCDHEC:

- Reg. 61-9 Water Pollution Control Permits
- Reg. 61-68 Water Classifications and Standards
- Reg. 61-69 Classified Waters
- Reg. 61-110 Total Maximum Daily Loads (TMDLs) for Pollutants in Water
- Reg. 72-101 through 72-108 Erosion and Sediment Reduction and Stormwater Management
- Reg. 72-300 through 72-316 Standards for Stormwater Management and Sediment Reduction
- Reg. 70-405 through 72-445 Standards for Stormwater Management and Sediment Reduction

1.5.5 Required South Carolina Permits

1.5.5.1 Ocean and Coastal Resource Management Coastal Zone Consistency

Under the guidelines of CZMA and South Carolina Coastal Tidelands and Wetlands Act of 1977 (CTWA), the South Carolina Coastal Management Program was established to manage coastal
resources. Under the program, a Coastal Zone Consistency (CZC) Certification is required for any land disturbing activities in the coastal counties, including Charleston County, prior to receiving coverage under the NPDES Permit Program. All CZC Certifications are granted through the OCRM in SCDHEC. CZC Certification guarantees a balance of environmental protection and economic and social improvements of the coastal zone. A CZC Certification must be obtained prior to applying for any Federal or State permit.

### 1.5.5.2 NPDES General Permit for MS4s ( Permit No. SCR030000)

The City is required to have a NPDES permit to discharge stormwater from MS4, officially titled as the “State of South Carolina NPDES General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SMS4).” Since land disturbing activities contribute to the discharge of pollutants, the NPDES permit requires that the City encourage, promote, and implement certain practices, programs, and procedures for the purpose of reducing or limiting discharge of pollutants into receiving waters of the State. The permit requires that the City develop and implement a Stormwater Management Program (SWMP) to control the discharge of pollutants from its MS4 to the maximum extent practicable (MEP).

### 1.5.5.3 NPDES Industrial General Permit ( Permit No. SCR000000)

All stormwater runoff from “industrial activities” is considered an illegal discharge without an NPDES discharge permit. The permit is titled “NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Except Construction),” and is informally known as the Industrial General Permit (IGP). These permits require certain industries to develop and implement a Stormwater Pollution Prevention Plan (SWPPP), which must include appropriate best management practices (BMPs) to minimize pollution to receiving waters. The two general types of industrial activity permits are construction related and other. Coverage under the NPDES General Permit for Stormwater Discharges from Construction Activities is required for all construction sites that disturb one-half (½) or more acres of land. Coverage is required for all construction activities within ½ mile of a receiving water. The requirements for obtaining and complying with this type of permit are the focus of the SWDSM.

### 1.5.5.4 NPDES Construction General Permit ( Permit No. SCR100000)

All stormwater runoff from construction activities is considered an illegal discharge without a NPDES discharge permit. The NPDES General Permit for Stormwater Discharges from Construction Activities, also known as a Construction General Permit (CGP), addresses discharges during and post construction activities. Requirements for discharges during construction activities set forth in the permit are based on the CWA, 33 U.S.C. §§ 1251 et seq. and the PCA, S.C. Code Sections 48-1-10 et seq. Additional requirements are established
in South Carolina Regulation 61-9. Water Pollution Control Permits, South Carolina Regulation 72-300, SMSRA, and coastal zone citation. EPA has delegated the authority to implement the CGP to SCDHEC within the state of South Carolina.

The Larger Common Plan (LCP) is any announcement, piece of documentation, or physical demarcation indicating construction activities may occur on a specific plot of land (63 Federal Register No. 128). Any land disturbing activities (e.g., clearing, grading, or excavating) are required to obtain coverage for stormwater discharges under the NPDES CGP. This requirement includes disturbed area of less than 1 acre.

1.6 Section 303(d) Listed Waters and TMDLs

Through the provision of Section 303(d) of the CWA, EPA requires the states to submit a list of all waterbodies (303(d) Listed Waters) that do not meet minimum water quality standards every two years. The 303(d) list allows water quality impairments to be identified and corrective actions to be implemented. Once on the Section 303(d) List, a TMDL for the waterbody must be developed within 2 to 13 years of the initial listing by the state. SCDHEC develops the TMDL and forwards the information to the EPA Region 4 office for final approval.

1.7 City of Charleston Ordinances, Regulations, and Standards

1.7.1 Qualifying Local Program

EPA gives authority of NPDES permitting agencies SCDHEC to recognize when a local sediment and erosion control program meets or exceeds the requirements of the stormwater regulation 40 C.F.R. § 122.44(s). SCDHEC has the authority to incorporate the local program by reference in its permit for construction activities. The local program is then known as a Qualifying Local Program (QLP). The advantages of a QLP include streamlining the permit process and providing one set of requirements for construction activities. QLPs allow municipalities to modify stormwater programs to meet local needs as long as the requirements are met on a state and federal level. QLPs undertake the responsibility of reviewing and approving erosion and sediment control plans, inspecting sites to ensure compliance, and taking corrective actions when needed to protect water quality.

The City has promulgated and adopted ordinances and standards based on State and Federal regulations to address concerns associated with uncontrolled stormwater runoff. A number of ordinances and standards for the City may affect construction activities, and the development and redevelopment of land, such as:
Other ordinances and standards may also be applicable and should be consulted as necessary.

1.7.2 1984 Master Drainage Plan

The 1984 Master Drainage Plan was the first phase of a four-phase plan to improve the existing stormwater facilities in the City. The plan was submitted in compliance with the agreement between the City and the Engineers and constituted the completion of the first phase of identifying the existing drainage problems and recommendations for improvement. The Master Drainage Plan included all areas within the 1984 City boundaries.

1.7.3 Level of Service for Maintenance

Level of Service (LOS) is a set of standards and services the community can expect from the stormwater management program. The citizens of the City are ensured consistent and reasonable standards of service through paying the monthly stormwater fee. The City will maintain the MS4 and certify the system is serviceable and has minimal negative impact on the receiving waters in order to comply with the requirements set forth by SCDHEC. The LOS and fee can only be applied within the City boundaries and MS4 jurisdiction.

1.8 Easements

An easement is a “right of use for access granted on, above, under, or across a tract of land by the landowner to another person or entity” (Section 54-1051(k) Ord. No. 2018-031 § 11, 4-10-18). Specifically, a drainage easement is the “right of access of stormwater runoff from adjacent drainage basins into the drainage way within the defined easement” (Section 54-1051(i) Ord. No. 2018-031 § 11, 4-10-18). Easements are permanent and exist even after transfer of ownership of property. An example of an easement agreement with the City is located in Appendix A. The City uses easements for maintenance and repairs of stormwater infrastructure and other utilities within the easement.

1.9 Standards Superseded

When the SCDHEC or the City updates design standards associated with stormwater discharges, the City must provide notification of the new design standards and the cancellation
of current design standards via the City's website. The City must also provide a timeline when
the new design standards will be implemented.

1.10 Other Standards Sought

The City shall require the most restrictive standard as the driver of design standards:

“Whenver the provisions of this article impose more restrictive standards than
are required in or under any other law, regulation, or article, the requirements
contained in this article shall prevail. Whenever the provisions of any other law,
regulation, or ordinance require more restrictive standards than are required in
this article, the requirements of such law, regulation, or ordinance shall prevail.
(Ord. No. 2007-158, § 2, 8-21-07)"

1.11 Duty to Comply

Unless otherwise allowed by the Stormwater Management Ordinance or the SWDSM, the
surface of land in the City shall not be disturbed or altered for any purpose whatsoever, nor any
major drainage channel or component of the stormwater system impeded or encroached upon
without approval from the Department of Stormwater Management. Construction, development, and redevelopment activities cannot commence prior to approval from the
Department of Stormwater Management and other City Departments as necessary.

1.12 Engineering Design Accountability

The SWDSM will assist engineers, plan reviewers, inspectors, and contractors in the design and
layout of most land disturbance projects. The user of the SWDSM is hereby cautioned that
many aspects of engineering design must be considered, including but not limited to:

- Public health and safety
- Site-specific conditions or unusual features of a project site that warrant special designs
- Current versions of design texts, manuals, technical documents, and research

The design engineer must have sufficient education and experience to perform a complete and
thorough design of each element shown on the construction plans and must also have
complete control to change or alter the plans during the design phase. The design engineer
shall thoroughly investigate field conditions and coordinate all design efforts with the City.
Construction plans, site plans, details, calculations, construction specifications, and other
technical documents must be designed, stamped, and sealed by a Professional Engineer
or Tier B Land Surveyor actively licensed in the state of South Carolina, unless otherwise stated in the SWDSM.

The SWDSM is not intended to restrain or inhibit engineering creativity, freedom of design, or the need for engineering judgment. When shown to be applicable, it is encouraged that new procedures, techniques, and innovative stormwater BMPs be submitted with supporting documentation. However, the use of such approaches shall be substantiated with submitted documentation by design engineers showing that the proposed design is equal to or exceeds the traditional procedures in terms of performance and economic feasibility.

1.13 Severability

It is the declared intent of the City that if any portion of the SWDSM is ruled to be invalid or unconstitutional by any court with adequate jurisdiction over the City, then such portion shall be considered to have been selectively removed from the SWDSM without affecting the overall applicability, validity, or enforceability of any remaining provisions, and it is the intent of the City that such remaining provisions shall continue in full force and effect.

1.14 Language and Interpretation of Text

The following language rules are applicable to the SWDSM:

- The imperative case is always mandatory. The words “shall” and “must” are always mandatory. These actions must be performed unless sufficient engineering justification is submitted to the City’s Department of Stormwater Management and written approval has been specifically granted.

- The word “should” indicates an action that is highly recommended under most conditions.

- The word “may” indicates an allowable action or choice that is usually beneficial in meeting the minimum City requirements.

- Use of the singular or plural case of a noun shall not affect the applicability of the SWDSM, or any other law, regulation, or ordinance, unless the context of the sentence specifically indicates that the singular/plural case affects the intended use or function on a scientific or engineering basis. The use of a singular or plural noun does not necessarily indicate whether to design or construct a single unit or multiple units.

- Any reference to the Department of Stormwater Management shall mean the duly authorized representatives, sections, or employees under the Director’s supervision who have delegated responsibilities. Areas of delegated responsibility may include, but are not limited to, review and approval of plans, review and approval of survey plats, interpretation of standards or requirements, approval of special conditions, review and issuance of
approvals, inspections and field investigations, enforcement actions, issuing notices of violation, conducting public meetings, etc.

- The use of “and” shall imply conjunction of items in lists of required elements, in which all items must be complied with.
- The use of “or” shall imply the disconnection of items in lists of required elements, in which either or one or the other items in the list must be complied with.
- The rules of verbal construction found in the Stormwater Management Ordinance apply to the SWDSM.

1.15 Disclaimer

The SWDSM is not intended as a textbook or as a comprehensive engineering design reference. It was developed under the assumption that the user possesses a thorough understanding of stormwater control design, construction, and land development. Guidance documents from federal, state, and local agencies as well as other relevant references are given throughout the SWDSM and are only for the purposes of providing additional references and information. See Chapter 8 for a complete listing of recommended references.
CHAPTER 2. CONCEPTUAL OVERVIEW

2.1 Introduction

This chapter provides a conceptual overview of stormwater, the site conditions that dictate stormwater runoff quantity and quality, and the impacts that urban development have on stormwater. The topics introduced throughout this chapter are intended to establish a baseline understanding of stormwater concepts for developers, engineers, and any other members of the general public who have an interest in the many factors that impact stormwater management in the Charleston area. Later chapters will go more in depth into the stormwater considerations that factor into design, permitting, and construction.

2.2 Stormwater and Watersheds

The City is flush with water resources that we all enjoy. This chapter describes how proper stormwater management can protect and preserve these water resources for generations to come.

2.2.1 Introduction to Stormwater

During a storm, rainfall can either be intercepted by plants and trees, or fall on the land. In a natural condition, the land is able to absorb the majority of rainfall by a process called infiltration. As the land is developed and becomes urbanized, more of the landscape is covered by impervious surfaces, such as rooftops, pavement, and compacted soil. As shown on Figure 2-1, an increasing percentage of impervious surface results in less rainfall being infiltrated into the soil, and more of the rainfall running off. These hard surfaces generate a larger volume of stormwater runoff, and without the natural obstacles that would otherwise slow the water down, the runoff travels at a faster rate. Fast-moving, large volumes of water cause erosion and flooding, and can damage land and property downstream. Additionally, as the runoff travels over the land, it picks up pollutants. Pollutants are any substance or material not naturally present in rainwater or surface water, or a natural substance that is present in excessive quantities (such as sediment). Impaired waters cannot be used as intended, for recreation, water supply, fishing or shellfishing, etc., due to pollution, or may lose their ability to support aquatic life.
Figure 2-1: Diagram depicting changes in runoff and infiltration with increasing amounts of impervious surface (Source: City of Charleston Redevelopment Standards for Stormwater).

The basis for stormwater design in the City is the storm annual exceedance probability (AEP) percentage, or the percent chance that a 24-hour rain event will occur in any given year, for the area. For example, a 1% probability storm event in Charleston will result in 10.3 inches of precipitation over a 24-hour period. The AEP is determined using historical rainfall and tide gage data within a given region. AEP will be used as opposed to recurrence intervals to avoid the public confusion that occurs in certain situations, such as when multiple 100 year storm events occur over a period of five years. Table 2-1 shows the equivalents for the most commonly used storm recurrence intervals and AEPs.
Table 2-1: Recurrence Interval Compared to Annual Exceedance Probability

<table>
<thead>
<tr>
<th>Recurrence Interval (years)</th>
<th>Annual Exceedance Probability (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years</td>
<td>50%</td>
</tr>
<tr>
<td>5 years</td>
<td>20%</td>
</tr>
<tr>
<td>10 years</td>
<td>10%</td>
</tr>
<tr>
<td>25 years</td>
<td>4%</td>
</tr>
<tr>
<td>50 years</td>
<td>2%</td>
</tr>
<tr>
<td>100 years</td>
<td>1%</td>
</tr>
</tbody>
</table>

2.2.2 What is a Watershed?

A watershed is an area of land that drains to a single point, bounded by higher elevations at the edges. Within a watershed, water travels over land until it reaches a body of water, and as the water passes farther downstream, draining a larger area, pollutants can accumulate. Ultimately, the rivers and streams reach the ocean, and any accumulated pollutants are discharged into the ocean. In coastal areas, wetlands fringe the edge of the land, and many of the local streams and creeks enter wetlands before discharging to the ocean. Wetlands perform a crucial function in the watershed, intercepting pollutants carried downstream and removing them from the water in a natural treatment process. Additionally, wetlands slow the water down, allowing some of the runoff to infiltrate or be stored in the wetlands and slowly released long after the storm has passed. Figure 2-2 depicts how wetlands work.
2.2.3 Changes from Natural Conditions to Development

Land development is the process of converting natural landscapes, such as forests, swamps, and grasslands, to developed, urban, or residential areas. This process typically begins with site clearing, which is the removal of trees, shrubs, and other vegetation. The landscape is then graded using a combination of cut and fill of the existing soil surface to provide clear, level building sites. In place of the previously vegetated land, developed, impervious areas such as buildings, roads, and parking lots are constructed. By altering the landscape from a natural to a developed condition, the hydrology of the site is also changed. The natural drainage pathways that dominate the undisturbed stormwater system are replaced with a system of gutters, pipes, and channels designed to efficiently move water offsite.

Due to the continued increase in the stringency of stormwater management regulations, as outlined in Chapter 1, the inclusion of vegetated land and natural drainage pathways in site development designs has become more common. By including natural systems into their designs, developers can help offset the impact of urbanization on the stormwater system.

Figure 2-2: Diagram depicting role of wetlands in a watershed (Source: City of Charleston Redevelopment Standards for Stormwater).
2.2.4 Effects of Development

The development and redevelopment of urban and residential areas is necessary in the City as the economy and population continue to grow. Given that development will continue for the foreseeable future, the key is to consider the impacts that development will have on the landscape and receiving waterbodies. Chapter 3 through Chapter 8 of this document outlines the design, permitting, and construction standards that should be implemented to ensure that stormwater management is a major consideration in development going forward.

As outlined in Section 2.1.4, changing a landscape from a natural condition to a developed condition also alters the hydrology of the site. By compacting the soil, installing roads, and constructing buildings, the overall impervious area of a site is dramatically increased. The reduction in evapotranspiration and infiltration, increase in impervious area, and traditional stormwater management principle of moving stormwater runoff offsite as fast as possible often lead to increased stream flow downstream of a development. This increased stream flow offsite can be seen in the increased runoff volume, peak runoff discharges, and runoff velocities. The high runoff rates and decreased infiltration rates caused by development also lead to decreases in groundwater recharge rate, which reduces the base flow in streams.

Urbanization also leads to significant changes in the geometry of streams in a watershed. Traditionally, farmers and developers would straighten stream channels to reduce the area covered by a meandering stream channel and to increase the speed at which stormwater flows offsite. Additionally, the increase in runoff volume and velocity offsite increases the amount of channel forming bankfull and near bankfull events. Bankfull events are the flow condition where the highest stresses are applied to streambanks, causing streambank erosion and channel enlargement. Figure 2-3 shows a typical stream progression as a watershed is developed.

![Figure 2-3: Changes to a stream's geometry due to watershed development (Source: GA Stormwater Management Manual, 2016 Edition).](image-url)

The direct and indirect changes to the landscape following development have an impact on the aquatic habitats of these ecosystems. The increase in channel-forming bankfull events causes increased streambank erosion rates that undercut and uproot riparian vegetation. The streambed is scoured away as a result of more intense storm events that mobilize the native bed material downstream. In addition to the loss of valuable habitat along the streambank and bed, increased erosion causes higher sediment loads to downstream aquatic ecosystems. The
additional sediment load often accumulates in downstream stream reaches and wetlands, degrading their aquatic habitat value. In wetlands, the higher runoff rates and volumes resulting from development cause greater fluctuations in water levels. Water levels fluctuating from extreme high levels to extreme low levels can stress wetland ecosystems causing a decline in aquatic plants and wildlife. Stormwater runoff from developed areas also has a higher temperature than runoff from natural landscapes. Aquatic organisms are typically sensitive to water temperatures, so the addition of warmer water from runoff can have a harmful effect on habitat diversity.

Stormwater runoff due to development also increases the pollutant loads associated with runoff, degrading the water quality in aquatic resources. As stormwater runoff flows over developed areas, hydrocarbons from oil and gasoline, heavy metals, pesticides, and other pollutants are picked up and transported to receiving waters. Sediment contaminated by oil spills, pesticides, or construction operations also may discharge into receiving waters as a result of surface erosion from runoff. Green spaces (e.g., parks, recreational fields, gardens) in urbanized areas can be over fertilized or fertilized immediately prior to a rain event. The excess fertilizer is transported in stormwater runoff to bodies of water, increasing nutrient loads. The added nutrient load causes a rapid increase in the algal growth, which in turn increases nutrient competition for other organisms. In extreme cases, the increased algal growth can lead to algal blooms that can harm other plants, animals, and humans and lead to no oxygen being present in the water when the sun goes down.

The increased stormwater runoff rates caused by development may also result in property damage and public safety concerns. Surface erosion around building foundations, scour around roadways, and streambank loss due to erosion are potential sources of property damage and safety concerns due to the increased stormwater runoff in developed areas. Additionally, algal blooms caused by increased nutrient loads in waterways can cause human health hazards.

Surface runoff over roadways and parking lots often picks up and deposits loose trash and debris into rivers, ponds, and lakes. The discharge of trash into waterways and degradation of natural ecosystems contribute to a loss in the aesthetic value of the areas surrounding developments. The decline in wildlife abundance and diversity resulting from the loss and degradation of terrestrial and aquatic ecosystems also reduces the recreational value of these areas.

2.3 Introduction to Soils

Soils provide nutrients for plant growth, filtration of pollutants, and the storage or release of stormwater. The soil characteristics at a site should be considered when designing a development or redevelopment. Soil characteristics often dictate which practices are
necessary for the management of stormwater during and after construction. Site factors that impact stormwater drainage include soil texture, soil permeability, vegetation, topography, groundwater levels, and climate. Based on these soil characteristics, one of four hydrologic soil groups (HSGs) are used to classify the infiltration rates of different soil units: Group A, Group B, Group C, and Group D. Additionally, characteristics such as the pH and organic content of soil influence the type of vegetation that can thrive at a particular site. The growth of vegetation on a site can help to stabilize the soil, improve infiltration, and promote pollutant removal from stormwater.

Soils are generally made up of four main components: mineral elements; pore space, organic matter, and living organisms. Soil texture is determined by the concentration of the three sizes of mineral elements found in soil. From smallest to largest, these particles are clay, silt, and sand. Soils with a higher concentration of sand are considered coarse textured and tend to be well draining, have low nutrient content, and are highly erodible. A higher concentration of clay will result in fine-textured soils that have reduced air and water movement, tend to shrink and swell, and become slippery when saturated (Figure 2-4).

Soil permeability is the measure of the ability of fluids to pass through soil. Permeability is determined based on a combination of soil texture, structure, and density. Soils with very low permeability have dense, clayey mineral elements restricting the movement of air and water between pores. Highly permeable soils have loose, sandy minerals allowing fluids to easily
infiltrate into pore spaces. In terms of stormwater management, this characteristic is one of the main factors in determining how quickly an area will drain following a storm event. The ability, or in some cases inability, of water to infiltrate through soil may determine the design requirements for a development’s stormwater management.

While soil texture and permeability are important to site stormwater infiltration, many other site conditions and soil characteristics influence the overall drainage of a particular soil unit. To simplify the determination of soil infiltration rates, the NRCS classifies soils as one of four HSGs (Table 2-2). Group A is characterized by low runoff potential, high infiltration rates even when wetted, and large amounts of sand and gravel. Group B soils have moderate infiltration rates when wetted and are composed of fine to moderately coarse sand. Soils in Group C have low infiltration rates when wetted, have a layer that impedes the infiltration of water, and are composed of fine-textured soils. Group D soils have a high runoff potential, low infiltration rates, and consist of clay soils with a permanent high water table or shallow soils over nearly impervious material. The infiltration rates for all of these hydrologic soil groups are reduced when the soil is saturated due to large storm events.

<table>
<thead>
<tr>
<th>Soil Group</th>
<th>Description</th>
<th>Runoff Potential</th>
<th>Infiltration Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Deep sandy soils</td>
<td>Very low</td>
<td>High</td>
</tr>
<tr>
<td>B</td>
<td>Shallow sandy soils over low permeability layer</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>C</td>
<td>Sandy soil with high clay or mineral content</td>
<td>Medium to high</td>
<td>Low</td>
</tr>
<tr>
<td>D</td>
<td>Clayey soils</td>
<td>Very high</td>
<td>Low to none</td>
</tr>
</tbody>
</table>

The characteristics influencing the hydrologic soil groups are often site-specific; however, the addition of vegetation to a site design can stabilize the soil, improve infiltration, and promote pollutant removal from stormwater. Soil characteristics such as pH and organic content influence the ability for vegetation to grow in soil. Topsoil and compost can be added to the upper layer of the existing soil onsite to provide the nutrients and chemical composition for vegetation to establish.

2.4 Water Quality

The potential impacts to water quality should be considered when designing developments and redevelopments. Stormwater pollutants most often come from nonpoint sources, and are an
indirect impact of land development. As stormwater runoff washes over streets and parking lots, garbage, vehicle-related chemicals, pesticides, and other debris are picked up and discharged into ditches and receiving waterbodies. Common pollutants associated with land development are provided in Table 2-3 and include suspended solids, oxygen demanding matter and bacteria, and nutrients. High levels of these pollutants in stormwater runoff can lead to multiple issues for receiving waterbodies, including reduced dissolved oxygen (DO) levels; increased algal growth, which may lead to eutrophication; and habitat degradation.

Table 2-3: Typical stormwater pollutants and sources

<table>
<thead>
<tr>
<th>Pollutant Source</th>
<th>Pollutants of Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>Sediments and attached soil nutrients, organic matter, and other adsorbed pollutants.</td>
</tr>
<tr>
<td>Atmospheric Deposition</td>
<td>Hydrocarbons emitted from automobiles, dust, metals, nutrients, and other chemicals released from industrial and commercial activities.</td>
</tr>
<tr>
<td>Roadways/Transportation Related Areas</td>
<td>Hydrocarbons emitted from automobiles, dust, and metals.</td>
</tr>
<tr>
<td>Construction Sites</td>
<td>Sediment, metals, paint, and wood preservatives.</td>
</tr>
<tr>
<td>Manufactured Products (Industrial Land Uses)</td>
<td>Heavy metals, phenols, and oils from automobiles, and zinc and cadmium from tire wear.</td>
</tr>
<tr>
<td>Lawn and Landscape Maintenance</td>
<td>Fertilizer and pesticides.</td>
</tr>
<tr>
<td>Plants and Animals</td>
<td>Plant debris, grass clippings and animal excrement.</td>
</tr>
<tr>
<td>Septic Tanks</td>
<td>Coliform bacteria, nitrogen, and NO3.</td>
</tr>
<tr>
<td>Non-Stormwater Connections</td>
<td>Sanitary sewage, industrial wastewater, commercial discharge, swimming pool discharge, and water line flushing.</td>
</tr>
<tr>
<td>Accidental Spills</td>
<td>Pollutants of concern depend on the nature of the spill.</td>
</tr>
<tr>
<td>Animal Waste Management</td>
<td>Coliform bacteria, nitrates, and phosphorus.</td>
</tr>
<tr>
<td>Pesticide Applications</td>
<td>Pollutants of concern depend on the pesticide being used and the type of crop or pest being treated.</td>
</tr>
<tr>
<td>Agricultural Land Disturbance</td>
<td>Sediment and attached soil nutrients, organic matter, and other adsorbed pollutants.</td>
</tr>
<tr>
<td>Fertilizer Applications</td>
<td>Nitrogen and phosphorus.</td>
</tr>
</tbody>
</table>

2.4.1 Suspended Solids

The most prevalent form of stormwater pollution is the presence of suspended matter that is either eroded by stormwater or washed off paved surfaces by stormwater. Sediment is derived from a variety of sources, including erosion from disturbed areas and washoff of sediment deposited on impervious areas. Several models are available to predict total suspended solids (TSS) contributions from “clean” sediment, but few of the models have parameters specific to urbanized areas. Models that have capabilities that have been used for predicting urban clean sediment include SWMM, SEDPRO, SWAT, and SEDCAD models. For the models to be effectively utilized in sizing BMPs, predictions should be made of time varying quantities as well as the size distribution. Those distributions should be of the aggregated particles, not just the primary particles.

2.4.2 Oxygen Demanding Matter and Bacteria

Sufficient levels of DO in the water column are necessary to maintain aquatic life, growth, and reproductive activity, as well as to maintain aerobic conditions. The introduction of stormwater containing oxygen-demanding organic matter can impair the receiving water quality by reducing the DO levels, such that it is unable to sustain certain forms of aquatic life and can further cause the water to become foul.

Bacteria enters the stormwater drainage system typically from the washoff of animal feces and organic matter from the catchment’s surface, through leaking sewer systems (lateral connections, manholes, and industrial or commercial drains, etc.), and malfunctioning septic systems, all of which are termed illicit discharges and illegal by the City’s Stormwater Management Ordinance. Pathogenic bacteria and viruses in stormwater discharges pose human health threats. The removal of pathogenic bacteria is achieved primarily through the process of biological decay and physical-chemical disinfection where practiced. The reduction of bacteria in waters of the State has been the focus of TMDL efforts by SCHDEC to date.

2.4.3 Nutrients

Nitrogen and phosphorus are nutrients that promote the growth of plants and protista such as algae, and are the second leading stressor of impaired rivers and streams and the leading stressor of impaired lakes (USEPA 1997). Such nutrients contribute to the eutrophication of waterbodies, resulting in associated liabilities such as decreased oxygen supply, alteration of aquatic life, and decreased recreational value (Novotny 1985).

Nutrients are typically derived from agricultural runoff and runoff from chemicals applied to lawns in urbanized areas, runoff from industrial sites, municipal wastewaters (of more concern for combined sewer overflows), or dry fall onto impervious surfaces that is later washed into
stormwater. Nutrients can be removed from stormwater prior to discharge through biological uptake, such as by plantings in BMPs.

Models of nutrient loading in urban runoff are typically based on washoff type calculations or user-defined loadings and concentrations, all of which require user-defined constants. BMPs treat nutrient-rich runoff through settling (particulates), adsorption (to clay particles), uptake (by plants), and denitrification (nitrogen only).

### 2.4.4 Illicit Discharge Detection and Elimination

An illicit discharge is any discharge to the City’s stormwater system that is not composed entirely of stormwater. There are a variety of illicit discharge sources, including those depicted in Table 2-4. It is important for property owners to know and understand these sources so that they may help to reduce their impact on the pollutant load of the stormwater system.

**Table 2-4: Typical illicit discharge sources**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Source</th>
<th>Activity</th>
</tr>
</thead>
</table>
| Residential | • Apartments  
• Single Family Homes | • Car washing  
• Driveway cleaning  
• Chemical dumping/spills  
• Septic system maintenance  
• Landscaping  
• Swimming pool discharges |
| Commercial | • Car dealers  
• Car washes  
• Laundry facilities  
• Auto repair shops  
• Gas stations  
• Restaurants  
• Swimming pools | • Building maintenance (power washing)  
• Chemical dumping/spills  
• Landscaping  
• Outdoor material storage  
• Vehicle fueling  
• Vehicle washing  
• Washout of grease traps |
| Industrial | • Recycling centers  
• Distribution centers  
• Food processing  
• Construction vehicle washouts  
• Garbage truck washouts  
• Marinas  
• Chemical storage facilities | • Industrial process water or rinse water  
• Loading and unloading area washout  
• Outdoor material storage  
• Vehicle washing  
• Vehicle fueling  
• Building maintenance  
• Landscaping |
The City’s Small MS4 General Permit requires the implementation of a program to detect and eliminate illicit discharges. The City is responsible for field screening to identify potential illicit discharges and their source, and the subsequent enforcement and elimination of the illicit discharge source. This procedure is essential to the reduction in point source pollution in the City’s waterways.

2.5 Water Quantity

Often, the first consideration when designing a new development or redevelopment is water quantity. The addition of impervious surfaces and removal of vegetation when developing a previously natural landscape disrupts the hydrologic cycle and leads to increases in stormwater runoff peak flows and total runoff volume. Changes in water quantity can be readily visible to property owners when flood frequency, severity, and duration increase. In coastal areas, factors such as changing tides, low depths to the groundwater table, and a generally flat terrain can exacerbate the impact that development has on flooding (Figure 2-5).

![Figure 2-5: Stormwater Flow Changes Associated with Urbanization](source: U.S. EPA CADDIS Vol. 2)

There are five types of flooding that occur in the Charleston area. These five are discussed in the following sections.
2.5.1 Coastal and Tidal Flooding

In areas along the coastline, factors including high tide, storm surge, and tailwater contribute to the risk of coastal flooding. High tide flooding, also referred to as sunny day flooding or nuisance flooding, occurs during higher than average high tide conditions in low-lying areas along the coast. These higher than average high tide conditions are also called spring tides or king tides. High tide flooding may lead to more frequent road closures, overwhelmed storm drains, or deterioration of stormwater infrastructure. In some areas, land subsidence, or the sinking of land over time, has led to an increased frequency of high tide flooding. Another condition impacting coastal flooding is storm surge. Storm surge is the rising of coastal water levels as a result of strong winds and changing atmospheric pressure during hurricanes and tropical storms. Higher high tides and land subsidence can also lead to tailwater issues for stormwater drainage systems. Tailwater occurs when the water surface elevation of a receiving waterbody is higher than the discharge point of a stormwater system. When at this condition, there is not enough energy for the stormwater to be discharged out of the system, causing the stormwater system to become overloaded. Figure 2-6 depicts this type of flooding.

Figure 2-6: Coastal flooding causes and impacts.
2.5.2 Extreme Event (Flash) Flooding

Floods that develop within six hours of their immediate cause are considered to be extreme event floods. Extreme event floods are typically associated with mountainous regions where stormwater flows rush down mountainsides and overwhelm downstream communities. However, extreme event floods can occur in coastal areas under certain conditions, including intense rainfall during king tides; high-intensity rainfalls inland of a coastal community that drain toward the coast, leading to inundation of coastal river systems; and high-intensity rainfalls that occur in areas that are already partially inundated by previous storm events. Figure 2-7 depicts this type of flooding.

![Extreme Event Flooding Diagram](image)

Figure 2-7: Extreme event flood causes and impacts.

2.5.3 Fluvial (Riverine) Flooding

Another flooding risk experienced in coastal regions is fluvial flooding. This type of flooding occurs when water levels in stream channels rise and overtop the streambanks, causing water to flow into the floodplain. In natural landscapes, this process is an integral part of a stream ecosystem that reduces stress on the channel during high flows and helps add nutrients to the
stream that boost the aquatic habitat. In developed landscapes, riverine flooding can cause
damage to buildings, roadways, and other infrastructure that have been built too close to the
stream. The frequency of fluvial flooding is often increased in developed, coastal areas due to
multiple factors, including impervious area that increases stormwater runoff volume and
intensity; persistent, intense rain events; and debris or log jams causing blockages in the
stream channel. The National Weather Service (NWS) classifies fluvial floods as minor,
moderate, or major based on the projected water surface elevation and impacts along the river.
Minor floods occur in low-lying areas adjacent to streams found in rural areas and secondary
roads. Moderate flooding is characterized by water levels high enough to impact homes,
businesses, and larger roads. This level of flood event may require some evacuations for
residents in the impacted areas. Major floods cause extensive flooding that may flood major
traffic routes and isolate some neighborhoods. These events require evacuations of numerous
homes to protect citizens from injury.

2.5.4 Groundwater Flooding

In pervious landscapes, the higher intensity and duration of storm events along the coast can
cause groundwater recharge to occur faster than groundwater discharge. This leads to the
water table rising and saturating subsurface soil layers, resulting in groundwater flooding.
During this condition, previously permeable soil layers are no longer able to allow stormwater
to infiltrate, causing ponding along the soil surface. Error! Reference source not found. depicts this type of flooding.
2.5.5 Surface Flooding

A common misconception is that flooding can only occur near bodies of water. Surface flooding occurs when the excessive stormwater flows from intense or extended rain events causes the ground to become saturated. This type of flooding is observed as standing water in grassed and impervious areas resulting from stormwater flows that saturate the soil and overwhelm the stormwater drainage system. Surface flooding does not typically have a significant flood depth, but can cause property damage when combined with other sources of flooding. Figure 2-9 depicts this type of flooding.
2.6 Principles of Floodplain Management

Floodplain management is a community program of preventive and corrective measures implemented to reduce the risk of current and future flooding. The main goals of floodplain management are to promote the natural functions of the floodplain, where practical, and mitigate damages to structures in FEMA designated Special Flood Hazard Areas (SFHAs) from natural flooding events. Promoting the functions of the floodplain improves natural flood storage and erosion control, water quality maintenance, groundwater recharge, and biological productivity. In the City, these goals are achieved by promoting and managing multiple programs, including:

- FEMA requirements and recommendations
- National Flood Insurance Program (NFIP) requirements and recommendations
- Expanded participation in the Community Rating System (CRS)
- FIRM information
- Filing of elevation certificates for structures in the SFHA
2.7 Master Planning for Stormwater

Implementing stormwater considerations into a city master plan is integral to improving the effectiveness and longevity of a stormwater system. Stormwater master plans typically outline the characteristics of the watershed, define the existing stormwater system, and make recommendations on how to improve the stormwater infrastructure within the city. Key concepts to ensure a stormwater master plan’s success include:

- Adopting a long-term approach to planning. Communities can provide a plan for implementation that allows for the integration of selected projects within other community development plans, such as capital improvement.
- Managing stormwater close to where precipitation falls. Encourage features such as wetlands and riparian buffers to control stormwater runoff volumes and rates.
- Implementing innovative technologies, or green infrastructure, to site designs. This can generate benefits ranging from improved water quality to cost savings for community amenities.
- Use of requirements set forth by the CWA and the City’s Phase II MS4 Permit. Considering these requirements at the front end of the planning process helps to ensure that stormwater regulations are easily attainable long-term.

The City has developed multiple stormwater master plans including the 1984 Master Drainage Plan, the Dupont-Wappoo Watershed Master Plan, and the Church Creek Stormwater Master Plan. The 1984 Master Drainage Plan is intended to improve the stormwater drainage throughout the City municipal area. The Dupont-Wappoo and Church Creek Master Plans are specifically aimed at mitigating the stormwater drainage issues within the Dupont-Wappoo and Church Creek watersheds in West Ashley. Each master plan is broken up into phases to ensure their effective implementation. These sequential phases include:

- Assess the current conditions of the stormwater drainage system.
- Make recommendations for drainage improvements.
- Secure funds for the construction of recommended improvements.
- Design and construct recommended improvements.

2.8 Principles of Stormwater Management

At its core, the goal of stormwater management is to prevent flows associated with rain events from negatively impacting human health and safety. Traditional stormwater management was solely focused on controlling water quantity. Stormwater systems were composed mainly of pipes designed to convey runoff directly to downstream aquatic resources. Over time, the water quality impacts of stormwater have become a much greater consideration, which is reflected in the regulations, municipal codes, and permits that drive the stormwater
management of new developments and redevelopments. However, managing stormwater quality and quantity is the goal of stormwater management.

### 2.8.1 Introduction to Stormwater Management

Construction, development, and redevelopment have the potential to alter the natural drainage patterns, flow rates, and volumes of water in the environment. Construction, development, and redevelopment can directly or indirectly change the physical, chemical, and biological conditions of natural waterways. When land is developed or redeveloped, the natural hydrology of the watershed is disrupted and traditionally stormwater systems that have facilitated the efficient removal of not just runoff, but associated pollutants into receiving waters is impacted. Clearing land removes vegetation that intercepts and slows rainfall runoff. Grading removes the benefits of topsoil, compacts the subsoil, and fills in depressions that provide natural storage. As a result of land development and redevelopment, infiltration is decreased and rainfall that once seeped into the ground runs off the surface at an accelerated rate.

### 2.8.2 Innovative Design

In recent times, the innovative design of new developments has helped to address the impacts of stormwater quantity and quality. The goal of innovative design is to reduce runoff, reduce the amount of pollutants carried offsite by runoff, and capture and treat runoff onsite. The amount of pervious area onsite can be maximized by preserving the amount of open spaces and functional landscapes, which reduces the impact new development and redevelopment has on stormwater runoff. BMPs are used to enhance open spaces and capture and treat stormwater runoff onsite. Source control provides added pollutant reduction by preventing pollutants from ever being exposed to stormwater.

### 2.8.3 Site Planning

The first step in addressing stormwater management begins in the site planning and design stage of the construction, development, and redevelopment project. By implementing BMPs during the site planning process, the amount of runoff and pollutants generated from a site can be reduced by minimizing the amount of impervious area and utilizing natural onsite treatments. The minimizing of adverse stormwater runoff impacts by the use of BMPs and site planning should be a consideration for a design engineer.

The reduction of runoff volumes and stormwater pollutants decreases the total number and size of stormwater management controls that must be implemented under the guidelines set forth in this manual. BMPs reduce the amount of total post construction, post development, and post redevelopment impervious areas and maintain natural characteristics of the pre-construction and pre-development site conditions. Therefore, the post construction, post...
development, and post redevelopment curve number and time of concentrations are maintained more closely to the pre-construction and pre-development conditions. This reduces the overall hydrologic and hydraulic impact of the construction, development, and redevelopment.

2.8.3.1 Maintaining Site Resources and Natural Undisturbed Areas

Conservation of site resources and natural, undisturbed areas helps to reduce the post construction, post development, and redevelopment runoff volume and provides areas for natural stormwater management. Some natural site resources that should be maintained include, but are not limited to:

- Natural drainageways
- Vegetated buffer areas along natural waterways
- Floodplains
- Areas of undisturbed vegetation
- Low areas within the site terrain
- Natural forested infiltration areas
- Wetlands

2.8.3.2 Lower Impact Site Layout Techniques

Lower impact site layout techniques involve identifying and analyzing the location and configuration of structures on the site to be constructed, developed, or redeveloped (Figure 2-10). Where applicable, the following options that create lower impact layouts should be used:

- Fit the design layout to follow the natural contours of the site to minimize clearing and grading and preserve natural drainageways and patterns.
- Limit the amount of clearing and grading by identifying the smallest possible area on the site that would require land disturbance.
- Place construction activities, development, and redevelopment areas on the least sensitive areas of the site and avoid steep-sloped areas when possible.
- Utilize nontraditional designs to reduce the overall imperviousness of the site by providing more undisturbed open space and minimizing clear-cutting.
- Consider the utilization of cisterns and rain barrels to collect stormwater for reuse.
- Consider the use of energy dissipation devices, such as level spreaders, at discharge points. Such devices should also be considered for discharge points into ponds and other basin-type BMPs.
2.8.3.3 Minimization of Impervious Cover

The minimization of total impervious area directly relates to a reduction in stormwater runoff volume and the associated pollutants from a construction, development, and redevelopment site. The amount of impervious cover on a site can be reduced by the following techniques where applicable:

- Reduce building footprints by constructing some buildings as multi-story.
- Reduce parking lot areas and use porous/pervious pavement surfaces for overflow parking.
- Increase the amount of vegetated parking lot “islands” that can also be utilized for stormwater management practices such as bioretention areas.
- Disconnect impervious surfaces by directing runoff to adjacent pervious areas so that runoff can be filtered and infiltrated.

2.8.3.4 Utilization of Natural Features for Stormwater Management

Structural stormwater drainage controls are traditionally designed to remove stormwater runoff quickly from the site without utilizing any of the natural storage areas. These natural drainage areas should be considered as potential stormwater drainage systems. The natural areas can be utilized in the following ways where applicable:

- Vegetated buffers and undisturbed areas on the site are useful to control sheet flow (not concentrated flows) by providing infiltration, runoff velocity reduction, and pollutant removal.
- Natural drainageways should be maintained and not disturbed to provide a natural stormwater drainage system to carry runoff to an existing outlet. The use of natural drainageways allows for more storage of stormwater runoff, lower peak flow rates, reduction in erosive runoff velocities, and capture and treatment of pollutants.
- The use of vegetated swales instead of curb and gutter applications allows for more storage of stormwater runoff, lower peak flow rates, reduction in erosive runoff velocities, and capture and treatment of pollutants.
- Rooftop runoff should be directed to pervious natural areas for water quality treatment and infiltration instead of connecting rooftop drains to roadways and other structural stormwater conveyance systems.

### 2.8.3.5 Engineered/Proprietary Devices

The City is aware of the potential benefit in using a number of stormwater engineered devices currently available on the market, such as baffle boxes, cartridge filters, and sock and tube erosion control devices. The Department of Stormwater Management will evaluate any and all such devices specified for a given project and require drawings, specifications, and discussions as to the applicability of the product, expected performance, and required maintenance to be submitted. The Department of Stormwater Management reserves the right to require that certain devices be installed or certain devices be prevented from use.

### 2.9 Types of Development

Urban development is categorized as new development, redevelopment, or brownfield development. The design requirements for stormwater management in each category are different in order to ensure that negative impacts are minimized. In general, new development requirements are aimed at minimizing the amount of impervious area in the design, whereas redevelopment and brownfield development requirements are aimed at reducing the amount of impervious area on the existing site.

#### 2.9.1 New Development

New development includes land-disturbing activities, structural development, and the creation of impervious surfaces on previously undeveloped land. The transition from native landscapes to a developed condition reduces the infiltration, evapotranspiration, and surface roughness onsite, regardless of the amount of green space and BMPs implemented into the site design. This results in a significant increase in the site stormwater runoff volume and rate, which often impacts areas downstream of the development. The stormwater management portion of a new development's design is typically based on location-specific storm event probabilities of exceedance (e.g., 50 percent, 10 percent, 1 percent, etc.), soil characteristics, and water quantity and quality requirements.

#### 2.9.2 Redevelopment

Redevelopment includes land-disturbing activities, structural development, installation of impervious surfaces, and replacement of impervious surfaces on a previously developed site.
Activities such as exterior remodeling or routine maintenance are not typically considered to be redevelopment. The change in impervious area, and the associated stormwater impacts, for redevelopment activities are typically much less significant than for new development. The standards for redevelopment design are typically based on the reduction of stormwater runoff rate, runoff volume, amount of impervious area, and pollutant load. In some cases, there may be exceptions to the need for reduction of these factors if the initial developed condition was within the required standards.

2.9.3 Brownfields

There is a unique opportunity to mitigate pollutants during the redevelopment of brownfields. EPA defines brownfields as a property in which expansion, redevelopment, or reuse may be complicated by the presence or potential presence of hazardous substances, pollutants, or other contamination. In preparing these landscapes for redevelopment, the contaminated soils are often capped to prevent their exposure to stormwater runoff generated onsite, which created additional impervious area. Challenges associated with the management of stormwater on brownfield sites include:

- Capping contaminated soils while mitigating the negative impact the impervious surfaces have on downstream waterways
- Implementing practices designed to increase infiltration may inadvertently mobilize pollutant loads in the soil and discharge them into groundwater and nearby surface water
- Installing green infrastructure practices that can retain, treat, and release stormwater without coming in contact with contaminated soils
- Considering how the location of the site within the watershed may impact areas downstream and groundwater

2.10 Introduction to Permanent Best Management Practices

BMPs are practices that are implemented in the design of developments to prevent or reduce the pollutant load carried offsite by stormwater runoff. Typically, multiple BMPs are implemented at a site to meet pollutant and runoff discharge requirements. Permanent BMPs can be placed into two main categories, structural and nonstructural. Structural BMPs are features that must be constructed in order to mitigate the runoff rate, runoff volume, and pollutant load offsite. These structures are designed to capture and treat stormwater runoff onsite, and include practices such as rain gardens, filter strips, pervious pavement, extended detention ponds, and wetlands. Nonstructural BMPs focus on source reduction to reduce the amount of stormwater runoff and pollution generated onsite. Implementing features into site design such as minimizing the total disturbed area, protecting existing wetlands and natural flow pathways, and directing rooftop runoff to vegetated areas can help to reduce the stormwater runoff generated by a development. Nonstructural BMPs can also be behavioral.
practices that reduce pollutant loads at the source, such as routinely sweeping streets and sidewalks to keep impervious surfaces clean, encouraging homeowners to clean up pet waste, and handling and storage of chemicals.

2.11 Sea Level Rise

Over the past 100 years, the sea level in the City has risen slightly more than 1 foot. Climate experts have projected that sea levels will continue to rise at an increasing rate over the next 100 years. Being a coastal city with elevations near sea level, the City already experiences tidal flooding of some streets during spring tides and due to storm surge. In the 1970s, the City experienced tidal flooding an average of 2 times per year, while in the 2010s, tidal flooding has been experienced an average of 11 times per year (Figure 2-11).

![Figure 2-11: Tidal flood events (Source: City of Charleston Sea Level Rise Strategy).](image)

To begin planning for continued sea level rise, the City released the Sea Level Rise Strategy in December 2015, which provides a framework to improve the City’s resilience to sea level rise. The three essential aspects of the Sea Level Rise Strategy are to reinvest, respond, and be ready. The first portion of the framework, reinvest, involves the additional investment in infrastructure to provide long-term improvements to public health, safety, and quality of life.
The Sea Level Rise Strategy also acknowledges that it is impossible to plan for all possible events, but the key is to be able to adapt to unexpected situations. An improved response to, communication during, and management of flooding helps to minimize service disruptions and ensure public safety and quality of life. The final portion of the framework is to be ready for future sea level rise. This involves continued planning, monitoring, and identification of changing vulnerabilities and risks to enable preparedness.
Chapter 3 Design Requirements

3.1 Introduction

This chapter provides engineers, designers, developers, and others with the information needed to develop adequate stormwater management approaches and systems that will manage the stormwater rate, volume, and pollutants released from new development and redevelopment projects. These design requirements have been developed based on common engineering practices and references to State and Federal requirements, engineering publications, and other municipal and academic guidance.

A goal of this chapter is to provide a minimum set of design standards that will result in effective stormwater management to mitigate the impact of land development on existing/natural hydrologic and hydraulic processes, as well as attempt to prevent further degradation of the water resources in the City through proper planning, design, installation, and maintenance. All land shall be developed in a manner consistent with City Ordinances and the SWDSM. Specific methods and applications not covered in the SWDSM can and should be discussed with the Department of Stormwater Management for applicability. The following sections detail the criteria that shall be followed in the absence of specific watershed master plan criteria.

3.2 Determination of Construction Activity

A party wanting to construct, develop, or redevelop in the City limits is subject to the Stormwater Design Standards requirements as determined by the application type. The application types determine the construction activity and design parameters. Specifics can be found in Section Error! Reference source not found..

3.3 Design Approach

Proper planning is necessary to ensure that stormwater management is considered and fully integrated at the various stages of construction, development, and redevelopment. This involves a comprehensive approach to site planning and a thorough understanding of the physical characteristics and resources associated with the project site. This planning includes addressing each of the following categories:

- Stormwater quantity controls
- Erosion prevention and sediment controls
- Stormwater quality controls
- Stormwater conveyance controls
- Maintenance schedules for temporary and permanent stormwater BMPs
The design of successful stormwater management plans involves adhering to the following principles, where applicable:

- Pre-submittal site meeting/site visit
- Review of site development requirements
- Detailed site analysis and supporting calculations
- Creation of a Stormwater Concept Plan
- Design aspects of the stormwater management plans
- Completion and approval of the construction activity application

When designing for land disturbing activities, the design should address the following three categories of control: (1) water quantity (flood control), (2) erosion prevention and sediment control (EPSC), and (3) pollution control (permanent water quality standards). If an innovative stormwater design approach is to be used, the design engineer shall take the following considerations in mind, in addition to meeting the above listed three categories of control:

- Stormwater quantity and quality are best controlled at the source of the problem by reducing the potential maximum volume of runoff and pollutants. Source control will typically be more economical in order to treat the first flush of a storm event.
- Implement stormwater management by using simple structural and non-structural methods.
- Equaling or exceeding traditional stormwater management designs in terms of performance (rate/volume attenuation, pollutant removal) and economic feasibility (long-term) are essential to a proposed concept’s eventual approval.

Innovative approaches to site design often focus on source control for stormwater runoff that limit the amount of runoff generated and incorporate permanent BMPs throughout the site. These types of design concepts are described in detail in several sources, including Georgia Stormwater Management Manual, Volume 1: Policy Guidebook (ARC 2016); Low Impact Development in Coastal South Carolina: A Planning and Design Guide (Ellis et al. 2014); and Green Infrastructure Design Manual – Green Management Practices and Design Strategies to Manage Stormwater in Our Community Chapter 18 (Louisville and Jefferson County MSD 2011).

General requirements for all stormwater systems and facilities shall include, but may not be limited to, the following:

- Site designs shall minimize the generation of stormwater and maximize pervious areas by:
  - Selecting portions of the site where the drainage pattern, topography, and soils are favorable for the intended use.
  - Exposing the smallest practical area of land for the least possible time during construction, development, and redevelopment. This includes maintaining or creating buffers and preserving natural areas.
  - Limiting the drainage area to all BMPs and installing BMPs as soon as practical in the development process.
o Retaining and protecting natural vegetation and saving topsoil for replacement on graded areas.

o Using temporary plant cover, mulching, hydroseeding, or BMPs to control runoff and protect areas subject to erosion during and after construction.

o Maintaining pre-development infiltration rates through soil amendments/treatments.

- One of the goals of the City’s stormwater program is to comply with the water quality requirements in the Phase II MS4 permit, which requires 80 percent TSS removal in the stormwater runoff by using permanent structural BMPs. The following four tiers are considered by the City to be equivalent and comply with the MS4 permit, though the water quality volumes for each differ. The permittee must choose which tier, or combination of tiers in the case of multiple subwatersheds, they will implement on their project. The four tiers are as follows:

  o Green Infrastructure
  o Green Infrastructure with an Underdrain
  o Detention Practices
  o Pass-through Devices that provide the requisite water quality treatment through physical/mechanical, chemical, or biological processes

3.4 Stormwater Hydrology and Routing

This section discusses the hydrologic criteria that a designer should use when designing stormwater infrastructure on their projects. In addition, this section presents stormwater collection and conveyance design criteria and design criteria for roadway drainage.

3.4.1 Introduction to Hydrologic Requirements

Hydrologic computations shall be completed using volume/peak/duration-based hydrograph methods acceptable to the Department of Stormwater Management. The design storm duration for these computations shall be the 24-hour storm event based on a Soil Conservation Service (SCS) Type III distribution with a 0.1-hour duration time increment and a 484 peaking factor. Typical hydrologic inputs include, but are not limited to, the following:

- Rainfall depth or intensity
- NRCS soil classification and hydrologic soil group
- Land use
- Time of concentration
- Initial abstraction (surface storage and/or vegetative capture).

The remainder of this section provides basic information for the hydrologic calculations. The intent of the SWDSM is not to provide detail on every aspect of hydrologic computations, their limitations, assumptions, or appropriateness of use, but rather to present general guidance on commonly accepted standards.
3.4.2 Rainfall and Design Storms

The 24-hour duration precipitation depths corresponding to various probabilities for exceedance in any given year are shown in Table 3-1 and are to be used for projects within the City. These values contain a 10 percent safety factor to account for uncertainties in the design process and the increasing intensities of storms.

Table 3-1. Design storm precipitation (inches) data for Charleston, South Carolina

<table>
<thead>
<tr>
<th>Probability Exceedance</th>
<th>100%</th>
<th>50%</th>
<th>20%</th>
<th>10%</th>
<th>4%</th>
<th>2%</th>
<th>1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return Frequency (Year)</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>25</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Precipitation</td>
<td>3.8</td>
<td>4.6</td>
<td>6.1</td>
<td>7.2</td>
<td>8.7</td>
<td>9.9</td>
<td>11.3</td>
</tr>
</tbody>
</table>

3.4.3 Reservoir Routing

Controls shall be designed by a traditional reservoir routing procedure.

3.4.4 Recommended Methods and Design Procedures

The City recommended methods and corresponding design circumstances are listed in Table 3-2 and Table 3-3. If other methods are used, approval shall first be obtained from the Department of Stormwater Management. Complete source documentation shall be submitted for review.

Table 3-2. Recommended methodologies based on land disturbance area

<table>
<thead>
<tr>
<th>Method</th>
<th>Size Limitations&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Modified) Rational Method</td>
<td>0 – 2 acres</td>
<td>Acceptable for sizing individual culverts or storm drains that are not part of a pipe network or system. Not to be used for storage design.</td>
</tr>
<tr>
<td>SCS Method (TR-55)</td>
<td>0 – 2,000 acres</td>
<td>Used for estimating peak flows from urban areas.</td>
</tr>
</tbody>
</table>

<sup>a</sup>Size limitations refer to the subwatershed size to the point where a stormwater system component (i.e., culvert, inlet, BMP) is located.

Table 3-3. Recommended hydrologic methods for designing various stormwater management systems and controls

<table>
<thead>
<tr>
<th>Method</th>
<th>Rational Method</th>
<th>SCS Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Watersheds</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Storage/Sedimentation Facilities</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Outlet Structures</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Gutter Flow and Inlets</td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

### 3.4.5 Time of Concentration

Methods for calculating the time of concentration and abstraction are numerous. However, the most common method to calculate time of concentration for surface flow is using the TR-55 methodology. Surface runoff initially flows through a watershed as sheet flow for the first 100 feet after which it starts to concentrate and flow as shallow concentrated flow for the next 1,200 feet. Any flow beyond that is referred to as open channel/pipe flow. The type of surface flow that occurs in a watershed is a function of surface cover. The maximum sheet flow length recommended in the TR-55 publication was 300 feet; however, recent studies and publications (Merkel (2001), McCuen and Spiess (1995), Engman (1983, 1986), Welle and Woodward (1986), Ree et al. (1977), Emmett (1970), Ree (1963), and Parson (1949)) recommend a maximum flow length of 100 feet for sheet flow. Therefore, a maximum sheet flow length of 100 feet shall be used for sheet flow travel time calculations. The shallow concentrated flow length is divided by the average velocity determined to get the travel time for shallow concentrated flow. In most urban watersheds, it is suggested to use a maximum shallow concentrated length of 1,200 feet. For open channel/pipe flow travel time, the flow velocity is calculated based on the physical parameters of the conveyance such as dimensions of the pipe or channel, roughness coefficient, bottom slope, and hydraulic radius.

A minimum time of concentration of 6 minutes shall be used for all hydrologic calculations. See references given above for the suggested methodologies for information on these calculations.

Hydrographs shall be used to evaluate entire systems by routing storm events through pipe or storage systems. The use of a hydrograph will provide better insight into system performance than simply using the peak discharge. The City will accept commonly used computer models. Other models may be accepted with appropriate documentation.
3.4.6 Collection and Conveyance Requirements

This section provides the design requirements for various stormwater drainage and collection system components, including design storms, velocities, and pipe and inlet sizes. Storm drainage systems shall include all storm drainage structures and pipes that convey runoff under roadways. The standards in the following sections are required for all publicly maintained drainage systems and are recommended for privately maintained systems.

3.4.6.1 Storm Drain Pipes

1. Storm drainage lines shall be staked at each box and at intervals that would be sufficient to check alignment and grade of the construction with the approved plans. The use of lasers to augment control is encouraged.

2. The minimum size storm drainage pipe allowable in the right-of-way shall be 15 inches in nominal inner diameter. The minimum size pipe allowable outside the right-of-way shall be 12 inches in diameter.

3. The minimum slope for storm drainage pipe shall be three tenths of 1 percent [0.003 ft/ft] where possible. The minimum flow velocity shall be 3 fps for pipes flowing full or half full. Often the controlling factor is velocity rather than grade. Pipes that have the purpose of equalization between two or more ponds do not have to meet this requirement. Maximum allowable flow velocity shall be 10 fps under any flow condition.

4. Drainage system installation shall be such that stormwater discharge is not concentrated on adjacent property and that the velocity is less than erosive limits for the site soils. At pipe outfalls, this normally requires the use of a riprap apron placed on filter fabric and lightly grouted, turf reinforcement mats, or articulating concrete mat for a minimum distance equal to or greater than six pipe diameters. To use an alternative measure, the design engineer shall submit substantial supporting documentation that the proposed measure shall perform at least equivalent to the currently approved erosion prevention measures approved and contained in this SWDSM.

5. Submerged conveyances shall require a variance due to the significant nature of maintenance on such conveyances. However, conduits used for equalization, such as between ponds, may be submerged if isolator boxes are installed at both ends of the conduit to facilitate draining for maintenance purposes. If the distance of the conduit exceeds 200 feet, additional isolator boxes shall be installed such that the maximum distance between isolator boxes shall be 200 feet. For submerged conveyances, the variance request shall address pretreatment for sediment, demonstrate construction methodology to replace system (including dewatering and excavation without the need for shoring), and provide for a methodology for cleaning of the submerged pipes such as isolator boxes.

6. Type and class of storm drainage pipe and the installation of pipes shall be in accordance with Sections 714 (Permanent Pipe Culverts) and 715 (Temporary Pipe and Pipe Arch) of the latest South Carolina Department of Transportation (SCDOT) specifications. The use of any storm drain pipe other than reinforced concrete pipe (RCP) shall require approval in writing by the Department of Stormwater Management.

7. All pipes and boxes (catch basins, drop inlets, manholes, junction boxes, etc.) shall have stone bedding made of 4 inches and 6 inches, respectively, of #57 stone. Backfill shall consist of suitable material and compaction requirements per the latest SCDOT specifications.
8. A minimum of 1 foot of cover shall be provided for storm drainage pipes unless otherwise specified. RCP Class IV or V pipe may be requested by the Department of Stormwater Management in special conditions (deep installation, excessive surface loads, etc.).

9. Storm drainage pipe shall be placed to minimize the length running under pavement. Where it is necessary for pipe to cross the roadway, it preferably shall be placed at a 90-degree angle and in no case at less than 45 degrees. All cross lines in the roadway shall have backfill compacted in 6-inch lifts to 95 percent Standard Proctor maximum density and to 98 percent Standard Proctor on the last 6 inches.

10. Any "open" storm drainage cross line pipe shall extend beyond the toe of the roadway embankment. In no case shall the end of the pipe be within the 5-foot roadway shoulder.

11. Storm drainage pipe discharging into a drainage channel shall intersect the channel in a manner such that the interior angle measured from their centerlines of flow is less than or at most equal to 90 degrees. Riprap (grouted), articulating concrete matting, or other suitable protection is required from the top of the pipe at the outlet point to the bottom of the channel and on the opposite channel bank to prevent scour and erosion. Pipe must be cut at outfall to be flush with the bank of the intersecting channel.

12. Storm drainage pipe shall have the discharge invert above the permanent pool elevation for wet ponds, wetlands, and lakes or 2 feet above mean higher high water (MHHW), when the receiving waterbody is tidally influenced. Riprap (grouted), concrete matting, or other energy dissipation structures shall be placed from the bottom of the outlet to 2 feet below the normal permanent pool level when discharging into a wet pond or lake.

13. Any connections to existing brick arch drainage systems shall be coordinated with the Department of Stormwater Management during initial planning stages. Failure to communicate early in the design process will delay processing.

14. A maintenance access point shall be available at a minimum within every 200 feet for closed conduit conveyance structures (e.g., pipes). Junction boxes with manholes shall be placed at all pipe intersections, grade changes, alignment changes, and pipe size or geometry changes.

15. The 1 percent probability of exceedance, 24-hour storm event shall be used to check all drainage designs for local flooding and possible flood hazards at adjacent structures or property.

16. Hydraulic grade line and head loss calculations for determining water surface elevations shall be performed for all system connections.

17. Calculations shall be performed for the appropriate design storm event.

18. For storm drainage systems with less than five connections, Manning’s Equation shall be acceptable for sizing the capacity of drain pipes for non-submerged conditions where the free water surface elevation is below the crown of the pipes. The Saint-Venant equations (full dynamic wave), which are used in many common engineering programs, should be employed in larger design situations.

19. Storm drain profile plots shall be included in the set of construction plans and shall show the hydraulic grade line for the required design storm.

20. Storm drainage systems shall be designed to convey stormwater runoff by gravity flow unless otherwise approved.
21. It shall be unlawful for any person to uncover any component of the public stormwater system or connection branches thereof, for any purpose or to make connection therewith, unless and except with the approval and inspection of the Department of Stormwater Management.

22. No person shall lay pipe or conduit for any purpose whatsoever in any street within 5 feet on either side of the public stormwater system in such street.

23. In opening trenches in any street or public way, the paving or ballast shall be removed in a manner directed by the Department of Stormwater Management. The sides of the trench shall be sheeted or braced in accordance with current Occupational Safety and Health Administration standards. The earth thrown from the trench shall be placed so as not to obstruct the gutters and so as to cause the least obstruction to public travel. Gas and water pipes shall be protected from injury, the trench enclosed and lighted at night, and every precaution taken to prevent injury to person or property during the progress of the work.

24. Notice shall be left at the Engineering Division of the Department of Public Service two working days prior to the beginning of any work laying a storm drain. No material shall be used or work covered until inspected and approved by the Engineering Division.

25. The area upstream of and outside a project area (i.e., offsite areas) that drains to a particular design point (on or downstream from the project area) shall be included in determining the appropriate conveyance size. Hydrological computations shall be based on the contributing watershed, not just the project area or disturbed area.

3.4.6.2 Culverts

1. Culvert design shall include all cross drains that transport stormwater runoff under roadways. Culvert selection techniques can range from using empirical formulas, nomographs and charts; or comprehensive mathematical analysis for specific hydraulic conditions. The models used for these calculations are listed below in item 8. Other widely accepted models may be used, but shall be approved by the Department of Stormwater Management. Designs shall be based on SCDOT requirements.

2. Proper consideration of inlet and outlet control shall be given in the design of culverts and outlets.

3. The pipe, appurtenant entrance, and outlet structure shall properly account for water, bed-load, sedimentation, and floating debris at all stages of flow.

4. The outlet shall be designed to prevent undermining and washout.

5. A 25 percent factor of safety in flow area shall be used for culvert design to account for debris and clogging. If grating is proposed, then a 50 percent factor of safety shall be used for culvert flow area calculations.

6. The 20 percent, 10 percent, 4 percent, and 1 percent probability of exceedance, 24-hour storm event hydraulic grade lines shall be shown on all profile sheets.

7. Additional hydraulic capacity shall be required as necessary to prevent backwater effects that may adversely impact upstream property or structures.

8. Acceptable models for designing culverts include, but are not limited to:

- **ICPR**
- **HY8**
9. A complete study of culverts and design considerations is provided in USDOT (2001a).

3.4.6.3 Headwalls and Outlets

1. All exposed ends of pipes shall be protected by a flared end section (limited to pipes 36 inches or less in diameter) or one of the following type headwalls:
   a. A headwall constructed of concrete or brick plastered with non-shrink grout is preferred; it is required on culverts located in major defined drainage channels.
   b. A riprap headwall is acceptable for pipes 24 inches or less in a number of situations. Note that this technique requires the use of both filter fabric and grout.

2. Storm drainage or pond outfalls shall be carried to an existing drainage system structure or facility such as a pipe, ditch, etc.

3. No new point discharge onto adjacent property where there was not an existing point discharge shall be allowed without the adjacent property owner's written consent. Discharge points created by construction, development, and redevelopment shall connect to an existing drainage system, whether natural or man-made. The new outlet shall not cause flooding or in any way degrade the existing stormwater drainage system and proof of such shall be provided. In some cases, conveyances shall be constructed from the project to a point of discharge into the existing stormwater drainage system and this shall be done at the owner's expense. In these cases, the owner shall be responsible for obtaining necessary easements and agreements to construct such. If downstream engineered conveyances are damaged, the owner shall work with the City to get the damage repaired.

4. The inverts of pipes and channels discharging to receiving waters shall not be less than 6.5 feet NGVD29 or 2 feet above MHHW (referenced to NGVD), whichever is greater. Any outlet below 5.0' NGVD or not more than 0.5 feet above MHHW, whichever is greater, shall incorporate measures to prevent sedimentation and the need for frequent maintenance.

5. Outlets shall not discharge on fill slopes.

3.4.6.4 Energy Dissipation Structures

1. All outlets shall be sufficiently stabilized. Calculations shall be provided justifying the design and material used (e.g., riprap aprons, geometry, and diameter).

2. If riprap aprons are used, filter fabric shall be installed beneath all riprap and grout shall be used to hold the riprap in place.

3. Level spreaders, plunge pools, etc., shall be properly designed and installed at the proposed outlet(s).
3.4.6.5 Catch Basins, Inlets, Manholes, and Junction Boxes

1. Materials and construction shall be as specified in Section 719 (Catch Basins, Drop Inlets, Manholes, Junction Boxes, and Spring Boxes) of the latest SCDOT specifications.

2. Side inlet catch basins or junction boxes with concrete covers shall have a metal ring and manhole lid cast within the top for easy access. Manhole lids and catch basins shall contain a label identifying the system as stormwater and marked with an appropriate stormwater awareness message such as ‘No Dumping – Drains to Waterways.’ Contact the Department of Stormwater Management for more information.

3. When the depth of a catch basin or junction box exceeds 4 feet, rungs or steps shall be provided for ascent and descent. Steps shall be American Society for Testing and Materials (ASTM) C478 or equivalent.

4. The box top shall be a minimum of 3 feet by 3 feet. Sides shall be plastered with non-shrink grout.

5. Pipes entering or leaving a catch basin or junction box shall not protrude more than 6 inches into the box.

6. Roadway catch basins shall comply with the latest SCDOT standard specifications and details.

7. Maximum roadway catch basin inlet capacity for an inlet shall be determined based on the following:
   a. For inlets at sags, capacity shall be based on either weir flow (unsubmerged) or orifice flow (submerged). The depth of flow shall be limited to the curb depth, but may be further limited by the allowed spread. In sag conditions, a 15 percent factor of safety shall be used to account for debris and clogging if an open throat inlet is proposed. A 50 percent factor shall be used if a grate is proposed.
   b. For inlets on grades, theoretical capacity shall consider in the design the longitudinal and cross slopes, and gutter depression. The length of the gutter opening shall be such that the gutter efficiency is 80 percent of the theoretical capacity. Maximum flow depth shall be limited to the depth of curb.

8. SCDOT Type 9 inlets shall be designed to accommodate a given flow based on road type and so as not to cause flooding on adjacent property.

9. It is desirable to locate catch basins outside curve radii. If this is not reasonably possible, the catch basin shall be set back an extra 1 foot and the face of the catch basin shall be parallel to a chord joining the two points on the curve radius located by projecting lines from the sides of the catch basin box.

10. Junction boxes and catch basins shall contain a minimum drop of 0.1 feet from invert in to invert out.

11. Waffle and knockout boxes are prohibited. Boxes with pre-cast openings shall be used.

12. Inlet catch basins shall have a 1-foot sump at the bottom to contain sediment and debris.

13. Within a catch basin, inlet, manhole, or junction box, the elevation at the crown of any inlet pipe shall be equal to or greater than the crown of the outlet pipe. Where crowns do not match, the engineer must demonstrate that the unmatched crowns do not adversely affect the capacity or functionality of the system.
14. Catch basins shall be field staked to ensure proper catch basin inlet alignment with the street gutter line.

15. Rubber gaskets and resilient flexible type connections conforming to ASTM C923 shall be used for all pipe-to-box connections, including road subgrade connections. Pipes shall enter perpendicularly to the face of the box. Pipe may extend into the box such that it breaks the plane of the inside wall, but by no more than 6 inches. If pipes must enter structure at an angle, circular junctions shall be used. Use of an approved alternative detail will be allowed for non-perpendicular pipe connections where circular boxes cannot be used.

16. Subgrade drains connected to catch basins, manholes, or junction boxes shall be required for the length of all roads unless a geotechnical report shows less is necessary.

17. All stormwater structures under this heading shall be backfilled in 6 inch lifts compacted to 95 percent Standard Proctor maximum density.

18. Inlet protection shall be provided at all inlets into the stormwater system during the construction of the project until the closure procedures have been completed or notification from the Department of Stormwater Management has been given stating that an acceptable level of stabilization has been achieved. Guidance on design, installation, and maintenance of inlet protection can be found in the latest SCDOT specification.

19. Inlet spacing shall be based partly on the maximum spread of water into the travel lane. Allowable gutter spread is limited to one-half of the travel lane for the appropriate design storm listed in SCDOT Requirements for Hydraulic Design Studies (2009). Inlet spacing for alleys shall be based on a 50 percent probability of exceedance storm event, limited to one-half of the travel lane.

20. Inlets upgrade of a road intersection, sag inlets, or the last inlet for a given system shall be designed with sufficient capacity to handle the entire flow, such that there is no flow through or bypass. Spread calculations shall be provided for review by the Engineering Division of the Department of Public Service.

21. Maximum depth in which the water may pond above or around an inlet shall not threaten surrounding permanent structures or facilities including vehicular or pedestrian traffic.

22. Design procedures for inlet and stormwater facility design may be referenced in AASHTO (1999), USDOT (2001c), Mays (2001), and Yen (2001). Culvert design guidance is found in USDOT (2001a).

3.4.6.6 Underdrain Piping

Underdrain piping may be PVC or PE in accordance with Section 802 (Pipe Underdrains) of the latest SCDOT specifications.

3.4.6.7 Emergency Spillways

All ponds shall have an emergency spillway designed to convey the peak flow associated with the 1 percent probability of exceedance, 24-hour storm event if the storage capacity is exceeded. All emergency spillways shall be armored to resist erosive flows. For a system of ponds, the downstream-most pond shall have an emergency spillway able to pass the 1 percent probability of exceedance storm event.
3.4.6.8 Open Channels

1. Open channels shall include all permanent storm drainage channels including swales, ditches, some culverts, and diversions. These stormwater drainage systems shall be designed based upon the following criteria:

2. Open channels shall fully contain all stormwater from the 1 percent probability of exceedance, 24 hour storm event with no overtopping of the bank along the channel’s entire length.

3. The design of open channels shall be based on Manning’s Formula where backwater effects from obstructions and/or tailwater is not present.

4. The minimum channel grade shall be 0.01 ft/ft and shall be designed to accommodate flows resulting from the appropriate design frequency storm.

5. Design conditions can be assumed to be steady, uniform flow.

6. Channels may be designed with multiple stage levels with a low flow section to carry the 50 percent probability of exceedance, 24-hour storm event and a high flow section to carry storms of larger frequencies up to the 1 percent probability of exceedance, 24-hour storm event.

7. The City allows vegetated channels. Guidance on the design of these types of channels can be found in the *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014).

8. Additional hydraulic capacity shall be required as necessary to prevent backwater effects that may adversely impact upstream properties or structures.

9. The side slopes of grassed lined channels without erosion control blankets or turf reinforcement matting shall be no steeper than 3H:1V.

10. Open channels shall be uniform and shall be stabilized to prevent erosion in a manner approved by the Engineering Division of the Department of Public Service. Acceptable techniques are shown in SCDHEC (2005).

11. Permissible velocities for channels shall be established and not exceeded during the design storm(s) used to size the conveyance. In the case of an existing conveyance, permissible velocities shall not be exceeded during the design storm(s) used to size the outlet. See Table 3-4 for vegetated channels. For bare soils, permissible velocities will depend on the nature of the soil (cohesiveness and void ratio) and runoff (sediment concentration). Mays (2001) provides graphs to select the permissible velocity. For typical soils in the City, the maximum permissible velocity is less than 3.5 fps. For well vegetated channels, velocity shall be 5 fps or less.

### Table 3-4. Maximum permissible velocities for channels

<table>
<thead>
<tr>
<th>Cover</th>
<th>Permissible Velocity (fps)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Erosion Resistant Soils</td>
</tr>
<tr>
<td></td>
<td>% Slope</td>
</tr>
<tr>
<td>Bermuda Grass</td>
<td></td>
</tr>
<tr>
<td>Buffalo Grass</td>
<td></td>
</tr>
<tr>
<td>Cover</td>
<td>Permissible Velocity (fps)¹</td>
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<tr>
<td>------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td></td>
<td>Erosion Resistant Soils</td>
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<tr>
<td></td>
<td>% Slope</td>
</tr>
<tr>
<td></td>
<td>0-5</td>
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<tr>
<td>Blue Gamma</td>
<td>7</td>
</tr>
<tr>
<td>Centipede Grass</td>
<td>7</td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td>7</td>
</tr>
<tr>
<td>Grass-legume Mixture</td>
<td>5</td>
</tr>
<tr>
<td>Lespedeza Sericea</td>
<td>3.5</td>
</tr>
<tr>
<td>Temporary Vegetation</td>
<td>3.5</td>
</tr>
</tbody>
</table>


¹ NR = Not Recommended

Allow velocities over 5 fps only where good cover and maintenance will be provided. If poor vegetation exists due to shade, climate, soils or other factors, the permissible velocity shall be reduced by 50 percent.

12. Acceptable models for designing open channels include, but are not limited to:
   - ICPR
   - HY8
   - Pond Pack
   - HEC-RAS
   - Flow Master
   - SWMM Extran
   - InfoWorks ICM

3.4.7 Roadway Drainage Design

This section provides additional design requirements for stormwater drainage on roadways.

- Roadside channels shall meet the definition of a swale.
- For the purposes of road passage and hydraulic design, the capacity of a system to transport stormwater runoff shall be based on the criteria provided in Section 3.4.6.
- The minimum street center line elevation at finish grade shall be 8.5 feet above mean sea level in NGVD29 unless a model demonstrates site-specific consideration is acceptable. However, the street center line elevation shall be no less than 6.5 feet NGVD29.

3.5 Redevelopment Requirements

According to the definition the City of Charleston Ordinance, redevelopment pertains to development on a previously developed site where the impervious surface exceeds 20 percent of
the total site and improvements to subject property exceed 50 percent of the total site value.
Redevelopment excludes ordinary maintenance activities, remodeling of existing building interiors, resurfacing of paved areas, exterior building changes, and improvements which do not increase or concentrate stormwater runoff or cause additional nonpoint source pollution.

3.5.1 Redevelopment Standards

In an effort to improve stormwater management on existed developed site, the City requires one of the following performance standards to be implemented on redeveloped sites (City of Charleston Ordinance (Section 27-29):

- Reduce the impervious cover on the site by at least 20 percent, based on a comparison of existing impervious cover at the time of submittal of a Construction Activity Application (CAA).
- Achieve a 10 percent reduction in the total volume of runoff generated from the site by a 50 percent AEP storm event. Runoff calculations shall be based on a comparison of existing site conditions at the time of submittal of a CAA to the post-development site conditions.
- Reduce the post-development peak discharge rates by 20 percent of the existing peak discharge rates at the time of submittal of a CAA for the 10 percent and 4 percent AEP storm events based on a comparison of existing ground cover at the time of submittal of a CAA to post-development site conditions.

For non-special protection areas, one of these requirements shall be applied unless adequate downstream storm drainage conveyance capacity can be demonstrated. For special protection areas, one of these requirements must be applied in addition to the requirements set in Section 3.5.2 and Section 3.6.

3.5.2 Special Protection Areas Redevelopment Standards

In addition to meeting the redevelopment standards set in Section 3.5.1, the following standards must be met for redevelopment in special protection areas:

- For non-SFR sites of a half acre or more but less than 1 acre, no increase in 24 hour discharge volume for the 50 percent, 10 percent, and 4 percent AEP storm events.
- For sites of 1 acre or more, achieve a 20 percent reduction for the 50 percent, 10 percent, and 4 percent AEP storm event peak flow and 24 hour discharge volume. However, no site shall be required to reduce below the values for an undeveloped site with the assumption of cover as fair condition open space.
- For SFR sites or non-SFR of less than a half acre with an increase of 500 square feet of impervious area or more, offset the increase in runoff through implementation of runoff reduction practices (e.g., disconnected downspouts, rain garden, infiltration trench, rain barrel).

Disconnect Downspouts from Impervious Areas or Piped Systems
500 sf of impervious area allowed per 500 sf of roof area disconnected
Install Rain Barrel | 500 sf of impervious area per 50 gallon rain barrel installed
---|---
Install Rain Garden | 500 sf of impervious area allowed per 50 sf of rain garden installed
Install Infiltration Trench | 1’ deep x 2’ wide trench filled with clean sand along each side of surface features such as driveways or patios with no more than 15 feet of linear unit area flowing to the feature.

3.5.3 Redevelopment Exemptions

Exemptions must be documented for City approval as Stated in Section Error! Reference source not found.. Exemptions for redevelopment include:

- Construction or improvement of a single family residence (SFR), except for SFR located in a special protection area adding 500 square feet or more impervious area.
- Minor land disturbing activities that do not disturb more than 0.5 acres, are not part of a LCP, are not located in a special protection area and do not increase post-development impervious area by greater than 10 percent of the impervious area at the time of submittal of a CAA.

3.6 Special Protection Areas

In an effort to address some of the most critical water resource problems that exist in the City, special protection areas have been established. Any development or redevelopment (see Section 3.5.2 for additional redevelopment requirements) within or discharging to these special protection areas must comply with a more stringent set of design criteria in addition to the minimum standards and LOS determined by the City. For any conflicting design criteria, the more stringent set will supersede the minimum standards for special protection areas.

The City can designate any area as a special protection area. The permittee has the responsibility to contact the City through the Technical Review Committee (TRC) to determine whether the proposed project site is within or discharging to a special protection area. The Director of Stormwater Management shall make the determination on whether a site is within a special protection area.

3.6.1 Areas Associated With Known Flooding

Flooding occurs in many locations around the City where development has increased stormwater runoff to the point that stormwater conveyance systems have become overwhelmed. The following design criteria shall be used for projects discharging to receiving waters within these special protection areas:
• For non-SFR sites of 0.5 acres or more, the post-development, peak discharge rates are restricted to one-half the pre-development rates for the 50 percent probability of exceedance and 10 percent probability of exceedance, 24-hour storm events or to the downstream system capacity, whichever is less.

• For non-SFR sites of 0.5 acres or more, the post-development runoff volumes for the 50 percent, 10 percent, and 4 percent probability of exceedance, 24-hour duration storm events above the pre-development level shall be stored for 24 hours before release.

• For SFR sites or non-SFR sites less than 0.5 acres with an increase of 500 square feet of impervious area or more, offset the increase in runoff through implementation of runoff reduction practices (e.g., disconnected downspouts, rain garden, infiltration trench, rain barrel).

<table>
<thead>
<tr>
<th>Disconnect Downspouts from Impervious Areas or Piped Systems</th>
<th>500 sf of impervious area allowed per 500 sf of roof area disconnected</th>
</tr>
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<tbody>
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<td>1’ deep x 2’ wide trench filled with clean sand along each side of surface features such as driveways or patios with no more than 15 feet of linear unit area flowing to the feature.</td>
</tr>
</tbody>
</table>

Additional stormwater design criteria may be determined and required by the Department of Stormwater Management during the permitting process.

### 3.6.2 Areas Discharging to Total Maximum Daily Load and Impaired Waters

Projects that discharge either directly or indirectly into an impaired waterbody as determined by the existence of an adopted TMDL by SCDHEC or through SCDHEC’s listing of the waterbody on the latest Section 303(d) list shall reduce pollutant loads to meet applicable water quality standards. This will require the installation and implementation of measures, structural or non-structural BMPs shall adequately reduce pollutant loads to levels required by the TMDL (currently expressed as percent reductions) or prevent further impairment. An evaluation of the BMPs chosen to control the release of pollutants shall be provided. Such evaluations may reference published values on BMP effectiveness. The following design criteria shall be used for projects occurring within or discharging to these special protection areas:

• BMP and water quality analysis following design procedures in Section 3.12.
Buffers along perennial and intermittent streams adjacent to the project within a watershed where there is an established TMDL. Buffers shall be required on other waters as dictated by the City. Within buffer areas, significant sources of aquatic contamination and degradation shall be excluded including construction resulting in land disturbance, impervious surfaces, logging roads, mining, septic tank drain fields, agricultural fields, waste disposal sites, stormwater BMPs (except those designed as wetlands), access of livestock, clear cutting, and application of pesticides and fertilizers. The width of buffers shall be as follows:

- Base width shall be 50 feet plus 2 feet per 1 percent of slope of the stream valley, centered on the stream.
- Existing impervious surfaces in the riparian zone as well as wetlands do not count toward buffer width (i.e., the width is extended by the width of the impervious surface, just as for wetlands).
- Slopes over 25 percent do not count toward the width.

### 3.6.3 Basin Specific Requirements

Certain basins within the City of Charleston have been studied in additional detail to develop basin specific requirements that target the specific stormwater management needs of an area. Projects in these areas are required to meet additional basin specific requirements. Basins may be added or modified by City Council.

#### 6.6.3.1 Church Creek Drainage Basin Requirements

Projects in the Church Creek Watershed shall meet the following additional requirements per the City of Charleston Ordinance (Section 27-102):

- Detain the excess runoff volume difference between the pre-development and post-development conditions for 24 hours for the 50 percent, 10 percent, 4 percent, 2 percent, and 1 percent probability of exceedance, 24 hour storm events, for a period of 24-hrs, with tolerances for a peak flow rate match for the 4 percent and 2 percent probability of exceedance storm events being ±10 percent, with all others matching pre- and post-development conditions.
- Detention facilities shall be designed and constructed to contain the excess runoff volume difference between the pre-development and post-development conditions for the 24-hour period and the volume required to release the post-development peak flow rates at or below the pre-development peak flow rates. For areas in the Church Creek Basin north of Bees Ferry Road, storm event volumes above predevelopment volumes shall be released over a minimum period of 72 hours. For areas located south of Bees Ferry Road, release rates shall be reviewed on a case-by-case basis to determine the optimum storage period based on conditions anticipated during a 100-year event. Release rates will be controlled to prevent downstream impacts.
- The minimum required easement width for any open conveyance shall be 24 feet. This easement shall include a maintenance shelf accessible to a public right-of-way of 20 feet. For open conveyances greater than four feet wide and/or four feet deep, the easement width shall be increased by two feet for each foot of channel width or depth in addition to four feet. Main conveyance components shall utilize open drainage channels and ponds to move large
volumes of stormwater over long distances. Culverts may be used where required where main
conveyances cross topographical features. A main conveyance is defined as a drainage asset
that serves 100 lots or more or provides drainage for more than one subdivision or community
or commercial project greater than 30 acres. Box culverts or pre-engineered spans or bridges
shall be used in lieu of pipes for locations where main conveyance assets or channels cross
roadways or trails. Channels shall be sized to operate at full capacity with reasonable
vegetation growth. A channel opening dimension factor of safety of 1.25 shall be used for
conveyance structures to account for normal accumulation of debris and sediment between
maintenance cycles. The 1.25 factor of safety shall be based upon hydraulic capacity during
the 50-year and 100-year storm conditions. Channel easement width shall be adequate for the
channel as well as for access and maintenance. Access shall be sufficient to allow for loading
and unloading of equipment and enable mowers and excavators to traverse the length of the
conveyance asset. Access for loading/unloading equipment shall be within, adjacent to, and
nearby to enable efficient maintenance activity. Main conveyance easements shall allow for a
maintenance shelf on one side of the channel. Side slopes shall include a maximum slope of
2.5H:1V. Projects where alternate channel side slopes are proposed, such as a wall, bulkhead
or hard scape will be considered on a case-by-case basis. The minimum width for a main
conveyance channel easement shall be 50 feet. Access and shelf areas shall accommodate
maintenance equipment such as excavators and other equipment required for effective
operation to traverse, function, and freely move without risks associated with encroaching upon
private property.

- Conveyance culverts shall be sized to ensure operation at full required capacity under severe
  conditions common in the area of installation. Minimum sizes shall be determined to reduce
  the potential for fouling or clogging due to trapped debris. Culverts shall be sized with a 1.25
  safety factor based on hydraulic capacity during a 50-year event to allow for normally occurring
  conditions. Maintenance access easements shall be provided on each side of culvert crossings
  parallel to the flow way to enable maintenance equipment to stage and operate without risk of
  inflicting permanent damage to improvements in the easement. Culvert headwalls shall include
  robust components not easily damaged by a backhoe or excavator bucket.

- All discharges to tidally affected receiving waters shall be equipped with surge protection
devices. Surge protection devices will not be required in areas located upstream of existing
devices where protection is provided. All devices shall be located to facilitate maintenance and
shall be constructed of stainless steel, aluminum, or other materials that are corrosion resistant
and designed for installation in a marine, saltwater environment. The city reserves the right to
standardize, develop standards for, and review designs associated with tidal surge protection
devices. In some cases, maintaining tidal flow under normal conditions may be necessary. In
these cases, a self-regulating tide gate shall be used to prevent storm surge in upstream areas.
Tide gates and self-regulating tide gates shall be manufactured from non-corrosive material
and shall be in accordance with the Waterman Industries SRT or an approved equal. The city
reserves the right to continue to develop, amend, update, revise, and implement standards
associated with devices as technology evolves.

- Floodplain storage impacts that reduce storage shall be prevented. In cases where floodplain
impacts are proposed, impacts shall be mitigated on a minimum 1.25:1 basis based on storage
volume to prevent deterioration of basin storage capacity during storm events over time.
Mitigation shall be within the same basin having an effect on the same water surface elevations
and hydraulics as the proposed impact.
Basin Improvement Plan Participation: Where a project is located in a portion of the basin where capital improvements have been recommended to improve drainage or reduce flooding potential, property owners may incorporate improvements into site design plans, provided the drainage improvements shown on plans are consistent with the function, intent, and effect of the capital project recommended in the Church Creek Basin Study or any prior or subsequent study or evaluation commissioned by the City or their agent. These projects will be reviewed on a case-by-case basis and the City reserves the right to engage in collaborative and creative design efforts that result in improvements to drainage in the basin serving the best interest of the public.

- The soil characteristics of fill material placed on non-structural areas to ensure that granular soils are used which promote infiltration and reduce runoff. Soil infiltration BMPs shall be incorporated into the site design where practical. Soils in non-structural areas shall have an infiltration rate of 0.3 inch per hour or greater. Infiltration BMPs must be consistent with the most current version of the Low Impact Development in Coastal South Carolina guide.
  - Home builders shall be encouraged to retain stormwater on site for re-use as irrigation water.
  - Low Impact Development aspects shall be considered during the design process to help mitigate stormwater runoff volume while improving quality.

These requirements are specified in the City of Charleston Church Creek Watershed Storm Water Master Plan Summary Report (Woolpert, LLP 2001) and more fully explained online at:


3.7 Sea Level Rise

The City has adopted a sea level rise strategy to accommodate future sea level rise and storm surge. The Flood and Sea Level Rise Strategy (City of Charleston 2019b) can be found at:

https://www.charleston-sc.gov/slr

To accommodate sea level rise and storm surge, all designs shall use 6.5 feet NVGD 29 datum tailwater elevation as a boundary condition with roadway elevation no less than 8.5 feet NVGD 29. If the developer/designer desires to design a lower road elevation, they shall develop a hydrologic and hydraulic model, using computational methods or software approved by the City’s Department of Stormwater Management, that demonstrates the performance of the roads during a 1 percent probability of exceedance, 24 hour storm event that coincides with a peak tide and storm surge elevation of 6.5 feet NVGD 29.

3.8 Soils and Geotechnical Information

Information on the native soils in the City can be obtained from the NRCS Web Soil Survey at the following website.
The challenge with most of the soils in the City is that they are no longer native because they have been modified by development. The modifications may include compaction or import of non-native fill. The best way to understand the types of soils that are on a site is to hire professional engineers, geologists, or scientists. They can provide critical information such as soil types, depth to relatively impenetrable soil type, and depth to groundwater and infiltration ability. These are critical considerations when performing calculations for stormwater runoff and determining the ability to implement green infrastructure.

### 3.9 Permanent Stormwater Design

This section discusses the design criteria for stormwater management measures that will remain after the construction project is complete. Permanent stormwater management measures are separate but can be related to measures required during construction. Important considerations in all permanent stormwater management measure designs are access and ease of maintenance.

#### 3.9.1 Introduction to Permanent Stormwater Design Requirements

##### 3.9.1.1 Stormwater Quantity Control

Water quantity control is an integral component of overall stormwater management. Its purpose is to negate the effects of development during storm events. Quantity control is effectively flood control, reducing potential damage and health risks, but because uncontrolled runoff can cause erosion, it can also be a form of water quality control. The design criteria, as described in Section 3.12, shall be considered when determining the types of quantity controls to be implemented in a project. For further information and documentation on the design, installation, and maintenance of stormwater quantity facilities, see the *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014).

##### 3.9.1.2 Stormwater Quality Control:

Water quality control is an integral and required component of an overall stormwater management system. Construction, development, and redevelopment projects shall include controls that treat or otherwise limit the discharge of pollutants. These requirements have been added due to State and Federal requirements, but also due to the need to improve and preserve the water resources in the City.

- **Use of BMPs:** Stormwater runoff generated from construction, development, and redevelopment shall be treated through the use of structural and/or non-structural practices. It is presumed that sufficient treatment is provided by the proposed BMPs if they are:
  - Designed according to the specific performance criteria outlined in the SWDSM
  - Constructed properly
  - Maintained regularly
• **Special Protection Areas**: Stormwater discharges to special protection areas with sensitive resources or that have existing flooding or water quality problems (e.g., recreational waters, water supply reservoirs, TMDLs, and Section 303(d) listed waterbodies) are subject to additional performance criteria.

• **Maintenance Agreement**: All BMPs shall have an enforceable operation and maintenance agreement to ensure the system functions as designed.

• **Sediment Basins**: Sediment basins and other BMPs shall be used during construction to remove heavy sediment loads from runoff waters leaving the disturbed area.

• **Disturbed Area Limit**: Clearing for installation of utilities and roads or for development shall be allowed, but limits have been established. The total disturbed area shall not exceed 25 acres. The Department of Stormwater Management may reduce the total area that may be disturbed at any time. Project areas exceeding 25 acres in disturbed area shall be phased to comply with this requirement. All clear-cutting areas shall be clearly identified on construction documents. The decision to consider an activity as clear cutting (logging) versus land disturbance for development shall belong to the Director of Stormwater Management or their designee.

• **Wetlands**:  
  - If wetlands are suspected to exist on the property, they shall be investigated and delineated by a qualified consultant. The USACE and OCRM policies regarding wetlands shall be followed.
  - Where existing wetlands are intended as a component of an overall stormwater management system, the approved plan for stormwater management shall not be implemented until all necessary Federal and State permits have been obtained.

• **Vector Control**: Stormwater management and sediment control practices shall be designed, constructed, and maintained with consideration of the proper control of mosquitoes and other vectors.

• **South Carolina Building Code**: On all new construction or renovations required by the South Carolina Building Code to conform to requirements for new buildings, it shall be unlawful for any person to collect stormwater for deposit on any public street, sidewalk, or right-of-way, or otherwise suffer or permit, or by mechanical means propel stormwater on such public street, sidewalk, or right-of-way.

### 3.9.2 Permanent Stormwater Design Volumes

The City has adopted a tiered approach to managing post-construction stormwater runoff. One of the goals of this approach is to reduce stormwater runoff and thus reduce stormwater pollutant loads. If stormwater runoff volumes are removed through infiltration, evapotranspiration, or beneficial reuse, then the pollutants associated with those volumes will also be removed.

The City requires that all post-construction stormwater runoff from development or redevelopment sites be managed for water quality control. Four technology tiers are available for use to meet this runoff management requirement. Each tier prescribes an amount of rainfall (rainfall depth) that shall be applied to the area draining to the four technology tiers. These rainfall depths correspond to a runoff volume that shall be treated.
Post-construction stormwater runoff from the developed site must be managed through one, or a combination of the technology tiers. Rainfall depths exceeding the values prescribed in Table 3-5 are allowed to bypass or pass through the permanent stormwater management practices. The rainfall depths for the four tiers are based on a 24-hour duration, Type III distribution storm and are summarized in Table 3-5 and described in detail in the following bullets:

<table>
<thead>
<tr>
<th>Tier</th>
<th>Rainfall Depth Required for Treatment Design (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I – Green Infrastructure</td>
<td>1.0</td>
</tr>
<tr>
<td>I – Green Infrastructure (within 1,000 feet of shellfish beds)</td>
<td>1.5</td>
</tr>
<tr>
<td>II – Green Infrastructure with an Underdrain</td>
<td>2.0</td>
</tr>
<tr>
<td>III – Detention Practices</td>
<td>2.8</td>
</tr>
<tr>
<td>IV – Pass Through Devices</td>
<td>Peak flow from 2.8</td>
</tr>
</tbody>
</table>

- **Tier I**: Green infrastructure includes any permanent stormwater management measure that infiltrates, evaporates, or beneficially reuses stormwater runoff. These measures can be at a development or at a lot level. These measures provide water quality treatment through reduction of stormwater runoff volume.

- **Tier II**: Green infrastructure with an underdrain provides some stormwater volume reduction as the stormwater infiltrates into surrounding soils and is absorbed by vegetation, but mostly provides water quality treatment through the filtering process.

- **Tier III**: Detention practices are permanent stormwater management measures that capture stormwater runoff and then release it slowly over time. These measures provide peak flow reduction and water quality treatment, but little to no stormwater runoff volume reduction. This tier is not allowed for projects discharging within 1,000 feet of shellfish beds.

- **Tier IV**: Pass through devices are permanent stormwater management measures that only provide water quality treatment. They do not provide peak flow reduction or stormwater runoff volume reduction. This tier is not allowed for projects discharging within 1,000 feet of shellfish beds.

**Water Quality Volume:**

- The water quality volume for a construction project, or any portion thereof, is the stormwater runoff volume from the rainfall depth selected from the tier chosen, applied over the area of the construction project.

- Designers may use different tiers for different portions of the construction project.

- Designers may manage more water quality volume required in portions of the construction project to compensate for portions of the project where they cannot provide the required water quality volume, provided the required water quality volume is managed for the entire construction project area.

- Detention practices shall return to their normal pool elevation over a minimum period of 48 hours and maximum period of 72 hours unless otherwise indicated by watershed models.
• All projects within 0.5 mile of a receiving waterbody in the coastal zone must meet Section III.C.3.XIII.A of the Coastal Zone Management Program Refinements. Recommended Methods and Design Procedures

3.9.3 Project Discharge

Stormwater runoff generated and discharged from construction, development and redevelopment activities shall not exceed pre-development discharge rates for the 4 percent, 10 percent, and 50 percent probabilities for exceedance, 24-hour duration storm events. Of particular importance to the City is whether detention anywhere in the watershed will cause downstream coincident peak flows greater than pre-development peak flow rates. The same hydrologic procedures shall be used in determining both the pre-development and post-development peak flow rates.

In certain instances where re-development occurs within a Special Protection Area (see Section 3.5), the City Stormwater Department may require runoff rates be reduced below pre-development peak flow rates.

3.9.4 1 Percent Probability of Exceedance Storm Event Analysis

Construction, development, and redevelopment activities that disturb 1 acre or more shall include a hydrologic/hydraulic analysis to determine the impacts of the proposed development during the 1 percent probability of exceedance, 24-hour storm event (precipitation only).

For the 1 percent AEP Storm Event Analysis, the project shall not:

• Increase the likelihood of dwelling flooding and property damage above current conditions.

• Increase water surface elevations or reduce system capacity in the stormwater system and facilities upstream or downstream of the project. An increase or reduction shall be based on a comparison with pre-development conditions (with more stringent requirements potentially applied in special protection areas).

• Increase erosion potential and pollutant loads that would adversely impact the quality of receiving waters.

If the project is in an area that has a stormwater master plan and model, the analysis shall use the master plan model provided by the City. The model shall extend up to the top of the watershed and down to the project if the modeling results indicate there is an impact as listed above, then stormwater volume and flowrate leaving the site must be reduced until such point that there are no impacts.

If the project is not in an area that has a stormwater master plan and model, then an analysis shall be performed from the top of the watershed to a point down system of the site where the site makes up 10% of the basin area. The evaluation should also continue down system for the project to identify any likely choke points. If the modeling results indicate there is an impact as listed above, then stormwater volume and flowrate leaving the site must be reduced until such point that there are no impacts.
The analysis criteria shall include, but are not limited to:

- Use current zoning for all upstream and downstream land parcels.
- Utilization of existing land use curve numbers for all developed areas outside the project.
- The weighted curve number for the proposed development site shall be used, except special protection areas.
- Flows shall be routed using a hydrologic and hydraulic method accepted by the City Department of Stormwater Management.

Other calculations may be required by the Department of Stormwater Management based on the severity of potential impact and the location of the project.

### 3.9.5 Recommended Methods and Design Procedures

#### 3.9.5.1 General Requirements for BMPs

The following design criteria are established for permanent stormwater management BMPs and shall be incorporated in one or more BMPs for a given subbasin unless a specific quality variance is granted by the Department of Stormwater Management. Incorporation of these requirements shall constitute adequate control of the discharge of pollutants.

- **Quality Control Threshold**: All sites that disturb 0.5 acres or more shall have at least one permanent water quality structural BMP installed and shall require the execution of a CPMSF.
- **Pretreatment**: Pretreatment devices or forebays shall be provided as described in Section 3.10.
- **Maintenance Plan**: All BMPs shall have a maintenance plan. Suggested schedules and routine activities are provided in the South Carolina BMP Handbook (SCDHEC 2005) and the Low Impact Development in Coastal South Carolina: A Planning and Design Guide (Ellis et al. 2014).
- **Effluent Limits**: The Department of Stormwater Management reserves the right to require specific effluent limits for any pollutant from a site if necessary to ensure the water quality standards and other State and Federal water quality regulations are met.

#### 3.9.5.2 Typical Design Procedures

1. Determine design criteria for site including additional criteria for redevelopment projects, projects in special protection areas, and projects with basin specific requirements.
2. Determine appropriate accepted BMPs needed for the site, considering the land use, pollutants of concern, soils, maintenance requirements, location in relation to receiving waters, and any impairments that may exist.
3. For detention practices capturing runoff from 5 acres or more, provide a forebay or vault at each inlet, unless the inlet provides less than 10 percent of the total design storm inflow to the pond.
4. Calculate the water quality volume using Equation 3-1.
Equation 3-1. Water Quality Volume

\[ WQV = \frac{Q \times DA}{12} \]

Where:

- \( WQV \) = Water quality volume (acre-feet)
- \( Q \) = Rainfall depth (inches) based on the tier selected
- \( DA \) = Drainage area to permanent stormwater management BMP (acres)

5. Compute the inflow hydrograph for the permanent stormwater management BMP for the 50 percent, 10 percent, 4 percent, and 1 percent probability of exceedance, 24-hour storm events for both the existing and proposed conditions. From this, determine peak flow rates for each storm.

6. Compute a stage-storage relationship for the proposed BMP. A stage-storage curve defines the relationship between the depth of water and storage volume within the detention practice.

7. Compute the stage-discharge relationship for the outlet control structure. A stage-discharge curve defines the flow capacity of a structure at a given stage or elevation.

8. Perform routing calculations for the 50 percent, 10 percent, 4 percent, and 1 percent probability of exceedance, 24-hour storm events. Calculations may be done by hand or by using a storage routing computer model.

9. Evaluate the control structure outlet flow velocity and provide velocity control and channel stabilization. Drawings and details shall be provided for outlet structures and basin.

10. Repeat steps 2-9 for post-development condition until peak, volume, and velocity criteria are met.

11. Stage-storage and stage-discharge calculations shall be included in the engineering calculations. Common methodologies for stage-storage curves include the double end area method and the pyramid frustum method. Other methods will be accepted upon adequate justification at the discretion of the Department of Stormwater Management.

12. Hand calculations are available for routing hydrographs through detention structures; however, they are time consuming and inefficient when multiple designs are required to be evaluated. For the SWDSM, the design engineer shall use one of the many computer software packages available to perform storage routing calculations. All models and methodologies used shall be approved by the City. Currently, the City has approved the following computer models:

- ICPR
- Drain:Edge
- PondPack/Civil Storm
- HEC-1
- HYDRAFLOW
3.10 Detention and Infiltration Requirements

This section contains the requirements for the design and maintenance of permanent structural stormwater detention and infiltration practices. These practices help to improve water quantity and quality and may be implemented as part of the overall site design for any project. The following requirements should be applied to all detention and infiltration facilities:

- **Forebays and Pretreatment Devices:** Permanent structural BMPs shall have a forebay or pretreatment BMP to facilitate more efficient removal of debris and coarse sediments. These can be created through grading or a manufactured or engineered device.
  - Forebays shall be placed upstream of the inlets into the main BMP storage area.
  - Unless a separate vault (engineered device) is to be used for the forebay, the forebay shall be separated from the larger BMP storage area by barriers or baffles that may be constructed of earth, stones, riprap, gabions, or geotextiles.
  - Maintenance of forebays shall be performed once a year unless otherwise specified by a manufacturer. Designs shall consider the maintenance needs by ensuring equipment has adequate access to forebay and adequate clearance to perform dredging and cleaning operations. A visual marker shall be placed in the forebay to assist in monitoring sedimentation depth.
  - The forebay shall be sized to contain 0.1 inch of runoff per impervious acre of contributing area. The forebay shall be a minimum of 2 feet deep. The volume in the forebay counts towards the total water quality volume requirements of the BMP. As an alternative, the forebay may be designed to meet a sediment trapping efficiency of 60 percent.

- **Construction Specifications:** Construction specifications shall conform to the latest version of SCDOT’s *Standard Specifications for Highway Construction* (2007).

3.10.1 Detention Requirements

Detention practices are essential for providing increased storage within a stormwater management system. The storage of stormwater flows by these structures helps provide water quality protection and reduces peak flows. Designs of storage facilities used for stormwater flow rate control and required downstream analyses shall be submitted as part of the engineering calculations. Requirements that shall be applied to detention practices include the following:

- **Discharge Velocities:** Post-development discharge velocities shall be reduced to provide non-erosive flow velocities from structures, channels, or other control measures, or equal the pre-development 10 percent probability of exceedance, 24-hour storm event flow velocities, whichever is less. Refer to Table 3-4 for maximum non-erosive flow velocities.

- **Impoundment Requirements:**
Ponds with vegetated embankments shall be less than 15 feet in height and shall have side slopes (inside and outside) no steeper than 3H:1V. Embankments protected with erosion control blankets may be used but shall be no steeper than 2H:1V. Geotechnical slope stability analysis is required for slopes greater than 10 feet in height and embankments that have steeper slopes than those indicated above. Access inside a pond shall be provided with at least one side slope at 3H:1V or flatter for maintenance.

A minimum freeboard of 0.5 feet above the 1 percent probability of exceedance, 24-hour design storm high water elevation shall be provided for all impoundments.

3.10.2 Detention-Specific Requirements

Stormwater detention facilities are used to reduce the peak discharge and capture runoff for a short period of time. Detention facilities should be designed to completely drain or return to a normal pool elevation after a design storm has passed. Requirements specific to detention facilities include:

- **Limits of Detention Pool**: Any development that uses a parking area or other feature for detention storage capacity shall clearly identify the limits and depths of the expected detention pool.

- **Recovery Time**: The detention volume from detention facilities shall be drained from the structure within 72 hours. For instances where the modeling still shows minimal discharge from the detention facilities after 72 hours, a second storm event analysis can be performed to show the detention facilities still have available freeboard.

- **Pond Requirements**: The bottom of detention facilities shall be graded towards the outlet structure(s) to prevent standing water conditions in dry facilities and to facilitate draining of wet facilities to perform maintenance. The bottom slope shall be a minimum of 0.5 percent.

3.10.3 Wet Detention-Specific Requirements

Wet stormwater detention facilities contain a permanent pool of water and are primarily implemented to promote water quality treatment. The maximum depth of wet detention facilities with a permanent pool shall be determined by site conditions, design constraints, and environmental needs. The facility shall provide a permanent pool of water with a depth sufficient to discourage weed and mosquito growth without creating undue potential for anaerobic bottom conditions. A depth of 3 to 8 feet is reasonable unless County Mosquito Control requirements dictate otherwise. Aeration or other means shall be used as necessary to prevent anaerobic conditions.

- **Aquatic Bench**: A minimum 10-foot-wide aquatic bench around the perimeter of the wet stormwater detention facility (with exception of the forebay area) with the inside edge of the shelf 6” below the permanent pool level and the outside edge 6” above the permanent pool level with a resulting slope of 10:1 must be provided. With half the shelf below the water and half the shelf above the water, the vegetated shelf will provide a location for an appealing, diverse population of native, emergent wetland vegetation that enhances biological pollutant removal, provides a habitat for wildlife, protects the shoreline from erosion, promotes ecological mosquito control (i.e., attracts a variety of predator insects for natural mosquito control) and improves sediment trapping efficiency.
The wet stormwater detention facility must incorporate several (minimum of three (3)) diverse, native species of shallow water emergent and shallow land herbaceous vegetation on the vegetated shelf. A minimum of 50 plants per 200 sf of shelf area shall be planted. Diversity in species increases the robustness of the vegetated shelf by increasing the chances that some species will survive minor changes in the permanent pool water level. This vegetation enhances pollutant removal, protects the shoreline from erosion, and increases safety by discouraging people from entering the basin. Planting density is dependent on the targeted time to full coverage, and on the individual selected species’ mature size. Spacing must be approximately 24” to 36” centers; yielding coverage in approximately 1 – 2 years respectively. On the tops of berms and on the exterior slopes of containment berms, maintain turf grass in access areas; Centipede grass is recommended.

3.10.4 Infiltration Requirements

Infiltration BMPs are encouraged at all sites and may be required on those sites that do not currently discharge stormwater runoff, have no existing outlet, or are in the Church Creek Watershed. The following other criteria, based primarily on South Carolina Regulation 72-307.C requirements, shall be followed in the design of infiltration systems:

- Areas draining to these facilities shall be stabilized and vegetative filters established prior to runoff entering the system. Infiltration devices shall not be used if a suspended solids filter system does not accompany the practice. If vegetation is the intended filter, there shall be at least a 20-foot length of vegetative filter prior to sheet flow stormwater runoff entering the infiltration practice. Forebays or other engineered devices for sediment removal are also required.

- Each system shall be designed to prevent clogging by fine material and for ease of maintenance.

- The bottom of the infiltration practice shall be at least 0.5 feet above the seasonal high water table, whether perched or regional, determined by direct piezometer measurements, which can be demonstrated to be representative of the maximum height of the water table on an annual basis during years of normal precipitation, or by the depth in the soil at which mottling first occurs as determined by an appropriately licensed individual.

- The infiltration device shall be designed to completely drain of water within 72 hours.

- Soils shall have adequate permeability to allow water to infiltrate. Infiltration practices are limited to soils having an infiltration rate of at least 0.5 inch per hour. Initial consideration shall be based on a review of the appropriate soil survey and proposed depths of excavation or field testing. The survey or testing may serve as a basis for rejection. Onsite soil borings and textural classifications shall be accomplished to verify the actual site and seasonal high water table conditions when infiltration is used.

- Infiltration practices greater than 3 feet deep shall be located at least 25 feet from basement walls.

- Infiltration practices designed to handle runoff from any parking areas or commercial properties shall be a minimum of 150 feet from any public or private water supply well.
• The design of an infiltration practice shall have a properly sized overflow or bypass for larger storm events. Measures to provide a non-erosive velocity of flow along its length and at the outfall shall also be included as necessary. Additional control devices will typically be necessary prior to a release to a watercourse to meet water quality requirements.

• The slope of the bottom of the infiltration practice shall not exceed 5 percent.

• An infiltration practice shall not be installed on or atop a slope whose natural or existing angle of incline exceeds 20 percent.

• If an underdrain system is required, clean-outs shall be provided at a minimum every 100 feet along the infiltration practice to allow for access and maintenance.

3.11 Equalization Pipes and Submerged Systems

A stormwater pipe experiences submerged flow conditions when downstream resistance to flow increases above a certain point, reduces the upstream velocity through the pipe, and causes flow depths to increase as water cannot exit the pipe quick enough. This downstream resistance and increase in flow depth is known as a backwater effect. Because of the slower velocities in submerged conveyances, solid material in the stormwater settles out causing maintenance difficulties. The City acknowledges this situation may occur on stormwater pipe at extreme storm events, but they shall not be designed for storm events up through the 1 percent probability of exceedance, 24 hour storm event without a variance. Variance requests shall address the items as presented in section 3.4.6.1 Item 5. However, conduits used for equalization may be submerged if isolator boxes are installed at both ends of the conduit to facilitate draining for maintenance purposes. If the distance of the conduit exceeds 200 feet, additional isolator boxes shall be installed such that the maximum distance between isolator boxes shall be 200 feet.

Storm drainage systems shall be designed to convey stormwater runoff by gravity flow unless otherwise approved.

3.12 Accepted Permanent Structural and Non-Structural Best Management Practices

Permanent structural BMPs are those practices that remain after the project has been closed out. Permanent structural BMPs typically fall into two categories: water quantity (runoff retention for a design rainfall depth) and water quality. Permanent structural quantity BMPs accepted by the City are listed in Table 3-6.

Table 3-6. Accepted permanent water quantity (Runoff Reduction) BMPs

<table>
<thead>
<tr>
<th>General Structural Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioretention Areas – Rain Gardens, Stormwater Planters, Tree Boxes</td>
<td>Bioretention areas are shallow stormwater basins or landscaped areas that use engineered soils and vegetation to capture and treat stormwater runoff. Runoff may be returned to the conveyance system through an underdrain or exfiltrated into the soil.</td>
</tr>
</tbody>
</table>
Permanent structural quality BMPs accepted by the City are listed in Table 3-7. These BMPs may also provide runoff peak flow attenuation benefits.

<table>
<thead>
<tr>
<th>General Structural Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Channel Systems – Wet Swale and Two Stage Ditches</td>
<td>Stormwater conveyance systems that provide water quality benefits through filtration and pollutant uptake.</td>
</tr>
<tr>
<td>Stormwater Filtering Systems: Perimeter Sand Filter</td>
<td>Perimeter sand filters are multi-chamber structures designed to treat stormwater runoff through filtration using a sand bed as its primary filter media. Filtered runoff may be returned to the conveyance system.</td>
</tr>
<tr>
<td>Dry Detention Ponds</td>
<td>Dry detention ponds are constructed stormwater basins that are dry between rain events. Runoff from each rain event is detained and treated in the basin, and released at a designed rate.</td>
</tr>
<tr>
<td>Wet Detention Ponds</td>
<td>Wet detention ponds are constructed stormwater basins that have a permanent pool, shallow marsh, or micropool of water. Runoff from each rain event is detained and treated in the pool, and released at a designated rate.</td>
</tr>
</tbody>
</table>
General Structural Control | Description
---|---
Stormwater Wetlands | Stormwater wetlands are natural or constructed systems used for stormwater management. Stormwater wetlands consist of a combination of shallow marsh areas, open water and semi-wet areas above the permanent water surface.
Vegetated Filter Strip | A vegetated buffer, or filter strip, is a uniformly graded and densely vegetated area that treats sheet flow stormwater runoff. The vegetation in the buffer works to slow down the stormwater runoff, settling and filtering some pollutants and uptaking others.
Underground Detention | Underground detention is used as an alternative to surface dry-detention basins. They are used in areas that are space-limited where there is not adequate land to provide the required detention volume. The underground storage uses tanks, vaults, and buried pipes to supply the required storage volume.
Manufactured Treatment Devices: Vortex Separator Baffles Cartridges Skimmers Gravity Oil-Grit Separator Filter Material Inlet Inserts | Pre-fabricated controls use the movement of stormwater runoff through a specially designed practice to remove target pollutants. They are typically used on smaller commercial sites and urban hotspots. There are numerous commercial vendors of these practices, but there is limited data on their performance. Until further research is done and substantial removal efficiencies are published, these structures may require monitoring. Popular vendors/products include, but are not limited to, Crystal Stream, Vortechnics, Aquashield, Filtera, Stormceptor, Stormfilter, CDS, BaySaver, and Downstream Defender.
Note: This list is not intended to indicate a preference or endorsement of these devices or to exclude others.

Regardless of the structural control used, maintenance schedules shall be included for each proposed BMP.

Listed below are some permanent non-structural BMPs not contained in Table 3-6 or Table 3-7 that shall be considered for use in larger construction, development, and redevelopment projects.

- **Buffers**: an area along a shoreline, wetland, or other waterway where development is restricted or prohibited. The primary function of the buffer is to physically protect and separate a stream, lake, or wetland from future disturbance or encroachment.
- **Disconnected Roof Drains**: directing stormwater runoff from rooftops towards pervious areas where it is allowed to filter through vegetation and other landscaped material and infiltrate into the soil.
- **Cluster Development**: concentrate development away from environmentally sensitive areas such as streams, wetlands, mature wooded areas, and steep slopes.
- **Education Materials**: literature for owners and homeowner’s associations to educate themselves on the impact they can have on water quality and the activities necessary to maintain structural controls. These efforts are particularly critical in low impact development (LID) designs.
3.12.1 Stormwater Quantity Best Management Practices

Stormwater quantity BMPs help to minimize the effects of development during storm events and to reduce the overall stormwater volume that is discharged after a project is completed. Since stormwater quantity and quality are closely linked, many stormwater quantity BMPs also help to improve water quality. This section describes several commonly used stormwater quantity BMPs that are accepted by the City.

3.12.1.1 Bioretention Basins

Bioretention basins are shallow depressional areas (18 to 36 inches deep) that are filled with an engineered soil media and are planted with trees, shrubs, and other herbaceous vegetation. They are an effective practice to reduce post-construction stormwater runoff rates, volumes, and pollutant loads. They also provide several other benefits, including improved aesthetics, wildlife habitat, urban heat island mitigation, and improved air quality. These BMPs are either a Tier I or Tier II practice depending upon whether the practice has an underdrain.

Bioretention basins are designed to capture, infiltrate, and evaporate stormwater runoff. However, if the soils do not percolate as much as desired, an underdrain can be installed, so at least the stormwater runoff is temporarily stored before being conveyed back into the storm drain system through an underdrain. However, the underdrain must have an upturned elbow providing an underground storage layer. The engineered soil media is comprised of sand, soil, and organic matter.

The City requires the design, installation, and maintenance requirements for bioretention basins to be as outlined in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014). Bioretention basins designed and installed in the City shall also meet the following criteria:

- An observation well shall be provided to allow easy monitoring of the water level within the practice. The observation well shall be a 6-inch perforated PVC pipe with a removable and lockable cap.

3.12.1.2 Permeable Pavement Systems

Permeable pavement allows the stormwater to infiltrate through the pavement into a rock storage layer under the pavement. Examples of permeable pavement include porous asphalt, pervious concrete, and permeable pavers. Pervious concrete is designed without any “fine” material, resulting in a gap-graded mixture with high void space. Porous asphalt is similar to pervious concrete and consists of an open-graded surface course. Permeable pavers consist of individual concrete or stone shapes that are placed adjacent to one another, but with gaps all around, over a specially designed sub-base. These BMPs are either a Tier I or Tier II practice depending upon whether the practice has an underdrain.

The critical aspect of permeable pavement systems is application. They can be very effective, but not when they are placed in areas where they will regularly receive runoff concentrated with...
mulch, leaf litter, grass clipping, etc. This organic matter will plug the void spaces in the pavement and restrict the infiltration that can occur.

The City requires the design, installation, and maintenance requirements for permeable pavement system to be as outlined in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014). Permeable pavement systems designed and installed in the City shall also meet the following criteria:

- Permeable pavement systems shall be designed to completely drain within 72 hours.
- The ratio of drainage area to area of permeable pavement should be less than 10:1, instead of 5:1.
- An observation well shall be provided to allow easy monitoring of the water level within the practice. The observation well shall be a 6-inch perforated PVC pipe with a removable and lockable cap.

### 3.12.1.3 Infiltration Trenches/Basins

Infiltration trenches/basins are shallow excavated areas that receive stormwater. Infiltration trenches/basins are suitable for sites with limited space, reduce the volume of stormwater runoff and peak flows, are appropriate for small sites (less than 5 acres), provide infiltration and pollutant filtration, and work well with other BMPs in series. These BMPs are either a Tier I or Tier II practice depending upon whether the practice has an underdrain.

Infiltration trenches/basins are applicable for a variety of uses such as the perimeter of parking areas or medians between drive lanes. They can also be applicable for sites with limited space available for water quality features. There are a variety of ways these structures can be designed but must include pretreatment. Infiltration trenches/basins can receive overland flow from a forebay through gravel or grass. They can also receive point flow from a proprietary water quality unit that drains to the aggregate filter media.

The City requires the design, installation, and maintenance requirements for infiltration trenches/basins to be as outlined in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014).

### 3.12.1.4 Green Roofs

Green roofs are roofs of buildings that have a waterproof membrane overlaid with planting media and vegetation including plants, shrubs, or trees. Green roofs capture and absorb rainwater, resulting in decreased stormwater runoff. Green roofs provide more than a stormwater benefit, such as reducing rooftop temperatures, creating urban habitats, and enhancing outdoor gathering spaces. These BMPs are a Tier I practice.

All buildings must have the structural capacity to hold a green roof. Extensive green roofs use less than 6 inches of planting media, whereas intensive green roofs use greater than six inches of planting media. Rooftop applications will vary based on structural capacity of the building. It is
important to consider the maintenance requirements, leak detection systems or tray systems, planting plans (using plants with minimal irrigation requirements), and replacement of green roof layers.

The City requires the design, installation, and maintenance requirements for green roofs to be as outlined in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014).

### 3.12.1.5 Rainwater Harvesting

Rainwater harvesting is the practice of capturing and temporarily storing rainwater, typically from rooftops, in a cistern or rain barrel for beneficial use. The beneficial use often includes landscape watering but may include water for flushing toilets (contact City for regulations regarding reuse of rainwater), make-up water for HVAC units and boilers, and water for vehicle washing. These BMPs are typically a Tier I practice.

Rainwater harvesting can be used in most land use practices, including high-density residential, commercial, institutional, and industrial areas. Considerations for rainwater harvesting include the distance of the harvested rainwater from its intended use, water treatment requirements that may limit use of harvested rainwater, storage of harvested rainwater below ground versus above ground, seasonal use, and decrease in potable water usage.

The City requires the design, installation, and maintenance requirements for rainwater harvesting to be as outlined in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014).

### 3.12.1.6 Impervious Surface/Roof Disconnection

The goal of downspout disconnection is to allow stormwater from impervious surfaces to run across pervious surfaces to be treated and infiltrated. For new construction or redevelopment, it is prohibited to connect downspouts to the sewer system. When disconnecting impervious surfaces/roofs from the sewer system or allowing impervious surfaces to be directed to pervious surfaces, the designer needs to consider the proximity of adjacent buildings, the direction of downspout conveyance after disconnection, and the routing of disconnected downspouts to other BMPs or pervious surfaces. These BMPs are typically draining to either a Tier I or Tier II practice depending upon whether it has an underdrain.

The City requires the design, installation, and maintenance requirements for impervious surface/roof disconnection to be as outlined in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014).

### 3.12.1.7 Open Channel Systems – Grass Channel and Dry Swale

Grass channels and dry swales are long, shallow stormwater basins (typically 4 to 18 inches deep) that mimic the ecological functions of a natural landscape. Dry swales are similar to linear bioretention areas. These open channel systems can be flexible in design to accommodate
landscape requirements and can be used to retrofit the natural or design landscape, reduce the
volume of stormwater runoff, provide infiltration, provide filtration, provide groundwater recharge,
and are suitable for runoff from highly impervious areas. These BMPs are either a Tier I or Tier II
practice depending upon whether the practice has an underdrain.

The City requires the design, installation, and maintenance requirements for grass channels and
dry swales to be as outlined in Low Impact Development in Coastal South Carolina: A Planning
and Design Guide (Ellis et al. 2014).

3.12.1.8 Site Reforestation

Site reforestation is a practice in which an impervious area is retrofit with or replaced (entirely or
in part) with a combination of vegetation and trees. This reduces the impervious area and
consequently reduces the peak stormwater runoff flows and overall stormwater volume that
discharges from a site. These BMPs are typically a Tier I practice.

Site reforestation promotes infiltration; reduces the heat island effect, soil erosion, and stream
temperatures; and can provide bank stabilization. When evaluating the feasibility of site
reforestation, consideration should be given to land development code standards, a combination
of site reforestation with other BMPs, the use of site reforestation as a visual buffer or a part of a
filter strip, soil conditions, and the type of trees/vegetation proposed.

The method for incorporating trees into runoff reduction calculations shall be in accordance with
the Green Infrastructure Center Case Study “Trees to Offset Stormwater – Case Study 04:
Charleston, South Carolina” (2018) and the associated calculator tool.

3.12.2 Stormwater Quality Best Management Practices

Stormwater quality BMPs treat or otherwise limit the discharge of pollutants that result from or are
impacted by construction, development, or redevelopment projects. This section describes
several stormwater quality BMPs that are accepted by the City. These Stormwater quality BMPs
help to improve and preserve the water resources in and around the City.

3.12.2.1 Stormwater Filtering Systems - Perimeter Sand Filter

Sand filters are shallow, excavated areas that receive stormwater through overland flow or a
perforated inlet pipe. The stormwater runoff flows through the sand bed and into the underdrain
filtering and treating stormwater pollutants. These BMPs are typically a Tier IV practice, but may
be a Tier II.

A pretreatment device or forebay is required to filter large sediment and debris before entering
the filter to prevent clogging. Sand filters are applicable for a wide variety of uses such as the
perimeter of parking areas or medians between drive lanes. They can also be applicable for sites
with limited space available for water quality features.
3.12.2.2 Dry Detention Practices – Dry Ponds

Dry detention basins or dry ponds are surface storage facilities intended to provide temporary storage of stormwater runoff and to release it at a designed flow rate to reduce downstream water quantity impacts. These practices contain a forebay for capturing the heavier sediment and floatables and are designed to completely drain to a dry condition within 72 hours. These BMPs are a Tier III practice. If the practice can infiltrate significant amounts of stormwater runoff, then the practice should be treated as a bioretention basin.

Dry ponds require a significant footprint (between 1 percent and 3 percent of their contributing drainage area depending on the depth) and are best suited for drainage areas greater than 10 acres. Dry ponds also do not reduce the overall stormwater runoff volume and provide less pollutant removal than other practices.

The City requires the design, installation, and maintenance requirements for dry ponds to be as outlined in Low Impact Development in Coastal South Carolina: A Planning and Design Guide (Ellis et al. 2014). Dry ponds designed and installed in the City shall also meet the following criteria:

- Dry ponds must retain the water quality volume required for Tier III and release it over 24 to 72 hours, unless the pond is in an identified flood-prone area.

3.12.2.3 Wet Pond

Water quality wet ponds are similar to standard extended wet detention ponds, except they contain an aquatic bench along the perimeter of the pond just below the normal pool level and possibly other plantings above the normal pool elevation (safety bench) in the extended detention portion of the pond that provide water quality benefits and detain the stormwater runoff for a slow release over at least 24 hours and no more than 72 hours. The vegetation helps provide water quality benefits. These BMPs are a Tier III practice.

Wet ponds improve water quality by biological uptake and filtering of native plants, sediment settling, including attached pollutant, and detention of stormwater. Wet ponds have a relatively high removal rate for many pollutants, increase biodiversity by providing habitats for wildlife and aquatic life, reduce channel/streambank erosion by reducing the number of bankfull events, and provide an opportunity for multiple use areas, including active and passive recreation. Wet ponds may require complying with South Carolina dam regulations, have a large space requirement, present possible safety concerns with a pool of water (fence may be required), and are not to be used in high groundwater areas.

The City requires the design, installation, and maintenance requirements for wet ponds to be as outlined in Low Impact Development in Coastal South Carolina: A Planning and Design Guide.
(Ellis et al. 2014). Wet ponds designed and installed in the City shall also meet the following criteria:

- Extended detention above the normal pool elevation shall be based on the 2.8 inch, 24-hour storm per Tier III requirements.
- The safety bench should contain plantings to aid in the treatment of the stormwater runoff. Plant selection can be found in Section 3.15.2.

3.12.2.4 Stormwater Wetlands

Constructed wetlands incorporate marsh and pool areas to temporarily store stormwater runoff, treat pollutants, and create habitat. Constructed wetlands are generally shallow, except for the pool areas, and contain dense native aquatic vegetation, typically covering 50 percent of the surface area, that help treat the stormwater. Wetland systems can store runoff, provide extended detention, or incorporate the benefits of a pond in a pond/wetland system. Stormwater wetlands should detain the stormwater runoff for a slow release over at least 24 hours and no more than 72 hours. These BMPs are a Tier III practice.

Constructed wetlands improve water quality through biological uptake through native plants and biodegradation by microorganisms, sediment settling, adsorption, and other chemical/physical processes. Wetlands also increase biodiversity by providing habitat for aquatic and wildlife species and provide an opportunity for multiple uses including passive recreation. Wetlands typically require larger tracts of land, need a regular flow of water (so stormwater runoff may need to be supplemented during dry conditions), and need to be properly designed and managed to reduce the potential to breed mosquitoes. Water quality of the discharge can also change with seasonal growth of plantings.

The City requires the design, installation, and maintenance requirements for stormwater wetlands to be as outlined in Low Impact Development in Coastal South Carolina: A Planning and Design Guide (Ellis et al. 2014). Stormwater wetlands designed and installed in the City shall also meet the following criteria:

- Extended detention above the normal pool elevation shall be based on the 2.8 inch, 24-hour storm per Tier III requirements.

3.12.2.5 Vegetated Filter Strip

A vegetated filter strip is a uniformly graded and densely vegetated area that treats and infiltrates stormwater runoff. The vegetation in the filter strip works to slow down the stormwater runoff, settling and filtering some pollutants and uptaking others. The stormwater runoff volume can also be reduced by infiltration into the pervious soil, if available, and by absorption and evapotranspiration of the vegetation. For a vegetated filter strip to be effective, the stormwater has to enter and flow through the buffer in sheet flow. A vegetated buffer can be managed or unmanaged depending on the desired aesthetics.
Often a vegetated filter strip is used as preliminary treatment of the stormwater prior to entering another permanent stormwater BMP; however, if the soils are suitable, it can be a Tier I practice.

**Vegetated Filter Strip Feasibility Criteria**

The following feasibility criteria shall be considered when designing a vegetated filter strip:

- **Sheet Flow:** A vegetated filter strip should receive stormwater runoff from an upstream impervious area and through sheet flow it is able to treat the runoff and, if the soils allow, infiltrate some of the stormwater runoff volume. For the filter strip to be effective, the runoff needs to enter and flow through the entire strip length in sheet flow. Uniform grading within the strip is required to maintain the sheet flow throughout the strip.

- **Depth to Water Table:** The designer must ensure a standard separation distance of at least 0.5 feet between the seasonally high groundwater table or any soil layers without minimum infiltration rates (e.g. clay lenses) and the bottom invert of the filter strip.

- **Drainage Area:** The vegetated filter is intended to treat runoff from a small contributing drainage area, typically not to exceed 3 acres.

- **Flow Length of Drainage Area:** The flow length of the drainage area shall be less than 300 feet.

**Vegetated Filter Strip Design Criteria**

- **Slope:** The filter strip slope shall be a maximum of 6 percent to allow the flow to move slow enough for the vegetation to filter and settle out the pollutants and for the runoff to infiltrate, if possible. If the slope is less than 1 percent, then ponding water may be produced, which can lead to mosquito concerns.

- **Length:** The length of the filter strip (parallel to flow) shall be a minimum of 25 feet and shall be determined using Equation 3-2.

**Equation 3-2. Calculation of Length of a Vegetative Filter Strip**

\[ L = \frac{T^{1.25} p^{0.625} S^{0.5}}{0.334 n} \]

Where:

- \( L \) = Length of the filter strip parallel to the flow path (feet)
- \( T \) = Travel time through the filter strip (minutes), see Equation 3-3
- \( P \) = Required WQV rain amount
- \( S \) = Slope of the filter strip along the flow path (%)
- \( n \) = Manning’s roughness coefficient, typical values per USDA *Urban Hydrology for Small Watersheds* (1986):
  - Grass, dense grasses, \( n=0.24 \)
  - Range (natural), \( n=0.13 \)
  - Woods, light underbrush, \( n=0.40 \)
Woods, dense underbrush, n=0.80

- **Travel Time**: The amount of time (minutes) water flows through the filter strip shall be calculated as follows:

  **Equation 3-3. Calculation of Travel Time of Water in a Vegetative Filter Strip**

  \[ T = \frac{0.42(nL)^{0.8}}{P^{0.5}S^{0.4}} \]

  Where
  
  - \( T \) = Travel time through the filter strip (minutes)
  - \( n \) = Manning’s roughness coefficient
  - \( L \) = Length of the filter strip parallel to the flow path (feet)
  - \( P \) = Required WQV rain amount
  - \( S \) = Slope of the filter strip along the flow path (%)

- **Width**: The width of a vegetated filter strip is perpendicular to the flow. The width shall be greater than or equal to the width of the contributing drainage area.

- **Velocity**: The velocity of the stormwater runoff across the filter strip shall be less than 2.0 fps using **Equation 3-4**.

  **Equation 3-4. Calculation**

  \[ V = \frac{Q}{dW} \]

  Where
  
  - \( V \) = Velocity (fps)
  - \( Q \) = Peak discharge to the filter strip from the required WQV rain event (cfs)
  - \( d \) = Depth of flow (feet)
  - \( W \) = Minimum width of the filter strip (perpendicular to the flow) (feet)

- **Soils**: A vegetated filter shall be used on soils that have minimal clays and an infiltration rate greater than 0.5 inch/hour. The objective is to use soils that are able to sustain a dense vegetative growth.

### Vegetated Filter Strip Landscaping Criteria

A naturalized planting plan is required for vegetated filters. Native species or native, non-invasive cultivars shall be used in vegetated filters. Plants shall consist of native or native cultivars of deep-rooted herbaceous plants (grasses, forbs, wildflowers), shrubs, and trees. Native plants indigenous to Charleston that are low-maintenance and require minimal watering, weeding, pest control, fertilization, and pruning are ideal for naturalized vegetated filters. For this reason, exotic, non-native species are not suitable for vegetated filters due to watering and other maintenance requirements. Invasive plant species shall be removed if they are present in the vegetated filter.
and replaced with approved native plants. For more information on plant selection, see Section 3.15.2. An inventory of plants present in the vegetated buffer shall be provided in the planting plan.

The plan shall include the following:

- Delineation of filter strip
- Selection or inventory of corresponding plant species
- Sources of native plant material
- Bedding preparation
- Identification of the various planting zones and recommended plants for each planting zone

**Vegetated Filter Strip Construction Sequence**

The following is a typical sequence for constructing or preserving a vegetated filter strip.

1. If the vegetated filter strip is existing, protect it from damage during construction with demarcation and sediment control.
2. Stabilize the portion of the construction site draining to the filter strip. The vegetated filter strip should not be constructed, or if existing, allowed to receive stormwater runoff, until the area draining to the BMP is permanently stabilized.
3. If the filter strip is existing, remove any invasive or undesired species, and complete planting per the planting plan.
4. If the filter strip is to be planted, remove existing vegetation; prepare the soil, including tilling, scarifying, fertilizer, lime, and amendments; and install plantings per the planting plan.

**Vegetated Filter Strip Maintenance Criteria**

Maintenance of the filter strip is important to allow it to function as intended. In general, the inspection and maintenance of vegetated filter strips includes:

- Removal of debris from filter strip and areas immediately upstream
- Local erosion prevention and sediment control
- Irrigation and weeding during the first few months of planting to ensure species establishment
- Maintenance of the health and abundance of native species and plantings
- Removal of any invasive species

A typical maintenance plan is provided in Table 3-8.

**Table 3-8. Example of a maintenance plan for a vegetative filter strip**

<table>
<thead>
<tr>
<th>Maintenance Items</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.12.2.6 Underground Detention

Underground detention is the practice of collecting and detaining stormwater runoff underground in pipes, vaults, chambers, or modular structures. The collected stormwater runoff is intended to be released back to the surface drainage system or storm sewer system at a reduced rate and completely drained prior to the next rain event, similar to a dry detention pond. Underground storage systems may also infiltrate the stormwater into the underlying soils, provided the surrounding soils have the necessary permeability. An underground storage system may be constructed of concrete, steel, or plastic with many proprietary products in the market. This permanent structural BMP is typically a Tier III practice.

Underground detention reduces the peak stormwater runoff flows, requires less installation than other BMPs, adapts to unusual shaped properties, and has increased public safety when compared with other BMPs. These systems provide very little water quality benefit, so additional BMPs or pretreatment devices are required where water quality improvements are needed. These systems also cannot be used in areas with a high groundwater table.

Underground Detention Feasibility Criteria

The following feasibility criteria should be considered when designing an underground detention system:

- **Location:** Underground detention should be located such that the stormwater runoff gravity feeds into and out of the detention system.
- **Accessibility:** Underground detention should be located in areas that can be excavated in the future, should the need arise.
- **Access:** Several manholes/access ports should be provided to allow for maintenance and inspection of the system. Spacing of access ports should consider the ability of equipment intended to be used for maintenance.
• **Space availability:** Sufficient space is needed to locate the required storage volume in accordance with the SWDSM.

### Underground Detention Pretreatment Criteria

Pretreatment, focused on the removal of floatables and sediment, should be provided at the inlets to reduce maintenance efforts and prevent groundwater contamination, if infiltration is provided. Pretreatment may include catch basin inserts or proprietary water quality units.

### Underground Detention Design Criteria

The design of underground detention includes several elements to properly reduce stormwater runoff volumes and reduce peak flow rates into the storm sewer system.

- **Inlet and Pretreatment:** Inlets should be provided in the quantity and size needed for the desired stormwater runoff to enter the underground detention system.

- **Outlet:** The outlet orifices should be sized to prevent clogging, typically no smaller than 8 inches, but provide the required detention of stormwater runoff.

- **Overflow and Bypass:** The underground detention system should have an emergency overflow to allow for safe passage of the larger storm events. In addition, a bypass system should be provided to allow the underground system to be taken out of service if it becomes inoperable.

- **Infiltration:** If the underground detention system intends to infiltrate the stormwater runoff into the surrounding soils, the soils should have a permeability rate of at least 0.5 inches/hour. Pretreatment of the stormwater runoff should be provided to prevent groundwater contamination.

- **Overburden Support:** When selecting the underground detention system material, loading from above should be considered. The loading includes backfill, pavement, and possibly vehicular traffic.

- **Access Ports:** The underground detention system shall be designed with multiple access ports that are of such size and spacing to allow maintenance to be readily performed with the intended type of maintenance equipment. Access shall include provisions for necessary equipment to perform the necessary maintenance in site layout.

- **Drain Time:** The stormwater runoff WQV collected in the underground detention should drain out to a surface drainage or sewer system or infiltrate into the surrounding soils in no less than 24 hours and no more than 72 hours.

### Underground Detention Construction Sequence

The following is a typical construction sequence to properly install an underground detention system:

1. Provide sediment controls and/or diversion berms around the underground detention system installation area to prevent stormwater runoff from entering the excavation area.

2. Install the underground detention system in accordance with manufacturer’s instructions.
3. Install temporary EPSC BMPs around the inlets to prevent any pollutant-laden stormwater runoff from entering the system.

4. Stabilize the portion of the construction site draining to the underground detention system.

5. Once stabilized, remove the temporary EPSC BMPs from around the inlets and place the system in service.

**Underground Detention Maintenance Criteria**

Manufacturer’s guidelines should be followed and an individual maintenance plan should be developed for all systems. In general, maintenance should include cleaning blockage or sediment buildup with use of vacuum trucks or boom trucks. Repairs to inlets, outlets, control valves, or other structures should be performed periodically. Drainage areas should be regularly maintained to prevent the flow of trash, sediment, and debris into the system. The system may need additional cleaning if a spill of a foreign substance enters the unit. Drainage areas should be regularly maintained to prevent the flow of trash, sediment, and debris into the system.

Working inside these units is considered a confined space, so the maintenance plan shall consider the health and safety requirements for working inside a confined space.

A typical maintenance plan is provided in Table 3-9.

Table 3-9: Example maintenance plan for underground detention

<table>
<thead>
<tr>
<th>Maintenance Items</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform cleanout if hazardous or foreign substances are spilled in the drainage areas.</td>
<td>As needed</td>
</tr>
<tr>
<td>Inspect system after major rain events to ensure it is draining properly.</td>
<td>First Year</td>
</tr>
<tr>
<td>Inspect system for blockage or sediment buildup and perform cleanout if necessary.</td>
<td></td>
</tr>
<tr>
<td>Follow manufacturer’s guidelines and develop/adjust maintenance plan for the system.</td>
<td>Annually</td>
</tr>
<tr>
<td>Inspect drainage areas for trash, erosion, and debris.</td>
<td></td>
</tr>
<tr>
<td>Inspect inlets, outlets, and other structural features; repair as needed.</td>
<td></td>
</tr>
<tr>
<td>Clean out the system with vacuum or boom trucks</td>
<td>Every 5 to 10 years</td>
</tr>
</tbody>
</table>

**3.12.2.7 Manufactured Treatment Devices**

Manufactured treatment devices vary based on manufacturer but are typically underground treatment systems installed at inlet structures. These systems are space-efficient and use a swirling vortex or multiple chambers to separate sediments and floatables, such as oil/grease, from stormwater inflow. These devices are commonly used as pretreatment and in series with other BMPs. They are a Tier IV BMP. They are not effective for removal of dissolved pollutants.
and fine particles and can be a potential source of pollutants due to resuspension if maintenance is neglected.

Example manufactured treatment devices include the following:

- **Chambered Devices**: Chambered devices allow water to flow into a sump-like structure separated by vertical baffle plate walls, dividing the structure into chambers. Sediment and debris typically settle out in the first chamber, oil and grease collect at the surface in the first and second chambers, and flow exits the unit out of the third chamber. A filter inside the manufactured treatment device to absorb oil and grease may be necessary for applications receiving runoff from potential hot spots. These structures are typically designed to bypass larger storms.

- **Hydrodynamic Devices**: Hydrodynamic units route flow through the system using a swirling motion where particles of sediment and debris separate and fall to the bottom, while floating materials are retained by a baffle wall. A filter inside the water quality unit to absorb oil and grease may be necessary for applications receiving runoff from hot spots. Hydrodynamic devices are generally effective in treating smaller storms and are typically designed to bypass flow from larger storm events to prevent resuspension of captured sediment and debris.

** Manufactured Treatment Devices Feasibility Criteria **

The following feasibility criteria should be considered when designing a manufactured treatment device:

- **Contributing Drainage Area**: Manufactured treatment devices are optimal for sites less than 5 acres.

- **Space Requirements**: Because these units are compact compared to other permanent BMPs, they can be installed in many locations.

- **Location**: These devices should be located such that the stormwater runoff gravity feeds into and out of them, and they can be readily accessed for maintenance.

- **Access**: Several manholes/access ports should be provided to allow for maintenance and inspection of the system. The spacing of access ports should consider the ability of equipment intended to be used for maintenance and the chambers of the devices.

** Manufactured Treatment Device Design Criteria **

Design requirements and procedures for manufactured treatment devices are outlined below. The designer should work closely with the manufacturer of the devices to ensure that the criteria below are met and the system is adequately sized for the expected stormwater runoff WQV.

- **Location**: Manufactured treatment devices can be installed upstream of BMPs in series for pretreatment. Pretreatment is required for BMPs where maintenance access is limited such as infiltration trenches, etc.

- **Inflow Regulation**: Manufactured treatment devices shall be configured as offline systems, diverting the WQV into the unit for treatment and returning flow to the conveyance system or
downstream BMP. Inflow regulation protects the unit from peak flows while treating the first flush and designed WQV.

- **Pretreatment**: Manufactured treatment devices containing a filter media shall have a pretreatment/settling chamber to remove coarse sediment, solids, and debris that could clog the filter media.

- **Sizing**: Manufactured treatment devices should be sized to treat 100 percent of the design WQV for a Tier IV BMP.

- **Installation**: Installation should occur per manufacturer’s recommendations. A manufacturer’s representative should be present on-site during the installation of the manufactured treatment device to ensure proper installation. Based on the manufactured treatment device chosen, screens may also be installed to prevent mosquitoes and rodents from entering the device.

- **Pollutant Removal**: Pollutant removal varies based on the individual design of the manufactured treatment device and can be customized per manufacturers’ recommendations. At a minimum, units must achieve a TSS removal efficiency of 80 percent based on OK-110 (\(D_{50}=110 \mu m\)) particle size distribution for the peak flow rate and must be approved by the City. If the manufactured treatment device is to be used as pretreatment for another BMP, a minimum of 50 percent TSS removal is required. Manufacturers’ claims for device performance must be verified by data that are obtained through independent, third party testing and submitted for City review and approval. Devices currently New Jersey Corporation for Advanced Technology verified and the New Jersey Department of Environmental Protection certified are acceptable.

- **High Flow Bypass**: Manufactured treatment devices shall be designed to safely bypass flows higher than the requirement for Tier IV to protect the device from the higher flows.

### 3.13 Site Grading Requirements

The grading plan shall include the following general measures at a minimum:

- The finished cut and fill slopes to be vegetated shall not be steeper than 3H:1V.

- Cuts or fills shall not be so close to property lines as to endanger adjoining property without adequately protecting such properties against erosion, sedimentation, slippage, settlement, subsidence, or other damage.

- Fill slopes shall meet the following buffer requirements (This buffer may overlay other vegetated buffers and may contain stormwater features designed to manage stormwater generated by the fill slope. For grades between listed slopes, the necessary buffer shall be interpolated):
  - 3H:1V slopes 2 feet in height or more above the adjoining property shall maintain a 5 foot wide vegetated buffer area with a maximum slope of 5% for each 1 foot of height above the 2 feet of height.
  - 4H:1V slopes 2 feet in height or more above the adjoining property shall maintain a 3 foot wide vegetated buffer area with a maximum slope of 5% for each 1 foot of height above the 2 feet of height.
5H:1V slopes 2 feet in height or more above the adjoining property shall maintain a 1-foot wide vegetated buffer area with a maximum slope of 5% for each 1 foot of height above the 2 feet of height.

- Subsurface drainage shall be provided in areas having a high water table to intercept seepage that would affect slope stability or bearing strength or create undesirable wetness.
- No fill shall be placed where it can slide or wash onto another property.
- Fill shall not be placed adjacent to channel banks where it can create bank failure, reduce the capacity of the stream, or result in downstream sediment deposition.
- Borrow and disposal areas shall be included as part of the grading plan.
- Adequate channels and floodways shall be provided to safely convey increased runoff from the developed area to an adequate outlet without causing significant channel degradation or increased offsite flooding.
- The site shall be graded to direct flows to appropriate controls.

### 3.14 Erosion Prevention and Sediment Control

This section discusses the considerations for EPSC.

#### 3.14.1 Introduction to Erosion Prevention and Sediment Control Requirements

The City requires that an EPSC plan be submitted and approved prior to initiating construction, development, or redevelopment activities. This plan shall describe the practices and controls that will be used during and after construction to meet the following goals:

- Minimize the extent and duration of disturbed soil exposure
- Protect offsite and downstream locations, drainage systems, and natural waterways from the impacts of erosion and sedimentation
- Limit the exit velocities of the flow leaving the site to non-erosive or pre-development conditions
- Design and implement an ongoing inspection and maintenance plan

The design procedures vary depending on the EPSC BMP. Many of the BMPs listed in Table 3-10, Table 3-11, and Table 3-12 do not need to be “designed” using calculations, such as surface roughening or dust control. Others require the use of equations or design aids to be properly designed. SCDHEC has two handbooks, the BMP Handbook (SCDHEC 2005) and the Stormwater Management and Sediment Control Handbook for Land Disturbing Activities (SCDHEC 2003), that provide the procedures and equations needed to design the EPSC BMPs and include example problems for most types of EPSC BMPs. Proper design shall be complemented with proper installation and routine maintenance in order for BMPs to be effective and adhere to the provisions of Section 3.14.
3.14.2 Rainfall, Design Storms, and Design Volumes

3.14.2.1 SCS Procedures

SCS procedures shall be used to determine runoff amounts. When a BMP is designed for the 10 percent probability of exceedance, 24-hour storm event, the BMP shall have a greater trapping efficiency for more frequent events such as the 50 percent probability of exceedance, 24-hour storm event.

3.14.2.2 Sediment Basin Threshold

A sediment detention basin is required when 10 or more acres of disturbed land area drain to a single outlet point. Such basins shall be designed to have a design effluent concentration of 0.5 mg/L peak suspended solid concentration or 80 percent trapping efficiency, whichever is less, and control the 10 percent probability of exceedance, 24-hour storm event to pre-development conditions and successfully pass the 1 percent probability of exceedance, 24-hour storm event. A single sediment basin shall be limited to controlling runoff for up to 20 acres. Sediment traps shall not have more than 5 acres draining to it.

Activities that disturb between 1 and 5 acres that do not drain to a single outlet point may incorporate practices other than a sediment basin to achieve an equivalent removal efficiency.

3.14.3 Accepted Erosion Prevention and Sediment Control Best Management Practices

The types of EPSC BMPs that are acceptable for use in the City are presented in the following sections. These generally fall into three categories: erosion prevention measures, temporary sediment controls, and runoff controls and conveyance measures. Runoff from sites shall contain controls that fall into each one of these categories.

3.14.3.1 Erosion Prevention Measures

Erosion prevention measures shall be used during and after construction site preparation to avert the discharge of runoff highly concentrated with sediment and other associated pollutants. One or more measures are typically needed on a site. Measures that fall into this category along with their preferred application are provided in Table 3-10.

Table 3-10. Erosion prevention BMP suggested uses

<table>
<thead>
<tr>
<th>BMP</th>
<th>Slope Protection</th>
<th>Waterway Protection</th>
<th>Surface Protection</th>
<th>Enclosed Drainage</th>
<th>Large Flat Areas</th>
<th>Borrow Areas</th>
<th>Adjacent Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Roughening</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.14.3.2 Temporary Sediment Control Measures

The City emphasizes preventive measures as the main control to protect against erosion, both during and following construction. However, there are instances where erosion prevention measures alone do not provide sufficient control. For these instances, temporary sediment controls shall be implemented to control the migration of eroded sediment offsite. These temporary sediment control measures are typically only applicable as practices for use during construction. One or more of the measures shall be used as appropriate during the project's construction phase. **Table 3-11** lists some of the suggested controls of this type along with their intended use. Details on these and other measures can be found in Appendix B in SCDHEC (2003).

<table>
<thead>
<tr>
<th>BMP</th>
<th>Slope Protection</th>
<th>Waterway Protection</th>
<th>Surface Protection</th>
<th>Enclosed Drainage</th>
<th>Large Flat Areas</th>
<th>Borrow Areas</th>
<th>Adjacent Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bench Terracing</td>
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<td></td>
<td>X</td>
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<td>Temporary Seeding</td>
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<td>Mulching</td>
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<td>Erosion Control Blankets (ECB) and Turf Reinforcement Mats (TRM)</td>
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<td>Topsoiling</td>
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<td>Permanent Seeding and Planting of Grasses</td>
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<td>Permanent Ground Cover Plants</td>
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<td>Riprap or Aggregate</td>
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</tr>
<tr>
<td>Outlet Protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyacrylamide</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
### Table 3-11. Temporary sediment control BMP suggested uses

<table>
<thead>
<tr>
<th>BMP</th>
<th>Slope Protection</th>
<th>Waterway Protection</th>
<th>Surface Protection</th>
<th>Enclosed Drainage</th>
<th>Large Flat Areas</th>
<th>Borrow Areas</th>
<th>Adjacent Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Volumes and Maintenance Schedules</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Temporary Sediment Basin</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Multipurpose Basin</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Temporary Sediment Trap</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Silt Fence</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rock Ditch Check</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Stabilized Construction Entrance</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Storm Drain Inlet Protection</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Vegetated Filter Strips</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rock Sediment Dike</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

### 3.14.3.3 Runoff Controls and Conveyance Measures

This category of EPSC BMPs shall be used as necessary during and following construction. Suggested varieties and their corresponding uses are provided in Table 3-12.

### Table 3-12. Runoff control and conveyance BMP suggested uses

<table>
<thead>
<tr>
<th>BMP</th>
<th>Slope Protection</th>
<th>Waterway Protection</th>
<th>Surface Protection</th>
<th>Enclosed Drainage</th>
<th>Large Flat Areas</th>
<th>Borrow Areas</th>
<th>Adjacent Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Slope Drains</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary Stream Crossing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
3.14.3.4 Temporary and Permanent Vegetation

Information regarding temporary and permanent vegetation for construction and post-construction activities can be found in the SCDHEC BMP Handbook (2005).


Information regarding EPSC BMP design requirements can be found in the SCDHEC BMP Handbook (2005) and in Appendix E of the *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014). Additional requirements and standards include:

1. **Removal Efficiency**: EPSC plans shall be developed to achieve an 80 percent design removal efficiency goal. Simply applied, when a site is completely denuded of vegetation, the structural and non-structural EPSC measures are designed to trap 80 percent of TSS or 0.5 mg/L peak settable solids concentration, whichever is greater, that are generated by the site. The design storm event associated with this level of control is the 10 percent probability of exceedance, 24-hour SCS Type III storm event. Calculations using models, such as SEDPRO or SEDCAD, or SCDHEC design aids shall be provided to show adherence to these criteria.

2. **Non-Structural Site Management Practices**: The following non-structural site management practices shall be used on the plans where applicable:
   a. Minimize site disturbance to preserve and maintain existing vegetative cover.
   b. Limit the number of temporary access points to the site for land disturbing activities.
   c. Protect offsite and downstream locations, drainage systems, and natural waterways from the impacts of erosion and sedimentation.
   d. Phase and sequence construction activities to minimize the extent and duration of disturbed soil exposure.
   e. Implement an ongoing inspection and maintenance plan. Maintenance schedules are provided in SCDHEC (2005).

3. **Sediment Storage Volumes**: Sediment storage volumes shall be calculated for all sediment controls to determine the required clean-out frequencies and maintenance schedules. The
Universal Soil Loss Equation or other acceptable methods that determine sediment yield may be used to predict the required sediment storage volumes for specific sediment control structures.

4. Alternative EPSC Controls: To encourage the development and testing of innovative alternative EPSC BMPs, alternative management practices that are not included in the SWDSM may be allowed upon review and approval by the Department of Stormwater Management. To use an alternative BMP, the design engineer shall submit substantial supporting documentation that the proposed measure will perform at least equivalent to currently approved BMPs contained in the SWDSM. Documentation shall include, but is not limited to, the following:

   a. Supporting hydraulic and trapping efficiency calculations
   b. Peer-review by a panel of licensed professional engineers
   c. Research results as reported in professional journals
   d. Manufacturer literature

5. EPSC Plans:

   a. Detailed EPSC plans shall comply to the maximum extent practicable with the following specific standards and review criteria:
      
      i. Sediment tracking control shall be implemented using stabilized construction entrances that are located and used at all points of ingress and egress on a construction site. The transfer of soil, mud, and dust onto roads shall be prevented.
      
      ii. Crossings of waterways during construction shall be minimized and shall be approved by the Department of Stormwater Management and possibly the USACE. Encroachment into stream buffers, riparian areas, and wetlands shall be avoided.
      
      iii. Topsoil shall be stockpiled and preserved from erosion or dispersal during and after site grading operations.
      
      iv. Where construction, development, or redevelopment will or have temporarily ceased on any portion of a site, temporary site stabilization measures shall be implemented as soon as practicable, but no later than 14 calendar days after the activity has ceased. Hydroseeding shall be done as often as necessary to avoid bare areas of soil. Stabilization of disturbed areas is one of the best approaches for EPSC.
      
      v. Slopes shall be stabilized through grassing, hydroseeding, synthetic or vegetative matting, diversion berms, temporary slope drains, etc., and shall be performed within 2 working days after the necessary grading (temporary or permanent) has been achieved.
      
      vi. Final stabilization of the site shall occur within 14 calendar days of construction completion.
      
      vii. Temporary structural controls installed during construction shall be designed to accomplish maximum stabilization and control of erosion and sedimentation and shall be installed, maintained, and removed according to the specifications set forth in the SWDSM and project specifics developed as part of the permit application and engineering calculations. Temporary structural controls shall be designed to control the peak runoff resulting from the 10 percent probability of exceedance, 24-hour storm event.
      
      viii. Permanent structural controls, including drainage facilities such as channels, stormwater inlets, and detention basins, shall be cleaned out as part of the project closeout and Notice of Termination (NOT) processes.
ix. Linear projects (utility lines, road construction) over, under, or along a waterbody shall include measures and controls that adequately protect the waterbody from undue impact. Such work shall not be performed without approval from USACE. In addition, such work shall be coordinated with the installation of EPSC measures so that disruption is minimized. Every effort shall be made to install utilities during the initial construction phases. Trench sharing is encouraged to the extent practicable.

b. EPSC plan shall contain the following information in a cohesive and easy-to-follow manner:

i. Location of all EPSC BMPs on construction documents

ii. Delineation of sensitive features (wetlands, streams, ponds, existing stormwater structures, etc.) and potential sediment sources

iii. Installation sequencing and maintenance schedules for EPSC BMPs during and after construction

iv. Provisions to preserve topsoil and limit the amount of total disturbed area

v. Details of site grading

vi. Design details and computations for EPSC BMPs

vii. Protection of storm drain inlets and outlets

viii. For sites that disturb greater than 5 acres, a list or calculation of the trapping efficiency for all EPSC BMPs

ix. For sites that disturb greater than 5 acres, calculations of required sediment storage volumes for all EPSC BMPs

x. Explanation of any computer models or software used with highlights of or notes on the output data

xi. Location of temporary and permanent soil disposal areas, haul roads, and construction staging areas to minimize erosion, sediment transport, and disturbance to existing vegetation

3.15 Landscape Design

Landscape design with the intention of reducing stormwater runoff improves the function and appearance of stormwater BMPs. Designing landscapes with stormwater routing as an objective can provide benefits, such as lower construction costs, reduced maintenance, aesthetic enhancement, increased property value, and improved long-term functionality. Once established, a well-designed landscape can prevent soil erosion post-construction. Other benefits of a well-designed landscape include mitigation of urban heat island effects, improved air and water quality, improved local habitat and ecosystems, and reduced atmospheric carbon levels.

Site improvements shall include the installation of landscaping and the maintenance of existing landscaping as required by the Zoning Administrator. A landscaping plan must be provided with the overall construction plans and must include species selection.
3.15.1 Best Management Practice Soils and Compaction

Soils in the landscaping areas should be protected, amended as needed, and treated similar to soils of green infrastructure. Refer to the *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al. 2014) for guidance on green infrastructure soils. Disturbed soils in areas of fill or heavy equipment operation that will be vegetated in the final site stabilization shall be scarified or treated as directed by the designer to improve infiltration and water retention prior to final establishment of vegetation.

3.15.2 Plant Selection

Plants play a vital role in natural drainage patterns, and landscape-based stormwater treatment (vegetated BMPs) is encouraged as an effective, aesthetic, and relatively simple way to achieve LID goals. Plants can be used to aid in infiltration, evapotranspiration, sedimentation, pollutant trapping, phytoremediation, and soil stabilization. Given these varying and important functions, each planting plan shall be carefully designed and shall be site and BMP specific with the long-term goal of naturalization.

Plant selection must take several factors into consideration to ensure plant success, including but not limited to, geographic region, soil characteristics (type, moisture, and pH), sunlight and water availability, wildlife (attracting or deterring), salt tolerance, planting season, and proximity to existing and proposed infrastructure. In addition, plants shall be selected that can tolerate heat, coastal conditions, flooding, and high winds.

It is also important to determine whether temporary or permanent vegetation is required. Temporary seeding is recommended to serve as EPSC until permanent vegetation is established. This method uses quickly growing plants to provide rapid ground cover. Permanent vegetation should be established once construction is complete, and future maintenance must be taken into consideration. Vegetation should be selected that minimizes the need for fertilizers, pesticides, irrigation, and mulching.

When selecting plants, it is important to select native (recommended) and non-invasive species that will thrive together. Several sources from the State of South Carolina list native plant and tree species, such as the South Carolina Wildlife Foundation and South Carolina Forestry Commission. For guidance on determining which plant species will best suit a project, the Carolina Yards Plant Database is a tool that has over 300 plants that are suited to grow in South Carolina and has plant recommendations that benefit specific stormwater BMPs. The database was created through the collaborative effort of the Clemson Cooperative Extension, Carolina Clear, and South Carolina Master Gardener. These programs are helpful resources that aim to provide stormwater education, outreach, and opportunities for public involvement. Table 3-13 includes websites for plant selection resources.

Table 3-13. Resources for plant selection
Plants that are known to be or could potentially be invasive are illegal in the State of South Carolina via the South Carolina Noxious Weed Act shall not be used. Invasive species are defined as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. **Table 3-14** lists State and Federal resources that can be consulted to help determine whether a specific species of plants is invasive.

### Table 3-14. Resources for invasive plant species

<table>
<thead>
<tr>
<th>Resource</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA NRCS</td>
<td><a href="https://plants.usda.gov/java/noxious?rptType=State&amp;Statefips=45">https://plants.usda.gov/java/noxious?rptType=State&amp;Statefips=45</a></td>
</tr>
<tr>
<td>South Carolina Exotic Pest Plant Council</td>
<td><a href="https://www.se-eppc.org/southcarolina/index.cfm">https://www.se-eppc.org/southcarolina/index.cfm</a></td>
</tr>
<tr>
<td>South Carolina Native Plant Society</td>
<td><a href="https://scnps.org">https://scnps.org</a></td>
</tr>
</tbody>
</table>

### 3.15.3 Fertilizer, Pesticides, Irrigation, and Mulch

Final stabilization of a site includes establishing the flora landscape quickly. While plant selection includes limiting maintenance (needing the use of fertilizer, pesticide, irrigation, and mulch), these may be needed to quickly establish vegetation after completion of construction activity (**Table 3-15**). Frequent inspections are necessary to check that conditions for growth are good.

### Table 3-15. Landscaping activity to establish final stabilization vegetation

<table>
<thead>
<tr>
<th>Landscaping Activity</th>
<th>Requirement</th>
</tr>
</thead>
</table>
| Fertilizer           | • A minimum of 1,000 pounds per acre of a complete 10-10-10 fertilizer (23 pounds per 1,000 square feet) or equivalent should be applied during permanent seeding of grasses unless a soil test indicates a different requirement.  
|                      | • Fertilizer and lime (if used) should be incorporated into the top 4 to 6 inches of the soil by disking or other means where conditions allow. Do not mix the lime and the fertilizer prior to the field application. |
Landscaping Activity | Requirement
--- | ---
Pesticide | • Use of pesticides during final stabilization is prohibited.

Irrigation | • Permanent seeded areas should be kept adequately moist, especially late in the specific growing season.
• Irrigate the seeded area if normal rainfall is not adequate for the germination and growth of seedlings.
• Water seeded areas at controlled rates that are less than the infiltration rate to prevent runoff and erosion.

Mulching | • Permanent seeded areas should be covered with mulch immediately upon completion of the seeding application to retain soil moisture and reduce erosion during establishment of vegetation.
• The mulch should be applied evenly in such a manner that it provides a minimum of 75 coverage.
• Typical mulch applications include straw, wood chips, bark, wood fiber, and hydro-mulches.
• Mulch applications shall be dry and free from mold damage and noxious vegetation.
• Light weight mulch applications shall be anchored with netting or asphalt emulsions to prevent it from being blown or washed away.

3.16 Maintenance Access and Easements

The following section provides the required easement widths for various components of the stormwater system. In all cases, there will be an allowance for offset easements, in which the pipe, channel, or other stormwater system components do not necessarily have to be in the middle of the easement width but may be offset to allow for certain construction needs. Proposed offset easements will be identified and additional width may be required as prescribed by the Department of Stormwater Management.

3.16.1 Stormwater Pipe

Drainage easements shall provide adequate room for maintenance equipment to operate and maintenance activities to occur. Table 3-16 provides minimum drainage easement widths for typical situations:

<table>
<thead>
<tr>
<th>Pipe size (inches)</th>
<th>Maximum depth to invert (feet)</th>
<th>Width of drainage easement (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - 18</td>
<td>3.5</td>
<td>16</td>
</tr>
<tr>
<td>21 - 24</td>
<td>5.0</td>
<td>20</td>
</tr>
<tr>
<td>27 - 42</td>
<td>7.0</td>
<td>26</td>
</tr>
<tr>
<td>48 - 54</td>
<td>7.0</td>
<td>30</td>
</tr>
<tr>
<td>60 - 72</td>
<td>9.0</td>
<td>36</td>
</tr>
</tbody>
</table>

Notes:
(1) For depths greater than shown, add 2 feet for each additional foot to the invert.
(2) For pipe sizes not specifically listed above, the easement width and depth to invert shall be that of the next larger size.
(3) For larger pipe sizes and/or multiple lines of pipe, easement width shall be as determined by the Director of Public Service or their designee.

3.16.2 Open Conveyances

A minimum easement width for any open conveyance is 20 feet. For open conveyances with trapezoidal geometry or a depth greater than 2 feet, a minimum width of 15 feet shall be provided for a maintenance shelf in addition to the easement for the channel. For channels where the depth exceeds 4 feet, a shelf may be required on both sides of the channel as determined by the Director of Stormwater Management.

3.16.3 Detention Ponds

An access easement with a width of 20 feet, minimum, shall be provided from the right-of-way to the pond. In addition, the entire pond and sufficient access room on the perimeter shall be included as part of the drainage easement that will include a minimum width of 20 feet outward from the top of the bank for the bench. The perimeter easement around the top of the bank of a pond shall have a maximum cross slope of 10H:1V.

3.16.4 Other Stormwater Facilities and Best Management Practices

All other structures used for the control of stormwater runoff (quantity or quality) not otherwise covered above shall have an easement for access and maintenance that is a minimum of 10 feet beyond the boundary of any such structure. The Department of Stormwater Management may require or allow other easement widths on a case-by-case basis given site constraints or special conditions.

3.16.5 Offsite Easements

Any required offsite easements shall be obtained prior to construction activity that would impact that area. Any work done without proper and adequate easements shall be at the owner's own risk. Non-subdivision projects shall provide validation of necessary easements before a construction activity application approval will be given.

3.17 Additional Design Considerations

Apart from designing a site to meet established water quantity and quality requirements, the interaction of the public with the stormwater management system should also be considered. Public safety should be a top priority when designing a stormwater management system, as this is essentially the purpose of water quantity and quality requirements. Promoting public education of the stormwater system’s intended function helps to ensure the effectiveness and longevity of the constructed design.
3.17.1 Safety

In general, safety considerations in stormwater design are limited to directing stormwater away from public property and restricting access to stormwater facilities. An emergency spillway shall be included in all stormwater pond designs and shall be designed to safely pass extreme flood flow. Stormwater flows should be discharged from ponds in a manner that prevents erosion at the outfall.

The principle outfall shall not permit access by small children. Pipe outfalls greater than 24 inches in diameter should be fenced or include a trash rack in the design to prevent access.

A safety bench shall be provided for embankments greater than 10 feet in height and having a side slope steeper than 3H:1V. The safety bench shall extend no less than 15 feet outward from the normal water edge, and the slope shall not exceed 10H:1V. Warning signs should be posted near ponds to prohibit swimming and fishing.

3.17.2 Signage and Stenciling

Signage should be provided near stormwater facilities to help educate the public and restrict access as necessary. Educational signage varies from interpretive signs that explain the function of BMPs, to signs intended to prevent the public from damaging BMPs or polluting stormwater. For BMPs requiring a buffer strip of native vegetation, signage designating the area as a “no mow” zone should be provided. In designated green spaces, signs should be posted to restrict the public from dumping yard waste or littering. Signs shall be constructed with durable materials and shall be warranted for a period of at least 5 years. Manhole lids and catch basins shall contain a label identifying the system as stormwater and marked with an appropriate stormwater awareness message such as “No Dumping – Drains to Waterways.

Stormwater facilities intended to have restricted access shall have signs posted indicating the facility-specific access restriction. Signs at stormwater ponds should indicate that no swimming is allowed.
Chapter 4 Construction Activity Permitting

4.1 Overview of Application/Approval Process

This chapter provides applicants (including, but not limited to, developers, owners, engineers, and contractors) with the information needed to obtain approval of a stormwater management plan from the City as required for certain construction, development, and redevelopment activities within the city. This chapter describes conditions when City approval is needed, the types of applications that apply based on the construction activity, application package and submittal requirements, and criteria for design exceptions (formerly variances).

4.2 Roles and Responsibilities

This section of Chapter 4 details the responsibilities of all parties affected by the application/approval process. These parties include the City, the Applicant, the Owner/Operator (Permittee), and the Engineer-of-Record.

4.2.1 City of Charleston Stormwater Management

The City will process and approve, or reject, permit documentation related to construction activities in accordance with the requirements set forth in this SWDSM. The City will have Certified Stormwater Plan Reviewers assess each application.

4.2.2 Applicant, Owner/Operator (Permittee)

In accordance with applicable local, State, and Federal stormwater requirements including, but not limited to, the NPDES CGP, owner/operators are responsible for conducting construction, development, and redevelopment projects.

The Primary Permittee has operational control over the SWPPP and the construction plans and specifications, including the ability to request modifications to those plans (typically the owner or developer).

The Secondary Permittee is an individual lot owner or residential builder that conducts land-disturbing activity at a construction site that is limited to an individual lot or a group of lots that are part of an LCP.

In addition to the responsibilities outlined in the City of Charleston Ordinance and in other sections of this SWDSM, during construction, development, or redevelopment activity, the owner/operator shall carry out the proposed work in accordance with the approved plan, specifications, and schedule and in compliance with the requirements of the City of Charleston Ordinance and this SWDSM. SCDHEC may request additional information from the applicant for NPDES permit compliance, which may result in changes to the technical report or construction plans. Such changes shall be provided to the City as well. During construction, the owner shall conduct
inspections of temporary erosion and sediment controls on the site in accordance with the submitted and approved maintenance schedule, and if applicable, the NPDES permit from SCDHEC OCRM.

4.2.3 Engineer-of-Record

The Engineer-of-Record is the individual who provides their signed seal, or stamp, on the construction documents including, but not limited to, stormwater management reports and construction plans.

Signed construction plans with Certificates of Authorization shall be included as part of the approval application in the number required by the City’s TRC.

A Qualified Individual is a person who is knowledgeable in the principles and practices of stormwater management and infrastructure and who possesses the skills to assess the quality of the infrastructure installation.

4.3 Permanent Structural Stormwater Facility Ownership

This section of Chapter 4 specifies who is responsible for owning and maintaining the stormwater facilities, inclusive of conveyances, for both residential and non-residential developments. The necessity for easements is also addressed in this section.

4.3.1 Residential

Ownership of residential permanent structural stormwater facilities (green infrastructure, ponds, etc.) shall belong to the owner of the parcel or to the Home Owners’ Association (HOA). The City will maintain the stormwater conveyances (pipes, junction boxes, inlets, etc.) that convey water from public infrastructure. Easements shall be granted to the City for maintenance where stormwater conveyances are located on private property.

4.3.2 Non-Residential

Ownership of the entire non-residential stormwater system (permanent structural facilities, conveyances, BMPs, ponds, etc.) shall belong to the owner.

For any project, the owner of a portion or the entire non-residential stormwater system shall be clearly designated before a construction activity approval will be given by the City. Ownership shall also be recorded on the final plat. Ownership shall imply responsibility for maintaining the entire non-residential stormwater system. Ownership does not imply that the owner(s) may in any way alter the size or function of any component of the stormwater system without consent from the City. Owners found altering such components shall be required to remove any alterations and restore the stormwater system to its approved condition.
4.3.3 Easements

City maintained stormwater conveyances located on private property and outside of the City right-of-way shall be located in a publicly dedicated easement. See Section Error! Reference source not found. for easement width discussion.

4.4 Construction Activity Applications

A party wanting to construct, develop, or redevelop in the City limits is subject to the requirements determined by the application type: CAA shall be made via the City’s Citizen Access Portal (CAP). (Applicants MUST register for a CAP account at https://cap.charleston-sc.gov/energoveprod/citizenaccess/site/public/main in order to submit an application.) Construction activity applications for review and approval under this chapter may be obtained by contacting the City and initiated by petition of (1) all the owners of the property that is the subject of the application or (2) the owners’ authorized operators. The application package shall be uploaded to the CAP and then distributed to the necessary City departments for their review and approval. Once an application is approved by the City, documentation of such approval and a signed set of construction plans will be issued through the City’s TRC. The City may require applicants that need certain permit coverage from any State or Federal agency to have such permits in hand prior to approving a CAA.

Applications required in this SWDSM will be considered complete only if they are submitted in the required format, include mandatory information, and are accompanied by the fees established in this SWDSM (see Section 4.9.1). An application that is determined to be incomplete will be returned to the applicant along with an explanation of the application's deficiencies via the CAP. Fees established in this SWDSM will not be refunded. No further processing of the application will occur until the deficiencies are corrected. Once the deficiencies are corrected, the application may be resubmitted via the CAP without the payment of additional fees established in this SWDSM, provided that it is resubmitted within six months of the date that the application was returned to the applicant. Applications resubmitted more than six months after the date that the application was returned as incomplete will require repayment of applicable fees established in this SWDSM.

Whenever the procedures of the City expressly State that applications are to be submitted after a pre-submittal meeting (see Section 4.5.4), applicants shall schedule and attend such meetings. When pre-submittal meetings are required, an application will not be accepted until the pre-submittal meeting has been conducted.

Once a complete application has been forwarded to the Department of Stormwater Management, the Department will review the application and either approve, deny, make comments, or request additional information from the applicant as part of the TRC or Subdivision Review Committee process.

If review comments or requests for additional information are required or a denial is issued, a letter detailing the comments, requests, or reasons for the denial will be issued to the applicant.
Prior to replying to this letter, a meeting between the City and the engineer/developer may be required to be scheduled and attended by the applicant. If a meeting is required, the applicant may submit a reply after the meeting has been held.

If the reply from the applicant does not contain the requested information, another letter will be issued by the City to the applicant. The applicant must then reply with the requested information. This process will continue until all information needed by the City has been received.

ALL CORRESPONDENCE BETWEEN THE CITY AND APPLICANT WILL BE FACILITATED VIA THE CITY’S CAP.

4.5 Types of Applications

This section of Chapter 4 details the various types of applications and the requirements for each. The City currently has five applications that are specific to the type of construction activity. Those activities are SFR, Small Construction (Type I), Medium Construction (Type II), Large Construction (Type III), and Linear/Utility.

4.5.1 Single Family Residence Applications

SFR construction shall require the submittal of a complete building permit application. This application requires the completion of an EPSC certification form by the owner or contractor to ensure that measures will be installed and maintained during construction to prevent the discharge of sediment-laden runoff and to prevent the construction from causing noncompliance for adjacent construction activities that may be under another city, State, or Federal permit.

SFR construction not part of a larger common plan of development shall also provide a scale site plan for pre-development and post-development conditions. The site plan shall include:

- North Arrow
- Scale
- Delineated wetlands
- Easements
- 1 foot interval topographic contours
- Flow arrows delineating stormwater drainage paths
- Site grading necessary to convey water from new impervious area to public stormwater drainage systems
- Any BMPs installed for post-construction stormwater management

4.5.2 Small Construction Activity Applications (Type I)

A construction, development, or redevelopment activity that falls within the following parameters shall use a Type I application:
The following submittal shall be provided as part of a complete small construction activity application:

1. **Application Form**: The applicant shall complete the Small Construction Activity Application form (Error! Reference source not found.). Information requested in the form shall be provided and the certifications shall be signed.

2. **EPSC Certification Form**: This certification requires that measures be installed and maintained to prevent the discharge of sediment-laden runoff and to prevent construction from causing noncompliance issues for adjacent construction activities that may be under another city, State, or Federal permit.
   - a. Pre-development and Post-development site plans including the following items:
   - b. North Arrow
   - c. Scale
   - d. Delineated wetlands
   - e. Easements
   - f. 1 foot interval topographic contours
   - g. Flow arrows delineating stormwater drainage paths
   - h. Site grading necessary to convey water from new impervious area to public stormwater drainage systems

3. A checklist of guidelines for submittal is located in Error! Reference source not found..

### 4.5.3 Medium Construction Activity Applications (Type II)

A construction, development, or redevelopment activity that falls within the following parameters shall use a Type II application:

- Construction, development, or redevelopment activities disturbing at least 1 acre, but less than 5 acres, regardless of proximity to a receiving water.
- Construction, development, or redevelopment activities disturbing 0.5 acre to 1 acre within 0.5 mile of a receiving water.

Some medium projects may be required to comply with conditions for large construction activities such as those developments that have a high potential for waterbody impacts as determined by the City. The following submittal shall be provided as part of a complete medium construction activity application:
1. **Application Form**: This form, as shown in Error! Reference source not found., serves as the City’s form and Notice of Intent (NOI) to SCDHEC OCRM. Information requested shall be completely filled in. Certifications shall be signed.

2. **Site Narrative**: A narrative shall be submitted with the application describing the site in general, purposes of the construction activity, topographic and soil information, adjacent properties and owners, waterbodies receiving stormwater runoff (existing and proposed), anticipated starting and completion dates of the various stages of the construction activities and the expected date of final stabilization, existing water quality and flooding issues, and anticipated impacts and benefits. If applicable, the narrative shall also contain justification for design exceptions or other special conditions for the site. Also, if applicable, wetland and waterbody disturbance issues shall be discussed along with details on the status of necessary permit applications to the USACE. If a TMDL is in place for the receiving waterbody, the narrative shall describe how the project will comply with the TMDL. The narrative shall also discuss the roles and responsibilities of co-responsible parties and others involved in the construction, development, or redevelopment activity.

3. **Sketch**: A sketch of the project area shall accompany the narrative and contain the following:
   a. Site location drawing of the proposed project showing the project location in relation to roadways, jurisdictional boundaries, streams, rivers, lakes, and the boundary lines of the site to be developed
   b. Identification of areas within the site that will be included in the construction activities and a calculation of the total disturbed area
   c. Location of temporary and permanent structural stormwater management controls

4. **Stormwater Technical Report**: The technical report shall be prepared by a licensed professional engineer and submitted as part of the application package. This report shall consist of maps, supporting design calculations for the proposed stormwater system, and erosion measures used during construction, and shall include, but not be limited to, the following:
   a. Pre-development hydrologic analysis that determines the existing stormwater peak flow rates, flow velocities, runoff volumes, and pollutant loads for delineated sub-basins/discharge points. The natural or historic condition will be the standard by which the stormwater plan for a construction, development, and redevelopment activity is evaluated.
   b. Post-development hydrologic analysis that determines the existing stormwater peak flow rates, flow velocities, runoff volumes, and pollutant loads for delineated sub-basins/discharge points. The stormwater plan shall demonstrate control of runoff quantity and quality in accordance with the design criteria provided in Error! Reference source not found..
   c. Stormwater management system design to include:
      i. Description of the stormwater management system, methodologies used in the design, existing and proposed runoff patterns, outfalls, offsite run-on, and critical downstream areas.
      ii. Map(s) showing the location of existing and proposed stormwater management control facilities and outfalls.
      iii. Supporting calculations that demonstrate that the system meets the City’s requirements for runoff rates, volumes, and pollutant loads. The following computations shall be included: hydrographs, routing of hydrographs through system components, estimates of trapping
efficiencies of each BMP used, pipe and open channel capacity, velocity calculations, and water surface elevations. System components shall have standard details and specifications.

iv. Calculations for energy dissipation, fill slopes and embankments, and channel stabilization.

v. Explanation and discussion of models used in the design.

d. If the project is located in a stormwater management area, a comprehensive evaluation of engineering calculations and analysis shall be included that demonstrates the project will not negatively impact current drainage conditions and will comply with State and Federal conditions on stormwater discharges.

e. EPSC plan to include:

i. Description of the EPSC facilities selected.

ii. Map showing the location of EPSC facilities.

iii. Design calculations of each measure, including trapping efficiencies. Each measure shall also have a standard detail and specification.

iv. Explanation and discussion of models used in the design.

f. Downstream analysis calculations showing the effect of post-development design flows on downstream stormwater conveyance systems and channels.

g. Watershed delineation maps with consistent sequential notations.

h. Location map showing topography and waters of the State in relation to proposed project.

i. Discussion and calculation of any wetland issues.

j. Map showing type and classification of soils expected to be encountered or used at the development site including imported soils.

k. Presentation of existing and proposed contours at the development site.

l. General description of the adjacent properties and description of existing structures, buildings, and other fixed improvements located on surrounding properties.

m. Discussion of site access issues and easements to be obtained and provided to the City.

5. Construction Plans: The information required on the construction plans shall include, but is not limited to, the following list. Other items may be required by the City. Some items may be included in other components of the application package, but this shall be adequately noted on the construction plans. D-Size or larger plan sheets/drawings are required. Drawing scale shall be large enough to show required detail at the discretion of the City.

a. North arrow and scale.

b. Property lines, adjacent landowners’ names, and land use conditions.

c. Legend.

d. Licensed engineer’s seal.

e. Certificate of Authorization seal.

f. Existing and proposed contours and land uses.

g. Limits of disturbed area.
City of Charleston  Stormwater Design Standards Manual  Construction Activity Permitting

h. Delineation of wetlands and waters of the State.

i. Easements.

j. Stormwater system profiles with existing and proposed ground elevations.

k. Construction sequence. The purpose of a construction sequence is to list and describe the order of events and activities for a construction site. This sequence must include the following:

i. The order in which planned major construction activities that relate to soil disturbance will occur and the anticipated timing.

ii. It must start with the installation of the construction entrance(s) and perimeter control BMPs and it must end with the removal of temporary BMPs and the construction of permanent stormwater control measures once final stabilization has been reached.

l. Locations of temporary and permanent structural control measures.

m. Details for temporary and permanent structural control measures.

n. Grassing and stabilization specifications and schedule.

o. Maintenance requirements (for temporary and permanent structural controls).


q. Tree protection, preservation, and overall landscaping plan with appropriate species selection and screening for ponds and other components required by the City’s Zoning Ordinances.

r. Details and specifications of necessary construction components.

s. Location map.

t. A cover sheet that contains, at a minimum, the following items:

i. Project name

ii. Engineer’s contact information to include name, mailing address, telephone, and fax

iii. Owner or operator contact information to include name, mailing, address, telephone, and fax

iv. Vicinity map

v. Table of contents

vi. Tax map number

u. Drawing elevations shall be based on the North American Vertical Datum (NAVD) 88 datum clearly stated on all sheets of plan sets where elevations are noted and referenced to the state plane coordinate system North American Datum (NAD) 83 Federal Information Processing Standard (FIPS) 3900 feet.

v. The following standard notes shall be shown on the plans. This list is not meant to be exhaustive and other notes shall be included as necessary:

i. Slopes that exceed 8 vertical feet shall be stabilized with synthetic or vegetative mats in addition to hydoseeding. It may be necessary to install temporary slope drains during construction. Temporary berms may be needed until the slope is brought to grade.
ii. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after work has ceased, except as stated below:

1. Where stabilization by the 14th day is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable.

2. Where construction activity on a portion of the site is temporarily ceased and earth-disturbing activities on that portion of the site will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the site.

iii. Final stabilization shall provide 70 percent or more of permanent cover, whether it is vegetative or non-vegetative.

iv. EPSC measures shall be routinely inspected every seven days and after each rainfall occurrence that exceeds 0.5 inch. The inspection schedule shall be clearly stated on the plans and in the EPSC Plan. Damaged or ineffective devices shall be repaired or replaced.

v. Silt fence and/or other sediment control devices shall be provided to control sedimentation during utility construction. Disturbed areas shall be cleaned, graded, and stabilized with grassing immediately after the utility installation.

vi. EPSC measures shall be properly maintained during all phases of construction until the completion of construction activities and disturbed areas have been finally stabilized. Additional EPSC measures may be required during construction to prevent erosion and offsite sedimentation. Temporary control devices shall be removed once construction is complete and the site is finally stabilized.

vii. Sediment track-out shall be minimized by using approved construction entrances at all points that exit onto paved roads and restrict vehicle use to properly designated exit points. Sediment shall be removed from pavement as required.

viii. Residential subdivisions require EPSC features for infrastructure as well as for individual lot construction. Individual property owners shall follow these plans during construction.

ix. Temporary diversion berms and/or ditches shall be provided as needed during construction to protect work areas from upslope runoff and/or to divert sediment-laden water to appropriate traps or stable outlets.

x. If water is encountered while trenching, the water shall be filtered to remove any sediment before being pumped back into waters of the State.

xi. Sediment controls shall be installed along perimeter areas of the site that will receive pollutant discharges and remove sediment before it has accumulated to one-third of the aboveground height of perimeter control.

xii. Stockpiles shall be located outside of natural buffers and away from stormwater conveyances, drain inlets, and areas where stormwater flow is concentrated. A sediment barrier shall be installed along down gradient perimeter areas. For piles that will be unused for 14 or more days, cover or appropriate temporary stabilization shall be provided.

xiii. Dust generation shall be minimized in areas of exposed soil or gravel through the appropriate application of water or other dust suppression techniques.

xiv. Storm drain inlets shall be protected by installing inlet protection measures that remove sediment from discharges prior to entry into a storm drain inlet. Clean, or remove and
replace, the protection measures as sediment accumulates, the filter becomes clogged, or
performance is compromised.

xv. Erosion controls and velocity dissipation devices shall be used within and along the length
of any stormwater conveyance channel and at any outlet to slow down runoff to minimize
erosion.

xvi. Litter, construction debris, oils, fuels, building products with significant potential for impact
(such as stockpiles of freshly treated lumber), and construction chemicals that could be
exposed to stormwater shall be prevented from becoming a pollutant source in stormwater
discharges.

6. **Plans and Specifications**: Activities shall have a complete set of plans and specifications to
include, but not be limited to, the following items, as appropriate:

   a. Lot layout/site plan and staking
   b. Acreage
   c. Road plan/profiles
   d. Storm drainage plan/profile
   e. Drainage areas (both onsite and offsite) with characteristics
   f. EPSC measures
   g. Utilities (water and sanitary sewer)
   h. Permanent structural stormwater management facilities
   i. Traffic patterns with temporary (construction) traffic signage

7. Plans shall provide existing and proposed contours with intervals of not more than 1 foot. Where
possible, and as needed, contour lines shall be extended beyond the site boundary lines. While
some of these items lend themselves to combining information on a single sheet/drawing, care
shall be taken to ensure that plans are not overcrowded or cluttered. The lot layout sheet shall
show a tie distance from the primary entrance of the proposed project to the nearest existing
intersection.

8. **Benchmarks and Elevations**: Available or used benchmarks and elevations shall be shown on
this or other applicable sheets. At least one benchmark shall be available or established on or near
(within survey instrument sight distance) the site. The benchmark shall be referenced to NAVD 88.

9. **Construction Schedule**: The applicant shall provide a tentative construction time schedule for the
development. EPSC measures shall be some of the first work at a site and such implementation
shall be demonstrated on the plans. The schedule shall also provide for coordination with the
responsibilities of all parties and other contractors, including those installing utilities.

10. **Specifications**: Specifications for components of construction activities related to grading, utilities,
EPSC, temporary and permanent vegetation, and water quality BMPs.

11. **Maintenance Schedules and Maintenance Covenants**.

12. **Datum**: Datum used for plans must be clearly stated on documentation including, but not limited
to, all sheets of construction plans sets where elevations are noted and all supporting
documentation.
4.5.4 Large Construction Activity Applications (Type III)

A Type III application shall be completed for construction, development, and redevelopment activities that disturb an area that is 5 acres or greater. The following submittal shall be provided as part of a complete large construction activity application:

1. Pre-submittal Meeting: This meeting is intended to coordinate stormwater management needs such as impaired water and existing flooding problems. The meeting shall be scheduled by the applicant and attended by the applicant prior to submitting a Type III application. The meeting may be held in conjunction with other concept and early-stage meetings; however, the City may require separate and additional meetings.

2. Items 1- identified in Section 4.5.3 for medium construction activities.

3. Stormwater Master Plan
   a. For large construction activities that are located in stormwater management areas, a stormwater Master Plan shall be submitted prior to the submittal of the complete package. The Master Plan shall be created to give the design engineer the opportunity to propose a site layout and to propose stormwater controls to the City. The Master Plan shall be submitted via the City's CAP and can be incorporated for discussion at the pre-submittal meeting.
   b. The master plan can be a preliminary sketch of the site and shall contain the following items:
      i. Site layout showing buildings, roads, parking areas, utilities, and grassed or landscaped areas
      ii. Vicinity map
      iii. Pre- and post-development primary runoff patterns and discharge points
      iv. Location/distances to waters of the State and other existing natural features such as wetlands, ponds, lakes, floodplains, and stream buffers
   c. The applicant should be prepared to discuss the following items:
      i. Modeling methodologies to be used
      ii. Methods to show compliance with adopted TMDLs or other waterbody impairments that may limit the allowable pollutant load that can be discharged
      iii. Preliminary design exception requests

4. Phased EPSC Plan. For non-linear construction sites disturbing more than 5 acres, the construction plans must include a phased EPSC plan. This phased plan identifies BMPs and grading work implemented during a specific portion of a site’s construction sequence (e.g., initial grading and perimeter controls, interim land disturbances through final grading, final stabilization, and permanent stormwater practices). Each phase must be addressed and identified on at least one separate plan sheet. One sheet showing BMPs and grading work for the entire course of the construction project will not be considered a complete phased plan.
   a. For site disturbances less than 10 acres and more than 5 acres, at least two separate plan phases shall be developed. Each plan phase shall be identified and must be addressed separately on at least one single plan sheet, with each sheet reflecting the conditions and the
BMPs necessary to manage stormwater runoff, EPSC during the phases, at a minimum, listed below:

i. **Initial Land Disturbance Phase.** This includes, but is not limited to, the perimeter BMPs, EPSC BMPs to be installed prior to initial/mass grading, and additional BMPs to keep the construction site in compliance with this permit.

ii. **Stabilization Phase.** This includes, but is not limited to, BMPs required to be installed, maintained, and retrofitted during the time required to begin the majority of construction and grading activities, and the time required to bring the construction site into compliance with permanent water quality requirements and into final stabilization.

b. For site disturbances greater than or equal to 10 acres, at least three separate plan phases shall be developed. Each plan phase shall be identified and must be addressed separately on at least one single plan sheet, with each sheet reflecting the conditions and the BMPs necessary to manage stormwater runoff and EPSC during the phases, at a minimum, as listed below:

i. **Initial Land Disturbance Phase.** This includes but is not limited to the perimeter BMPs, the EPSC BMPs to be installed prior to initial/mass grading, and additional BMPs to keep the construction site in compliance with this permit.

ii. **Construction Phase.** This includes but is not limited to EPSC BMPs to be installed, maintained, and designed to prevent sediment-laden stormwater from discharging offsite during construction. Examples of such BMP control measures to include in this phase are temporary BMPs used to convey, manage, and treat stormwater runoff including additional sediment traps and sediments basins, rock check dams, silt fence, sediment tubes, inlet protection, temporary conveyance channels, and other sediment control measure.

iii. **Stabilization Phase.** This includes but is not limited to BMP control measures required to be installed, maintained, and retrofitted during the time required to bring a construction site into compliance with permanent water quality requirements and into final stabilization.

A checklist of guidelines for submittal is located in Error! Reference source not found.

4.5.5 **Linear/Utility Applications**

If SCDHEC does not issue a general permit to cover utility construction activities, the City requires that companies performing utility installations shall obtain City approval prior to beginning work. This shall be done whether the utility installation is done as part of another construction project (e.g., telephone line extension) or an independent project (e.g., gas force main). A complete linear/utility application shall include the following items:

1. Site narrative that describe the installation to be performed and the measures that will be used for EPSC. Inclusion of typical design details is preferred, but simple sketches may be used. Details shall include, at a minimum, temporary and final stabilization measures and silt fencing. Supporting calculations should be provided as necessary but are required if disturbing greater than 1 acre.

2. A sketch of the location and type of EPSC practices if a waterbody crossing is necessary. If a USACE permit is needed, a copy of the permit application shall also be included. City approval will not be issued until USACE approval is obtained.
3. A signed EPSC certification form agreeing to the conditions of the City approval and NPDES permit if applicable. The certification form is provided in Error! Reference source not found.

4. A Type I, Type II, or Type III CAA may be required by the City.

A checklist of guidelines for submittal is located in Error! Reference source not found.

4.6 Additional Permits and Approvals

In addition to the CAA, the applicant or owner/operator is responsible for obtaining required permits and/or approvals. These include, but are not limited to, SCDOT encroachment permit, USACE permits, and SCDHEC CZC approval. CAAs WILL NOT be approved without the necessary permits/approvals.

4.6.1 South Carolina Department of Transportation Encroachment Permits

An encroachment permit, which controls the impacts of traffic, storm drainage, and sediment entering upon public property and the public rights-of-way, shall be obtained from the SCDOT and/or the City’s Department of Public Service – Engineering Division before construction begins. Applicants shall be aware of the City’s requirements, which may differ from SCDOT’s.

A copy of an Encroachment Permit application to SCDOT shall be included in the CAA package. The applicant shall comply with SCDOT Encroachment Permit application requirements. Approved encroachment permits are required prior to final approval of the application from the City’s Department of Public Service – Engineering Division.

4.6.2 US Army Corps of Engineers Permits

A Section 404 permit shall be obtained from the USACE before construction begins for projects that occur in or discharge into waters of the United States. The permitting process typically starts with a jurisdictional determination at the project site to determine whether wetlands or other waters are present and whether they are regulated by the USACE. If such waters are present and regulated by the USACE, then the process proceeds with the following steps:

1. An optional pre-application meeting. It may be requested for any type of project and can be beneficial for complex or potentially controversial projects.

2. Submittal of the completed application and required attachments. The types of permit applications include nationwide, regional, individual, and joint Federal and State.

For more information, visit https://www.sac.usace.army.mil/Missions/Regulatory/Permitting-Process/.
4.6.3 South Carolina Department of Health and Environmental Control Office of Ocean and Coastal Resource Management Coastal Zone Consistency Certification

A CZC Certification is required for land-disturbing activities that require permit coverage within the eight coastal counties (Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry, and Jasper) prior to receiving coverage under the NPDES Permit Program.

A request for CZC Certification must include the following:

- State CZC request form
- Project outline (digital boundary) and Digital Boundary Details form
- Appropriate Coastal Zone Management Plan policy checklists and Statement of Consistency

For more information, visit https://www.scdhec.gov/coastal-zone-consistency.

4.7 Approval of Applications

Once the City approves the application and required documentation, including additional permits or approvals required, the City will issue a CAA Approval and MS4 Approval Letter. The MS4 Approval Letter shall be forwarded to the SCDHEC for coverage under South Carolina NPDES General Permit for Stormwater Discharges from Construction Activities.

4.8 Changes After Project Approval

This section of Chapter 4 details how an applicant or owner addresses changes to the project/permit after the application has been approved by the City, MS4 Approval Letter has been issued, and NPDES coverage has been granted to the project. These changes may include revisions to the approved application, transferring ownership, and approval expiration. Each have specific requirements and should be taken into consideration.

4.8.1 Changes to Approved Applications

Revisions to the approved plans and construction documents shall be submitted in writing to the City along with any subsequent fees established in this SWDSM. Changes shall not be implemented until review and approval is given by the City. Revisions for stormwater management issues may include, but are not limited to, pipe size and grade alterations that affect hydraulic capacity, changes to easement boundaries due to changes in the stormwater system components, or changes to the general grading plan of the site that affect the flow direction, rate, volume, or quality of stormwater runoff.

4.8.2 Transfer of Responsibility (Change of Owner)

In certain cases, and as requested by an applicant, approval to conduct construction activities may be transferred from one applicant or responsible party to another. The most obvious example of this is when a developer readies a piece of property for a new neighborhood by performing...
grading activities, utility installation, and building of roads, then turns the property over to a
homebuilder. In such cases, the applicant shall make the City and SCDHEC aware of plans to
transfer responsibility of the approval and associated stormwater management issues through
completion of the transfer form in Error! Reference source not found.. A transfer of responsibility
is also allowed for phases within a project. At the time of transference, the City/SCDHEC will issue
the NOT for the responsible party and issue a new permit to the new responsible party. If a transfer
is not requested using the appropriate form, the current responsible party will continue to
responsible for stormwater management concerns at the site. No work shall be performed during
the process of transferring responsibility and an application for transference shall only be made
and granted after a construction phase has been completed.

4.8.3 Expiration of City Approval

A CAA Approval will remain valid for up to five years from the date of issuance, provided that the
project is in compliance with the City of Charleston Ordinance and this SWDSM and is not inactive
for a period of 12 consecutive months. Construction, development, and redevelopment activities
shall be initiated within 12 months of issuance of the City approval. Failure to initiate these
activities will render the approval invalid at the end of the twelfth month.

4.9 Fees

This section of Chapter 4 explains the fees associated with construction activity, both the permit
application and the pre-construction inspection. The fees associated with the pre-construction
inspection are assessed after obtaining application approval and issuance of a land disturbance
permit. Both the construction activity plan review and construction activity inspection fees are
based on disturbed area. The plan review fee is a one-time fee submitted with the initial
application and the inspection fee is paid to the City in order to inspect pre-construction activity
EPSC measures.

4.9.1 Construction Activity Fee

For land-disturbing activities, the following fees shall be paid to the City by the permittee:

Construction Activity Plan Review Fee:

$250.00 per disturbed acre rounded up to the next whole acre (up to $5,000 maximum)

Construction Activity Inspection Fee to Authorize Commencement of Construction:

For each inspection:

$75.00 for less than 1-acre site

$150.00 for 1 to 5-acre site

$250.00 for 5.01 to 10-acre site
$500.00 for 10.01 or more-acre site

Inspection fees are only for the initial inspection prior to the authorization to begin construction. Two re-inspections are included with the initial fee at no additional cost to the owner/permittee.

If after two re-inspections the BMPs are not installed and operating per the approved set of construction plans during the initial inspection effort, commencement of construction shall not be authorized, re-inspection shall be necessary, and additional inspection fees shall apply as per the schedule above.

**Transfer Fees:**

$100.00 for each property ownership transaction

Fees are subject to change per approval from the City Council. These fees are separate from other fees charged by the City or other agencies with jurisdiction over construction, development, or redevelopment projects. Fees shall be paid separately.

**4.9.2 Major Modification**

Changes to the disturbed area after the CAA has been submitted, but before approval or after an application has been approved, will be considered a major modification. The permittee is responsible for notifying the City and paying fees incurred as a result of the modification.

**4.10 Exemptions and Design Exceptions**

Per the City of Charleston Ordinance, the provisions of this section shall not apply to:

- Land-disturbing activities undertaken on forestland for the production and harvesting of timber and timber products and conducted in accordance with BMPs and minimum erosion protection measures established by the South Carolina Forestry Commission pursuant to the South Carolina Code of Laws Title 48, Chapter 18, Erosion and Sediment Reduction Act of 1983, Section 70, as amended.

- Activities undertaken by persons who are otherwise regulated by the provisions of the South Carolina Code of Laws, Title 48, Chapter 20 - South Carolina Mining Act.

- Land-disturbing activities on agricultural land for production of plants and animals, including but not limited to, forages and sod crops, grains and feed crops, tobacco, cotton, and peanuts; dairy animals and dairy products; poultry and poultry products; livestock, including beef cattle, sheep, swine, horses, ponies, mules, or goats, including the breeding and grazing of these animals; bees, fur animals, and aquaculture. The construction of an agricultural structure that requires the disturbance of 1 or more acres, such as, but not limited to, broiler houses, machine sheds, repair shops, coops, barns, and other major buildings shall require the submittal and approval of an application prior to the start of the land-disturbing activity.
The City may grant a design exception from the requirements of this SWDSM if exceptional circumstances applicable to a site exist such that strict adherence to the provisions of this SWDSM will not fulfill the intent of the SWDSM.

A written design exception request shall be required and shall State the specific exception sought and the reasons, with supporting data, why the exception should be granted. Requests can be for either water quantity or water quality requirements. The request shall include information necessary to evaluate the proposed exception. A separate written exception request shall be required if there are subsequent additions, extensions, or modifications that would alter a previously approved exception. A project may be eligible for an exception of stormwater management for water quantity and quality control if the applicant can demonstrate that the imposition of peak or volume control requirements of stormwater runoff would aggravate downstream flooding.

Final approval of a design exception request will be given at the discretion of the City. The City is cognizant that the need for an exception may not be known during planning stages and only evident after considerable design work has been completed. The City intends to work with the owner and engineers during the design process to find a resolution as long as the above items are adequately demonstrated.

Approved design exceptions shall be fully documented on a table similar to the one below. This table is to be included on the title sheet of the approved stamped construction drawings, and in the title sheet of the project record drawings.

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<th>APPLICABLE SECTION</th>
<th>DESCRIPTION OF THE DESIGN EXCEPTION</th>
<th>SUBMITTAL DATE</th>
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Final approval of a design exception request will be given at the discretion of the City. The City is cognizant that the need for an exception may not be known during planning stages and only evident after considerable design work has been completed. The City intends to work with the owner and engineers during the design process to find a resolution as long as the above items are adequately demonstrated.

Approved design exceptions shall be fully documented on a table similar to the one below. This table is to be included on the title sheet of the approved stamped construction drawings, and in the title sheet of the project record drawings.
Chapter 5 Construction Phase

5.1 Roles and Responsibilities

This section of Chapter 5 details the responsibilities of parties involved during the construction, inclusive of pre-construction, process. Those parties include the City, the Applicant, the Owner/Operator (Permittee), and the inspector.

5.1.1 City of Charleston Stormwater Management

The City has the authority to enter and inspect facilities, conduct sampling, examine and copy records that must be kept under the conditions of an NPDES permit and to comply with their MS4 permit, and perform any other duties deemed necessary by state and federal law.

5.1.2 Applicant, Owner/Operator (Permittee)

In accordance with applicable local, state, and federal stormwater requirements including, but not limited to, the NPDES CGP, owner/operators are responsible for conducting construction, development, and redevelopment and post-construction, post-development, and post-redevelopment site inspections. Records of such inspections shall be kept for a minimum of five years and shall be made available to the City upon reasonable request.

The Primary Permittee meets one or both of the following criteria:

- Has operational control over the SWPPP, construction plans, and specifications, including the ability to request modifications to those plans (typically the owner or developer)
- Has day-to-day operational control of those activities necessary to ensure compliance with the SWPPP

A Secondary Permittee is an owner/operator with control of an individual lot or a group of lots within a larger construction site, independent of the Primary Permittee. The Secondary Permittee is also subject to the approved Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) submitted by the Primary Permittee for the overall construction site.

5.1.3 Inspector

The Inspector must be a Certified Erosion Prevention and Sediment Control Inspector (CEPSCI) or SCDHEC-approved equivalent. The Inspector is responsible for inspecting the construction sites, issuing the Stormwater Field Inspection Report, determining compliance of construction sites, and recommending stabilized sites for site closeout.
5.2 Pre-Construction Requirements

After MS4 approval has been granted and NPDES coverage has been issued by SCDHEC, a series of events must occur before CAA approval. This section of Chapter 5 details the events, which involve both the City and the applicant. The construction process cannot occur without CAA approval.

5.2.1 Pre-Construction Activities

Prior to any construction activities, the following must occur:

- All necessary permits must be in hand.
- Pre-construction meeting must be completed.
- Inspections and approvals of tree protection and temporary EPSC BMPs must be completed by the City. For BMPs, pre-operational and in-service tests shall be conducted to ensure proper installation and function. For infiltration BMPs, pre-operational and in-service tests shall consist of in situ infiltration testing or other verification of design infiltration rate as described in Section 3.10.4 and Section 6.9, respectively.

The City shall witness field tests. The applicant shall perform field tests and provide labor, equipment, and incidentals required for testing. This includes coordination of water supply needed for hydrostatic or in situ testing.

5.2.2 Inspection Fees

The primary permittee shall be responsible for inspection fees. See fee schedule in Section 4.9.

5.2.3 Other Planning Considerations

Before starting construction, due diligence for site investigation shall be performed by the applicant or permittee.

- Call to notify South Carolina 811 (SC811) of planned excavation to avoid damages to existing underground infrastructure.
- Be prepared to implement traffic control measures if working in a roadway or right-of-way.
- Provide ancillary permit requirements as needed.
- Prepare On-Site Stormwater Pollution Prevention Plan (OS-SWPPP).

The OS-SWPPP must contain the following documents, which may not be required to be part of the C-SWPPP submitted prior to approval of the City:
· **SCDHEC CGP**: one copy of this permit, excluding the appendices. Provisions may be made for the general permit to be accessed electronically as long as a hard copy can be made available by the end of the working day when required.

· A copy of the **NOI**.

· **NPDES Coverage Approval Letter**: the letter generated once the C-SWPPP is determined to be in compliance with the CGP.

· **Local Approvals**: any additional letters, approvals, or certifications necessary to implement the OS-SWPPP, when necessary.

· **USACE Permits**: permits necessary to allow impacts to waters of the state or jurisdictional wetlands, when necessary.

· **Critical Area Permit** (Coastal Zone Only): authorizations necessary to allow impacts to a critical area, when necessary.

· **Contractor Certifications**: certifications necessary to allow contractors to conduct construction activities within the construction site. This includes contractor certifications required under **Chapter 4** of this SWDSM.

· **Recordkeeping**: logs necessary to track the progress, compliance, and modifications associated with the construction site. These logs may include, but are not limited to:
  - Pre-construction conference log
  - Inspection log
  - Stabilization log
  - Rain log
  - Contractor log
  - Additional recordkeeping as deemed necessary by the permittee, contractor, SCDHEC, MS4, or an entity delegated under South Carolina Regulation 72-300

· **CZC Certification**: For projects located in the coastal zone, the acquired CZC certification must be kept in the OS-SWPPP.

The OS-SWPPP contains all items required for review and approval of the C-SWPPP, except for the Engineering Reports.

### 5.2.4 Pre-Construction Meeting

Before any construction activities occur, a pre-construction meeting must be held for each construction site or project for which there is an approved C-SWPPP. The attendees include, but are not limited to, the design professional, contractors, subcontractors, and inspectors. During this meeting the following activities must occur:
· The SWPPP preparer, the person with operational control of the plans and specifications, or the authorized representative shall review and explain the OS-SWPPP so that everyone is aware of the design intent and requirements, as well as any areas that will require special attention.

· All parties shall be made aware of the construction sequence and timeframe, as well as possible time constraints and anticipated issues.

· Attendance shall be recorded and maintained in the OS-SWPPP.

· All parties shall be informed of modification procedures.

The location of the pre-construction meeting shall be as follows:

· For non-linear projects that disturb 10 acres or more, the meeting shall be held onsite.

· For non-linear projects that disturb less than 10 acres, the meeting may be held offsite.

· For linear projects that are not part of an LCP, the meeting may be held offsite.

· For linear projects that are part of an LCP and are less than 10 acres, the meeting may be held offsite.

· For linear projects that are part of an LCP and are 10 acres or more, the meeting shall be held onsite.

The person conducting the pre-construction meeting shall have the choice of conducting an offsite meeting, onsite, if so desired.

5.3 Construction Requirements

After the pre-construction requirements have been met, the City will issue CAA approval and the applicant can begin construction activities. The applicant shall adhere to the guidance of the OS-SWPPP throughout the entirety of the construction process. This section of Chapter 5 details the applicant’s responsibilities in addition to those outlined in the OS-SWPPP.

5.3.1 Implement and Maintain Erosion Prevention and Sediment Control Best Management Practices

EPSC BMPs shall be implemented and maintained in accordance with the requirements stated in the OS-SWPPP throughout the entirety of the construction process.

5.3.2 Conduct Inspections

The purpose of the SWPPP inspections is to regulate non-stormwater discharges to the storm drainage system as required by federal and state law. After construction activities begin, inspections must be conducted a minimum of at least once every calendar week, with no time...
period between inspections exceeding 9 days, and must be conducted until final stabilization
is reached on all areas of the construction site. An inspection is recommended within 24 hours
of the end of a storm event of 0.5 inch or greater and during the first rain event after the initiation
of construction activities, after the installation of EPSC BMPs.

Inspection frequencies for portions of the construction site that have reached temporary or
final stabilization may be reduced to at least once every month, as long as the stabilization is
maintained and there is no additional disturbance in these areas.

If the entire site has reached final stabilization and the permit holder does not submit a NOT, the permit holder must continue to perform monthly inspections.

If site inspections identify EPSC BMPs that are damaged or are not operating effectively, the OS-SWPPP must be modified as necessary to include additional or modified EPSC BMPs that are designed to correct the identified problems. Revisions to the OS-SWPPP must be completed within seven calendar days following the inspection.

If site inspections identify EPSC BMPs that require maintenance, maintenance shall be performed as soon as practical or as reasonably possible and before the next storm event, whenever practicable.

5.3.2.1 Inspection Reports

At a minimum, the inspection report must include:

- Inspection
- Names, titles, and qualifications of personnel conducting the inspection if not previously given in an inspection report, unless those qualifications change
- Discharge points and a description of discharges occurring at the time of the inspection
- Current weather information
- Total rainfall since last inspection
- Location(s) of discharges of sediment or other pollutants from the site
- Location(s) of EPSC BMPs that need maintenance
- Location(s) of EPSC BMPs that failed to operate as designed or proved inadequate for a particular location
- Location(s) where additional EPSC BMPs are needed that did not exist at the time of inspection
- Corrective action required including any necessary changes to the OS-SWPPP and implementation dates
5.3.2.2 Monthly Reports

The City may require, on a case-by-case basis, that the permittee submit a monthly report summarizing the inspections at the site and associated maintenance activity.

5.3.2.3 Inspection Records

A record of each inspection and of any actions taken in accordance with this section must be retained as part of the OS-SWPPP for at least three years from the date that permit coverage expires or is terminated. The qualified inspector, as identified in Section 5.1.3, must sign the inspection report.

5.3.2.4 Primary Permittees

Inspectors employed by the Primary Permittee retain the authority to inspect, report, and document areas of the construction site that are under direct control of the Secondary Permittee, but only when a lack of compliance by the Secondary Permittee inhibits the Primary Permittee’s ability to maintain compliance with the overall OS-SWPPP or the CGP.

5.3.2.5 Maintain Stormwater Documents Onsite

The owner is required to maintain at least one copy of the City approved construction plans and OS-SWPPP on the project site and make them available upon request by the City. The City will conduct inspections during the construction phase. Frequency and specific times and dates of these inspections will be done at the discretion of the City.

5.3.2.6 Spills and Illicit Discharge Detection and Elimination

40 CFR 122.26(b)(2) defines illicit discharge as:
any discharge to an MS4 that is not composed entirely of storm water except discharges pursuant to a NPDES permit and discharges resulting from firefighting activities.

The permittee is responsible for the prevention of spills and illicit discharge detection and elimination. Spills shall be prevented by taking appropriate precautions and preparing a response procedure for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases. Appropriate facility personnel, emergency response agencies, and regulatory agencies shall be notified where a leak, spill, or other release containing a hazardous substance or oil has occurred. The permittee must provide contact information in locations that are readily accessible and available to all employees. The permittee may also reference the existing Spill Prevention, Control, and Countermeasure plans developed for the construction activity under Part 311 of the CWA.

5.4 Changes During Construction

The construction process may be subject to changing climatic conditions and unforeseen site conditions. If any of the involved parties (City, Applicant, or Inspector) notice the need for EPSC changes, this section of Chapter 5 gives the protocol for how to implement those changes. Changes range from revisions to the design/SWPPP, transferring ownership, and the potential for the approval expiring.

5.4.1 Changes to Approved Design

Refer to Section 4.8.

5.4.2 Changes to Approved Stormwater Pollution Prevention Plan

Major modifications to the SWPPP include the following:

- Modification that will affect the hydrology or trapping efficiency calculations, including:
  - Resizing sediment or detention basin
  - Deleting sediment or detention basin or sediment trap
  - Relocating sediment or detention basin
  - Adding sediment or detention basin
  - Modifying sediment or detention basin outlet structure
  - Amending construction sequence so that basin is not installed before grubbing operations begin
- Point discharge location change (near property line)
Addition of new point discharge (within 20 feet of property line)
Addition of impervious area
Addition of disturbed area
Changes to navigable water crossing
Addition of sediment trap

If such changes are necessary, then construction plans and the SWPPP must be updated and submitted to the City for approval. Major modifications to the construction plans and SWPPP shall comply with Chapter 3 of this SWDSM. Additional fees may be incurred as a result of increasing the disturbed area.

Minor modifications include the following changes to the approved SWPPP:
Addition of silt fence, slope drains, inlet protection, outlet protection, or check dams
Relocation of construction entrance
Relocation of pond inlet pipes (still within the pond)
Omission of disturbed area
Individual lot drainage, unless that changes the detention structure or analysis point to which the lot drains.

If such changes are necessary, then construction plans must be updated, the modification must be recorded in the OS-SWPPP and be made available upon request. No changes to approved applications are necessary.

5.4.3 Qualifications
Major modifications to the EPSC Plan and the SWPPP shall be properly prepared and signed by a registered engineer, landscape architect, or Tier B land surveyor.

5.4.4 Transfer of Responsibility (Change of Owner)
Where the operator changes (new owner), after the initial NOI and C-SWPPP have been approved, SCDHEC and the City must be notified in writing within 14 calendar days. Accompanying this notification, the new operator must submit one of the following:

A new NOI (to SCDHEC and the City) and C-SWPPP (to the City), when the new operator does not agree to comply with the approved C-SWPPP and/or elects to modify the approved C-SWPPP
A new NOI and Compliance Statement (to both the SCDHEC and the City), when the new operator agrees to comply with the approved C-SWPPP.
The new operator may not commence work at the construction site until approved by the SCDHEC. The new NOI must reference the project's name and tracking number assigned to the initial operator's NOI. Acknowledgement from the of the change in operator should be included with the new NOI.

If the construction site under the control of the new owner is **inactive and all areas disturbed have reached stabilization**, the NOI may not need to be submitted immediately. Written notification to SCDHEC should:

- Identify both the previous owner and new owner that will obtain operational control at a construction site.
- Identify the construction site as inactive.
- Identify each project area and the stabilization status (either as temporary stabilization or final stabilization).
- Provide a detailed explanation for delayed commencement of construction at the construction site under the direction of the new owner and proposed plans, schedule, dates, etc., for recommencement under the new owner.
- An NOI will need to be submitted before any additional construction activities are implemented at the construction site. A copy of the NOI will shall be provided to the City.

If the site under the control of the new owner is **inactive and all areas disturbed have not reached stabilization**, the new Owner must obtain permit coverage and provide stabilization as defined in the permit. Stabilization measures may be implemented prior to issuance of new permit coverage.

- If the new owner or operator has elected to modify the layout of the construction site, thereby altering the approved C-SWPPP, then the new owner or operator must apply for new coverage under the CGP.
- If the sale or transfer of the construction site's ownership does not change the signatory requirements for the NOI, but the site's owner or developer's company name has changed, an updated NOI should be submitted to the SCDHEC along with written notification defining the proposed sale or transfer of ownership. If the new operator agrees to comply with an existing C-SWPPP already implemented at the site, an SWPPP acceptance and compliance statement should be included in the notification to SCDHEC. If the new operator does not agree to comply with an existing C-SWPPP, a new C-SWPPP must be submitted with the NOI to apply for new coverage under the permit. A copy of all documentation shall be provided to the City.
- Each new owner/operator will be subject to the standard NPDES permit coverage fee for construction sites. There will be no additional review fees associated with the sale or transfer of ownership for existing permitted construction sites when no major modifications to a C-SWPPP occur.
If a lending institution, government entity, etc., takes operational control of a construction site due to foreclosure, permittee filing for bankruptcy, abandonment, etc., then that entity is responsible for the construction site's stormwater discharges. Coverage is required prior to the entity initiating construction activity at the site. The entity shall contact SCDHEC and the City within 14 business days of taking title to the property. If stabilization of the inherited construction site is required, SCDHEC may issue a compliance agreement. A copy of the compliance agreement shall be provided to the City.

### 5.4.5 Expiration of City Approval

Refer to Section 4.8.3.

### 5.4.6 Notifications

Notification to designated personnel shall be provided, at a minimum, for the following occurrences:

<table>
<thead>
<tr>
<th>Occurrence</th>
<th>Contact</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifications to the construction sequence or timeframe</td>
<td>Onsite personnel</td>
<td>Immediately</td>
</tr>
<tr>
<td>Major modifications to the approved design or SWPPP</td>
<td>City and SCDHEC</td>
<td>Prior to implementing modification</td>
</tr>
<tr>
<td>Transfer of responsibility</td>
<td>City and SCDHEC</td>
<td>14 calendar days</td>
</tr>
<tr>
<td>Dangerous spills or leaks</td>
<td>Minor: Onsite personnel</td>
<td>Immediately</td>
</tr>
<tr>
<td></td>
<td>Major: Contact 911 or local emergency response team</td>
<td></td>
</tr>
<tr>
<td>Illicit discharge(s)</td>
<td>City</td>
<td>24 hours</td>
</tr>
<tr>
<td>Inspection reports</td>
<td>Personnel responsible for EPSC maintenance</td>
<td>Notify immediately, seven days to perform maintenance</td>
</tr>
<tr>
<td>Changes to permit status</td>
<td>Citizen Access Portal</td>
<td>Immediately</td>
</tr>
<tr>
<td>City enforcement as described in Section 7.2</td>
<td>Onsite personnel</td>
<td>Immediately</td>
</tr>
</tbody>
</table>
Chapter 6 Post-Construction

6.1 Overview of Project Closeout Requirements

Chapter 6 details the Department of Stormwater Management’s requirements for project closeout. Requirements are based on the submitted and approved CAA. Prior to the City’s acceptance of the stormwater management system and related structural elements, the owner shall adhere to the process and requirements outlined in this chapter.

6.2 Final Stabilization and Project Closeout

At the conclusion of construction activities, the owner shall ensure the site is stabilized with permanent vegetation, paved areas, and stormwater conveyances are clean of debris and sediment, and that permanent stormwater controls are working properly. The City will conduct an inspection to confirm the aforementioned and upon confirmation, the City will notify the owner to complete and submit a CAA Close-out Application Form (COA) as found in Appendix B along with supporting documentation based on construction activity designation. The submittal package requirements are as follows:

6.2.1 Single-Family Residential

- CAA Close-out Application
- Hydrostatic testing and dye testing results (if applicable)
- In situ testing results for infiltration based permanent stormwater measures (if applicable)

6.2.2 Site Plan (Commercial, Multi-Family) Projects

- CAA COA
- SCDHEC NOT (SCDHEC Form D-2610)
- Stormwater record drawings (as-builds)
- CPMSF agreement with fee ($10 for the first four pages and $1/per additional page)
- Hydrostatic testing and dye testing results (if applicable)
- In situ testing results for infiltration based permanent stormwater measures (if applicable)
- Stormwater inspection video

If the project has a permanent structural stormwater measures, as-builds and CPMSF are required.
If there are no permanent structural stormwater measures, as-builts and CPMSF are not required.

6.2.3 Subdivision/Road Construction Plan Projects

- CAA COA
- SCDHEC NOT (SCDHEC Form D-2610)
- Stormwater record drawings (as-builts)
- CPMSF agreement with fee ($10 for the first four pages and $1/per additional page
- Final plat
- Hydrostatic testing and dye testing results (if applicable)
- In situ testing results for infiltration based permanent stormwater measures (if applicable)
- Stormwater inspection video

Final plat, as-builts, and CPMSF will be addressed at the time of right-of-way dedication/final platting.

6.2.4 Utility Projects

- CAA COA
- SCDHEC NOT (SCDHEC Form D-2610)

6.3 Stormwater Record Drawings (As-Builts)

As part of the project closeout process, a full-size hard copy and one electronic PDF format copy of the record drawings, properly identified, executed, and certified shall be delivered to the Engineering Division. Additionally, the record drawings for stormwater facilities shall contain the following information:

6.3.1 Piped Drainage Systems

For piped drainage systems, the following information shall be provided on the drawings.

1. Actual values beside planned values on the approved construction plans.
2. Elevations to the nearest 0.01 foot. Actual elevations within 0.10 foot of the planned values are sufficient except where higher accuracy is needed to indicate positive flow.
3. Diameter, material, and class of all pipes.
4. Type of joint of all pipes (O-Ring, T&G, etc.).
5. Invert of pipe at outfall and all structures.
6. Slope and lengths of all pipe.

7. Structure type and elevations (top of grate, throat elevation, etc.).

8. Location of pipe and structures in relation to drainage easements on plan view.

9. Centerline roadway elevations at all low points and other stormwater crossings.

10. Length, depth, and width of outfall protection as specified.

6.3.2 Open Channel Drainage Systems

For open channel drainage systems, the following information shall be provided on the drawings.

1. Actual values beside planned values on the approved construction plans.

2. Elevations to the nearest 0.1 foot except where higher accuracy is needed to indicate positive flow.

3. Actual elevations within 0.1 foot of the planned values are sufficient except where higher accuracy is needed to indicate positive flow.

4. Slope of all open channels.

5. For swales 1 foot or less in depth, actual side slopes and spot invert elevations at a frequency of at least every 100 feet.

6. For swales or ditches greater than 1 foot in depth, top of bank and toe of slope designations and elevations at a frequency of at least every 100 feet.

7. For ditches 3 feet or greater in depth, actual 1 foot contours.

8. Location of ditch or swale in relation to drainage easements on plan view.

9. Length, depth, and width of outfall protection or other erosion control as specified.

6.3.3 Stormwater Management Pond or Basin

For stormwater management ponds or basins, the following information shall be provided on the drawings.

1. Actual values beside planned values on the approved construction plans.

2. Elevations to the nearest 0.01 foot. Actual elevations within 0.10 foot of the planned values are sufficient except where higher accuracy is needed to indicate positive flow.

3. Sufficient elevations along top of dam/pond to verify design elevation.

4. Sufficient elevations along toe of slope and bottom of pond to verify design elevation.

5. Actual 1 foot contours and a stage-volume table to confirm design volume.

6. Pond slopes and vegetative cover.
7. Location, elevations, slopes, and dimensions of orifices, weirs, spillways, trash racks, or any other aspects of outfall control.

8. Location, dimensions, and elevations of emergency spillway.

9. Outfall protection location and dimensions.

10. Water elevation in pond at time of survey, if applicable.

11. Location, dimensions, make or brand, model, serial number and maintenance manual for any engineered water quality treatment devices.

6.3.4 Project Datum

As-builts shall clearly state the project datum (NAVD 88) on all pages where elevations are noted.

6.3.5 Certifications Statement

The record drawing must include the following statement:

I hereby sign and affix my seal to certify to the best of my knowledge that this record drawing accurately represents existing field conditions and that the comprehensive stormwater management system, as constructed, is in substantial conformance with the standards, dimensions and specifications of the approved construction plans.

SC Registered Professional Engineer

6.4 Maintenance Plan and Covenants

Each component of the stormwater management system shall have a maintenance plan as part of the application to conduct construction, development, and redevelopment activities. The plan shall also cover temporary EPSC measures used during construction in addition to the long-term maintenance of the system.

In addition, the owner, HOA, and/or operator will enter into a permanent maintenance agreement with the City. The CPMSF is recorded in the permanent land records with the Charleston County Register Mesne Conveyance Office, in addition to being fully described on the final plat. The CPMSF document is prepared with assistance from the Engineering Division and shall be signed and executed prior to the issuance of City approval of the final plat. The CPMSF shall address maintenance to be performed by a third party such as an operator or
other contractor. However, the owner shall also be listed and is ultimately responsible for adherence to the maintenance requirements. An example of the Covenant template is provided in Appendix B.

6.5 Final Plat

Ownership shall also be recorded on the final plat. Ownership shall imply responsibility for maintaining the permanent stormwater system, including all ponds and permanent structural stormwater measures. Ownership does not imply that the owner(s) may in any way alter the size or function of any component of the stormwater system without consent from the City. This will be considered a major modification and subject to the procedures outlined in Section 5.4.1. Owners found altering such components without City approval must remove any alterations before the City will accept the stormwater management system and related structural elements.

6.6 Stormwater Video Inspection

All closed conveyances (pipes, boxes, etc.) to be owned and maintained by the City shall be inspected with a video system showing the condition of the installed sections prior to recording the final plat and acceptance of the system by the City. All video inspections shall be completed in fully dewatered conditions at the expense of the owner. The video files shall be submitted to the City as part of the closeout procedure. All video inspections shall be reviewed by a Professional Engineer or another qualified individual under the direct supervision of a Professional Engineer. A report documenting the inspections shall be prepared by the Engineer and submitted to the City at the expense of the owner. All videos shall comply with the following requirements:

- Color video submitted on a CD or DVD in a high-resolution digital format compatible with City-approved and available software and equipment.
- All visual observations recorded on a log inspection form incorporating at a minimum the following items:
  - Date and time televised;
  - Operator name;
  - Starting and ending manhole (Sta. number, street name, etc.);
  - Pipe diameter (inches), geometry, and material;
  - Location of any connections (feet);
  - Location of broken pipe, offsets, obstructions, or notable items (feet);
  - Location of sags and standing water (feet);
Location of inflow and infiltration (feet); and,
Location of dry weather flow (feet).

The notation of footage (starting at 0.0 feet at the beginning manhole and moving upstream through the pipe) superimposed on the video and be recorded in increments of tenths of feet.

Any problems detected shall be corrected by the owner. Upon confirming such corrections are complete and the site is ready, the City will release any remaining bonds and notify the TRC. The City may require additional items to close out a project.

### 6.7 Stormwater Facility Warranty

After the stormwater facilities have been inspected and approved by the City, a two-year warranty of the installed stormwater system shall be signed by the owner and submitted to the City. Any deficiencies, defects, or failures that occur during the warranty period shall be addressed by the owner/permittee. The City shall be notified, and a subsequent inspection will be required.

Prior to the end of the warranty period, the City will re-inspect the stormwater facilities. Any deficiencies noted shall be addressed by the owner/permittee and a subsequent inspection will be required. Pipes shall be video inspected at the end of the two-year warranty period and will be subject to the same requirements as the initial video inspection outlined in Section 6.6.

The stormwater facility warranty MUST be signed and submitted along with the City's acceptance of the stormwater management system with its structural elements before issuance of any of the various types of Certificates of Occupancy.

During the stormwater facility warranty period, the following maintenance activities shall be completed:

- Trash and debris removal from permanent structural measures
- Sediment removal from permanent structural measures
- Weed/brush removal from permanent structural measures
- Cartridge/media and/or filter replacement
- Street sweeping and/or vacuuming of permanent structural measures
- System flushing or other maintenance required for proper function of permanent structural measures
All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, vaults, manholes, pipes, culverts, etc., shall be free of sediment or debris. Erosion damage shall be repaired during warranty period.

Manufactured BMPs with a separate one-year warranty; cartridge, media, or filter replacement and other provided maintenance shall be as directed by the manufacturer and at a minimum, mandatory at the end of the warranty period.

### 6.8 Hydrostatic Testing and Dye Testing

The City may require hydrostatic testing on watertight joints. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM ASTM C443. Certified copies of test results shall be delivered to the City before gaskets or jointing materials are installed.

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures that might adversely affect the performance of such materials. Performance requirements for joints in reinforced concrete pipe shall conform to ASTM C990 or ASTM ASTM C443.

Dye testing may also be required to detect and eliminate illicit discharges. The owner shall follow the manufacturer’s recommendation on the amount of dye used.

A representative from the Stormwater Management Department shall be present for all testing and must be notified 72 hours prior to any testing. The owner/permittee shall be responsible for coordination.

### 6.9 In Situ Testing of Permanent Structural Best Management Practices that Rely on Infiltration

Post-construction permeability tests of infiltration based permanent structural measures shall be conducted in accordance with the following approach to ensure that the installed BMP functions as designed. Such testing should be carefully undertaken when all BMP construction that may affect soil permeability has been completed. This includes the use of all construction equipment and the placement of all construction material that may affect soil permeability. All in situ testing of permanent structural BMP’s shall comply with the Low Impact Development in Coastal South Carolina: A Planning and Design Guide (Ellis et al. 2014).
6.10 City Roadways Inventory/Stormwater Geographic Information System

File format, data standards, and other information shall conform to the current data submittal requirements as issued by the City’s GIS Division for merging into the City’s stormwater geodatabase.
CHAPTER 7. CITY INSPECTION AND ENFORCEMENT

7.1 Stormwater Management Inspections

The City will inspect, at its discretion, applicable construction, development, and redevelopment project sites for the purposes of verifying compliance with and enforcement of the City’s SWMP, Stormwater Management Ordinance, and SWDSM. Additionally, maintenance inspections, at the City’s discretion, will be performed on permanent stormwater management systems and facilities throughout their useful life to confirm adherence to their submitted maintenance plans. Additional information can be located in the City’s Construction Activities SOP.

7.1.1 City Inspection Duties and Responsibilities

Inspections for the purposes of ensuring compliance and enforcement of the City’s SWMP and Ordinance include the following:

- Ensuring that the approved City construction activity application, SWMP, SWPPP, and construction, development, and redevelopment plans are on the project site and are being followed and implemented.

- Ensuring that the permittee is conducting required inspections, documenting those inspections, and leaving copies of the reports on the project site within seven days after the site inspection.

- Conducting post construction, post development, and post redevelopment inspections to ensure that maintenance is being performed in accordance with the maintenance schedules for the permanent stormwater management facilities.

- Taking enforcement actions, as necessary, when any portion of the construction, development, and redevelopment and post construction, post development and post redevelopment activity does not comply with the approved City construction activity application, SWMP, or work is occurring without appropriate approvals.

- Performing a final inspection upon the completion of the stormwater system to determine whether the system is constructed in accordance with the approved City construction activity application and SWMP. The permittee shall furnish Stormwater Record Drawings in accordance with this manual to the City’s Engineering Division for use prior to final inspection.

- Taking immediate action, if necessary, if the permittee fails to comply with the approved City construction activity application or the approved stormwater management plan and an imminent hazard exists along with notifying any applicable local, state, and federal agencies.
Maintaining accurate and comprehensive project inspection files ensuring relevant information is entered in the files, which are to be maintained by the Department of Stormwater Management.

### 7.1.2 Inspector Qualifications

The Inspector must be a CEPSCI or SCDHEC approved equivalent.

### 7.1.3 Inspection Reports

Upon completion of a construction, development, or redevelopment site inspection, the City will include the following in their inspection report and correspondence to be provided to the permittee:

- Date and identification of the site inspected
- Status of the site in relation to the approved City construction activity application or SWMP, SWPPP, and construction plans
- Identification of maintenance deficiencies noted (photos to identify deficiencies)
- Any corrective actions needed
- Time period for correcting the deficiencies

Upon completion of a permanent BMP maintenance inspection, the City will include the following in the inspection report to be provided to the permittee as necessary:

- Date and location of the site inspection
- Status of the activities identified in the approved maintenance schedule
- Identification of maintenance deficiencies noted (photos to identify deficiencies)
- Any corrective actions needed
- Time period for correcting the deficiencies

### 7.2 Enforcement

If the City determines that a project is in noncompliance with the City’s Stormwater Management Ordinance, the City may direct conformity by proceeding with the appropriate enforcement action. The types of enforcement tools available to the City include an Administrative Order (AO), Notice of Violation (NOV), Uniform Ordinance Summons (UOS), and other civil and criminal penalties. The enforcement mechanism to be utilized will be at the City’s discretion.
7.2.1 Administrative Order

The Director of the Department of Stormwater Management or their designee may issue a written AO for offenses of noncompliance with the City’s Stormwater Management Ordinance, the approved City construction activity application, or the approved SWMP. AOs will be made in writing, but a verbal notice may be given if the deficiency needs immediate correction to prevent offsite or downstream impacts. All AOs, verbal or written, shall be noted in the project file.

The four common types of AOs are (1) Cease and Desist Orders, (2) Show Cause Orders, (3) Consent Orders, and (4) Compliance Orders. The circumstances of the violation will determine the type of AO the violator will receive. Since no single type of AO can account for all circumstances, the City may issue multiple AOs for the violation.

Each of the types of AOs will include the following:

- Nature of the violation(s)
- Proposed penalty
- Required corrective actions
- Time period for correcting the violation(s)

7.2.1.1 Cease and Desist Order and Stop Work Order

A Cease and Desist Order directs a violator to cease illegal or unauthorized discharges or activity immediately. A Cease and Desist Order will be used in situations where the discharge could cause environmental damage or cause an emergency situation. The Order may be issued immediately upon discovery of the problem or following a hearing. In an emergency, the Order to cease and desist may be given by telephone. However, a subsequent written order will be served on the violator, either in person or by certified mail. If necessary, the City may order immediate cessation of any illegal discharge to its stormwater system. In non-emergency situations, the Cease and Desist Order may be used to suspend or revoke stormwater discharge permits or land-disturbance permits. A Stop Work Order is a specific type of Cease and Desist Order authorized under Chapter 27, Division 5 of the City Ordinance.

A Stop Work Order may be issued for, but is not limited to, the following:

- Construction, development, and redevelopment activities occurring without an approved City construction activity application or a City approved stormwater plan
- Past enforcement actions taken by the City to remedy a situation(s) that have not been properly addressed with appropriate and prompt action to the satisfaction of the Director of the Department Stormwater Management or their designee
A health or safety issue resulting from failure to comply with the City’s Stormwater Management Ordinance, an approved City construction activity application or an approved stormwater plan

· Offsite sedimentation resulting from noncompliance with the approved stormwater plan that has eliminated or degraded a use in a downstream waterbody or that such degradation is imminent

· Offsite sedimentation resulting from noncompliance with the approved stormwater plan that has caused damage to adjacent land

A Stop Work Order may allow or require correction of violations, but no other construction activities may occur. The Stop Work Order will state that failure to comply may result in the suspension or revocation of any City approvals for development activities and possible criminal penalties, civil penalties, or both.

7.2.1.2 Show Cause Order

An Order to Show Cause directs the violator to appear before the City's Hearing Officer, explain the noncompliance, and show cause why more severe enforcement actions against the violator should not go forward, including but not limited to, civil penalties. The Order to Show Cause is typically issued after informal contacts or NOVs have failed to resolve the noncompliance or if civil penalties are being sought. The Show Cause Hearing can also be used to investigate violations of previous orders. During the hearing, the City can explore the circumstances surrounding the noncompliance and evaluate the sufficiency of evidence for subsequent civil or criminal actions. The Hearing Officer must then determine whether further action is warranted and, if so, its nature and extent.

7.2.1.3 Consent Order

The Consent Order combines the force of an AO with the flexibility of a negotiated settlement. The Consent Order is an agreement between the City and the violator that may contain three elements:

· Compliance schedule(s)

· Stipulated fines or remedial actions

· Signatures of the City and violator(s)

A Consent Order is appropriate when the violator assumes responsibility for the noncompliance and is willing (in good faith) to correct its cause(s). The violator need not admit the noncompliance in the text of the Order. Thus, signing the Order is neither an admission of liability for purposes of civil litigation nor a plea of guilty for purposes of criminal prosecution. However, the City must make sure that the Consent Order prohibits future violations and provides for corrective action on the part of the violator.
7.2.1.4 Compliance Order

A Compliance Order directs the violator to achieve or restore compliance by a date specified in the Order. It is issued unilaterally, and its terms need not be discussed with the violator in advance. The Compliance Order is usually issued when noncompliance cannot be resolved without construction or repair. Compliance Orders are also frequently used to require violators to develop BMPs, spill prevention programs, and related City stormwater program requirements. The Compliance Order should document the noncompliance and state required actions to be accomplished by specific dates, including interim and final reporting requirements. In drafting the compliance schedule, the City should be firm but reasonable taking into consideration all factors relevant to an appropriate schedule duration. Once these milestones are set, the City must track the violator's performance against them and escalate its enforcement response as needed. For example, the City orders the violator to show cause for failing to meet a major milestone, imposes an additional fine, or initiates judicial proceedings.

7.2.2 Notice of Violation

The NOV is an official communication from the City to the violator that informs the violator that a stormwater program violation has occurred. The NOV is an appropriate initial response to minor violations, with no significant adverse environmental impact, or when the violator is cooperative in resolving its problems. In the case of a major violation resulting in significant adverse impact to the environment or when the violator does not promptly undertake corrective action, an NOV may also be issued prior to issuing an AO or pursuing civil or judicial remedies. The NOV's purpose is to notify the violator of the violation(s); it may be the only response necessary in cases of infrequent and generally minor violations. If the violator does not return to compliance following receipt of the NOV, the City will proceed to more stringent enforcement measures. For maximum effectiveness, the NOV will be written and delivered to the violator immediately upon detection of the violation. As a general rule, the NOV will be mailed to the violator no later than five business days after discovery of the noncompliance. The NOV will either be hand delivered by City personnel or be sent to the violator via Certified Mail, Return Receipt Requested.

In addition to stormwater program violations, if the City determines that an owner or operator of any property is causing or partially causing flooding, erosion, or noncompliance with water quality standards, upon providing valid proof of such impacts, the City can issue an NOV to the owner to require removal of the proven impact in a concerted, prudent manner and to restore the impacted property.

The Director of the Department Stormwater Management or their designee may issue an NOV for offenses of noncompliance with the City's Stormwater Management Ordinance, the
approved City construction activity application, or the approved SWMP. If an AO has been
previously issued and there are either subsequent noncompliance issues or failure to complete
the items on the AO within a specified time period, an NOV may be issued.

A NOV will include the following:

- Nature of the violation(s)
- Proposed penalty
- Notification that a Stop Work Order may be issued or that approvals for the site may be
  suspended or revoked if there is continued noncompliance
- Required corrective actions;
- Time period for correcting the violation(s)

7.2.3 Uniform Ordinance Summons

A code enforcement officer authorized by state law or any other city employees designated by
the City Council as a code enforcement officer may issue a UOS for offenses of noncompliance
with the City’s Stormwater Management Ordinance or SWDSM. This UOS may result in the
offending individual having to appear before the Magistrate in the Livability Court of the City of
Charleston. These violations can result in a fine, incarceration, or both.

7.2.4 Civil and Criminal Penalties

Through the use of UOSs, the City may summon the violator to civil or criminal proceedings,
depending on the severity of the violation. A violator may be summoned for both civil litigation
and criminal prosecution. Criminal prosecution may be brought prior to, concurrently with, or
subsequent to civil litigation. If the City litigates or prosecutes in Court, the Courts will
determine the appropriate penalties for the violations. The penalties for violations may include
but are not limited to fines, incarceration, or both.
Chapter 8 References


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