



NEW HANOVER COUNTY

ZONING BOARD OF ADJUSTMENT

230 Government Center Drive, Lucie Harrell Conference Room, Wilmington, NC 28403

Members of the Board

Cameron Moore, Chair | **Kristin Freeman**, Vice-Chair
Henry "Hank" Adams | **Maverick Pate** | **Luke Waddell**

Board Alternates

Pete DeVita | **Richard Kern** | **Michael Keenan, Sr.**

Rebekah Roth, Director of Planning & Land Use | **Sharon Huffman**, Deputy County Attorney

February 23, 2021, 5:30 PM

I. Call Meeting to Order (Chairman Cameron Moore)

II. Approval of January Minutes (*currently in draft status*)

January Member Attendees: Cameron Moore, Kristin Freeman, Richard Kern, Maverick Pate, Luke Waddell

III. Regular Items of Business

Case ZBA-955 - McAdams, applicant, on behalf of City of Wilmington, property owner, is requesting a variance from tree retention requirements per Section 5.3.4(C) and parking lot interior landscaping requirements per Section 5.4.5(C) of the New Hanover County Unified Development Ordinance. The property is located at 205 Sutton Steam Plant Road.

IV. Other Business

V. Adjourn

MEETING MINUTES
BOARD OF ADJUSTMENT-DRAFT

The New Hanover County Board of Adjustment held a regular and duly advertised meeting at 5:30 P.M. at the New Hanover County Government Center Complex, 230 Government Center Drive, in the Lucie Harrell Conference Room, Wilmington, NC, on Tuesday, January 26, 2021.

Members Present

Cameron Moore -Chairman
Kristin Freeman - Vice- Chair
Luke Waddell
Maverick Pate
Richard Kern

Members Absent

Hank Adams
Pete DeVita
Michael Keenan, Sr.

Ex Officio Members Present

Ken Vafier - Executive Secretary
Sharon Huffman – Deputy County Attorney
Denise Brown - Administrative Zoning Technician

The meeting was called to order at 5:30 P.M. by the Chairman, Mr. Cameron Moore.

Chairman Moore explained that the board is a quasi-judicial board appointed by the Board of Commissioners to consider ordinance variances from residents in New Hanover County where special conditions would create unnecessary hardships. He said the board also hears appeals of the County's interpretation and enforcement of the Unified Development Ordinance. The appellants have thirty days in which to appeal any decision made by the Board to Superior Court.

ELECTION OF CHAIR AND VICE-CHAIR FOR 2021

Mr. Moore opened the floor to receive nominations for Chairman of the Board of Adjustment for the 2021 calendar year.

Mr. Waddell nominated Mr. Cameron Moore as Chairman of the Board of Adjustment.

With there being no further nominations the members proceeded to vote.

Mr. Kern second the motion. The board voted unanimously to elect Mr. Cameron Moore as the Chairman of the Board.

Mr. Moore opened the floor to receive nominations for Vice-Chair of the Board of Adjustment for the calendar year.

Mr. Moore nominated Ms. Kristin Freeman as Vice-Chair of the Board of Adjustment. With there being no further nominations the members proceeded to vote.

Mr. Kern second the motion. The board voted unanimously to elect Ms. Kristin Freeman as Vice-Chair to the Board of Adjustment.

New board members Luke Waddell and Maverick Pate were introduced and welcomed to their first meeting proceeding.

FIRST ORDER OF BUSINESS

The minutes from the November 10, 2020 meeting were reviewed and unanimously approved by the board as submitted.

BOARD OF ADJUSTMENT 2021 CALENDAR ADOPTION

Mr. Waddell motioned to approve the 2021 calendar. Mr. Kern second the motion. The 2021 calendar was unanimously approved and adopted by the board members.

CASE ZBA-954

The Chairman then swore in Ken Vafier, Bradley Wivell and Matthew Nichols.

Mr. Vafier stated the applicant, is requesting a variance from three ordinance provisions governing non-conforming situations and required front yard setbacks within the New Hanover County Unified Development Ordinance in order to construct a single-family dwelling within the B-2 District.

Mr. Bradley Wivell, applicant and property owner, is requesting a variance from the discontinuance of a non-conforming use duration per Sections 11.4 and 11.6; and a variance of 20.4' from the 35' minimum required front yard setback in the B-2, Regional Business District per Section 3.4.5 D of the New Hanover County Unified Development Ordinance. The property is located at 1112 Elm Street.

The parcel is located in the Seabreeze community in the southern section of New Hanover County. The parcel is one of several lots in the area that comprise approximately 10 acres which were zoned B-2 in 1971 due to their historic use as waterfront business and recreation destinations. Currently, the site is operating as a boat trailer storage lot which is affiliated with the applicant's boat storage business located across Elm Street to the southwest of the subject site. The applicant was notified upon expansion to the lot a minor site plan would be required. After discussing plans for the site, staff was informed by the applicant that they wanted to construct a single family dwelling on the subject site.

Mr. Vafier stated single family dwellings are not permitted in the B-2 district, but mentioned that there are some legal non-conforming uses in the area which pre-date the current zoning classification. Mr. Vafier stated there are criteria that allow legal non-conformities to remain until they are removed, however the continual use is not encouraged.

Mr. Vafier stated that once the use is discontinued, the ordinance allows a 180-day duration after which the property may only be used for conforming uses. The applicant provided a survey of a home at the subject site in 2002, however, this home was not present when the applicant purchased the property in 2017.

Staff has not located records to confirm a structure was on site within the 180-day time limit.

Mr. Vafier stated once the use has been discontinued, the use can only be used for legal conforming uses such as a business or commercial use. As staff is not able to approve a single family home on the subject site; the applicant elected to pursue approval of a variance for constructing a home at the site.

Chairman Moore asked how long has the 180-day duration rule been in the county in the ordinance.

Mr. Vafier stated the variance request is for the single family structure. He stated the 180-day duration has been on the books prior to the adoption of the Unified Development Ordinance.

Mr. Waddell inquired if the property had a well and if the area will pass for perk test.

Mr. Matthew Nichols, PLLC- Mr. Nichols presented representing Mr. Brad Wivell, who owns a local trailer and boat storage facility in the Seabreeze community. The storage business is located on the opposite side of the subject site. Mr. Nichols stated the community has a mixture of structures in the area in addition to the old home that was previously located on Mr. Wivell's parcel prior to 2017.

Mr. Nichols stated that there is a mobile home across the street from the subject site that was removed and currently a single family dwelling is being constructed at this site. Mr. Nichols stated the subject site is 9/10 of an acre, which is extremely small due to the wide right of way of Elm Street. Mr. Nichols stated the subject site is challenging due to its size in the B-2 district. Mr. Nichols stated the applicant is requesting a single family dwelling to be built at the subject site.

Mr. Nichols stated the situation was not created by the applicants, a rezoning of the site would not be beneficial to the applicant, the subject site is extremely small, and the applicant would be closer to his business across the street on Elm Street if the request were to be approved.

Mr. Kern asked about the time from when the structure was removed to when the applicant purchased the parcel.

Ms. Freeman inquired as to where the photos of the old house that were presented at the property came from.

Mr. Nichols stated that Mr. Clyde Dinkins owned the property from approximately in 2003 -2012, and that photos of the old home were taken around 2012 per the date on the photos.

Mr. Waddell asked if the applicant started using the property immediately after purchasing.

Mr. Wivell stated he purchased the subject site in 2017 and starting utilizing it as a boat storage. He is requesting approval to construct a future home close to his business.

Mr. Pate asked if tax records ever showed of a single family home on the subject site.

Mr. Vafier stated the tax records shows no data for the subject site.

PUBLIC HEARING CLOSED

BOARD DELIBERATION

Mr. Waddell asked if granting this variance would it set a precedent, and Ms. Freeman asked if the board would need to consider a prior case.

Ms. Huffman stated the board is tasked with deciding if the request constitutes an acceptable application for variance proceedings. Ms. Huffman stated the board cannot grant a variance for a permitted use in a zoning district. Ms. Huffman stated that the applicant is requesting approval of a use that is not allowed at the subject site.

Chairman Moore asked how long has B-2 zoning been in the Seabreeze community.

Mr. Vafier stated the B-2 zoning was applied to the area in 1971. Mr. Vafier stated this type of inquiry has been requested in past in the Seabreeze community.

Mr. Vafier stated applicants have tried unsuccessfully to have certain areas in or near the community rezoned over the years.

Mr. Kern asked in the past was the community a residential district.

Mr. Vafier stated the area was both residential and non- residential. In addition, there was no zoning regulations in years' prior when a lot of the community was constructed.

Mr. Nichols displayed photos of mixed structures in the past of the community.

Ms. Freeman asked if there are future plans for the Seabreeze area to become a more residential community, also if the UDO has language of rezoning small communities like Seabreeze and Castle Hayne.

Mr. Vafier stated as residents purchase larger tracts and request of rezoning it's possible these areas could be rezoned in the future, but there is not a current initiative to proactively rezone the area at the staff level.

Chairman Moore re-opened the public hearing for applicant rebuttal.

Mr. Nichols (rebuttal) Mr. Nichols referenced a case before the City of Wilmington's Board of Adjustment at 6320 Oleander Drive which suffered a fire and the building at the time was subject to a time limit to reconstruct. This time limit had expired to rebuild and the applicant presented this hardship to the Wilmington Board of Adjustment.

Mr. Nichols stated although the hearing was in the city's jurisdiction, the request is similar to today's case hearing whereby the board does have the authority to approve these type of request. Mr. Nichols stated the Wilmington Board of Adjustment request was approved and rebuilt.

Mr. Nichols stated it is in the board's authority to grant the variance as presented today. In addition, granting the variance would resolve a difficult situation for the applicant. No opposition to build the home has been received.

Mr. Nichols concluded that the request is not a use variance.

PUBLIC HEARING CLOSED

Mr. Vafier stated that the owner across the street and Ms. Dinkins stated they had no opposition to the applicant's request.

Mr. Kern stated the applicant should not be punished due to not knowing when the home old home was removed.

Ms. Freeman reiterated that a use variance is not allowed in the B-2 district.

Chairman Moore stated that the 180-day use is a common time line within a county ordinance.

Mr. Vafier stated that the applicant could apply for a special use permit or a live work-unit permit in order to construct a single-family dwelling, but would have to meet the respective UDO requirements for those uses.

Chairman Moore stated the board is tasked with upholding the ordinance. He recommended that the applicant work with staff on other avenues for a successful outcome.

Ms. Freeman made a motion that the application is not eligible for board authority for approval.

Chairman Moore second the motion that pursuant to state statute the application is not eligible for a variance, therefore a formal vote on the specific variance requests would not move forward.

Chairman Moore, Vice-Chair Freeman and Mr. Waddell voted Nay. Mr. Kern and Mr. Pate voted yay.

The vote was 3-2, and the request was not considered by the board as it was found to not be an eligible application for a variance.

Chairman Moore motioned to adjourn. Mr. Kern second the motion. All ayes to adjourn the January 26, 2021 meeting.

Executive Secretary

Chairman

Date: _____

The minutes of this meeting are not verbatim*

**VARIANCE REQUEST
BOARD OF ADJUSTMENT
February 23, 2021**

CASE: ZBA-955

PETITIONER: McAdams, applicant, on behalf of City of Wilmington, property owner.

REQUEST: Variance from tree retention requirements per Section 5.3.4(C) and interior landscaping requirements per Section 5.4.5(C) of the New Hanover County Unified Development Ordinance (UDO).

LOCATION: 205 Sutton Steam Plant Road
PID: R04000-001-012-000

ZONING: I-2, Heavy Industrial District

ACREAGE: 65.47 Acres

BACKGROUND AND ORDINANCE CONSIDERATIONS:

McAdams, applicant, on behalf of City of Wilmington, property owner, is requesting variances from two UDO provisions related to tree retention and interior landscaping requirements.

The subject property consists of 65.47 acres located to the south of Sutton Steam Plant Road, north of Sampson Street, and is zoned I-2, Heavy Industrial. Currently, there are seven existing sports fields on the northern half of the property. The applicant intends to construct four additional sports fields for the southern portion of the property, totaling eleven sports fields. When applying the UDO language from these sections, the proposed development would require additional off-street parking, interior landscaping in the amount of eight percent of the parking area, and tree retention where 15 trees would have to be retained or planted for each acre of area on the parcel disturbed by the development.

The subject tract was once a landfill and is now part of an EPA Brownfield Revitalization Program. This means that an environmental cleanup for the earlier use is active on the site. EPA Brownfield Revitalization Programs are common for abandoned industrial facilities, waste disposal sites, and former gas stations. These programs can aid in returning properties to productive future uses.

Sites involved in Brownfield Revitalization Programs may have limitations accompanied with the redevelopment. These limitations on the subject parcel are because of a geocell cover system or soil cover system placed over the contaminated area. In the case of the subject site, vegetative restrictions within the landfill/brownfield boundary are placed on root depth and root runners.

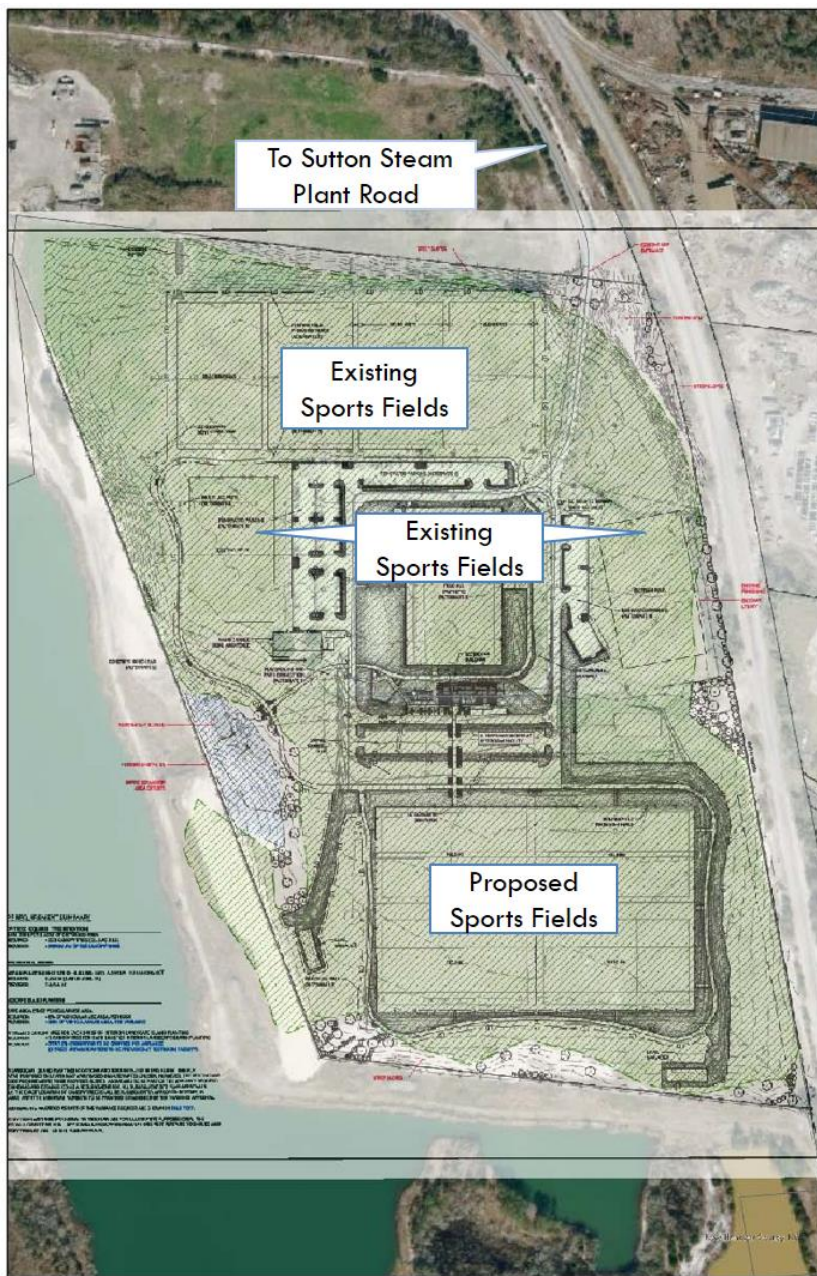


Figure 1: Aerial with Applicant's Conceptual Plan with Staff Markups

Under the provisions of the UDO, approximately 323 trees would be required to be planted within the proposed disturbed area (approximately 21.5 acres) as part of the tree retention requirements, and one tree per 144 square feet (approximately 49 trees) would be required to be planted to meet the interior parking standards. However, a large percentage of the site is occupied by landfill/brownfields, subject to restrictions on root depth, and available space outside the landfill/brownfields boundary is limited. According to the applicant, difficulties arise with providing the required number of plantings because of the vegetative cover restrictions on root depth within the landfill/brownfields.

5.3.4 TREE RETENTION STANDARDS TRANSITIONAL BUFFERS

C. A minimum of 15 trees at least two inches DBH or two caliper inches, as applicable, shall be retained or planted on a parcel where development occurs in accordance with Section 5.4, Landscaping and Buffering.

5.4.5. PARKING LOTS

C. Landscaping for parking lot interiors shall be in accordance with the requirements in Table 5.4.5.C: Standards for Parking Lot Interiors.

Table 5.4.5.C: Standards for Parking Lot Interiors	
Dimensional Standards	- Landscaped areas in the interior of parking lots shall be equal to eight percent of the total area to be used for parking, loading, automobile sales, driveways, internal drive aisles, and other vehicular or pedestrian use. - Landscaping islands, either separate from or protruding from perimeter landscaping strips, shall be a minimum of 12 feet in width measured from back of curb to back of curb.
Plantings Required	- One planted or existing tree shall be required for every 144 square feet rounded to the next lowest whole number of total interior landscaped area, with a minimum of one tree in each island. - At least 75 percent of trees required for interior landscaping shall be of a shade/canopy species. - The remainder of interior landscaped area shall be covered with appropriate mulching or vegetative groundcover, except for designated pedestrian walkways.

Figure 2: Variance Requested from Tree Retention Requirements per Section 5.3.4(C) and Interior Landscaping Requirements per Section 5.4.5(C) of UDO

As such, the applicant is requesting the following variances:

- (A) A variance of 173 trees required from Section 5.3.4(C) of the UDO requiring that a minimum of 15 trees at least two inches DBH or two caliper inches, as applicable, shall be retained or planted on a parcel where development occurs.

The applicant is proposing to disturb approximately 21.5 acres, requiring about 323 trees to be retained or planted. The applicant is proposing to plant about 150 trees outside of the Landfill/Brownfield boundary.

- (B) A variance of 49 trees required from Section 5.4.5(C) of the UDO requiring one planted or existing tree shall be required for every 144 square feet of total interior landscaped area, with a minimum of one tree in each parking island.

The applicant is proposing for the interior parking landscaped areas to be increased from eight percent to about sixteen percent, providing more areas for shrubs because of the inability to plant trees.

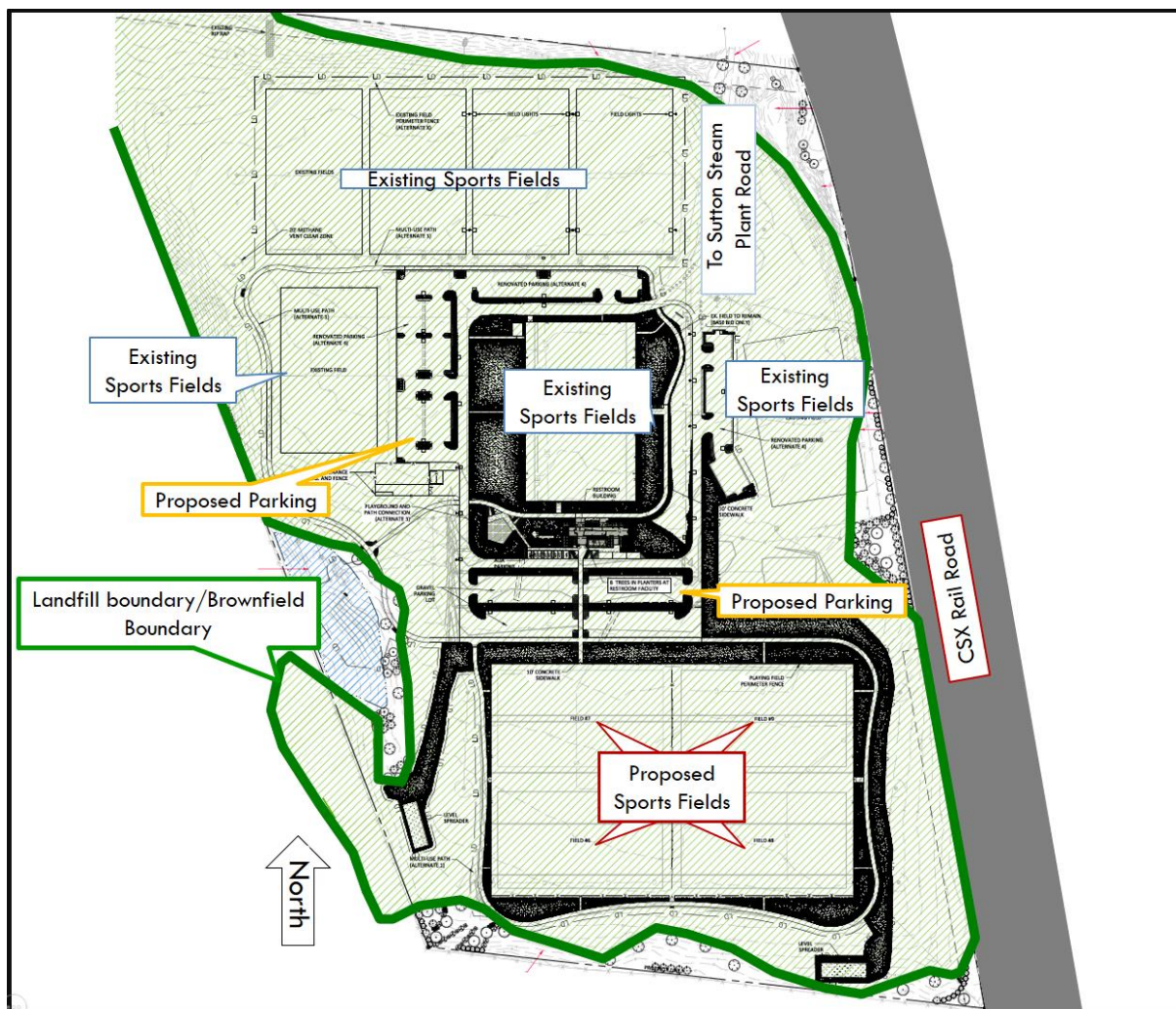


Figure 3: Applicant's Conceptual Plan with Staff Markups Illustrating the Landfill /Brownfield Boundary

The applicant contends that the variance is necessary in order to be compliant with site vegetative cover standards for landfills/brownfields, as specified by North Carolina's Department of Environmental Quality. When applying the UDO language from Sections 5.3.4(C) and 5.4.5(C), the landfill/brownfield boundary illustrated above in green is restricted by the Landfill Site Vegetative Cover documentation provided in your packet that states that root depth shall be no greater than 18 inches at maturity with no root runner greater than 6 inches.

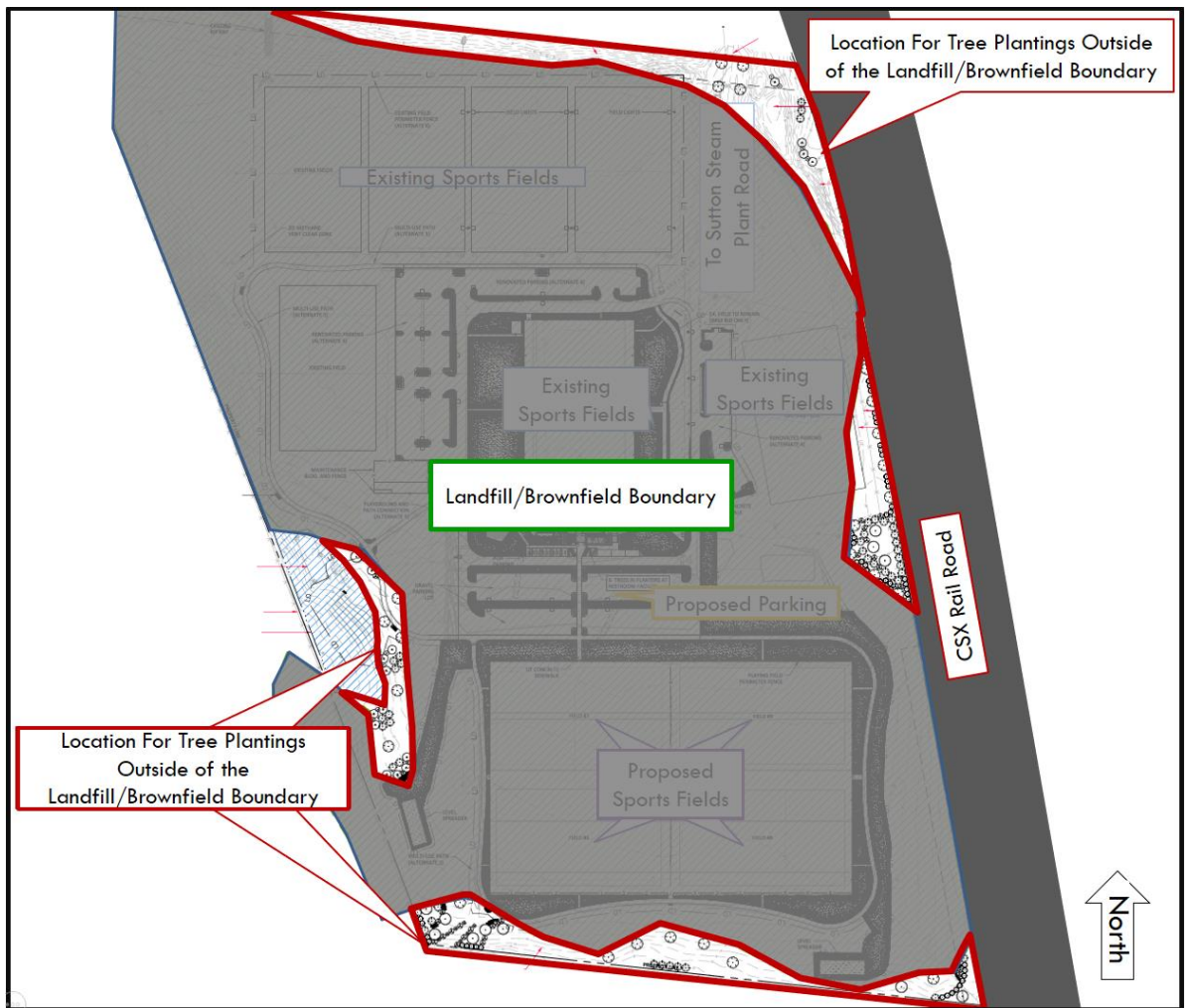


Figure 4: Applicant's Conceptual Plan with Staff Markups Illustrating Areas Not Restricted For Vegetative Cover of Root Depth

The applicant has submitted a landscaping plan that proposes about 150 understory trees to be placed outside the landfill/brownfields boundary located in red above.

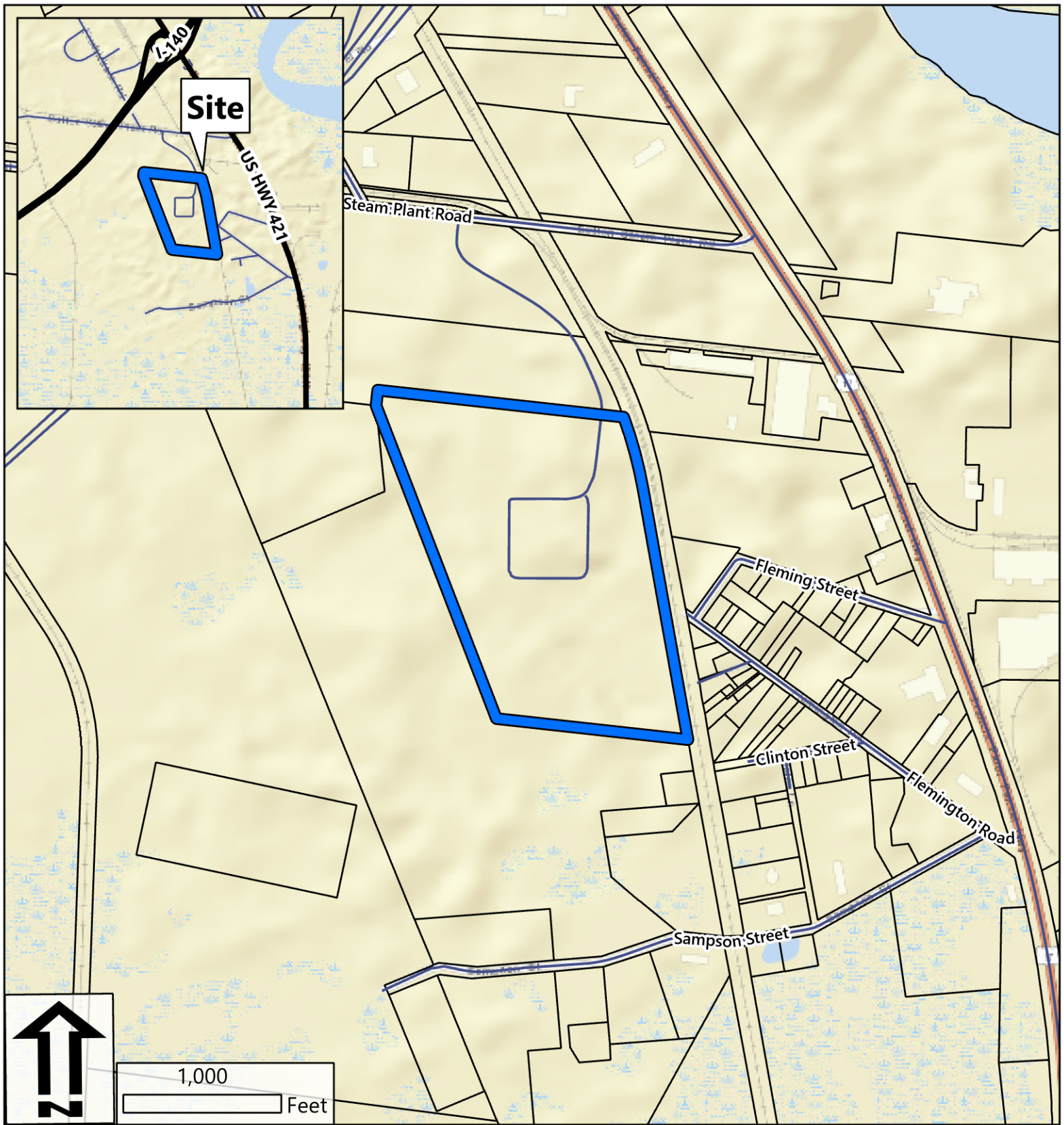
BOARD OF ADJUSTMENT POWER AND DUTY:

The Board of Adjustment has the authority to authorize variances from the terms of the Unified Development Ordinance where, due to special conditions, a literal enforcement of the regulations would result in unnecessary hardship. In granting any variance, the Board may prescribe appropriate conditions and safeguards in conformity with the Unified Development Ordinance. A concurring vote of four-fifths (4/5) of the voting members of the Board shall be necessary to grant a variance. A variance shall not be granted by the Board unless and until the following findings are made:

1. Unnecessary hardship would result from the strict application of the ordinance. It shall not be necessary to demonstrate that, in the absence of the variance, no reasonable use can be made of the property.
2. The hardship results from conditions that are peculiar to the property, such as location, size, or topography. Hardships resulting from personal circumstances, as well as hardships resulting from conditions that are common to the neighborhood or the general public, may not be the basis for granting a variance.
3. The hardship did not result from actions taken by the applicant or the property owner. The act of purchasing property with knowledge that circumstances exist that may justify the granting of a variance shall not be regarded as a self-created hardship.
4. The requested variance is consistent with the spirit, purpose, and intent of the ordinance, such that public safety is secured, and substantial justice is achieved.

ACTION NEEDED (Choose one):

1. **Motion to approve the variance request based on the findings of fact (with or without conditions)**
2. **Motion to table the item in order to receive additional information or documentation (Specify).**
3. **Motion to deny the variance request based on specific negative findings in any of the 4 categories above.**



Case: ZBA-955

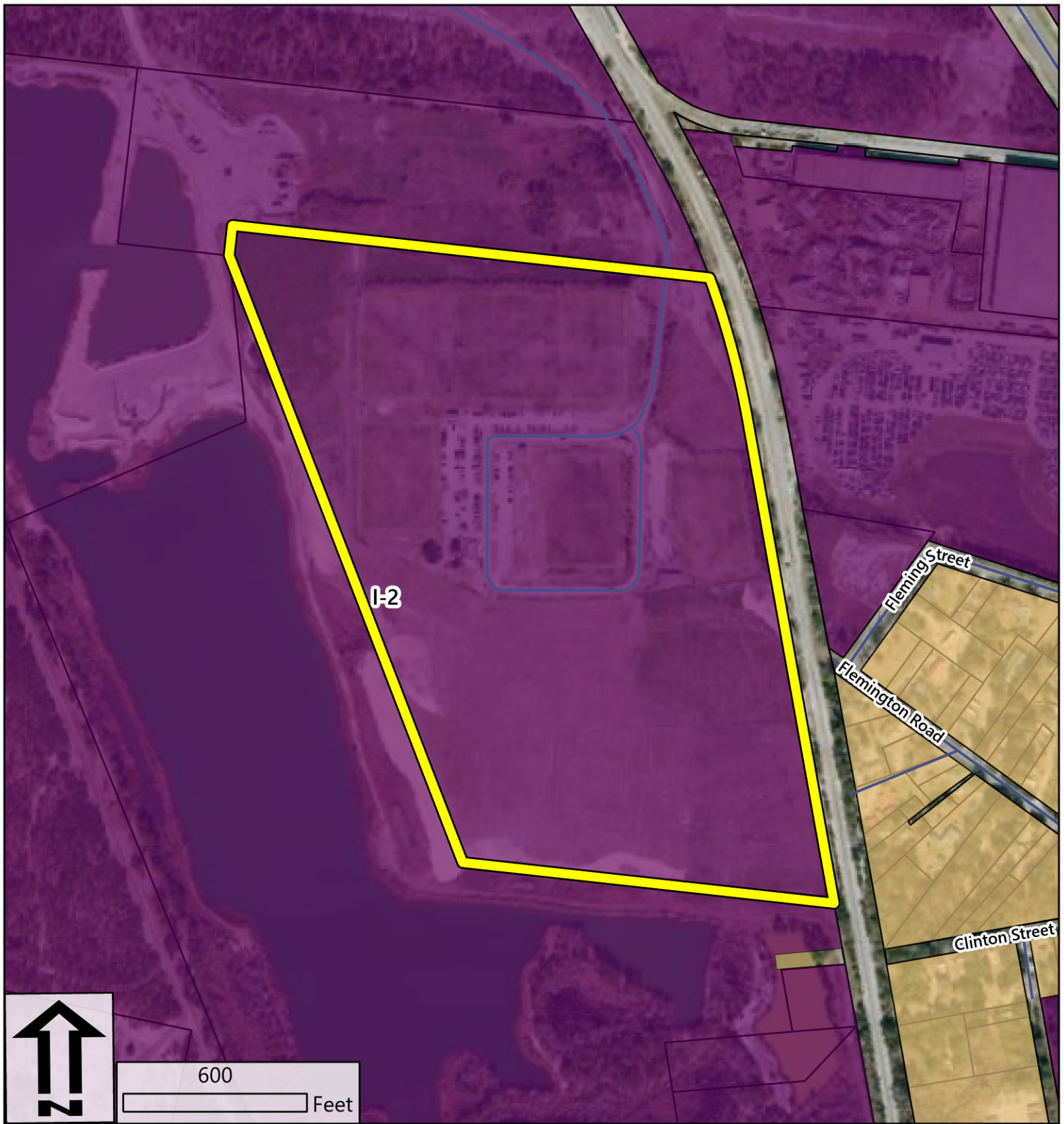
Address: 205 Sutton Steam Plant Rd

Variance from Sections 5.3.4 and 5.4.5 C of the UDO

Applicant: David Bergmark

Owner: City of Wilmington

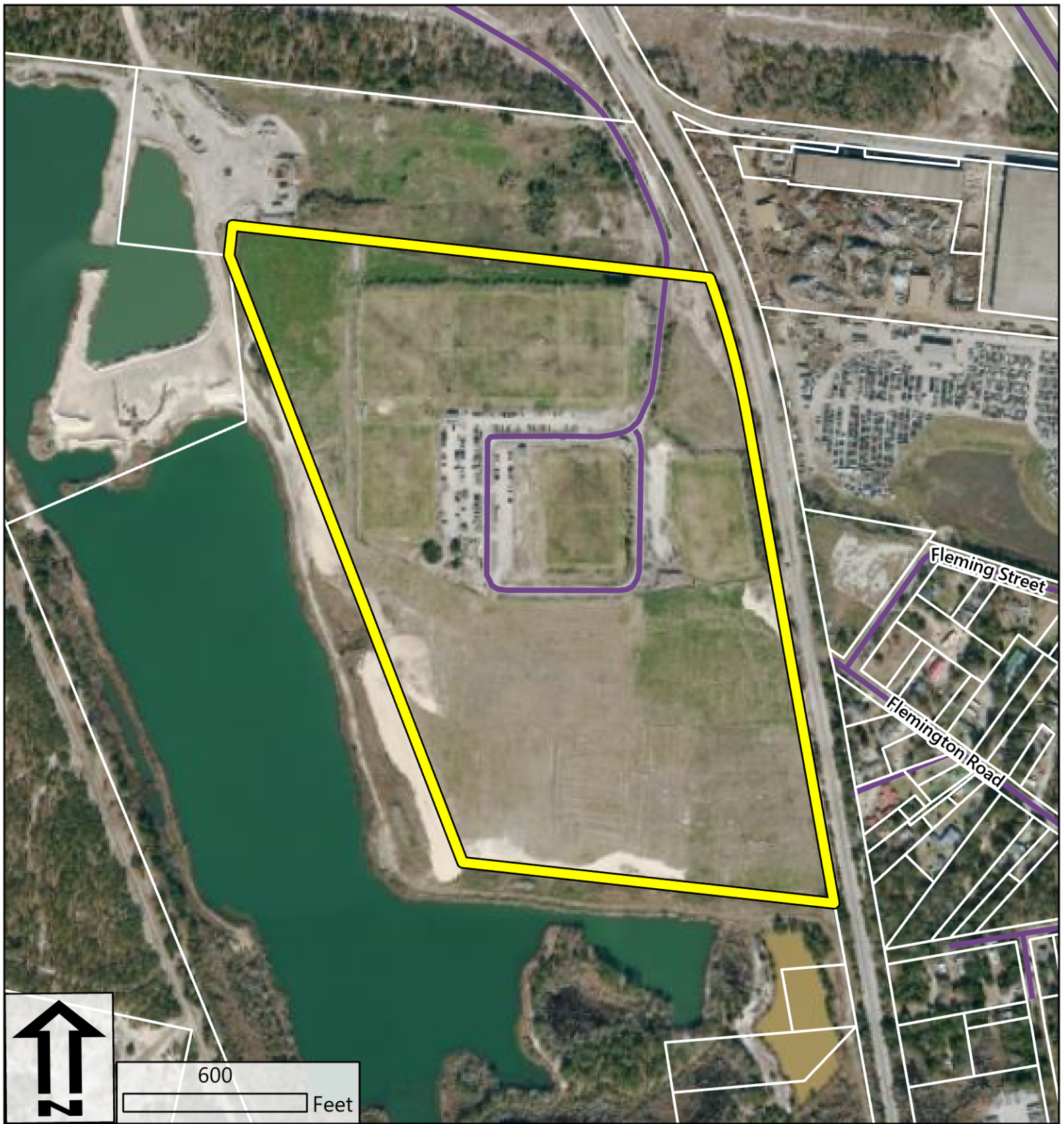
Vicinity Map



Case: ZBA-955

Address: 205 Sutton Steam Plant Rd
Variance from Sections 5.3.4 and 5.4.5 C of the UDO
Applicant: David Bergmark
Owner: City of Wilmington

Zoning Map



Case: ZBA-955

Address: 205 Sutton Steam Plant Rd
Variance from Sections 5.3.4 and 5.4.5 C of the UDO
Applicant: David Bergmark
Owner: City of Wilmington

Aerial Map



NEW HANOVER COUNTY

ZONING BOARD OF ADJUSTMENT

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Rebekah Roth, Director of Planning & Land Use | Sharon Huffman, Deputy County Attorney

ORDER TO GRANT A VARIANCE – Case ZBA-955

The Board of Adjustment for New Hanover County, having held a public hearing on February 23, 2021 to consider application number ZBA-955, submitted by McAdams, applicant, on behalf of City of Wilmington, property owner, a request for a variance of 173 trees from Section 5.3.4(C) of the UDO requiring that a minimum of 15 trees at least two inches DBH or two caliper inches, as applicable, shall be retained or planted on a parcel where development occurs; and a variance of 49 trees required from Section 5.4.5(C) of the UDO requiring one planted or existing tree shall be required for every 144 square feet of total interior landscaped area, with a minimum of one tree in each parking island in a manner not permissible under the literal terms of the ordinance and having heard all the evidence and arguments presented at the hearing, makes the following FINDINGS OF FACT and draws the following CONCLUSIONS:

1. It is the Board's conclusion that, if the applicant complies with the literal terms of the ordinance, specifically a variance of 173 trees from Section 5.3.4(C) of the UDO requiring that a minimum of 15 trees at least two inches DBH or two caliper inches, as applicable, shall be retained or planted on a parcel where development occurs; and a variance of 49 trees required from Section 5.4.5(C) of the UDO requiring one planted or existing tree shall be required for every 144 square feet of total interior landscaped area, with a minimum of one tree in each parking island of the New Hanover County Unified Development Ordinance, that an unnecessary hardship would/would not result. *(It shall not be necessary to demonstrate that, in the absence of the variance, no reasonable use can be made of the property.)* This conclusion is based on the following FINDINGS OF FACT:

- _____.
- _____.
- _____.
- _____.

2. It is the Board's conclusion that the hardship of which the applicant complains results/does not result from unique circumstances related to the subject property, such as location, size, or topography. *(Hardships resulting from personal circumstances, as well as hardships resulting from conditions that are common to the neighborhood or the general public, may not be the basis for granting a variance.)* This conclusion is based on the following FINDINGS OF FACT:

- _____.
- _____.

- _____.
- _____.

3. It is the Board's conclusion that the hardship did/did not result from actions taken by the applicant or the property owner. *(The act of purchasing property with knowledge that circumstances exist that may justify the granting of a variance shall not be regarded as a self-created hardship.)* This conclusion is based on the following FINDINGS OF FACT:

- _____.
- _____.
- _____.
- _____.

4. It is the Board's conclusion that, if granted, the variance will/will not be consistent with the spirit, purpose, and intent of the ordinance, such that public safety is secured, and substantial justice is achieved. This conclusion is based on the following FINDINGS OF FACT:

- _____.
- _____.
- _____.
- _____.

THEREFORE, on the basis of all the foregoing, IT IS ORDERED that the application for a VARIANCE from New Hanover County Unified Development Ordinance to allow a variance of 173 trees from Section 5.3.4(C) of the UDO requiring that a minimum of 15 trees at least two inches DBH or two caliper inches, as applicable, shall be retained or planted on a parcel where development occurs; and a variance of 49 trees required from Section 5.4.5(C) of the UDO requiring one planted or existing tree shall be required for every 144 square feet of total interior landscaped area, with a minimum of one tree in each parking island of the UDO be GRANTED/DENIED, subject to the following conditions, if any:

ORDERED this 23rd day of February, 2021.

Cameron Moore, Chairman

Attest:

Kenneth Vafier, Executive Secretary to the Board

NEW HANOVER COUNTY

DEPARTMENT OF PLANNING & LAND USE

230 Government Center Drive, Suite 110

Wilmington, North Carolina 28403

Telephone (910) 798-7165

FAX (910) 798-7053

planningdevelopment.nhcgov.com



ZONING & SUBDIVISION VARIANCE APPLICATION

This application form must be completed as part of a request for a zoning and/or subdivision variance. The application submitted through the county's online COAST portal. The main procedural steps in the submittal and review of applications for a variance are outlined in the flowchart below. More specific submittal and review requirements, as well as the standards to be applied in reviewing the application, are set out in Section 10.3.11 of the Unified Development Ordinance.



1. Applicant and Property Owner Information

Applicant/Agent Name David Bergmark	Owner Name (if different from Applicant/Agent) CITY OF WILMINGTON
Company McAdams	Company/Owner Name 2 Sterling Cheatham (City Manager)
Address 2905 Meridian Parkway	Address 102 N THIRD STREET (P.O. BOX 1810)
City, State, Zip Durham, NC 27713	City, State, Zip WILMINGTON, NC 28402
Phone (919) 449 - 4005 (mobile)	Phone (910-765-7469)
Email bergmark@mcadamsco.com	Email Anne.Ballweg@wilmingtonnc.gov

2. Subject Property Information

Address/Location 205 Sutton Steam Plant Rd	Parcel Identification Number(s) PID: R04000-001-012-000
Total Parcel(s) Acreage 65.47 acres	Existing Zoning and Use(s) I-2 (industrial) / Former Flemington Landfill

Applicant Tracking Information (This section completed by staff)

Case Number: ZBA-955	Date/Time Received: 1/22/21	Received by: RM
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3. Proposed Variance Narrative

Subject Zoning Regulation, Chapter and Section

In the space below, please provide a narrative of the application (attach additional pages if necessary).

The City of Wilmington is seeking to develop the subject property into a regional athletic complex. However the site's former use as a landfill and the associated state regulations governing former landfill sites creates conflicts with local landscaping code. As a result, the applicant is unable to meet the strict language of the County's Tree Retention (Section 5.3.4) and Landscaping for Parking Lot Interiors (Section 5.4.5.C) standards, as they are unable to plant canopy trees within the boundaries of the former landfill due to their root depth. To resolve this conflict, the applicants requests the following variances and associated conditions (and submits **Exhibit L1** for reference):

1. Variance to Section 5.3.4 (Tree Retention)

- a. In lieu of providing 15 canopy trees per 1 acre of disturbed area (323 required), the applicant will provide a minimum of 150 canopy trees outside of the former landfill boundary.

2. Variance to Section 5.4.5.C (Landscaping for Parking Lot Interiors)

- a. The applicant requests an exemption from the required 1 canopy tree for each 144 SF of interior landscape island planting, but offers to include 6 trees within planters to be placed around the restroom facility.
- b. To offset the lack of interior parking lot canopy trees, the applicant offers as a condition to provide a minimum interior landscaped area of 16% of Vehicular Use Area (instead of 8%).

CRITERIA REQUIRED FOR APPROVAL OF A VARIANCE

The Board of Adjustment may grant a variance if it finds that strict application of the ordinance results in an unnecessary hardship for the applicant, and if the variance is consistent with the spirit, purpose, and intent of the ordinance. The applicant must explain, with reference to attached plans (where applicable), how the proposed use meets these required findings (attach additional pages if necessary).

- 1. Unnecessary hardship would result from strict application of the ordinance.** It shall not be necessary to demonstrate that, in the absence of the variance, no reasonable use can be made of the property.

Due to this site's previous use as a landfill, the strict application of local ordinance as it relates to tree plantings would directly conflict with the North Carolina Department of Environmental Quality's vegetative cover regulations for prior landfill sites. The DEQ's planting requirements include that root depth be no greater than 18 inches at maturity with no root runner greater than 6 inches (**See Exhibit A - Section 2.1 Plant Requirements**). This requirement permits grasses and shrubs, but precludes planting of trees within the area of the site previously used as a landfill (which is the vast majority of the site and fully includes the parking area by the building - **See Exhibit L1**).

2. **The hardship results from conditions that are peculiar to the property, such as location, size or topography.** Hardship resulting from personal circumstances, as well as hardships resulting from conditions that are common to the neighborhood or general public, may not be the basis for granting a variance.

The prior use of the site as a landfill is what is creating the conflict the Town's landscaping requirements. This existing condition is particular to this site, and with only one other landfill in the county, is not indicative of a condition that is common to the surrounding area or county in general.

3. **The hardship did not result from actions taken by the applicant or the property owner.** The act of purchasing property with knowledge that circumstances exist that may justify the granting of a variance shall not be regarded as a self-created hardship.

Neither the applicant nor the property owner established the prior use as a landfill. Thus, the site-specific circumstance creating the hardship did not result from actions taken by the applicant or the property owner.

4. **The requested variance is consistent with the spirit, purpose and intent of the ordinance, such that public safety is secured, and substantial justice is achieved.**

Tree protection and landscaping regulations are intended to enhance the aesthetic appearance of new development with the natural landscape to the benefit of the County's visual and environmental character.

The requested variance to the County's Tree Retention (Section 5.3.4) and Landscaping for Parking Lot Interiors standards (Section 5.4.5.C) represents the minimum variance required in order to accommodate the State's regulations for prior landfill sites by removing specified tree plantings, while providing double the required amount of interior landscape island planting areas to offset the reduction in tree coverage.

Care will be taken to provide natural and aesthetically pleasing landscaping in areas where tree root depth would violate state regulations, through the use of shrubs, ground covers, and ornamental grasses. It is our firm belief that the requested variance proposal is true to the spirit of the ordinance within the site's limitations, and will preserve public safety and justice.

Staff will use the following checklist to determine the completeness of your application. Please verify all of the listed items are included and confirm by initialing under "Applicant Initial". Applications determined to be incomplete must be corrected in order to be processed for further review.

Application Checklist

- ☒ This application form, completed and signed
- ☒ Application fee: \$400 per application
- ☒ Site plan or sketch illustrating the requested variance
- ☒ One (1) hard copy of ALL documents
- ☒ One (1) PDF copy of ALL documents

Applicant Initial

Staff Initial

DB

AB

DB

AB

DB

RM

DB

RM

DB

RM

Acknowledgement and Signatures

By my signature below, I understand and accept all of the conditions, limitations, and obligations of the variance application for which I am applying. I understand that I have the burden of proving why this application meets the required findings necessary for granting a variance. I certify that this application is complete and that all information presented in this application is accurate to the best of my knowledge, information, and belief.

If applicable, I also appoint the applicant/agent as listed on this application to represent me and make decisions on my behalf regarding this application during the review process. The applicant/agent is hereby authorized on my behalf to:

1. Submit an application including all required supplemental information and materials;
2. Appear at public hearings to give representation and comments; and
3. Act on my behalf without limitations with regard to any and all things directly or indirectly connected with or arising out of this application.

Sterling B. Cheatham

Signature of Property Owner(s)

Sterling B. Cheatham

Print Name(s)

David Bergmark

Signature of Applicant/Agent

David Bergmark

Print Name

Note: This form must be signed by the owner(s) of record. If there are multiple property owners, a signature is required for each owner of record.

- **The land owner or their attorney must be present for the case at the public hearing**

X:\Projects\Shared\WLM-17000\04-Production\Engineering\Construction Drawings\Current Drawings\WLM17000-L1.dwg, 12/23/2020 2:22:55 PM, Jenkins, Garrett

LANDSCAPE REQUIREMENT SUMMARY

TOTAL CANOPY TREES REQUIRED (TREE RETENTION)
15 TREES (2" MIN. DBH) PER 1 ACRE OF DISTURBED AREA
REQUIRED: = 323 CANOPY TREES (21.5 AC X 15)
PROVIDED: = **MINIMUM OF 150 CANOPY TREES**

BUILDING FOUNDATION PLANTING

FOUNDATION PLANTING BED: 12% OF BUILDING FACE ADJACENT TO PARKING LOT
REQUIRED: = 250 SF (12% OF 2,080 SF)
PROVIDED: = 1,410 SF

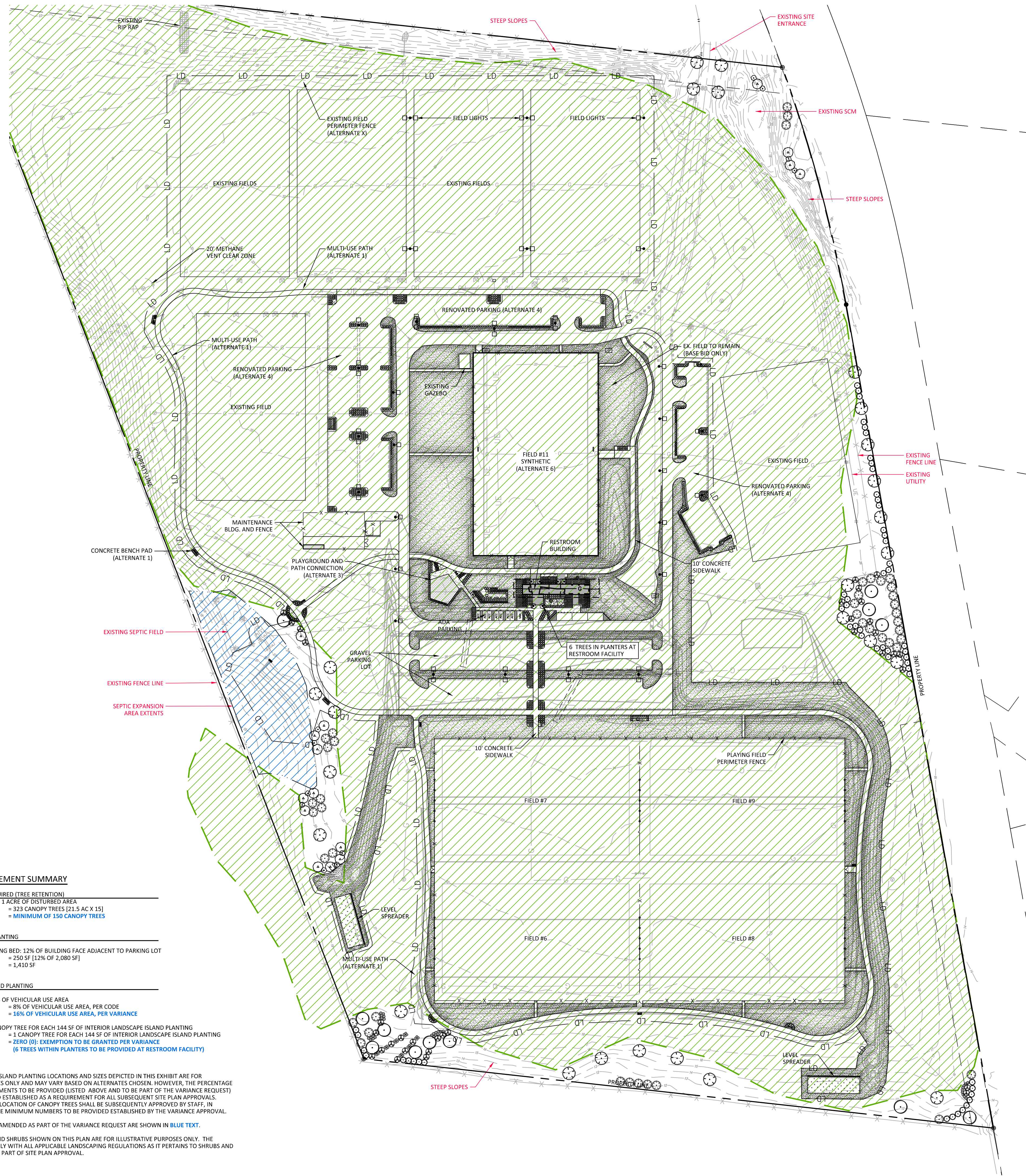
INTERIOR LANDSCAPE ISLAND PLANTING

LANDSCAPE AREA: 8% OF VEHICULAR USE AREA
REQUIRED: = 8% OF VEHICULAR USE AREA, PER CODE
PROVIDED: = **16% OF VEHICULAR USE AREA, PER VARIANCE**

CANOPY TREES: 1 CANOPY TREE FOR EACH 144 SF OF INTERIOR LANDSCAPE ISLAND PLANTING
REQUIRED: = 1 CANOPY TREE FOR EACH 144 SF OF INTERIOR LANDSCAPE ISLAND PLANTING
PROVIDED: = **ZERO (0); EXEMPTION TO BE GRANTED PER VARIANCE**
(6 TREES WITHIN PLANTERS TO BE PROVIDED AT RESTROOM FACILITY)

NOTES

- INTERIOR LANDSCAPE ISLAND PLANTING LOCATIONS AND SIZES DEPICTED IN THIS EXHIBIT ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON ALTERNATES CHOSEN. HOWEVER, THE PERCENTAGE ABOVE CODE REQUIREMENTS TO BE PROVIDED (LISTED ABOVE AND TO BE PART OF THE VARIANCE REQUEST) SHALL BE BINDING AND ESTABLISHED AS A REQUIREMENT FOR ALL SUBSEQUENT SITE PLAN APPROVALS. SIMILARLY, THE EXACT LOCATION OF CANOPY TREES SHALL BE SUBSEQUENTLY APPROVED BY STAFF, IN ACCORDANCE WITH THE MINIMUM NUMBERS TO BE PROVIDED ESTABLISHED BY THE VARIANCE APPROVAL.
- CODE REQUIREMENTS AMENDED AS PART OF THE VARIANCE REQUEST ARE SHOWN IN **BLUE TEXT**.
- UNDERSTORY TREES AND SHRUBS SHOWN ON THIS PLAN ARE FOR ILLUSTRATIVE PURPOSES ONLY. THE APPLICANT WILL COMPLY WITH ALL APPLICABLE LANDSCAPING REGULATIONS AS IT PERTAINS TO SHRUBS AND UNDERSTORY TREES AS PART OF SITE PLAN APPROVAL.

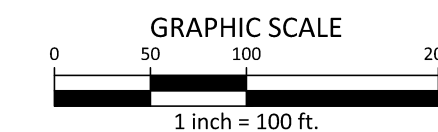


SITE LEGEND

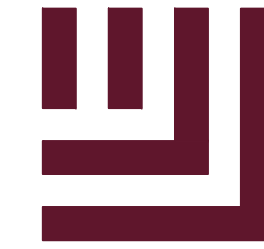
	SIGNAGE
	YARD LIGHTS
	LIGHT POLE
	POWER POLE
	TRAFFIC DIRECTIONAL ARROW
	ACCESSIBLE PARKING STALL
	VAN ACCESSIBLE PARKING STALL
	PROPERTY LINE
	EASEMENT LINE
	LIMITS OF DISTURBANCE
	CENTERLINE
	EXISTING CHAINLINK FENCE
	PROPOSED FENCE
	ACCESSIBLE ROUTE
	PROPOSED GRAVEL DRIVE
	PROPOSED CONCRETE SIDEWALK
	PROPOSED HEAVY-DUTY CONCRETE PAVEMENT
	PROPOSED GRAVEL MULTI-USE PATH (ALTERNATE X)
	METHANE VENT AND 20' CLEAR ZONE
	APPROXIMATE EXTENTS OF LANDFILL, PLANTING DEPTH: 18' MAX.
	EXTENTS OF SEPTIC EXPANSION AREA

PLANT SCHEDULE

CANOPY TREES	COMMON NAME	QTY
	Duraheat River Birch	15
	Eastern Red Cedar	54
	Longleaf Pine	43
	Willow Oak	12
	Southern Live Oak	26
	Cherokee Princess Dogwood	33
	Chaste Tree	17
UNDERSTORY TREES	COMMON NAME	QTY
	Butterfly Bush	
	Yaupon Holly	
	Andorra Juniper	
	Pixie Loropetalum	
	Dwarf Variegated Pittosporum	
SHRUBS	COMMON NAME	
	American Beautyberry	
	Katrinus Deluxe Mat Rush	
	Shenandoah Switch Grass	
DECIDUOUS SHRUBS	COMMON NAME	
	Bermuda 419	
	Brown Eyed Susan	
	Autumn Joy Sedum	
	Delaware Chalet River Rock	
ORNAMENTAL GRASSES	COMMON NAME	
GROUND COVERS	COMMON NAME	



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REGIONAL ATHLETIC COMPLEX LANDSCAPING EXHIBIT FOR VARIANCE REQUEST 205 SUTTON STEAM PLANT ROAD WILMINGTON, NC 28401

REVISIONS

NO. DATE

PLAN INFORMATION

PROJECT NO. WLM-17000
FILENAME WLM17000-L1
CHECKED BY -
DRAWN BY GLJ
SCALE SEE DRAWINGS
DATE 12.23.2020

SHEET

**VARIANCE
EXHIBIT**

L1.00



NORTH CAROLINA
Environmental Quality

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

MICHAEL SCOTT
Director

January 15, 2019

Addendum for Pre-Regulatory Landfill Site Vegetative Cover

Pre-Regulatory Landfill Unit (PRLF)

The reference documents included in this addendum were assembled by contractors for use by the PRLF Unit.

Key Considerations

- The list of preferred perennials/annuals suitable for planting on PRLF sites, may be considered for remedial action plans that incorporate a soil cover system with a minimum of 18-inches of soil on top of waste.
- PRLF sites covered with geocell type cover systems or soil cover systems that use less than 18-inches of soil on top of waste, must use turf grasses only.
- Box planters are permissible as alternatives if other types of vegetation are used.
- If the box planters are re-located or removed from the PRLF site, the area containing the box planter must be vegetated immediately.

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1. "Plants Suitable for Revegetation of Pre-Regulatory Landfill Sites with Soil Cover Systems in the North Carolina Coastal Plain & Piedmont". S&ME, Inc., 5/2017.
2. "Plant Recommendations for Pre-Regulatory Landfill Sites to Be Used as Parks". OBS Landscape Architects, 2017
3. "Plant Species Suitable for Landfill Containment Remedies – North Carolina Coastal Plain". Mihaly Land Designs, 2017



Plants Suitable for Revegetation of Pre-Regulatory Landfill Sites with Soil Cover Systems in the North Carolina Coastal Plain & Piedmont



May 2017



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1.0 INTRODUCTION

Maintaining vegetation over a landfill cover system is vital to maintaining the integrity of the landfill. Plants provide ecological diversity while preventing soil erosion. Additionally, landfills with established vegetated soil cover systems are considered aesthetically pleasing to the public. However, if plant roots puncture the liner, the soil cover system is then vulnerable to damage due to uprooting in extreme weather events. A list of plants that are suitable for these sites as alternatives to standard lawns has been developed. These plants will serve to retain soil placed over the waste and prevent erosion.

2.0 METHODOLOGY

The purpose of this report was to create a plant list of species suitable for planting on pre-regulatory landfills with soil cover systems in the coastal plain and Piedmont of North Carolina (NC). These plant lists are an alternative vegetative cover to standard grasses and may be provided to property owners. Plants of interest are small shrubs and herbaceous plants, including grasses, grass alternatives, rushes, perennials, annuals, and groundcovers.

2.1 Plant Requirements

The NCDEQ provided S&ME, Inc. and Carolina Silvics, Inc. with a list of specifications for plants. These requirements are intended to ensure that the cap lining is not damaged, plants used are suitable for the geographic province in which the landfill is located, and that plant growth and survival is not dependent on costly, routine maintenance. Plants included on the list must meet the following requirements:

- Root depth no greater than 18 inches at maturity with no root runner greater than 6 inches,
- Prevents soil erosion,
- Not an exotic intrusive species,
- Drought and pest resistant,
- Can withstand extreme weather events, and
- If woody, height not greater than 24 inches at maturity.

Other characteristics that may be vital to sustain a healthy flora include but are not limited to:

- Salt tolerance,
- Freezing points,
- Flood tolerance, and
- Low maintenance requirements.

2.2 Availability Search

As plant lists not cognizant of current commercial availability often frustrate land management objectives, we began by contacting the North Carolina Nursery & Landscape Association for a list of large wholesale nurseries in the North Carolina coastal plain and Piedmont. Twelve (12) nurseries were contacted. Ten (10) were willing to share their current availabilities via email or online access. These 10 nurseries are listed in Table 1 below.

Table 1. Nurseries contacted that were willing to share plant availability.

Nursery Name	Phone Number	Region Located
Baucoms Nursery	(800) 438-0444	Piedmont
Cure Nursery	(919) 542-6186	Piedmont
Mellow Marsh Farm	(919) 752-1200	Piedmont
Southeastern Native Plants	(828) 670-8330	Piedmont/Mountains
Grants Creek Nursery	(910) 353-0326	Coastal Plain
Johnson Nursery	(800) 624-8174	Coastal Plain
Cooperation		
Native Roots	(910) 385-8385	Coastal Plain
Southern Branch Nursery	(757) 373-7763	Coastal Plain (Virginia)
Taylor's Nursery	(919) 231-6161	Piedmont
Tinga Nursery	(910) 762-1975	Coastal Plain

To determine species available as sod, we visited the North Carolina Sod Producers Association website to obtain a list of providers. We then attempted to contact each provider to determine size of operation. The following six farms included in Table 2 were determined to be the largest in North Carolina and their availability was included in our lists.

Table 2. Sod farms contacted for species availability.

Nursery Name	Phone Number	Region Located
American Turf Grass Coop	(800) 315-9574	Coastal Plain
Cape Fear Turf Farm	(910) 669-2295	Coastal Plain
DMG Farms	(919) 639-4027	Coastal Plain/Piedmont
Jackson Turf	(910) 669-2991	Coastal Plain
Piedmont Turf Farm	(828) 428-8359	Piedmont
Vandemark	(252) 437-1501	Coastal Plain

2.2 List Development

All available plants were divided into three categories: shrubs, grasses/groundcovers, and perennials/annuals. We then attempted to obtain the following information for each species/cultivar:

- Scientific name,
- Common name,
- Invasive status,
- Invasive potential/status,
- Root Depth (in) at maturity,
- Height (in) at maturity,
- Drought tolerance (high, moderate, low),
- United States Fish & Wildlife Service (USFWS) Wetland Indicator Status
- Flood tolerance (high, moderate, low),
- Salt tolerance (high, moderate, low),
- Disease/insect resistance (high, moderate, low),
- Animal resistance (high, moderate, low),
- Annual/Perennial,
- Maintenance requirements (high, moderate, low),
- Recommended United States Department of Agriculture (USDA) hardiness zone,
- Cold hardiness (high, moderate, low and/or minimum temp for survival (F))
- Suitability for NC Piedmont (USDA hardiness zones 8a, 7b & 7a),
- Suitability for NC Coastal Plain (USDA hardiness zones 8b, 8a & 7b), and
- other pertinent information readily available.

Species determined to be invasive or to exceed maximum root depths or maximum height at maturity were removed from the lists. Those that remained were then researched for USFWS indicator status and drought tolerance. Species found to be drought intolerant or obligate wetland species (indicator status of OBL) were also removed from the lists. The lists were then revised to remove any species that additional research indicated would not be suitable.

The main sources relied upon to gather this information were the USDA Plants Database and the Missouri Botanical Garden's online site. Other online sources, such as personal blogs and antidotes, were used when these two sources lacked sufficient data. If information could not be found for a certain species/cultivar, that field was left blank.

3.0 RESULTS

Review of the availability lists from the nurseries yielded a total of 503 plant species/cultivars of shrubs, grasses/groundcovers, and perennials/annuals to be included on our initial list. Of these, 143 were determined to likely meet NCDEQ requirements and are included in Appendix A.

Root depth information is scarce, and when available, typically is provided as minimum root depth versus maximum. As such, maximum root depth often had to be estimated based on other factors, and we cannot guarantee that all 143 species have root depths of less than 18 inches with no runners exceeding six inches. To ameliorate this concern, species that we are confident typically meet the 18-inch maximum rooting depth requirement were further separated and then ranked based on drought tolerance and maintenance. Species with moderate to high drought tolerance, low to moderate maintenance requirements, and strongly believed to have root systems less than 18 inches deep were included in our list of 53 preferred species. Each of the three preferred lists (species/cultivars of shrubs, grasses/groundcovers, and perennials/annuals) are discussed in more detail below.

3.1 Shrubs

Shrubs provide habitat for birds and small animals and have varied bloom and fruit periods that can provide year-long aesthetic interest. Unfortunately, most shrubs grow greater than twenty-four inches tall and many require regular maintenance to maintain a pleasing shape. Two hundred and thirty-five (235) species of shrubs were obtained for our initial list. Nineteen (19) of these were determined to likely meet NCDEQ criteria; ten (10) made the preferred list and are shown in Table 3.

Table 3. List of preferred shrubs for planting on pre-regulatory landfills with soil cover systems in North Carolina.

Scientific Name	Common Name	Suitable for	
		CP*	P*
<i>Buleja davidii</i> 'Blue Chip PP#19,991'	butterfly bush	X	X
<i>Cotoneaster procumbens</i> . 'Little Dipper'	Queen of Carpets	X	X
<i>Cotoneaster salicifilius</i> . 'Scarlet Leader'	willow-leaved cotoneaster	X	X
<i>Cotoneaster salicifolius</i>	willow-leaved cotoneaster	X	X
<i>Juniperus conferta</i> 'Blue Pacific'	juniper	X	X
<i>Juniperus horizontalis</i> 'Blue Rug'	juniper	X	X
<i>Juniperus horizontalis</i> 'Youngstown'	Andorra juniper	X	X
<i>Juniperus procumbens</i> 'Nana'	juniper	X	X
<i>Spirea tomentosa</i>	steeplebush	X	X
<i>Vaccinium angustifolium</i>	lowbush blueberry	X	X

*CP = coastal plain, P = Piedmont

3.2 Grasses/Rushes/Groundcovers

Grasses offer great ground coverage for soil erosion and can act as buffer for when leaks occur. They are often low maintenance and some species provide habitat for birds and small animals. Unfortunately, most of the grass species have root depths greater than 18 inches. One hundred and five (105) species of grasses, rushes, and groundcovers were obtained from all of the nurseries contacted. Forty-four (44) were determined to likely meet NCDEQ criteria; eight (8) made the preferred list and are presented in Table 4.

Table 4. List of preferred grasses/groundcovers for planting on pre-regulatory landfills with soil cover systems in North Carolina.

Scientific Name	Common Name	Suitable for	
		CP*	P*
<i>Elymus hystrix</i>	bottlebrush grass	X	X
<i>Lomandra longifolia</i> 'Breeze Pat #15,420'	dwarf mat rush	X	X
<i>Lomandra longifolia</i> 'Katrinus Deluxe #19,262'	dwarf mat rush	X	X
<i>Ophiopogon japonicus</i> 'Dwarf Mondo'	monkey Grass	X	X
<i>Ophiopogon japonicus</i> 'Mondo'	monkey Grass	X	X
<i>Panicum anceps</i>	beaked panicgrass	X	X
<i>Pennisetum orientale</i> 'Karly Rose'	Karly Rose oriental fountain grass	X	X
<i>Eremochloa ophiuroides</i>	common centipedegrass	X	X

*CP = coastal plain, P = Piedmont

3.3 Perennials/Annuals

Perennials' and annuals' bright flowers are visually appealing and diverse. Most species have shallow root systems, are deer resistant, and require low maintenance. One hundred and sixty-three (163) different perennials and annuals were obtained from the nurseries contacted. Eighty (80) were determined to likely meet NCDEQ criteria; thirty-five (35) made the preferred list and are presented in Table 5.

4.0 CONCLUSION

From a list of 513 potential plants currently commercially available at large wholesale nurseries in the coastal plain and Piedmont, 152 plants were determined to likely meet NCDEQ requirements for planting on pre-regulatory landfills with soil cover systems. Root depth is one of the most important requirements, but is also the statistic least readily available. The final list of 53 preferred plants that are expected to meet the height and root depth requirements, have moderate to high drought tolerance and low to moderate maintenance needs.

Table 5. List of preferred perennials/annuals for planting on pre-regulatory landfills with soil cover systems in North Carolina.

Scientific Name	Common Name	Suitable for	
		CP*	P*
<i>Aster carolinianus</i>	climbing aster	X	X
<i>Baptisia australis</i> 'Twilite Prairie Blues'	wild indigo	X	X
<i>Baptisia lactea</i>	white baptista	X	X
<i>Chrysopsis mariana</i>	Maryland golden aster	X	X
<i>Coreopsis auriculata</i>	mouse-ear tickseed	X	X
<i>Coreopsis lanceolata</i>	lanceleaf coreopsis	X	X
<i>Echinacea paradoxa</i>	Ozark coneflower	X	X
<i>Geranium maculatum</i>	wild geranium	X	X
<i>Helenium flexuosum</i>	purple sneezeweed	X	X
<i>Helianthus angustifolius</i>	swamp sunflower	X	X
<i>Iris cristata</i>	dwarf crested iris	X	X
<i>Liriope muscari</i> 'Evergreen Giant'	lily turf	X	X
<i>Liriope muscari</i> 'Royal Purple'	royal purple liriope	X	X
<i>Liriope muscari</i> 'Super Blue'	big blue lily turf	X	X
<i>Liriope muscari</i> 'Variegata'	variegated liriope	X	X
<i>Liriope muscari</i> 'Big Blue'	lily-turf-blue	X	X
<i>Liriope muscari</i> 'Emerald Goddess'	lily turf Grass	X	X
<i>Marshallia obovata</i> var. 'Obovata'	Piedmont Barbra's buttons	X	X
<i>Monarda fistulosa</i>	wild bergamot	X	X
<i>Monarda punctata</i>	spotted beebalm	X	X
<i>Parthenium integrifolium</i>	wild quinine	X	X
<i>Penstemon digitalis</i>	foxglove beardtongue	X	X
<i>Penstemon laevigatus</i>	smooth beardtongue	X	X
<i>Physostegia virginiana</i>	obedient plant	X	X
<i>Rudbeckia fulgida</i>	orange coneflower	X	X
<i>Rudbeckia laciniata</i>	cutleaf coneflower	X	X
<i>Rudbeckia nitida</i>	shiny coneflower	X	X
<i>Rudbeckia subtomentosa</i> 'Little Henry Eilers'	sweet coneflower	X	X
<i>Rudbeckia triloba</i>	three-lobed coneflower	X	X
<i>Ruellia caroliniensis</i>	Carolina wild petunia	X	X
<i>Silene virginica</i>	firepink	X	X
<i>Solidago tenuifolia</i> /Euthamia graminifolia	slender goldenrod	X	X
<i>Stokesia laevis</i>	stokes aster	X	X
<i>Symphyotrichum cordifolium</i>	heartleaf aster	X	X
<i>Vernonia noveboracensis</i>	New York ironweed	X	X

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(all websites were accessed between February 21, 2017 and March 13, 2017)

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**APPENDIX A – PLANTS DETERMINED TO LIKELY MEET NCDEQ
REQUIREMENTS FOR PLANTING ON PRE-REGULATORY LANDFILL SITES
WITH SOIL COVER SYSTEMS IN THE NORTH CAROLINA PIEDMONT AND
COASTAL PLAIN**

Table A1. Shrubs determined to likely meet NCDEQ requirements for planting on pre-regulatory landfills with soil cover systems in the North Carolina coastal plain and Piedmont.

Scientific Name	Common Name	Height (in) at maturity	Root Depth (in) at maturity	Tolerance/ Resistance ^{1, 2}					Maint. Req ²	Life Expectancy	USDA Zone	Suitability ³	Annual (A) or Perennial (P)	Freezing Point	Notes
				D	F	S	Dis/Ins	A							
<i>Buleja davidii</i> 'Blue Chip PP#19,991'	butterfly bush	6 to 12	16	H	L	M	H	H	L	Long	5 to 9	CP, P	P		
<i>Caryopteris x clandonensis</i> Sapphire Surf Blauer Splat	sapphire surf bluebeard	24		H	M		L	H			5 to 9	CP, P			
<i>Cotoneaster procumbens</i> . 'Little Dipper'	Queen of Carpets	6 to 12	<18	H	L	H	M		L	Long	5 to 9	CP, P	P		
<i>Cotoneaster salicifilius</i> . 'Scarlet Leader'	willow-leaved cotoneaster	0-12	<18	H	L	H	M		L	Long	6 to 8	CP, P	P		
<i>Cotoneaster salicifolius</i>	willow-leaved cotoneaster	12	<18	H	L	H	M		L	Long	6 to 8	CP, P	P		
<i>Deutzia</i> Yuki 'Cherry Blossom'	deutzia	12 to 24	14	L	L		M	H	L	Long	5 to 8	CP, P	P		
<i>Deutzia</i> Yuki 'Snowflake'	deutzia	12 to 24	14	L	L		M	H	L	Long	5 to 8	CP, P	P		
<i>Gardenia jasminoides</i> 'Radicans'	trailing gardenia	6 to 12	<18	M	L	M	L		H		9 to 11	CP, P	P		
<i>Juniperus conferta</i> 'Blue Pacific'	juniper	6 to 12	5 to 14	H	L	H	H	H	L		6 to 11	CP, P	P		
<i>Juniperus horizontalis</i> 'Blue Rug'	juniper	0-6	14	H	L	M	H	H	L		3 to 9	CP, P	P		
<i>Juniperus horizontalis</i> 'Youngstown'	Andorra juniper	6 to 12	14	H	L	M	H	H	L		3 to 9	CP, P	P		
<i>Juniperus procumbens</i> 'Nana'	juniper	6 to 12	14	H	L	M	H	H	L		4 to 9	CP, P	P		
<i>Lorapetalum chinense</i> var. <i>rubrum</i> 'Purple Pixie'	lorapetalum	12 to 24		M	M	M	H		L		7 to 10	CP, P	P		
<i>Pittosporum crassifolium</i> 'Compacta'	compact pittosporum	24-36				H									
<i>Rosa hybrida</i> 'Drift'	drift rose	12 to 24	<18	H	L	H	H		H		4 to 11	CP, P	P		
<i>Spirea tomentosa</i>	steeplebush	24-48	<18	M	L	L	M		L		3 to 8	CP, P	P		
<i>Symphoricarpos orbiculatus</i>	coralberry	24-60													
<i>Symphoricarpus</i> spp.	pink snow berry	12 to 48													
<i>Vaccinium angustifolium</i>	lowbush blueberry	24	10	M	M	H	H		M		3 to 8	CP, P	P		

¹ D = drought, F = flood, S = salt, Dis/Ins = disease/insect, A = animal ² H = high, M = moderate, L = low ³ CP = coastal plain, P = Piedmont

Table A2. Grasses/groundcovers determined to likely meet NCDEQ requirements for planting on pre-regulatory landfills with soil cover systems in the North Carolina coastal plain and Piedmont.

Scientific Name	Common Name	Height (in) at maturity	Root Depth (in) at maturity	Tolerance/ Resistance ^{1, 2}					Maint. Req ²	Life Expectancy	USDA Zone	Suitability ³	Annual (A) or Perennial (P)	Freezing Point	Notes
				D	F	S	Dis/Ins	A							
<i>Andropogon glomeratus</i>	bushy beard grass	75	12	L	M	L	M	H	L	Avg	5 to 9	CP, P	P	-23	Weedy and spreads fast
<i>Andropogon glomeratus</i>	bush bluestem	75	>12	L	M	L	L	H	L	Avg	5 to 9	CP, P	P	-23	
<i>Andropogon virginicus</i>	broomsedge bluestem	36	>14	H	L	L	M	H	L	Avg	5 to 8	CP, P	P	-18	
<i>Borrichia frutescens</i>	bushy seaside tansy	32	>14	L	M	H	H	H	M	Avg	8 to 11	CP	P	17	
<i>Bouteloua curtipendula</i>	sideoats gramma	36	>12	M	L	L	H	M	L	Avg	4 to 9	CP, P	P	-43	
<i>Carex cherokeensis</i>	Cherokee sedge	6 to 12	4 to 12	L	M	L	H	H	L	Avg	6 to 9	CP, P	P	-33	
<i>Carex glaucescens</i>	southern waxy sedge	58	>16	L	M	None	H	M	M	Long	5 to 8	CP, P	P	-13	
<i>Carex intumescens</i>	greater bladder sedge	36	>8	None	H	None	M	H	L	Avg	5 to 8	CP, P	P	-33	
<i>Carex scoparia</i>	broom sedge	30	>8	None	M	L	M	H	L	Long	4 to 8	CP, P	P	-38	
<i>Carex stipata</i>	awlfruit sedge	42	>8	L	M	L	M	H	L	Avg	3 to 9	CP, P	P	-38	
<i>Carex vulpinoidea</i>	fox sedge	39	>16	L	M	None	H	H	L	Long	3 to 7	CP, P	P	-38	
<i>Chasmanthium latifolium</i>	river oaks	55	>10	M	M	None	H	H	L	Avg	3 to 8	CP, P	P	-33	
<i>Cortaderia selloana</i> 'Blue Bayou'	dwarf Pampas grass	120	>14	H	H	M	H		M	Avg	6 to 10	CP, P	P		
<i>Cymbopogon citratus</i>	lemongrass	24-48	<18	M	M	M	H	H	H	Short	9 to 11	CP	P		
<i>Cynodon dactylon</i>	bermudagrass	18	9	H	M	H	L	M	M	Long			P	38	Can be aggressive once established
<i>Elymus hystrix</i>	bottlebrush grass	36	<18	H	M	L	H	L	L		5 to 9	CP, P	P		
<i>Elymus virginicus</i>	Virginia wild rye	30	<18	M	L	L	H	H	L	Short	3 to 8	CP, P	P		
<i>Eragrostis spectabilis</i>	purple love grass	24	>4	H	L	L	H	M	L	Avg	5 to 9	CP, P	P	-43	
<i>Eremochloa ophiuroides</i>	common centapedegrass	5	6 to 8	M	H	L	L	L	L	Long			P		
<i>Juncus tenuis</i>	path rush	6 to 24	>6	L	H	L	H	H	L	Long	2 to 9	CP, P	P		
<i>Lomandra longifolia</i> 'Breeze Pat #15,420'	dwarf mat rush	36	<18	M	M	L	H	H	M	Long	7 to 11	CP, P	P	24	
<i>Lomandra longifolia</i> 'Katrinus Deluxe #19,262'	dwarf mat rush	36	<18	M	M	L	H	H	M	Long	7 to 11	CP, P	P	24	
<i>Muhlenbergia capillaris</i>	muhly grass	36	<18	L	M	H	H	H	L	Short	5 to 9	CP, P	P	7	
<i>Muhlenbergia capillaris</i> 'White Cloud'	white muhly grass	48		L	M	H	H	H	L	Short	5 to 9	CP, P	P	7	
<i>Muhlenbergia dumosa</i>	bamboo muhly	36	<18	H	L	H	H	H	M	Short	7 to 10	CP, P	P		
<i>Ophiopogon japonicus</i> 'Dwarf Mondo'	monkey grass	3	<18	H	M	H	H	H	M		7 to 10	CP, P	P		
<i>Ophiopogon japonicus</i> 'Mondo'	Monkey Grass	15	<18	H	M	H	H	H	M		6 to 10	CP, P	P		
<i>Panicum amarum</i>	bitter panicum	60	>10	H	M	L	H	H	L	Long	2 to 9	CP, P	P	-18	Intolerant of full sun Tolerates shade
<i>Panicum anceps</i>	beaked panicgrass	48	>6	M	M	L	L	H	L	Long	4 to 11	CP, P	P		
<i>Panicum rigidulum</i>	redtop panicgrass	40	>6	L	M	L	H	H	L	Long	4 to 9	CP, P	P	-33	
<i>Panicum virgatum</i>	switchgrass	60	>12	M	M	M	M	M	L	Long	5 to 9	CP, P	P	-43	
<i>Panicum virgatum</i> 'Cloud Nine'	tall switch grass	72	>12	H	H	M	M	M	L	Long	5 to 9	CP, P	P	-43	
<i>Panicum virgatum</i> 'Dallas Blues'	blue switch grass	72	>12	H	H	M	M	M	L	Long	5 to 9	CP, P	P	-43	
<i>Panicum virgatum</i> 'Northwind'	upright switch grass	72	>12	H	H	M	M	M	L	Long	5 to 9	CP, P	P	-43	
<i>Panicum virgatum</i> 'Prairie Fire'	red switch grass	60	>12	H	H	M	M	M	L	Long	5 to 9	CP, P	P	-43	
<i>Panicum virgatum</i> 'Shenandoah'	Shenadoad switch grass	48	>12	H	H	M	M	M	L	Long	5 to 9	CP, P	P	-43	
<i>Pennisetum alopecuroides</i> 'Black Moundry'	fountain grass	30	>8	L	H	M	M	H	L	Long	5 to 9	CP, P	P	-15	
<i>Pennisetum alopecuroides</i> 'Cassian'	dwarf fountain grass	30	>8	L	H	M	M	H	L	Long	5 to 9	CP, P	P	-15	
<i>Pennisetum alopecuroides</i> 'Hamlen'	fountain grass	30	>8	L	H	M	M	H	L	Long	5 to 9	CP, P	P	-15	
<i>Pennisetum orientale</i> 'Karly Rose'	Karly Rose Oriental fountain grass	18	>8	M	M	L	M	H	L	Long	5 to 8	CP, P	P	-15	
<i>Schizachyrium scoparium</i>	little blue stem	36	>14	H	M	None	H	H	L	Long	5 to 9	CP, P	P	-38	Tolerates clay soils, poor soils, and H heat Grows best in well drained soils
<i>Sisyrinchium angustifolium</i>	blue-eyed grass	24	>4	L	H	None	M	H	M	Long	4 to 9	CP, P	P	-8	
<i>Spartina patens</i>	saltmeadow cordgrass	24	>10	L	H	H	H	H	M	Long	7 to 11	CP, P	P	-3	
<i>Tridens flavus</i>	purpletop	30	>10	H	L	None			L	Short	3 to 7	P	P	-23	

¹ D = drought, F = flood, S = salt, Dis/Ins = disease/insect, A = animal ² H = high, M = moderate, L = low ³ CP = coastal plain, P = Piedmont

Table A3. Annuals/perennials determined to likely meet NCDEQ requirements for planting on pre-regulatory landfills with soil cover systems in the North Carolina coastal plain and Piedmont.

Scientific Name	Common Name	Height (in) at maturity	Root Depth (in) at maturity	Tolerance/ Resistance ^{1,2}					Maint. Req ²	Life Expectancy	USDA Zone	Suitability ³	Annual (A) or Perennial (P)	Freezing Point	Notes
				D	F	S	Dis/Ins	A							
<i>Amsonia hubrichi</i>	Threadleaf Bluestar	36		M	M		M	H	L		5 to 8	CP, P	P		
<i>Amsonia tabernaemontana</i>	Eastern Bluestar	36		H	M		L	H	L		3 to 9	CP, P	P		
<i>Anemone virginiana</i>	Thimbleweed	24		M	L		H	H	M		2 to 8	CP, P	P		
<i>Aquilegia canadense</i>	Wild Columbine	36		H	M		H	H	M		3 to 8	CP, P	P		
<i>Asclepias tuberosa</i>	Orange Butterflyweed	30		H	L		M	H	L		3 to 9	CP, P	P		
<i>Asclepias verticillata</i>	Whorled Milkweed	30		H	L		M	H	L		4 to 9	CP, P	P		
<i>Aster carolinianus</i>	Climbing Aster	120	<18	M	M		L	H	M		7 to 9	CP, P	P		
<i>Aster novae-angeliae</i>	New England Aster	72	<6	L	M	H	M	M	M		4 to 8	CP, P	P		
<i>Baptisia alba</i>	White Wild indigo	48		H	M		H	M	L		5 to 8	CP, P	P		
<i>Baptisia australis</i>	Blue False Indigo	48	<8	H	L	M	H	H	L	Avg	3 to 9	CP, P	P		
<i>Baptisia australis 'Twilite Prairie Blues'</i>	Wild Indigo 'Twilite Prairie Blues'	60	<8	H	M	M	H	M	L	Avg	4 to 8	CP, P	P		
<i>Baptisia lactea</i>	White Baptista	60	<8	M	M	M	H	M	L	Avg	4 to 9	CP, P	P		
<i>Callirhoe involucrata</i>	Winecup	12	>12	M	L	L	M	L	L	Avg	4 to 8	CP, P	P	-38	
<i>Chrysopsis mariana</i>	Maryland Golden Aster	30	<18	M	M	None	H	L	M	Avg	4 to 9	CP, P	P		Sandy, well drained soils with full sunlight
<i>Conoclinium coelestinum</i>	Blue MistfLer	40	>14	M	M	None	L	M	M	Avg	4 to 9	CP, P	P	-13	
<i>Coreopsis auriculata</i>	Mouse-ear Tickseed	9	>10	M	M	None	H	M	L	Avg	4 to 9	CP, P	P		
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	24	>6	M	M	None	L	H	M	Avg	4 to 9	CP, P	P	-8	Well drained soils
<i>Coreopsis palmata</i>	Prairie Coreopsis	30	>10	M	L	None	M	H	L	Avg	3 to 8	CP, P	P		Rocky, Sandy, Well Drained soils
<i>Coreopsis verticillata</i>	Threadleaf Tickseed	36	<18	H	L	None	L	H	L	Avg	3 to 9	CP, P	P		Well drained soils in full sun
<i>Dianthus gratianopolitanus</i>	Carnations	24		M	L	None	M	H	L	Avg	4 to 8	CP, P	P		Needs well drained soils/non- native
<i>Dicentra cucullaria</i>	Duchman's Breeches	24		M	M	None	M		M		3 to 7	P	P		Needs moist well drained soils
<i>Echinacea pallida</i>	Pale Purple ConefLer	14	>14	M	L	L	M	H	L	Long	3 to 10	CP, P	P	-33	Full sun to part shade, well drained soils
<i>Echinacea paradoxa</i>	Ozark coneFler	36	<5	M	M	None	M	H	L	Long	5 to 8	CP, P	P		
<i>Eupatorium perfoliatum</i>	Boneset	72	>10	L	H	None	H	H	L	Avg	3 to 8	CP, P	P		Does well both sandy and clay soils. Average moisture
<i>Eutrochium dubium</i>	Dwarf Joe Pye Weed	48	>12	L	H	None	H	H	L	Long	3 to 9	CP, P	P		Moist soil
<i>Gaillardia pulchella</i>	Indian Blanket	24	>12	H	L	None	M	M	L	Short	2 to 11	CP, P	P	32	
<i>Geranium maculatum</i>	Wild Geranium	24	3 to 4	M	M	L	M	H	M	Avg	3 to 8	CP, P	P		
<i>Helenium autumnale</i>	Common Sneezeweed	58	<6	L	H	L	M	M	M	Avg	3 to 8	CP, P	P	-43	
<i>Helenium flexuosum</i>	Purple Sneezeweed	36	<6	M	H	None	M	M	M	Short	5 to 9	CP, P	P	-28	Moist soils
<i>Helianthus angustifolius</i>	Swamp SunfLer	67.2	<6	M	H	None	M	H	Moderare	Avg	6 to 9	CP, P	P		
<i>Heuchera americana</i>	Alumroot	24		H	M	M	H	L	L	Avg	4 to 9	CP, P	P		
<i>Iris cristata</i>	Dwarf Crested Iris	9	<7	M	M	None	L	H	M	Avg	3 to 9	CP, P	P		
<i>Lilium superbum</i>	Turk's Cap Lily	9	<12	L	M	M	H	L	M	Avg	5 to 8	CP, P	P		
<i>Liriope muscari 'Evergreen Giant'</i>	Lily Turf	24	<18	M	M	L	H	H	L	Avg	5 to 10	CP, P	P	-23	
<i>Liriope muscari 'Royal Purple'</i>	Royal Purple Liriope	18	<18	M	M	L	H	H	L	Avg	5 to 10	CP, P	P	-23	
<i>Liriope muscari 'Super Blue'</i>	Big Blue Lily Turf	30	<18	M	M	L	H	H	L	Avg	5 to 10	CP, P	P	-23	
<i>Liriope muscari 'Variegata'</i>	Variegated Liriope	18	<18	M	M	L	H	H	L	Avg	5 to 10	CP, P	P	-23	
<i>Liriope muscari 'Big Blue'</i>	Lily-Turf-Blue	24	<18	M	M	L	H	H	L	Avg	5 to 10	CP, P	P	-23	
<i>Liriope muscari 'Emarld Goddess'</i>	Lily Turf Grass	20	<18	M	M	L	H	H	L	Avg	5 to 10	CP, P	P	-23	
<i>Marshallia obovata</i> var. 'Obovata'	Piedmont Barbra's Buttons	24	<18	H	M		H	L	L		7 to 8	CP, P	P		
<i>Monarda didyma</i>	Beebalm	48	10	L	M	M	L	H	L		4 to 9	CP, P	P		

<i>Monarda fistulosa</i>	Wild Bergamot	48	16	H	M	M	M	H	Medium	Avg	3 to 9	CP, P	P	-32	May struggle in NC heat
<i>Monarda punctata</i>	Spotted Beebalm	24	6	H	M	M	M	H	Medium		3 to 8	CP, P	P		
<i>Oenothera fruticosa</i>	Southern Sundrop	18	<18	H	L	H	H	H	L	Avg	4 to 8	CP, P	P	-33	
<i>Parthenium integrifolium</i>	Wild Quinine	48	9	H	M	M	H	H	L		4 to 8	CP, P	P		
<i>Penstemon digitalis</i>	Foxglove Beardtongue	60	8	H	M	M	H	H	Medium	Avg	3 to 8	CP, P	P	-38	
<i>Penstemon laevigatus</i>	Smooth Beardtongue	42	9	H	M	M	M	H	L		7 to 10	CP, P	P		
<i>Phlox maculata</i>	Summer Phlox	36	8	L	M	M	L	M	Medium		3 to 8	CP, P	P		
<i>Phlox paniculata</i>	Garden Phlox	36	7	L	M	L	L	M	Medium		4 to 8	CP, P	P		
<i>Phlox stolonifera</i> 'Sherwood Purple'	Creeping Phlox	6	<18	H	L	M	L	L	L		2 to 8	CP, P	P		
<i>Physostegia virginiana</i>	Obedient Plant	48	8	M	M	M	M	H	Medium		3 to 9	CP, P	P		
<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint	36	8	L	H	H	H	H	L		5 to 7	P	P		
<i>Ratibida columnifera</i>	Prairie ConefLer	36	7	H	L	L	H	H	Medium	Avg	4 to 9	CP, P	P	-43	
<i>Ratibida pinnata</i>	YeLL ConefLer	60	12	H	L	L	H	H	Medium	Avg	4 to 8	CP, P	P	-38	
<i>Rudbeckia fulgida</i>	Orange ConefLer	36	8	H	M	H	H	H	L		3 to 9	CP, P			
<i>Rudbeckia hirta</i>	Blak-eyed Susan	36	<18	H	L	H	H	H	L	Short	5 to 7	P	A	-23	
<i>Rudbeckia laciniata</i>	Cutleaf ConefLer		6												
<i>Rudbeckia maxima</i>	Giant Black-eyed Susan	84	>12	M	M	H	H	H	L	Short	4 to 9	CP, P	P	-23	
<i>Rudbeckia nitida</i>	Shiny ConefLer	60	>6	M	M	L	H	H	L	Short	4 to 8	CP, P	P	22	
<i>Rudbeckia subtomentosa</i> 'Little Henry Eilers'	Sweet ConefLer 'Little Henry Eilers'	60	<18	M	M	L	H	H	L		4 to 8	CP, P	P		
<i>Rudbeckia triloba</i>	Three-lobed conefLer	36	7	M	M	H	H	H	L	Short	4 to 8	CP, P	P		
<i>Ruellia caroliniensis</i>	Carolina Wild Petunia	24	10	H	M	M	H	H	L		6 to 10	CP, P	P	-10	
<i>Salvia nemorosa</i>	Woodland Sage	24	<18	H	L	H	H	H	L		4 to 8	CP, P	P		
<i>Scabiosa columbaria</i>	Pincushion FLer	18	7	H	L	L	H	H	L		5 to 9	CP, P	P		
<i>Scutellaria incana</i> var. <i>punctata</i>	Downy skullcap	36	<18	H	L	L	H	H	L		5 to 8	CP, P	P		
<i>Sedum kamtschaticum</i>	Stonecrop	6	<18	H	L	H	H	H	L		3 to 8	CP, P	P		
<i>Sedum rupestre/reflexum</i>	Reflex Stonecrop	6	<18	H	L	H	H	H	L		5 to 9	CP, P	P		
<i>Sedum tetractinum</i>	Chinese Sedum	4	<18	H	L	?	H	H	L		5 to 8	CP, P	P		
<i>Sedum/Hylotelephium spectabile</i> 'Autumn Joy'	Autumn Joy Sedum	24	15	H	L	H	H	H	L		4 to 9	CP, P	P		
<i>Silene virginica</i>	Firepink	20	<18	H	M	L	H	L	Medium	Short	4 to 8	CP, P	P		
<i>Sisyrinchium angustifolium</i>	Blue-eyed Grass	24	9	L	M	L	H	M	Medium	Short	4 to 9	CP, P	P	-3	
<i>Solidago caesia</i>	Blue-stemmed Goldenrod	36	<18	H	L	L	H	H	L	Short	4 to 8	CP, P	P	-28	
<i>Solidago tenuifolia</i> / <i>Euthamia graminifolia</i>	Slender Goldenrod	42	<18	M	H	M	M	L	L		3 to 9	CP, P	P		Wide rane of soils
<i>Stokesia laevis</i>	Stokes Aster	24	<18	M	M	L	H	H	L		5 to 9	CP, P	P		
<i>Symphyotrichum cordifolium</i>	Heartleaf Aster	60	10	M	M	M	M	M	L	Short	3 to 8	CP, P	P	-38	
<i>Symphyotrichum ericoides</i>	Heath Aster	36	<18	H	L	M	H	L	L		3 to 10	CP, P	P		
<i>Symphyotrichum novae-angliae</i>	New England Aster	60	<18	L	H	H	M	H	Medium		4 to 8	CP, P	P		
<i>Symphyotrichum oblongifolium</i>	Aromatic Aster	36	15	H	L	H	H	H	Medium		3 to 8	CP, P	P		
<i>Vernonia noveboracensis</i>	New York Ironweed	79	>6	M	M	None	H	H	L	Short	5 to 9	CP, P	P	-33	

¹ D = drought, F = flood, S = salt, Dis/Ins = disease/insect, A = animal

² H = high, M = moderate, L = low

³ CP = coastal plain, P = Piedmont



INTRODUCTION

The intent of this report is to provide a list of plant materials that can be used as alternatives to manicured grasses for pre-regulatory landfill sites to be used as parks. Plants exhibit the following characteristics:

- Suitable for landfill containment / provides stabilization
- Locally hardy to the Piedmont Region of North Carolina and/or native
- Non-invasive / non exotic or intrusive
- Root depth no greater than 18"
- Drought and pest tolerant
- Can withstand extreme weather events
- No height greater than 24" at maturity for woody vegetation
- No root runner to extend greater than 6" in depth

SOIL PREPARATION

The minimum soil depth for areas that will be seeded, planted with grasses, or groundcovers should be 18".

Adequate drainage is important. The soil specifications should include a drainage layer of gravelly sand, a substrate of loamy coarse sand followed by a layer of topsoil. Care should be taken to ensure soil is not compacted.

Compacted soil will inhibit root growth and negatively impact the health of plant material. To avoid compaction, final grading should not be completed unless soil is dry. A 6" minimum drainage layer should be used. The minimum soil depth does not include this drainage layer.

Plant material should be chosen based on the maintenance plans and budget for specific projects. Remediation projects typically require more maintenance to get plant material established.

PLANTS

The following list includes plant materials that exhibit the characteristics identified above:

Grasses

Botanical Name	Common Name	Mature Height	Light Req.	Notes
<i>Agrostis perennans</i>	Autumn Bentgrass	3.5'	Sun / Part Shade	
<i>Bouteloua curtipendula</i>	Side Oats Grama	2' - 3' with bloom	Sun	
<i>Bouteloua gracilis</i>	Blue Grama Grass	1'	Sun	
<i>Carex bicknellii</i>	Bicknell's Sedge	3'	Sun / Part shade	
<i>Chasmanthium latifolium</i>	Inland River Oats	4'-5'	Sun / Shade	
<i>Deschampsia cespitosa</i> 'Goldtau'	Golden Dew Tufted Hair Grass	1'-2' with bloom	Sun	
<i>Deschampsia flexuosa</i>	Crinkled Hair Grass	1.5'-2' with bloom	Shade / Part Sun	
<i>Elymus virginicus</i>	Virginia Wild Rye	3-4' with bloom	Sun / Part shade	
<i>Festuca brevipila</i> 'Chariot'	Hard Fescue	12"	Sun	
<i>Festuca ovina</i> 'Whisper'	Sheeps Fescue	12"	Sun	
<i>Festuca rubra</i>	Creeping Red Fescue	8"-12"	Sun / Part shade	
<i>Koeleria macrantha</i>	June Grass	1.5'-2' with bloom	Sun	
<i>Muhlenbergia capillaris</i>	Pink Muhly Grass	3' - 4' with bloom	Sun	
<i>Nassella tenuissima</i>	Mexican Feather Grass	2'	Sun	non-native
<i>Poa pratensis</i>	Kentucky Bluegrass	3'	Sun	non-native
<i>Trifolium pratense</i>	Red Clover	2'-3'	Sun	non-native



Perennials

Botanical Name	Common Name	Mature Height	Light Req.	Notes
<i>Achillea millefolium</i>	Yarrow	24"	Sun	
<i>Coreopsis verticillata</i>	Tickseed	12"	Sun	
<i>Echinacea purpurea after midnight</i>	Emily Saul Coneflower	12"	Sun	
<i>Echinacea purpurea Big Sky Sunset</i>	Big Sky Sunset Coneflower	24"	Sun	
<i>Echinacea purpurea Harvest Moon</i>	Harvest Moon Coneflower	24"	Sun	
<i>Echinacea purpurea 'Kims Knee High'</i>	Dwarf Purple Coneflower	24"	Sun	
<i>Echinacea x 'Mango Meadowbrite'</i>	Mango Meadowbrite Coneflower	2'	Sun	
<i>Eupatorium dubium 'Baby Joe'</i>	Dwarf Joe Pye Weed	2.5'	Sun	
<i>Monarda didyma Balmy Pink</i>	Balmy Pink Bee Balm	12"	Sun	
<i>Monarda x 'Mahogany'</i>	Bee Balm	36"	Sun	
<i>Rudbeckia fulgida v. sullivantii</i>	Black-eyed Susan	24"	Sun	
<i>Sedum reflexum 'Blue Spruce'</i>	Sedum	4"-6"	Sun	
<i>Sedum rupestre 'Angelina'</i>	Stone Crop	4"-6"	Sun	
<i>Sedum tectractinum</i>	Stone Crop	4"-6"	Sun	
<i>Sedum x 'Autumn Joy'</i>	Autumn Joy Sedum	2'	Sun	



Seed Mixes

Seed Mix name	Where seedm mix can be found	Seeding Rate
ERNMX-186	Ernst Seed	6lbs per 1,000 sf
ERNMX-186-1	Ernst Seed	6lbs per 1,000 sf

Customn Seed Mix

2 lbs per 1,000 sf

20% Crinnkled Hair Grass (*Deschampsia flexuosa*)

8% Red Clover (*Trifolium pretense*)

10% Creeping Red Fescue (*Festuca rubra*)

20% Virginia Wildrye, (*Elymus virginicus*)

20% Sideoats Grama, 'Butte' (*Bouteloua curtipendula*, 'Butte')

5% Purple Coneflower (*Echinacea purpurea* 'Kims Knee High')

5% Blackeyed Susan (*Rudbeckia hirta*)

3% Yarrow (*Achillea millefolium*)

2% Ohio Spiderwort (*Tradescantia ohiensis*)

2% Tickseed (*Coreopsis verticillata*)

2% Smooth Blue Aster (*Aster laevis*)

2% Bee Balm (*Monarda* x 'Mahogany')

1% Dwarf Joe Pye Weed (*Eupatorium dubium* 'Baby Joe')

INVASIVE PLANTS TO AVOID

The following list includes plant materials that exhibit the characteristics identified above:

- Lespedeza
- Bermuda grass
- Canada thistle
- Mimosa
- Privet
- Wild Sugarcane
- Serrated tussock
- Mission grass
- Microstegium (Bamboo Grass)
- Cattails

RESOURCE LINKS

The following list includes websites that can be used as resources:

- <http://hort.ifas.ufl.edu/woody/groundcover-selection.shtml>
- <http://www.ncwildflower.org/>
- <http://www.waste360.com/%5Bprimary-term%5D/landfill-revegetation-hidden-assets>
- <https://www.invasive.org/species/list.cfm?id=21>

GRASSES



Agrostis perennans - Autumn Bentgrass⁵



Bouteloua curtipendula - Side Oats Grama¹



Bouteloua gracilis - Blue Grama Grass¹



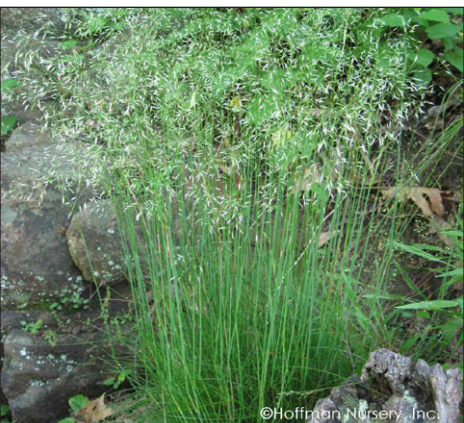
Carex bicknelli - Bicknell Sedge¹



Chasmanthium latifolium - Inland River Oats¹



Deschampsia cespitosa 'Goldtau' - Golden Dew Tufted Hair Grass¹



Deschampsia flexuosa - Crinkled Hair Grass¹



Elymus virginicus - Virginia Wild Rye¹



Eragrostis elliotii 'Wind Dancer' - Wind Dancer Love Grass¹

GRASSES - continued



Festuca brevipila 'Chariot' -
Hard Fescue²



Festuca ovina 'Whisper' -
Sheeps Fescue²



Festuca rubra - Creeping
Red Fescue²



Koeleria macrantha - June Grass¹



Muhlenbergia capillaris - Pink Muhly
Grass¹



Nassella tenuissima - Mexican
Feather Grass¹



Poa pratensis - Kentucky
Bluegrass²



Trifolium pratense - Red
Clover²

PERENNIALS



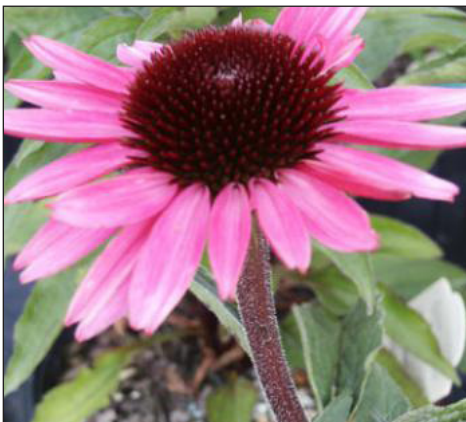
Achillea millefolium - Yarrow³



Coreopsis verticillata - Tickseed³



Coreopsis verticillata - Tickseed³



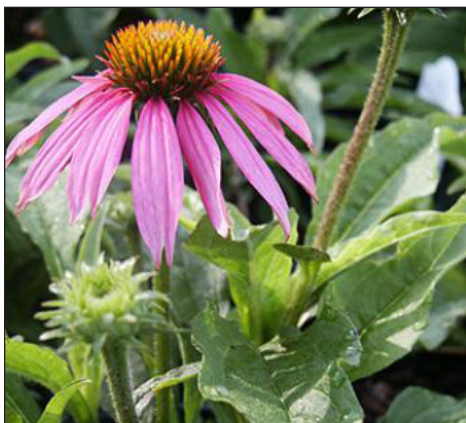
Echinacea purpurea after midnight
'Emily Saul' - Emily Saul Coneflower³



Echinacea purpurea Big Sky Sunset -
Big Sky Sunset Coneflower³



Echinacea purpurea Harvest Moon -
Harvest Moon Coneflower³



Echinacea purpurea 'Kims Knee High'
- Dwarf Purple Coneflower³



Echinacea x 'Mango Meadowbrite' -
Mango Meadowbrite Coneflower³



Eupatorium dubium 'Baby Joe' -
Dwarf Joe Pye Weed³

PERENNIALS - continued



Monarda didyma 'Balmy Pink' - Balmy Pink Bee Balm⁴



Monarda x 'Mahogany' - Bee Balm³



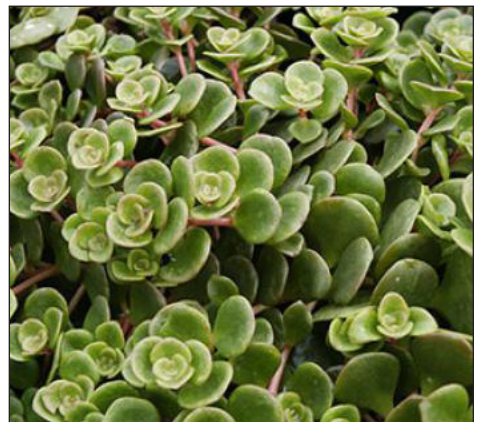
Rudbeckia fulgida v. *sullivantii* 'Goldstrum' - Black-eyed Susan³



Sedum reflexum 'Blue Spruce' - Sedum³



Sedum rupestre 'Angelina' - Stone Crop³



Sedum tetractinum - Stone Crop³



Sedum x 'Autumn Joy' - Autumn Joy Sedum³



Image Credits:

¹ Image by Hoffman Nursery via <http://hoffmannnursery.com/>

² Image by USDA via <https://plants.usda.gov/java/>

³ Image by Pender Nursery via <http://www.pendernursery.com/>

⁴ Image by Emerald Coast Growers via <http://www.ecgrowers.com/Monarda-p/1411.htm>

⁵ Image by Agriculture Victoria via <http://agriculture.vic.gov.au/agriculture/farm-management/pastures/what-is-bent-grass>



MIHALY
LAND DESIGN
PLANNING+LANDSCAPE ARCHITECTURE

PLANT SPECIES SUITABLE FOR LANDFILL CONTAINMENT REMEDIES

TASK ORDER 679MIS

NORTH CAROLINA COASTAL PLAIN



INTRODUCTION

The following report outlines suitable vegetation options for landscaping closed landfills developed as parks. Plants included in the report are non-invasive, hardy substitutes for the standard lawn. Suitable plants for the site must thrive in a coastal plain ecosystem and meet the following requirements:

- Root depth no greater than 18" at maturity
- Prevents soil erosion
- Not an exotic intrusive species
- Drought and pest resistant
- Can withstand extreme weather events
- No height greater than 24" at maturity for any woody vegetation
- No root runner that extends to a depth greater than 6"

Stabilizing the landfill surface and prevent runoff are the important concerns when revegetating a landfill site. Typically, trees and shrubs' root systems cause concern with damaging the surface of the containment system, therefore, vegetation with shallower root systems like grasses and perennials are better options. By utilizing native plants, a hardy, low maintenance, drought resistant landscape is established and simultaneously beautifies the landfill. The native plants over time develop into a self-sustaining ecosystem and eliminate the need for fertilizers, pesticides and irrigation.

The following list of plants meet the criteria described above and are suitable for a coastal environment. All plants included in the list are North Carolina natives.

SOIL PREPARATION

Proper soil preparation will influence the success of planting. Optimum soil depth for planting is 18-24". Prior to planting, the soil should be prepared to have a healthy layer of topsoil. Soil should be tested for pH, nitrogen, phosphorus and other nutrients. Soil should be amended accordingly up to a 6" depth and within a few weeks of planting. Soil amendments should be performed no closer than one week from planting.

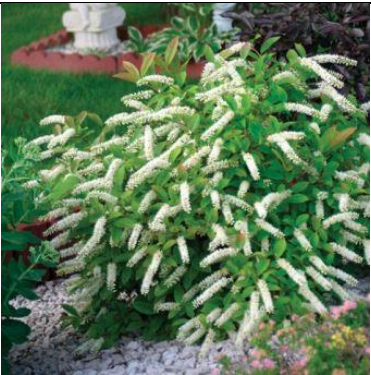
It is important to avoid soil compaction, as it will hinder plant development. Upon planting, initial plantings of rapid growth annual or perennial grasses should be used to prevent soil erosion.

INVASIVE PLANTS

The following plants exhibit the characteristics listed above but should be avoided due to their classification as exotic invasives:

- *Alternanthera philoxeroides* (Alligatorweed)
- *Hedera helix* (English Ivy)
- *Microstegium vimineum* (Trin.) A. Camus (Japanese stilt-grass)
- *Arthraxon hispidus* (Thunb.) Makino (Hairy jointgrass)
- *Miscanthus sinensis* Andersson (Chinese silver grass)
- *Vinca minor* L. (Common periwinkle)
- *Ajuga reptans* L. (Bugleweed)
- *Chrysanthemum leucanthemum* L. (Ox-eye Daisy)

SHRUBS

Botanical Name	Common Name	Mature Height	Sun Req./Notes	Picture
<i>Clethra alnifolia</i> 'Hummingbird'*	Sweet Pepperbush	2-3'	Sun-Partial Shade	
<i>Itea virginica</i> 'Little Henry'**	Virginia Sweetspire	3'	Sun-Partial Shade	
<i>Yucca filamentosa</i> ***	Adam's Needle	2'	Sun	

All pictures obtained from Lady Bird Johnson Wildflower Center, <http://www.wildflower.org/> unless otherwise noted.

*<http://www.clemson.edu/extension/hgic/plants/landscape/shrubs/hgic1090.html>

** <https://www.ces.ncsu.edu/files/library/71/Natives%20NCMGVA%20Conf.pdf>

*** <http://www.thedangergarden.com/2013/02/another-yucca-filamentosa-is-my.html>

GRASSES

Botanical Name	Common Name	Mature Height	Sun Req./Notes	Picture
Andropogon virginicus	Broomsedge bluestem	2-4'	Partial Shade	
Elymus virginicus	Virginia Wildrye	3'	Shade tolerant	
Muhlenbergia capillaris	Pink Muhly Grass	3-4'	Full Sun	
Panicum anceps*	Beaked Panicgrass	2-4'	30-35% shade/ Very adaptable	

Panicum virgatum	Switchgrass	3-6'	Sun/Partial Shade	
Sorghastrum nutans	Indiangrass	3-5'	Full sun-Full shade	
Schizachyrium scoparium	Little Bluestem	18"	Full sun	

All pictures obtained from Lady Bird Johnson Wildflower Center, <http://www.wildflower.org/> unless otherwise noted.

*https://en.wikipedia.org/wiki/Panicum_anceps#/media/File:Panicum_anceps.jpg

PERENNIALS

Botanical Name	Common Name	Mature Height	Sun Req. /Notes	Picture
Ampelaster carolinianus	Climbing Aster	3-4'	Sun	
Achillea millefolium	Common yarrow	3'	Sun/Partial Shade	
Coreopsis verticillata	Tickseed	1-2'	Sun/Partial Shade	
Gaillardia aestivalis var. aestivalis	Lanceleaf blanketflower	2'	Partial Shade	

Monarda didyma	Scarlet Beebalm	2-4'	Sun/Partial Shade	
Penstemon australis	Eustis Lake Beardtongue	1-2'	Partial Shade	
Rudbeckia hirta	Blackeyed Susan	3.5'	Sun	
Silene virginica	Fire Pink	1'	Partial Shade	
Vernonia noveboracensis	New York Ironweed	5-8'	Sun	

All pictures obtained from Lady Bird Johnson Wildflower Center, <http://www.wildflower.org/> unless otherwise noted.

RESOURCE LIST

EOL Encyclopedia of Life

<http://eol.org/>

Incorporating NC Native Plants into your Landscape. NC Cooperative Extension

<https://www.ces.ncsu.edu/files/library/71/Natives%20NCMGVA%20Conf.pdf>

Lady Bird Johnson Wildflower Center

<http://www.wildflower.org/plants-main>

North Carolina Native Plant Society

http://ncwildflower.org/native_plants/recommendations

North Carolina Regional Vegetation

<http://www.ncpedia.org/vegetation#coastalplain>

Revegetating Landfills and Waste Containment Areas Fact Sheet. National Service Center for Environmental Publications (NSCEP). 2006.

<https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockkey=600003T6.txt>

USDA Coastal & Shoreline

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mdpmcsr11767.pdf

USDA Natural Resources Conservation Service Plants Database

<https://plants.usda.gov/java/>