Nutrient Management Plan

Thomas Jefferson Elementary School

Prepared for:
The City of Falls Church, Virginia

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Executive Summary

Thomas Jefferson Elementary School (TJES) is a public school within the City of Falls Church system, located at 601 South Oak Street. The site lies in the relative headwaters of Tripps Run, which drains to Holmes Creek, then to Cameron Run, to the Potomac River, and ultimately the Chesapeake Bay. The school is surrounded by a well-established neighborhood of single family residences, typically a quarter acre in size. More dense areas of townhomes and commercial properties are found northeast of the site, off of Route 7 (West Broad Street), and south of the property served by Route 29/237 (South Washington Street). While historical maintenance practices are limited at TJES, bermudagrass playing fields found at the school require some routine inputs.

This Nutrient Management Plan (NMP) has been developed to assist TJES, and entities responsible for its grounds maintenance, in the management of nutrients applied to the grounds over the next three years in order to maintain healthy, playable ball fields and school grounds while protecting water quality in Tripps Run and downstream water bodies. As such, it should be used as a resource for planning the quantity and timing of nutrient application based on sound agronomic practices.

Abbreviations

BMP	Best Management Practice
DCR	The Virginia Department of Conservation and Recreation
DPW	The City of Falls Church Department of Public Works
GIS	Geographic Information System
MS4	Municipal Separate Storm Sewer System
NMP	Nutrient Management Plan
RPA	Resource Protection Area
TJES	Thomas Jefferson Elementary School
T&L	Turf and Landscape
SCS	USDA Soil Conservation Service (formerly), now USDA-NRCS
USDA-NRCS	U.S. Department of Agriculture – Natural Resource Conservation Service

1.0 Introduction

Thomas Jefferson Elementary School (TJES) is a public school within the City of Falls Church system, located at 601 South Oak Street. The site lies in the relative headwaters of Tripps Run, which drains to Holmes Creek, then to Cameron Run, to the Potomac River, and ultimately the Chesapeake Bay. The school is surrounded by a well-established neighborhood of single family residences, typically a quarter acre in size. More dense areas of townhomes and commercial properties are found northeast of the site, off of Route 7 (West Broad Street), and south of the property served by Route 29/237 (South Washington Street).

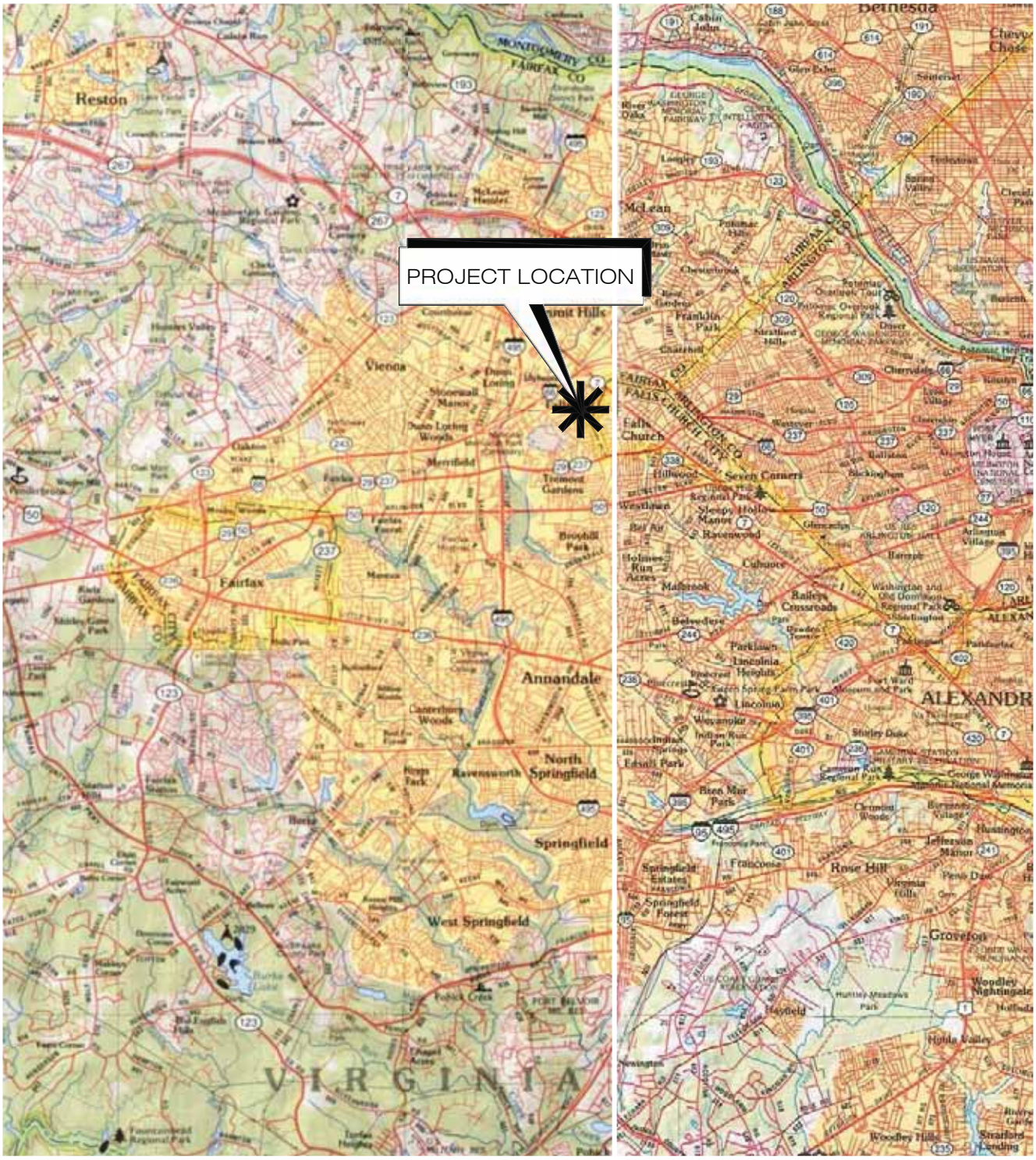
Generally, the impervious school facilities (i.e. building and parking areas) are situated on upstream and southwester portions of the site. To the northeast and downstream of these facilities lie existing bermudagrass playing fields (baseball/soccer), which are directly upstream of Tripps Run. While historical maintenance practices are limited at TJES, bermudagrass playing fields require some routine inputs. See Figures 1.1 and 1.2 for vicinity and location maps of the school.

The following is a brief summary of the site location and watershed characteristics:

Table 1 1.1 Watershed Summary

Virginia 6th Order HUC	Receiving Streams	D/S Stream-River Basins	Locale
PL26 (HUC12: 020700100302 Cameron Run)	Tripps Run	Holmes Creek – Cameron Run – Potomac River – Chesapeake Bay	City of Falls Church

According to the Falls Church, VA Real Estate Assessments Mapping Site, the school site is comprised of four (4) separate parcels owned by either the City or the City School Board: 1) 52-302-026, 2) 52-302-021, 3) 52-302-019, and 4) 52-302-051. GIS data queries noted the total project area (all four parcels) at 12.3 acres; however, per the City tax data, these parcels encompass a combined area of 11.4904 acres. As such, the 11.4904 acre value has been used as the total planning area for the school property. These parcels are shown on Figure 1.3 City Parcels and summarized in Table 1.2 Parcel Data Summary below. Note: Yellow areas are City Geographical Information System (GIS) data for Chesapeake Bay Resource Protection Areas (RPA), to be discussed in more detail in later sections.



2.4 MILES 1.2 0 MILES 2.4 MILES

SCALE: 1 INCH = 2.4 MILES

SOURCE: VIRGINIA ATLAS AND GAZETTEER, DeLORME MAPPING CO., 1995.

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 1.1

PROJECT VICINITY MAP

FALLS CHURCH MS4 SUPPORT

CITY OF FALLS CHURCH, VIRGINIA | MARCH, 2014

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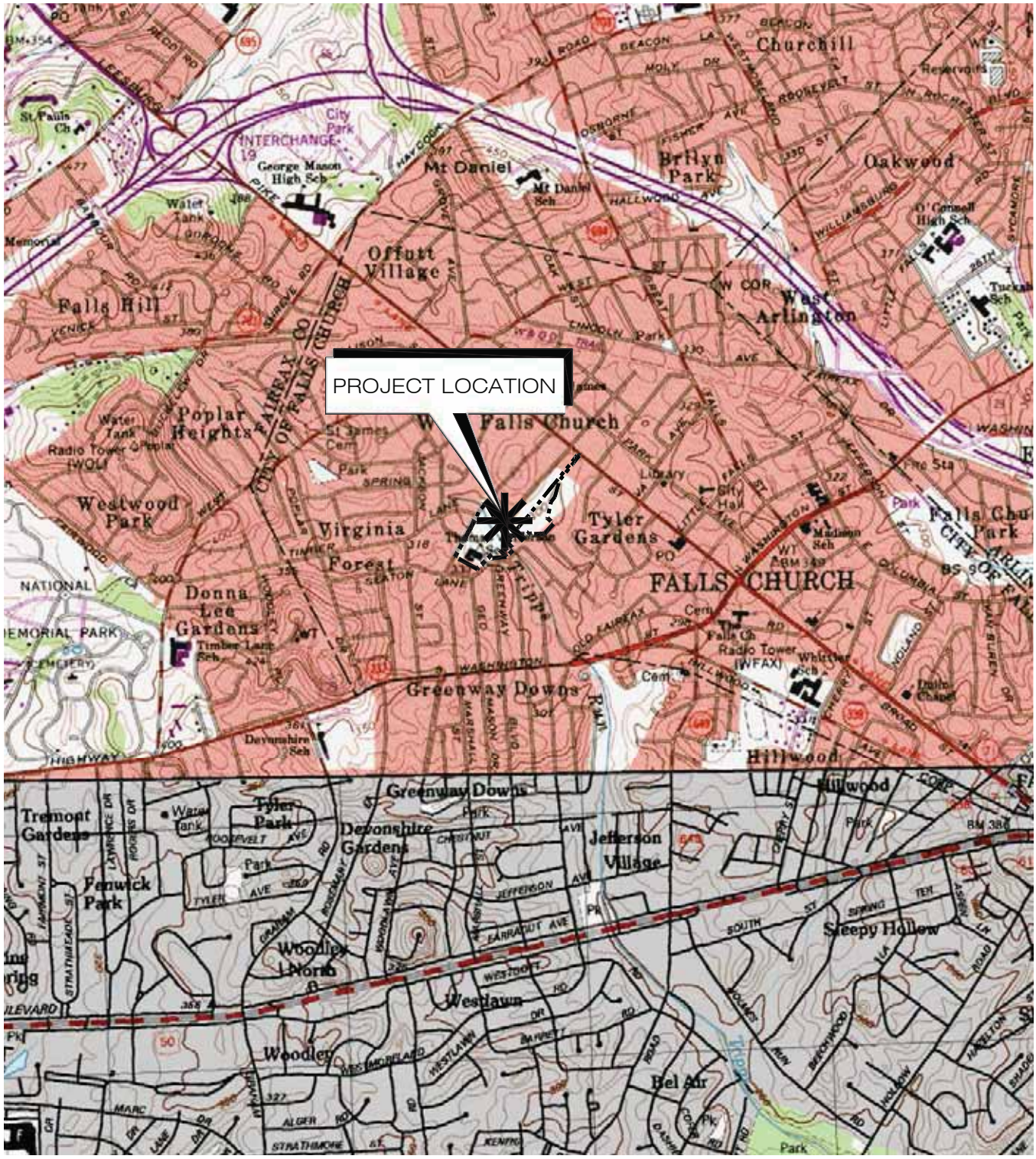

2000' 1000' 0' 2000'

SCALE: 1 INCH = 2000 FEET

LATITUDE: 38°53'0.28"N
LONGITUDE: 77°11'1.50"W

SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP,
FALLS CHURCH VA QUADRANGLE, 1994 (REV N/A)
ANNONDALE VA QUADRANGLE, 1998 (REV N/A)

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FIGURE 1.2
PROJECT LOCATION MAP
FALLS CHURCH MS4 SUPPORT

CITY OF FALLS CHURCH, VIRGINIA | MARCH, 2014

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Figure 3 1.3 City Parcels

Table 2 1.2 Parcel Data Summary

Parcel 1	Parcel 2	Parcel 3	Parcel 4
601 South Oak Street • RPC#: 52-302-026 • Area: 5.831 Ac • Approx. T&L: 3.02 Ac	223 West Cameron Road • RPC#: 52-302-021 • Area: 0.30610 Ac • Approx. T&L: 0.30 Ac	Sherrow Avenue • RPC#: 52-302-019 • Area: 0.98740 Ac • Approx. T&L: 0.10 Ac	601 West Broad Street • RPC#: 52-302-019 • Area: 4.36590 Ac • Approx. T&L: 0.00 Ac

Portions of the maintained TJES site are found on parcels one, two, and three, but there is no managed turf or landscaping to our knowledge on parcel 4, also known as Falls Park (containing a tributary to Tripps Run. As such, this plan will address nutrient applications to those managed areas on parcels one, two, and three, denoting any parcel four areas as natural or conserved. All areas will be included and discussed in the plan coverage and shall be treated as one property; however, no nutrient applications are anticipated on parcel four.

This Nutrient Management Plan (NMP) has been developed to assist TJES, and entities responsible for its grounds maintenance, in the management of nutrients applied to the grounds over the next three years in

order to maintain a healthy, playable ball fields and effective, mature landscaping and green space while protecting water quality in Tripps Run and downstream water bodies. As such, it should be used as a resource for planning the quantity and timing of nutrient application based on sound agronomic practices.

1.1 TURFGRASS AND LANDSCAPING COVERAGE

Across the whole of the roughly 11.5 acre site, only roughly 4.40 acres would be considered maintained to some degree. However, in reality only approximately 3.42 acres this managed area (3.10 acres of turfgrass and roughly 0.32 acres of more formal beds) would be considered to receive moderate to higher levels of management and maintenance.

The remainder of the managed/maintained areas (0.98 acres) should really be considered transitional areas, informal beds, or maintained understory. The resultant 7.10 acres of the total site is comprised of paths, parking, building (combined at roughly 1.95 acres), and relatively unmaintained forested canopy (approximately 5.15 acres). As such, the 3.42 acres of beds and turfgrass should be considered the nutrient management planning area, until maintenance practices and management of other areas are redefined and addressed in future nutrient management plans. These estimates are approximate based on take-offs from aerial photography.

The following provides additional detail into composition and historical management of these areas, and Figure 1.4: Thomas Jefferson Elementary School Facility Layout provides an overview of the property and its characteristics for reference.

1.1.1 Turfgrass Coverage

The majority of the turfgrass found at TJES is within the bermudagrasss ball field areas on the east side of the school site. As these are more high traffic areas, the City has recently installed a hardy, cold-tolerant, and dense Patriot variety of bermudagrass. There are other areas of limited-maintenance turfgrass areas (i.e. within parking islands etc.) that routinely mowed; however receive little nutrient input. These areas consist of a mixture of species, including fescues, annual bluegrass, and some more limited occurrences of white clover, chickweed, and ground ivy. For purposes of this plan, the associated recommendations for these areas will be consistent with cool-season (fescue) lawn grasses, although it is likely that no nutrient inputs will be applied in these area as a matter of practice that is currently the case.

1.1.1.1 Existing Turfgrass Maintenance Practices

Existing standard cultural practices for the turfgrass areas include routine mowing two or three times per week with a Toro ReelMaster Reel Mower with periodic slice aerification and deep tine aerification on an as needed basis determined by the maintenance staff. No over-seeding of the turfgrass is performed.

The current nutrient applications are limited with two seasonally timed applications of 21-0-0 (N-P-K) at a rate of 2 pounds per 1,000 square feet and 19-0-19 at 1 pound per 1,000 square feet (lbs/1,000 s.f.). No phosphorus is applied to the ball fields by the maintenance staff. Pre-emergent weed control applications

in the form of Ronstar are performed annually, while post-emergent (Revolver) weed control is performed on an as needed basis.

1.1.2 Landscaping Coverage

There is little formal landscaping at TJES; however, City staff has myriad initiatives and learning opportunities for students that take advantage of the small spaces that are utilized for landscaping. Birdhouses, benches, and rain gardens can be found that make the existing entry and other select areas of the school a living outdoor classroom. Beds consist of areas near the school building, in and around walkways, and some other isolated plantings within parking areas and the periphery. Several mature landscape trees are located at the school in the parking areas off of Seaton Lane and in front of the building on the South Oak Street boundary. All of these landscape areas receive little to no maintenance and no routine nutrients according to information provided by the City and their vendors.

W:\WMBGcad\4900s\4976 - Falls Church MS4 Support\Site Plans\4976 Thomas Jefferson Elementary School Facility Layout.dwg

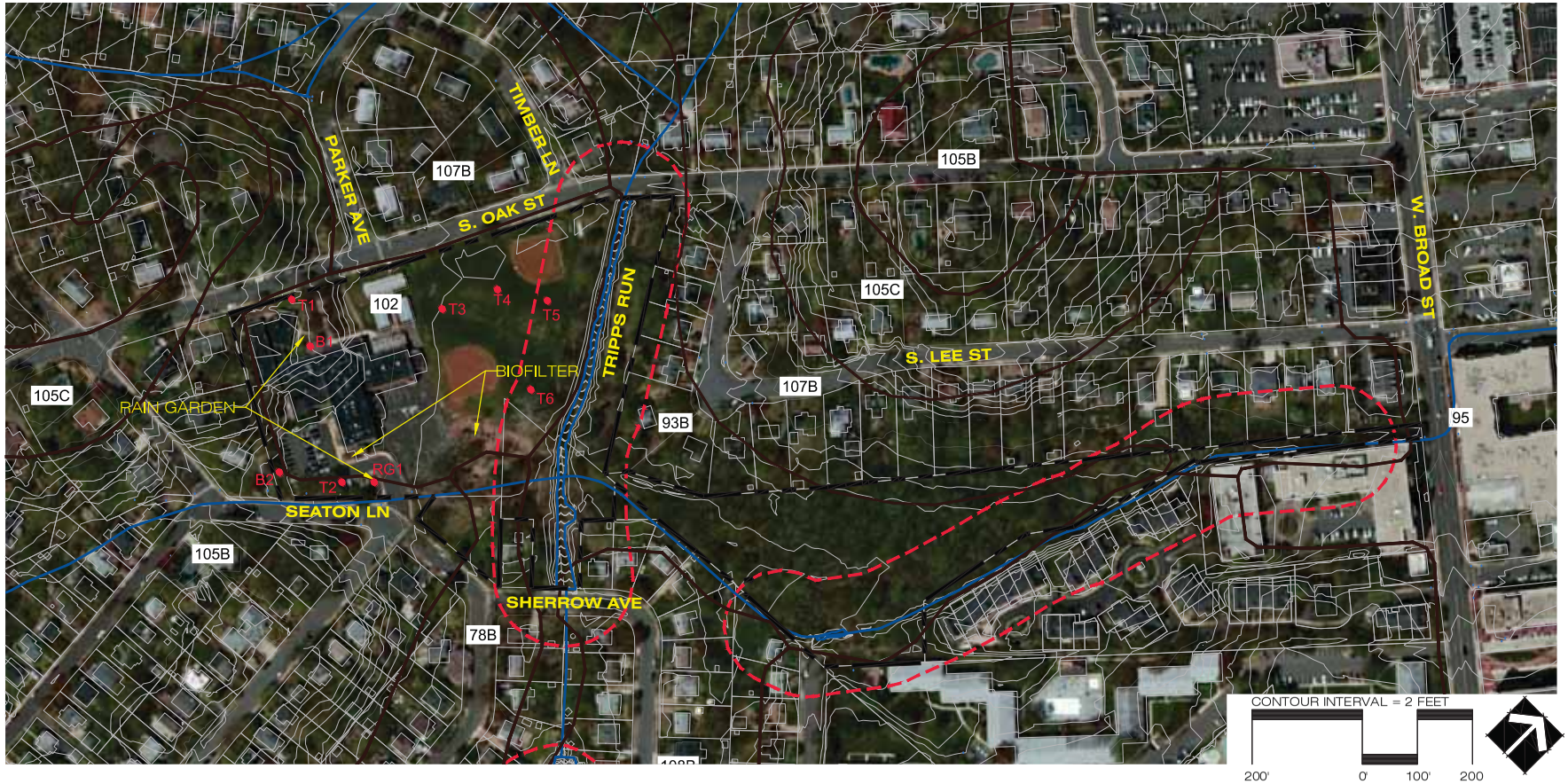
LEGEND

- APPROXIMATE WETLAND LIMITS
- APPROXIMATE STREAM CHANNEL
- APPROXIMATE OPEN WATER LIMITS
- EXISTING CONTOURS
- RESOURCE PROTECTION AREA (RPA) LINE
- 107B — SOIL LINE AND TYPE
- T3 — SOIL SAMPLE LOCATION

SOILS CHARACTERISTICS TABLE

SOIL GROUP	NAME	HSG	DEPTH TO WATER ft	DEPTH TO BEDROCK ft	PERMEABILITY in/hr
78B	MEADOWVILLE LOAM	A	3.4-6.6	>6	0.57-5.95
93B	SUMERDUCK SILT LOAM	C	2.0-3.3	>6	0.5-0.57
95	URBAN LAND	N/A	>6	>6	0.06-0.20
101	URBAN LAND-WHEATON COMPLEX	N/A	>6	>6	0.06-0.20
102	WHEATON LOAM	C	>6	>6	0.06-0.20
105B	WHEATON-GLENELG COMPLEX	C	>6	>6	0.06-0.20
105C	WHEATON-GLENLEG COMPLEX	C	>6	>6	0.06-0.20
107B	WHEATON-MEADOWVILLE COMPLEX	C	>6	>6	0.06-0.20
108B	WHEATON-SUMERDUCK COMPLEX	C	>6	>6	0.06-0.20

SOURCE: USDA-NRCS Soil Survey for The City of Falls Church, Virginia; Date: 2010



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THOMAS JEFFERSON ELEMENTARY SCHOOL FACILITY LAYOUT
FIGURE 1.4
FALLS CHURCH MS4 SUPPORT
CITY OF FALLS CHURCH, VIRGINIA

DATE: MARCH 11, 2014

JOB NUMBER: 4976

SCALE: 1 INCH = 200 FEET

SOURCE: BASE MAPPING PROVIDED BY CITY OF FALLS CHURCH GIS

1.2 ENVIRONMENTALLY SENSITIVE AREAS

The initial step taken in developing this management plan for the TJES was a review of the overall physical setting and environmental resources, to the extent readily available. A general site analysis of the property and surrounding areas was conducted by desktop methods and some limited field inspection. Information evaluated in these studies included the following: topography, soils, existing vegetation, water features and/or drainage ways. Based on this review, there are several environmentally sensitive areas found on the TJES properties. These are comprised generally of the buffer areas associated with Tripps Run and its tributaries. As noted above, waters in these drainage features eventually make their way to Holmes Creek, then to Cameron Run, to the Potomac River, and ultimately the Chesapeake Bay.

Based on review of the City's GIS data, The terrain on the site is generally flat, particularly in the area of the playing fields. Slopes in this area vary from 1.0% to 2.6%. Upstream areas in turf may be slightly steeper in grade transitions from the building and parking areas, but generally these areas are also typically flattish. Slopes within the buffer areas of parcel 4 range from 1.3% to over 6%, areas within the Tripps Run forested areas adjacent to the playing fields, become steeper within the channel section approaching 45%. The banks of the Tripps Run Channel, which is approximately 12-33 feet wide in this area, are roughly 4-6 feet in height.

1.2.1 Maintained School Areas

These areas are found one the TJES areas on parcels 1, 2, and 3. Generally, they consist of the turfgrass areas on the northeast boundary of parcel 1 along Tripps Run. The following provides discussion of the areas that are typically maintained.

1.2.1.1 Chesapeake Bay Resource Protection Areas (RPA)

The existing ball fields in this area encroach within the noted City GIS layers for RPA, and as such represent an allowable pre-existing non-conforming use in these areas under the Chesapeake Bay Preservation Act. Based on rough estimations of available data, the approximate turf area with the RPA on parcels 1, 2, and 3 equates to roughly 0.95 acres. Routine management of this area is required for school operation; however, these areas should be maintained within limited nutrient inputs to protect downstream waters to the maximum extent practicable. The current limited nutrient inputs should fall within this limit, and is discussed in further detail in section 4.0 Nutrient Needs.

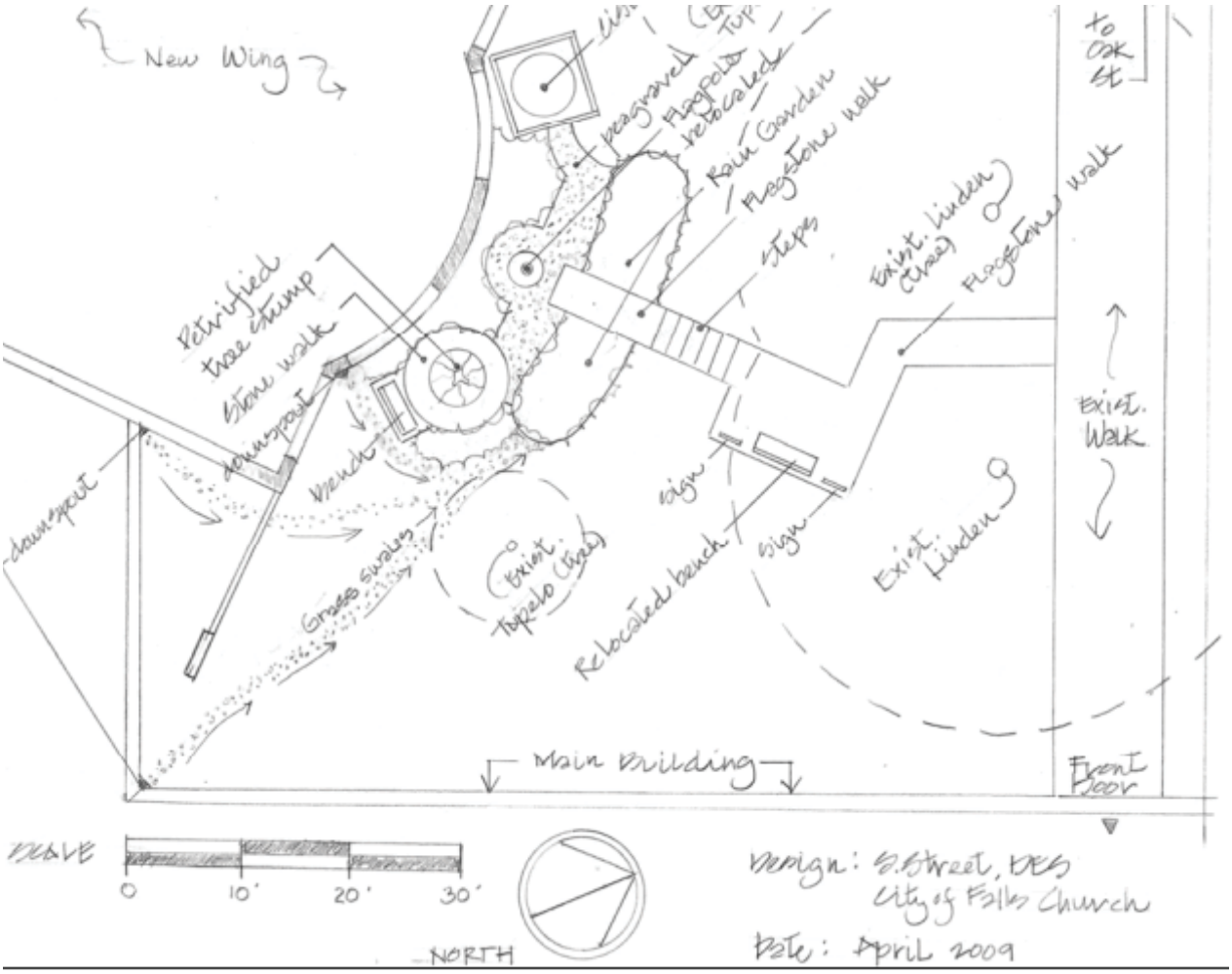
Currently a buffer of variable width (typically 20 feet to 45 feet) exists on the southwest side of Trips Run. This buffer should be maintained, and nutrient inputs within the RPA should be kept to the minimum levels needed to promote a healthy, stable, and non-eroding turfgrass surface. As a planning measure, no nutrients should be applied within 25 feet of the stream. If possible, this zone should be extended beyond these limits to the extent practicable, depending on the field limits. The application of fertilizers, herbicides, insecticides, fungicides, and other pesticides should be limited within these areas. Consideration should be given to providing vegetative buffers and "no-spray zones" to the extent possible.

If the application of any type of selective herbicide is required within twenty-five feet of a jurisdictional area, such applications should be made by hand using back-pack sprayers. No disposal of clippings, brush, or other debris should be allowed in these areas.

1.2.1.2 Stormwater Management Facilities

In addition, there are several stormwater management facilities are located on the school grounds. As noted on Figure 1.4, there are several rain gardens and bioretention filters on-site. The City engaged in a deliberate initiative in 2009, obtaining grant funding from the Virginia Department of Conservation and Recreation (DCR), to implement rain garden retrofits at the school, inclusive of educational signage. Several of these rain gardens can be found at the entry walk off Oak Street shown on Figure 1.5.

Figure 5 1.5 Entry Rain Garden Locations



Additionally, a curb cut rain garden was installed at the entry to the parking lot from Seaton Lane, inclusive of educational signage. See Figures 1.6 and 1.7 for more detail.

Figure 6 1.6 Rain Garden Educational Sign

Figure 7 1.6 Corner Rain Garden at Parking Entry

Additionally, several newer stormwater management facilities in the form of bioretention filters have been constructed. One such facility is located near the school building (Figure 1.8), while a larger biofilter (Figure 1.9) is located adjacent to the paved playground and ball field areas. All of these facilities are intended to provide water quality treatment from the developed areas of the site, and ultimately drain to Tripps Run.

Figure 8 1.7 Biofilter near School Building

Figure 9 1.8 Biofilter near Playground and Ball Fields

As such, care must be taken around these facilities in effort to ensure that no nutrients are applied directly to these structural best management practices (BMP). Ideally, a small application buffer should be provided around each facility if nutrients are needed in the vicinity.

1.2.1.3 Parking, Playgrounds, & Other Impervious Surfaces

While impervious areas are not in of themselves considered environmentally sensitive, they do pose management issues with regard to nutrient application and the protection of downstream environmentally sensitive areas. For example, granular overlap onto existing parking or curb and gutter sections promotes rapid runoff to storm sewers and downstream resources. Grounds staff should take note of these areas and limit any distribution of applications to these areas. Should nutrients be applied directly to these areas via overspray or granular applications, staff should immediately clean or sweep these areas in an effort to either completely remove the nutrients or relocate them to areas intended for their application.

1.2.2 Adjacent Unmaintained Areas

Additionally, there exists a well-established forested buffer on portions of all four parcels. These include part of the buffer noted above on the southwest boundary of Tripps Run (parcels 1, 2, &3), an established buffer on the northeast boundary of Tripps Run (which also includes an existing City trail), and the entirety of parcel four, which envelopes a significant drainage tributary to Tripps Run, which joins with that stream on parcel 3. In effect, the total natural wooded area consisting of portions of all four properties should be managed as conservation areas. Hence, no nutrients should generally be applied to these areas.

The application of fertilizers, herbicides, insecticides, fungicides, and other pesticides should be limited or prohibited within these buffer areas, unless deemed specifically required by qualified City staff under extenuating and City-approved circumstances. These vegetated buffers will provide for infiltration and filtering of stormwater runoff before reaching the jurisdictional areas, therefore the use of chemicals should not be permitted in these areas, unless specifically required and approved by the Department of Public Works (DPW) Director or designee. No formal conservation easements were noted based on a cursory review of the City's online GIS mapping; however some apparent drainage easements were noted on parcel four.

1.2.3 Sensitive Area Education and Outreach

As this facility is a central point of gathering for the neighborhood and its youth, it represents a substantial opportunity for education and outreach efforts to local citizens as to the presence of , and need to protect, Virginia's natural resources. As noted previously, City staff has already invested substantial effort in environmental education efforts; however, even more opportunities may be available on-site. Since school children interact routinely with the buffer areas along Tripps Run while playing on the fields, frequent and safely-positioned signage could be added along this interface to both A) inform the children and others of the resource and management program, and B) reinforce the importance of the management practices to maintenance personnel. Additionally, notices and/or signage could be placed at school entrances and bulletin boards, further educating the public as to both the importance of these practices and the on-going City efforts to protect the environment. This represents and exciting avenue to further youth education, and advance the City's MS4 Phase II General Permit compliance efforts.

1.3 IRRIGATION WATER SOURCES AND CONSIDERATIONS

There is no irrigation system installed at TJES, and there is no routine practice for temporary seasonal irrigation, such as roller bases. As such, there are no on-site nutrient inputs or management issues related to irrigation water.

2.0 Management Areas

As the nutrient management areas at the TJES site are located predominantly on similar soils and generally drain to a common outfall (Tripps Run), management of the nutrient input areas can be broken down into four general areas: 1) managed bermudagrass turfgrass areas, and 2) managed fescue lawn grass areas, 3) managed landscape beds, and 4) forested and/or conservation areas. All forested/conservation areas should be generally left free from nutrient inputs as described above. The following is a brief summary of these four management areas:

Table 3 2.1 Management Area Summary

1 - Bermudagrass Ball Fields	2 - Fescue Lawn	3 - Landscape Beds	4 - Forested/Conservation
2.26 Acres	0.84 Acres	0.32 Acres	5.15 Acres

3.0 Soils

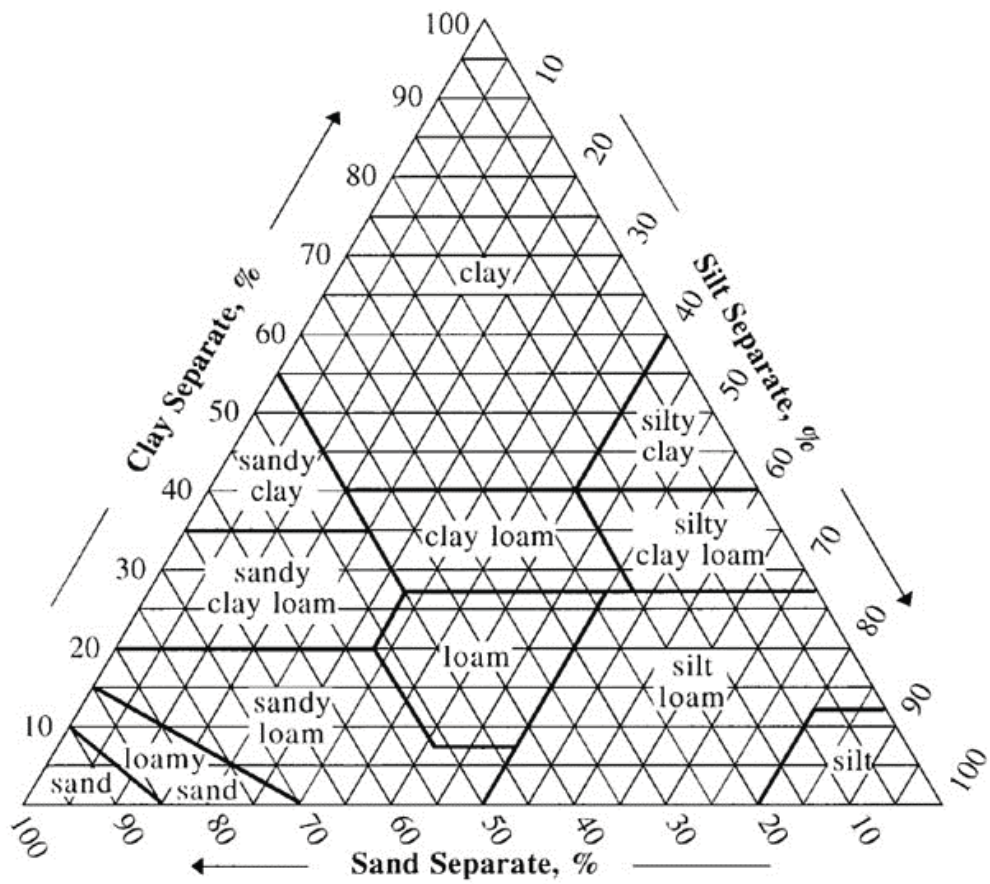
Both USDA Soil Survey information and on-site soil samples were referenced in the preparation of this plan. The following provides discussion of these findings.

3.1 USDA-NRCS SOILS SURVEY

Information on soils located on the TJES site was obtained from the USDA-NRCS Soil Survey for the City of Falls Church, Virginia (2010). Two primary soils are found within the main management areas (ball fields, lawn, and beds). These are defined as the Wheaton Loam and Wheaton-Glenelg Complex. The soils types are predominantly well-drained soils; although both soil types fall within hydrologic soil group C with moderately low to moderately high permeability (0.06 – 0.20 inches/hour).

Under the USDA Soil Classification System, loams are characterized as having a clay content roughly between 7 and 27%, a silt content between 28 and 50%, and a sand content between 24 and 50% (see "soil textural triangle" in Figure 3.1).

Figure 10 3.1 USDA Soil Textural Triangle (USDA 1993)



The Wheaton Loam series soils are generally characterized as being deep and well drained, found on slopes ranging from 2% to 25%. Typically, depth to both seasonally high water table and bedrock are greater than six feet. The Wheaton-Glenelg Complex is also deep and well drained, and found on slopes ranging from 2% to 15%, with similar water table and bedrock depths as the Wheaton Loam series.

No series specific rating for either soil series was found according to the Virginia Nutrient Management Standards and Criteria, Table 1-4, which is used to determine the soils environmental sensitivity and related category. However, the Glenelg series, a relative component of the Wheaton-Glenelg Complex is rated as Moderate for nitrogen loss risk and environmental sensitivity due to leaching. Generally, the soils are deep and well drained, however, with a variably (potentially high) permeability the soils on-site should be managed with the knowledge that there is potential for nitrogen loss due to leaching. Particularly attention should be paid to amended soils and profiles with underdrains, in and around ball fields and certainly near augmented soil profiles with drains such as near bioretention filters.

Figure 1.4 provides the distribution of soils on-site and a legend detailing the soil characteristics. Detailed soil information from the Soil Survey is included in Appendix A.

3.2 SOIL TESTING

As part of this plan development, Stantec performed soil samples comprehensively across the property, nine in total. These samples were taken in mid-March 2014 and at representative locations to provide insight to existing nutrient levels within the routinely maintained areas. No sampling was performed within forested/conservation areas, or management area four.

The samples were provided to A&L Eastern Laboratories in Richmond, Virginia, which is an approved lab according to DCR. The laboratory provides soil test results and nutrient recommendations based upon the Mehlich III procedure. The Mehlich I procedure is required to determine phosphorous soil levels for writing nutrient management plans in Virginia. As such the Virginia Nutrient Management Standards and Criteria (Revised October 2005) were utilized to convert the Mehlich III reporting values to Mehlich I. Additionally, A&L utilizes the SMP Single Buffer method to determine Soil Buffer pH.

Generally, phosphorus and potassium levels were moderate to optimum within the more highly maintained areas of the ball fields. One sample, RG1, was taken at the rain garden along Seaton Lane and the parking entry. The keystone nutrients of phosphorus and potassium were both found to very high in this location. This is not intended to be a management area in terms of nutrients, but should provide additional insight as to nutrient mobility on-site, and reinforce the importance of eliminating nutrient applications in the stormwater management features.

The Soil Test Reports from the recent sampling event are included in Appendix B. Table 3.1 provides a summary of the soil test reports. The results of the soil test reports are used in the recommendation of soil amendments proposed in the plan as discussed later in Section 4.

Table 4 3.1 Soil Test Summary

Sample	Man. Area	Use	P	Mehlich I	P_2O_5	K	Mehlich I	K_2O	Soil pH	Buffer
			(ppm)	(ppm)	Rating	(ppm)	(ppm)	Rating		pH
T1	2	Lawn	9	0.86	L-	174	123.54	H	7.2	
T2	2	Lawn	13	2.69	L	75	53.25	M	5.9	6.82
T3	1	Field	253	135.59	VH	159	112.89	H	5.9	6.79
T4	1	Field	111	47.58	H+	121	85.91	M+	5.8	6.84
T5	1	Field	63	25.59	H-	143	101.53	H-	5.9	6.85
T6	1	Field	81	33.84	H	143	101.53	H-	5.7	6.8
B1	3	Bed	68	27.88	H-	268	190.28	VH	7	
B2	3	Bed	24	7.73	M-	144	102.24	H-	6.5	
RG1	-	SWM	102	43.46	H+	244	173.24	VH	7.4	

*Note initial values are noted in Mehlich III, converted to Mehlich I in table to provide recommendations.

3.3 FUTURE SOIL TESTING

Soil testing is important in managing the future application of nutrients at TJES. Even though typical nutrient inputs at the school are well below annual thresholds and guidance, there may come times when greater inputs are needed to re-vitalize or re-invigorate plant health based on turfgrass or plant stress and visible field indicators. Without a measure of soil nutrient availability to balance with plant needs, it will be difficult to accurately determine plant nutrient needs and develop relevant, justifiable recommendations in these instances. TJES is encouraged to continue soil collection and sampling on a frequent basis, and maintaining test-critical information. Not only is the soil information recommended every three years for developing credible nutrient management plans and adaptations in the future, it is also important in the operational and management decision-making process and for ensuring that the facility proper nutrient distribution to keep the grounds in good, stable health without becoming a threat to water quality on-site or downstream waters. While it is not necessary to test at a several times a year, it is recommended that test be taken every, or every other, growing season, if possible. But again, at minimum soil test should be performed once every three years, as this will provide information for use in revising the plan in the future.

4.0 Nutrient Needs

Nutrient needs in the form of soil amendments are based upon the type of turfgrass and bed plants, the level of maintenance provided, and the existing soil fertility. The following sections discuss the nutrient needs for TJES, including the macronutrients nitrogen (N), phosphorous (P), and potassium (K). Micronutrients and soil pH and buffer capacity are also discussed below, as they are essential to good plant growth. The timing and application rates for nutrient applications are discussed later in Section 5.0.

4.1 NITROGEN

Nitrogen is a macronutrient essential for healthy plants. It is a mobile nutrient in plant useable forms, so it is not generally available in the soils for any length of time, unless it is applied in insoluble forms that are not plant available. Nitrogen recommendations are based upon the turfgrass needs, not soil fertility. The Virginia Nutrient Management Standards and Criteria provide recommended nitrogen fertilization rates for athletic fields and lawns. These rates vary by turfgrass (cool vs. warm season) and level of management (standard vs. intensive). The following nitrogen rates are recommended for TJES; however, City and/or maintenance staff may elect to limit nitrogen based on field experience and desired turf performance. The timing of fertilizer application and type of nitrogen fertilizer recommended is discussed in Section 5.

Table 5 4.1 Nitrogen Rates

Feature	Plant Type	Maximum Rate Per Application (lbs/1,000 ft^2)	Total Maximum Annual Rate (lbs/1,000 ft^2)
Fields	Bermudagrss	1[a]	4
Lawns	Fescue	0.5	3.5
Beds[b]	Variable	0.5	2.5

[a] Water Soluble Nitrogen (WSN) sources must be applied as two applications not to exceed 0.5 lbs/1,000 ft^2 each, with a minimum of 15 days between applications. Alternatively, Water Insoluble Nitrogen (WIN) sources with greater than 50% WIN may be applied in a single applicationf of no more than 1 lbs/1,000 ft^2 with a minimum of 30 days between applications. [b] Based on recommendations from A&L Eastern Laboratories.

4.2 PHOSPHORUS AND POTASSIUM

Phosphorous (P2O5) and potassium (K2O) are required where indicated by soil fertility testing. Review of the recent soil test results for TJES shows phosphorous levels vary from extremes of Low- (L-) to Very High (VH), but generally trend towards the high end of the spectrum. The potassium levels range from Medium (M) to Very H (H). Table 4.2 provides a summary of the recommended P2O5 and K2O application rates for various features, based upon the test results.

Table 6 4.2 Annual Phosphorus and Potassium Needs

Area	Based on Sample	P_2O_5 Level	P_2O_5 Needs (lbs/1,000 ft^2)	K_2O Level	K_2O Needs (lbs/1,000 ft^2)
Fields	T3	VH	0	H	0.75
Lawn	T2	L	2.5	M	1.5
Bed	B1	H-	0.5	VH	0

4.3 SECONDARY AND MICRONUTRIENTS

Secondary nutrients tested in the soil include Calcium (Ca) and Magnesium (Mg). The micronutrients Zinc (Zn), Manganese (Mn), Copper (Cu), Iron (Fe), and Boron (B) are also reported in the soils test results. Generally, the test results noted good to low levels of both Ca and Mg; however some lower Calcium levels were found within the more intensively maintained ball field area. Most other levels were near optimum in the ball field area; however some deficits in Boron and Sulfur were noted. Some Sulfur and Magnesium deficiencies were noted with the landscape beds. See the soil test results when considering any minor supplemental inputs of secondary micronutrients.

4.4 LIME

Lime is important for correcting low pH, adding acid buffering capacity, and providing secondary nutrients Ca and Mg and some micronutrients needed for turfgrass to grow. Soil acidity is critical to plants because it affects the availability of nutrients in the soil and potential leaching of nutrients from the soil. Turfgrass generally prefers soil pH that is slightly acidic. Many Virginia soils are generally very acidic without the addition of lime, so lime periodic lime application is important for managing plant health. Lime application rates are based on the type of turfgrass and the soil pH and buffering capacity reported from soil testing. For TJES, lime recommendations are based upon SMP Buffer Test and Buffer Index from Table 3-2 of the *Virginia Nutrient Management Standards and Criteria*. Table 4.3 summarizes the range of pH and buffer pH by feature with recommendations for lime application rates. Reductions in lime application may be necessary based on individual area observations, additional test results, and composition of the liming agent. No lime is recommended within bed areas.

Table 7 4.3 pH, Buffer pH, and Lime Recommendations

Feature	Based on Sample	pH	Buffer pH	Target Soil pH	Lime Application (lbs/1,000ft^2)
Fields	T3	5.9	6.79	6.2	30
Lawn	T2	5.9	6.82	6.2	25

*Lime Application Recommendation provided by A&L

5.0 Nutrient Application

This section provides details on the application of soil amendments for TJES and the timing of applying the soil amendments, including fertilizer and lime as discussed in Section 4.0. In addition to the amount of nutrients required, the application rate is dependent upon the growing season, form of fertilizer applied, and method of application. Landscape beds found on-site appear to be self-sustaining, and based on the soil results are at good levels for phosphorus and potassium. Individual bed recommendations may be consulted from the test results shown in Appendix B. The following sub-sections discuss nutrient application in detail and provide recommendations for fertilization and soil amendments based upon the turfgrass needs, soil fertility, and current types of fertilizer and methods of application used at TJES.

5.1 NITROGEN APPLICATION (GROWING) SEASON

TJES uses cool season (Fescue) turfgrasses on its lawn areas, and warm season (bermudagrass) turfgrass in the higher traffic and maintenance areas associated with the ball fields. The growing seasons for these different types of turfgrasses varies in the northern Piedmont of Virginia. The timing of nutrient applications will vary based upon the growing season, especially for Nitrogen. For cool season grasses, the Nitrogen application season begins six weeks prior to the last spring killing frost and ends six weeks past the first fall killing frost. Separately, warm season grasses have a different window – between the last average killing frost date in the spring and one month prior to the first average fall killing frost date. The landscape beds do not currently receive any nitrogen and appear to be vigorous; however, individual plant recommendations can be consulted if any performance issues are determined. Table 5.1 provides the approximate dates for Nitrogen application based upon the growing season as determined by average dates of the first fall and last spring frost killing dates, and Table 5.2 details the maximum recommended nutrient inputs per management area. For landscape beds, it is advisable to generally follow the timing recommendations for cool season turf in addition to any plant specific requirements that may apply. Appendix B provides additional guidance on related to gardens via the DCR publication *A Virginian's Year-Round Guide to Yard Care*.

Table 8 5.1 Growing Season/Nitrogen Application Summary

Turfgrass	Feature	Last Spring Killing Frost	Nitrogen Application Start	First Fall Killing Frost	Nitrogen Application End
Bermudagrass	Ball Fields	April 10	April 10	October 25	September 25
Fescue	Lawn	April 10	February 27	October 25	December 6

Table 9 5.2 Nutrient Application Summary

Area	Based on Sample	Annual N-P-K Application Recommendation (lbs/1,000 ft^2)
Fields	T3	4.0-0-0.75
Lawn	T2	3.5-2.5-1.5
Bed	B1	2.5-0.5-0

5.2 TYPES OF FERTILIZER USED

TJES currently uses only a small variety of fertilizers to provide the nutrients required to manage the turf on the ball fields at the school, as previously mentioned. No other applications to lawns and beds are planned. These inputs have provided for acceptable quality, and will likely remain in place moving forward. This is understandable and even advisable given limited financial resources. The actual fertilizers applied may vary as noted, provided that the maximum rate per application and total annual rate are not exceeded as detailed in Tables 4.1 and 4.2 above.

5.3 METHODS OF FERTILIZER APPLICATION

Only a limited few fertilizers are currently used at TJES, although additional options are provided for in Table 5.3. It includes the fertilizers in use as well as other options to meet the maximum allowable inputs per this plan. However, as previously stated the school may continue to input lower levels of nutrients based on availability, need, and satisfaction with existing plant performance.

Table 10 5.3 Fertilizers and Application Methods

Form	Application Method	N-P-K %	Nutrients Provided	% WIN
Granular	Spreader	21-0-0	N	0.00%
Granular	Spreader	19-0-19	N, K	Low (2.5-10%)
Granular	Spreader	10-0-20	N, K	Low (2.5-10%)
Granular	Spreader	10-0-0	N	65.00%
Granular	Spreader	16-4-8	N, P, K	50.00%
Granular	Spreader	21-3-7	N, P, K	2.00%

5.4 RECOMMENDED NUTRIENT APPLICATION

The following pages present the recommended nutrient application schedules for TJES, based the Virginia Nutrient Management Standards and Criteria. However, recommended values may be in excess

of normal inputs and/or are cost prohibitive for the facility based on application records provided. Particularly with respect to nitrogen applications, these values exceed recent past application records for TJES. It should be noted that the grounds management staff may continually check turf conditions, and may find adjustments may be required. If applicable, the grounds staff should adjust schedules and amounts accordingly while keeping to below maximum annual and maximum per application recommendations. If drastic changes are noted, plan revision may be appropriate in the future.

Nutrient Application Worksheet

Prepared Date 4/1/2014 Expires Date 4/1/2017

Management Area ID One

Feature/Species Ball Fields / Bermudagrass

Needs N-P-K (lb/1,000 ft²)	Application Date(s) MM/DD[1]	N-P-K (%) (lb/1,000 ft²)			% SAN	N (lb/1,000 ft²)	P (lb/1,000 ft²)	K (lb/1,000 ft²)	Lime (lb/1,000 ft²)
4.0-0-0.75	4/15	19	0	19		0.48		0.48	
		2.5							
	5/15	10	0	0		1.00		0.00	
		10							
	6/15	21	0	0		1.00		0.00	
		4.75							
	7/15	19	0	19		0.27		0.27	
		1.4							
	8/15	10	0	0	65	0.50		0.00	
		5							
	9/1	21	0	0		0.74		0.00	
		3.5							
	9/1	Dolomitic Lime							30.00
Annual Totals						3.97	0.00	0.74	30.00

[1]The Month/Day designations may not always be followed due to weather, etc. Experience and judgement of the grounds superintendent shall intercede as to the applicability of individual products and timing based on conditions. Standard maximums as defined herein regarding individual and annual applications shall apply.

Nutrient Application
March 30, 2014

Nutrient Application Worksheet

Prepared Date 4/1/2014 Expires Date 4/1/2017

Management Area ID Two

Feature/Species Lawn / Fescue

Needs N-P-K (lb/1,000 ft²)	Application Date(s) MM/DD[1]	N-P-K (%) (lb/1,000 ft²)	% SAN	N (lb/1,000 ft²)	P (lb/1,000 ft²)	K (lb/1,000 ft²)	Lime (lb/1,000 ft²)
3.5-2.5-1.5	3/1	19 0 19 2.5		0.48	0.00	0.48	
	4/1	16 4 8 3	50	0.48	0.12	0.24	
	5/1	21 0 0 2.75		0.58	0.00	0.00	
	6/1	16 4 8 3	50	0.48	0.12	0.24	
	7/1	19 0 19 2		0.38	0.00	0.38	
	8/1	21 0 0 1		0.21	0.00	0.00	
	9/1	21 0 0 2.5		0.53	0.00	0.00	
	10/1	21 0 0 1.25		0.26	0.00	0.00	
	11/1	21 0 0 0.5		0.11	0.00	0.00	
	11/1	Dolomitic Lime					25.00
Annual Totals				3.50	0.24	1.34	25.00

[1]The Month/Day designations may not always be followed due to weather, etc. Experience and judgement of the grounds superintendent shall intercede as to the applicability of individual products and timing based on conditions. Standard maximums as defined herein regarding individual and annual applications shall apply.

Nutrient Application
March 30, 2014

Nutrient Application Worksheet

Prepared Date 4/1/2014 Expires Date 4/1/2017

Management Area ID Three

Feature/Species Landscape Beds / Variety of Shrubs, Etc.

Needs N-P-K (lb/1,000 ft²)	Application Date(s) MM/DD[1]	N-P-K (%) (lb/1,000 ft²)			% SAN	N (lb/1,000 ft²)	P (lb/1,000 ft²)	K (lb/1,000 ft²)	Lime (lb/1,000 ft²)
2.5-0.5-0	3/1	21	0	0		0.42	0.00	0.00	
		2							
	4/1	21	0	0		0.42	0.00	0.00	
		2							
	5/1	21	0	0		0.42	0.00	0.00	
		2							
	6/1	0	0	0		0.00	0.00	0.00	
		0							
	7/1	21	0	0		0.21	0.00	0.00	
		1							
	8/1	0	0	0		0.00	0.00	0.00	
		0							
	9/1	21	0	0		0.42	0.00	0.00	
		2							
	10/1	21	0	0		0.42	0.00	0.00	
		2							
	11/1	21	0	0		0.11	0.00	0.00	
		0.5							
Annual Totals						2.42	0.00	0.00	0.00

[1]The Month/Day designations may not always be followed due to weather, etc. Experience and judgement of the grounds superintendent shall intercede as to the applicability of individual products and timing based on conditions. Standard maximums as defined herein regarding individual and annual applications shall apply.

6.0 Equipment Calibration

Equipment calibration is critical to nutrient management plan implementation. Plan recommendations will do little to save money and protect water quality if they are not followed due to inaccurate nutrient application. Calibration of all application equipment should be checked on a periodic basis. Without necessary adjustments indicated by calibration testing, the result may be the application of too few or too many nutrients. Too little nutrients could result in unacceptable turf durability, playability, and aesthetics. Applying excess nutrients could be costly, not only because of the unnecessary expense, but also because of a negative impact on water quality. Information on application equipment calibration is available in Chapter 10 of the Urban Nutrient Management Handbook, from the Virginia Cooperative Extension, and from equipment manufacturers and vendors. Equipment calibration records can be maintained in Appendix D of this document.

7.0 Records

Another area to emphasize for proper plan implementation is record keeping. Without records, it is impossible to know what has been applied and if any progress or improvements in nutrient management are made. Important information to retain with the plan includes soil tests reports; calibration settings; dates of fertilizer application and rates applied; seeding or renovation; and unusual stresses caused by disease, drought, and pests. These items could impact the health and appearance of the turfgrasses on the grounds. This information will also provide the background needed for fine-tuning future plan revisions. Soil test results can be maintained in Appendix B of the plan. A section has been provided in Appendix C for Nutrient Application information, and Appendix D includes a place to maintain application equipment calibration information. We recommend that documents and records be maintained for at least 3 years, unless a longer period of record is required.

8.0 Plan Revisions

There are several reasons for revising the plan, including the expiration of the plan, which is only good for a maximum of three years. The plan can also be refined to take advantage of what has been learned from the previous growing season, including updated soil test results or results for features not previously tested. Some factors may result in the need for significant plan revisions, such as changes in the turfgrasses used on the grounds. Nutrient management plans are dynamic documents that always be evolving. A Log of Plan Revisions is included in Appendix E to maintain a record of the changes that occur during the three year life of the plan.

Appendix A – USDA-NRCS Soil Information

United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Falls Church City, Virginia

March 17, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

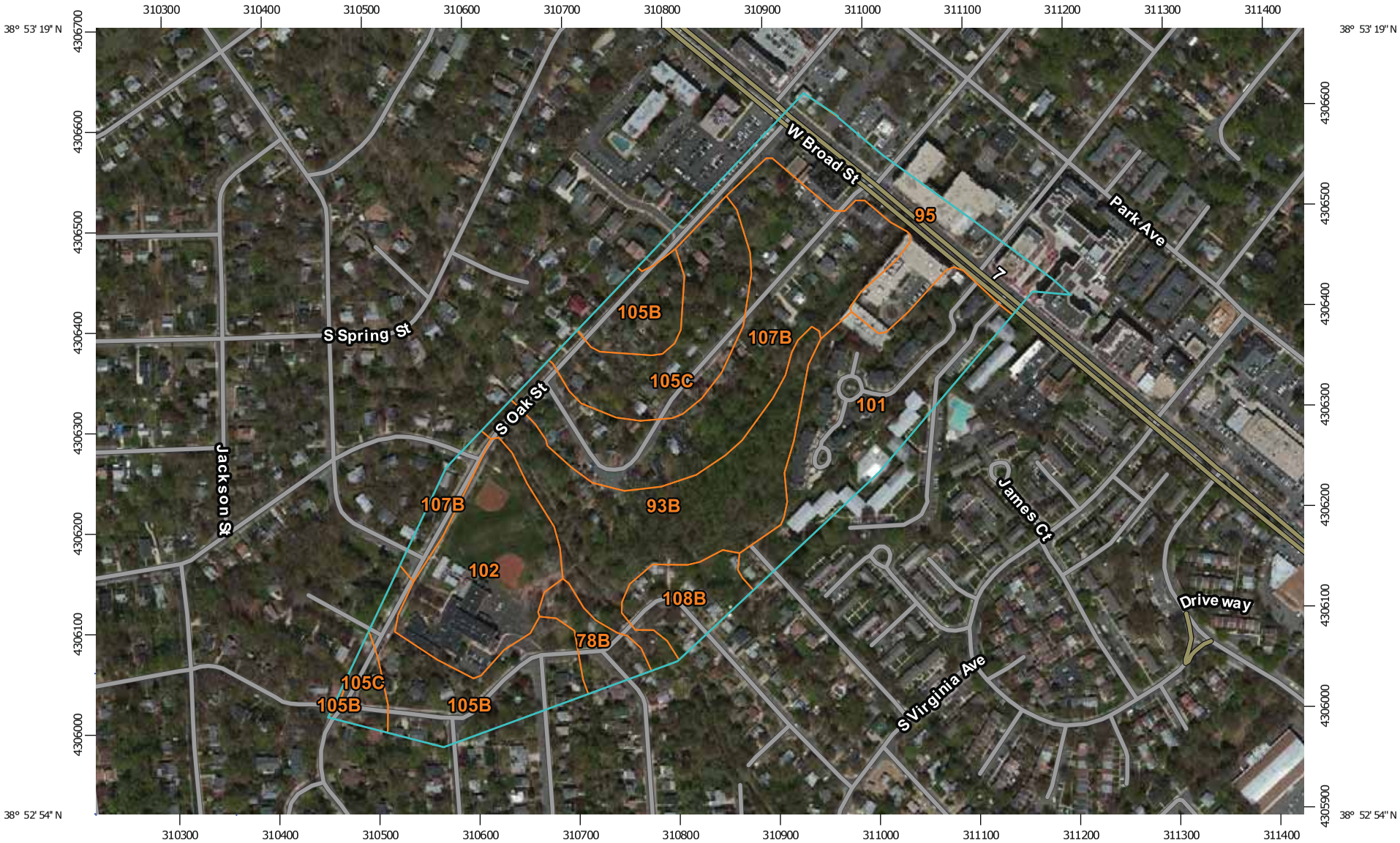
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,520 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Falls Church City, Virginia
Survey Area Data: Version 6, Dec 11, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 14, 2011—Nov 7, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Falls Church City, Virginia (VA610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
78B	Meadowville loam, 2 to 7 percent slopes	1.2	2.4%
93B	Sumerduck silt loam, 2 to 7 percent slopes	7.8	15.0%
95	Urban land	6.1	11.8%
101	Urban land-Wheaton complex	7.5	14.3%
102	Wheaton loam, 2 to 25 percent slopes	5.5	10.6%
105B	Wheaton-Glenelg complex, 2 to 7 percent slopes	6.1	11.6%
105C	Wheaton-Glenelg complex, 7 to 15 percent slopes	5.3	10.2%
107B	Wheaton-Meadowville complex, 2 t0 7 percent slopes	10.5	20.2%
108B	Wheaton-Sumerduck complex, 2 to 7 percent slopes	2.0	3.9%
Totals for Area of Interest		**52.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used.

Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Falls Church City, Virginia

78B—Meadowville loam, 2 to 7 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Meadowville and similar soils: 85 percent

Description of Meadowville

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Local alluvium over residuum weathered from schist

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 41 to 79 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.8 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2w
Hydrologic Soil Group: A

Typical profile

0 to 12 inches: Loam
12 to 31 inches: Clay loam
31 to 39 inches: Gravelly loam
39 to 72 inches: Sandy loam

93B—Sumerduck silt loam, 2 to 7 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Sumerduck and similar soils: 85 percent
Minor components: 2 percent

Description of Sumerduck

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from schist and/or alluvium derived from phyllite

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Loam
4 to 31 inches: Silty clay loam
31 to 100 inches: Silt loam

Minor Components

Hatboro

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

95—Urban land

Map Unit Setting

Mean annual precipitation: 28 to 58 inches
Mean annual air temperature: 87 to 89 degrees F
Frost-free period: 175 to 200 days

Map Unit Composition

Urban land: 95 percent

Description of Urban Land

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8s

101—Urban land-Wheaton complex

Map Unit Setting

Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Urban land: 50 percent
Wheaton and similar soils: 49 percent

Description of Urban Land

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8s

Description of Wheaton

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill derived from phyllite

Properties and qualities

Slope: 2 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 9 inches: Loam
9 to 60 inches: Loam

102—Wheaton loam, 2 to 25 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Wheaton and similar soils: 100 percent

Description of Wheaton

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill derived from phyllite

Properties and qualities

Slope: 2 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 9 inches: Loam
9 to 60 inches: Loam

105B—Wheaton-Glenelg complex, 2 to 7 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Wheaton and similar soils: 45 percent
Glenelg and similar soils: 40 percent

Description of Wheaton

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill derived from phyllite

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 9 inches: Loam
9 to 60 inches: Loam

Description of Glenelg

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from mica schist and/or residuum weathered from phyllite

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: B

Typical profile

0 to 6 inches: Silt loam
6 to 27 inches: Silt loam
27 to 71 inches: Channery loam

105C—Wheaton-Glenelg complex, 7 to 15 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Wheaton and similar soils: 45 percent
Glenelg and similar soils: 40 percent

Description of Wheaton

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill derived from phyllite

Properties and qualities

Slope: 2 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile
0 to 9 inches: Loam
9 to 60 inches: Loam

Description of Glenelg

Setting
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mica schist and/or residuum weathered from phyllite

Properties and qualities
Slope: 7 to 14 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.6 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 3e
Hydrologic Soil Group: B

Typical profile
0 to 6 inches: Silt loam
6 to 27 inches: Silt loam
27 to 71 inches: Channery loam

107B—Wheaton-Meadowville complex, 2 t0 7 percent slopes

Map Unit Setting
Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition

Wheaton and similar soils: 46 percent
Meadowville and similar soils: 44 percent

Description of Wheaton

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill derived from phyllite

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 9 inches: Loam
9 to 60 inches: Loam

Description of Meadowville

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Local alluvium over residuum weathered from schist

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 41 to 79 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.8 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability (nonirrigated): 2w
Hydrologic Soil Group: A

Typical profile
0 to 12 inches: Loam
12 to 31 inches: Clay loam
31 to 39 inches: Gravelly loam
39 to 72 inches: Sandy loam

108B—Wheaton-Sumerduck complex, 2 to 7 percent slopes

Map Unit Setting
Mean annual precipitation: 37 to 49 inches
Mean annual air temperature: 45 to 67 degrees F
Frost-free period: 185 to 212 days

Map Unit Composition
Wheaton and similar soils: 45 percent
Sumerduck and similar soils: 40 percent
Minor components: 2 percent

Description of Wheaton

Setting
Landform: Interfluves
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill derived from phyllite

Properties and qualities
Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile
0 to 9 inches: Loam
9 to 60 inches: Loam

Description of Sumerduck

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from schist and/or alluvium derived from phyllite

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Loam
4 to 31 inches: Silty clay loam
31 to 100 inches: Silt loam

Minor Components

Hatboro

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

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