ATTACHMENT PTA-XII - LOCATION OF BORINGS AND BORING LOGS

In accordance with §9 VAC 20-81-460.E.2.a., a map showing boring locations, along with the corresponding DAA boring logs is presented herein. KBJW boring logs are contained in Appendix 2 of the Hydrogeologic Report.

Table 1 presented in this attachment provides completion details, groundwater and bedrock elevation data for both DAA and KBJW borings and piezometers.

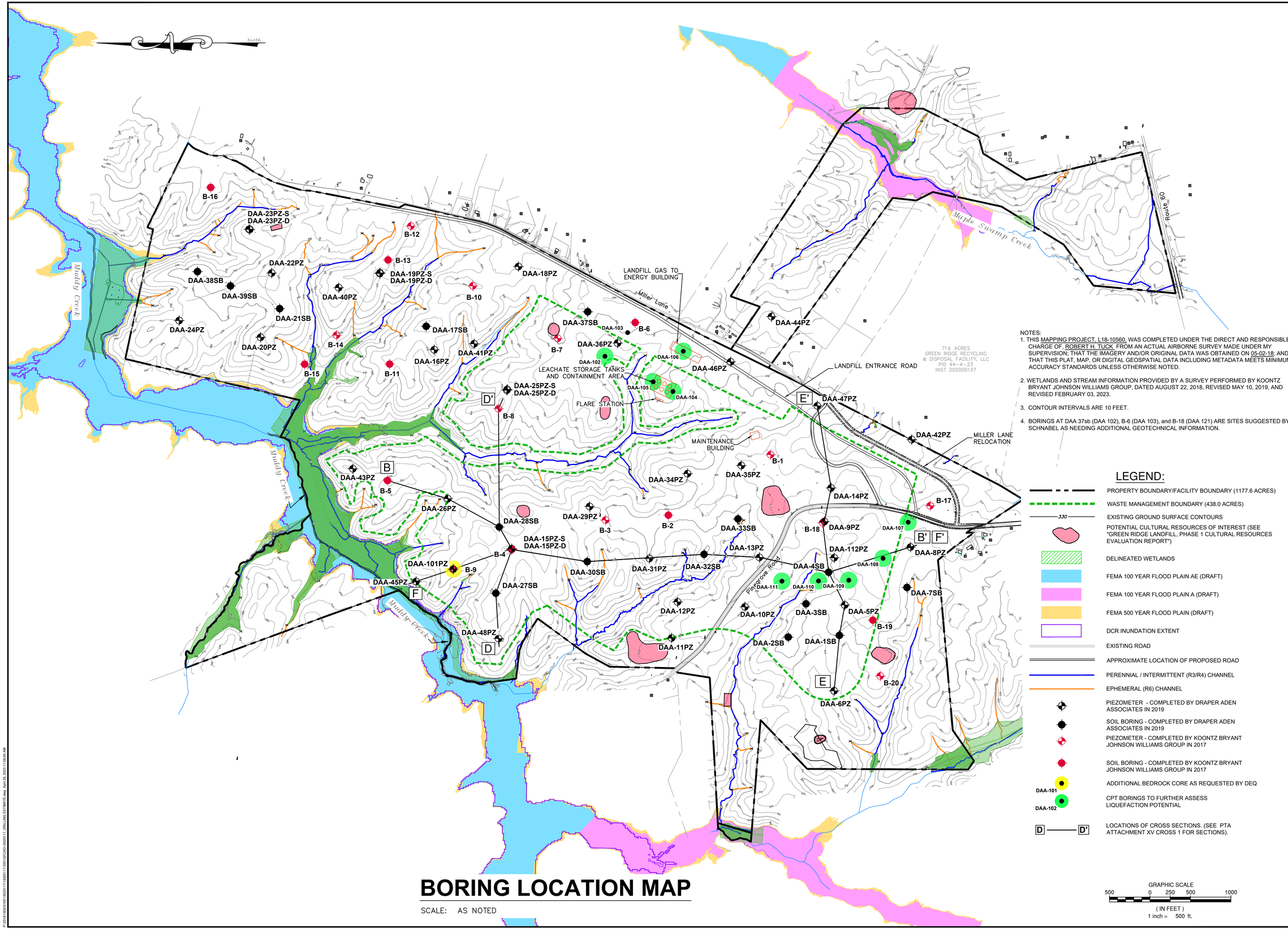
The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. Responses on TR 1 were provided to DEQ on October 1, 2021 (Comments 1 – 10, 12 -13 and 17 - 22) with a TR 1 supplement issued on April 13, 2022 (Comments 11, and 14-16). In order to respond to TR 1, two additional borings were completed, DAA-101pz and DAA-112pz. Information on these borings is now included in this Attachment.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. This Attachment updates the document to incorporate TR 1 information as appropriate. It is submitted as the final response to TR 2.

The following is a list of the documents associated with this section:

PTA Attachment XII Figure: BOR – Boring Location Map - Dated 05/12/2023
Boring Logs (TR 1 Supplement)
Table 1 – Boring Log Completion Details - Dated 04/12/2022

DRAFT



BORING LOCATION MAP

SCALE: AS NOTED

NOTES:
1. THIS MAPPING PROJECT, L18-10560, WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, ROBERT H. TUCK, FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER MY SUPERVISION; THAT THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON 05-02-18; AND THAT THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.
2. WETLANDS AND STREAM INFORMATION PROVIDED BY A SURVEY PERFORMED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP, DATED AUGUST 22, 2018, REVISED MAY 10, 2019, AND REVISED FEBRUARY 03, 2023.
3. CONTOUR INTERVALS ARE 10 FEET.
4. BORINGS AT DAA 37sb (DAA 102), B-6 (DAA 103), and B-18 (DAA 121) ARE SITES SUGGESTED BY SCHNABEL AS NEEDING ADDITIONAL GEOTECHNICAL INFORMATION.

LEGEND:

- PROPERTY BOUNDARY/FACILITY BOUNDARY (1177.6 ACRES)
- WASTE MANAGEMENT BOUNDARY (438.0 ACRES)
- 330 — EXISTING GROUND SURFACE CONTOURS
- POTENTIAL CULTURAL RESOURCES OF INTEREST (SEE "GREEN RIDGE LANDFILL, PHASE 1 CULTURAL RESOURCES EVALUATION REPORT")
- DELINEATED WETLANDS
- FEMA 100 YEAR FLOOD PLAIN AE (DRAFT)
- FEMA 100 YEAR FLOOD PLAIN A (DRAFT)
- FEMA 500 YEAR FLOOD PLAIN (DRAFT)
- DCR INUNDATION EXTENT
- EXISTING ROAD
- APPROXIMATE LOCATION OF PROPOSED ROAD
- PERENNIAL / INTERMITTENT (R3/R4) CHANNEL
- EPHEMERAL (R6) CHANNEL
- PIEZOMETER - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- SOIL BORING - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- PIEZOMETER - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
- SOIL BORING - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
- DAA-101 — ADDITIONAL BEDROCK CORE AS REQUESTED BY DEQ
- DAA-102 — CPT BORINGS TO FURTHER ASSESS LIQUEFACTION POTENTIAL
- D — D' LOCATIONS OF CROSS SECTIONS. (SEE PTA ATTACHMENT XV CROSS 1 FOR SECTIONS).

GRAPHIC SCALE
500 0 250 500 1000
(IN FEET)
1 inch = 500 ft.

COMMONWEALTH OF VIRGINIA
MICHAEL D. [illegible] LAWLESS II
No. 032
PROFESSIONAL GEOLOGIST

Draper Aden Associates
Engineering • Surveying • Environmental Services
2200 South Main Street, Suite A
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
www.daa.com
• Raleigh, NC
• Fayetteville, NC
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• Northern Virginia
• Richmond, VA
• Hampton Roads, VA
• Virginia Beach, VA

GREEN RIDGE
RECYCLING AND DISPOSAL FACILITY

UPDATED BORING PLAN SUPPLEMENTAL
BORING LOCATIONS

GREEN RIDGE RECYCLING AND DISPOSAL FACILITY

CUMBERLAND COUNTY, VIRGINIA

REVISIONS

TR-1 Supplement Response
April 12, 2022

TR-2 Response
May 12, 2023 Minor updates to TR-1 Supplement Response

DESIGNED BY:	DC
DRAWN BY:	DLD
CHECKED BY:	LPK
SCALE:	1" = 500'
DATE:	05/12/2023
PROJECT NUMBER:	18020117-090102

PTA ATTACHMENT XII
FIGURE: BOR

P:\2018\18020100\18020117\18020117.DRILLING ESTIMATE.dwg, April 26, 2023 11:08:09 AM

ATTACHMENT PTA-XIII - LABORATORY AND FIELD DATA

As required by §9 VAC 20-81-460.E, laboratory analysis documentation and field data are herein provided as Attachment XIII. This includes slug test results and geotechnical laboratory analysis of soils.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. No comments were received on Attachment PTA-XII under TR 1. However, in order to respond to TR 1, two additional borings were completed, DAA-101pz and DAA-112pz. No additional laboratory or field data was collected during the TR 1 field activities.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with an addendum to TR 2 issued on October 25, 2022. Again, no comments specific to this Attachment were received.

This Attachment is submitted as part of the final package for the final response to TR 2.

The following is a list of documents associated with this section:

Slug Test Data
Geotechnical Laboratory Test Data

DRAFT

ATTACHMENT PTA-XIV - MATERIALS VOLUME CALCULATIONS

As required by §9 VAC 20-81-460.E.2.b.(3), calculations supporting the estimate of soil materials required for development and operation of the landfill are provided as Attachment XIV. On-site soil materials will be used for structural fill, bedding layers, upper layers of closure cap, intermediate cover and some operations. On-site soils will not be used for liner or the infiltration layer component of the cap. A geosynthetic clay liner will be used in place of clay soil materials. Green Ridge plans to use alternate daily covers in lieu of the 6 inches of soil, where appropriate.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) was issued on April 8, 2021. No comments were received on Attachment PTA-XIV under TR 1. Responses on TR 1 were provided to DEQ on October 1, 2021 to address comments 1 – 10, 12 -13 and 17 – 22. A TR 1 Supplemental response was provided to DEQ on April 13, 2022 to address comments 11, and 14-16.

DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with an addendum to TR 2 issued on October 25, 2022. Again, no comments specific to this Attachment were received.

However, the applicant under TR 1 Supplement modified the conceptual base grades, raising the elevation at the northern end, which decreased the potential excavation depth in the area. New calculations for the estimated soil materials for landfill development and operation are provided under the TR 2 updated Part A.

Note that the calculations indicate a slight deficit of 84,000 cubic yards. This would be equivalent to approximately 10 acres of borrow at an average depth of 5 feet. Given the additional acreage on the site and the adjacent properties owned by Green Ridge, this deficit should be readily addressed within the facility boundary or from other properties under control of the applicant.

This Attachment is submitted as part of the final response to TR 2.

The attached table provides the calculations supporting the estimate of soil materials required.

DRAFT

Green Ridge Recycling and Disposal Facility, LLC

Material Balance Calculations - 8:1 Waste to Soil

Estimated Maximum Operational Area - Conceptual

TR 2 Revision 5/12/2023 - lpk

Assumptions:					
Area(acres)		240	Rounded		
Available soil resource (cy)		4,800,000	Estimated	TR 1 Supplement base grade	
Conceptual airspace (cy)		54,000,000	Estimated	Maximum	
On-site borrow areas					
Area (acres)		180	Estimated borrow		
Depth of excavation (ft)		15	Average		
Available soil resource (cy)		4,356,000	Estimated borrow		

MATERIAL USAGE	THICKNESS OF LAYER (ft)	MAX. OPERATIONAL AREA EXCAVATION	ON-SITE BORROW AREAS	TOTALS	COMMENTS
Available soil material		**4,800,000**	**4,356,000**	**9,156,000**	
Engineered uses					
Perimeter road fill (TR 1 concept)	Varies	1,191,000	0	1,191,000	Fill for perimeter road and berm
Structural fill (other)	Varies	500,000			Estimated - no design parameters
Low permeability soil liner material	2.0	0	0	0	Will use GCL instead of 24" clay
Liner bedding layer	0.5	193,600	0	193,600	
Interim cover	1.0	387,200	0	387,200	
Infiltration layer	1.5	0	0	0	Will use GCL instead of 18" clay
Cap bedding layer	0.5	193,600	0	193,600	
Erosion layer	1.5	580,800	0	580,800	
Vegetative layer	0.5	193,600	0	193,600	
SUBTOTAL		***3,239,800***	***0***	**3,239,800**	
Operations (intermediate cover, others)		6,000,000	0	6,000,000	Waste to soil ratio 8:1
TOTAL Soil Required		***9,239,800***	***0***	**9,239,800**	
Soil Balance		-4,439,800	4,356,000	**-83,800**	Can borrow from other areas within the site or from adjacent properties under ownership

ATTACHMENT PTA-XV - GEOLOGIC MAPS, ORTHOGONAL CROSS-SECTIONS, POTENTIOMETRIC SURFACE MAPS, and BEDROCK SURFACE MAP

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. TR 1 included comments on this Attachment. Responses on TR 1 were provided to DEQ on October 1, 2021 and April 13, 2022 (Supplement). In order to respond to Comments 14 – 16 in TR 1, two additional borings were completed, DAA-101pz and DAA-112pz.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 and an addendum to TR 2 issued on October 25, 2022. Neither of these technical reviews provided any comments on the documents in this attachment. ATTACHMENT PTA-XV has been updated with the information from the additional borings and other TR-1 items.

This Attachment updates the document to incorporate TR 1 information and TR 1 Supplement information, as appropriate. It is submitted as the final response to TR 2.

Geologic Map

A geologic map of the site has been prepared, and is provided as **PTA Attachment XV – Geologic - Map,** as required by §9 VAC 20-81-460.E.2.c.(4). There is no change from the original Part A submittal.

The Green Ridge site is underlain by porphyroblastic biotite gneiss (map symbol bgp), which is described as a light-gray, medium grained segregation-layered gneiss containing prominent potassium feldspar porphyroblasts. The minerology includes quartz + biotite + plagioclase + potassium feldspar + muscovite + hornblende. Accessory minerals include epidote, apatite and opaque minerals. It is of Proterozoic age.

Cross Sections

~~In accordance with §9 VAC 20-81-460.E.2.c.(5), and based on the data collected from the Part A subsurface investigation, five orthogonal cross sections of the site have been prepared and are presented as Figures **PTA Attachment XV - Cross-1 and PTA Attachment XV - Cross-2.**~~

In accordance with §9 VAC 20-81-460.E.2.c.(5), and based on the data collected from the Part A subsurface investigation and additional work completed under TR 1, four orthogonal cross sections of the site have been prepared and are presented as revised **Figure PTA Attachment XV - Cross-1 (**also identified as LA-11 under the TR 1 supplement submittal). Cross sections were previously submitted to DEQ on April 13, 2022, as part of our TR 1 Supplemental response. As noted in the October 1, 2021 TR 1 response, base grades in the original Part A application were incorrect and the drilling of an additional deep boring, DAA-101, was proposed. In addition, several cross sections (A

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and C as well as an extended Cross Section D) were eliminated as outside of the anticipated disposal unit. The document provided in this Attachment PTA-XV replaces all other cross section submittals.

It should be noted that the base grades illustrated on the cross sections are based on an overall disposal unit layout developed during the conceptualization of the Facility and does not represent a final designed facility disposal unit. Future disposal units will be permitted under the Part B process within the approved Waste Management Boundary.

Potentiometric Maps

~~Potentiometric surface maps of the site have been prepared, based on measurements collected during May and October 2019, and are provided as **PTA Attachment XV - GW-1 and PTA Attachment XV - GW-2** as required by §9 VAC 20-81-460.E.2.c.(6).~~

Potentiometric surface maps of the site have been prepared based on measurements collected during May and October 2019, and are provided as **PTA Attachment XV - GW-1 and PTA Attachment XV – GW-2** as required by §9 VAC 20-81-460.E.2.c.(6). After numerous water level measurement events, the May 2019 potentiometric map overall represents the maximum (highest) water level for the Facility. As such, this potentiometric surface was used on the cross section map and for the development of conceptual base grades for the Facility. **PTA Attachment XV-GW 1** was modified and submitted under the TR 1 Supplement April 13, 2022 response. Minor edits were made for the TR 2 response. **PTA Attachment XV – GW-2** for the October 2019 data is the same as previously submitted with the original Part A application, with minor edits for the TR 2 response.

Groundwater elevation data continued to be collected after the original Part A submittal with the data from April 2019 through June 2022 events summarized in Table 1A, provided in **PTA Attachment XI.**

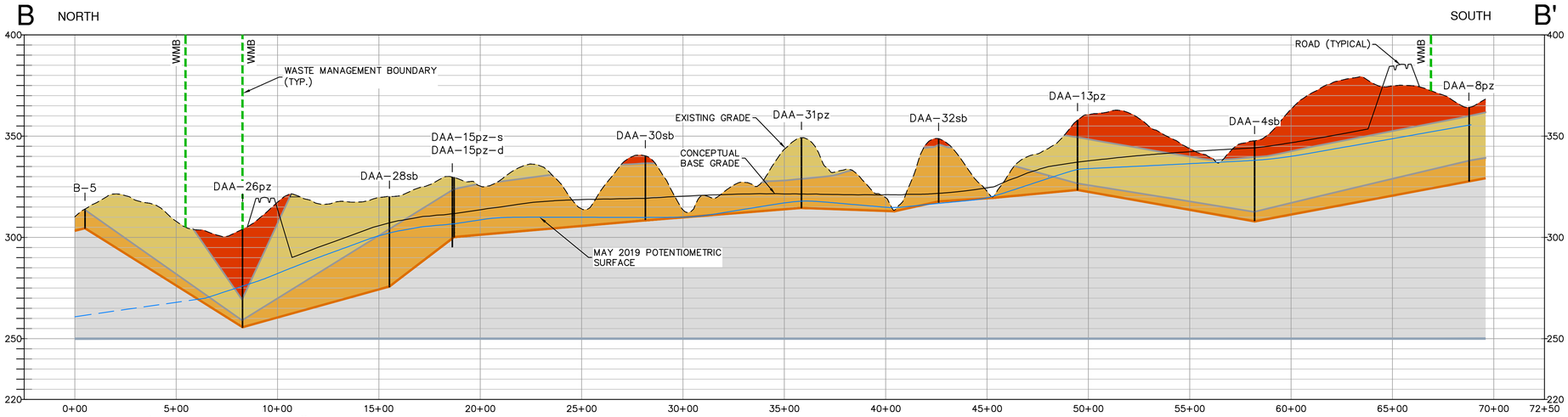
Bedrock Surface Map

A map of the bedrock surface is provided at **PTA Attachment XV-Bed-1.** This shows the configuration of the bedrock surface beneath the site, as it contributes to the overall groundwater flow pattern. This figure was modified and submitted under the TR 1 Supplement April 13, 2022 response. The TR 2 response incorporates the TR 1 Supplement information into the original PTA Attachment XV-Bed-1 mapping. To bring consistency among the various drawings, streams, boundaries, road networks etc. have also been updated.

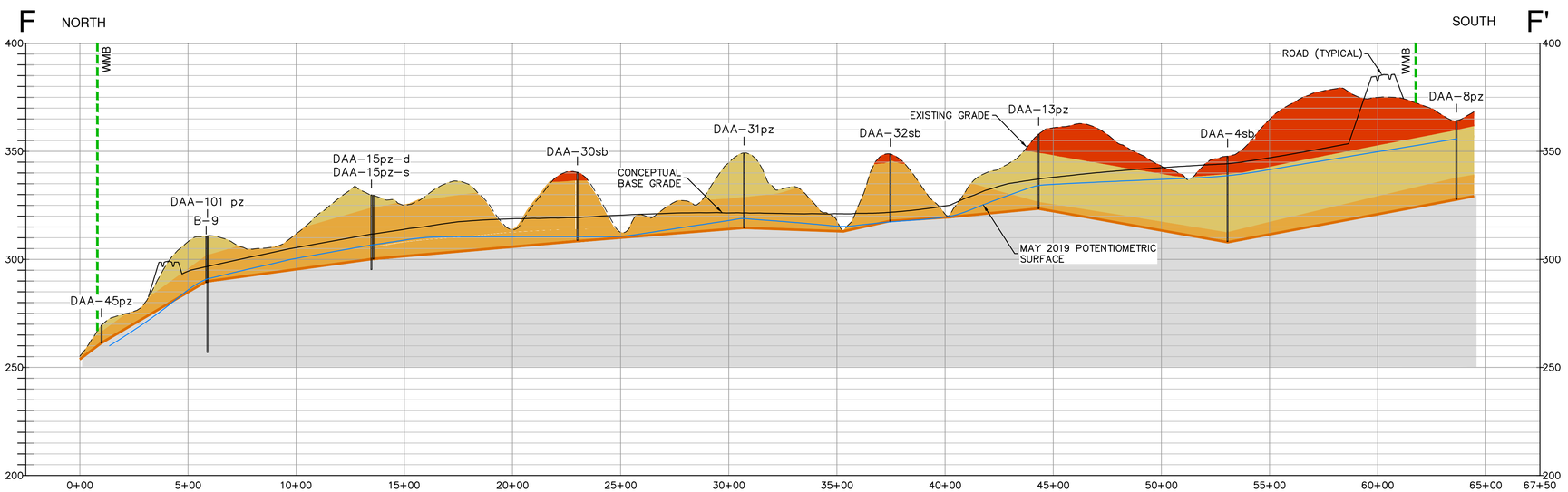
The following is a list of documents associated with this section:

PTA Attachment XV – Geologic Map – Dated December 3, 2019 (Original Part A)
PTA Attachment XV – Figure: Cross-1 - Updated Cross Sections B, D, E, and F Dated May 12, 2023
PTA Attachment XV – Figure: GW-1 - Potentiometric Surface map – May 2019 Dated May 12, 2023
PTA Attachment XV – Figure: GW-2 - Potentiometric Surface Map – Oct 2019 Dated May 12, 2023
PTA Attachment XV – Figure: BED - Bedrock Surface Map Dated May 12, 2023

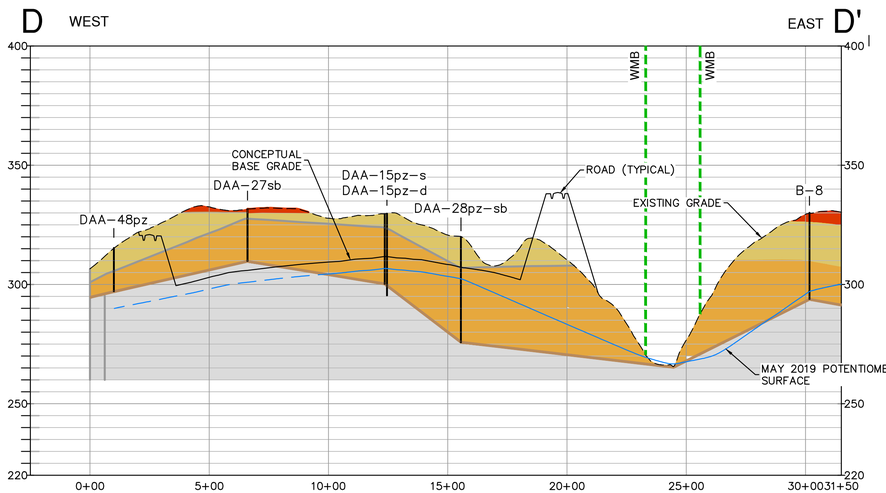
DRAFT



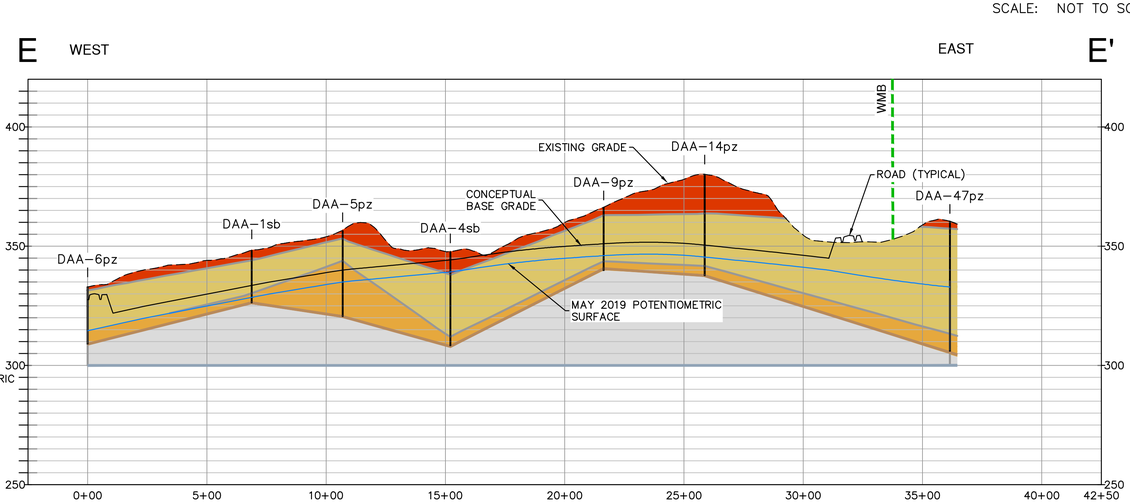
SECTION B–B' – Scale: H: 1"=300', V: 10:1



SECTION F–F' – Scale: H: 1"=300', V: 10:1



SECTION D–D' – Scale: H: 1"=300', V: 10:1



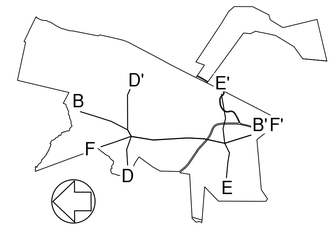
SECTION E–E' – Scale: H: 1"=300', V: 10:1

LEGEND:

- MH/ML–SILTS & CLAYS
- SM–SILTS & SANDS
- SAPROLITE (PARTIALLY WEATHERED ROCK)
- AUGER REFUSAL/BEDROCK
- EXISTING GRADE
- POTENTIOMETRIC SURFACE MAY 2019
- GROUNDWATER ELEVATION INFERRED

NOTES:

1. Cross Sections A and C have been removed from documentation since not located within Waste Management Boundary.
2. Groundwater elevation data from new piezometer DAA-101pz was collected in December 2021 and incorporated into May 2019 potentiometric surface contours.



KEY MAP

SCALE: NOT TO SCALE

COMMONWEALTH OF VIRGINIA
MICHAEL D[illegible] LAWLESS
No. 682
CERTIFIED PROFESSIONAL GEOLOGIST
DRAFT

Draper Aden Associates
Engineering • Surveying • Environmental Services
1030 Wilmer Avenue, Suite 100
Richmond, VA 23227
804-264-2228 Fax: 804-264-8773
www.daa.com
• Blacksburg, VA
• Charlottesville, VA
• Hampton Roads, VA
• Raleigh, NC
• Fayetteville, NC
• Northern Virginia
• Virginia Beach, VA

GREEN RIDGE RECYCLING AND DISPOSAL FACILITY

RECYCLING AND DISPOSAL FACILITY

UPDATED CROSS SECTIONS B, D, E, AND F

CUMBERLAND COUNTY, VIRGINIA

REVISIONS

TR-1 Response:
October 01, 2021

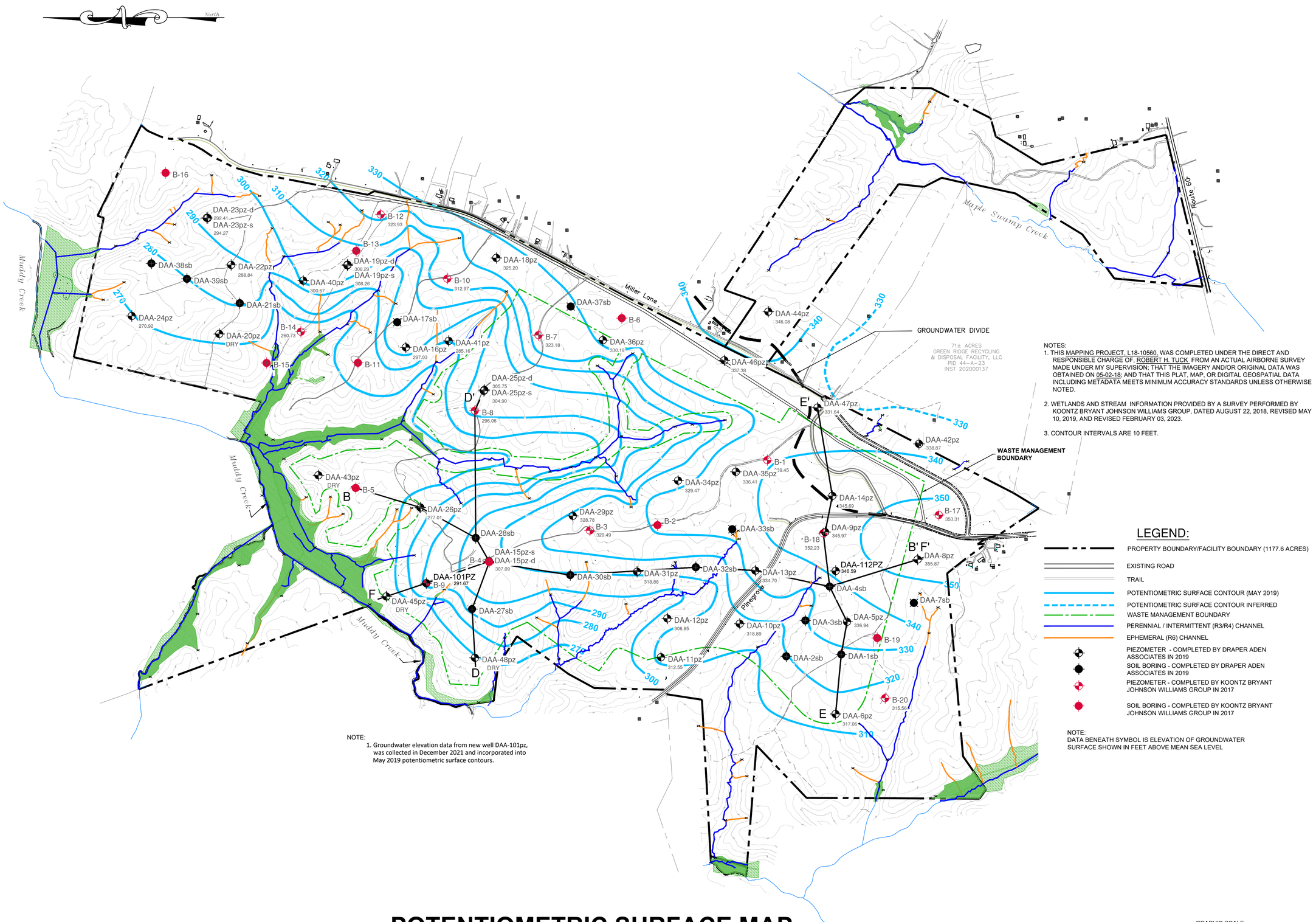
TR-1 Supplement Response:
April 12, 2022

TR-2 Response:
May 12, 2023 , Minor Updates to TR-1 Supplement Response

DESIGNED BY:	DC
DRAWN BY:	DLD/DJF
CHECKED BY:	KEB
SCALE:	AS NOTED
DATE:	05/12/2023
PROJECT NUMBER:	18020117-090102

PTA ATTACHMENT XV
FIGURE: CROSS-1

P:\2018\18020117\18020117-090102\CAD\18020_Combined SECTIONS & SECTIONS MOD 11-13-2019.mod Wed, April 26, 2023 11:50:09 AM



NOTES:
1. THIS MAPPING PROJECT, L18-10560, WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, ROBERT H. TUCK FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER MY SUPERVISION; THAT THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON 05-02-18; AND THAT THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.
2. WETLANDS AND STREAM INFORMATION PROVIDED BY A SURVEY PERFORMED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP, DATED AUGUST 22, 2018, REVISED MAY 10, 2019, AND REVISED FEBRUARY 03, 2023.
3. CONTOUR INTERVALS ARE 10 FEET.

LEGEND:

- PROPERTY BOUNDARY/FACILITY BOUNDARY (1177.6 ACRES)
- EXISTING ROAD
- TRAIL
- POTENTIOMETRIC SURFACE CONTOUR (MAY 2019)
- POTENTIOMETRIC SURFACE CONTOUR INFERRED
- WASTE MANAGEMENT BOUNDARY
- PERENNIAL / INTERMITTENT (R3/R4) CHANNEL
- EPHEMERAL (R6) CHANNEL
- PIEZOMETER - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- SOIL BORING - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- PIEZOMETER - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
- SOIL BORING - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017

NOTE:
DATA BENEATH SYMBOL IS ELEVATION OF GROUNDWATER SURFACE SHOWN IN FEET ABOVE MEAN SEA LEVEL

NOTE:
1. Groundwater elevation data from new well DAA-101pz, was collected in December 2021 and incorporated into May 2019 potentiometric surface contours.

POTENTIOMETRIC SURFACE MAP

SCALE: AS NOTED

GRAPHIC SCALE
500 0 250 500 1000
(IN FEET)
1 inch = 500 ft.

COMMONWEALTH OF VIRGINIA
MICHAEL D. [illegible] LAWLESS II
No. 032
PROFESSIONAL GEOLOGIST
PRELIM

Draper Aden Associates
Engineering • Surveying • Environmental Services
1030 Wilmer Avenue, Suite 100
Richmond, VA 23227
804-264-2228 Fax: 804-264-8773
www.daa.com
• Blacksburg, VA
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• Raleigh, NC
• Fayetteville, NC
• Northern Virginia
• Virginia Beach, VA

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POTENTIOMETRIC SURFACE MAP - MAY 2019

GREEN RIDGE RECYCLING AND DISPOSAL FACILITY

CUMBERLAND COUNTY, VIRGINIA

REVISIONS

TR-1 Supplement Response April 12, 2022

TR-2 Response May 12, 2023, Minor updates to TR-1 Supplement Response

DESIGNED BY:	DAC
DRAWN BY:	DLD
CHECKED BY:	LPK
SCALE:	1" = 500'
DATE:	05/12/2023
PROJECT NUMBER:	18020117-090102

PTA ATTACHMENT XV
FIGURE: GW-1

P:\2018\18020117\18020117-090102\CAD\18020117-GAUGING WELLS_MAY 2019-POT MAP TR2.dwg, April 05, 2023 11:52:37 AM

POTENTIOMETRIC SURFACE MAP

SCALE: AS NOTED

NOTES:
1. THIS MAPPING PROJECT, L18-10560, WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, ROBERT H. TUCK FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER MY SUPERVISION; THAT THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON 05-02-18; AND THAT THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.
2. WETLANDS AND STREAM INFORMATION PROVIDED BY A SURVEY PERFORMED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP, DATED AUGUST 22, 2018, REVISED MAY 10, 2019, AND REVISED FEBRUARY 03, 2023.
3. CONTOUR INTERVALS ARE 10 FEET.

LEGEND:

- PROPERTY BOUNDARY/FACILITY BOUNDARY (1177.6 ACRES)
- WASTE MANAGEMENT BOUNDARY (438.1 ACRES)
- 330 — EXISTING GROUND SURFACE CONTOURS
- DELINEATED WETLANDS
- EXISTING ROAD
- TRAIL
- APPROXIMATE LOCATION OF PROPOSED ROAD
- PERENNIAL / INTERMITTENT (R3/R4) CHANNEL
- EPHEMERAL (R6) CHANNEL
- 320 — GROUNDWATER ELEVATION CONTOUR, SHOWN IN FEET. (10-29-2019)
- 380 — GROUNDWATER ELEVATION CONTOUR, SHOWN IN FEET. (INFERRED) (10-29-2019)
- PIEZOMETER - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- SOIL BORING - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- PIEZOMETER - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
- SOIL BORING - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017

NOTE:
DATA BENEATH SYMBOL IS ELEVATION OF GROUNDWATER SURFACE SHOWN IN FEET ABOVE MEAN SEA LEVEL

GRAPHIC SCALE
500 0 250 500 1000
(IN FEET)
1 inch = 500 ft.

GROUNDWATER DIVIDE

Miller Lane
Maple Swamp Creek
Route 60
Muddy Creek
Muddy Creek Branch
Muddy Creek

COMMONWEALTH OF VIRGINIA
MICHAEL D. TAWLESS
No. 032
LICENSED PROFESSIONAL GEOLOGIST

Draper Aden Associates
Engineering • Surveying • Environmental Services
1030 Wilmer Avenue, Suite 100
Richmond, VA 23227
804-264-2225 Fax 804-264-8773
www.daa.com
• Blacksburg, VA
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• Northern Virginia
• Virginia Beach, VA

GREEN RIDGE RECYCLING AND DISPOSAL FACILITY
CUMBERLAND COUNTY, VIRGINIA

POTENTIOMETRIC SURFACE MAP - OCTOBER 2019

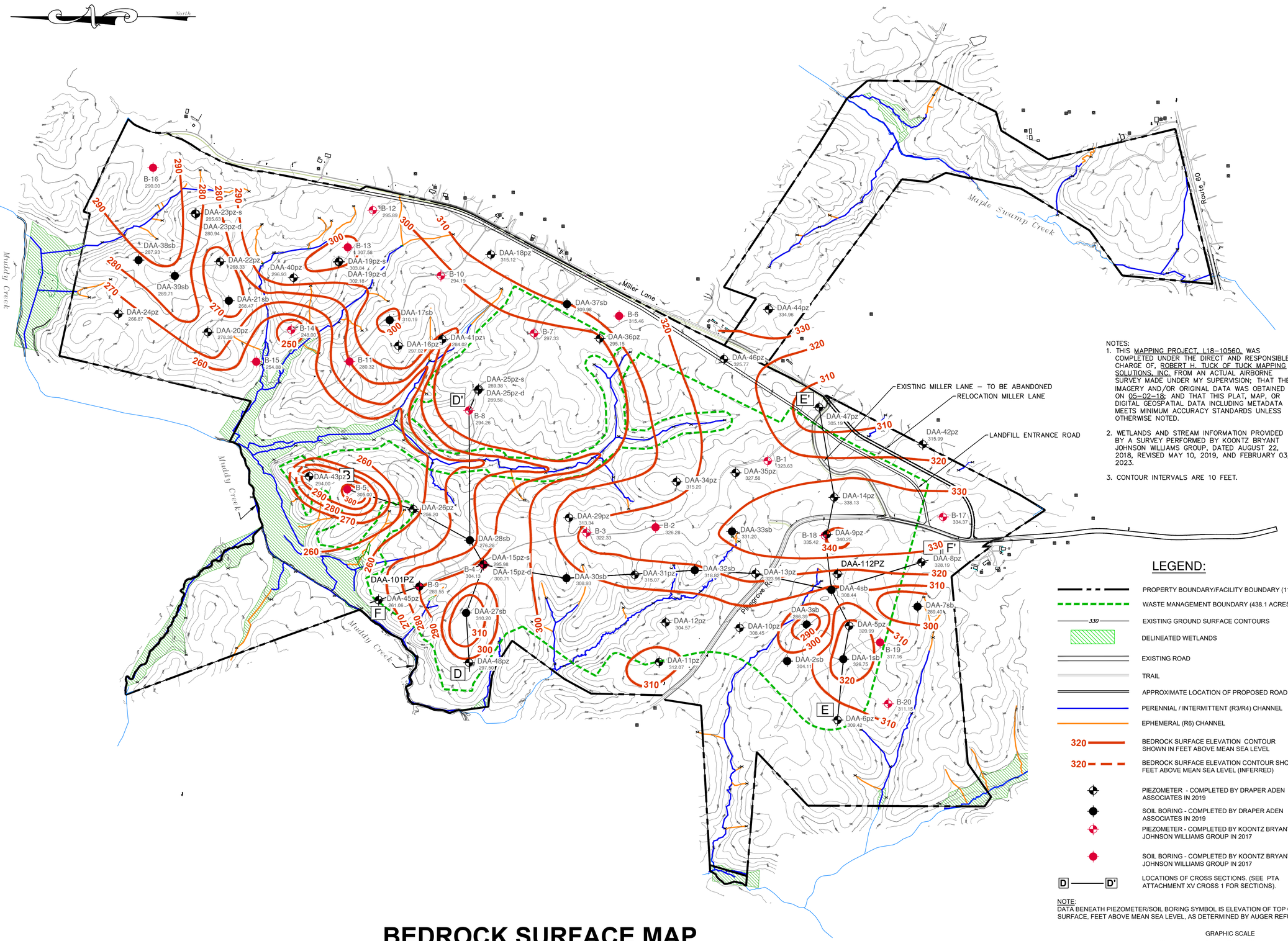
REVISIONS

TR 2 Response 05/12/2023, Minor revisions to Part A submission - potentiometric contours were not revised.

DESIGNED BY:	DC
DRAWN BY:	DLD/DJF
CHECKED BY:	KEB
SCALE:	1" = 500'
DATE:	05/12/2023
PROJECT NUMBER:	18020117-030102

PTA ATTACHMENT XV
FIGURE: GW-2

D:\2018\18020100\18020117\18020117-030102\CAD\LDMS_Cumberland\POTMAP.mxd\VALUES OCT 2019 - TR2.mxd, May 1, 2023 10:09:17 AM



NOTES:
1. THIS MAPPING PROJECT, L18-10560, WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, ROBERT H. TUCK OF TUCK MAPPING SOLUTIONS, INC. FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER MY SUPERVISION; THAT THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON 05-02-18; AND THAT THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.
2. WETLANDS AND STREAM INFORMATION PROVIDED BY A SURVEY PERFORMED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP, DATED AUGUST 22, 2018, REVISED MAY 10, 2019, AND FEBRUARY 03, 2023.
3. CONTOUR INTERVALS ARE 10 FEET.

LEGEND:

- PROPERTY BOUNDARY/FACILITY BOUNDARY (1177.6 ACRES)
- WASTE MANAGEMENT BOUNDARY (438.1 ACRES)
- 330 — EXISTING GROUND SURFACE CONTOURS
- DELINEATED WETLANDS
- EXISTING ROAD
- TRAIL
- APPROXIMATE LOCATION OF PROPOSED ROAD
- PERENNIAL / INTERMITTENT (R3/R4) CHANNEL
- EPHEMERAL (R6) CHANNEL
- 320 — BEDROCK SURFACE ELEVATION CONTOUR SHOWN IN FEET ABOVE MEAN SEA LEVEL
- 320 - - BEDROCK SURFACE ELEVATION CONTOUR SHOWN IN FEET ABOVE MEAN SEA LEVEL (INFERRED)
- PIEZOMETER - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- SOIL BORING - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
- PIEZOMETER - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
- SOIL BORING - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
- D — D' LOCATIONS OF CROSS SECTIONS. (SEE PTA ATTACHMENT XV CROSS 1 FOR SECTIONS).

NOTE:
DATA BENEATH PIEZOMETER/SOIL BORING SYMBOL IS ELEVATION OF TOP OF BEDROCK SURFACE, FEET ABOVE MEAN SEA LEVEL, AS DETERMINED BY AUGER REFUSAL.

GRAPHIC SCALE
500 0 250 500 1000
(IN FEET)
1 inch = 500 ft.

BEDROCK SURFACE MAP

SCALE: AS NOTED

COMMONWEALTH OF VIRGINIA
MICHAEL D. [illegible] LAWLESS II
No. 032
PROFESSIONAL GEOLOGIST
PRELIM

Draper Aden Associates
Engineering • Surveying • Environmental Services
2200 South Main Street, Suite A
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
www.daa.com
• Raleigh, NC
• Fayetteville, NC
• Charlottesville, VA
• Northern Virginia
• Hampton Roads, VA
• Virginia Beach, VA

GREEN RIDGE RECYCLING AND DISPOSAL FACILITY
CUMBERLAND COUNTY, VIRGINIA
BEDROCK SURFACE MAP

REVISIONS
TR-1 Supplement Response April 12, 2022
TR-2 Response May 12, 2023 Minor updates to TR-1 Supplement Response

DESIGNED BY:	DC
DRAWN BY:	DLD/DJF
CHECKED BY:	KEB
SCALE:	1" = 500'
DATE:	05/12/2023
PROJECT NUMBER:	18020117-090102

PTA ATTACHMENT XV
FIGURE: BED

P:\2018\18020100\18020117\18020117.090102\CAD\10560_Cumberland BEDROCK & SECTIONS MOD 11-13-2019 TR2.dwg, April 26, 2023 11:05:24 AM

ATTACHMENT PTA-XVI - VDOT ADEQUACY REPORT AND APPROVAL LETTER

In accordance with §10.1-1408.1.D.1 and 1408.4-.A-1 of the Code of Virginia and §9 VAC 20-81-460 of the *VSWMR*, an application for a new sanitary landfill shall include a written site-specific report approved by the Virginia Department of Transportation (VDOT), evaluating the adequacy of the transportation facilities that will be available to serve the landfill, including the impact of the landfill on local traffic volume, road congestion, and highway safety.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. TR 1 had four comments on the various road issues as follows:

18.) *The Traffic Impact analysis included in Attachment XVI includes a VDOT review letter dated July 10, 2019, which recommends both right and left turn lanes be installed on Route 60. It is not clear from the LIS if the applicant intends to install both turn lanes in accordance with the VDOT recommendations. Please clarify.*

19.) *The current alignment of Pinegrove Road and Miller Lane cross over the proposed disposal unit boundary. The NVM depicts an overhead utility line along the road alignment. Please provide any easement agreements that may exist with VDOT and electric, storm or other utilities, and describe how the road and utilities will be removed or relocated outside of the waste management boundary, in order to demonstrate that these roads and utilities will not be limiting site characteristics in accordance with 9 VAC 20-81-120.F.1.d.*

20.) *The Waste Management Boundary, and the Disposal Unit Boundary, appear to be within 500 feet of portions of Pinegrove Road and Miller Lane, after proposed realignment. Please provide a description and schematics of how the facility will be screened and noise reduced by natural objects, plantings, fences, or other means so as to minimize the visibility from the main-traveled way of the highway or city street, or otherwise removed from sight, in accordance with 9 VAC 20-81-120.C.1.e.(1), and 9 VAC 20-81-130.E.*

21.) *The permit application documents indicate that the scale house and site office are located southeast of Miller Lane, and the disposal unit itself will be located on the other side of Miller Lane. Portions of Miller Lane and Pinegrove Road will remain within the facility boundary after proposed realignment. Please provide a description and schematics of how the facility will limit all access by gates, and be surrounded on all sides by natural barriers, fencing, or an equivalent means of controlling vehicular and public access and preventing illegal disposal, in accordance with 9 VAC 20-81-130.B.*

Responses to these comments were provided on October 1, 2021.

DRAFT

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. No comments specific to this Attachment were received.

Based on subsequent changes to the disposal area, access into the site for the initial phase of the landfill will not utilize the private access road off of Route 60. Therefore, none of the comments from TR 1 nor the responses are currently relevant. For this initial phase, access for vehicles entering the landfill will be via a commercial entrance off Pine Grove Road. Miller Lane will no longer be crossed, but a portion will still require relocation as approved by VDOT and the County. A new Traffic Impact Analysis (TIA) was conducted to evaluate potential impacts to traffic on Pine Grove Road and Route 60 based on the new entrance and a revised (reduced) volume of waste anticipated for the initial phase of the landfill. The new TIA is included in this attachment. Accordingly, a new VDOT letter regarding its review of the TIA and approval of the recommendations is also provided in this attachment (pending).

With the proposed relocated Miller Lane, the initial disposal unit area will be 285 feet from a section of Miller Lane. Additionally, portions of the initial disposal unit may be within 300 feet of the existing Pine Grove Road. The property owned by Green Ridge for the Green Ridge Recycling and Disposal Facility has been zoned M2 (Industrial) and site development is addressed through a conditional use permit as approved by the Cumberland County Board of Supervisors. (Code of Ordinances - Chapter 74 Zoning, Article XV, Industrial District M-2). Green Ridge believes, therefore, that it is exempt from the 500-foot restriction per the regulation below.

***VSWMR* 9VAC20-81-120.C.1.e** states as follows:

> *C. Restrictions (distances are to be measured in the horizontal plane).*
> *1. No disposal unit or leachate storage unit shall be closer than:*
> *.....*
> *e. 1,000 feet from the nearest edge of the right-of-way of any interstate or primary highway or 500 feet from the nearest edge of the right-of-way of any other highway or city street, except the following:*
> *(1) Units that are screened by natural objects, plantings, fences, or other means so as to minimize the visibility from the main-traveled way of the highway or city street, or otherwise removed from sight;*
> *(2) Units that are located in areas that are zoned for industrial use under authority of state law or in unzoned industrial areas as determined by the Commonwealth Transportation Board; or*
> *(3) Units that are not visible from the main-traveled way of the highway or city street.*

With that said, Green Ridge is aware of its need to provide appropriate buffers to minimize impacts from its operations on residents traveling these roads. Buffer requirements and other restrictions (e.g. noise and light limits) have been identified in the Conditional Use Permit and must be upheld by Green Ridge.

DRAFT

This Attachment is submitted as part of the final response to TR 2.

The following is a list of documents associated with this section:

Traffic Impact Analysis – Green Ridge Recycling and Disposal Facility - Gorove Slade, Dated 4/27/2023

VDOT Traffic Adequacy Report – pending

DRAFT

GOROVE SLADE
Transportation Planners and Engineers

TRAFFIC IMPACT ANALYSIS

To:	Wendy Karably, PMP	TRC Companies, Inc.
Cc:	Stephany Johnson, CZA	Cumberland County
	Scott Frederick, P.E.	VDOT
From:	Carl Hultgren, P.E., PTOE	Gorove Slade
Date:	April 27, 2023	
Subject:	**Green Ridge Recycling and Disposal Facility**	

Introduction

Green Ridge Recycling and Disposal Facility, LLC is proposing to construct a recycling and disposal facility located in Clinton, Virginia, north of U.S. 60 (Anderson Highway). The facility is loosely bounded by Route 654 (Pinegrove Road) and Route 685 (Miller Lane). Currently, the facility operations will be primarily on the east side of Pinegrove Road. The proposed access plan includes relocating a portion of Miller Lane approximately 950 feet to the south along Pinegrove Road. The facility is also planning to build a new driveway on Pinegrove Road approximately 400 to 500 feet north of the relocated Miller Lane.

If approved, the facility is expected to be built and operational by 2027. The facility is expected to operate between 6:00 AM and 4:00 PM on weekdays, and from 6:00 AM to Noon on Saturdays.

The purpose of this analysis is to estimate the traffic impact that the proposed facility will have on the surrounding roadway network. The analysis is based on our Traffic Impact Analysis (TIA) scope meeting with the County and VDOT on April 13. Figure 1 shows the site location and study intersections.

Existing Conditions

Existing Roadway Network

Existing lane configurations were observed in the field by Gorove Slade. A description of the major roadways within the study area is presented below in Table 1, and the existing lane configuration is shown in Figure 2.

Table 1: Existing Roadway Network

Roadway	RTE #	VDOT Classification	Legal/Design Speed Limit (mph)	AADT (vpd)
Anderson Highway	60	Minor Arterial	55	5,000
Pinegrove Road (South of Miller Lane)	654	Local	55	300
Frenchs Store Road	654	Local	55	525
Miller Lane	685	Local	35	50

The annual average daily traffic (AADT) column reports the estimated 2023 daily two-way traffic volume on each roadway – assuming that the AM peak hour and PM peak hour each represent 10% of the daily traffic volume.

Note that there approximately 100 feet of offset between Pinegrove Road and Frenchs Store Road along U.S. 60. For the purpose of this analysis, it was assumed to be a single intersection.

Existing (2023) Traffic Volumes

The weekday AM peak hour (6:00 to 8:00 AM) and PM peak hour (3:00 to 5:00 PM) traffic volumes were conducted by Burns Services Inc. on April 18 at the following intersections:

- U.S. 60 at Pinegrove Road / Frenchs Store Road
- Pinegrove Road at Miller Lane

Figure 3 shows the 2023 traffic volumes at the study intersections.

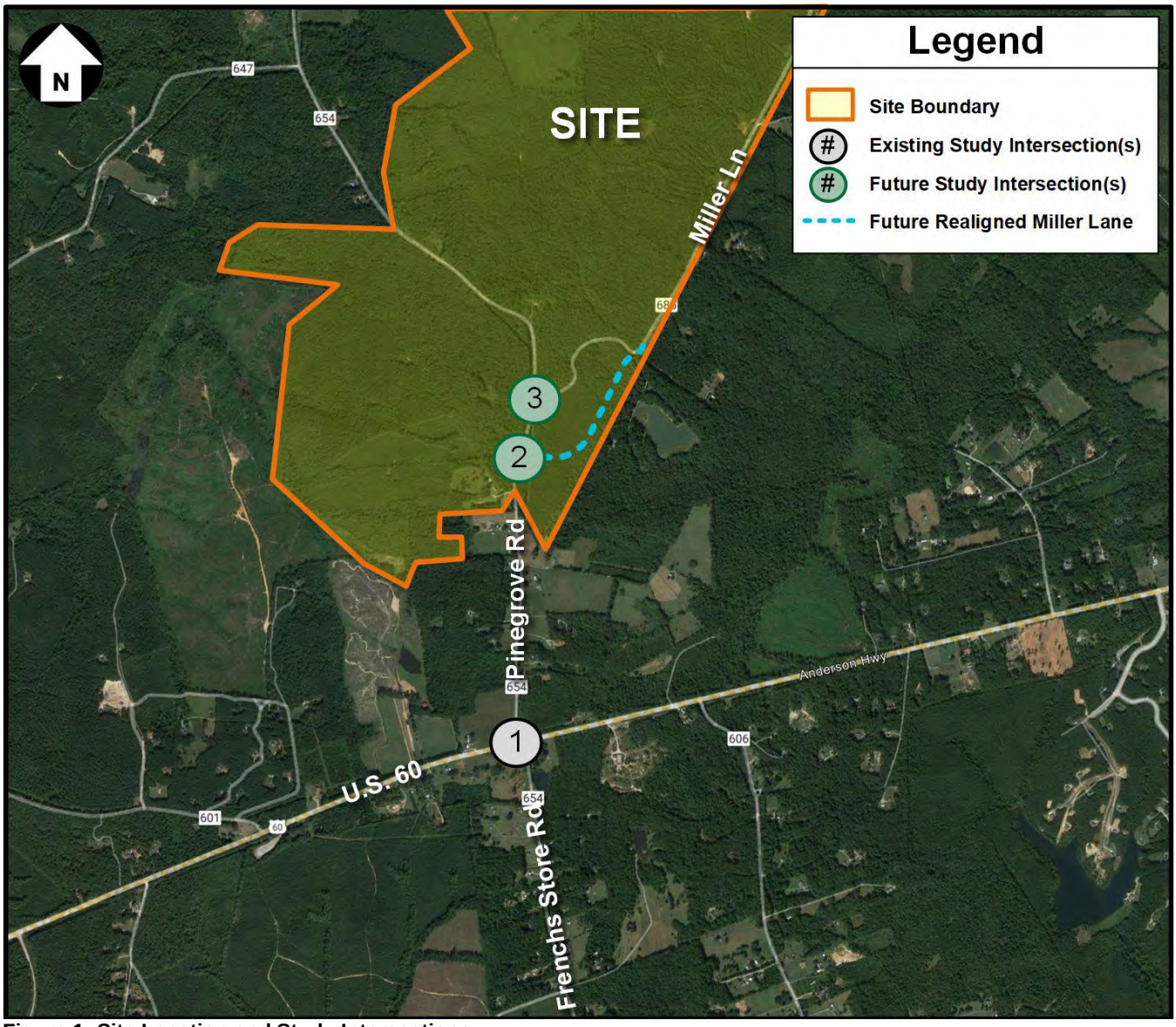


Figure 1: Site Location and Study Intersections

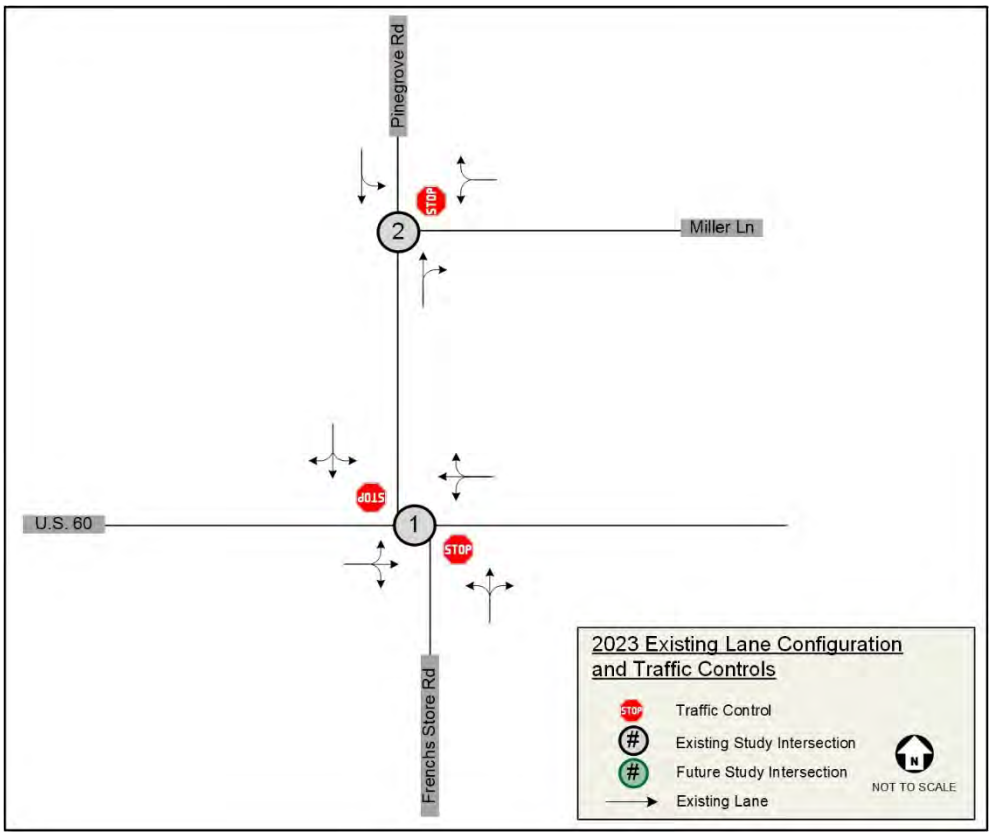


Figure 2: Existing Lane Configuration

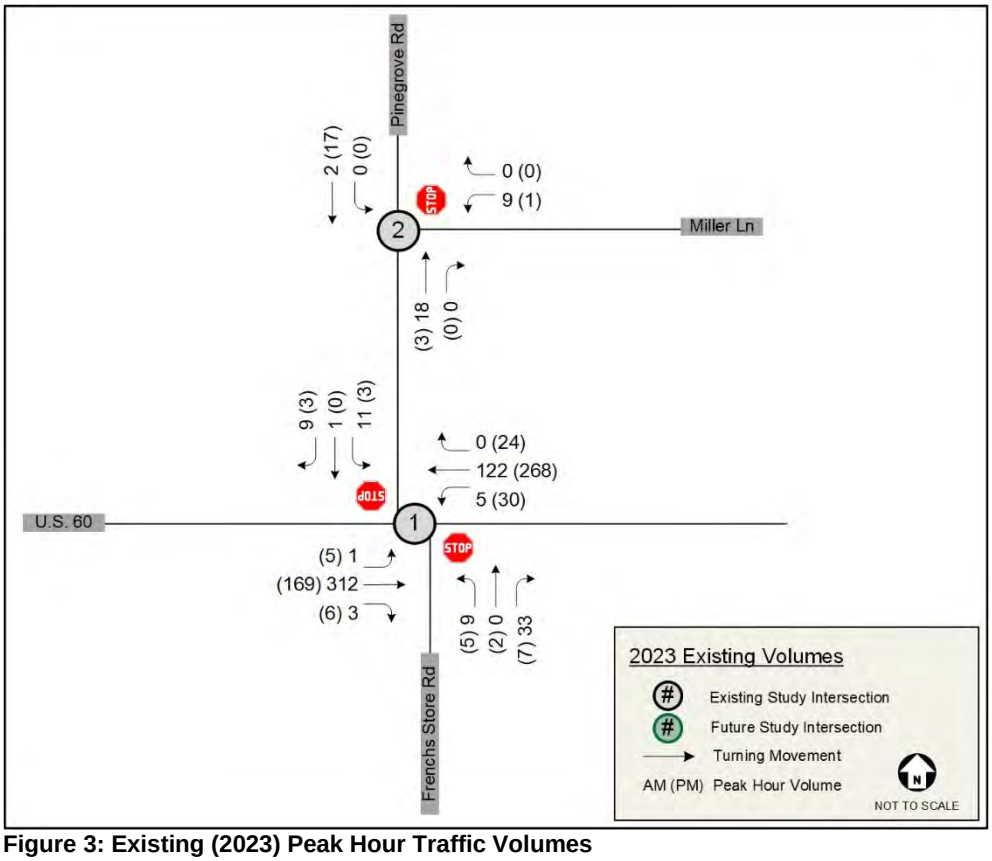


Figure 3: Existing (2023) Peak Hour Traffic Volumes

No-Build (2027) Conditions

Background Improvements

Based on the TIA scoping meeting, there are no planned roadway improvements at the study intersections. The proposed realignment of Miller Lane was assumed under Build conditions only.

Background Developments

Based on the TIA scoping meeting, there are no approved developments in the vicinity of the site that will have a significant impact on the study intersections.

Background Traffic Growth

An annual background growth rate of 1.0% for four years was applied to the existing traffic volumes to estimate the 2027 traffic volumes, which are shown in Figure 4.

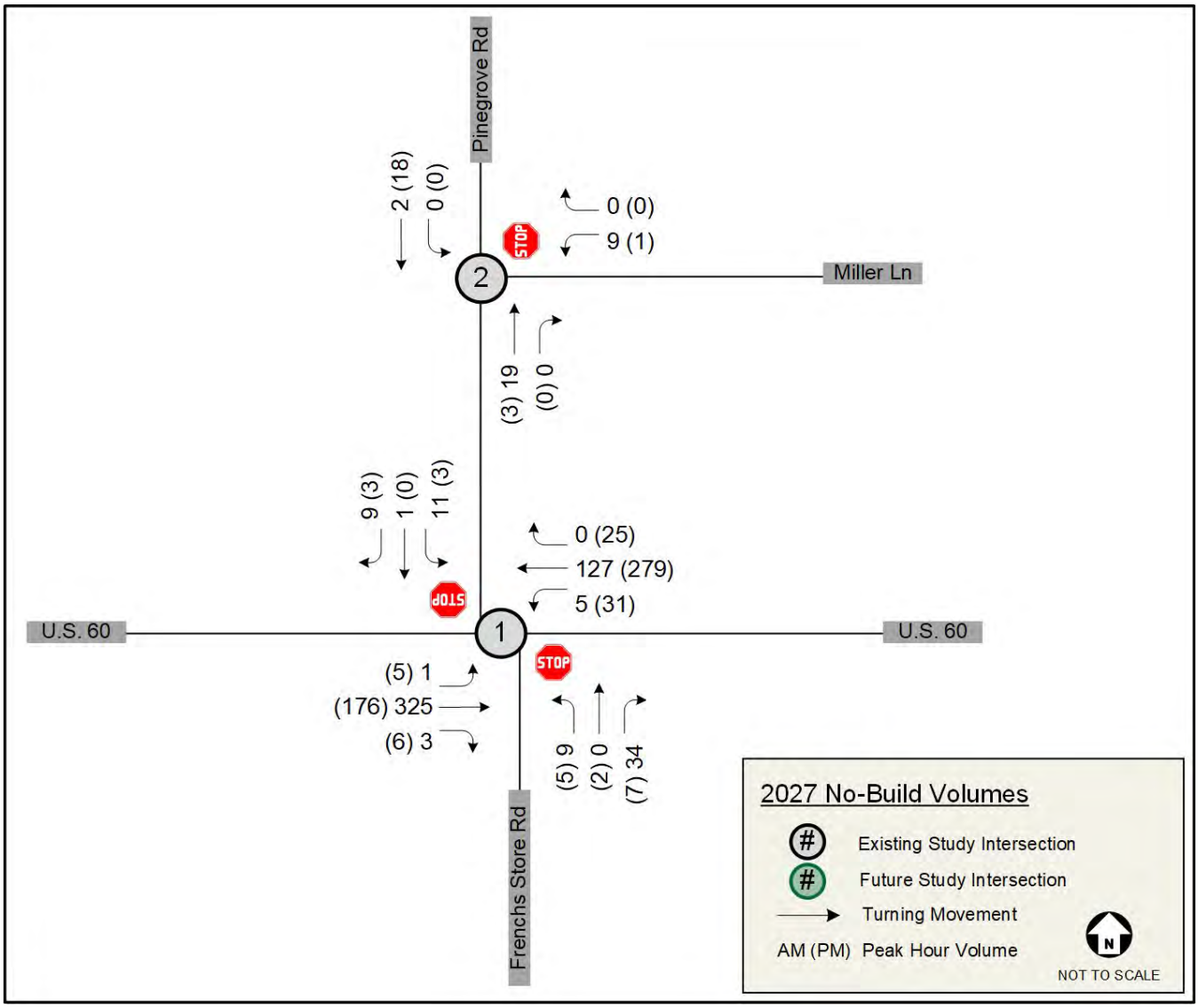


Figure 4: No-Build (2027) Peak Hour Volumes

Site Generated Trips

Table 2 shows the trip potential of the facility based on traffic projections provided by Green Ridge.

Table 2: ITE Trip Generation – Typical Weekday – 11th Edition

Vehicle Type	Amount	Average Weekday Daily Traffic (vpd)		AM Peak Hour		PM Peak hour	
		Enter	Exit	Enter	Exit	Enter	Exit
Regional Waste Hauling	1,500 tons per day	75	75	10	10	10	10
Leachate Hauling	31 trucks per day	31	31	4	4	4	4
Local Garbage Trucks	15 trucks per day	15	15	2	2	2	2
Construction Truck Traffic	66 trucks per day	66	66	9	9	9	9
Total Trucks		187	187	25	25	25	25
Local Residents	4 per hour	40	40	4	4	4	4
Employees	30 per day	45	45	30	5	5	30
Vendors	3 per day	3	3	0	0	0	0
Total Passenger Cars		88	88	34	9	9	34
Total Trips		**275**	**275**	**59**	**34**	**34**	**59**

Trip Generation Assumptions:

- Regional Waste Hauling – 1,500 tons per day and 20 tons per truck, so 75 trucks per day
- Leachate Hauling – 31 trucks per day
- Local Garbage Trucks – 15 trucks per day
- Construction Truck Traffic (6 months every other year) – 15 material deliveries per week (3 per day), 60 stone trucks per day, 3 concrete trucks per day
- All Truck Traffic – the facility is expected to operate between 6:00 AM and 4:00 PM every weekday – a period of 10 hours. If all of the trucks arrive / depart evenly throughout the day, then 10% of the trucks would arrive / depart during each hour. To be conservative, it was assumed that 12.5% of the trucks will arrive / depart during each peak hour.
- Employees – 15 during regular operation, 15 more during construction phase (6 months every other year), All drive their own car, and half leave and return once per day (lunch, appointments, etc.)

Site Trip Distribution

The site trip distribution was based on input from the County and VDOT, surrounding land uses, exiting traffic patterns, and engineering judgement. The following regional trip distribution was applied to the passenger cars:

- 55% to / from the east on U.S. 60
- 35% to / from the west on U.S. 60
- 5% to / from the north on Pinegrove Road
- 5% to / from the south on Frenchs Store Road

The following regional trip distribution was applied to the heavy vehicles:

- 75% to / from the east on U.S. 60
- 25% to / from the west on U.S. 60

Figure 5 shows the site trip distribution and assignment for passenger cars, and Figure 6 shows the site trip distribution and assignment for heavy vehicles.

Build (2027) Traffic Volumes

The build (2027) traffic volumes were estimated by adding the no-build (2027) volumes (Figure 4) and the site trips (Figure 5 and Figure 6). Figure 7 shows the build (2027) peak hour traffic volumes.

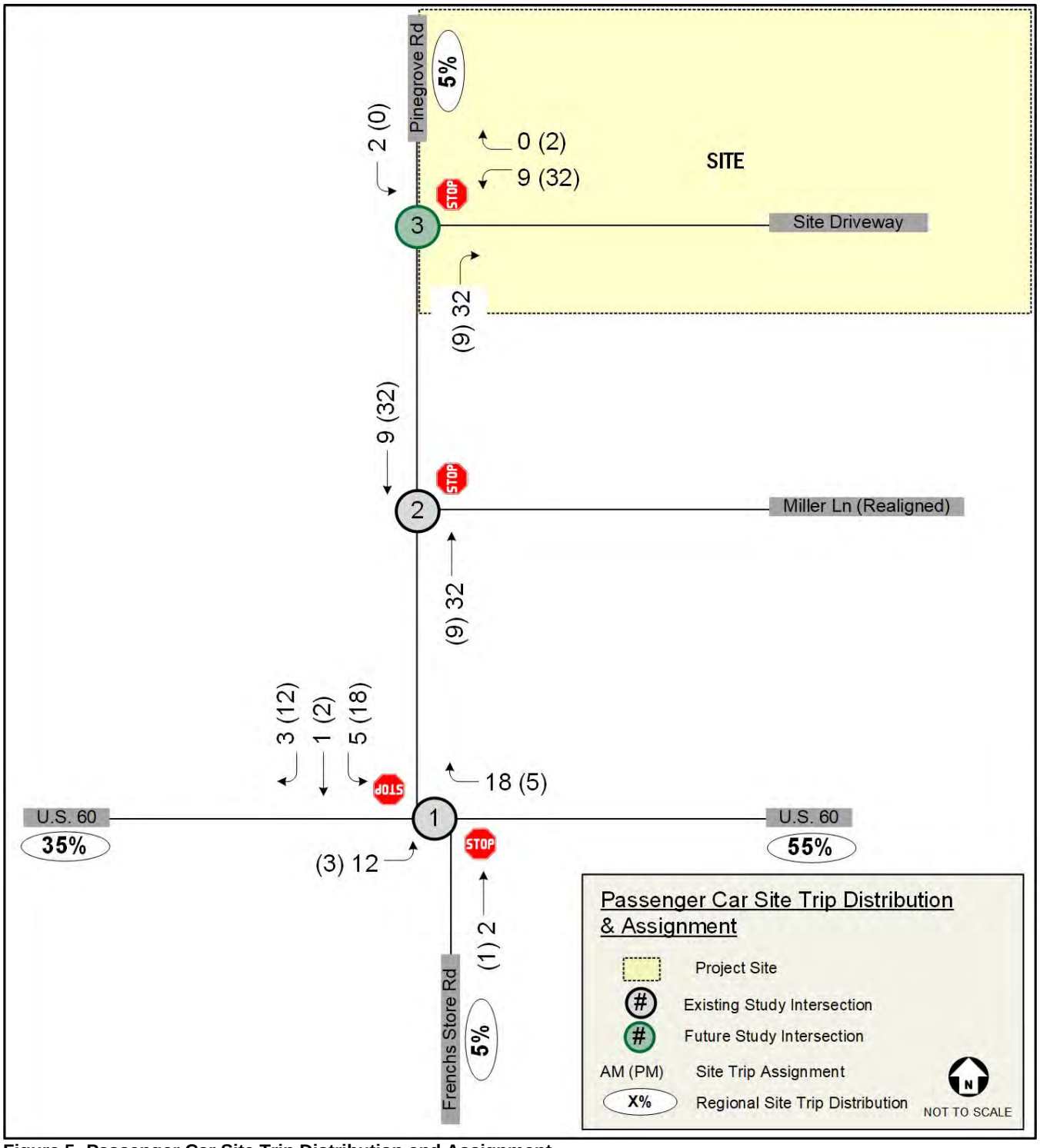


Figure 5: Passenger Car Site Trip Distribution and Assignment

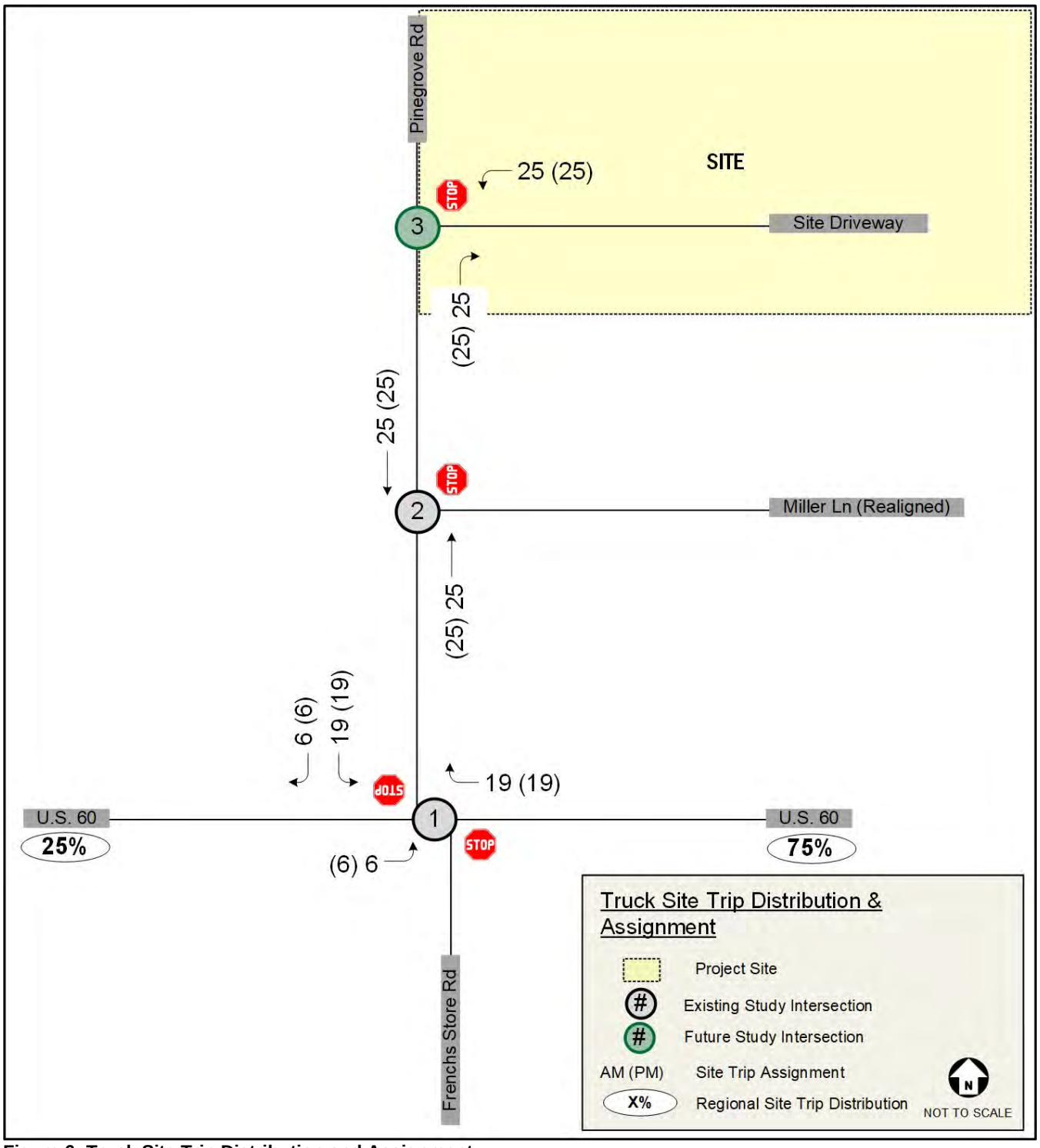


Figure 6: Truck Site Trip Distribution and Assignment

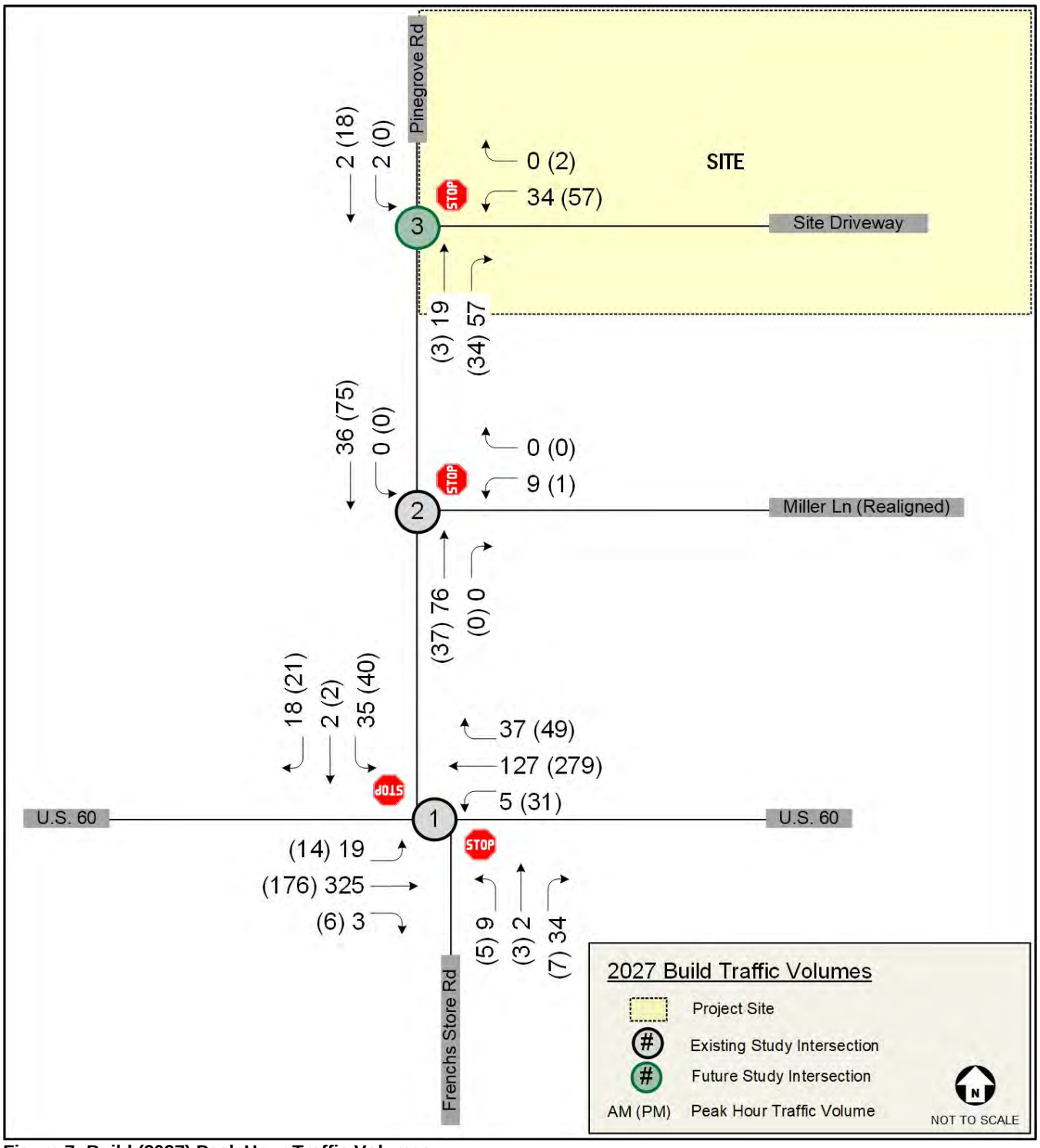


Figure 7: Build (2027) Peak Hour Traffic Volumes

Turn Lane Warrant Analysis

Tables 3 and 4 summarize the turn lane warrant evaluation at the study intersections, and the VDOT turn lane worksheets are included in the Appendix.

Table 3: Right-Turn Lane Warrant Summary (2-Lane) – Build 2027 Conditions

Study Scenario	Approach Volume	Right Turn Volume	Minimum Right Turn Taper Threshold	Minimum Right Turn Full Lane Threshold	Treatment
U.S. 60 at Pinegrove Rd / Frenchs Store Rd - Build 2027 AM - WBR	169	37	53	96	Not Warranted
U.S. 60 at Pinegrove Rd / Frenchs Store Rd - Build 2027 PM - WBR	359	49	34	71	Taper Required
Pinegrove Rd at Site Driveway - Build 2027 AM - NBR	76	57	62	108	Not Warranted
Pinegrove Rd at Site Driveway - Build 2027 PM - NBR	37	34	66	113	Not Warranted

Table 4: Left-Turn Lane Warrant Summary (2-Lane) – Build 2027 Conditions

Study Scenario	Opposing Vol. (VPH)	Advancing Vol. (VPH)	Left Turn Vol. (VPH)	Left Turn %	Treatment
U.S. 60 at Pinegrove Rd / Frenchs Store Rd - Build 2027 AM - EBL	169	347	19	5.48%	Not Warranted
U.S. 60 at Pinegrove Rd / Frenchs Store Rd - Build 2027 PM - EBL	359	196	14	7.14%	Not Warranted
Pinegrove Rd at Site Driveway - Build 2027 AM - SBL	76	4	2	50.00%	Not Warranted
Pinegrove Rd at Site Driveway - Build 2027 PM - SBL	37	18	0	0.00%	Not Warranted

Based on the results of the turn lane warrant analysis, a westbound right-turn taper is warranted at the intersection of U.S. 60 at Pinegrove Road / Frenchs Store Road in the PM peak hour only. No other turn lanes or tapers are warranted at any study intersections.

Traffic Capacity Analysis

Capacity analysis was performed at the study intersections during the weekday AM and PM peak hours under all analysis conditions. Synchro Version 11 was used to analyze the study intersections based on the Highway Capacity Manual (HCM) 6th methodology and includes level of service (LOS), delay, and queue length comparisons for the turning movements analyzed. Existing peak hour factors were used for all analysis conditions. If the peak hour factor was less than 0.92, then a minimum value of 0.92 was used for all future conditions, otherwise, the existing PHF was used. HCM 2000 methodology was used to generate capacity and queuing results if HCM 6th was not applicable at a study intersection. The Synchro outputs are included in the Appendix.

For unsignalized intersections, the average delays for the minor street movements are described as short delays (less than 25 seconds), moderate delays (between 25 and 50 seconds), and long delays (greater than 50 seconds). It is common for side street movements to experience long delays during the peak hours at intersections with major thoroughfares.

Table 4: Capacity Analysis Results – U.S. 60 at Pinegrove Road / Frenchs Store Road

Condition	Lane Group	Lane Storage (ft.)	AM Peak Hour			PM Peak Hour		
			LOS	Delay (sec)	Queue (ft.)	LOS	Delay (sec)	Queue (ft.)
Existing (2023) Traffic Conditions	EBL/T/R	-	A	7.5	0	A	8.0	0
	WBL/T/R	-	A	8.0	0	A	7.7	3
	NBL/T/R	-	B	11.2	5	B	11.8	3
	SBL/T/R	-	B	11.6	3	B	11.9	0
No-Build (2027) Traffic Conditions	EBL/T/R	-	A	7.5	0	A	8.0	0
	WBL/T/R	-	A	8.0	0	A	7.7	3
	NBL/T/R	-	B	11.2	5	B	11.9	3
	SBL/T/R	-	B	11.6	3	B	12.0	0
Build (2027) Traffic Conditions	EBL/T/R	-	A	8.0	3	A	8.6	0
	WBL/T/R	-	A	8.0	0	A	7.7	3
	NBL/T/R	-	B	11.7	8	B	12.7	3
	SBL/T/R	-	C	15.2	13	C	16.3	15

Capacity analysis indicates that the minor street left-turn movement currently operates with short delays during the AM and PM peak hours. Under no-build conditions, the minor street left-turn movement will continue to operate with short delays during the AM and PM peak hours.

Under build conditions, the minor street left-turn movement is expected to continue to operate with short delays during the AM and PM peak hours, with queue lengths of just one vehicle.

The following roadway improvement is warranted in the PM peak hour only:

- Westbound right-turn taper on U.S. 60

Table 5: Capacity Analysis Results – Pinegrove Road at Miller Lane

Condition	Lane Group	Lane Storage (ft.)	AM Peak Hour			PM Peak Hour		
			LOS	Delay (sec)	Queue (ft.)	LOS	Delay (sec)	Queue (ft.)
Existing (2023) Traffic Conditions	WBL/R	-	A	8.7	0	A	8.6	0
	NBT/R	-	-	-	-	-	-	-
	SBL/T	-	A	0.0	0	A	0.0	0
No-Build (2027) Traffic Conditions	WBL/R	-	A	8.6	0	A	8.6	0
	NBT/R	-	-	-	-	-	-	-
	SBL/T	-	A	0.0	0	A	0.0	0
Build (2027) Traffic Conditions	WBL/R	-	A	9.1	0	A	9.1	0
	NBT/R	-	-	-	-	-	-	-
	SBL/T	-	A	0.0	0	A	0.0	0

Capacity analysis indicates that the minor street left-turn movement currently operates with short delays during the AM and PM peak hours. Under no-build conditions, the minor street left-turn movement will continue to operate with short delays during the AM and PM peak hours.

Under build conditions, the minor street left-turn movement is expected to continue to operate with short delays during the AM and PM peak hours, with queue lengths of just one vehicle.

No improvements are warranted or recommended at this intersection at build-out of the proposed facility.

Table 6: Capacity Analysis Results – Pinegrove Road at Proposed Site Driveway

Condition	Lane Group	Lane Storage (ft.)	AM Peak Hour			PM Peak Hour		
			LOS	Delay (sec)	Queue (ft.)	LOS	Delay (sec)	Queue (ft.)
Build (2027) Traffic Conditions	WBL/R	-	A	9.7	3	A	9.4	5
	NBT/R	-	-	-	-	-	-	-
	SBL/T	-	A	7.4	0	A	0.0	0

Capacity analysis indicates that the minor street left-turn movement is expected to operate with short delays during the AM and PM peak hours, with queue lengths of just one vehicle.

No improvements are warranted or recommended at this intersection at build-out of the proposed facility.

Summary and Conclusions

Based on the results of the analysis, all study intersections are expected to operate with short delays (less than 25 seconds) and queueing at build-out of the proposed facility with the following improvement:

U.S. 60 at Pinegrove Road / Frenchs Store Road

- Construct a westbound right-turn taper on U.S. 60

All of the roadways in the study area are projected to operate well below their capacity:

- U.S. 60 has a capacity of approximately 15,000 vehicles per day, and is projected to carry approximately 5,800 vehicles per day at build-out of the proposed facility in 2027 (39% of the roadway capacity)
- Pinegrove Road has a capacity of approximately 10,000 vehicles per day, and is projected to carry approximately 1,250 vehicles per day at build-out of the proposed facility in 2027 (13% of the roadway capacity)
    - Although not part of the TIA, it is recommended that Green Ridge confirm the width and pavement structure of Pinegrove Road between U.S. 60 and the proposed site driveway, and improve the road as and if necessary to carry an ADT volume of at least 1,250 vehicles per day with 70% heavy vehicles
- Frenchs Store Road has a capacity of approximately 10,000 vehicles per day, and is projected to carry approximately 550 vehicles per day at build-out of the proposed facility in 2027 (6% of the roadway capacity)

APPENDIX

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APPENDIX C: Synchro Output – Existing (2023) Conditions 4
APPENDIX D: Synchro Output – No-Build (2027) Conditions 5
APPENDIX E: Synchro Output – Build (2027) Conditions 6
APPENDIX F: VDOT Turn Lane Warrant Analysis 7

APPENDIX A: TIA SCOPING DOCUMENT

PRE-SCOPE OF WORK MEETING FORM

Information on the Project
Traffic Impact Analysis Base Assumptions

The applicant is responsible for entering the relevant information and submitting the form to VDOT and the locality no less than three (3) business days prior to the meeting. If a form is not received by this deadline, the scope of work meeting may be postponed.

Contact Information				
Consultant Name: Tele: E-mail:	Gorove Slade - Carl Hultgren, P.E., PTOE (804) 362-0578 ch@goroveslade.com			
Developer/Owner Name: Tele: E-mail:	TRC Companies - Wendy Karably, PMP (804) 515-1385 wkarably@trccompanies.com			
Project Information				
Project Name:	Green Ridge Recycling and Disposal Facility		Locality/County:	Cumberland County
Project Location: (Attach regional and site specific location map)	See Figure 1			
Submission Type	Comp Plan ☐	Rezoning ☐	Site Plan ☒	Subd Plat ☐
Project Description: (Including details on the land use, acreage, phasing, access location, etc. Attach additional sheet if necessary)	The proposed facility is located north of U.S. 60 (Anderson Highway) on both sides of Pinegrove Road. Initially, major operations will all be east of Pinegrove Road. The access plan includes relocating Miller Lane to the south, and adding one new driveway on Pinegrove Road.			
Proposed Use(s): (Check all that apply; attach additional pages as necessary)	Residential ☐	Commercial ☐	Mixed Use ☐	Other ☒
	Residential Uses(s) Number of Units: See trip table ITE LU Code(s): _____ _____ _____ **Commercial Use(s)** ITE LU Code(s): _____ _____ _____ Square Ft or Other Variable:		_____ _____ _____ **Other Use(s)** ITE LU Code(s): _____ _____ _____ Independent Variable(s): _____ _____ _____	
Total Peak Hour Trip Projection:	Less than 100 ☒	100 – 499 ☐	500 – 999 ☐	1,000 or more ☐

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Traffic Impact Analysis Assumptions				
Study Period	Existing Year: 2023	Build-out Year: 2027	Design Year: 2027	
Study Area Boundaries (Attach map)	North: See Figure 1	South:		
	East:	West:		
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	None			
Consistency With Comprehensive Plan (Land use, transportation plan)	The current zoning is M-1 with a CUP for the proposed use			
Available Traffic Data (Historical, forecasts)	Route 60 - 4,600 vpd in 2016 / 4,700 vpd in 2021 Pinegrove Road - 330 vpd in 2016 / 360 vpd in 2021			
Trip Distribution (Attach sketch)	Road Name: See Figure 1	Road Name:		
	Road Name:	Road Name:		
Annual Vehicle Trip Growth Rate:	1.0%	Peak Period for Study (check all that apply)	☒ AM ☒ PM ☐ SAT	
		Peak Hour of the Generator		
Study Intersections and/or Road Segments (Attach additional sheets as necessary)	1.U.S. 60 at Pinegrove Road / Frenchs Store Road	6.		
	2.Pinegrove Road at Miller Lane	7.		
	3.Pinegrove Road at Site Driveway	8.		
	4.	9.		
	5.	10.		
Trip Adjustment Factors	Internal allowance: ☐ Yes ☒ No Reduction: _____% trips	Pass-by allowance: ☐ Yes ☒ No Reduction: _____% trips		
Software Methodology	☒ Synchro ☐ HCS (v.2000/+) ☐ aaSIDRA ☐ CORSIM ☒ Other SimTraffic			
Traffic Signal Proposed or Affected (Analysis software to be used, progression speed, cycle length)	Synchro / SimTraffic 11 will be used to analyze LOS, delay, and queueing at the study intersections.			

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Improvement(s) Assumed or to be Considered	The need for turn lanes and other off-site improvements will be determined based on the results of the analysis.
Background Traffic Studies Considered	None
Plan Submission	☐ Master Development Plan (MDP) ☐ Generalized Development Plan (GDP) ☐ Preliminary/Sketch Plan ☒ Other Plan type (Final Site, Subd. Plan)
Additional Issues to be Addressed	☒ Queuing analysis ☐ Actuation/Coordination ☐ Weaving analysis ☐ Merge analysis ☐ Bike/Ped Accommodations ☒ Intersection(s) ☐ TDM Measures ☐ Other ____

NOTES on ASSUMPTIONS:

The facility is expected to operate 6:00 am to 4:00 pm on weekdays, and 6:00 am to Noon on Saturdays

The traffic counts will be performed on a weekday between 6:00 and 8:00 AM and 3:00 to 5:00 PM

The TIA will include three analysis scenarios:

- Existing (2023) Conditions
- No-Build (2027) Conditions
- Build (2027) Conditions

SIGNED: _____ DATE: 4-13-23
Applicant or Consultant

PRINT NAME: Carl Hultgren
Applicant or Consultant

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Green Ridge
Cumberland County, VA

Table 1: Trip Generation – Typical Weekday – 11th Edition

Land Use (ITE Land Use Code)	Size	Average Daily Traffic (vpd)		AM Peak Hour (vph)		PM Peak Hour (vph)	
		Enter	Exit	Enter	Exit	Enter	Exit
Regional Waste Hauling	1,500 tons per day	75	75	10	10	10	10
Leachate Hauling	31 trucks per day	31	31	4	4	4	4
Local Garbage Trucks	15 trucks per day	15	15	2	2	2	2
Construction Truck Traffic	66 trucks per day	66	66	9	9	9	9
Trucks		*187*	*187*	*25*	*25*	*25*	*25*
Local Residents	4 per hour	40	40	4	4	4	4
Employees	30 per day	45	45	30	5	5	30
Vendors	3 per day	3	3	0	0	0	0
Passenger Cars		*88*	*88*	*34*	*9*	*9*	*34*
Total Trips		**275**	**275**	**59**	**34**	**34**	**59**

Assumptions:

Regional Waste Hauling:

- 1,500 tons per day, 20 tons per truck, Assume 12.5% arrive / depart during the AM and PM peak hours

Leachate Hauling:

- 31 trucks per day, Assume 12.5% arrive / depart during the AM and PM peak hours

Local Garbage Trucks:

- 15 trucks per day, Assume 12.5% arrive / depart during the AM and PM peak hours

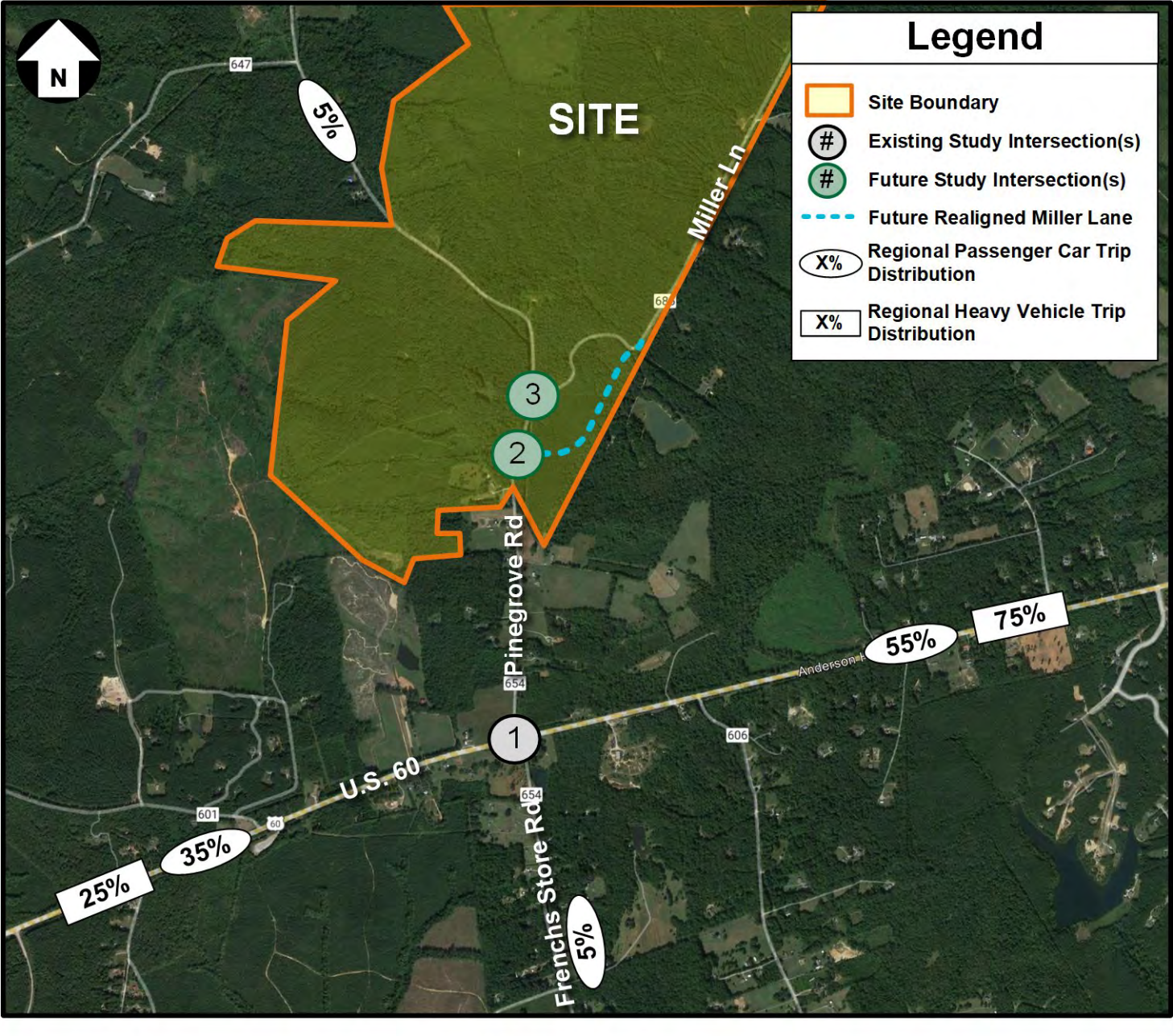
Construction Truck Traffic (6 months every other year):

- 15 material deliveries per week (3 per day), 60 stone trucks per day, 3 concrete trucks per day, Assume 12.5% arrive / depart during the AM and PM peak hours

Employees:

- 15 during regular operation, 15 more during construction phase (6 months every other year), All drive their own car, Half leave and return once per day (lunch, appointments, etc.)

April 10, 2023


Legend
Site Boundary
Existing Study Intersection(s)
Future Study Intersection(s)
Future Realigned Miller Lane
X%
Regional Passenger Car Trip Distribution
X%
Regional Heavy Vehicle Trip Distribution
N
SITE
Miller Ln
Pinegrove Rd
Frenchs Store Rd
U.S. 60
647
654
606
601
60
5%
75%
55%
35%
25%
5%
1
2
3

APPENDIX B: TURNING MOVEMENT COUNT DATA

File Name : Cumberland-Cumberland(Anderson Highway and Pine Grove Road)
Site Code :
Start Date : 4/18/2023
Page No : 1

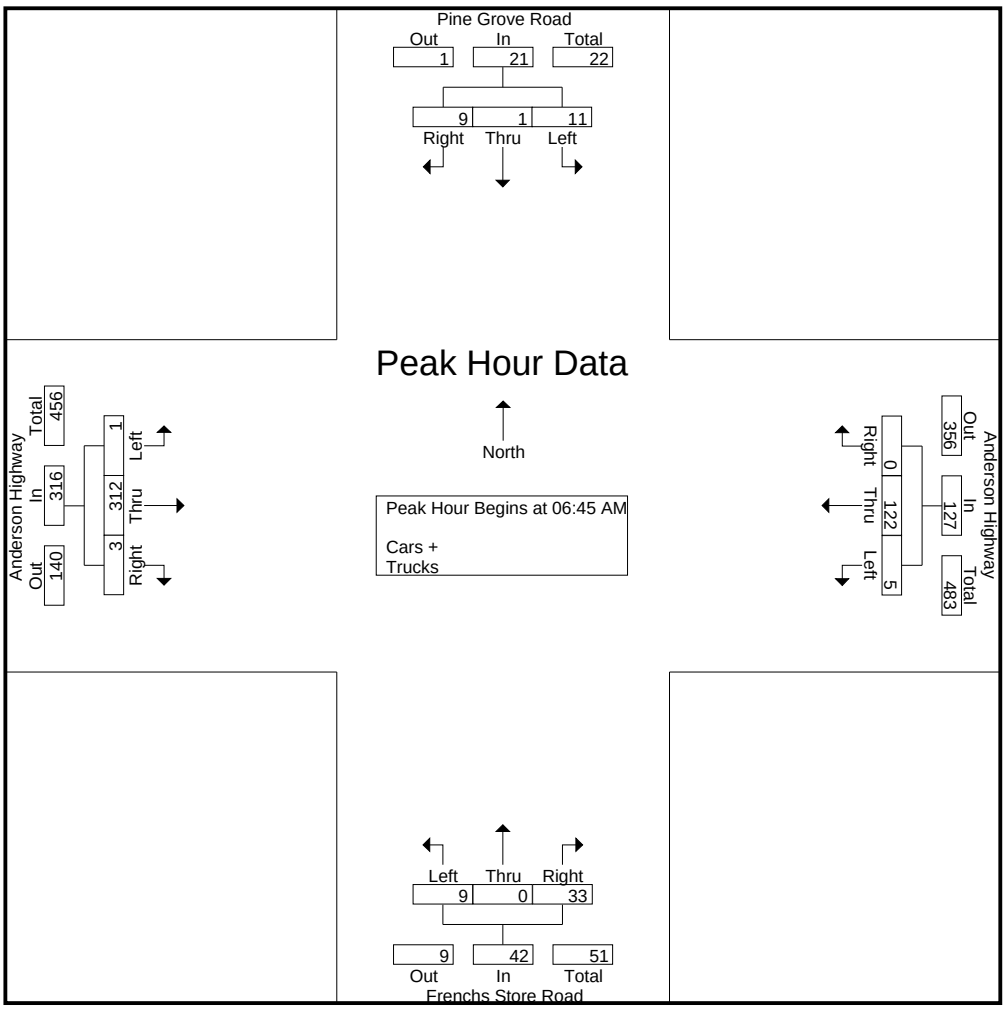
Groups Printed- Cars + - Trucks

	Pine Grove Road Southbound				Anderson Highway Westbound				Frenchs Store Road Northbound				Anderson Highway Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
06:00 AM	0	0	5	5	0	12	0	12	4	0	0	4	0	53	1	54	75
06:15 AM	0	1	9	10	0	23	0	23	2	0	0	2	0	61	1	62	97
06:30 AM	0	0	10	10	1	22	0	23	6	0	1	7	3	57	0	60	100
06:45 AM	3	1	3	7	0	24	2	26	8	0	4	12	0	76	0	76	121
Total	3	2	27	32	1	81	2	84	20	0	5	25	3	247	2	252	393
07:00 AM	1	0	6	7	0	38	1	39	10	0	2	12	1	80	1	82	140
07:15 AM	2	0	2	4	0	31	0	31	9	0	2	11	1	78	0	79	125
07:30 AM	3	0	0	3	0	29	2	31	6	0	1	7	1	78	0	79	120
07:45 AM	1	0	5	6	2	26	0	28	3	0	1	4	3	61	0	64	102
Total	7	0	13	20	2	124	3	129	28	0	6	34	6	297	1	304	487
Grand Total	10	2	40	52	3	205	5	213	48	0	11	59	9	544	3	556	880
Apprch %	19.2	3.8	76.9		1.4	96.2	2.3		81.4	0	18.6		1.6	97.8	0.5		
Total %	1.1	0.2	4.5	5.9	0.3	23.3	0.6	24.2	5.5	0	1.2	6.7	1	61.8	0.3	63.2	
Cars +	10	2	39	51	3	184	5	192	47	0	11	58	8	521	3	532	833
% Cars +	100	100	97.5	98.1	100	89.8	100	90.1	97.9	0	100	98.3	88.9	95.8	100	95.7	94.7
Trucks	0	0	1	1	0	21	0	21	1	0	0	1	1	23	0	24	47
% Trucks	0	0	2.5	1.9	0	10.2	0	9.9	2.1	0	0	1.7	11.1	4.2	0	4.3	5.3

TRAFFIC DATA COLLECTION

File Name : Cumberland-Cumberland(Anderson Highway and Pine Grove Road)
Site Code :
Start Date : 4/18/2023
Page No : 2

	Pine Grove Road Southbound				Anderson Highway Westbound				Frenchs Store Road Northbound				Anderson Highway Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 06:45 AM																	
06:45 AM	**3**	**1**	3	**7**	0	24	**2**	26	8	0	**4**	**12**	0	76	0	76	121
07:00 AM	1	0	**6**	7	0	**38**	1	**39**	**10**	0	2	12	**1**	**80**	**1**	**82**	**140**
07:15 AM	2	0	2	4	0	31	0	31	9	0	2	11	1	78	0	79	125
07:30 AM	3	0	0	3	0	29	2	31	6	0	1	7	1	78	0	79	120
Total Volume	9	1	11	21	0	122	5	127	33	0	9	42	3	312	1	316	506
% App. Total	42.9	4.8	52.4		0	96.1	3.9		78.6	0	21.4		0.9	98.7	0.3		
PHF	.750	.250	.458	.750	.000	.803	.625	.814	.825	.000	.563	.875	.750	.975	.250	.963	.904



File Name : Cumberland-Cumberland(Anderson Highway and Pine Grove Road)
Site Code :
Start Date : 4/18/2023
Page No : 1

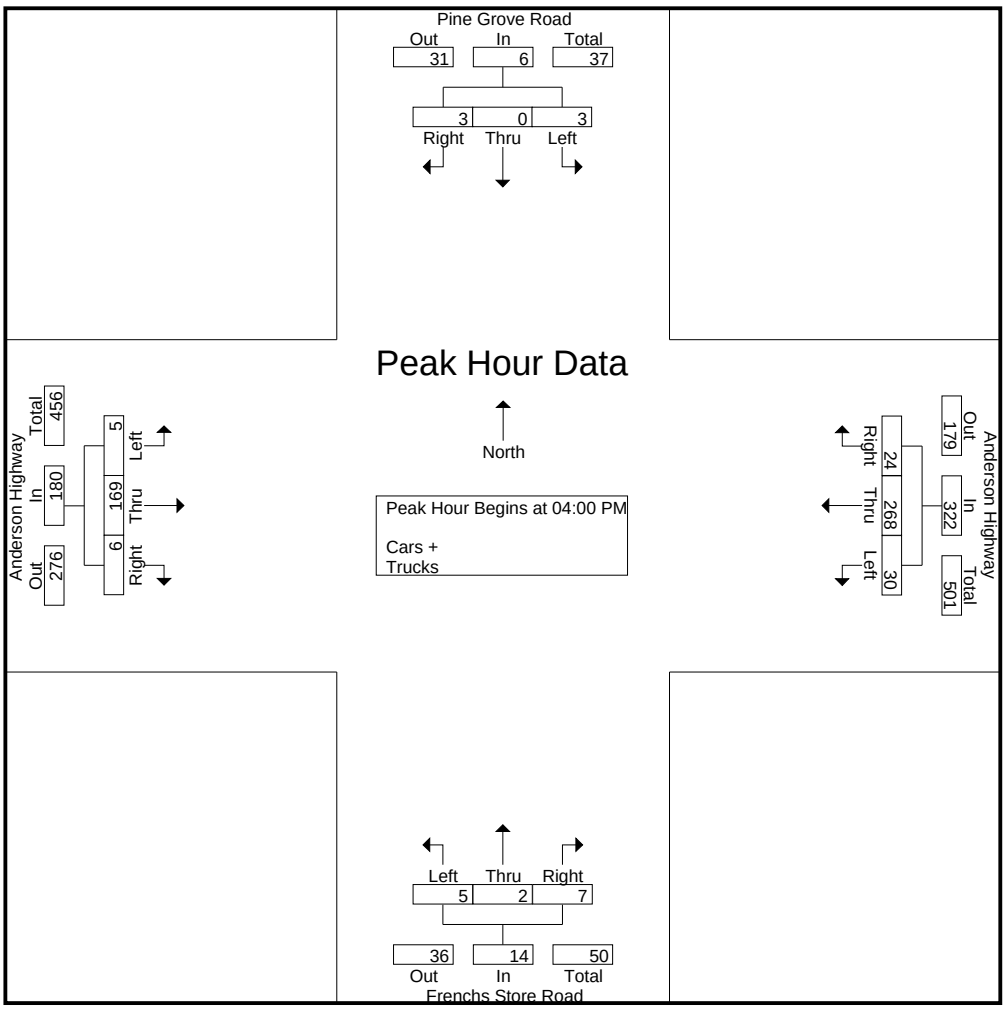
Groups Printed- Cars + - Trucks

	Pine Grove Road Southbound				Anderson Highway Westbound				Frenchs Store Road Northbound				Anderson Highway Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
03:00 PM	0	0	4	4	0	54	1	55	1	0	0	1	0	37	1	38	98
03:15 PM	0	1	0	1	4	44	6	54	2	0	0	2	3	41	2	46	103
03:30 PM	0	0	0	0	3	55	4	62	2	0	0	2	0	52	3	55	119
03:45 PM	0	1	2	3	2	47	5	54	5	1	2	8	1	23	0	24	89
Total	0	2	6	8	9	200	16	225	10	1	2	13	4	153	6	163	409
04:00 PM	1	0	0	1	6	77	6	89	3	0	2	5	1	47	0	48	143
04:15 PM	1	0	1	2	7	70	4	81	2	1	1	4	1	45	0	46	133
04:30 PM	0	0	0	0	4	55	10	69	0	1	2	3	2	42	5	49	121
04:45 PM	1	0	2	3	7	66	10	83	2	0	0	2	2	35	0	37	125
Total	3	0	3	6	24	268	30	322	7	2	5	14	6	169	5	180	522
Grand Total	3	2	9	14	33	468	46	547	17	3	7	27	10	322	11	343	931
Apprch %	21.4	14.3	64.3		6	85.6	8.4		63	11.1	25.9		2.9	93.9	3.2		
Total %	0.3	0.2	1	1.5	3.5	50.3	4.9	58.8	1.8	0.3	0.8	2.9	1.1	34.6	1.2	36.8	
Cars +	3	2	9	14	33	448	44	525	17	3	6	26	9	305	10	324	889
% Cars +	100	100	100	100	100	95.7	95.7	96	100	100	85.7	96.3	90	94.7	90.9	94.5	95.5
Trucks	0	0	0	0	0	20	2	22	0	0	1	1	1	17	1	19	42
% Trucks	0	0	0	0	0	4.3	4.3	4	0	0	14.3	3.7	10	5.3	9.1	5.5	4.5

TRAFFIC DATA COLLECTION

File Name : Cumberland-Cumberland(Anderson Highway and Pine Grove Road)
Site Code :
Start Date : 4/18/2023
Page No : 2

	Pine Grove Road Southbound				Anderson Highway Westbound				Frenchs Store Road Northbound				Anderson Highway Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	**1**	0	0	1	6	**77**	6	**89**	**3**	0	**2**	**5**	1	**47**	0	48	**143**
04:15 PM	1	0	1	2	**7**	70	4	81	2	**1**	1	4	1	45	0	46	133
04:30 PM	0	0	0	0	4	55	**10**	69	0	1	2	3	**2**	42	**5**	**49**	121
04:45 PM	1	0	**2**	**3**	7	66	10	83	2	0	0	2	2	35	0	37	125
Total Volume	3	0	3	6	24	268	30	322	7	2	5	14	6	169	5	180	522
% App. Total	50	0	50		7.5	83.2	9.3		50	14.3	35.7		3.3	93.9	2.8		
PHF	.750	.000	.375	.500	.857	.870	.750	.904	.583	.500	.625	.700	.750	.899	.250	.918	.913



File Name : Cumberland-Cumberland (Pine Grove Road and Miller Lane)
Site Code :
Start Date : 4/18/2023
Page No : 1

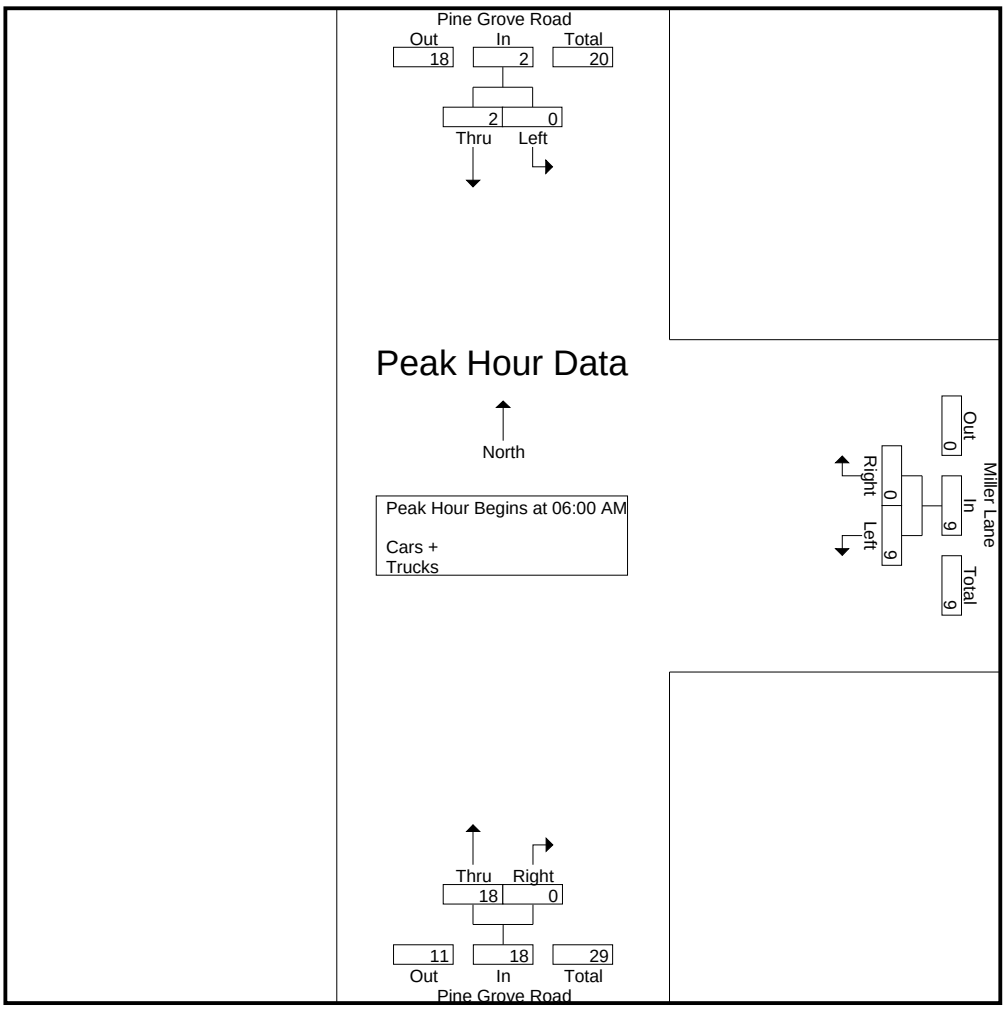
Groups Printed- Cars + - Trucks

	Pine Grove Road Southbound			Miller Lane Westbound			Pine Grove Road Northbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
06:00 AM	0	0	0	0	3	3	0	3	3	6
06:15 AM	1	0	1	0	2	2	0	6	6	9
06:30 AM	1	0	1	0	2	2	0	6	6	9
06:45 AM	0	0	0	0	2	2	0	3	3	5
Total	2	0	2	0	9	9	0	18	18	29
07:00 AM	0	0	0	0	1	1	0	4	4	5
07:15 AM	0	0	0	0	4	4	0	0	0	4
07:30 AM	0	0	0	0	0	0	0	1	1	1
07:45 AM	1	0	1	0	0	0	0	4	4	5
Total	1	0	1	0	5	5	0	9	9	15
Grand Total	3	0	3	0	14	14	0	27	27	44
Apprch %	100	0		0	100		0	100		
Total %	6.8	0	6.8	0	31.8	31.8	0	61.4	61.4	
Cars +	3	0	3	0	14	14	0	26	26	43
% Cars +	100	0	100	0	100	100	0	96.3	96.3	97.7
Trucks	0	0	0	0	0	0	0	1	1	1
% Trucks	0	0	0	0	0	0	0	3.7	3.7	2.3

TRAFFIC DATA COLLECTION

File Name : Cumberland-Cumberland (Pine Grove Road and Miller Lane)
Site Code :
Start Date : 4/18/2023
Page No : 2

	Pine Grove Road Southbound			Miller Lane Westbound			Pine Grove Road Northbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 06:00 AM										
06:00 AM	0	0	0	0	**3**	**3**	0	3	3	6
06:15 AM	**1**	0	**1**	0	2	2	0	**6**	**6**	**9**
06:30 AM	1	0	1	0	2	2	0	6	6	9
06:45 AM	0	0	0	0	2	2	0	3	3	5
Total Volume	2	0	2	0	9	9	0	18	18	29
% App. Total	100	0		0	100		0	100		
PHF	.500	.000	.500	.000	.750	.750	.000	.750	.750	.806



File Name : Cumberland-Cumberland (Pine Grove Road and Miller Lane)
Site Code :
Start Date : 4/18/2023
Page No : 1

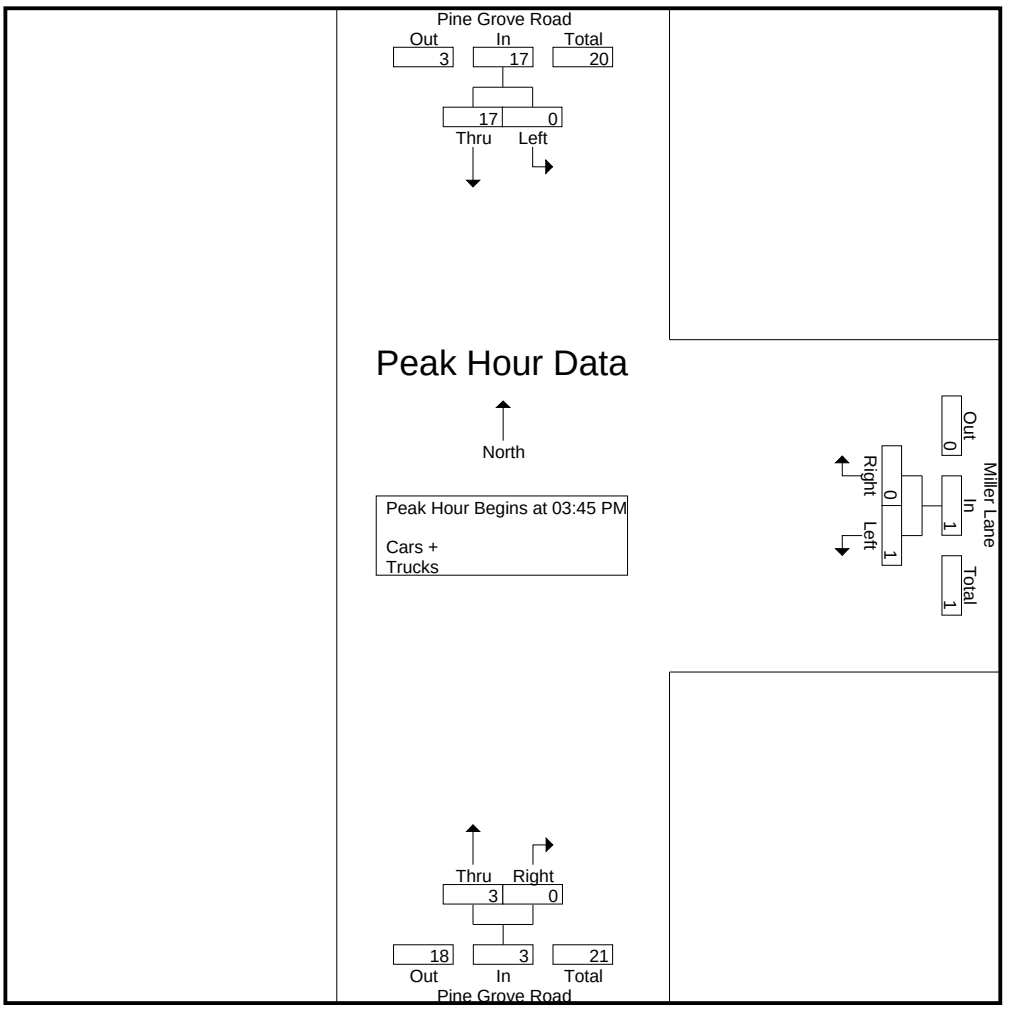
Groups Printed- Cars + - Trucks

	Pine Grove Road Southbound			Miller Lane Westbound			Pine Grove Road Northbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
03:00 PM	1	0	1	0	1	1	0	1	1	3
03:15 PM	4	0	4	0	0	0	0	1	1	5
03:30 PM	4	0	4	0	0	0	0	1	1	5
03:45 PM	3	0	3	0	0	0	0	2	2	5
Total	12	0	12	0	1	1	0	5	5	18
04:00 PM	2	0	2	0	0	0	0	0	0	2
04:15 PM	5	0	5	0	0	0	0	1	1	6
04:30 PM	7	0	7	0	1	1	0	0	0	8
04:45 PM	2	0	2	0	0	0	0	0	0	2
Total	16	0	16	0	1	1	0	1	1	18
Grand Total	28	0	28	0	2	2	0	6	6	36
Apprch %	100	0		0	100		0	100		
Total %	77.8	0	77.8	0	5.6	5.6	0	16.7	16.7	
Cars +	28	0	28	0	2	2	0	6	6	36
% Cars +	100	0	100	0	100	100	0	100	100	100
Trucks	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0

TRAFFIC DATA COLLECTION

File Name : Cumberland-Cumberland (Pine Grove Road and Miller Lane)
Site Code :
Start Date : 4/18/2023
Page No : 2

	Pine Grove Road Southbound			Miller Lane Westbound			Pine Grove Road Northbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	3	0	3	0	0	0	0	**2**	**2**	5
04:00 PM	2	0	2	0	0	0	0	0	0	2
04:15 PM	5	0	5	0	0	0	0	1	1	6
04:30 PM	**7**	0	**7**	0	**1**	**1**	0	0	0	**8**
Total Volume	17	0	17	0	1	1	0	3	3	21
% App. Total	100	0		0	100		0	100		
PHF	.607	.000	.607	.000	.250	.250	.000	.375	.375	.656



APPENDIX C: SYNCHRO OUTPUT – EXISTING (2023) CONDITIONS

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	1	312	3	5	122	0	9	0	33	11	1	9
Future Vol, veh/h	1	312	3	5	122	0	9	0	33	11	1	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	4	11	0	10	0	0	0	2	3	0	0
Mvmt Flow	1	347	3	6	136	0	10	0	37	12	1	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	136	0	0	350	0	0	505	499	349	517	500	136
Stage 1	-	-	-	-	-	-	351	351	-	148	148	-
Stage 2	-	-	-	-	-	-	154	148	-	369	352	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.22	7.13	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.13	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.13	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.318	3.527	4	3.3
Pot Cap-1 Maneuver	1461	-	-	1220	-	-	481	476	694	467	476	918
Stage 1	-	-	-	-	-	-	670	636	-	852	779	-
Stage 2	-	-	-	-	-	-	853	779	-	649	635	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1461	-	-	1220	-	-	473	473	694	440	473	918
Mov Cap-2 Maneuver	-	-	-	-	-	-	473	473	-	440	473	-
Stage 1	-	-	-	-	-	-	669	635	-	851	775	-
Stage 2	-	-	-	-	-	-	838	775	-	614	634	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	11.2	11.6
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	631	1461	-	-	1220	-	-	569
HCM Lane V/C Ratio	0.074	0.001	-	-	0.005	-	-	0.041
HCM Control Delay (s)	11.2	7.5	0	-	8	0	-	11.6
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	2.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	0	18	0	0	2
Future Vol, veh/h	9	0	18	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	81	81	81	81	81	81
Heavy Vehicles, %	0	0	4	0	0	0
Mvmt Flow	11	0	22	0	0	2

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	24	22	0	0	22	0
Stage 1	22	-	-	-	-	-
Stage 2	2	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	997	1061	-	-	1607	-
Stage 1	1006	-	-	-	-	-
Stage 2	1026	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	997	1061	-	-	1607	-
Mov Cap-2 Maneuver	997	-	-	-	-	-
Stage 1	1006	-	-	-	-	-
Stage 2	1026	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	997	1607	-
HCM Lane V/C Ratio	-	-	0.011	-	-
HCM Control Delay (s)	-	-	8.7	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	5	169	6	30	268	24	5	2	7	3	0	3
Future Vol, veh/h	5	169	6	30	268	24	5	2	7	3	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	9	5	10	4	4	0	14	0	0	0	0	0
Mvmt Flow	5	186	7	33	295	26	5	2	8	3	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	321	0	0	193	0	0	576	587	190	579	577	308
Stage 1	-	-	-	-	-	-	200	200	-	374	374	-
Stage 2	-	-	-	-	-	-	376	387	-	205	203	-
Critical Hdwy	4.19	-	-	4.14	-	-	7.24	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.281	-	-	2.236	-	-	3.626	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1200	-	-	1368	-	-	411	425	857	429	430	737
Stage 1	-	-	-	-	-	-	775	739	-	651	621	-
Stage 2	-	-	-	-	-	-	622	613	-	802	737	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1200	-	-	1368	-	-	399	411	857	412	415	737
Mov Cap-2 Maneuver	-	-	-	-	-	-	399	411	-	412	415	-
Stage 1	-	-	-	-	-	-	771	735	-	648	603	-
Stage 2	-	-	-	-	-	-	601	595	-	788	733	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.7	11.8	11.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	548	1200	-	-	1368	-	-	529
HCM Lane V/C Ratio	0.028	0.005	-	-	0.024	-	-	0.012
HCM Control Delay (s)	11.8	8	0	-	7.7	0	-	11.9
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	3	0	0	17
Future Vol, veh/h	1	0	3	0	0	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	66	66	66	66	66	66
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	0	5	0	0	26

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	31	5	0	0	5	0
Stage 1	5	-	-	-	-	-
Stage 2	26	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	988	1084	-	-	1630	-
Stage 1	1023	-	-	-	-	-
Stage 2	1002	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	988	1084	-	-	1630	-
Mov Cap-2 Maneuver	988	-	-	-	-	-
Stage 1	1023	-	-	-	-	-
Stage 2	1002	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	988	1630	-
HCM Lane V/C Ratio	-	-	0.002	-	-
HCM Control Delay (s)	-	-	8.6	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-

APPENDIX D: SYNCHRO OUTPUT – NO-BUILD (2027) CONDITIONS

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	325	3	5	127	0	9	0	34	11	1	9
Future Vol, veh/h	1	325	3	5	127	0	9	0	34	11	1	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	4	11	0	10	0	0	0	2	3	0	0
Mvmt Flow	1	353	3	5	138	0	10	0	37	12	1	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	138	0	0	356	0	0	511	505	355	523	506	138
Stage 1	-	-	-	-	-	-	357	357	-	148	148	-
Stage 2	-	-	-	-	-	-	154	148	-	375	358	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.22	7.13	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.13	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.13	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.318	3.527	4	3.3
Pot Cap-1 Maneuver	1458	-	-	1214	-	-	476	473	689	463	472	916
Stage 1	-	-	-	-	-	-	665	632	-	852	779	-
Stage 2	-	-	-	-	-	-	853	779	-	644	631	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1458	-	-	1214	-	-	468	471	689	437	470	916
Mov Cap-2 Maneuver	-	-	-	-	-	-	468	471	-	437	470	-
Stage 1	-	-	-	-	-	-	664	631	-	851	776	-
Stage 2	-	-	-	-	-	-	839	776	-	609	630	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	11.2	11.6
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	627	1458	-	-	1214	-	-	566
HCM Lane V/C Ratio	0.075	0.001	-	-	0.004	-	-	0.04
HCM Control Delay (s)	11.2	7.5	0	-	8	0	-	11.6
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	2.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	0	19	0	0	2
Future Vol, veh/h	9	0	19	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	4	0	0	0
Mvmt Flow	10	0	21	0	0	2

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	23	21	0	0	21	0
Stage 1	21	-	-	-	-	-
Stage 2	2	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	998	1062	-	-	1608	-
Stage 1	1007	-	-	-	-	-
Stage 2	1026	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	998	1062	-	-	1608	-
Mov Cap-2 Maneuver	998	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	1026	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	998	1608	-
HCM Lane V/C Ratio	-	-	0.01	-	-
HCM Control Delay (s)	-	-	8.6	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection												
Int Delay, s/veh	0.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	176	6	31	279	25	5	2	7	3	0	3
Future Vol, veh/h	5	176	6	31	279	25	5	2	7	3	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	9	5	10	4	4	0	14	0	0	0	0	0
Mvmt Flow	5	191	7	34	303	27	5	2	8	3	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	330	0	0	198	0	0	591	603	195	595	593	317
Stage 1	-	-	-	-	-	-	205	205	-	385	385	-
Stage 2	-	-	-	-	-	-	386	398	-	210	208	-
Critical Hdwy	4.19	-	-	4.14	-	-	7.24	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.281	-	-	2.236	-	-	3.626	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1191	-	-	1363	-	-	401	416	851	419	421	728
Stage 1	-	-	-	-	-	-	770	736	-	642	614	-
Stage 2	-	-	-	-	-	-	614	606	-	797	734	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1191	-	-	1363	-	-	388	401	851	402	406	728
Mov Cap-2 Maneuver	-	-	-	-	-	-	388	401	-	402	406	-
Stage 1	-	-	-	-	-	-	766	732	-	639	595	-
Stage 2	-	-	-	-	-	-	592	587	-	784	730	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.7	11.9	12
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	536	1191	-	-	1363	-	-	518
HCM Lane V/C Ratio	0.028	0.005	-	-	0.025	-	-	0.013
HCM Control Delay (s)	11.9	8	0	-	7.7	0	-	12
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	3	0	0	18
Future Vol, veh/h	1	0	3	0	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	1	0	3	0	0	20

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	23	3	0	0	3	0
Stage 1	3	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	998	1087	-	-	1632	-
Stage 1	1025	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	998	1087	-	-	1632	-
Mov Cap-2 Maneuver	998	-	-	-	-	-
Stage 1	1025	-	-	-	-	-
Stage 2	1008	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	998	1632	-
HCM Lane V/C Ratio	-	-	0.001	-	-
HCM Control Delay (s)	-	-	8.6	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-

APPENDIX E: SYNCHRO OUTPUT – BUILD (2027) CONDITIONS

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	19	325	3	5	127	37	9	2	34	35	2	18
Future Vol, veh/h	19	325	3	5	127	37	9	2	34	35	2	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	32	4	0	0	9	51	0	0	3	54	0	33
Mvmt Flow	21	353	3	5	138	40	10	2	37	38	2	20

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	178	0	0	356	0	0	576	585	355	584	566	158
Stage 1	-	-	-	-	-	-	397	397	-	168	168	-
Stage 2	-	-	-	-	-	-	179	188	-	416	398	-
Critical Hdwy	4.42	-	-	4.1	-	-	7.1	6.5	6.23	7.64	6.5	6.53
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.64	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.64	5.5	-
Follow-up Hdwy	2.488	-	-	2.2	-	-	3.5	4	3.327	3.986	4	3.597
Pot Cap-1 Maneuver	1236	-	-	1214	-	-	431	426	687	355	436	812
Stage 1	-	-	-	-	-	-	633	607	-	726	763	-
Stage 2	-	-	-	-	-	-	827	748	-	523	606	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1236	-	-	1214	-	-	411	415	687	328	425	812
Mov Cap-2 Maneuver	-	-	-	-	-	-	411	415	-	328	425	-
Stage 1	-	-	-	-	-	-	620	594	-	711	759	-
Stage 2	-	-	-	-	-	-	801	744	-	483	593	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.2	11.7	15.2
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	590	1236	-	-	1214	-	-	412
HCM Lane V/C Ratio	0.083	0.017	-	-	0.004	-	-	0.145
HCM Control Delay (s)	11.7	8	0	-	8	0	-	15.2
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.5

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	0	76	0	0	36
Future Vol, veh/h	9	0	76	0	0	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	34	0	0	69
Mvmt Flow	10	0	83	0	0	39

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	122	83	0	0	83	0
Stage 1	83	-	-	-	-	-
Stage 2	39	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	878	982	-	-	1527	-
Stage 1	945	-	-	-	-	-
Stage 2	989	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	878	982	-	-	1527	-
Mov Cap-2 Maneuver	878	-	-	-	-	-
Stage 1	945	-	-	-	-	-
Stage 2	989	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.1	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	878	1527	-
HCM Lane V/C Ratio	-	-	0.011	-	-
HCM Control Delay (s)	-	-	9.1	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	34	0	19	57	2	2
Future Vol, veh/h	34	0	19	57	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	74	0	0	44	0	0
Mvmt Flow	37	0	21	62	2	2

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	58	52	0	0	83	0
Stage 1	52	-	-	-	-	-
Stage 2	6	-	-	-	-	-
Critical Hdwy	7.14	6.2	-	-	4.1	-
Critical Hdwy Stg 1	6.14	-	-	-	-	-
Critical Hdwy Stg 2	6.14	-	-	-	-	-
Follow-up Hdwy	4.166	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	796	1021	-	-	1527	-
Stage 1	815	-	-	-	-	-
Stage 2	858	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	795	1021	-	-	1527	-
Mov Cap-2 Maneuver	795	-	-	-	-	-
Stage 1	815	-	-	-	-	-
Stage 2	857	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	3.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	795	1527	-
HCM Lane V/C Ratio	-	-	0.046	0.001	-
HCM Control Delay (s)	-	-	9.7	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection												
Int Delay, s/veh	2.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	176	6	31	279	49	5	3	7	40	2	21
Future Vol, veh/h	14	176	6	31	279	49	5	3	7	40	2	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	43	5	17	3	4	39	20	0	0	48	0	29
Mvmt Flow	15	191	7	34	303	53	5	3	8	43	2	23

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	356	0	0	198	0	0	635	649	195	628	626	330
Stage 1	-	-	-	-	-	-	225	225	-	398	398	-
Stage 2	-	-	-	-	-	-	410	424	-	230	228	-
Critical Hdwy	4.53	-	-	4.13	-	-	7.3	6.5	6.2	7.58	6.5	6.49
Critical Hdwy Stg 1	-	-	-	-	-	-	6.3	5.5	-	6.58	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.3	5.5	-	6.58	5.5	-
Follow-up Hdwy	2.587	-	-	2.227	-	-	3.68	4	3.3	3.932	4	3.561
Pot Cap-1 Maneuver	1008	-	-	1369	-	-	367	391	851	337	403	654
Stage 1	-	-	-	-	-	-	739	721	-	545	606	-
Stage 2	-	-	-	-	-	-	584	590	-	680	719	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1008	-	-	1369	-	-	340	373	851	320	384	654
Mov Cap-2 Maneuver	-	-	-	-	-	-	340	373	-	320	384	-
Stage 1	-	-	-	-	-	-	726	709	-	536	587	-
Stage 2	-	-	-	-	-	-	544	572	-	659	707	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.7	12.7	16.3
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	484	1008	-	-	1369	-	-	388
HCM Lane V/C Ratio	0.034	0.015	-	-	0.025	-	-	0.176
HCM Control Delay (s)	12.7	8.6	0	-	7.7	0	-	16.3
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.6

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	37	0	0	75
Future Vol, veh/h	1	0	37	0	0	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	68	0	0	33
Mvmt Flow	1	0	40	0	0	82

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	122	40	0	0	40	0
Stage 1	40	-	-	-	-	-
Stage 2	82	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	878	1037	-	-	1583	-
Stage 1	988	-	-	-	-	-
Stage 2	946	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	878	1037	-	-	1583	-
Mov Cap-2 Maneuver	878	-	-	-	-	-
Stage 1	988	-	-	-	-	-
Stage 2	946	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.1	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	878	1583	-
HCM Lane V/C Ratio	-	-	0.001	-	-
HCM Control Delay (s)	-	-	9.1	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	4.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	57	2	3	34	0	18
Future Vol, veh/h	57	2	3	34	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	44	0	0	74	0	0
Mvmt Flow	62	2	3	37	0	20

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	42	22	0	0	40	0
Stage 1	22	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.84	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.896	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	873	1061	-	-	1583	-
Stage 1	902	-	-	-	-	-
Stage 2	904	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	873	1061	-	-	1583	-
Mov Cap-2 Maneuver	873	-	-	-	-	-
Stage 1	902	-	-	-	-	-
Stage 2	904	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.4	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	878	1583	-
HCM Lane V/C Ratio	-	-	0.073	-	-
HCM Control Delay (s)	-	-	9.4	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

APPENDIX F: VDOT TURN LANE WARRANT ANALYSIS

VIRGINIA DEPARTMENT OF TRANSPORTATION
COMMERCIAL ENTRANCE DESIGN

General Project Information

Enter a value for all input cells

Project Name: Green Ridge - US 60 at Pinegrove Road / Frenchs Store

County: Cumberland

Reviewer: Build 2027, AM Peak Hour Date: 4/28/2023

Adjacent Roadway Data

Adjacent Road Name: U.S. 60 Number of Lanes: 2

Posted Speed: 55 mph * Classification: Minor Rural Arterial

AADT: N/A VPD D: N/A k: N/A *enter N/A if factors are unknown*

*Use Design Speed if available

Trip Generation

Generated Trips: 550 VPD % Trucks in Entrance: 12 %

Right In: 37 VPH Advancing Volume: 347 VPH

Left In: 19 VPH 5% Opposing Volume: 169 VPH**

**Also used as Approaching Volume for Rt. Turns

Entrance Criteria

Entrance is a Standard Commercial Entrance

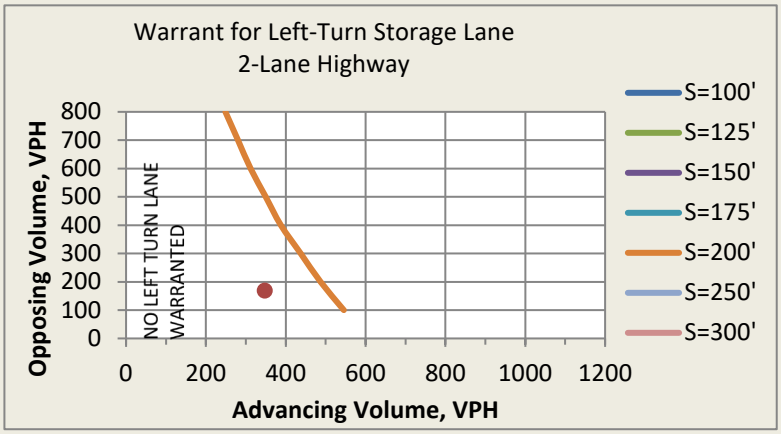
Entrance Type: Unsignalized Intersection/Crossover

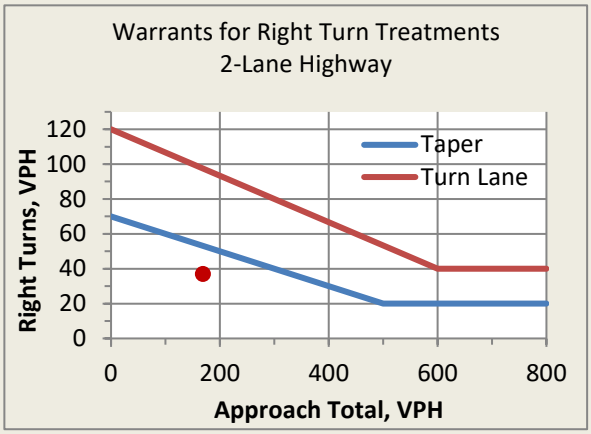
Minimum Spacing: **1050** ft SDL: **610** ft SDR: **610** ft

Left Turn Lane Warrant: Advancing Volume ≥ 505 VPH **No Left Turn Lane**

Right Turn Taper Warrant: Rt. Turn Volume ≥ 53 VPH **No Taper Required**

Right Turn Lane Warrant: Rt. Turn Volume ≥ 98 VPH **No Right Turn Lane Required**





1. The minimum warranted left turn lane length shall be 100' for speeds ≤ 40 mph and 200' for speeds ≥ 45 mph
2. Left turn lanes with high truck volume shall be increased as calculated and tabulated below:

Left Turn Storage Length Increase Required for Truck Ratio (in Feet)						
S = 100'	S = 125'	S = 150'	S = 175'	S = 200'	S = 250'	S = 300'
25	25	25	25	25	25	50

Version 2.1 -Based on July 2012 Appendix F - VDOT Road Design Manual 8-1-12

VIRGINIA DEPARTMENT OF TRANSPORTATION
COMMERCIAL ENTRANCE DESIGN

General Project Information

Enter a value for all input cells

Project Name: Green Ridge - US 60 at Pinegrove Road / Frenchs Store

County: Cumberland

Reviewer: Build 2027, PM Peak Hour Date: 4/28/2023

Adjacent Roadway Data

Adjacent Road Name: U.S. 60 Number of Lanes: 2

Posted Speed: 55 mph * Classification: Minor Rural Arterial

AADT: N/A VPD D: N/A k: N/A *enter N/A if factors are unknown*

*Use Design Speed if available

Trip Generation

Generated Trips: 550 VPD % Trucks in Entrance: 12 %

Right In: 49 VPH Advancing Volume: 196 VPH

Left In: 14 VPH 7% Opposing Volume: 359 VPH**

**Also used as Approaching Volume for Rt. Turns

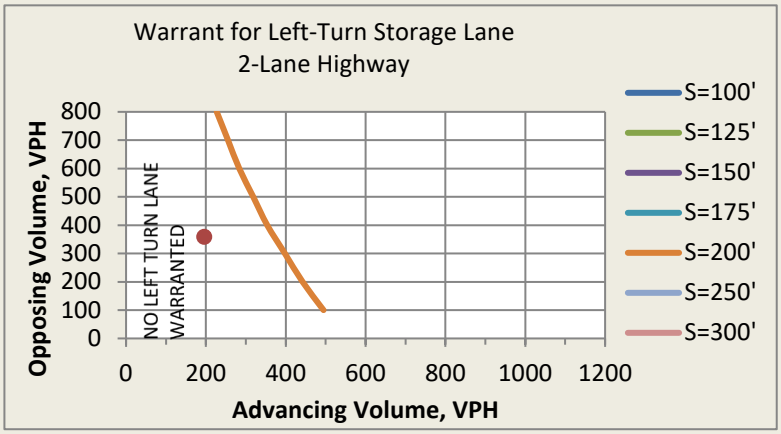
Entrance Criteria

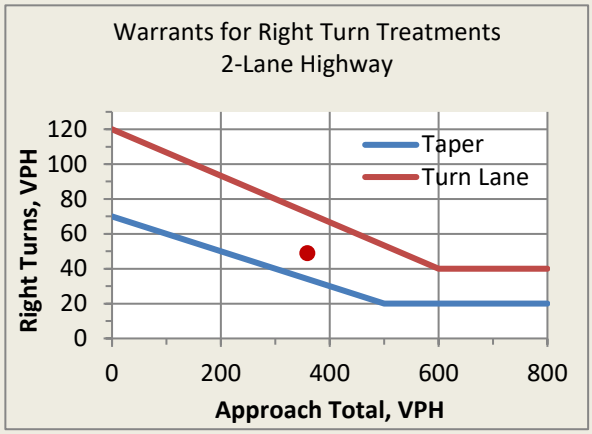
Entrance is a Standard Commercial Entrance

Entrance Type: Unsignalized Intersection/Crossover

Minimum Spacing: **1050** ft SDL: **610** ft SDR: **610** ft

Left Turn Lane Warrant: Advancing Volume ≥	371	VPH	**No Left Turn Lane**
Right Turn Taper Warrant: Rt. Turn Volume ≥	34	VPH	**200' Right Turn Taper Required**
Right Turn Lane Warrant: Rt. Turn Volume ≥	72	VPH	**No Right Turn Lane Required**





1. The minimum warranted left turn lane length shall be 100' for speeds ≤ 40 mph and 200' for speeds ≥ 45 mph
2. Left turn lanes with high truck volume shall be increased as calculated and tabulated below:

Left Turn Storage Length Increase Required for Truck Ratio (in Feet)						
S = 100'	S = 125'	S = 150'	S = 175'	S = 200'	S = 250'	S = 300'
25	25	25	25	25	25	50

VIRGINIA DEPARTMENT OF TRANSPORTATION
COMMERCIAL ENTRANCE DESIGN

General Project Information

Enter a value for all input cells

Project Name: Green Ridge - Pinegrove Road at Site Driveway

County: Cumberland

Reviewer: Build 2027, AM Peak Hour Date: 4/28/2023

Adjacent Roadway Data

Adjacent Road Name: Pinegrove Road Number of Lanes: 2

Posted Speed: 55 mph * Classification: Local Street/Road

AADT: N/A VPD D: N/A k: N/A *enter N/A if factors are unknown*

*Use Design Speed if available

Trip Generation

Generated Trips: 550 VPD % Trucks in Entrance: 55 %

Right In: 57 VPH Advancing Volume: 4 VPH

Left In: 2 VPH 50% Opposing Volume: 76 VPH**

**Also used as Approaching Volume for Rt. Turns

Entrance Criteria

Entrance is a Standard Commercial Entrance

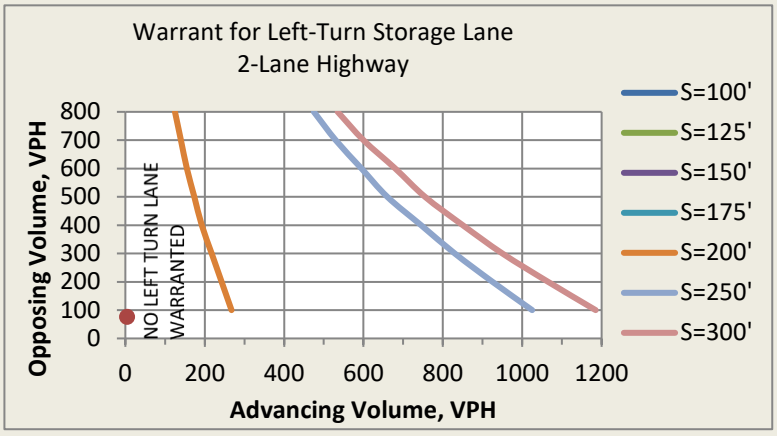
Entrance Type: Full Access Entrance

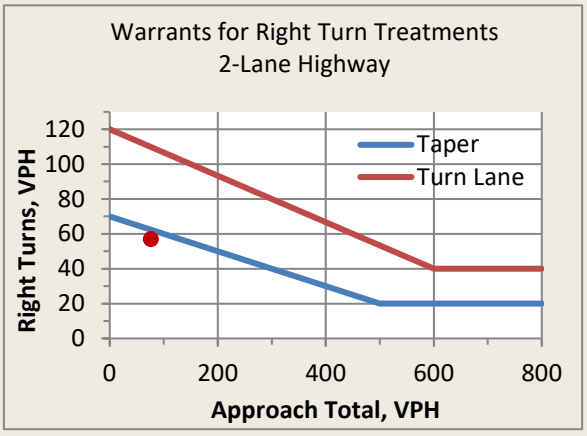
Minimum Spacing: **50 (clear) ft** SDL: **610** ft SDR: **610** ft

Left Turn Lane Warrant: Advancing Volume ≥ 267 VPH **No Left Turn Lane**

Right Turn Taper Warrant: Rt. Turn Volume ≥ 62 VPH **No Taper Required**

Right Turn Lane Warrant: Rt. Turn Volume ≥ 110 VPH **No Right Turn Lane Required**





1. The minimum warranted left turn lane length shall be 100' for speeds ≤ 40 mph and 200' for speeds ≥ 45 mph
2. Left turn lanes with high truck volume shall be increased as calculated and tabulated below:

Left Turn Storage Length Increase Required for Truck Ratio (in Feet)						
S = 100'	S = 125'	S = 150'	S = 175'	S = 200'	S = 250'	S = 300'
50	75	75	100	100	125	150

VIRGINIA DEPARTMENT OF TRANSPORTATION
COMMERCIAL ENTRANCE DESIGN

General Project Information

Enter a value for all input cells

Project Name: Green Ridge - Pinegrove Road at Site Driveway

County: Cumberland

Reviewer: Build 2027, PM Peak Hour Date: 4/28/2023

Adjacent Roadway Data

Adjacent Road Name: Pinegrove Road Number of Lanes: 2

Posted Speed: 55 mph * Classification: Local Street/Road

AADT: N/A VPD D: N/A k: N/A *enter N/A if factors are unknown*

*Use Design Speed if available

Trip Generation

Generated Trips: 550 VPD % Trucks in Entrance: 55 %

Right In: 34 VPH Advancing Volume: 18 VPH

Left In: 0 VPH 0% Opposing Volume: 38 VPH**

**Also used as Approaching Volume for Rt. Turns

Entrance Criteria

Entrance is a Standard Commercial Entrance

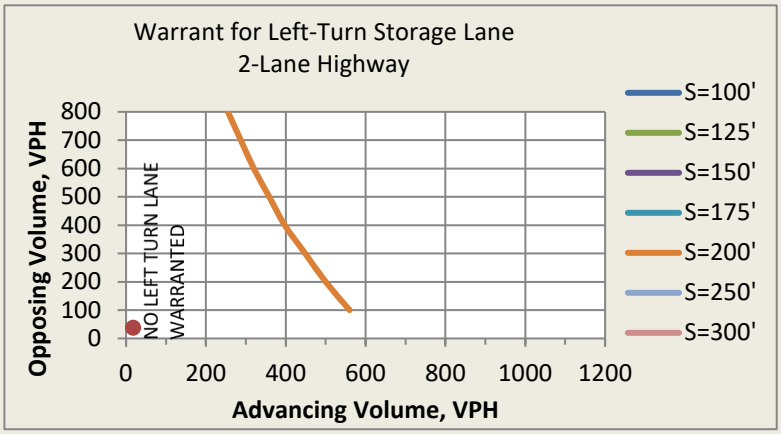
Entrance Type: Full Access Entrance

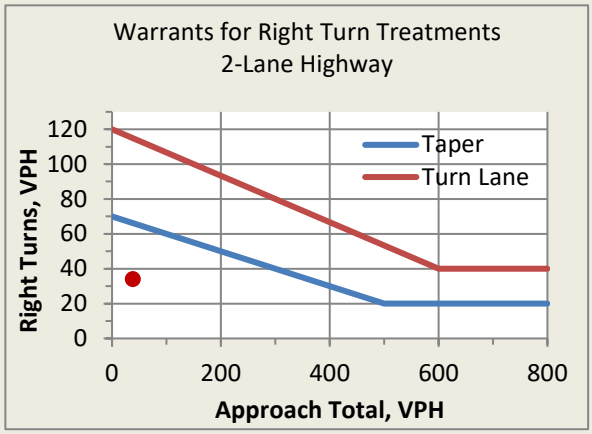
Minimum Spacing: **50 (clear) ft** SDL: **610** ft SDR: **610** ft

Left Turn Lane Warrant: Advancing Volume ≥ 560 VPH **No Left Turn Lane**

Right Turn Taper Warrant: Rt. Turn Volume ≥ 66 VPH **No Taper Required**

Right Turn Lane Warrant: Rt. Turn Volume ≥ 115 VPH **No Right Turn Lane Required**





1. The minimum warranted left turn lane length shall be 100' for speeds ≤ 40 mph and 200' for speeds ≥ 45 mph
2. Left turn lanes with high truck volume shall be increased as calculated and tabulated below:

Left Turn Storage Length Increase Required for Truck Ratio (in Feet)						
S = 100'	S = 125'	S = 150'	S = 175'	S = 200'	S = 250'	S = 300'
50	75	75	100	100	125	150

ATTACHMENT PTA-XVII - LANDFILL IMPACT STATEMENT

A Landfill Impact Statement (LIS) based on the information required under Code of Virginia §10.1-1408.4 A.2. and B.6.; §9 VAC 20-81-460.H.] has been prepared and submitted under separate cover.

The Part A Application was originally submitted to DEQ on January 22, 2020.

On February 16, 2021, DAA submitted supplemental information on a public water supply. A copy of this letter is included within this attachment and the information incorporated into the LIS.

The submitted information was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. TR 1 had two comments relating to the LIS. The responses to these comments were provided on October 1, 2021. The comments and responses are provided below:

17.) *Section 4.6 and Appendix LIS-2F of the Landfill Impact Statement (LIS) address Historic Resources. The applicant has prepared a Phase I Cultural Resources Investigation, dated February 2020. The Virginia Department of Historic Resources (DHR) has reviewed the Phase I report in a letter dated April 30, 2020. Draper Aden Associates indicated in a response to the DHR, dated November 11, 2020 that Browning & Associates is continuing with its onsite investigations on areas of interest within the Green Ridge Property and information on those activities will be forthcoming. DHR has provided the applicant additional review comments and recommendations in correspondence dated March 19, 2021. Please continue to provide the Department with any additional reports and evaluations as the Part A Permit Application is reviewed. Resolution of historic resources issues and concerns with DHR will be required prior to any permit approval.*

This is understood. Significant work is in progress on this aspect of the project. DHR accepted the consolidated Phase I report on June 3, 2021. A copy of their acceptance letter is provided in **LETTER ATTACHMENT 13.**

22.) *Section 4.3 of Attachment XVII (LIS) discusses Public Water Supplies, Section 4.8 of the LIS discusses the potential impact of the proposed landfill on Water Quality (both surface water and groundwater resources) within five miles of the landfill site, and Section 4.8.3 discusses Mitigating Potential Impacts.*

The additional information submitted February 16, 2021 by Draper Aden Associates indicates that there is a newly installed non-transient, non-community (NTNC) public water system within 2.7 miles of the proposed landfill. Although not denoted as public water systems within the LIS or VDH records, the following churches may have groundwater supply wells that may be considered transient non-community public waterworks: Oak Grove Baptist Church (on Route 45), Shiloh New Covenant Church (on Route 60), and Rising Zion Baptist Church (on Route 60).

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Please update the appropriate sections of the LIS as necessary to include an analysis of the hydrogeological setting of the new NTNC well and the three Church wells noted above, the potential for a hydrogeological connection between these wells and the proposed landfill, and any potential impacts.

Figure LA-15 has been created from a USGS watershed map (see **LETTER ATTACHMENT 15**) and shows the locations of the referenced wells. As shown on **Figure LA-15,** all the referenced wells are located upgradient of the proposed Green Ridge facility. Additionally, all but one of the wells (Rising Zion Baptist Church) are located in a different watershed than the proposed Green Ridge facility. The following paragraphs describes these wells and upon DEQ approval, Section 4.3. "Public Water Supplies" of the LIS will be updated to include this information.

Rising Zion Baptist Church (PWSID# 02124343) is located 1 mile south of the closest point of the Green Ridge WMB along Route 60 in Cumberland, VA. One groundwater well supplies the Church which is a transient non-community (NC) system. An NC system has a lower level of regulation than a "public water supply" or "community water system" (C) which is defined by the VDH as serving more than 25 year-round residents, or having at least fifteen service connections. There is no information available on the Rising Zion Baptist Church well construction. Any available VDH information for this well will be included in Appendix LIS-2C. The Green Ridge facility is NOT *upgradient* of the Rising Zion Baptist Church and will not impact this transient non-community water system.

Oak Grove Baptist Church is located 2.85 miles west of the closest point of the Green Ridge WMB along Route 45 in Cumberland, VA. The Oak Grove Baptist Church well is a transient non-community system (lower level of regulation than a public water supply system as defined by VDH) and is located up-valley from the Green Ridge facility at the border of the Trice Lake-Willis River water shed and the Muddy Creek watershed. There is no information available on the well construction. Any available VDH information for this well will be included in Appendix LIS-2C. The Green Ridge facility is NOT *upgradient* of the Oak Grove Baptist Church Rising Zion Baptist Church and will not impact this transient non-community water system.

Shiloh New Covenant Church (PWSID# 09124005) is located 2.94 miles southwest of the closest point of the Green Ridge WMB along Route 60 in Cumberland, VA. The Shiloh New Covenant Church well is a transient non-community system (lower level of regulation than a public water supply system as defined by VDH) and is located upgradient from the Green Ridge facility in the Maxey Mill Creek-Deep Creek watershed. Any available VDH information for this well will be included in Appendix LIS-2C. This well is 500 feet deep with an approximate yield rate of 3 gpm. The Green Ridge facility is NOT *upgradient* of the Shiloh New Covenant Church and will not impact this transient non-community water system.

Envigo Red #2 and Yellow #2 (Temporary Operation Permit # 5049110T) are newly permitted supply wells located approximately 2.6 miles south of the closest point of the Green Ridge WMB in Cumberland, VA. The Envigo wells are non-transient non-community system (lower level of

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regulation than a public water supply system as defined by VDH) and were not permitted when the initial Part A application was submitted for the Green Ridge Facility. Any available VDH information for this well will be included in Appendix LIS-2C. The Envigo wells have since been permitted by the VDH, however, the Envigo facility would not be impacted by the Green Ridge Site because the wells are in different watersheds (HUCs): the Green Ridge Facility is in the Muddy Creek watershed (020802050402), whereas the ENVIGO facility is in the Maxey Mill-Deep Creek watershed (020802050404). The divide between these two watersheds is approximately at the US Route 60-Pinegrove Road - Frenchs Store Road intersection. North of that point, flow is toward Muddy Creek.

The regional map has been updated to include this information and is provided in **LETTER ATTACHMENT 16.**

SUMMARY OF HISTORIC RESOURCE ACTIVITIES

Since the original Part A was filed a significant amount of work has been completed by Green Ridge to evaluate historic resources. The following provides a chronological (by topic) representation of the major correspondence to/from Green Ridge and the Virginia Department of Historic Resources (DHR) from 2020 through 2023:

- A project review application was submitted to the DHR on June 23, 2019.
- Response from DHR received on August 16, 2012 recommending the completion of a Phase 1 cultural resources survey.
- A Phase I Cultural Investigation was conducted by Browning & Associates and a report on the study was submitted by TRC[1] to DHR in March 2020. DHR provided comments (4/30/20) on the study, and as a result, additional work was conducted (including additional structure evaluation and a viewshed analysis). This comment response was submitted to DHR by TRC (11/11/20). DHR provided comments to that response (3/19/21) and TRC provided additional responses (4/13/21).

  On May 3, 2021, TRC provided a Revised Phase I Cultural Resources Investigation that incorporated the comment responses (above) to DHR, followed by a submittal of the same to DEQ – SW and ACOE on May 10, 2021. On June 3, 2021, DHR provided a letter stating that the Revised Phase I Cultural Resources Investigation satisfies the DHR request and accepted the report and its conclusions regarding the various potential historic sites on the Green Ridge property. The Phase I Cultural Investigation identified two areas within the then-proposed Disposal Unit (Chimney in the Field – 44CM0138 and Jeffries Site - 44CM0136) that would require further evaluation (Phase II). Another area called the "Frog Site", 44CM0137, was identified in the then-proposed Disposal Unit but because of the disturbance observed in and around the staging area, was thought to have a low probability to contain intact subsurface deposits. Thus, the research potential of deposits at this site was

[1] Draper Aden Associates was acquired by TRC Companies in May 2022. Any reference to TRC in this document may be considered a reference to Draper Aden Associates (specifically prior to May 2022).

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thought to be low and no additional work was recommended. Because of this recommendation, this site was removed from the Part A drawings as irrelevant to further discussion.

- Based on the conclusions from the Phase I Investigation, Browning & Associates submitted a mitigation plan (9/14/2021) to DHR to address the mitigation of adverse effects upon the Pine Grove School, Melrose and Clinton Manor. Additionally, on November 1, 2021, Browning & Associates submitted to DHR Memoranda of Agreement (MOAs) for the mitigation plan.

  The proposed mitigation includes digitization of data from the census and historical maps for all of Cumberland County, as well as accurately characterizing the Reverend's Still site. Follow up on the status of the MOAs was sent via email (from Browning to DHR) on August 4, 2022; specifically, based on "re-activation" of ACOE (based on submittal of comment responses on JPA) and the potential for moving forward with the mitigation discussed above.

  DHR responded via email that DHR had received no communication from ACOE and that DHR would not provide approval for mitigation as it would have to wait for the Section 106 process to catch up. Further, the email states that DHR is in no position at this time, nor has the authority to approve any proposed mitigation.

- In November and December 2021, the submittal of a Preliminary Information Form (PIF) from a local citizens group was made to DHR, and proceeded through various state and federal agencies, requesting the formation of a Pine Grove School Rural Historic District[2]. These documents were provided to Browning & Associates by DHR in December (12/13/2021) via email. Green Ridge legal consultants provided comments on the PIF (2/3/2022). DHR responded on 2/28/22 with additional clarification on the PIF process[3].

- Browning & Associates conducted extensive field investigation of the Chimney in the Field (Site ID 44CM0138) and prepared the Phase II report for submittal (by TRC) to DHR on June 9, 2022. Comments from DHR on the Phase II report on the Chimney in the Field were received on August 24, 2022. These comments indicate concurrence that this site is not likely individually eligible for National Register of Historic Places (NRHP). However, it states that the site could be a contributing resource to the NRHP-eligible Pine Grove School Rural

[2] On December 9, 2021, DHR's State Review Board (SRB) supported the December 2, 2021 recommendation of DHR's National Register Evaluation Committee that the Pine Grove School Rural Historic District (DHR ID #024-5125) is eligible for listing in the Virginia Landmarks Register and that it proceed to nomination on the NRHP. This nomination procedure is still underway, per our current understanding.

[3] The DHR response to the GR comments did not rescind the SRB's procedural approval of the PIF but did acknowledge that the PIF conflates and confuses the historic listing process with the ongoing environmental review of the proposed Green Ridge Landfill.

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Historic District, although the research potential at the site is largely exhausted and additional data recovery may not be warranted, direct impacts would adversely affect the district (assuming the PG School Historic District) and some resolution is warranted.

- On February 3, 2023, the Phase II report on the Jefferies Site (now known as Buena Vista – Site ID 44CM0136) as prepared by Browning & Associates was submitted by TRC to DHR. Comments from DHR have not yet been received.

The following documents are included in Appendix LIS 2F:

- "Green Ridge - Updated Phase I Cultural Resources Investigations, Cumberland County, Virginia" dated April 2021, prepared by Browning and Associates.
- "Chimney in the Field – Phase II Evaluation of Site 44CM0138, Cumberland County, Virginia," dated June 2022, prepared by Browning and Associates.
- "Buena Vista – Phase II Evaluation of Site 44CM0136, Cumberland County, Virginia," dated December 2022, prepared by Browning and Associates.

Green Ridge is in the process of working with DHR on several mitigation plans. Browning & Associates continue to provide professional services on this aspect of the project.

DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. No comments specific to this Attachment were received.

Parallel to the Part A permitting process, Green Ridge has been pursuing a Joint Permit Application (JPA) from the ACOE and DEQ-VWP for impacts to streams and wetlands delineated on the site. In the course of numerous site visits and discussions with ACOE and DEQ-VWP, it was determined that a supplement to the original PJD was needed to modify several stream reaches and to add in small areas of wetland. This supplement was submitted to the ACOE on February 28, 2023. Approval is pending.

After multiple submittals, communications and meetings with the various agencies, Green Ridge has redesigned their initial concept for the facility eliminating all impacts to streams and wetlands including secondary impacts for the initial disposal unit area. The redesigned concept made the following modifications:

- Identification of an initial disposal unit area within the Waste Management Boundary;
- Change in realignment of Miller Lane; and
- Replacing, at least for the initial phase of the landfill, the private access road from Route 60 to the site with a new proposed access to be an entrance off Pine Grove Road.

The JPA was withdrawn on _____.

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The following is a list of documents associated with this section:

Attachment XVII – Landfill Impact Statement (LIS) [For the May 12, 2023 Draft Document for DEQ review, we are only including the following documents/figures that have been revised:

- LIS Narrative (redlined and w/o Appendices)
- Buena Vista (aka Jeffries Site) Phase II Evaluation of Site 44CM0136 Cumberland County, Virginia, Browning & Associates, LTD - Dated December 2022 (included in Affected Environs Section F)
- Threatened and Endangered Species Technical Memorandum, by Koontz Bryant Johnson Williams, Dated April 21, 2023 (included in Affected Environs, Section G)
- Figure LIS-4H-1 Surface Water Resources – Dated February 24, 2023 (included in Affected Environs, Section H)]

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PTA Attachment XVII
Landfill Impact Statement
Green Ridge Recycling and Disposal Facility
Permit No. 626
Cumberland County, Virginia

GREEN RIDGE
RECYCLING AND DISPOSAL FACILITY

Prepared For:
Green Ridge Recycling
and Disposal Facility, LLC
12230 Deer Grove Road
Midlothian, Virginia 23112

Prepared By:
TRC Companies, Inc.
(formerly Draper Aden Associates)
1030 Wilmer Avenue, Suite 100
Richmond, Virginia 23227

December 9, 2019
TR 2 Response(DRAFT)
May12, 2023

TRC

SIGNATURE/CERTIFICATION

Qualified Groundwater Scientist:

I certify that I have prepared or supervised preparation of the attached report, that it has been prepared in accordance with industry standards and practices, and that the information contained herein is truthful and accurate to the best of my knowledge.

Certified this 12th day of May, 2023

Name:

Signature:

Professional Certification Type and Number: Professional Geologist, Virginia, xxxxxxxxxxx

Company: TRC

Address: 1030 Wilmer Avenue, Suite 100

City/State/Zip: Richmond, Virginia 23227

Seal:

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1.0 EXECUTIVE SUMMARY

Green Ridge Recycling and Disposal Facility, LLC (Green Ridge) is seeking permit approval to construct and operate a privately-owned solid waste disposal facility (Facility) in Cumberland County (County), Virginia. Draper Aden Associates (DAA) has prepared this Landfill Impact Statement (LIS) for Green Ridge in accordance with the requirements of the Code of Virginia, §10.1-1408.4.A.2 and B.6, and the *Virginia Solid Waste Management Regulations* (*VSWMR*) §9 VAC 20-81-460.H, Part A Landfill Permit Application. Note that in May 2022, Draper Aden Associates (DAA) merged with TRC Companies (TRC), a national engineering company specializing in environmental, infrastructure, and energy services. While the original Part A and TR 1 response were created by DAA, this TR 2 document is being prepared under TRC. With that said, title blocks and most documentation will maintain reference to DAA. Thus, the use of DAA and TRC is synonymous.

In addition, the original parent company of Green Ridge, County Waste of Virginia, has now become GFL. All disclosure information has been updated to reflect this. With that said, this narrative will continue to reference County Waste of Virginia which is now synonymous with GFL.

This LIS is a standalone document and satisfies a portion of the requirements for the Part A Permit Application, Attachment XVII, as required by the Virginia Department of Environmental Quality (DEQ), Solid Waste Permitting, Submission Instruction No. 1, Procedural Requirements for a New or Modified Solid Waste Management Facility (SWMF) Permit Application.

DEQ issued Technical Review 1 (TR 1) on April 8, 2021 with subsequent response submitted by DAA on October 1, 2021 and April 13, 2022. DEQ issued Technical Review 2 (TR 2) on June 16, 2022 and a supplement to TR 2 on October 25, 2022. The purpose of this document update is to incorporate (as appropriate) the TR 1 responses and to address TR 2.

The purpose of the LIS is to assess the potential environmental impacts of the proposed sanitary landfill on existing parks and recreational areas, wildlife management areas, critical habitat areas of endangered species as designated by applicable local, state, or federal agencies, public water supplies, marine resources, wetlands, historic sites, fish and wildlife, water quality, and tourism within a five-mile radius of the Facility. In addition, appropriate state agencies were contacted to request their opinion on the impact of the Facility on the resources listed above. Findings by those agencies along with studies conducted by consultants hired by Green Ridge are presented herein, along with an evaluation of landfill siting, configuration alternatives, and feasibility. Potential negative impacts identified in the studies and potential solutions to those impacts are discussed.

The proposed Facility site is located in eastern Cumberland County, in Clinton, Virginia. The site is comprised of 13 parcels totaling approximately 1,178 acres north of U.S. Route 60 (Anderson Highway), and loosely bounded by Route 654 (Pinegrove Road) and Route 685 (Miller Lane). ~~238 acres being dedicated to the waste disposal unit (disposal footprint).~~The Waste Management Boundary covers approximately 428 acres. A large portion of the site has been utilized to grow and harvest timber. Green Ridge has received a Conditional Use Permit from the County to construct and operate a landfill at the proposed Facility. The Conditional Use Permit addresses special conditions for development of the Facility.

The County and Green Ridge executed a Host Agreement (Agreement) on August 2, 2018 as amended on July 11, 2019 (**NOI-PTA ATTACHMENT VI**). The Agreement outlines the provisions under which the County and Green Ridge will forge a long-term relationship that will be beneficial to both parties. The County will receive financial stability through guaranteed income in the form of host fees, reduced solid waste disposal costs, a long-term disposal option, and increased job opportunities for residents of the area. Section 1.4 of the Host Agreement indicates a service area of "500 miles aerial radial distance" from the landfill. In subsequent discussions with the County and regulators, Green Ridge agreed initially to delete New York and New Jersey waste from disposal at the facility and then later agreed to only accept Virginia waste at the Green Ridge Recycling and Disposal Facility.

By conducting a thorough site screening and selection process, evaluation of potential impacts to regulatory-specified area resources, and confirmation of the findings with the appropriate agencies, no negative impacts are anticipated that could not be addressed and mitigated as part of the various permitting and approval processes. Simply put, the site evaluation process supports one of the main objectives of the project: to provide a Facility that serves the public interest by providing the County with a reliable and substantial source of revenue, which can be used to offset costs of needed infrastructure improvements (such as schools), and cost control through significantly reduced solid waste disposal costs, and a long-term disposal solution. The proposed project will be able to accomplish these goals while eliminating, avoiding, and/or mitigating potential negative impacts to the surrounding community. By completing the permitting process for all of the required operating permits, the Facility will have planned, designed and undergone regulatory review of proposed controls to adequately protect both human and environmental health and safety.

1.1 Introduction

The Green Ridge Recycling and Disposal Facility, LLC (Green Ridge) is seeking approval to construct and operate a privately-owned solid waste disposal facility (Facility) in Cumberland County (County), Virginia. The proposed sanitary landfill will provide an environmentally sound and responsible solid waste management solution, addressing the need for cost-effective disposal of non-hazardous solid waste. The siting, permitting and operations of the proposed Facility shall be in accordance with the *Virginia Solid Waste Management Regulations* (*VSWMR*), which are implemented and enforced by the Virginia Department of Environmental Quality (DEQ). This LIS has been prepared in accordance with 9 VAC 20-81-460 H and applicable Submission Instructions developed by the Virginia Department of Environmental Quality (DEQ).

This LIS is one piece of a larger application package for the Part A Permit submission (Attachment XVII of the Part A). Throughout this document, references will be made to Appendices, which will refer to material supplemental to this impact statement. References to Attachments shall refer to the overall Part A Permit submission package and its various sections that align with the submission instructions. Obtaining a permit for a solid waste management facility from the DEQ involves submitting the Part A Permit package, including a Notice of Intent that can be submitted prior or concurrently, and submitting a Part B Permit package subsequent to the Part A. The Part A Permit Application is intended to address requirements for

general siting criteria (setback from public water supplies, parks and recreational areas, schools, homes, etc.) and demonstrate that the proposed Facility: is located in a geologically stable region; does not adversely impact rare, threatened or endangered species; and can be reasonably monitored for groundwater impacts between the proposed Disposal Unit Boundary and the overall Facility Boundary. The Part B Permit application pertains to the engineering related items and addresses the detailed design, operating plans, construction quality assurance plans, closure and post-closure plans, and financial assurance.

2.0 PURPOSE OF AND NEED FOR ACTION

The purpose of a Landfill Impact Statement (LIS) is to identify the potential environmental impacts to existing parks and recreation areas; wildlife management areas; critical habitat areas of endangered species as designated by applicable local, state, or federal agencies; public water supplies; marine resources; wetlands; historic sites; fish and wildlife; water quality and tourism that could result from the construction and operation of a proposed sanitary landfill. The potential impacts, or lack thereof, are discussed in further detail in Section 4.0, Affected Environments of The Selected Alternative.

3.0 ALTERNATIVES, INCLUDING THE SELECTED ALTERNATIVE

The following section outlines the actions taken and factors considered by County Waste of Virginia, LLC ("County Waste") and Green Ridge Recycling and Disposal, LLC ("Green Ridge") in evaluating alternative sites prior to choosing the one undergoing permitting. As explained above, Green Ridge was~~is~~ a subsidiary of County Waste. Its parent company is now GFL but reference throughout this discussion will remain with County Waste as that is the entity that the original work was completed under. County Waste initiated the planning for this project including alternative site evaluations, then passed the permitting to Green Ridge after Green Ridge was approved by the State Corporation Commission as an LLC on May 10, 2018.

In general, when considering the permitting of a new landfill there are three broad categories of alternatives that can be considered. They are:

- Alternative 1 – Take no action – Use existing capacity in other facilities;
- Alternative 2 – Purchase an already permitted landfill; or
- Alternative 3 – Permit a new landfill.

As set forth below, permitting a new landfill on the subject property is the best and only feasible option among the alternatives available.

All figures referenced in this discussion can be found in **Appendix LIS-1.**

3.1 Alternative 1 – No Action – Use Existing Capacity in Other Facilities

County Waste serves over 320,000 customers in Virginia. As part of this application, Green Ridge's Notice of Intent includes a detailed discussion demonstrating the need for a new landfill in Virginia. As explained in that discussion, a new landfill would not only protect County Waste's interests and those of its hundreds of thousands of customers, but would also ensure a competitive environment in the solid waste disposal industry in Virginia, helping to control future costs for local governments and other agencies and institutions, as well as Virginia businesses and residents generally. (~~Currently in Virginia~~As reported in the Demonstration of Need, almost 88% of private landfill capacity is controlled by just two companies and that will likely increase to about 99% within the next six years.)

As also explained in Green Ridge's Demonstration of Need, less than 20 years of permitted landfill capacity exists in Virginia when waste streams are projected, the remaining life in existing facilities is evaluated, and the substantial future increase in out of state waste is accounted for.

In addition, the proposed landfill would provide much needed revenues to Cumberland County and drastically reduce its disposal costs.

Based on the need for additional landfill capacity in Virginia, the importance of County Waste's ability to serve its Virginia customers, and the advantages a landfill provides to Cumberland County, Alternative 1 was omitted from further consideration.

3.2 Alternative 2 – Purchase of an Already Permitted Landfill

County Waste first considered purchasing an existing permitted and operating landfill in Virginia. To that end, County Waste approached various landfill owners and considered multiple disposal facilities; however, confidentiality precludes identifying the specific landfills approached. Despite its efforts, County Waste could not find an operating landfill with sufficient remaining capacity that was suitable for purchase and would meet County Waste's long-term goals.

In addition to inquiring about currently operating landfills, County Waste contacted Republic Services, Inc. about purchasing its property in Cumberland County that was permitted by VDEQ as a sanitary landfill, but never constructed. **Figure 1** illustrates the location of the Republic Services site in relation to the Green Ridge site currently undergoing permitting, and **Figures 3A and 3B** provide additional details. During discussions, County Waste discovered that Republic would only sell its property with a restriction on the deed that would prohibit a landfill. Since initial discussions with Republic, the permit for that facility has been terminated.

Finally, purchasing an existing landfill would not address the overall projected lack of capacity in Virginia.

Based on the lack of available facilities, and the termination of the Republic permit, Alternative 2 was omitted from further consideration.

3.3 Alternative 3 – Permit A New Landfill

County Waste's hauling companies collect in excess of 3,200 tons per day of municipal solid waste in Virginia, which is mostly generated in Central and Southwest Virginia. County Waste is expanding, and anticipates that it may be collecting up to 5,000 tons of waste per day in projected growth plans as its network of collections continues to increase, further underscoring the need for additional disposal capacity. To reduce costs and better serve its Virginia customers, County Waste has determined that it needs to own a landfill to protect its interests and those of its customers. Without such a landfill, the waste collected by County Waste must be directed primarily to landfills owned by County Waste's competitors. County Waste would therefore not be able to control tipping fees and in turn could not control costs for its customers. Given the lack of competition in the market and the limited number of disposal facilities in the Commonwealth, private tipping fees will escalate significantly over the next ten years, to the detriment of local governments, businesses, and residents. Indeed, tipping fees have already begun to rise.

Given the duopoly that currently controls private landfills in Virginia and the projected decline in disposal capacity that County Waste predicts will occur, County Waste /Green Ridge began to search for a property on which to build a new landfill in Virginia. That process had two phases. The first phase was to identify a locality that would embrace the Facility; the second phase was to identify sites within an interested locality.

During its initial search over the course of several years to find a host locality, County Waste contacted multiple communities in locations suitable to receive waste from Central Virginia. Confidentiality precludes identifying the specific localities approached. Ultimately, the search narrowed to Cumberland County for two reasons:

- First, the County had previously indicated its interest in a private landfill in the County (i.e., the Republic facility). The County had approved all the required zoning and a conditional use permit for a municipal solid waste facility, signed the local government certification required by DEQ, and executed a Host Agreement. (As indicated earlier, this landfill was permitted by DEQ but never constructed, and the permit has now been terminated.)

- Second, the County continued to be interested in a private landfill because it needed to replace the substantial revenues that would have resulted from the Republic facility, revenues upon which the County had depended in making substantial capital improvements. (Among other things, the County incurred tens of millions of dollars of debt to build a new high school in reliance on the receipt of the fees set forth in the Republic Host Agreement.) A new landfill would offset deficits in the County's annual budget, reduce the County's waste disposal costs, fund much needed capital projects and avoid the possible loss of public services to Cumberland residents because of County budget shortfalls and fiscal constraints.

Based on the continued interest of the Cumberland County Board of Supervisors, County Waste /Green Ridge considered four potential landfill sites in Cumberland County, only one of which was found to meet all necessary criteria. The sites considered reflected the goal of minimizing the landfill's impact on productive agricultural lands, potential development properties, residential properties, the environment and historic resources. The search in Cumberland began by identifying timberland and timber farms

prevalent in the County. **Figure 1** illustrates the general location of the four sites in relation to the previously permitted Republic site.

A short description of each site follows.

3.4.1 Alternate 1: Old Buckingham Road (Route 13) (Figures 2A and 2B)

The Alternate 1 site is approximately 780± acres in size. Trucks accessing the site would travel west on Route 60 and most likely turn south onto Route 13. Access into the site would be directly from Route 13 and is approximately 3 miles from Route 60. The intersection of Route 13/Route 60 would need improvements. As an alternative, trucks could exit Route 60 further east onto Route 682 and then onto Route 13. A detailed evaluation, and discussions with VDOT made it apparent that both the intersection at Route 60 and the intersection at Route 13 would require significant upgrades if this site were selected.

The site is heavily dissected by streams with Little Guinea Creek running through the southern portion of the site. Because of this, significant wetlands are present in the southern part of the property.

A general overview of the potential historic resources on this site was completed by Browning and Associates. The report is contained in **Appendix LIS-2F**. The findings in that report indicate that the *"prehistoric potential for the three alternatives is much higher than for the chosen alternative (Green Ridge) due to the presence of watercourses that penetrate inland from larger water courses."*……(Page 15) *"Combining the potential archaeological sites for each of the alternatives, Alt 1, Alt 2, Alt 3, all have a higher potential for the presence of archaeological sites based upon standard settlement models than the chosen alternative."* (Page 16)

As the smallest of the sites considered, it contains the least usable acreage.

Because of the limited development acreage, the presence of Little Guinea Creek, the need for significant road improvements, and extended truck travel along secondary routes, the site was eliminated from further consideration.

3.4.2 Alternate 2: West of Clinton (south of Route 601) – Frenchs Store Road (Figures 3A and 3B)

The Alternate 2 site is approximately 1089± acres in size. Trucks accessing the site would travel east on Route 60 and turn south from Route 60 into the site. The site has a limited boundary on Route 60, and access through this area would be directly across from Route 601. Additional property or an alternate access into the site would need to be considered. The site also abuts Route 654 (Frenchs Store Road) approximately 3,000± feet south of Clinton. Frenchs Store Road is almost immediately across from Pinegrove Road, and improvements at the intersection of Route 654 and Route 60 would be needed, but may not be possible given the location. There are also a number of homes along this stretch of Route 654.

Route 654 divides the property in the southern area, leaving approximately 15% - 20% of the site south of the road and unusable.

The site is dissected by streams (Mill Creek runs through the southern part of the property), and because of this, wetlands are present in the south part of the property just north of Route 654, removing further acreage from availability.

A general overview of the potential historic resources on this site was completed by Browning and Associates. The report is contained in **Appendix LIS-2F**. The findings in that report indicate that the *"prehistoric potential for the three alternatives is much higher than for the chosen alternative (Green Ridge) due to the presence of watercourses that penetrate inland from larger water courses."……* (Page 15) *"Combining the potential archaeological sites for each of the alternatives, Alt 1, Alt 2, Alt 3, all have a higher potential for the presence of archaeological sites based upon standard settlement models than the chosen alternative."* (Page 16)

More usable acreage exists on this site than the Alternate 1 site. However, because of the difficulty with access to and from Route 60 or Route 654, limited setback from these roads for waste disposal, division of site by Mill Creek and Route 654, and the proximity to Clinton, the site was eliminated from further consideration.

3.4.3 Alternate 3: Guinea Mills (Figures 4A and 4B)

The Alternate 3 site is approximately 1,990± acres in size, but actual usable acreage is much smaller as discussed below. Trucks accessing the site would travel west on Route 60 and turn south from Route 60 onto Route 45 (Cumberland Road), then travel along Route 45 for approximately 4 miles to enter the site from Route 45 west of Guinea Mills. Route 60 at the intersection with Route 45 is divided and would probably require improvements for the additional truck traffic. Route 45 connects Route 60 to Farmville and is heavily trafficked. Thus, significant improvements would likely be needed at the entrance to the site.

The site is the furthest west of all the sites evaluated and is located near the Buckingham County line. Traffic from the east (the majority of the traffic) would travel through Cumberland Courthouse and past the primary entrance to the County schools.

The site is heavily dissected by streams. Significantly, the Willis River and its flood plain/wetlands divide the site in half. Access to the eastern half of the site would be as described above. Access to the western half of the site would require trucks to continue on Route 45 and to turn west on to Route 634. Further study of the bridge over the Willis River on Route 634 would be required to determine if it has the capacity for the volume of truck traffic, or if improvements would be needed. Route 634 divides the western side of the site in half, and there is a major utility corridor running north – south through this site as well. Because of the complications present in the western side of the property, only the eastern area is considered viable, but the eastern area is compromised by streams and has limited development area. In addition, development of the eastern half would push waste disposal closer to Route 45.

A general overview of the potential historic resources on this site was completed by Browning and Associates. The report is contained in **Appendix LIS-2F**. The findings in that report indicate that the *"prehistoric potential for the three alternatives is much higher than for the chosen alternative (Green Ridge) due to the presence of watercourses that penetrate inland from larger water courses."*..... (Page 15) *"Combining the potential archaeological sites for each of the alternatives, Alt 1, Alt 2, Alt 3, all have a higher potential for the presence of archaeological sites based upon standard settlement models than the chosen alternative."* (Page 16)

This site also has the potential for Willis River navigation structures (historic resources) and needs at least one bridge or ford. In addition, per the Browning report, this property has a *"very high probability of structures that were extant during the Civil War and thus possibly as early as the first round of land patents for the County."*

Because of the presence of the Willis River, the high probability of historic resources, the division of the site by various features, access, and the site's location on the western side of the County, the site was eliminated from further consideration.

3.5 Proposed Green Ridge Recycling and Disposal Facility Site (Figure 5)

The Green Ridge Recycling and Disposal Facility site is approximately 1,178 ± acres in size. The parcels combined for the site include American Timberland properties and some individual holdings. The site has been heavily timbered and disturbed historically.

~~Trucks accessing the site will travel west on Route 60 and, and immediately after crossing the Powhatan County Line, turn north onto a private road which will be constructed by Green Ridge. This road will be approximately 1 mile in length, thereby enabling the landfill to achieve separation from Route 60. Scales and infrastructure are to be located away from Route 60, to the south and east of Miller Lane, allowing for significant queuing space for traffic entering the site. Improvements at the intersection of this private road and Route 60 will be needed. VDOT has reviewed the traffic impact statement and conceptually agrees with the preliminary layout for the entrance.~~

When the original Part A was submitted, Green Ridge was accessing the site via a private entrance road off of Route 60 and the Part A included the traffic impact analysis for this concept along with the required VDOT letter. After some consideration, Green Ridge has modified their access into the site for the initial disposal unit area and this is addressed in this TR 2 submittal. For this initial phase, trucks accessing the site will travel west on Route 60 and turn on to Route 654 (Pine Grove Road) to travel to the site entrance. Scales and infrastructure are to be located away from the site entrance as space is available to allow for queuing space for traffic entering the site. Green Ridge has had a new traffic impact analysis completed for using Pine Grove Road to access the site, and this document has been submitted to VDOT for their review and issuance of the required letter.

The ~~expected disposal unit~~Waste Management Boundary will be approximately ~~4,300~~3,700 feet from Route 60 (straight- line distance). Usable acreage for disposal ~~is~~ was previously estimated at approximately 500 acres, or a little less than half the site, with sufficient room for buffers, internal roads, soil borrow areas, stormwater management, leachate handling and future active gas system installation in the remaining acreage. ~~The disposal unit under this permit, however, is only approximately 238 acres in size.~~ The Waste Management Boundary for the site covers approximately 438 acres.

The site is dissected by streams to a lesser extent than the other sites, with NWI wetlands identified in the northern area. Although wetland delineations have been performed on the proposed site, for consistency with comparison to the other alternate sites, only NWI information is illustrated on the mapping in Figure 5. The site is bounded on the north and northwest by Muddy Creek (and one of its unnamed tributaries). Muddy Creek ultimately flows into the James River over 5 miles northeast of the site. The site is bounded on the east by Miller Lane. Maple Swamp Creek is located on the far eastern side of Miller Lane.

Miller Lane will require some re-alignment during development of the site. Re-alignment will require coordination with VDOT and Cumberland County. VDOT has indicated conceptual agreement with the realignments proposed.

As expected with any site of this size, some historic resources have been identified that will be addressed when developing the site. Phase 1 historic resource inventories have been completed, with some areas identified for further investigation. Phase 2 evaluations on two sites were completed based on the Phase 1 findings. See Section 4.6 for more details. Per the Browning and Associates report, *"Combining the potential archaeological sites for each of the alternatives, Alt 1, Alt 2, Alt 3, all have a higher potential for the presence of archaeological sites based upon standard settlement models than the chosen alternative."* (Page 16). The Pine Grove School, a Rosenwald structure, is located to the west of the property on the western side of Pinegrove Road.

All sites considered had some residential properties located in their vicinity. At the Green Ridge Site, most properties with residences are located on the eastern side of the site along Miller Lane. Included in the Host Agreement with Cumberland County is a property value protection plan available for property owners of certain identified properties who believe they would be impacted by development of the landfill and who meet certain criteria outlined in the protection plan.

This site has ~~the best~~ access similar to~~of~~ the other alternatives but has~~,~~ the most usable disposal space~~,~~ and sufficient acreage for infrastructure and support operations.

As is typical for properties of the size needed for this landfill, all sites considered had wetlands and were dissected by streams, which is a function of the underlying geology. The initial disposal unit area for the facility (approximately 100 acres) will not impact any streams or wetlands. Future expansion of disposal areas, if undertaken, may impact streams and will need to go through appropriate JPA permitting with the DEQ and ACOE. Landfills under the Virginia Waste Management Act cannot disturb more than 2 acres of wetlands.

For the reasons identified above, this site was chosen for the Green Ridge Recycling and Disposal Facility.

4.0 AFFECTED ENVIRONMENTS OF THE SELECTED ALTERNATIVE

In accordance with 9 VAC 20-81-460 H, the purpose of the LIS is to document potential environmental impacts to the resources referenced in the regulations and in Section 4 of this report, within a 5-mile radius of the Facility. This section of the report evaluates resources, including parks and recreation areas, wildlife management areas, critical habitat areas of endangered species as designated by applicable local, state, or federal agencies, public water supplies, marine resources, wetlands, historic sites, fish and wildlife, water quality and tourism. In addition, appropriate state agencies were contacted to request their opinion on the impact of the Facility on the specific resources listed above. This section of the report also presents the findings of those agencies. Potential impacts (if any) and resolutions to each potential impact are discussed below. A five-mile radius map showing the resources is provided as **PTA Attachment IX-Figure 3- Regional Map**.

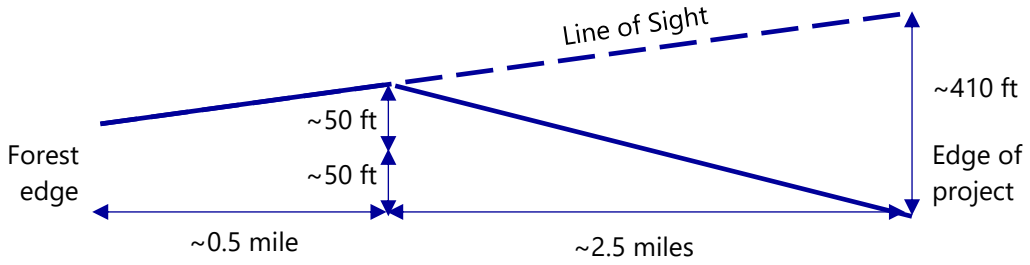
4.1 Parks and Recreation Areas

An online request for information services was submitted to the Department of Conservation and Recreation (DCR) for the project site, to identify surrounding Parks and Recreation areas within a two-mile radius. The response letter dated June 14, 2019 from DCR is included in **Appendix LIS-2A**. As stated in the letter, DCR reviewed the surrounding area and responded that there were no documented natural heritage resources within two miles of the project boundary, and that there are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity. An additional request was submitted to expand the area of interest to a 5-mile buffer around the site. The response from DCR is presented in **Appendix LIS-2A.** Since the original Part A submittal, no new parks or recreation areas have been developed within the 5 mile radius by DCR.

As depicted on **PTA Attachment IX – Figure 2- Regional Map**, portions of the Cumberland State Forest fall within five miles of the project site. The Cumberland State Forest is managed by the Virginia Department of Forestry. The proposed project is not anticipated to have an impact on the forest. Below are four factors that were considered in evaluating the potential impacts that are typical concerns related to landfills, including visual, traffic, odor and vectors.

Visual: The edge of the forest is approximately three miles west of the proposed landfill site. State Route 45 is approximately 2.5 miles west of the site and loosely follows a ridgeline between the site and the forest. The elevation difference from the edge of the forest and the ridgeline is approximately 50 feet of rise according to the USGS 7.5' Topographic Quad, Whiteville. This same topo map indicates that there is at least 100 feet of fall from the ridgeline to the proposed base of the project. This change in elevation, the ridgeline, and the surrounding trees that make up the forest provide a visual buffer that is anticipated to eliminate any visual impact to the forest.

Based on the geometry explained above, a person standing at the edge of the forest, looking up at the ridge line toward the proposed project (provided conditions are conducive to seeing three miles), would be looking at a point that is approximately 410' above the existing grades in the area of the proposed facility. This assumes that the line of sight from the edge of the forest to the ridgeline is unimpeded by any trees. Below is a sketch depicting the geometry discussed herein.



Traffic: It is anticipated that most of the traffic related to the proposed site will come from the east. Since the forest is west of the site, impacts to the forest from landfill traffic are anticipated to be minimal along Route 60, with no detrimental impact anticipated on the local routes around and through the State Forest due to little to no new traffic in the area created as a result of this project.

Odor: Green Ridge, through its Host Agreement with Cumberland County, has pledged to not accept many common waste types that contribute to odors that can be emitted from a landfill. The materials that are deemed unacceptable at the Facility include sludge, fly ash, drywall, and material amounts of animal carcasses during a one-day period. Additional best management practices will be employed by the Facility to reduce and/or eliminate odors. These will include the installation and operation of a landfill gas extraction system, daily cover, the use of rain cover, and partial closure of completed disposal phases. The gas extraction system will harvest the gas, and use the gas to either produce electricity, or in an evaporator system designed to reduce the quantity of leachate that needs to be treated.

Vectors: Vectors (including rodents, birds, insects) will be managed through many of the same best management practices that are used to control odors. These will include the use of daily cover, minimizing the working face to the smallest size practical, employing rain covers, and partial closure of completed portions of the landfill. Green Ridge will also seek outside vendors to assist with pest management should a situation arise where this is necessary.

4.2 Wildlife Management Areas

Wildlife Management Areas in Virginia are managed by the Department of Games and Inland Fisheries (VDGIF) now designated as the Virginia Department of Wildlife Resources (DWR). Since the original Part A submittal, no new Wildlife Management Areas areas have been developed within the 5 mile radius by DWR.

Their website locator map: (https://www.dgif.virginia.gov/wp-content/uploads/wmalocator.pdf) shows that there are no wildlife management areas as managed by VDGIF in Cumberland County. A copy of that map is included in **Appendix LIS-2B**.

The United States Forest Service does not have any wildlife management areas in Cumberland County.

In addition, a Threatened and Endangered Species review was conducted by Koontz Bryant, Johnson Williams. Their Summary report (dated December 9, 2019) was originally submitted with the initial Part A. However, for this TR 2 update, the data bases have been revisited and the updated report, dated April 21, 2023 is presented in **Appendix LIS-2G.**

4.3 Public Water Supplies

Pursuant to the requirements of Code of Virginia §10. 1-1408.4.B.3 no new sanitary landfill shall be constructed within 3 miles upgradient of any existing surface water or groundwater public water supply (PWS) intake or reservoir (unless certain criteria, monitoring requirements, and design considerations are met). Under no circumstances will any new sanitary landfill be permitted within one mile of any public water supply system.

A "*public water supply*" or "*community water system*" (C) is defined in the Virginia Department of Health (VDH) regulations as serving more than 25 year-round residents, or having at least fifteen service connections. This is the type of water system commonly understood to be a "*public water system*".

Additionally, water systems serving the same population daily, but in a non-residential setting, (e.g. schools) are classified as a non-transient, non-community public water system (NTNC). Water systems serving a transient population in a non-residential setting (e.g. restaurant or campground) are classified as a transient, non-community public water system (NC). Standards for each of these three system types are different, with the highest standards set for the community water systems (C).

VDH records were searched for all three forms of public water systems in Cumberland and Powhatan counties. A list of the systems is included in **Appendix LIS-2C**. Goochland County was not included in the search because it is located more than five miles from the Green Ridge Facility boundary (regulatory requirement). Goochland County is also north of the James River, which is a presumed hydrologic divide and barrier to groundwater flow from areas south of the River.

In addition to the records search, a review of aerial photography on Google Earth was conducted, looking for evidence of land uses indicating a public water system. Following this aerial review, a windshield survey was completed along public roads within five miles of the Green Ridge Facility boundary.

A total of ~~28~~ 32 public water systems (including the four transient non-community water systems identified below) within Cumberland and Powhatan counties were identified and plotted, to determine location and distance relative to the Facility's Waste Management Boundary (WMB). Per DEQ *Solid Waste Permitting*

Submission Instructions (IV.D.3, and §9 VAC 20-81-120.C3,120.I, and 460.H.), all public water systems within five miles of the WMB are shown on **PTA Attachment IX- Figure 3 - Regional Map**. Based on this analysis, the Green Ridge Facility is not located upgradient of, nor within three miles of any public water systems.

The Virginia Department of Health - Central Office also conducted a similar review and confirmed these findings (see email in **Appendix LIS-2C**). Four transient non-community water systems and one non-transient non-community water system are located within three miles of the Green Ridge Facility and are discussed below.

4.3.1 Public Water Systems Within Five Miles

Rising Zion Baptist Church (PWSID# 02124343) is located 1 mile south of the closest point of the Green Ridge WMB along Route 60 in Cumberland, VA. One groundwater well supplies the Church which is a transient non-community (NC) system. An NC system has a lower level of regulation than a "public water supply" or "community water system" (C) which is defined by the VDH as serving more than 25 year-round residents, or having at least fifteen service connections. There is no information available on the Rising Zion Baptist Church well construction. Available VDH information for this well has been included in Appendix LIS-2C. The Green Ridge facility is NOT *upgradient* of the Rising Zion Baptist Church and will not impact this transient non-community water system.

Oak Grove Baptist Church is located 2.85 miles west of the closest point of the Green Ridge WMB along Route 45 in Cumberland, VA. The Oak Grove Baptist Church well is a transient non-community system (lower level of regulation than a public water supply system as defined by VDH) and is located up-valley from the Green Ridge facility at the border of the Trice Lake-Willis River water shed and the Muddy Creek watershed. There is no information available on the well construction. There was no VDH information available for this well. The Green Ridge facility is NOT *upgradient* of the Oak Grove Baptist Church Rising Zion Baptist Church and will not impact this transient non-community water system.

Shiloh New Covenant Church (PWSID# 09124005) is located 2.94 miles southwest of the closest point of the Green Ridge WMB along Route 60 in Cumberland, VA. The Shiloh New Covenant Church well is a transient non-community system (lower level of regulation than a public water supply system as defined by VDH) and is located upgradient from the Green Ridge facility in the Maxey Mill Creek-Deep Creek watershed. Available VDH information for this well has been included in Appendix LIS-2C. This well is 500 feet deep with an approximate yield rate of 3 gpm. The Green Ridge facility is NOT *upgradient* of the Shiloh New Covenant Church and will not impact this transient non-community water system.

Envigo Red #2 and Yellow #2 (Waterworks Operation Permit # 5049110; 3/9/2021) are permitted supply wells located approximately 2.6 miles south of the closest point of the Green Ridge WMB in Cumberland, VA. The Envigo wells are non-transient non-community system (lower level of regulation than a public water supply system as defined by VDH) and were not permitted when the initial Part A application was submitted for the Green Ridge Facility. Available VDH information for this well has been included in Appendix LIS-2C. The Envigo wells would not be impacted by the Green Ridge Site because

the wells are in different watersheds (HUCs): the Green Ridge Facility is in the Muddy Creek watershed (020802050402), whereas the ENVIGO facility is in the Maxey Mill-Deep Creek watershed (020802050404). The divide between these two watersheds is approximately at the US Route 60-Pinegrove Road - Frenchs Store Road intersection. North of that point, flow is toward Muddy Creek. VDH - ODW has indicated that the agency issued a letter of intent to invalidate the permit on September 23, 2022 based on closure of the facility and service to less than 25 people. VDH-ODW staff performed a site visit in October 2022 to confirm this information and noted only two employees were on staff at that point.

Fairview Farm Events (PWSID# 4145170) is located on Ballsville Road in Powhatan, Virginia. The supply well is located 3.96 miles southeast of the closest point of the WMB, and 3.06 miles from the closest point of the Green Ridge Facility boundary (access road off Route 60). This is a transient, non-community system (NC - lowest level of regulation) with a groundwater source, a listed service population of 30, and a source capacity (Well No.1) of 5,760 gallons per day (gpd). However, the system only has a permitted flow capacity of 215 gpd, based on design factors.

The supply well was completed on April 19, 2016 by Anderson Well Drilling and was constructed to a total depth of 423 feet, with 72 feet of PVC casing grouted to a depth of 50 feet. Pump testing results indicated a yield of 4.6 gpm after 24 hours of pumping, with a static water level of 22 feet. The VDH Engineering Description Sheet describing the water system, the well drilling log, and the pump testing results are included in **Appendix LIS-2C**.

The Green Ridge Facility is over three miles from, and *NOT upgradient* of the Fairview Farm Events public water system. Two natural drainage systems separate the Green Ridge Facility from the Fairview Farms Events water system: Maple Swamp Creek and Deep Creek, both serving as hydrologic divides and barriers to flow between the two sites. Topography indicates surface and groundwater flow at Fairview Farm Events is northward to Deep Creek, in the direction of the Green Ridge Facility. There will be no impact to this public water system from the Green Ridge Facility.

4.3.2 Additional Systems Worth Noting > 5 Miles

No other public water systems were identified within the five-mile radius of the WMB, however there are a few other water systems worth noting at this time, addressing in advance any potential questions or concerns that may arise during the permitting process.

Cozy Acres Campground (PWSID# 4145080) is located approximately 6 miles east of the Green Ridge Facility along Ridge Road in Powhatan, Virginia. One groundwater well supplies the system and is located 5.71 miles southeast of the closest point of the WMB. This is a transient non-community system (NC - lowest level of regulation) with a groundwater source, although there is no information available on the well construction. The VDH Engineering Description Sheet is included in **Appendix LIS-2C**. The design capacity is 5,700 gpd, serving 144 campsites (assumes two persons per site), a bathhouse and a trading post.

The Green Ridge Facility is over five miles from, and *NOT upgradient* of the Cozy Ares Campground public water system. Four natural drainage systems separate the Green Ridge Facility from the Cozy Acres Campground water system: Maple Swamp Creek, Deep Creek, Moore Creek and an unnamed tributary to Deep Creek. All of these drainages combine to provide a distinct hydraulic barrier to flow between these locations. Topography indicates surface and groundwater flow at Cozy Acres Campground is westerly to the unnamed tributary to Deep Creek, in the direction of the Green Ridge Facility. There will be no impact to this public water system from the Green Ridge Facility.

Cumberland County Water System (PWSID# 4049150) is located over 7 miles southwest of the WMB along US Route 60 in Cumberland Courthouse, Virginia. Due to its size and its status as a public community water system (C - highest level of regulation), it is worth noting here. The system is supplied by three groundwater wells ranging in depth from 264 to 678 feet, the closest of which is 7.38 miles southwest of the closest point of the WMB. This well is located on Foster Road, behind the Cumberland Courthouse. The system has a greensand filtration system, and a total demand of 185,800 gpd. More information is available about this water system in the VDH Engineering Description Sheet included in **Appendix LIS-2C**.

The Green Ridge Facility is over seven miles from, and *NOT upgradient* of the Cumberland County public water system. Several natural drainage systems separate the Green Ridge Facility from the Cumberland County water system. There will be no impact to this public water system from the Green Ridge Facility.

Lakeside Village (PWSID# 4049400) is located 6.97 miles to the northwest of the WMB along Trice Lake Road in Cumberland County, Virginia. This is a public community water system (C - highest level of regulation) and is supplied by groundwater. The Green Ridge Facility is over six miles from, and *NOT upgradient* of the Lakeside Village public water system.

Three significant natural drainage systems separate the Green Ridge Facility from the Lakeside Village water system: Muddy Creek, Davis Creek and the Willis River. There will be no impact to this public water system from the Green Ridge Facility.

Cartersville Estates Mobile Home Park is located 3.5 miles to the northwest of the WMB, along Cartersville Road (SR 45). From a regulatory perspective, this is not a public water system as it has fewer than 15 connections. VDH records do not list this as a public system, nor was it identified as a public water system by the VDH during their research. However, being a small community water system, it is worth noting in the permitting process. No detailed information was collected for this system, which appears to be groundwater based.

The Green Ridge Facility is over three miles from, and *NOT upgradient* of, the Cartersville Estates Mobile Home Park. Two significant natural drainage systems separate the Green Ridge Facility from the Cartersville MHP: Muddy Creek and Davis Creek. There will be no impact to this water system from the Green Ridge Facility.

Cobbs Creek Reservoir is a public community water system reservoir under construction approximately 11 miles northwest of the Green Ridge Facility. This is a surface water system, drawing water from the James

River at a location approximately 11 miles upstream from the mouth of Muddy Creek, the main surface water body flowing adjacent to the Green Ridge Facility. Three major drainage systems separate the reservoir location from the Green Ridge Facility: Muddy Creek, Davis Creek and Willis River. The intake for this reservoir will not be impacted by the Green Ridge Facility.

4.4 Marine Resources

Marine resources are defined as "materials and attributes found in the ocean that are considered to have value." Cumberland County is in the Piedmont Physiographic Province of Virginia. Strictly speaking, marine resources will not be impacted by the project.

However, the Virginia Marine Resources Commission has jurisdiction over any encroachments in, on or over the beds of the bays, ocean, rivers, streams or creeks, which are the property of the Commonwealth. Accordingly permitting with VMRC could be required for the project. The Virginia Marine Resources Commission (VMRC) was contacted for their opinion of impacts from the proposed project. A response letter was received and is presented in **Appendix LIS-2D.** While the ~~project site is withing~~ Waste Management Boundary is within the jurisdictional areas of the VMRC, any impacts within this boundary will be addressed during the Joint Permit Application process. The initial disposal unit area will not impact any streams or wetlands. Thus, the previous JPA was withdrawn on _____ and VMRC, ACOE, and DEQ-VWP permitting is not required for the Part A application. Future expansions to the disposal area, if undertaken, may require appropriate JPA permitting during the Part B application process.

4.5 Wetlands

Koontz Bryant Johnson and Williams delineated all wetlands across the Facility and submitted their results to the Army Corps of Engineers on May 11, 2018 as part of a request for a Preliminary Jurisdictional Determination (PJD). The wetland delineation maps and the final Preliminary Jurisdictional Determination from the Army Corps dated August 22, 2019 and signed PJD form are contained in **Appendix LIS-2E** .

In the course of numerous site visits and discussions with ACOE and DEQ-VWP, it was determined that a supplement to the original PJD was needed to modify several stream reaches and to add in small areas of wetland. This supplement was submitted to the ACOE on February 28, 2023. Approval is pending.

~~The design of the facility has been modified, and~~The initial disposal unit area has been established under TR 2 and now there will be no impacts to streams or wetlands for this project under this Part A. The previously submitted JPA was withdrawn on _____ and VMRC, ACOE, and DEQ-VWP permitting is not required for ~~the current project.~~the Part A application. Future expansions to the disposal area, if undertaken, may require appropriate JPA permitting during the Part B application process.

4.6 Historic Sites

~~During 2018 and 2019, Browning and Associates, LTD completed a Phase 1 Cultural Resources Investigation of the Facility and surrounding areas. This included both a Phase 1A investigation (desktop and site walkover), as well as a Phase 1B investigation, (more detailed site investigations including over 2000 shovel test pits, metal detecting, and sampling of artifacts). Their report is undergoing final review and will be submitted under separate cover.~~

~~A project review application was submitted to the Virginia Department of Historic Resources on June 23, 2019,~~ ~~**Appendix LIS-2F.**~~

~~An August 16, 2019 response from the VDHR was received and is also included in~~ ~~**Appendix LIS-2F**~~. ~~The VDHR recommended the completion of a Phase 1 cultural resources survey, which has since been completed by Browning and Associates, and which will be submitted to the VDHR for their review.~~

Since the original Part A was filed a significant amount of work has been completed by Green Ridge to evaluate historic resources. The following provides a chronological (by topic) representation of the major correspondence to/from Green Ridge and the Virginia Department of Historic Resources (DHR) from 2020 through 2023:

- A project review application was submitted to the DHR on June 23, 2019.
- Response from DHR received on August 16, 2012 recommending the completion of a Phase 1 cultural resources survey.
- A Phase I Cultural Investigation was conducted by Browning & Associates and a report on the study was submitted by TRC to DHR in March 2020. DHR provided comments (4/30/20) on the study, and as a result, additional work was conducted (including additional structure evaluation and a viewshed analysis). This comment response was submitted to DHR by TRC (11/11/20). DHR provided comments to that response (3/19/21) and TRC provided additional responses (4/13/21).

  On May 3, 2021, TRC provided a Revised Phase I Cultural Resources Investigation that incorporated the comment responses (above) to DHR, followed by a submittal of the same to DEQ – SW and ACOE on May 10, 2021. On June 3, 2021, DHR provided a letter stating that the Revised Phase I Cultural Resources Investigation satisfies the DHR request and accepted the report and its conclusions regarding the various potential historic sites on the Green Ridge property. The Phase I Cultural Investigation identified two areas within the Disposal Unit (Chimney in the Field – 44CM0138 and Jeffries Site - 44CM0136) that would require further evaluation (Phase II). Another area called the "Frog Site", 44CM0137, was identified in the Disposal Unit but because of the disturbance observed in and around the staging area, was thought to have a low probability to contain intact subsurface deposits. Thus, the research potential of deposits at this site was thought to be low and no additional work was recommended. Because of this recommendation, this site was removed from the Part A drawings as irrelevant to further discussion.

- Based on the conclusions from the Phase I Investigation, Browning & Associates submitted a mitigation plan (9/14/2021) to DHR to address the mitigation of adverse effects upon the Pine Grove School, Melrose and Clinton Manor. Additionally, on November 1, 2021, Browning & Associates submitted to DHR Memoranda of Agreement (MOAs) for the mitigation plan.

  The proposed mitigation includes digitization of data from the census and historical maps for all of Cumberland County, as well as accurately characterizing the Reverend's Still site. Follow up on the status of the MOAs was sent via email (from Browning to DHR) on August 4, 2022; specifically, based on "re-activation" of ACOE (based on submittal of comment responses on JPA) and the potential for moving forward with the mitigation discussed above.

  DHR responded via email on that DHR had received no communication from ACOE and that DHR would not provide approval for mitigation as it would have to wait for the Section 106 process to catch up. Further, the email states that DHR is in no position at this time, nor has the authority to approve any proposed mitigation.

- In November and December 2021, the submittal of a Preliminary Information Form (PIF) from a local citizens group was made to DHR, and proceeded through various state and federal agencies, requesting the formation of a Pine Grove School Rural Historic District[1]. These documents were provided to Browning & Associates by DHR in December (12/13/2021) via email. Green Ridge legal consultants provided comments on the PIF (2/3/2022). DHR responded on 2/28/22 with additional clarification on the PIF process[2].

- Browning & Associates conducted extensive field investigation of the Chimney in the Field (Site ID 44CM0138) and prepared the Phase II report for submittal (by TRC) to DHR on June 9, 2022. Comments from DHR on the Phase II report on the Chimney in the Field were received on August 24, 2022. These comments indicate concurrence that this site is not likely individually eligible for National Register of Historic Places (NRHP). However, it states that the site could be a contributing resource to the NRHP-eligible Pine Grove School Rural Historic District, although the research potential at the site is largely exhausted and additional data recovery may not be warranted, direct impacts would adversely affect the district (assuming the PG School Historic District) and some resolution is warranted.

[1] On December 9, 2021, DHR's State Review Board (SRB) supported the December 2, 2021 recommendation of DHR's National Register Evaluation Committee that the Pine Grove School Rural Historic District (DHR ID #024-5125) is eligible for listing in the Virginia Landmarks Register and that it proceed to nomination on the NRHP. This nomination procedure is still underway, per our current understanding.

[2] The DHR response to the GR comments did not rescind the SRB's procedural approval of the PIF but did acknowledge that the PIF conflates and confuses the historic listing process with the ongoing environmental review of the proposed Green Ridge Landfill.

- On February 3, 2023, the Phase II report on the Jefferies Site (now known as Buena Vista – Site ID 44CM0136) as prepared by Browning & Associates was submitted by TRC to DHR. Comments from DHR have not yet been received.

The following documents are included in **Appendix LIS 2F**:

- "Green Ridge - Updated Phase I Cultural Resources Investigations, Cumberland County, Virginia" dated April 2021, prepared by Browning and Associates.
- "Chimney in the Field – Phase II Evaluation of Site 44CM0138, Cumberland County, Virginia," dated June 2022, prepared by Browning and Associates.
- "Buena Vista – Phase II Evaluation of Site 44CM0136, Cumberland County, Virginia," dated December 2022, prepared by Browning and Associates.
- "Cultural Resources Evaluation: 3 Alternatives to the chosen alternative at the Proposed Green Ridge Landfill, Cumberland County, Virginia", dated 2019, prepared by Browning and Associates.

4.7 Fish and Wildlife

Several Virginia agencies keep databases on fish and wildlife and threatened and endangered species. These include:

- Virginia Department of Conservation and Recreation – Division of Natural Heritage – Biotics Data System (natural resources and ecologically significant sites.) https://www.dcr.virginia.gov/natural-heritage/rare-species-com
- Virginia Department of Game and Inland Fisheries (vertebrates and invertebrates) https://www.dgif.virginia.gov/wp-content/uploads/virginia-threatened-endangered-species.pdf
- Virginia Department of Agriculture and Consumer Services (Plants and insects) https://www.vdacs.virginia.gov/plant-industry-services-endangered-species.shtml

Please see, *Threatened and Endangered Species Summary* **(Appendix LIS-2G)**, prepared by Koontz, Bryant, Johnson, Williams Group, April 21, 2023 for a more detailed summary of potential threatened and endangered species impacts. The April 21, 2023 document was prepared for TR 2 as an update as required, and replaces the previous documentation. Conclusions remain the same.

A mussel survey was conducted by Daguna Consulting, LLC on May 25 and 26, 2019 at Muddy Creek and Maple Swamp Creek. Results of the survey concluded that Muddy Creek supports a low-density mussel population that is comprised of common species, and the tributaries to Muddy Creek from the Green Ridge property do not exhibit signs of suitable habitat for mussels. Additionally, Maple Swamp Creek and its tributaries did not exhibit any signs of habitation by native mussel species. The final report is provided in **Appendix LIS-2G**.

4.8 Water Quality

4.8.1 Surface Water

USGS quadrangle maps were used to identify surface water resources within five miles of the Facility. In addition, mapping of surface waters and wetlands within the site has occurred and that information is available in **PTA Attachment XXII – Wetlands Demonstration**. The Virginia DEQ web site was used to obtain information on impaired surface waters.

Muddy Creek, a perennial stream flowing west to east across the northern portion of the site, is the main receiving water for the proposed Facility. Approximately 90% of the ~~Disposal Unit~~Waste Management Boundary is located within the Muddy Creek Basin. Muddy Creek discharges to the James River approximately 5.6 miles northeast of the Facility. There are approximately 10 miles of stream length along Muddy Creek between the Facility and the James River.

A portion of the southeast corner of the Facility drains into the Maple Swamp Creek basin. Maple Swamp Creek discharges to Muddy Creek approximately 0.6 miles downstream from and northeast of the Facility. Muddy Creek and Maple Swamp Creek, and their smaller tributaries, are the only surface water drainages that are direct receiving waters from the Facility.

Several other major surface water drainages that are not receiving waters for the Facility are located within five miles of the Facility. These include Davis Creek, located approximately 2.1 miles north-northwest of the Facility. Davis Creek flows northeasterly and discharges to Muddy Creek approximately 3.5 miles north-northeast of the Facility. Located northwest of the Facility at approximately 4.6 miles is Deep Run, a small drainage that also discharges to Muddy Creek just upstream from its mouth at the James River. Tributaries to the Willis River, the main stem of which is more than 5 miles from the Facility, are located approximately 3.5 miles northwest of the Facility. Approximately 2.5 miles south of the Facility, and on the opposite side of a major drainage divide, is Maxey Mill Creek, which discharges into Deep Creek at a location 2.9 miles southeast of the Facility. Deep Creek discharges to the James River at a location 7.6 miles to the northeast of the Facility.

Surface water resources within the 5-mile radius are shown on Figure **LIS-2H-01 Surface Water Resources**. Streams that are classified as impaired resources are shown in red and yellow. Information on impaired surface water bodies was obtained from the DEQ 2022 Impaired Waters 303(d) data associated with the 2018 305(b)/303(d) Water Quality Assessment Integrated Report. Davis Creek is identified as an impaired water body along its entire 7.68 miles length, from its headwaters to its mouth at Muddy Creek, due to *Escherichia coli*. Muddy Creek is impaired through the 3.58 miles reach from its confluence with Davis Creek downstream to its mouth at the James River, due to dissolved oxygen.

4.8.2 Groundwater

Groundwater is utilized as a source of drinking water in the vicinity of the Facility. This is true throughout the Piedmont Province as well, including the area within the five-mile radius of regulatory concern.

Information about public water systems is contained in previous section LIS- 4C. This section of the LIS focuses on groundwater as a resource utilized by private drinking water supplies.

Both the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)** and well records (logs) for private water wells help to characterize and assess the potential impacts to this resource. Per the DEQ Solid Waste Permitting Submission Instructions IV.D.2, and §9 VAC 20-81-460.C., "all water supply wells, springs or intakes, both public and private", within 500 ft. of the Facility Boundary are shown on **PTA Attachment IX-Figure 2 – Near Vicinity Map**. There are no known springs in use for water supply or public water supplies within this perimeter. Private wells exist within the 500-ft perimeter.

It should be noted that inconsistencies in GIS parcel maps, changes in ownership over the years since drilling, incomplete record keeping at the Virginia Department of Health (VDH), and a lack of reporting of logs (especially older wells), all contribute to inherent inaccuracies in locating water wells, and matching logs to a particular property. Through the permitting process, corrections and additional information about nearby water wells may emerge.

VDH was contacted for information about drinking water wells in the area **(Appendix LIS-2H-03)**. Logs for wells along Pinegrove Road and Miller Lane/Alder Lane were requested. Logs for wells along these roads provide useful information relevant to the analysis (even if that well is outside the 500-ft. perimeter around the Facility Boundary). Logs and additional information on private wells is found in **Appendix LIS-2H-04.**

Well logs were also sought for homes along abutting portions of US Route 60, Blenheim Road, Mosby Lane, Lily Lane, Pine Cove Trail and Brown Road.

Tax parcels interior to and exterior to the Facility are shown on **PTA Attachment IX- Figure 2 – Near Vicinity Map**, and were investigated for the presence of a water supply well. Although all tax parcels within the 500-ft. perimeter are shown on **PTA Attachment IX- Figure 2 – Near Vicinity Map,** if the well is known or suspected to be outside the 500-ft. perimeter, it is not shown on the map. **LIS-2H-02 - Table 1** shows a listing of tax parcels within this 500-ft. perimeter and the status of information relative to water supplies.

The locations of most private wells adjacent the site were obtained through a windshield survey, during which wells were visually identified and their locations recorded on field maps. For parcels where a well could not be visually verified (but a dwelling was present), a record review was conducted. Land records at the Cumberland County Courthouse were traced back to determine the original dwelling builder (and assumed original name on well drilling log and building permit). VDH records were searched for building permit plats showing well locations at the time of dwelling construction under the original owner. Lastly, to further aid in determining well locations, an unmanned aerial vehicle (drone) was used to fly selected areas around the site.

A total of forty-four (44) private drinking water wells (32 known, 12 assumed) were identified within the 500-ft. perimeter around the Facility boundary, **(PTA Attachment IX- Figure 2 – Near Vicinity Map)**.

Assumed wells are those not directly observed, but assumed to exist based on the presence of a dwelling, information from building plats, or from drone footage. During the permitting process, it is anticipated that further clarification on assumed well locations and/or additional information on existing wells may emerge.
Well records (drillers logs) obtained from the VDH are not available for many of the wells near the site, however logs for 18 wells could be matched to particular parcels. The logs and associated VDH permit plats (where available) showing well locations, are included in **Appendix LIS-2H-04**. A summary of the information from the logs is contained in **LIS-2H-02 - Table 1**. For the TR 2 submittal, Table 1 was reviewed and updated as appropriate. Specifically, property owners have changed, and some parcels have been subdivided since the original submittal. In the following sections, information from these logs is used to help characterize the resource, demonstrate how it is being used, and inform ways to monitor and protect it.

Examination of **PTA Attachment IX- Figure 2 – Near Vicinity Map** shows that the distribution of nearby water wells group into five main clusters as discussed below. All depths referred to in the following discussion are in feet below ground surface (bgs).

Cluster: Miller Lane/Alder Lane

Hydrogeology
Along Alder Lane, and Miller Lane north of Alder Lane, there are a total of 14 wells (9 observed, 5 assumed). Per the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)**, and the Potentiometric Surface Maps **(PTA Attachment XV)**, the direction of groundwater flow in the vicinity of these wells is west, toward an unnamed tributary to Muddy Creek, which bisects the Facility into an eastern and western side. Groundwater flow is toward the Facility, which is located downgradient of these wells. No portion of the Facility is located upgradient of these wells. All wells in this area are at least 500 ft. from the Waste Management Boundary. ~~The closest well is more than 2500 ft. from the (waste) Disposal Unit, and the most northerly of this group of private wells is over 5000 ft. from the Disposal Unit.~~

~~Only the~~The western side of the Facility will contain ~~a Disposal Unit~~the initial disposal unit area. The unnamed bisecting tributary provides protection to these wells as a hydraulic barrier (sink) that will redirect any groundwater flow from the Disposal Unit away from wells along Miller Lane.

At the northern end of this grouping of wells, groundwater flow is more northwesterly toward Muddy Creek (instead of the unnamed tributary).

Well ID #07-124-087 – Lot 45-A-2-G3 – 180 Miller Lane
There may be two wells on this lot, ~~(located more than 2500 ft. from the Disposal Unit),~~ as there are two sets of information (see well logs in **Appendix LIS-2H-04)**; however, both wells have the same number assigned - 07-124-087. A well with a small diameter PVC casing was visually observed on the property, which likely corresponds to the log for a drilled well that was constructed on 11/2/2007 to a depth of 205 ft. and yielding 5 gallons per minute (gpm). Casing was installed to 36 ft., which was also noted as the

depth to bedrock. The well was grouted with cement from 0 to 20 ft. Static water level was 25 ft. at the time of completion. No information was presented about the bedrock formation or the location of water bearing fractures.

A July 17, 2009 VDH Record of Inspection however indicates there is a well on this lot that is of large-diameter construction, (bored well-24 inch concrete casing) to a depth of 55.5 ft., and with a construction date of 11/17/2008. Static water level in this well when completed was 30 ft.

If both wells are in fact present, this would indicate capture of groundwater from two zones within the aquifer; one zone near the top of bedrock around 40-50 ft., captured by bored wells and concrete casings, and another zone in the deeper bedrock fracture system, tapped by rotary drilling and smaller diameter casings.

Well ID #07-124-151 – Lot 45-A-4 – 16 Alder Lane

A well was not visually observed on this parcel, only a tiny portion of which is within the 500-ft. perimeter. It is likely there is a well on this parcel based on the match of owner's name to parcel name, and a log for a well here with matching information. Although the tax parcel is within the 500-ft. perimeter, the well is likely not, and is not shown on **PTA Attachment IX- Figure 2 – Near Vicinity Map**. The information from the well is nonetheless useful. The well was drilled on 5/28/2008 to a depth of 305 ft. and yields 2 to 3 gpm. Depth to bedrock is 60 ft. Casing was installed to this depth, and grouted with cement to 20 ft. Static water level when drilled was 40 ft. No information was presented on the log regarding depth of water bearing fractures.

Summary

Based on the limited information available, and other wells of similar construction visible on the windshield survey, there are two zones within the aquifer being utilized in this vicinity. One zone is in the saprolite just above unweathered bedrock, at depths ranging from 36 to 60 ft., and the other is in the solid crystalline bedrock to depths of 300 ft. Static water levels range from 25 to 40 ft. Well yields ranged from 3 to 5 gpm, however higher yields are possible in other wells nearby. This is a limited database, but consistent with other information from the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)** on depth to bedrock and depth to static groundwater levels in the saprolite. Given the location upgradient from the Facility ~~and more than 2500 ft. from the Disposal Unit~~, it is unlikely that wells in this area will be impacted.

Cluster: Access Road/Miller Lane

Hydrogeology

In the area where Miller Lane intersects the proposed access road entrance to the Waste Management Unit, there are currently 8 private drinking water wells, (2 observed, 6 assumed). Per the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)**, and the Potentiometric Surface Maps **(PTA Attachment XV)**, groundwater flow in this area is complex due to a groundwater divide passing beneath the very sharp corner of Miller Lane. Most (>90%) of the approximately 1178 acre Facility drains northward to Muddy Creek; however, a small portion of the southeast corner of the Facility drains southeast to Maple Swamp

Creek, see Hydrogeologic and Geotechnical Report **(PTA Attachment XI)**. This area is where that divide in flow occurs.

Some wells may be within the Maple Swamp Creek (MSC) drainage system, others may not. The well on lot 44-A-23 is most likely within the MSC drainage system, and thus downgradient of the southeastern portion of the ~~Disposal Unit~~Waste Management Boundary. Four other wells to the south of the proposed intersection of Miller Lane with the access road, (Tax Parcels 45-2-3-C; 45-2-3 E1 (two wells) and 45-3-3-E) could potentially be downgradient of a small portion of the ~~Disposal Unit~~Waste Management Boundary. The other three wells to the north of this intersection (Tax Parcels 45-2-1-A1 (two wells) and 45-A-8-A) are not likely to be downgradient of the ~~Disposal Unit~~Waste Management Boundary and more likely to be protected by the headwaters of the stream that bisects the Facility. All wells are more than 500 ft. from the WMB~~,~~ ~~and more than 700 ft. from the Disposal Unit boundary.~~

Particular emphasis should be given to this area when designing the groundwater monitoring program for the Facility. With permission of the owners, all private wells in this vicinity should be monitored/sampled routinely for water quality impacts, including pre-construction sampling.

Well ID #00-124-067 – Lot 44-A-23 – 60 Miller Lane

One of the observed wells (now owned by the Facility), is Well ID #00-124-067. This well is located downgradient from the southeast corner of the ~~Disposal Unit~~Waste Management Boundary and was completed on 8/16/01 to a total depth of 356 ft. Casing was installed to 52 ft., which was also noted as the depth to bedrock. The well does not appear to be grouted. Water bearing fractures were noted in the log at 60 ft. (1.5 -2 gpm) and 215 ft. (total yield of 4 gpm). Water zones are also noted on the log at 45 – 65 ft. and 205 – 225 ft. No information is given on static water level. This well obtains about half of its yield from a shallow groundwater zone located just below the saprolite and into the top of the bedrock surface at around 60 ft., and a deeper zone in the solid bedrock at around 215 ft.

Well ID# 04-124-068 - Lot 45-2-3-E – 62 Miller Lane

Well ID# 04-124-068 was drilled on 10/27/04**.** There are several properties listed under this owner in this vicinity. It is believed that this well is located on Tax Parcel 45-2-3-E. The locational coordinates on the log place it closer to this lot than any of the others listed under that owner. This well is 50 ft. deep, and bedrock is at 50 ft., similar to nearby Well ID #00-124-067. This is what is commonly called a 'bored well', meaning it is a large diameter well, constructed in the saprolite using concrete tiles. The water zone is listed at 30-35 ft., as is the static water level, indicating this is an unconfined aquifer. The bottom of the concrete casing is at 50 ft., and grouted from 20 ft. to the surface. Thus, the capture point for the well is between 30 and 50 ft. below ground. The yield is only 2 gpm. This well is in the Maple Swamp Creek drainage basin; however, it is not directly downgradient of the ~~Disposal Unit~~Waste Management Boundary.

Summary

Based on the limited information above, and other wells of similar construction visible on the windshield survey, there are two zones within the bedrock aquifer being utilized in this vicinity, adjacent to the Facility. One is in the saprolite just above un-weathered bedrock, at depths ranging from 50 -52 feet, and the other

is in the solid crystalline bedrock at depths of over 200 feet. Static water level in the saprolite aquifer is 30 ft., the same as in the Miller Lane/Alder Lane saprolite well. Well yields ranged from 2 to 4 gpm; however, higher yields are possible in other nearby wells. This is a limited database, but consistent with other information from the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)** on depth to bedrock and depth to static groundwater levels in the saprolite. Given the location of wells downgradient of the ~~Disposal Unit~~Waste Management Boundary, and uncertainty relative to a groundwater divide, particular emphasis should be given to this area when designing the groundwater monitoring program for the Facility.

Cluster: Route 60 Facility Entrance

Hydrogeology

This area includes wells at homes along US Route 60 as well as nearby Mosby Lane, Lily Drive, Pine Cove Trail and Blenheim Road. There are 10 observed wells and 1 assumed well within 500 ft. of the Facility boundary. All of these wells are more than 3500 ft. away from and upgradient of the WMB ~~and Disposal Unit~~, and separated from the ~~Disposal Unit~~Waste Management Boundary by Maple Swamp Creek, a hydraulic divide. It is highly unlikely that groundwater in this area will be impacted by disposal operations. Because this area is so far from the Disposal Unit, it is not included in the Hydrogeologic and Geotechnical Report (PTA Attachment XI). Several wells provide information on the groundwater resource in this vicinity.

Well ID #08-124-117 – Lot 45-1-36-A - 2379 Mosby Road

This is a drilled well completed on 6/02/10 to a total depth of 205 ft. Casing was installed to 94 ft., which was also noted as the depth to bedrock. The well was grouted to a depth of 20 ft. No information was noted on water bearing fractures. The total yield is 8 gpm. Static water level is 35 ft.

Well ID #02-124-062 – Lot 45-1-16 - 24 Lily Drive

Two wells were observed on this lot, one drilled well and one bored well. The drilled well was completed on 5/17/02 to a total depth of 200 ft. Bedrock was logged at 70 ft., and casing was installed to 75 ft. and grouted. Water bearing fractures were noted in the log as "most water" at 160-180 ft., with a total yield of 12 gpm. The static water level was 25 ft. at the time of completion, indicating confined conditions in this well, and suggesting the presence of a confining unit protecting the lower aquifer zone. No information is available for the bored well.

Well ID #02-124-159 – Lot 45-1-16-A - 118 Lily Drive

One drilled well was observed on this lot, completed on 4/22/03 to a total depth of 170 ft. and yielding 25 gpm. This well is on tax parcel 45-1-16-A; however, the log indicated it was drilled on parcel 45-1-16-B. There is no such parcel, and it is believed that this well is correctly located on lot 45-1-16-A. Casing was installed to 61 ft., but the log shows depth to bedrock at 65 ft. The well is grouted to 30 ft. Water bearing zones were noted in the log at 140-141 ft. and 155-156 ft. The static water level was 26 ft., indicating confined conditions in this well, and suggesting the presence of a confining unit protecting the lower portions of the aquifer.

Well ID #05-124-164 – Lot 45-A-15-A - 15 Anderson Highway
One bored well was observed on this lot, completed on 12/20/06 to a total depth of 45 ft. and yielding 3 gpm. The lot is within the 500-ft perimeter, but the well is not, and is not shown on **PTA Attachment IX-Figure 2 – Near Vicinity Map**. Large-diameter casing was installed to 45 ft; however, the log shows the depth to bedrock is unknown. The well is grouted to 20 ft. The water bearing zone was noted in the log at 30-33 ft. Static water level is 17 ft. This is shallow saprolite well; however, "White Quartz" was noted at the bottom of the log, so it is likely that this well is completed near the bedrock surface.

Well ID #17-124-071 – Lot 45-A-12-C - 6678 Blenheim Road
One drilled well was observed on this lot, completed on 1/27/18 to a total depth of 475 ft. and yielding 50 gpm. Casing was installed to 64 ft., and the log shows depth to bedrock at 50 ft. The well is grouted to 55 ft. with a cement/bentonite mix. Water bearing zones were not noted in the log. Static water level was 30 ft. at the time of completion. This lot is inside the 500-ft. perimeter from the Facility Boundary; however, the well is not and thus not shown on **PTA Attachment IX- Figure 2 – Near Vicinity Map**.

Summary
Based on the above information, and other wells of similar construction visible on the windshield survey, there are two water zones within the aquifer being utilized in this vicinity. One well is completed in the saprolite just above bedrock, at a depth of 45 ft. (in the one bored well with a log). The yield in the saprolite well was low (3 gpm) with a high static level (17 ft.). Other bored wells nearby are likely to show similar conditions.

Other wells in this vicinity are completed in the solid crystalline bedrock at depths ranging from 170 to 475 ft.; however, in three of the four drilled wells total depths ranged from 170 – 205 ft. It appears likely that adequate supplies of water are available from the crystalline bedrock within the first 200 ft. Water bearing zones (where noted) ranged from 140 to 180 ft. Static water levels in the crystalline aquifer ranged from 25 to 35 ft., and yields ranged from 8 to 50 gpm. Depths to bedrock ranged from 50 to 94 ft. This area appears to be deeper to bedrock and higher in yield than areas near Miller Lane. This information is consistent with that presented in the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)** on depth to bedrock and depth to static groundwater levels in the saprolite.

Cluster: Pinegrove Road South

Hydrogeology
This is a group of homes located just to the south of the Facility, along Pinegrove Road. There are a total of 9 wells (8 observed and 1 assumed well) within the 500-ft. perimeter around the Facility Boundary. Per the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)**, and the Potentiometric Surface Maps **(PTA Attachment XV)**, groundwater in this area flows north, away from these wells, and toward the Facility. All wells are upgradient of, and greater than 500 ft. from, the WMB ~~and Disposal Unit~~.

Well ID #11-124-043 – Lot 44-A-32 - 79 Pinegrove Road

One drilled well was observed on this lot, completed on 6/21/11 to a total depth of 225 ft. and yielding 15 gpm. Casing was installed to 83 ft., and the log shows depth to bedrock at 81 ft. The well is grouted to 81 ft. with a cement/bentonite mix. Water bearing zones were not noted in the log. Static water level was 30 ft. at the time of completion.

Well ID #08-124-054 – Lot 44-2-7-A - 49 Pinegrove Road

This lot and well are outside of the 500-ft. perimeter around the Facility Boundary and were not field located, nor shown on the **PTA Attachment IX- Figure 2 – Near Vicinity Map**. However, based on information received from the VDH, the location can be identified as just south of the 500 ft. Facility ~~perimeter~~Boundary perimeter. Only the VDH Record of Inspection was available, and not the actual driller's log. This is a drilled well, completed on 6/20/08 to a total depth of 181 ft. and yielding 20 gpm. Casing was installed to 55 ft. and the well was grouted to 20 ft. with bentonite. Water bearing zones are not noted on the inspection form, nor was the static water level.

Summary

Both drilled and bored wells were observed south of the Facility along Pinegrove Road and Liberty Lane, although only logs for drilled wells are available. Drilled wells (for which logs are available) are completed in the solid crystalline bedrock at depths ranging from 185 to 225 ft. It appears likely that adequate supplies of water are available from the crystalline bedrock within the first 200 ft. No information on water bearing zones is available. Static water level in the crystalline aquifer is 30 ft., and yields ranged from 15-20 gpm. Depths to bedrock ranged from 55 to 81 ft. This area appears to be deeper to bedrock and higher in yield than areas near Miller Lane. This is a limited database, but consistent with other information from the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)** on depth to bedrock and depth to static groundwater levels.

Cluster: Pinegrove Road North

This area is along the northwest side of the Facility where Pinegrove Road exits the Facility in a northward direction. There are two observed wells in this area, one belonging to the Pinegrove Community Center (Tax Parcel 44-A-17), and the other belonging to Roosevelt Gregory (Tax Parcel 44-A-16). These wells are more than 500 ft. from the WMB, however, per the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)**, and the Potentiometric Surface Maps **(PTA Attachment XV)**, they are located in a general downgradient direction relative to the ~~Disposal Unit~~Waste Management Boundary. It is recommended that these wells be monitored as part of the nearby private well monitoring program offered by Green Ridge. The Part B groundwater monitoring program should also include sentinel well(s) between the Disposal Unit and this area. There are no other wells in this immediate vicinity. Wells further north along Pinegrove Road are more than 500 ft. from the Facility, not downgradient, and separated from the Facility by Muddy Creek, a likely hydraulic barrier. Wells located on properties on Brown Road are also more than 500 ft. from the Facility, not downgradient, and separated from the Facility by an unnamed tributary to Muddy Creek. Both Muddy Creek and the unnamed tributary crossing Brown Road provide a hydraulic divide that will serve to direct flow from the Facility away from wells along Pinegrove Road north of Muddy Creek, and away from wells along Brown Road.

Downgradient of Facility
No Well ID-Pinegrove Community Center – Lot 44-A-17 - 267 Pinegrove Road
One drilled well was observed on this lot, completed on 11/27/91 to a total depth of 145 ft. and yielding 2.5 gpm. Casing was installed to 38 ft., and the log shows depth to bedrock at 36 ft. The well is grouted to 38 ft. with cement. Water bearing zones were not noted in the log. Static water level was at 28 ft. at the time of completion. Bedrock was described in the log as "white and grey type of rock". Overburden is described as "sandy and clay type soil", consistent with findings of the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)**, as is the depth to bedrock in this well.

Upgradient of Facility
Well ID #02-124-345 – Lot 44-1-22 - 302 Brown Road
A very small portion of this lot is within the 500-ft. perimeter of the Facility Boundary but the dwelling and well are not. The well was not field located, nor is it shown on the **PTA Attachment IX- Figure 2 – Near Vicinity Map**. However, a well was completed on this lot on 3/14/02 to a total depth of 41 ft. and yielding 4 gpm. This is a large diameter bored well with concrete casing installed to 41 ft., and the log shows depth to bedrock at 41 ft. The well is grouted to 20 ft. The water bearing zone was at 23-24 ft. Static water level was 23 ft. at the time of completion, same as the encounter depth, indicating non-confining conditions as expected in the saprolite zone of the aquifer.

Upgradient of Facility
Well ID #01-124-012 – Lot 37-2-3 - 385 Pinegrove Road
This well is approximately 1500 ft. from and upgradient of the Facility Boundary, and thus is not shown on **PTA Attachment IX- Figure 2 – Near Vicinity Map**. A large-diameter bored well was constructed on this lot on 4/6/01, to a total depth of 36 ft. and yielding 2 gpm. Casing was installed to 36 ft., (assumed to be to bedrock, although the log does not specify). The well is grouted to 20 ft. with concrete. The water bearing zone is 22-23 ft. The static water level was not noted on the log at the time of completion.

Upgradient of Facility
Well ID #05-124-019 – Lot 37-2-2 - 391 Pinegrove Road
This lot and well are approximately 1500 ft. from and upgradient of the Facility Boundary, and are not shown on **PTA Attachment IX- Figure 2 – Near Vicinity Map**. However, a well was completed on this lot on 4/25/05 to a total depth of 140 ft. and yielding 10 gpm. Casing was installed to 57 ft., and the log shows depth to bedrock at 56 ft. The well is grouted to 20 ft. with bentonite. Water bearing zones were not noted in the log. The static water level was 40 ft. at the time of completion.

Upgradient of Facility
Well ID #09-124-042 – Lot 37-A-63-B - 448 Pinegrove Road
A small portion of this lot lies within the 500-ft. perimeter; however, the house and well are upgradient of and approximately 1000 ft. from the Facility Boundary. The well is not shown on **PTA Attachment IX-Figure 2 – Near Vicinity Map**; however, a well was completed on this lot on 11/8/11, to a total depth of 205 ft. and yielding 7 gpm. Casing was installed to 21 ft., and the log shows depth to bedrock at 21 ft. The

well is grouted to 20 ft. with cement. Water bearing zones were not noted in the log. The static water level was 40 ft. at the time of completion.

Summary
Both drilled and bored wells are present north of the Facility along Pinegrove Road. Bored wells ranged from 36 to 41 ft., with yields of 2-4 gpm. Drilled wells (for which logs are available) are completed in the solid crystalline bedrock at depths ranging from 140 to 205 ft. It appears likely that adequate supplies of water are available from the crystalline bedrock within the first 200 ft. No information on water bearing zones is available. Static water levels in the crystalline aquifer range from 28 to 40 ft., and yields ranged from 2.5 to 10 gpm. Depths to bedrock ranged from 21 to 56 ft. This is a limited database, but consistent with other information from the Hydrogeologic and Geotechnical Report **(PTA Attachment XI)** on depth to bedrock and depth to static groundwater levels.

4.8.3 Mitigating Potential Impacts

Surface Water
The project will not, by law, be permitted to impact applicable surface and/or groundwater resources. Sanitary landfills shall not:

- Cause a discharge of pollutants into Waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to the Virginia Pollutant Discharge Elimination System (VPDES) requirements and the Virginia Water Quality Standards (9 VAC 26-260).

- Cause the discharge of a non-point source of pollution to Water of the United States, including wetlands, that violates any requirements of an area-wide of statewide water quality management plan that has been approved under the Clean Water Act, as amended; or violates any requirements under the Virginia Water Quality Standards.

This includes preventing adverse impacts due primarily to stormwater run-on and runoff, and also to unauthorized discharge of leachate.

The site consists primarily of managed forestland, with deeply incised intermittent streams that discharge into Muddy Creek. ~~An approximate 300-foot~~ Nnatural wooded buffers will be maintained between the ~~Disposal Unit boundary~~Waste Management Boundary and the flood plain of Muddy Creek where practical. In addition, appropriate ~~a minimum 100-foot~~ buffers will be maintained on ~~all~~ streams ~~outside the Disposal Unit boundary.~~within the Facility Boundary as required by regulation.

In the Part B Permit Application, an erosion and sediment control plan and stormwater management plan will be prepared to maintain compliance with the regulations. Implementation of these controls will minimize stormwater discharges to receiving streams and minimize the potential for secondary wetland impacts. The measure will also include run-on controls, such as diversion swales designed to prevent storm

events of a certain size from coming onto the site, or at least active portions of the site. Stormwater erosion and sediment controls will include:

- adequately-sized gravity and pressure system conveyances,
- inlet/outlet and stream bed protection,
- sediment basins with appropriate outlet control structures,
- sediment traps such as silt fencing and rock filter berms,
- stilling basins and similar measures to reduce water velocity,
- seeding and mulching, and vegetated buffers, among others.

A Stormwater Pollution Prevention Plan (SWPPP) will be prepared as part of the VPDES permit requirements.

Groundwater

The Facility will not detrimentally alter or deplete groundwater supplies in the general area of the site. A majority of the 44 private drinking water supply wells identified within the vicinity of the site are upgradient of the Disposal Unit. There are two wells along Pinegrove Road, immediately north of the Facility, that are downgradient of the Disposal Unit. These wells should be monitored (once the owners grant permission). Additionally, there is at least one, and possibly as many as five private wells near the sharp corner of Miller Lane that are potentially downgradient of the ~~Disposal Unit.~~Waste Management Boundary. These wells should be monitored (once the owners grant permission). In the Part B Permit Application, a groundwater monitoring program will be developed that will include an appropriate groundwater monitoring well network to monitor the Facility in accordance with regulatory requirements. There is more than adequate room on the site to develop a monitoring network between the ~~Disposal Unit/~~WMB and the Facility Boundary. In addition, where given permission and where appropriate, other nearby drinking water supplies will be monitored. Mitigation of any impact caused by the Facility will be through the development of an alternate water supply.

Drainage Patterns / Flows

~~During construction and operation, the site drainage patterns will be altered to conform to the design of the Facility.~~

During design, construction and operation, care will be taken to minimize impacts to the site drainage patterns. Impacts to drainage patterns can be considered secondary impacts to the receiving streams and the applicant has committed to DEQ that there will be no primary or secondary impacts to the streams on site from the development of ~~the Facility.~~ the initial disposal unit. Future expansions, if considered, will follow the appropriate permitting requirements in force at the time of design and construction.

Stormwater controls and best management practices will be designed and implemented in accordance with the VPDES permitting process to eliminate impacts. Stormwater containment structures will be designed to a higher standard of care (a larger storm event) to provide additional management capacity. At completion, the project will not detrimentally alter general drainage patterns of the area, as

the landfill will be situated along an existing ridge. ~~There will be no primary impacts to wetlands from the landfill construction or operation. However, there will be impacts to streams located with the landfill footprint, and secondary impacts to wetlands and streams may be present. These secondary impacts will be determined by pre- and post-development drainage patterns and flows. Impacts to streams and wetlands will be mitigated by purchasing credits, as authorized by regulatory agencies.~~

Flood Plain

~~Per the Federal Insurance Administration Flood Insurance Rate Map for the site, no housing/structures will be placed within the 100-year flood hazard area near Muddy Creek. Additionally, none of the project structures will impede or redirect flood flows as the flood area is downstream of the site.~~

~~As mapped by the Federal Insurance Administration the Disposal Unit does not fall within the 100-year flood plain **(see Attachment PTA-XXI)**.~~

See **ATTACHMENT PTA-XXI** for a detailed discussion on the flood plain. Based on the information outlined in this attachment, the Waste Management Boundary is outside of the 100-year flood hazard area near Muddy Creek. In addition, ancillary facilities (including access into the site) supporting the operation, are outside of the 100-year flood hazard area.

Flooding

~~Flippen Lake is located just east of the proposed Facility and has been evaluated with respect to inundation due to breach of the dams. The Disposal Unit will not be impacted by potential flooding caused by breach of the dams.~~

Flippen Lake is located just east of the proposed Facility and under the original Part A was evaluated with respect to inundation due to breach of the dams. Under TR 1, DEQ provided the Department of Conservation and Recreation's simplified dam break analysis. This information was reviewed and incorporated into our documents. The DCR inundation zone information was added to the Near Vicinity Map. The Waste Management Boundary will not be impacted by potential flooding caused by breach of the dam~~s~~. See **Attachment PTA-IX** for the Near Vicinity Map.

The DCR information is included in **Appendix LIS-2H-05**.

4.9 Tourism

In Cumberland County, one site was identified as having potential for tourism located within 5 miles of the proposed project: the Cumberland State Forest. Located within the State Forest is Bear Creek Lake State Park. The potential for impacts to the forest (and thus, the park) is discussed above in Section 4.1, Parks and Recreation Areas. A brochure as distributed by the Cumberland State Forest, and information about Bear Creek Lake State Park are provided in **Appendix LIS-2I**.

5.0 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVE

5.1 Overview

Green Ridge has worked diligently to inform the public on all aspects of the project. As indicated in Section 3.0, County Waste of Virginia considered multiple alternatives and after careful consideration and support from Cumberland County, determined that the current Green Ridge Recycling and Disposal Facility site meets the goals of both the County and County Waste of Virginia. The landfill will be regulated by a number of agencies. A list of regulations that will govern the landfill includes but is not limited to:

- EPA Subtitle D (40 CFR Parts 257 and 258)
- Virginia Waste Management Act (Title 10.1, Chapter 14)
- Virginia Solid Waste Management Regulations (9 VAC 20-81)
    - Siting restrictions
    - Landfill design
    - Construction
    - Operations
    - Closure and post closure care
    - Groundwater monitoring
    - Gas and odor management
    - Leachate management
    - Storm water management
- Financial Assurance (9 VAC 20-20-70)
- Permit action fees and annual fees (9 VAC 20-90)
- Planning Regulations (9 VAC 20-130)
- Operator training (10.1-1408.2)
- VPDES industrial activity stormwater permitting (9VAC 25-151)
- Storm water Regulations (9 VAC 25-870)
- Erosion control regulations (4 VAC 25-840)
- Air permitting – Minor new source review (9 VAC-5-80-6)
- Air permitting – Title V (9 VAC 5-80-1)

- Wetland permitting (9VAC25-210)
- Department of Historic Resources

Submission Instruction No. 1 in referencing PTA Attachment XVII: Landfill Impact Statement – Section V Environmental Consequences of Alternative, states the following: "*Discuss the environmental consequences of each of the alternatives presented in Section III of the LIS, such as loss of land used for forestry, agriculture or other purposes, wetlands and streams, if any, noise pollution, odor and traffic. Discuss how the environmental consequences of the alternatives will be mitigated by meeting the regulatory requirements of the Virginia Waste Management Act and the Solid Waste Management Regulations.*" Because Section 3.0 of the Landfill Impact Statement indicates that based on the goals and objectives of the County and County Waste, there are no other viable alternatives, this section only addresses the chosen alternative.

Potential impacts from the Facility will be mitigated through appropriate design, proper operation, regulatory compliance and enforcement. A brief discussion of potential areas of impact at the Facility follows. The final design will carefully and thoughtfully consider and mitigate environmental consequences of the Facility and set up open communications with the County and the public to verify that mitigation efforts are in place and operating as planned. The County will employ a County Landfill Liaison who's duties will include monitoring and inspection of waste disposal practices at the Landfill and monitoring all requirements of the Host Agreement and zoning. (See Section 3.1 of the Host Agreement).

5.2 Loss of Forestry or Agricultural Land

The majority of the Green Ridge site was previously owned by American Timberland and heavily timbered. Approximately 400± acres were purchased from American Timberland. Historically the site was also farmed but not in recent history. While some timberland will be lost, the County has significant timber resources under management by American Timberland and other companies. The County's comprehensive plan indicates that as of 2006, the County had 119,000 acres of forestland or approximately 60% of the County's total land area. The Green Ridge site (if considered all forest in good condition – which is a conservative assumption) would constitute 1% of the forested land.

Green Ridge has pledged to maintain forested buffers around the facility boundary. The Host Agreement indicates a buffer of 100' to 200' depending on ownership of the adjacent property and its use. This buffer will be maintained as forest.

At the end of usage, the Facility will be maintained as green space. In addition, at the end of usage, Green Ridge will provide a minimum of 25 acres of land for public use.

5.3 Traffic Control

For the original Part A, a traffic impact analysis was completed by Davenport and submitted to VDOT. It received approval from VDOT. (**PTA Attachment XVI**) In that analysis it was assumed that 80% of the regional waste hauling vehicles would access the facility between 6:00PM and 6:00AM, to reduce traffic on Route 60 during peak travel times. At the entrance, appropriate turn lanes, tapers, signage and lighting will be provided to meet VDOT standards. An entrance permit from VDOT is required.

The access road into the site off of Route 60 is approximately 1 mile long. This will allow sufficient queuing space for trucks and allow the trucks to exit Route 60 rapidly.

After further consideration, the daily disposal tonnage is being reduced from a maximum of 5,000 tons per day to 1,500 tons per day for the initial phase of the landfill and the new route for access changed from a private access road to use of Pine Grove Road (Route 654). -The traffic impact analysis has been updated to address this new traffic flow pattern. Accordingly, the information contained in **Attachment PTA-XVI** has beenwill be replaced with the revised informationanalysis and VDOT letter when available. It is assumed that 75% of the regional waste hauling vehicles would access the facility from the east between 6:00AM and 4:00PM (from 6:00AM to 12:00PM on Saturdays).

In addition, the road relocation planned for Pine Grove Road and Miller Lane will be designed to improve traffic flow and safety along the relocated section of the road.

All efforts with regards to traffic control will conform to VDOT requirements and in accordance with subsequent permit approvals in addition to requirements as may be set forth in the Host Agreement and Conditional Use Permit.

5.4 Wetland and Stream Mitigation

VSWMR 9VAC20-81-120.E.1 sets forth requirements relative to landfill development and wetlands as follows: *"New sanitary landfills and expansions of existing landfills, other than those impacting less than 2.0 acres of nontidal wetlands, shall not be constructed in any tidal wetland or nontidal wetland contiguous to any surface water body."* Significant detail has been given to wetland and stream mapping on the site. The ACOE has issued their preliminary jurisdictional approval **(PTA Attachment XXII)** While wetlands are present on the site, efforts have been taken to eliminate primary impacts to wetlands. (**PTA Attachment IX – Near Vicinity Map**). There will be impacts to streams and potentially secondary impacts to wetlands. Green Ridge must adhere to all regulatory requirements and all permitting requirements of the Army Corps of Engineers and Virginia Department of Environmental Quality (VWP) during the development of the site. Permitting is in progress and must address mitigation of impacts.

Mitigation will take the form of avoidance, potential off-site improvements and as needed, the purchase of credits.

VSWMR 9VAC20-81-120.E.1 sets forth requirements relative to landfill development and wetlands as follows: *"New sanitary landfills and expansions of existing landfills, other than those impacting less than 2.0 acres of nontidal wetlands, shall not be constructed in any tidal wetland or nontidal wetland contiguous to any surface water body."* Significant detail has been given to wetland and stream mapping on the site. The ACOE has issued their preliminary jurisdictional approval **(PTA Attachment XXII)** with ACOE approval of a supplement to the original submittal pending. The applicant has committed to DEQ that there will be no primary or secondary impacts to the streams or wetlands on site from the development of the ~~Facility.~~initial disposal unit area. Future expansions to the disposal area, if undertaken, may require appropriate JPA permitting during the Part B application process.

Appropriate stormwater BMPs will be designed, permitted, and installed to protect wetlands and streams from impact. These BMPs will be approved and monitored by the appropriate regulatory agencies.

5.5 Stormwater

Stormwater on site will be managed under multiple regulatory agencies. Both the VDEQ – Land Protection and Revitalization Division (under the Sanitary Landfill Permit) and the VDEQ – Water Division (Individual Stormwater Permit for Industrial Activities) will review and issue appropriate permits. Cumberland County must issue land disturbance permits for construction. Thus, Green Ridge will be bound with regulatory monitoring and reporting requirements as set forth by these agencies.

~~During construction and operation, the site drainage patterns will need to be altered to conform to the design of the Facility. Stormwater controls and best management practices will be designed and implemented in accordance with the VPDES permitting process to reduce potential impacts. Stormwater containment structures will be designed to a higher standard of care (a larger storm event) to provide additional management capacity.~~

During design, construction and operation, care will be taken to minimize impacts to the site drainage patterns. Impacts to drainage patterns can be considered secondary impacts to the receiving streams and the applicant has committed to DEQ that there will be no primary or secondary impacts to the streams on site from the development of the initial disposal unit area. Stormwater controls and best management practices will be designed and implemented in accordance with the VPDES permitting process to eliminate impacts. Stormwater containment structures will be designed to a higher standard of care (a larger storm event) to provide additional management capacity.

At completion, the project will not detrimentally alter general drainage patterns of the area, as the landfill will be situated along an existing ridge.

5.6 Leachate

Leachate will be collected and disposed of in accordance with the Leachate Management Plan which will be submitted during the Part B application process. At this time, it is assumed that leachate will be collected from the landfill cell and pumped into a series of holding tanks. Appropriate backup power generation facilities will be provided. Leachate will be hauled from the site to a permitted wastewater treatment facility. The Part B application must provide evidence of approval for the leachate from the receiving facility. In the future, once sufficient tonnage has been landfilled, an evaporator system will be considered to reduce the volume of leachate that must be hauled off site. An evaporation system will require appropriate permitting with VDEQ including air permitting. At no time will untreated leachate be allowed to discharge off site.

5.7 Odor

Green Ridge has committed to excluding certain wastes from its operations which are known to be odor producing. Per the Host Agreement (Paragraph 1.2), the facility will not accept sludge or recycled/processed construction and demolition debris focusing on sheet rock. In addition, animal carcasses will be controlled and be approved by the County.

The Host Agreement specifically states the following under Section 1.20 relative to odor management: *"Green Ridge agrees to control odor at and around the Landfill property. As required by the Regulations, Green Ridge shall have an Odor Management Plan. To minimize odor, Green Ridge will not accept Sludge. The County shall be provided with a copy of this plan prior to submittal to VDEQ to review for adequacy in addressing complaints, including the timeliness of planned responses, and monitoring odor control activities. Any odor complaint shall be directed to the County and shall be immediately forwarded to VDEQ."*

In addition, Green Ridge has pledged to design and install an active gas system which will collect and burn landfill gas which will reduce not only greenhouse gas emissions but also manage odor.

5.8 Noise and Lighting

Noise and lighting impacts will be managed as outlined in the Host Agreement, Section 1.2.1 which states: *"Green Ridge shall take such steps as are necessary to prevent noise levels associated with operations on the site from exceeding 67 decibels (not including ambient noise) when measures at the property line of the landfill site (not including the normal sounds of trucks entering the site). Except for bird control, no external speakers shall be used at the Landfill. Except for the entrance lighting and lighting at intersections, any and all outside lighting shall be designed so that there is no more than 0.5 foot candles of ambient light conditions when measures at the landfill facility property line. "*

5.9 Summary

In summary, Green Ridge will act thoughtfully and responsibly to minimize impacts and to mitigate rapidly should an issue arise. The landfill operations will be overseen by the County's Landfill Liaison. Design and operational controls must be identified and outlined in detail in the Part B application which will allow public comment once the draft permit is prepared by DEQ. Nothing has been identified in the Part A application that could not be addressed adequately in the Part B.

6.0 COORDINATION

Several agencies were consulted during the process of the LIS and Part A preparation. A list of those agencies and contacts is provided in **APPENDIX LIS-3**.

7.0 LIST OF CONTRIBUTORS

Consultants and/or agencies that contributed in the preparation of this LIS are listed in **Appendix LIS-3**.

8.0 REFERENCES

Sources of information are cited at appropriate locations in the narrative. Consultants and/or agencies that contributed in the preparation of this LIS are listed in **Appendix LIS-3**.

Buena Vista

Phase II Evaluation of Site 44CM0136
Cumberland County, Virginia

December 2022

Prepared By:
J. Craig Rose, M.A.
Browning & Associates, LTD.
138 Scoggins Creek Trail
Hartfield, Virginia 23071

Prepared For:
Green Ridge Recycling and Disposal Facility, LLC
2230 Deer Grove Road
Midlothian, Virginia 23112

ABSTRACT

A Phase II archaeological evaluation was conducted at site 44CM0136 (2.23 acres), located on the ±1,178 acre Green Ridge property, north of the village of Clinton, in Cumberland County, Virginia. The work was carried out between July and December of 2020 by Browning & Associates, LTD of Hartfield, Virginia for Green Ridge Recycling and Disposal Facility, LLC of Midlothian, Virginia. The site was initially recorded in 2018 during a Phase I survey of the Green Ridge property.

The Phase II evaluation included documentary research, pedestrian inspection of the site and surrounding area, close interval shovel testing, and metal detection, followed by the excavation of 20 test units of varying dimensions in artifact concentrations and structure locations and mechanical removal of modern fills in select locations within the site.

Documentary research suggests John and Martha Jeffries inherited a half share of a 400 acre tract then known as "the quarter" from her father, James McLaurine, in 1849 and acquired the remaining half share from Martha's sister Eliza, following her death in 1856. The inherited property, along with a 150 acre parcel acquired in by the Jeffries in 1839, were named Buena Vista. At the time of the inheritance, tax records indicate there were $800 in buildings on the property and by 1851 that value had increased to $1,200. In 1860, Jeffries's estate was valued at more than $25,000, but by 1870 Jeffries was forced to sell the northern half of his farmstead (300 acres) to cover debts amassed during the previous decade. This began a period of decline that continued until the property was sold out of the family in 1975. At that time, the value of structures on the property had decreased to $270. Four years after John and Mary Wick purchased the property from the widow of John Jeffries grandson, the Wicks allowed Warren and Aldine West to dismantle the dilapidated dwelling so that the materials could be used to rebuild an addition on their reconstruction of Edgemont, the former home of John Jeffries father-in-law James McLaurine. The deconstruction of the Buena Vista House and reconstruction of Edgemont are documented in a 1983 article in the Richmond Time-Dispatch by Virginia Churn, titled *Piece by Piece, Plantation Reassembled.*

Phase II fieldwork demonstrated that Buena Vista included a house lot and agricultural area, typical of contemporary farmsteads throughout the Mid-Atlanic region. The house lot encompassed approximately three quarters of an acre and included the remains of an L-shaped dwelling and a smokehouse. The remains of a barn, two outbuildings, and a hog scalding pit were also identified in the surrounding agricultural activity area.

Subsurface testing revealed that much of the house lot was blanketed with a modern fill layer full of architectural debris believed to date to the deconstruction of the dwelling in 1979. Within the cellar, modern fills continued to the basement floor. Outside of the cellar, the modern fill was underlain by an occupation fill that included artifacts spanning the entire site occupation. Beneath the occupation fill along the exterior of the cellar wall, investigators also identified a continuous builder's trench believe to date to the construction of the dwelling. Additional excavations in the locations of the smokehouse, outbuildings, and hog scalding pit identified 2 intact features and stratified cultural deposits dating to the latter part of the site occupation as demonstrated by the presence of wire nails in the deepest fill layers.

Phase II excavations across the site suggest that anything that does remain of the Jeffries tenure is inseparably mixed with the much more prolific evidence of the later site occupation. As such, the Buena Vista site is believed to have limited research value.

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Introduction

Between July and December of 2020 Browning & Associates of Hartfield, Virginia conducted a Phase II archaeological evaluation of the 2.23 acre Buena Vista Site (44CM0136), located approximately 1,200 feet north of the intersection of Pinegrove Road (SR 654) and Miller Lane (SR 685) (Figures 1 and 2). The site is located within the ±1,178 acre Green Ridge property (*survey by Highmark Engineering dated April 17, 2019 and per boundary survey revisions by Draper Aden Associates dated July 18, 2019, November 6, 2019, November 18, 2019, and April 21, 2021*) in Cumberland County, Virginia and was recorded during a Phase I cultural resources survey of the property conducted by Browning & Associates between September 2018 and June 2019 for Green Ridge Recycling and Disposal Facility, LLC of Midlothian, Virginia.

The site was initially identified on the north side of a sharp bend in Pinegrove Road and was observed to contain a telephone pole, L-shaped cellar hole, a timber-framed structure with mortise and tenon joinery and cut and wire nails, a concrete silo base, and at least three piles of brick and stone suggestive of structure locations. Phase IB subsurface testing confirmed the presence of intact, possibly stratified, cultural deposits. Site 44CM0136 falls within the limits of disturbance for the proposed landfill and a Phase II evaluation was recommended to assess its eligibility for the National Register of Historic Places.

Craig Rose, M.A. served as Principal Investigator for the Phase II survey and was the author of this report. Field investigations were carried out by Mike Johnson and Steve Rann under the supervision of Craig Rose. Finds were analyzed and cataloged by Craig Rose and Mike Johnson in Clinton, Virginia. Artifacts and the original copies of field notes and maps are currently housed at the Green Ridge property and will be submitted to the Virginia Department of Historic Resources at the conclusion of this investigation.

All aspects of this investigation conformed to guidelines established in *Section 106 of the National Historic Preservation Act of 1966, as amended*, the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation(Childs et al. 2000)* and the requirements outlined by the Virginia Department of Historic Resources (DHR) in *Guidelines for Conducting Historic Resources Survey in Virginia* (2017)

Geographic Setting

Cumberland County lies within the Outer Piedmont sub-province of the Piedmont physiographic region of Virginia (Bailey 1999). Bounded by the Blue Ridge Mountains to the west and the Fall Line to the east, the Piedmont Province is the largest in Virginia, and is characterized by gently rolling topography and deeply weathered bedrock overlain with a 7 to 70 foot thick layer of saprolite, with elevations ranging between 1,000 feet above mean sea level (a.m.s.l.) along its western boundary and 160 feet a.m.s.l. near the Fall Line (Radford University 2014). Monadnocks, or isolated hills, such as Willis Mountain, approximately 20 miles southwest of the site, are formed from more resistant geologic deposits, and are scattered throughout the Piedmont region (National Park Service 2017). The Piedmont exhibits a dendritic, or vein-like drainage pattern with watercourses that generally flow in a southeasterly direction (Radford University 2014).

Elevations in Cumberland County range from 200 to 500 feet above mean sea level (a.m.s.l.) (Reber et al. 2007). Portions of the county located north and west of Routes 60 and 45 are drained by the James River, with drainage for the remainder of the county provided by the Appomattox River. These rivers converge north of the town of Hopewell, approximately 50 miles east of the site, before flowing into the Chesapeake Bay.

Site 44CM0136 is located on the crest of a broad upland ridge comprised of Appling fine sandy loam (1B) and Cecil sandy clay loam (6B) soils with elevations ranging between 362 feet and 375 feet above mean sea level (a.m.s.l.) (Figure 3). Drainage is provided by intermittent, unnamed tributaries of Muddy Creek located northwest and southwest of the site. Muddy Creek drains into the James River about six miles north of the site, downstream from the town of Cartersville.

Vegetation in the site vicinity is typical of most areas of the Piedmont and has been heavily altered by anthropogenic activities, including agriculture and logging. The forests surrounding the site consist principally of planted loblolly pine. However, much of the site is covered in fallow pasture grass, interspersed with eastern red cedar (*Juniperus virginiana*), black locust (*Robinia pseudoacacia*), and eastern black walnut (*Juglans nigra*).

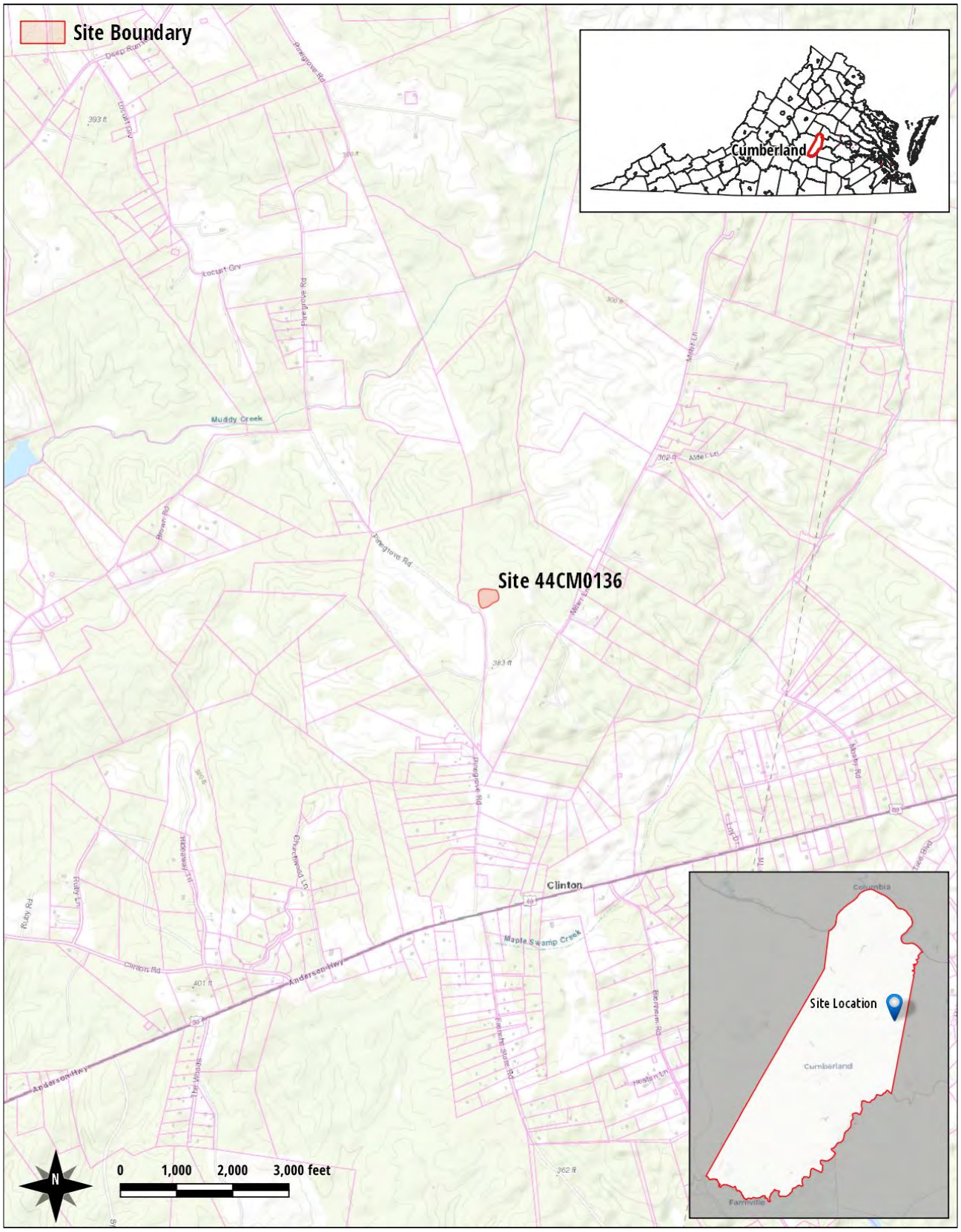

Figure 1: Overview of project area on ESRI Topo World map.

Figure 2: Location of the project area on the 1969 USGS Trenholm and Whiteville 24K quadrangles.

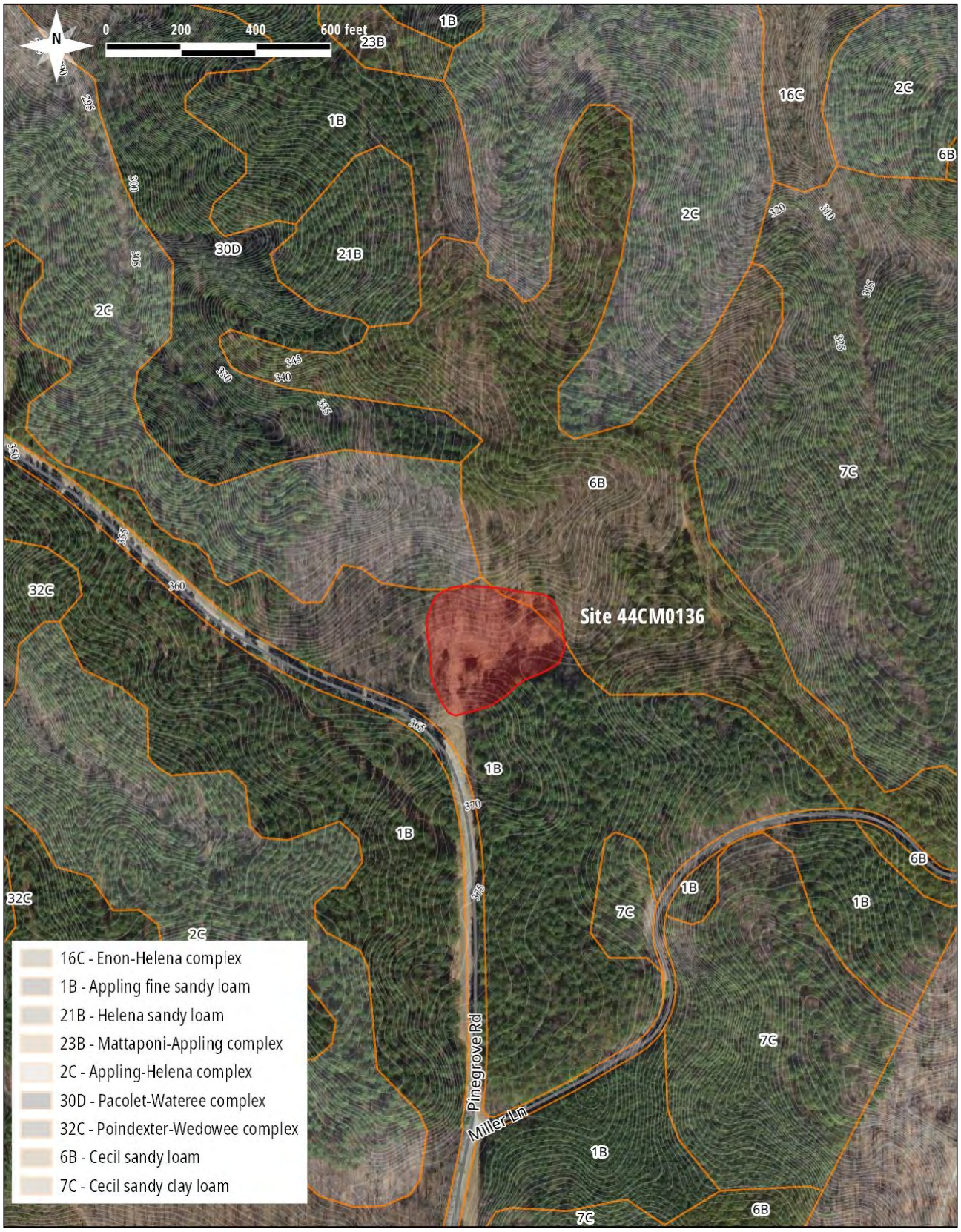

Figure 3: Location of the project area on the Most Recent Aerial Image (VGIN) with 1' Contours, and Soils Overlay.

Around the dwelling, large boxwoods (*Buxus sp.*) and patches of daffodils (Narcissus sp.) and perriwinkle (*Vinca minor*) were also noted.

Research Design

The objective of this investigation was to determine if Site 44CM0136 retains stratigraphic integrity and has sufficient research potential to be eligible for inclusion on the National Register. Research methods included archival research, metal detection, and shovel test and test unit excavation in portions of the site suspected to have an increased potential to contain intact subsurface cultural deposits.

Documentary Research

An archival investigation was conducted on the land encompassing Site 44CM0136 in order to establish a historic context, necessary to evaluate the research potential of its cultural deposits. Research was conducted in the Cumberland County Clerk of the Circuit Court's office and the Library of Virginia in Richmond, Virginia, and included examination of land tax records, deeds, wills, census listings, agriculture schedules, and historic maps. Phase II research was conducted concurrent with the field investigation and was focused on the period of site occupation and property ownership was established back to the Antebellum period (1830-1860). The partial chain for Site 44CM0136 is included as Appendix 1 to this report.

Fieldwork

The field methodology included visual inspection, metal detection, close-interval shovel testing, metal detection, test unit excavation, and mechanical stripping. The field investigation began with a pedestrian inspection of the site and relocation of the Phase I shovel test pits (STPs). During the visual inspection, surface vegetation within the site boundary was trimmed with a brush hog where surface features allowed. In areas where surface features were observed vegetation was removed using a string trimmer. Once cleared, much of the site was raked to uncover additional surface features, inform decisions about the locations and extent of cultural activity areas, and facilitate later survey strategies.

After establishing Phase I STP locations, a twenty-five foot grid was overlain on the previous grid to refine the horizontal extent of Site 44CM0136. Phase II shovel testing was completed within the previously defined site boundary and extended outward in all directions until two consecutive negative STPs were excavated or surface characteristics, such as the edge of the landform or evidence of modern disturbance suggested a low likelihood of identifying intact subsurface deposits. Phase II STPs were numbered consecutively from STP 996 to STP 1188. Twenty six additional STPs were excavated at 12.5 foot intervals in the central portion of the site and were numbered consecutively from STP 1189 to 1214.

STPs measured at least 15 inches in diameter and were excavated by natural soil horizon/cultural layer to sterile subsoil. All soil was sifted through 1/4-inch mesh screen and each pit was backfilled and stabilized before moving to the next STP. Soil colors were classified using the Munsell Soil Color Chart and soil textures were described using the USDA soil texture triangle. Traditional pedological classifications (A, E, B, etc.) were used to describe natural soil horizons. "Ap" was used in specific reference to the plow zone, or plowed soil horizons. The term "Fill" was used to describe cultural layers. Layer designations were defined by identifiable changes in soil color, texture, and inclusions, and cultural content. Recovered artifacts were bagged according to STP location and soil layer.

Following the STP survey, three areas were selected for additional investigation with a metal detector. The testing locations were selected to define activity areas associated with known and suspected structure locations and specifically avoided the area surrounding the dwelling because of the large quantities of architectural debris observed in this portion of the site. The testing areas were first divided into 25 foot squares and one hundred percent of each square was scanned with 6' instrument sweeps. All strikes were flagged and a random 20% sample of strikes were excavated. This survey was accomplished using a Minelab Vanquish 340 metal detector and Garrett Pro-Pointer Pinpointing metal detectors (or equivalent devices) by staff members that were experienced in their use. Modern materials were mapped, cataloged, and discarded in the field. All other finds were sorted by location, soil layer, and depth.

Nine, 3’x3’ test units, nine, 2’x5’ test units, and two, 2’x7’ test units were excavated in artifact concentrations and suspected structure locations. Test units (TUs) were numbered sequentially from TU 1 to TU 20. Vertical excavation of test units was by arbitrary levels within natural/cultural layers that exceeded four inches in depth. Judgmentally placed soil cores were also taken to explore soil layers beneath the base of excavations. Depths below ground surface were measured using datum steaks set approximately one foot from the highest corner of the test unit. Each test unit was backfilled and stabilized before moving to the next unit, except in cases where contiguous test units were excavated. In these instances all contiguous units were backfilled following excavation and recordation of the last of the contiguous units.

The approximate locations of specific survey areas, STPs, test units, and metal detector strikes were recorded on paper maps in the field. Test unit locations were mapped using compass and pull tapes relative to the Phase II STP grid. Following field excavations, STP and test unit locations were incorporated into the project GIS. Soil stratigraphy and other characteristics were documented on standardized STP forms and test unit level and summary forms during field investigations. Representative soil profiles and any subsurface features discovered during test unit excavation were also documented with scale drawings and digital photographs.

Laboratory

Artifacts were cleaned, inventoried, and curated at the field house in Clinton, Virginia in accordance with the Virginia Department of Historic Resources’ State Collection Management Standards (Virginia Department of Historic Resources 2017). Artifacts are currently stored in a climate controlled facility on the Green Ridge property and will be turned over to the Virginia Department of Historic Resources for permanent curation at the conclusion of this investigation.

Artifacts were classified using a system modeled after the Method of Abstracting the Carolina Artifact Pattern employed by Stanley South in Method and Theory in Historical Archaeology (South 1977), expanded to allow for the classification of prehistoric artifacts and those dating to more modern time periods. Historic artifacts were classified into South’s Groups and Classes and were further sorted by material type, vessel type, decorations, and method of manufacture, where definable. Prehistoric artifact were sorted based on material type, artifact type, and recognized classifications, such as ceramic type or stone tool type. Other informative characteristics were also recorded, including temper, decorative motif, and morphology.

Artifacts were grouped by provenience, soil layer, and artifact type and each artifact group was assigned an accession number comprised of the site number (CM0136), unit type/number (TU1), soil layer (Fill 1), excavation level (Lv1), and artifact number (ex. CM0136.TU1.Fill 1.Lv1.1).

Artifact information was cataloged in GEOGRifact, a PostGIS database extender for the PostgreSQL Database Management System and is included in the project GIS. The resultant database is geographically enabled, allowing seamless distribution of artifact attributes and location information.

CULTURAL BACKGROUND

Historic Overview

Ethnohistorical accounts suggest the Spanish reached the mouth of the Chesapeake Bay as early as the 1520s, having contacted the Powhatan Confederation by the middle of the century. In 1570, Spanish Jesuits founded the Ajacan mission (also known as St. Mary’s Mission), believed to have been on the York River; however, less than a year later all of the mission’s inhabitants were slain by local Native Americans, with the exception of a small boy named Alonso de Olmos. The Spanish retaliated in 1572, retrieving Alonso and killing twenty Powhatans, but made no attempt to reestablish the mission. In 1607, the English settlement of Jamestown was established on a defensible peninsula on the James River (Shackel and Little 1994). Jamestown would become the first permanent English settlement in North America.

At the time of English settlement, eastern Virginia was controlled by the powerful Powhatan Confederation, an alliance of approximately thirty Algonquian tribes comprised of 14,000 to 21,000 individuals (Egloff and Woodward 2015). To the west were the Siouan-speaking Manahoac of the upper Rappahannock drainage, the Monacan of the James River valley, and Occaneechi, Sappony, and Tutelo of southwest Virginia; to the south

were two small tribes of the Iroquois Confederacy, the Nottoway and Meherrin (Bracey 1977). The fall line roughly marked the boundary between the Powhatan Confederacy and western tribes and the Powhatans conducted seasonal raids to reinforce the boundary.

The early western political border separating the interior native populations from English settlements followed the fall line; which marked the limits of navigation for ocean-going vessels (Hatfield 2004). Just, as the fall line had been the border marking Powhatan territory, so it became the border marking early English control, as evidenced in John Smith's map of Virginia first drawn in 1608 (published in 1612) where he visually identified Virginia and Powhatan territory as similar – if not the same – entity (Hatfield 2004).

With the focus of English settlement primarily confined to the Coastal Plain, indigenous Native American communities in the interior of the Virginia colony were able to retain their traditional ways of life longer than their counterparts in the east. Initial interactions with Native Americans of the Tidewater frontier came in the form of explorers and trade parties, followed by a continuous migration of European settlers.

Frontier Period

The earliest written records of European and Native American encounters in western Virginia begins with Abraham Wood's expedition in 1654 followed by Batts and Fallam in 1671, and Governor Alexander Spottswood's 1716 expedition from Williamsburg into the Shenandoah Valley (Barber et al. 2004; Rouse 1976).

European westward expansion was slow. Typically, initial expansion came in the form of large land grants bestowed by the King of England. Over time, these grants were subdivided into smaller and smaller parcels as more settlers moved west. Barber et al. (Barber et al. 2004) states that while the earliest settlers were mostly English, a majority of the settlers in western Virginia in the early 18th century were of German or Scots-Irish descent. These settlers were fleeing religious persecution in Europe and subsequent discrimination in Pennsylvania. German and Scots-Irish settlers claimed the Shenandoah Valley by the mid-18th century as they largely moved down the backcountry via the Great Wagon Road, bringing non-English styles of religion, architecture, and agricultural practices. Examples of imported architectural styles include houses and bank barns built of stone instead of the brick structures more common in English communities (Virginia Department of Historic Resources 2017). As these English and non-English pioneers gained control of the interior regions, their understanding of the over ground trade networks increased.

Following the establishment of the Carolina and Maryland colonies on the Virginia borders, Virginia had to compete for trade with native populations outside of its boundaries. Carolina tried to stop Virginia traders from doing business with natives within its borders and in 1670, the Carolina Lords Proprietors ratified several acts passed by the Assembly of Albemarle County, one of which included a prohibition on "strangers" trading with the Carolina natives (Hatfield 2004).

Virginia also attempted to guard its resources from other colonies and colonial powers. When the Dutch cut the Carolina Road through the western portion of the colony and began using Susquehannock natives to trade with the Ocaneechees of southern Virginia and Carolina, in a blatant attempt to circumvent a ban on trading with Virginia, Virginia responded in turn by passing an act in 1661/2 prohibiting "all… Indians to the Northward of Maryland from trucking, trading, bartering or dealing with any English or Indians to the southward of that place" (Bracey 1977). This intercolonial competition placed added value on pivotal points in the Native American overland trading network as control of such areas allowed Virginia direct access to commodities otherwise regulated by other colonies or powers in the maritime network of the coast. By the end of the 17th century, the web of overland trails in the Southern Piedmont had become integrated with maritime trade (Hatfield 2004).

Rise of the Plantation System and the Institution of Slavery

As settlers pushed into the frontier of Virginia, they brought with them English culture and institutions associated with government, society and economy that had already been formalized in the Tidewater. These institutions included the House of Burgesses, established religion, and small commercial enterprises (Virginia Department of Historic Resources 2017). The new settlers raised tobacco, corn, potatoes, peas, sheep, cows, hogs, geese, bees, flax, and cotton (Bracey 1977).

Both the plantation system and the institution of slavery in Virginia are closely tied to tobacco monoculture, characteristic of farming practices beginning in the early 17th century. Following the successful cultivation of a milder type of tobacco by John Rolfe in 1612, tobacco quickly became the cash crop of the young Virginia colony. The complex process of tobacco cultivation led to the rise of the plantation system as a formula for economic success: large tracts of land cultivated with large labor forces (Virginia Department of Historic Resources 2017). While this system began in the Tidewater during the 17th and 18th centuries, it eventually expanded further inland along Virginia's many navigable rivers. Docks belonging to large plantations dotted the shorelines of rivers and towns serving as courthouse complexes and tobacco warehouses; however, the plantations existed as virtually autonomous entities (Virginia Department of Historic Resources 2017).

The first Africans came to Virginia in the early seventeenth century, most likely as indentured servants; however, slavery gradually became entrenched in Virginia society as the demand for labor increased (Virginia Department of Historic Resources 2017). At first, English emigration provided this labor, but as economic conditions in England improved and cheap land was available in Virginia, fewer Englishmen arrived as indentured servants, leading Virginia planters to look elsewhere to satisfy the labor demand required by their plantations, thus establishing the institution of slavery (Virginia Department of Historic Resources 2017).

The development of slavery in Virginia as an answer to the labor problem largely resulted from Virginia's 17th century exposure to slavery in the English Caribbean colonies, which provided a legal and cultural precedent of enslaved labor, and intercolonial trade with Dutch merchants, who were largely based in New Netherland and provided access to slaves. Slavery in Virginia before the 1670s emerged from these two connections, and by the end of the century laws were passed further regulating the lives of slaves and belief in racial distinction solidified throughout the English Atlantic (Hatfield 2004). Though slavery, like the early practice of indentured servitude, departed from English labor traditions, it took root in the English New World largely because Spanish and Portuguese America had laid the template for American colonization – a template that included slave labor. When the English colonized the New World they looked to the successful Iberian colonies and tried to emulate them. From this, English colonists learned how Africans fit into a colonial American context as labor benefiting Europeans, so when a labor shortage arose, merchants made slaves available for purchase and the institution of slavery quickly became embedded in English American colonies. The Caribbean English colonists mimicked the Iberian model and later more northern English colonies, such as Virginia, followed suit (Hatfield 2004).

The success of tobacco led to the development of colonial plantations and manor houses; which were the embodiment of Virginia's economic dominance in the early and mid-eighteenth century, even though most people lived in far humbler circumstances than the wealthy landed gentry. Today, the surviving plantation mansions and their networks of dependencies, outbuildings, and gardens are symbols of some of our nation's finest achievements in colonial design and craftsmanship, which yield valuable archaeological, historical, and architectural information critical to understanding this period of our nation's history (Virginia Department of Historic Resources 2017).

English settlement in the area now known as Cumberland County likely began on the floodplains of the James and Appomattox Rivers, as settlers in need of fertile soils for growing tobacco continued to push westward. The influx of settlers led to the formation of Cumberland County from Goochland County in 1749.

Colony to Nation (1751-1789)

Virginia played an important role in the formation of the United States. Her residents participated in crucial political and military phases of the Revolutionary War and in the shaping of the nation following the conflict. Many of the nation's founding fathers called Virginia home and a majority of their homes still stand, significant both for their architecture and the status of those who lived in them.

The passing of the Stamp Act (1765) and the Townsend Acts (1767) ignited simmering tensions between the American Colonies and Britain, inciting Virginia's planter-statesmen, such as Southside resident Patrick Henry, to stand up to what they believed was taxation without representation. Although initially considered radicals, Henry, and Samuel Adams and John Hancock of Massachusetts became the voice of the Revolution. While revolutionaries like Henry, Hancock, and Adams were early opponents to British sovereignty, many Southside

residents were reluctant to break ties with England. However, as British taxes and tariffs engendered a spirit of bitterness and resentment among both the plantation class and poorer southern planters, attitudes quickly changed. Given its location along the western frontier of Virginia, Southside was largely unaffected by the War. Economic impacts were minimal and were principally the result of decreased tobacco production, as many farmers opted to grow food, instead of tobacco, in support of the war effort (Mix and Weber 1998).

Cumberland's population continually increased throughout the latter part of the eighteenth century, leading to the formation of Powhatan County, from the eastern half of Cumberland County in 1777. The original county seat for Cumberland County was located in Deep Creek, near the intersection of Anderson Highway (US 60) and Old Tavern Road (SR 629), in what is now Powhatan County. Following the founding of Powhatan County, the courthouse was moved to Effingham, now known as Cumberland Courthouse.

Early National Period (1790-1829)

Following the Revolution, Britain refused to recognize American sovereignty. The British interfered with U.S. / European trade, encouraged Native American resistance to westward expansion, and impressed American seamen into Royal Navy service. After the execution of King Louis the XVI of France, Britain and France were once again at war. The British still viewed Americans as British subjects, and expected the United States should cease trade with France and join the fight on behalf of Britain. In response to British impressment of American sailors and French confiscation of American ships, the U.S. passed the Embargo Act of 1807. Intended to force Britain and France to respect U.S. neutrality by placing restrictions on trade with both nations, the measure was largely ineffectual and had the greatest impact on American citizens, who were unable to sell their goods. The embargo was lifted in 1809 and impressment of American sailors continued. On June 18, 1812, the United States declared war on Great Britain and by August 1814, British forces had captured and burned the nation's capital, Washington, D.C., but the Americans ultimately prevailed and the war ended with the ratification of the Treaty of Ghent on February 17, 1815, sparking a new era of patriotism (Bracey 1977).

After the War of 1812, Britain imposed prohibitive tariffs against the importation of American grain. Wheat prices briefly rose to two dollars a bushel again in 1817 due to the "year without a summer" when the global climate felt the effects of the Tambora volcanic eruption in the East Indies, but these prices were short-lived and quickly declined, eventually hitting their lowest point in 1843 (Sharrer 2001). However, after the war ended the U.S. overall experienced economic gains that relieved the hardship caused by the embargo until the Panic of 1819, the first major financial crisis in the U.S. during peacetime. The Panic was blamed on the policies of the Second Bank of the United States and the collapse of the American economy continued through 1821, after which it recovered and later fell to the Panic of 1837. Virginia, like the rest of the United States, experienced a variety of periods of both prosperity and depression in the years between the Revolution and the Civil War (Bracey 1977).

The period after the Revolution is sometimes called the "Great Rebuilding" in many of Virginia's rural areas. During this time living standards improved, resulting in expansion or replacement of smaller dwellings characteristic of the previous period. In the Piedmont region, the I-house became the dominating domestic type rather than the previously commonplace one- or two- room houses on small farms. Furthermore, numerous wealthy Tidewater families migrated to lands they owned farther west, transplanting the Tidewater-style plantation house where they went, and new churches were built as the Anglican Church was disestablished and other religious denominations rose.

The end of the 18th century and the beginning of the 19th century saw a transition in Virginia from a near completely agrarian colonial society to a new state with developing urban centers. Many Virginia counties had only small villages if they had any village at all, but the Early National Period witnessed the expansion of Fall Line river ports into flourishing economic centers, such as Alexandria, Fredericksburg, and Petersburg, as well as the prosperity of Piedmont county seats like Charlottesville, Warrenton, and Leesburg.

Originally known as Rutledge's Ford, Farmville was strategically located at the western limits of the Upper Appomattox Navigation Canal System. Constructed in 1795 and operational by 1816, the canal facilitated the transportation of tobacco and other local crops by bateau to markets in Petersburg, Williamsburg, and beyond.

Northern Cumberland County used the Willis River for its transportation route. In 1774, the County Court acted to clear the river from its mouth to Ca Ira. The General Assembly passed the Willis River Navigation Act in 1787 and divided it into maintenance precincts. The head of navigation was Ca Ira but was later extended another 11.8 miles and ended in Buckingham County. Combined with the lower precincts of 33.6 miles length, the total canal system ran for 45.4 miles. The system was complete by 1797 and provided farmers with access to markets in Richmond, via the James River.

The Willis River and Appomattox canal systems remained the primary means of transporting goods to market until the mid-nineteenth century, when ever expanding railroad networks provided a faster, more reliable means of transportation. Milling was a major industry in Cumberland County during this period. Mills were set up by individual millers who operated on a custom basis, either taking a set amount of grain as a fee or on a pay basis for grinding. Mills also processed cotton, lumber and a variety of other materials. Boye's 1823 Map of Virginia lists 21 mill locations in Cumberland County (Figure 4). Three are located on Muddy Creek in the vicinity of the project area.

Antebellum Period (1830-1860)

In the first half of the nineteenth century, rolling roads and canals gave way to improved roadways and rail transportation. The Virginia Board of Public Works made great strides in augmenting the state's transportation network, and roads and railroads challenged the reign of the waterways as the primary means of transportation for the first time (Virginia Department of Historic Resources 2017). Originally designed to provide an easier and more reliable means to transport farm products to port towns, railroads transformed the way people and goods moved through the landscape, opening up previously inaccessible areas for settlement and exploitation. Railroads required tremendous amounts of lumber for the construction of rail beds, trestles, stations, and cars and as railroads expanded west, so too did the lumber industry, resulting in unprecedented deforestation in Virginia's Piedmont region. The South Side Railroad was chartered in 1846 and had line completed to High Bridge by 1853 and service to Farmville by 1855, thus focusing rail transportation in the southern half of the county and rendering the Appomattox River canal system obsolete by the late 1850s. As regional transportation continued to expand and improve, population increased, tobacco warehouses were opened, towns were planned and the Cumberland County economy evolved based on commercial agriculture (Beeman 1989).

A hallmark of the Antebellum Period was that of the abolitionist debate. In Virginia, there had been free African Americans from as early as the middle of the 17th century. There was also an increase in emancipations after the Revolution for those slaves who had aided the American cause. In 1782, the Virginia General Assembly made the legal process easier for freeing one's slaves and the second Great Awakening of the latter 18th and early 19th centuries furthered this spirit of egalitarianism (Bracey 1977). However, the early emancipation momentum slowed and anti-emancipation sentiment grew in the South in the wake of Nat Turner's 1831 Rebellion in Southampton County, which created much fear among white southerners who were concerned about such an insurrection from their own slaves or from neighboring freedmen. Following the rebellion, the Virginia House of Delegates debated the issue of the abolition of slavery over the winter of 1831-32.

Civil War (1861-1865)

Virginia hesitated in declaring her secession for several months after South Carolina became the first to secede from the Union. Elected candidates attended the 1861 Virginia Peace Convention to consider the issue. In a secret session April 17, 1861, Virginia's secession was approved, after the mid-April attack on Fort Sumter in South Carolina shifted many of the opinions at the convention away from peace. On May 23, 1861 a vote officially approved secession and Virginia joined the Confederacy (Bracey 1977). Like most places in the South, Cumberland County was suffering effects of the war by the summer of 1861 as the Confederacy demanded of them soldiers, equipment, and other supplies. The closest documented engagement between Union and Confederated forces was the Battle of High Bridge (DHR #024-0416), located approximately twenty miles southwest of the project area.

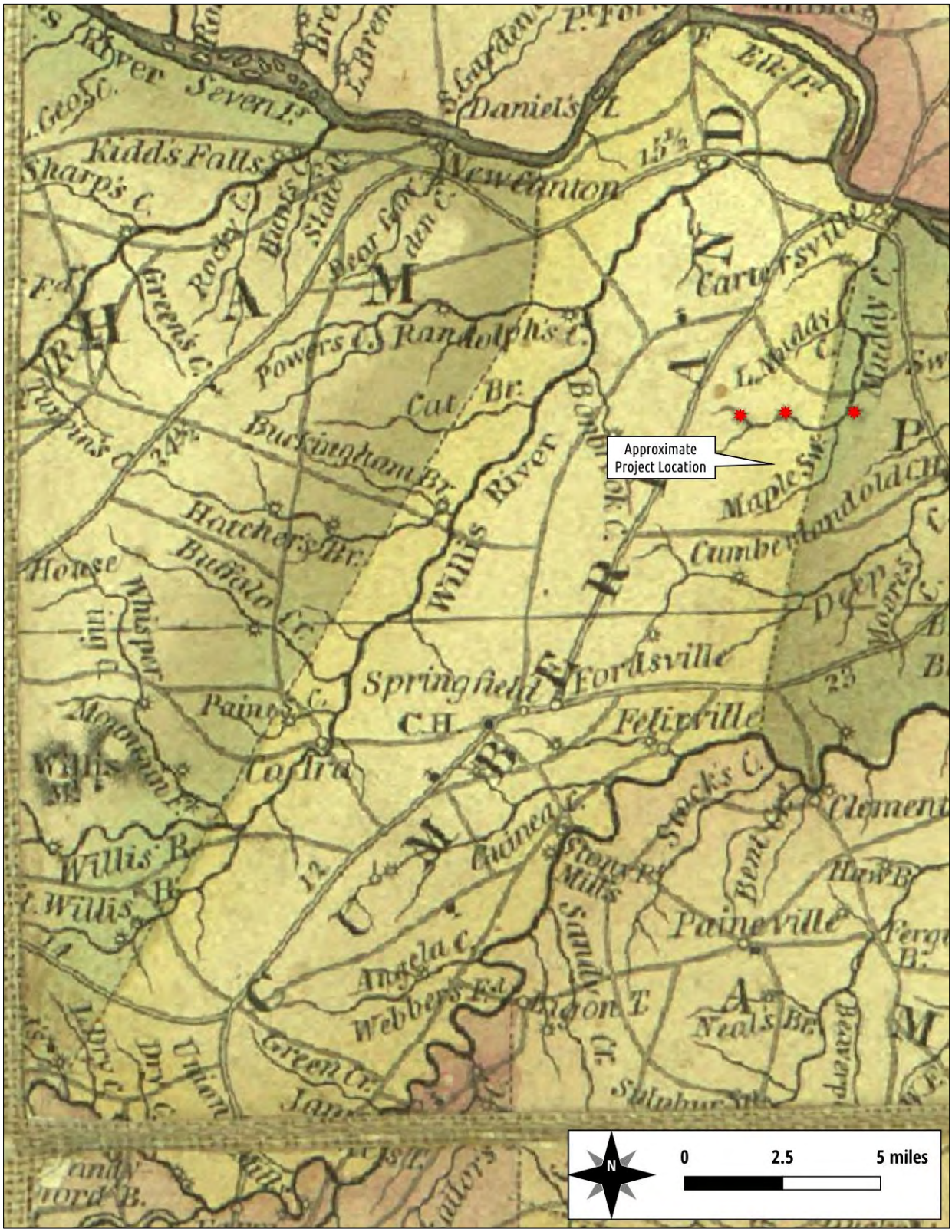

Figure 4: Approximate Project Location on 1823 Boye Map of Virginia.
(Mills in project vicinity noted in red.)

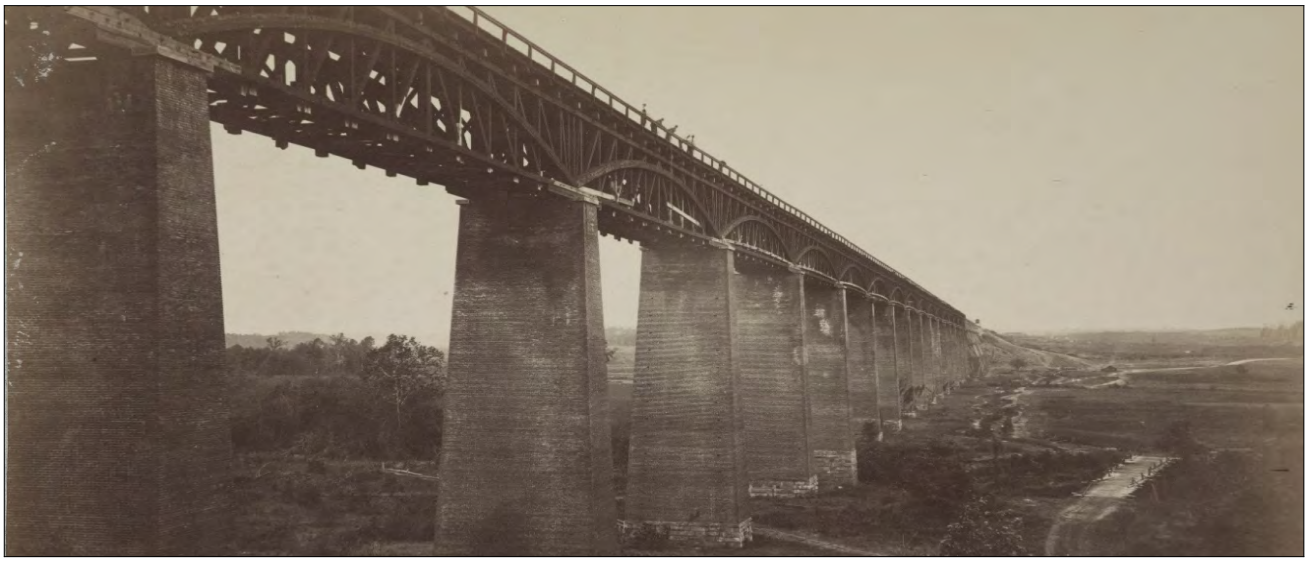

Figure 5: High Bridge in April 1865.

The battlefield spans Cumberland and Prince Edward counties and encompasses 3,760.5 acres. Included within the resource is the Battle of High Bridge (April 6-7, 1865) battlefield and the subsequent route of Confederate retreat. The battle was part of the Appomattox Campaign (March-April 1865). Following defeat at Sailor's Creek, Robert E. Lee's army retreated towards Farmville via the Southside Railroad. Union forces initially clashed with Confederate Reserves at High Bridge on April 6th, but were repelled by the Confederate cavalry and Lee's army successfully crossed the bridge and made their way to Farmville on April 7th (Figure 5).

Once safely across, the Confederates destroyed the high bridge, but the wagon bridge below remained intact and the Union army followed the Confederates to Appomattox where Lee was forced to surrender, officially ending the Civil War. The American Battlefield Protection Program (ABPP) and DHR collaborated with the Civil War Sites Advisory Commission to determine the boundaries of the resource. The resource includes an earthen fortification at High Bridge (024-0416-0001). The fortification features a raised perimeter in the shape of a square bisected by another raised section that runs through the middle. The corners of the squares exhibit a dirt mound used for mounting artillery. It was garrisoned by the 3rd Virginia Reserves and equipped with artillery during the Battle of High Bridge.

On the morning of April 7, 1865, Robert E. Lee in retreat from his defeat at Sailor's Creek, held a meeting at 304 Beech Street while awaiting trains of rations, but was forced to leave before his supplies had arrived, upon learning that Union forces were entering the town. Lee's forces would head to Appomattox Station, where two days later, he surrendered to Ulysses S. Grant.

The 1864 Gilmer Map of Cumberland County shows considerable expansion in local transportation networks. Cartersville, Cumberland Courthouse, and Ca Ira remained the major settlements, but an expanded secondary transportation network facilitated settlement throughout the County. In the project area, secondary roads connected the residents of the Chimney in the Field Site, as well as the Jesse Parker, Jeffrey, and Ammoynett farmsteads to Cartersville, Cumberland Courthouse, and Richmond via the predecessors of Pinegrove Road, Miller Lane, Cartersville Road, and Old Courthouse Road.

Reconstruction and Growth (1866-1916)

With the ratification of the 1870 Constitution, Virginia was once again a part of the United States, slavery was outlawed, and for the first time Virginia had a state-subsidized public school system. Emancipated slaves made up the majority of the work force and large Antebellum plantations were divided into smaller farms, a tenant and share-cropping system became prominent throughout the South in the century following the war (St. John and St. John 1990).

Although policies established during the brief period of martial law following the Civil War benefited freedmen, making education, suffrage, and land ownership available to them, institutionalized racism would curb their upward advance. African American workers were paid less, and their schools did not receive as much funding as white schools.

In 1912, Julius Rosenwald, president of Sears, Roebuck, became a member of the board of directors for the Tuskegee Institute and provided funding for a project developed by Dr. Booker T. Washington to design and construct schools for African American children throughout the rural south. The Rosenwald Fund, established in 1917 would be used to construct more than 5,000 schools in areas where African American schools were traditionally underfunded. The Pine Grove School (DHR #024-5082), located along Pinegrove Road, west of the Chimney in the Field Site, is an example of a two-room "Rosenwald" schoolhouse constructed between 1917 and 1920.

African American culture responded to institutionalized segregation, which among other things inspired the formation of institutions like the National Association for the Advancement of Colored People (NAACP), formed in 1909, but a lack of equal access to public institutions and programs created many difficulties in both economic and political advancement (Virginia Department of Historic Resources 2017). On July 10, 1902, the Virginia Constitutional Convention enacted the 1902 Constitution. This document established poll taxes and literacy tests specifically intended to disenfranchise African American voters.

Other provisions of the Constitution included mandated formation of the Virginia State Corporation Commission, which replaced the Virginia Board of Public Works and was charged with oversight of the State's growing railroad network (Maddex 1998). In 1884 the Farmville & Powhatan Railroad was chartered and by 1890 it was connected with the Brighthope Railway of Chesterfield and provided rail service for 93 miles between Farmville and Petersburg, via Cumberland County. The railway transported the region's coal, lumber, grains, and tobacco to urban markets and provided passenger service six days a week. When first established, the company owned 7 engines and 210 cars. Initially profitable, the railway was losing money by 1894 and by 1895 was down to five locomotives (Allen 1966). The Farmville & Powhatan was sold under receivership in 1905 to the Tidewater and Western Railroad Company.

World War I to World War II (1917-1945)

The Farmville & Powhatan line remained operational under the Tidewater and Western Railroad company until 1917 when the US Government decreed that all railroads less than 100 miles long were to be taken up for the war effort. That year, the 92 mile long Farmville & Powhatan Railroad was removed and sold to the French government. With the gradual demise of canal companies following the introduction of railroads and the loss of the Farmville & Powhatan, the Southside Railroad in Farmville became Cumberland's closest link to a railway with access to urban markets to the east and west. Overland transportation routes including Routes 45 and 60, which roughly followed the alignment of the former railway became increasingly important to the County's economy.

The country suffered casualties from WWI and the Great Influenza Epidemic simultaneously. American deaths on the front in France totaled 67,813 while 548,000 deaths from influenza were reported in the U.S. within the span of just a few months; just a fraction of the 20 million who perished worldwide (St. John and St. John 1990). In the period following the war, the U.S. economy was unstable, driven by international, post-war deflation. In 1919, tobacco crops sold for 51 cents per pound, but overproduction, in America and abroad, caused prices to fall to just 22 cents a year later. In the 1920s markets stabilized ushering in a decade of sustained economic prosperity.

Improvements in farming practices, including mechanization and more effective fertilizers, caused a decrease in the number of people needed to tend crops and vast numbers of Americans moved from the countryside into cities, urbanizing the nation (Virginia Department of Historic Resources 2017). Waves of small farmers and sharecroppers migrated from the rural South to the industrialized cities of the North, seeking better opportunities. For African-Americans, this move also represented a chance for increased social equality. They did, however, face restrictions that limited their housing to certain parts of cities. In response to this discrimination, African-Americans often created their own cultural and economic centers.

As people from diverse backgrounds converged in cities, arts and industry flourished. Telephones, automobiles, air travel, jazz music, motion pictures, radio, and professional sports were introduced to American culture. The optimism of the period led to over speculation amongst investors and by the end of the 1920s the stock market was beginning to show signs of instability. The Great Stock Market Crash of 1929 ushered in a twelve year downturn in the U.S. economy known as the Great Depression. While the crash devastated investors, farmers at first seemed safe; however, the U.S. suffered an extreme drought in the summer of 1930 that forced tobacco prices to a ten year low. Combined with the failure of banks and businesses, the country sank into an economic depression (St. John and St. John 1990).

During the period between 1929 and 1933, unemployment increased from 3.3% to 25% and gross domestic product decreased by one third (VanGiezen and Schwenk 2003). Beginning in 1933, President Franklin Roosevelt enacted regulations designed to stabilize the banking industry and created relief programs such as the Works Progress Administration (WPA), Civilian Conservation Corps (CCC), Tennessee Valley Authority (TVA), and Rural Electrification Administration (REA) to provide employment opportunities for Americans and stimulate the economy. At the time of the establishment of the REA in 1934, approximately 7.6 percent of rural Virginian farms had electricity, but in just four years that number rose to 21 percent (St. John and St. John 1990). Despite contributions from government funded programs, the economy of the region remained stagnant until the onset of World War II.

After the bombing of Pearl Harbor on December 7, 1941, America entered the Second World War. Again, citizens from Virginia served their country. The era of the World Wars saw struggles for both gender and racial equality. Black leaders pushed for equal rights in Virginia, and sometimes whites, such as *Richmond Times-Dispatch* editor Virginius Dabney, joined their cause. At times the fight for racial equality mixed with the drive for women's suffrage in the early parts of the century. The struggle for women's suffrage came to an end in the U.S. with the ratification of the 19th Amendment in 1920, although Virginia did not officially recognize women's right to vote until 1952. In 1948, the *Universal Declaration of Human Rights by the United Nations* added voting rights for women to international law. World War II brought much social change to the country. As African American veterans returned home from a segregated military and women who had gone to work during the war remained in the workforce the call for equality became louder (Virginia Department of Historic Resources 2017).

The New Dominion (1946 to the present)

The prosperity that followed World War II and the mechanization of farming brought about the decline of the share-cropping system that had developed after the Civil War (St. John and St. John 1990). Virginians began leaving rural homesteads and farms and moved to urban centers like Richmond and Washington, D.C. By 1955, Virginia had more urban residents than rural residents and by 1990, suburbs were the preferred place of residence. This transition from rural to urban lifestyle were aided by transportation progress including the construction of the Interstate Highway System.

On May 17, 1954 the Supreme Court ruled in *Brown v. the Board of Education* that "separate educational facilities are inherently unequal" and were a violation of the Fourteenth Amendment of the Constitution. By 1958, most Virginia counties had begun the process of integrating the public school systems; which ultimately led to the closure of Rosenwald Schools. The Pine Grove School remained open until 1964, and according to Muriel Branch, was later adapted for use as a community center (Branch 2018). At the time of this investigation, the building was in need of substantial repair and was no longer in use.

Agriculture remains a key component of the County's economy and Cumberland retains a largely agrarian landscape composed of grassy pastures, plowed fields, and managed timberland.

Property History

A property history was completed for the land encompassing the Buena Vista Site (44CM0136) to provide a historical context in which to place the site occupation. Research was conducted using the County records at the Library of Virginia, those housed at the Clerk of the Circuit Court in Cumberland County, Virginia, and other online sources. This investigation included examination of land tax records, deeds, wills, chancery causes, census listings, agricultural schedules, newspaper articles, maps, and other secondary sources.

Phase II documentary research focused on the period of occupation. Thus, property ownership prior to the mid nineteenth century is not included in the property history. Phase II documentary research established a chain of title extending from the current owners back to James McLaurine in the middle nineteenth century. The partial chain of title is summarized in the following discussion and included as Appendix 1.

The Buena Vista Site (44CM0138) is currently located on a 141.6 acre parcel located north and south of the intersection of Miller Lane (SR 685) and Pinegrove Road (SR 654), near the village of Clinton in Cumberland County (Cumberland County Tax Parcel #44-A-21). In the mid nineteenth century, the parcel was part of the vast landholdings of James McLaurine, reported to have included as much as 6,000 acres along the Powhatan/Cumberland county line.

The Quarter (McLaurine)

James Wren McLaurine, the earliest known owner of the Buena Vista site was the eldest son of Rev. Robert McLaurine and Elizabeth Blaikley, born in Cumberland County on November 25, 1758. Jame's father was a Scottish immigrant who served as the second Anglican rector of the St. James Southam Parrish (which covered portions of present-day Cumberland, Buckingham, and Fluvanna Counties) from 1751 until his death in 1772 (Meade 1861). While serving in this capacity, Robert, his wife, and their seven children resided on the parish glebe. However, in 1762 and 1766 Robert used the proceeds of his appointment to purchase two adjoining tracts of land totaling 633 acres on the north side of the Middle Road (Old Courthouse Road) near the present boundary between Cumberland and Powhatan Counties.

Robert died in 1772 and in his Will, he expressed his desire for his eldest son James to receive an "education such as shall entitle him to become a scholar" and in accordance with his wishes, James attended William and Mary up until his enlistment in 7th Virginia Regiment in the Revolutionary War. The 7th Virginia saw action in the Battles of Brandywine, Germantown, Monmouth, and the Siege of Charleston before it was disbanded in 1783. After the War, James returned to Powhatan and focused on expanding his family's landholdings.

Robert's Will also requested that 200 acres of his holdings be set aside for his wife and that the remaining portion of his plantation be divided among his two eldest sons, James and William. However, in 1774 Elizabeth purchased 50 acres from Absalom Davenport along the southern boundary of her former husband's plantation and in 1788, James purchased an adjoining 36 acres that he sold to his mother in 1791. Around 1775, a house, known as Somerset, was constructed on what would become the 86 acre tract and served as the home of Elizabeth, her youngest son Joseph, and his wife Susannah Ellis until Elizabeth's death in 1803.

In 1789, James McLaurine married Catherine Steger, the daughter of a wealthy local landowner. It is unclear where James and Catherine or his brother William and his wife Elizabeth Swann were living during this period although, historic accounts suggest William and Elizabeth may have been living with their mother at Somerset.

In 1795, James purchased the neighboring manor house and 884 acre plantation known as Edgemont from William and Margaret Chamberlayne. Throughout the remainder of the eighteenth century and early nineteenth century, James continued to expand his estate. Edgemont would eventually include thousands of acres along the Cumberland/Powhatan County boundary, and at the time of his death was roughly bound by Maple Swamp to the north, Deep Creek to the south, Ballsville Road (VA 630) to the east, and Pinegrove Road/French's Store Road (VA 654) to the west (West 1991). During the 53 years they lived at Edgemont James and Catherine raised seven daughters and two sons. Perhaps the most famous among them was their youngest daughter Virginia Jackson McLaurine, wife of Alfred Daniel Mosby and mother of Col. John Singleton Mosby of the Civil War.

Historic accounts suggest many if not all of James and Elizabeth's daughters were married at Edgemont. Census records indicate Virginia's older sister Martha likely remained at home following her marriage to John Bennett

Jeffries on September 7, 1825. John and his bride welcomed their first child James McKendree Jeffries in 1829, and over the next ten years Martha gave birth to two more boys and two girls, all of whom were born in Cumberland, Virginia. However, John's household is not enumerated in the 1830 Census.

Although the transaction was not recorded in deed records, land tax records indicate James acquired a 400 acre tract in 1839. At that time no buildings were present on the property. However, the following year James was taxed for $800 worth of buildings on the same parcel. That same year (1840) John Jeffries' household appears in Census records, immediately following James McLaurine.

Buena Vista (Jeffries)

The Jeffries household continued to grow during the 1840s, with the addition of Rosa (1844), Alice (1846), Catherine and William (1848), and Victoria (1849). In 1849, Martha and John inherited one half of a tract described as "the quarter" from Martha's father (Cumberland County Will Book 11:406). The remaining half of the property was devised to Martha's older sister Elizabeth, or "Eliza". James McLaurine's Will provides no description of the acreage or boundaries of the property, but specified that it was to be divided "to give Martha the dwelling house and buildings adjacent, and to Eliza the barn, tobacco houses and buildings near them". Tax records indicate that each sister inherited 200 acres with the total value for buildings on the 400 acre tract valued at $900, suggesting it was likely the same 400 acre parcel acquired by James in 1839. Eliza passed away while John and Martha were in the process of purchasing her half of the "quarter" tract when, in accordance with her Will, it was devised to Martha Jeffries, Virginia I. Mosby, wife of A.D. Mosby; and Mary F. Mosby. Jeffries' acquisition of Eliza's half of the "quarter" was finalized on September 1, 1856 and was recorded in Cumberland County Deed Book 28:517.

Nine years prior to their inheritance, John and Martha had purchased 154.5 acres "on Muddy Creek" from Reubin J Sims (Cumberland County Deed Book 23:375); which at that time, was bound by the lands of James W. McLaurine (likely the "quarter"), among others. Although deeds from the period provide no clear description of the property boundaries, a circa 1874 plat shows the boundaries of the Jeffries' Buena Vista farmstead including approximately 550 acres (highlighted in yellow, Figure 6).

James McLaurine's Will does not specify whether or not John and Martha were already living on the "quarter" tract, but Jeffries is listed next to James McLaurine in the 1840 census and his purchase of the 150 acre property adjoining the northern boundary of the "quarter" tract in 1839 suggest he and Martha were already living in the area at that time. Gilmer's 1864 Map of Cumberland County lists "Jeffrey" as the occupant of a house in the southern half of the farmstead, along what is currently known as Pinegrove Road (see Figure 6).

The 1850 and 1860 census records list Jeffries as a farmer, and by all indications he was prosperous during the Antebellum Period. The 1850 census values his estate at $10,000, more than double the value the of neighboring farmsteads. The agricultural schedule from the same year shows the Buena Vista farmstead was comprised of 600 acres and included 5 horses, 3 milch cows, 6 working oxen, 4 cattle, 30 sheep, 30 swine. Farm produce included 400 bushels of wheat, 650 bushels of Indian corn, 200 bushels of oats, 8,000 lbs. of tobacco, 45 lbs. of wool, 10 bushels of peas/beans, 35 bushels of Irish potatoes, 10 bushels of sweet potatoes, and 365 lbs. of butter. The value of home manufacture was $50 and the value of animals slaughtered was $200. In 1851, Jeffries was taxed for $1,200 worth of buildings, the same value as his former father-in-law's plantation, Edgemont.

By 1860, Jeffries land was valued at $8,120 and the value of his estate was $25,060. The 1850 and 1860 Slave Schedules show that the Buena Vista farmstead was heavily dependent upon enslaved labor. At both points in time, Jeffries is listed as the owner of 21 slaves, including 13 females and 8 males, aged from 2 years to 80 years in 1850. Subsequent records suggest Jeffries was unable to sustain his antebellum prosperity following the ratification of the 13th Amendment to the Constitution/abolition of slavery in 1865.

The 1870 Census provides no value for Jeffries' land or estate, but his wife Martha, who was "Keeping House" at the time, owned $1,986 worth of land and had an estate valued at $700; and John and Martha's daughter Rosa, who was living at home, had an estate worth $160. That same year his livestock were valued at $369 and included 2 horses, 1 mule, 3 milch cows, 2 working oxen, 5 cattle, and 13 swine. Farm produce consisted of 4 bushels of peas/beans, 3 bushels of Irish potatoes, and 5 bushels of sweet potatoes. The value of home

Figure 6: The Buena Vista Farmstead and Site Location Overlain on Gilmers 1864 Map of Cumberland Co. Virginia.

manufacture was $172 and the value of animals slaughtered was $2,193 (1870 Agricultural Schedule). During the 1870s, Jeffries' health was likely in decline. In 1880 he was 80 years of age, and the census lists him as sick with "consumption", or tuberculosis.

Frayser Tract

In the years immediately preceding the Civil War, Jeffries had become indebted to Albert Roderick Frayser, a farmer in the Macon District of Powhatan County. On November 4, 1865, Jeffries entered into an indenture with Frayser to secure a debt of $2,556.19, placing 540 acres of his farmstead as collateral (Cumberland County Deed Book 29:447). In accordance with the indenture, Jeffries was to repay the debt by January 1, 1870 or the farmstead where he and his family were living, would be sold to the highest bidder at public auction. Jeffries was unable to repay the debt in full and the northern half of his farmstead, including 300 acres, was sold to Albert Frayser, the highest bidder, for $7 per acre on April 27, 1870 (Cumberland County Deed Book 30:115) (Figure 7). The value of structures on Buena Vista decreased from $1,200 to $700 following the sale of 300 acres to Frayser in 1870. However, the assessed value of structures on the Frayser tract was $0 and only increased to $100 in 1876, suggesting that it was the buildings on the Buena Vista Farm that had lost nearly 50% of their value over the last twenty years.

Jeffries/Jones Tract

John Jeffries laid out his wishes for the disposition of his estate following his death and the death of his wife in a Deed of Gift dated December 27, 1873 (Cumberland County Deed Book 30:495). His son William was to inherit the dwelling and one third of the Buena Vista farm and the remaining two thirds were to be equally divided amongst his sisters Alice and Rosa. Historic records suggest John Jeffries died in 1880, but his estate was not settled until 1892, likely following the death of his wife Martha. That year the Cumberland Circuit Court ordered a plat of the 244 acre farmstead showing the division of the Buena Vista estate (Figure 8). Lot 1, including the dwelling house and the surrounding 5.33 acres was bequeathed to William. Lot 2, the portion of the property located west of Pinegrove Road and totaling 120.33 acres was given to Alice R. Perkins (formerly Jeffries). And Rosa V. Jones (formerly Jeffries) inherited the remaining 118 acre eastern portion of the property (Cumberland County Deed Book 37:144). By 1896, William Jeffries was living Alabama with his wife Sallie when they conveyed his inheritance, Lot 1 including the dwelling, associated buildings, and 5.33 acres, to his sister Rosa Jones for $200 (Cumberland County Deed Book 37:477). In 1880, prior to the death of her father, Census records indicate Rosa was already living on the neighboring farmstead and it is not know if Rosa moved back to Buena Vista following the acquisition of her childhood home. Around the time Rosa acquired the family farm, the value of buildings was reassessed to $400, suggesting it was likely in a worsening state of decline during the latter part of the nineteenth century.

Flippen/Wick Tract

In 1916 Rosa Jones and her children sold the Buena Vista site (44CM0136) and the surrounding 123.3 acres to Herman Flippen (Cumberland County Deed Book 53:455). Herman was the son of Menville Augustus Flippen and Catherine "Kate" Jeffries and was likely the grandson of John B. Jeffries. Tax records alternately list Herman and his wife Louise living in Sunny Side and Ballsville, but Census records from 1920 and 1930 list Herman and his wife next to the households of Grant Cooper (1920) and William Miller (1930), who, at that time, were living on the 300 acres of the Buena Vista farmstead, sold to Albert Frayser in 1870. Thus, it seems the Flippens were likely living at the Buena Vista site during this period. It appears the Flippens were also investing in the property during their tenure, as the value of buildings increased from $400 to $500 in 1927, the first increase in value since John and Martha inherited the property in 1850.

Herman died on February 15, 1944 in Cumberland, Virginia at the age of 84. His widow appears to have remained at Buena Vista until 1953, when tax records indicate she moved to 1021 Perry Street in the city of Richmond. Following her relocation to Richmond, the farmstead once again appears to fall into a state of disrepair, as the value of structures decreased to $380 in 1959. Interestingly, in the 1947 black and white aerial image (Figure 9), taken three years after Herman's death, the driveway is still visible, but the fields and farm roads surrounding the house and yard do not appear to be in use; and in 1958 (Figure 10), the year before the

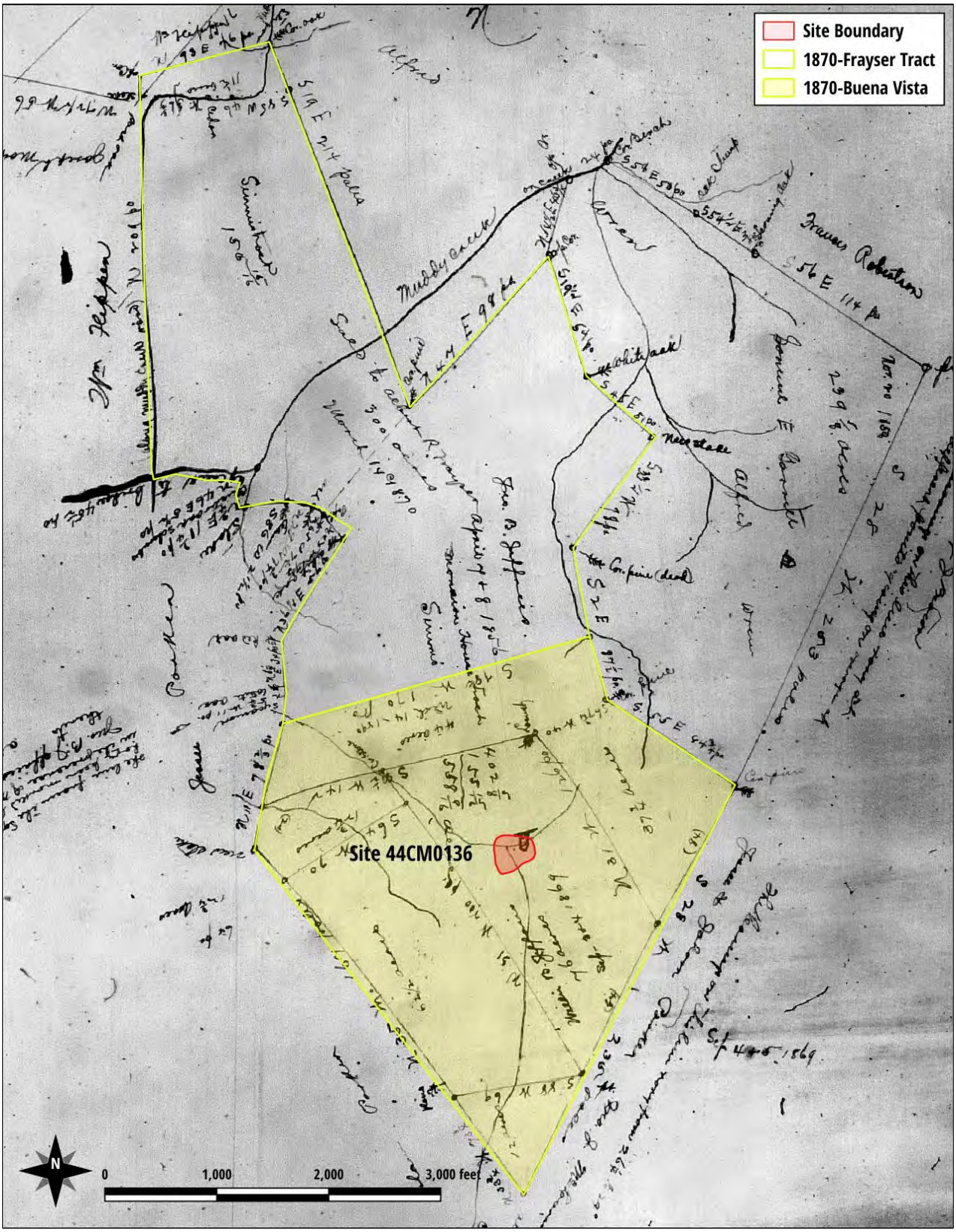

Figure 7: Buena Vista/Frayser Tract (ca. 1870) and Site Location Overlain on ca. 1874 William Garrett Plat (Cumberland County Plat Book 1:9).

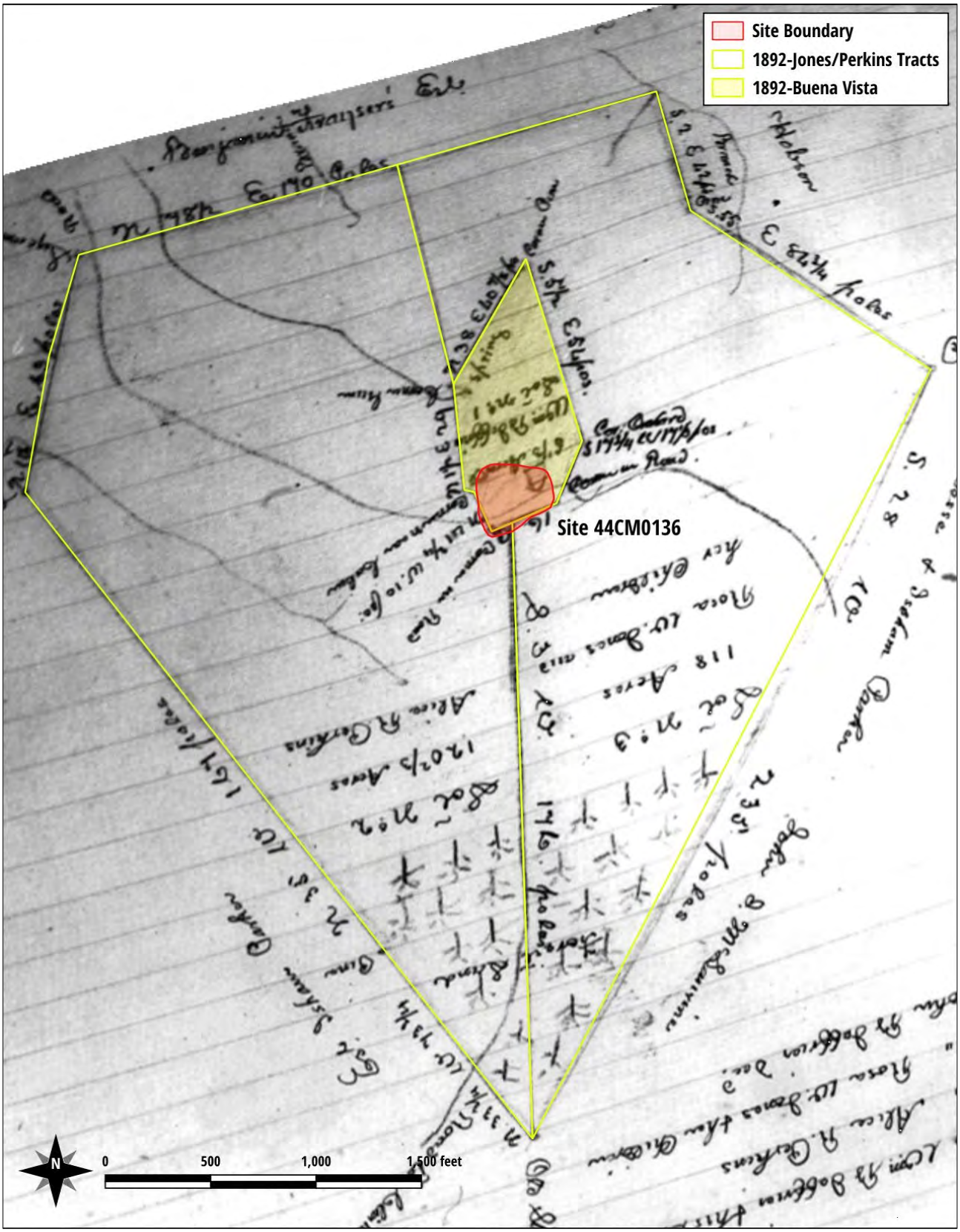

Figure 8: Site Location on the 1892 Plat of the Subdivision of Buena Vista (Cumberland County Deed Book 37:144).

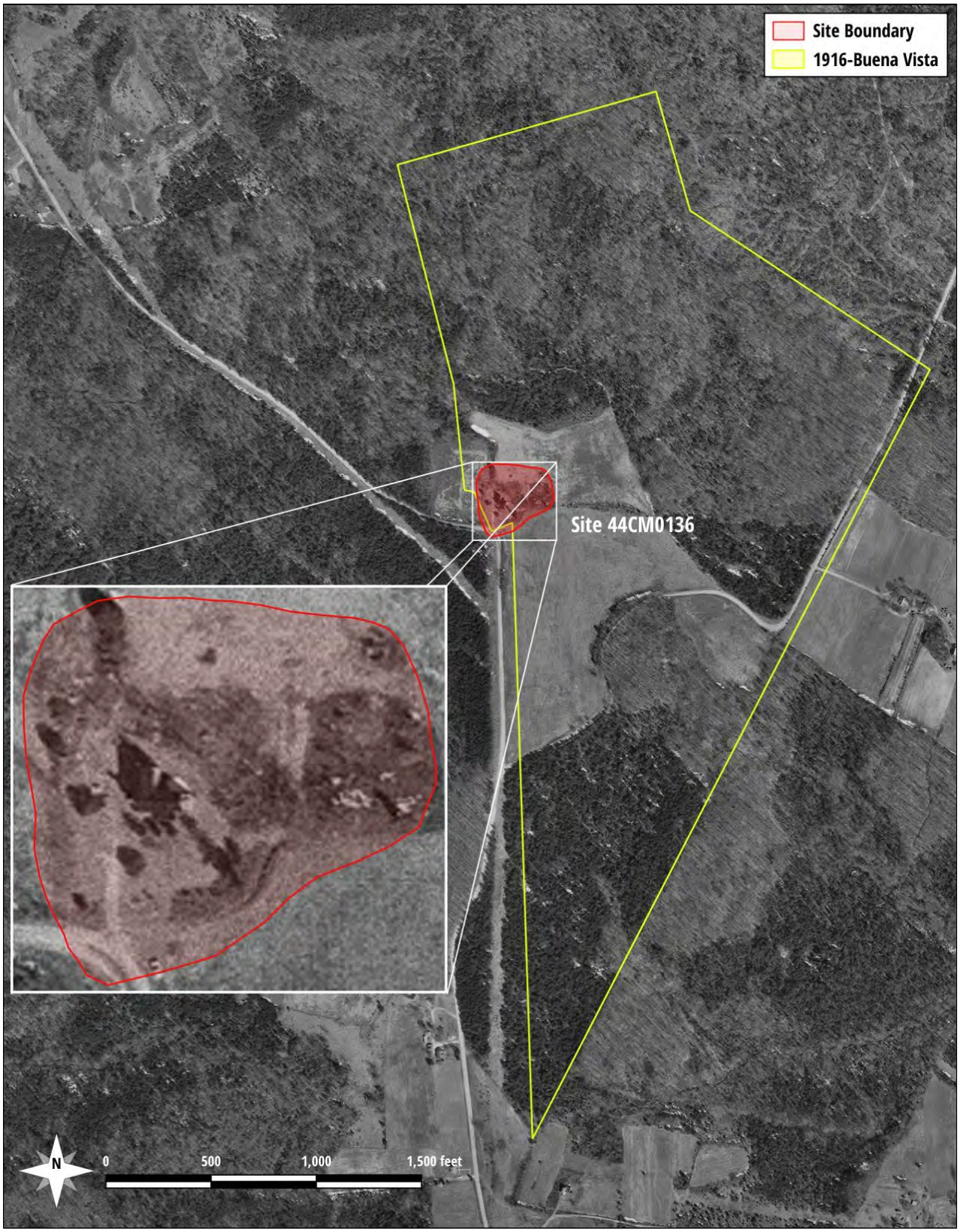

Figure 9: The Buena Vista Farmstead and Site Location Overlain on the 1947 Black and White Aerial Image of the Project Vicinity.

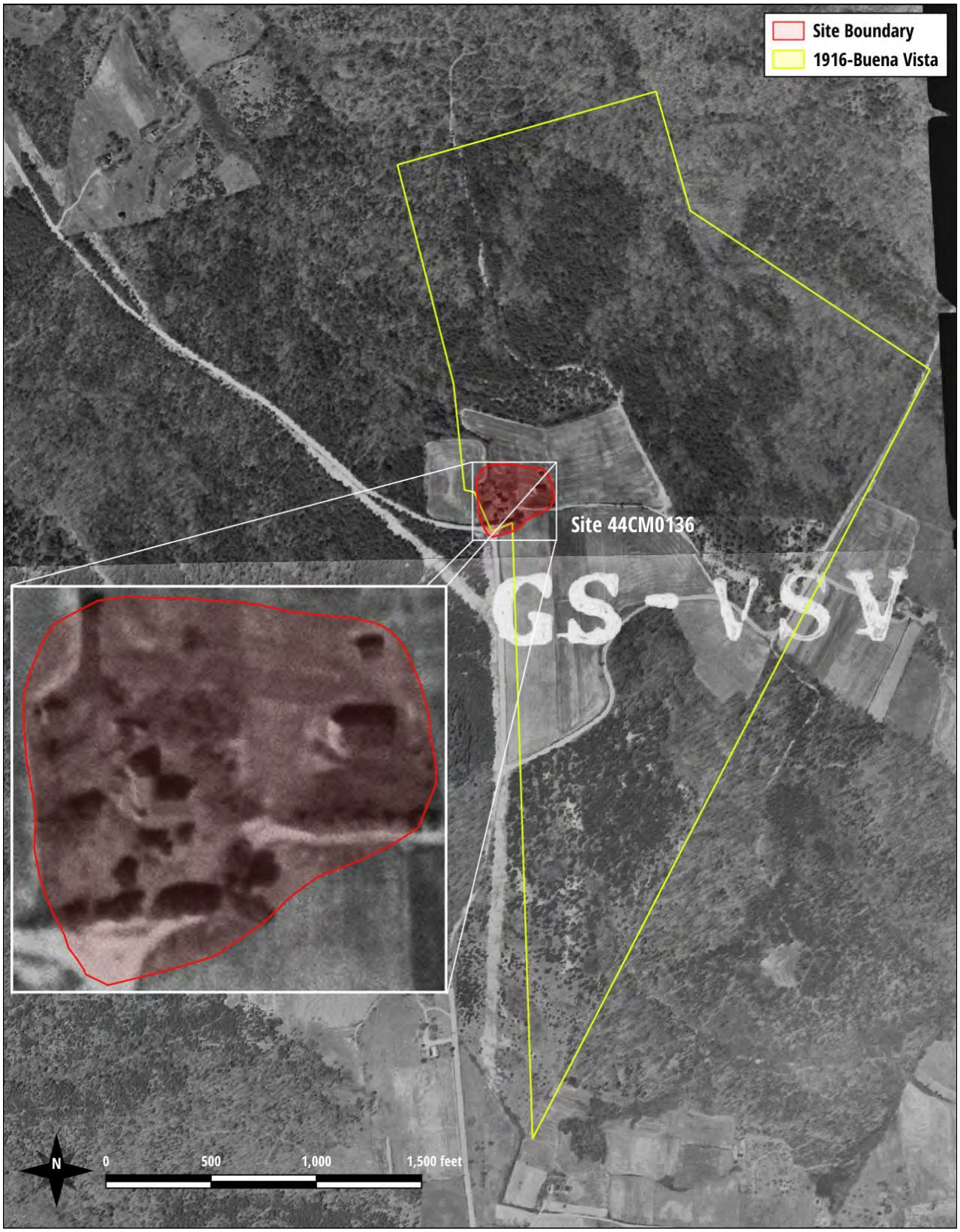

Figure 10: The Buena Vista Farmstead and Site Location Overlain on the 1958 Black and White Aerial Image of the Project Vicinity.

value of buildings decreased, two new structures are visible to the east of the house and the fields that were fallow in 1947, now appear recently harvested.
Louise retained ownership of Buena Vista until her death. In 1975, the property was sold to John H Wick III and his wife Mary. By that time the value of buildings had decreased to $270. Tax records indicate John and Mary were residents of Richmond and were not living on the property in 1979 when they agreed to allow Warren and Aldine West to dismantle the dwelling. Following their acquisition of the property, the value of buildings at Buena Vista was reassessed to the surprising value of $4,000; and in spite of the dwelling being removed in 1979, the building value was not reassessed to $0 until 1984. Aerial images from 1994 and 2002, show little to no evidence of cultural activity at the Buena Vista site (44CM0136) during the late 20th/early 21st centuries (Figures 11 and 12).

"Like a Little Edgemont"

Around the same time John and Mary Wick purchased Buena Vista, Warren and Aldine West worked out an agreement with the current owner of John McLaurine's Edgemont, now in a ruinous state, that would allow them to dismantle what remained of the structure, so that it could be reconstructed on a parcel they had purchased on Ballsville Road, approximately one-and-a-half miles southeast of its original location. Mrs. West was the great granddaughter of Leopold Levy, one of Mosby's Rangers, which spurred her efforts to preserve the Mosby birthplace, albeit in a new location.

Edgemont remained in the McLaurine family until 1862, at which point it was sold to Archer Wren, who was living on the property. During the late nineteenth and first half of the twentieth century, Edgemont had more that a dozen owners, and the house had fallen into a poor state of repair, when the West's approached the current owner, Landon Watkins, about moving the house to a new location.

The following is an excerpt from an article entitled *Piece by Piece, Plantation Reassembled* in **the Richmond Times-Dispatch**, written by Virginia Churn in 1983.

> "*The original Edgemont had a wing attached, but it was later torn down. Mrs. West was driving down a country road when she spotted what looked "like a little Edgemont", she said. The property was Buena Vista, built in Cumberland in 1838 and given by James McLaurine to his daughter, Martha Jefferies, in his will in 1848.*
>
> *The Owner [John Wick III] wanted the house removed, the Wests said, so West dismantled it, and used materials from it to reconstruct the wing onto the rear of Edgemont.*"

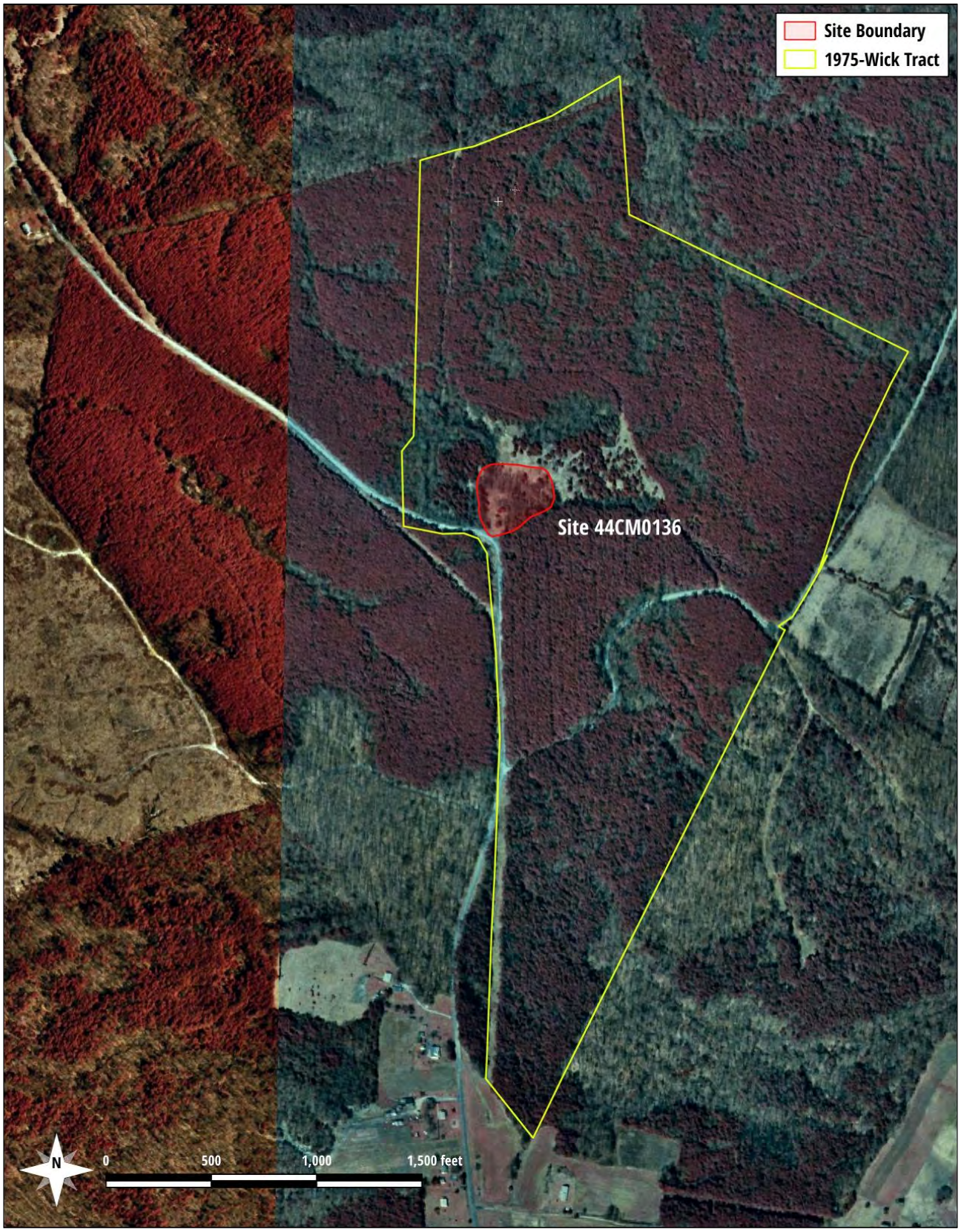

Figure 11: The Buena Vista Farmstead and Site Location Overlain on 1996 Infrared Aerial Image of the Project Vicinity.

Figure 12: The Buena Vista Farmstead and Site Location Overlain on the 2018 Natural Color Aerial Image of the Project Vicinity

Previous Investigations

A Phase I cultural resources survey was conducted on the ±1,178 acre Green Ridge property, located north of the village of Clinton, in Cumberland County, Virginia (Rose and Browning 2021). Subsurface testing was limited to 1,100 acres to be impacted by proposed construction activities and resulted in the discovery of a cemetery, a suspected cemetery location, an illegal liquor distillery, and nine historic farmsteads. One of the farmsteads identified during the Phase I investigation corresponds to the location of a dwelling associated with the name "Jeffrey" on Gilmer's 1864 Map of Cumberland County, Virginia (see Figure 6) and was recorded as site 44CM0136 during the Phase I survey. The site assemblage suggests an occupation dating to the nineteenth and twentieth centuries.

Buena Vista / Jeffries Site (44CM0136)

Historic records indicate the Jeffries site was once the home of John Jeffries and his wife Martha McLaurine and was know as Buena Vista. An L-shaped dwelling and associated outbuildings are visible on the 1947 and 1958 historic aerial photographs of the project vicinity. The 1958 photograph shows a yard area with what appears to be a dwelling, barn and other outbuildings surrounded by mowed pasture.

Visual inspection of the site identified a partially filled cellar hole, and stone piers, piles of stone, a circular concrete foundation, and at least 3 piles of brick and stone that appear to mark the locations of former outbuildings. Notably, for a site that was occupied for more than one hundred years, it appeared remarkably devoid of household debris, or any evidence of the 2-story structure that once stood on the site. The exceptions being a few items that had been dumped in the cellar hole.

Reports from local newspapers in the early 1980s suggest Buena Vista was occupied up until the late 1970s when it was dismantled by Warren and Aldine West and used in the reconstruction of Edgemont, the home of James McLaurine and birthplace of John S. Mosby. The materials obtained from Buena Vista were used to reconstruct an ell on the rear of Edgemont, a design feature that was a part of the home's original design, but had been demolished in the early twentieth century.

A total of 86 STPs were excavated within and immediately adjacent to the Phase IA boundary of site 44CM0136 (Figure 13). Soil profiles in the central portion of the site typically included a Fill layer (Fill 1) likely dating to the site occupation, encountered above an E horizon, which was underlain by sterile subsoil (B horizon). Along the site perimeter, profiles were variable and included a plowzone (Ap), and in some cases a buried plow zone (Apb), above subsoil. The profiles of STP 3-119 and 3-145 were typical of the stratigraphic profiles encountered in the central portion of the site and along the northern site perimeter, respectively (Figure 14). The site boundary was revised to include positive STPs and structural remains and includes approximately 2.23 acres. One hundred twenty-nine artifacts were recovered from 20 positive STPs during the Phase IB survey of site 44CM0136. Temporally diagnostic artifacts included cut (post 1790) and wire (post 1890) nails, lime soda windowpane fragments (post 1864), Automatic Bottle Machine (ABM) glass container fragments (post 1907), and pearlware (1775-1830) sherds. The variety of artifacts recovered from the site is typical of rural domestic farmsteads dating from the nineteenth and twentieth centuries. The artifacts recovered from the site are summarized in Table 1 and described in detail in Appendix 2.

Phase I Recommendations

Although documentary evidence confirmed that Buena Vista was removed from the site in the late 1970s, the remains of outbuildings and subsurface deposits associated with the site occupation remain and were thought to be relatively undisturbed. Based on the integrity of site deposits and its potential to contribute new information to our understanding of regional subsistence and agricultural practices and settlement patterns, site 44CM0136 was believed to be potentially eligible for inclusion on the National Register under Criterion D and avoidance or a Phase II evaluation was recommended.

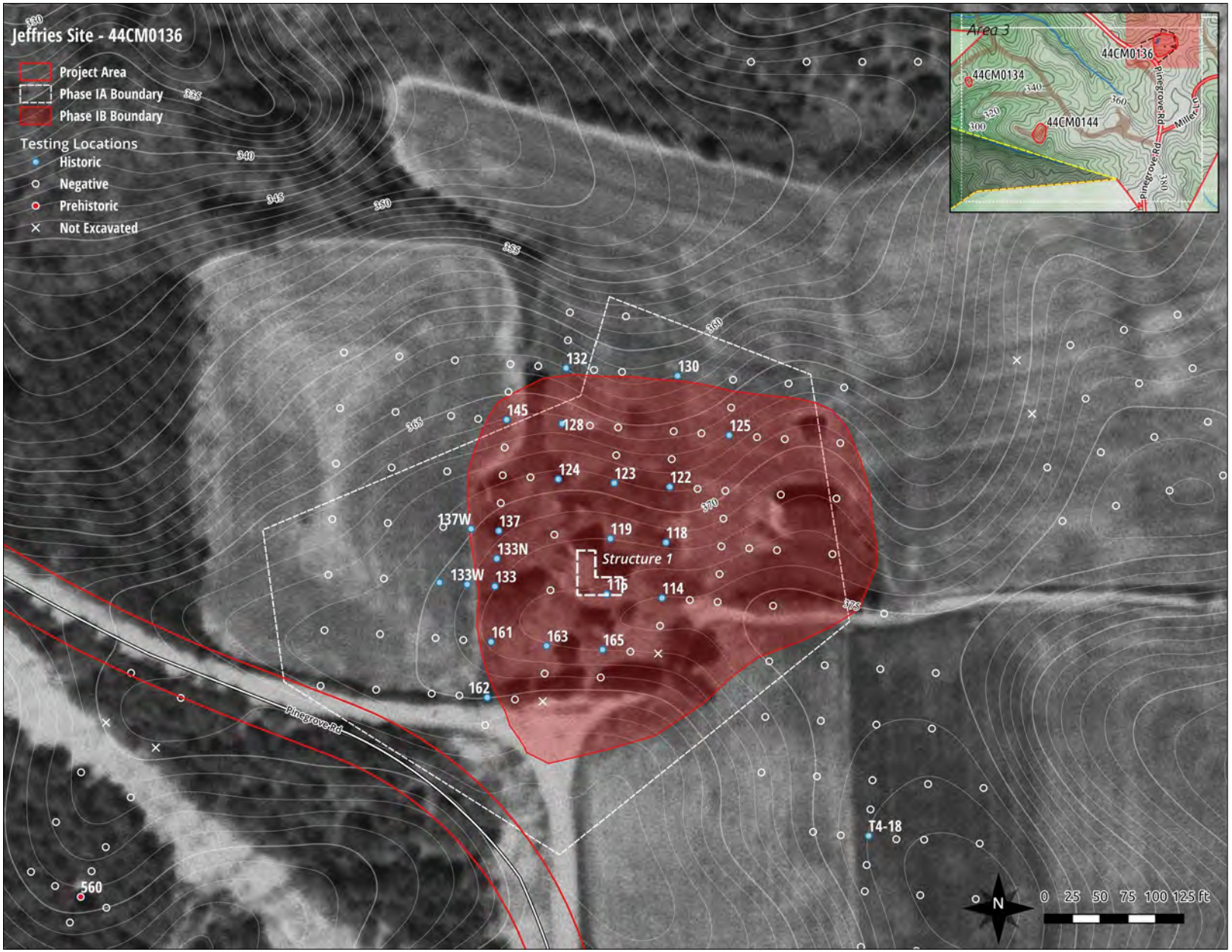

Figure 13: Closeup of Subsurface Testing, Phase IA Boundary (white) and Phase IB Boundary (red) for Site 44CM0136 Overlain on 1958 Black and White Aerial Imagery.

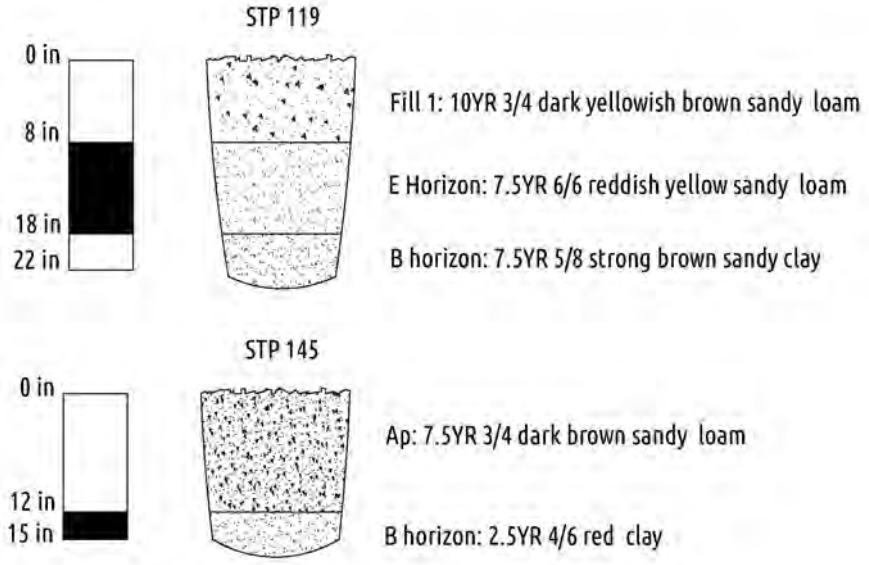

Figure 14: Typical Phase I Soil Profiles at the Buena Vista Site (44CM0136).

Table 1: Artifacts from Phase I Investigation

Artifact Type	Ap	Apb	Fill 1
Activities			
chain			1
Architecture			
brick			13
cut nail(s) (1790-present)			1
cut nail(s), machine headed (1825-present)			3
lime soda (post 1864) windowpane glass	1	1	29
unidentified nail(s)	1		8
wire nail(s) (1890s-present)	4		12
wrought nail(s)	1		
Clothing			
button(s)			1
Kitchen			
bottle/jar		1	15
bottle/jar, ABM (post 1907)	1		
canning jar			9
glassware			1
pearlware (1775-1830)			2
unidentified coarse earthenware	1		
unidentified refined earthenware	2		1
unidentified stoneware			2
white milk glass canning jar lid liner fragment			1
Organic			
animal bone			7
Unidentified			
ferrous metal fragments			9
glass fragments			1
Total - Phase I Survey	**11**	**2**	**116**

Phase II Survey Findings

A Phase II evaluation of Buena Vista (44CM0136) was carried out between July and November of 2020. At the outset of the evaluation, dense vegetation obscured the ground surface over much of the site and the surrounding environs. Thus, the initial step in the Phase II evaluation of Site 44CM0136 involved site clean up followed by visual inspection of the site for evidence of structural features and demarcation of low probability areas based on signs of post-occupational disturbance. This effort included brush hogging, selective tree removal, and hand removal of brush piles and surface vegetation in suspected structure locations.

Phase II Visual Inspection

Site cleanup revealed the remains of a historic road trace and six structures within the site boundary. Site structures included the "L-shaped" dwelling (Structure 1) identified during the Phase I survey, a suspected smokehouse (Structure 2), a barn (Structure 3), two outbuildings (Structures 4 and 5), and a hog scalding pit (Structure 6) (Figure 15). In the areas surrounding Structures 1, 2, and 4, investigators observed numerous modern objects and artifacts on the ground surface, including glass and plastic container fragments, unidentified ferrous metal fragments, and architectural debris.

Historic Road

Historic maps and aerial images of the project vicinity depict Buena Vista north of a "T" intersection, once the intersection of what is now Miller Lane and Pine Grove Road. The current alignment dates to the 1930s, when the County of Cumberland acquired rights to a strip of land approximately 30 feet wide and two miles long for use as a public road (Cumberland County Deed Book 72:72). The former east/west road remains visible in the southwestern portion of site 44CM0136 and appears to mark the southern limits of the house lot and agricultural activity area.

Structure 1-Dwelling

The former dwelling is located in the central portion of the site and is accessed by a gravel drive that extends from the current alignment of Pine Grove Road to the western side of the structure. A utility pole located off of the southwestern corner of the structure is evidence of electrification. On Gilmer's 1864 Map of Cumberland County, a structure in this approximate location is labeled with the name "Jeffries" and it is thought to be the location of Buena Vista, the 19th/20th century farmstead of three generations of the Jeffries family, beginning with the family of John Bennett Jeffries circa 1840, and ending with Herman Flippen and his wife Louise in the 1970s.

The former structure location is represented by an L-shaped cellar hole measuring approximately sixteen feet in width by forty feet along its long axes (Figure 16). Elevations within the cellar were approximately two to four feet below the surrounding ground surface and exposed wall segments revealed the foundation was constructed of at least two building materials, suggesting that the structure may have been modified or expanded during the site occupation.

The most recent section of the foundation was composed of cinder block, found along the southern wall in the southeastern corner of the structure. The cinder block did not appear to extend the full length of the southern wall and was interpreted as an emergency repair, and evidence that the foundation had become unstable at some point during the 20th century occupation. In the northern portion of the ell, an exposed segment of the northeastern wall and a large stone observed along the north wall, and interpreted as a possible hearth, indicate that this portion of the dwelling was constructed on a stone foundation. And based on the presence of masonry piers and wall segments within the cellar fill, it also seemed likely that at least some portions of the foundation were constructed of brick. No evidence of the dwelling's superstructure (roofing or walls) was observed during the visual inspection.

At the outset of the visual inspection the cellar was filled with a mixture of redeposited soil and domestic and architectural debris. While removing surface debris from Structure 1, the field crew collected a sample of temporally diagnostic artifacts representative of activities in this portion of the site. The surface collection was recorded as SC 2 and included a variety of kitchen and architectural artifacts suggestive of a site occupation dating to the 19th and 20th centuries. They are summarized in the table below.

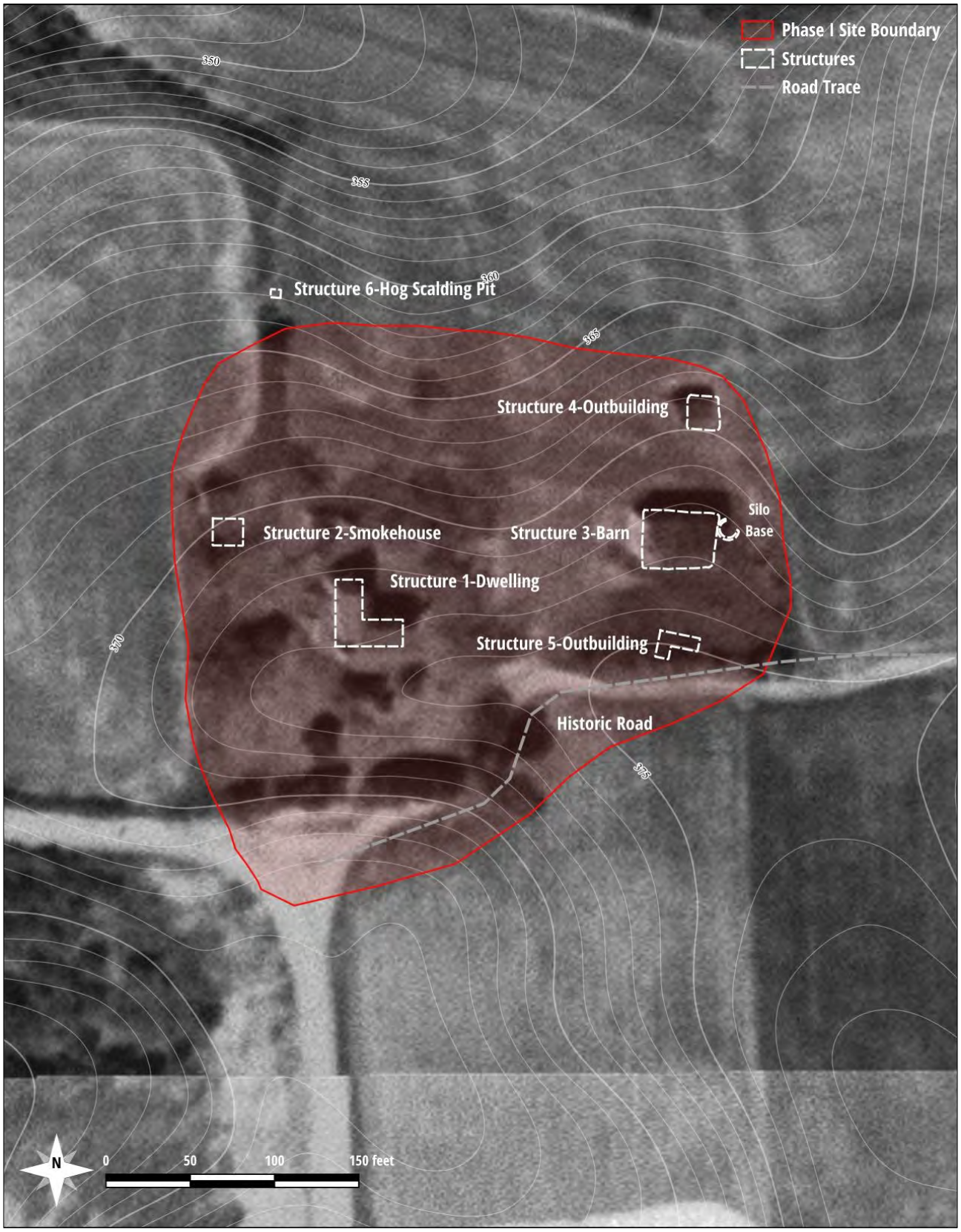

Figure 15: Man-Made Features Observed During the Phase II Visual Inspection of Site 44CM0136.

Figure 16: Structure 1-Dwelling, Facing East.

Table 2: Surface Finds from Structure 1

Artifact Type	Total
Activities	
axe head	3
Architecture	
cut nail(s) (1790-present)	4
fuse(s)	1
lime soda (post 1864) windowpane glass	1
molded brick	1
wire nail(s) (1890s-present)	12
Kitchen	
aluminum stay tab (post 1977)	1
bottle/jar	1
other porcelain	1
white milk glass canning jar lid liner	4
whiteware (post 1820)	2
Total – Structure 1 Surface Collection	**30**

Figure 17: Structure 2-Smokehouse Foundation and Standing Timbers, Facing North.

Structure 2-Smokehouse

Located approximately 60 feet northwest of the dwelling and on the opposite side of the driveway, investigators identified a standing mortise and tenon beam and stone foundation measuring approximately eighteen feet east to west by sixteen feet north to south (Figure 17). Although the structure appeared to have been collapsed for some time, the standing timbers retained a smell of smoke and soils within the stone foundation were almost black, prompting investigators to preliminarily interpret the structure as a smokehouse.

Apart from the standing timbers, no evidence of the superstructure of the smokehouse remained in association with the foundation. However, a debris pile including wire fencing, metal roofing panels and modern debris was identified along the eastern side of the structure and suggests the structure may have been demolished and/or dismantled. It is unclear if there is a structure in this location in the 1947 aerial, but a structure is clearly indicated in this location in the 1958 imagery.

A sample of artifacts collected from the ground surface while removing vegetation from Structure 2, including 21 wire nails (1890s-present), 3 cut nails, machine headed (1825-present), and one bone fragment suggest this structure is contemporary with the dwelling (Structure 1).

Structure 3-Barn

Inspection of the eastern portion of the site resulted in the discovery of a circular concrete foundation approximately ten feet in diameter and the subsequent removal of surface debris in the surrounding area identified a raised rectangular area immediately east of the circular foundation measuring approximately forty feet east to west by thirty-four feet north to south (see Figure 15). Historic aerial imagery suggests this area was distinct from both the yard encompassing Structures 1 and 2 and the surrounding pastures. No structures are visible in this location in the 1947 aerial image, but a large structure can be seen in the 1958 image. Based on the presence of the circular concrete foundation, believed to be the base of a silo, Structure 3 is interpreted as a barn.

Figure 18: Structure 5-Outbuilding, Stone Pier Foundation, Facing Southeast.

Structure 4-Outbuilding

Structure 4 was discovered approximately fifty feet north of the barn (Structure 3) and corresponds to the location of a partially constructed, or partially collapsed structure in the 1947 aerial image of the project vicinity and a standing structure in the 1958 image. Evidence of the former structure included a raised rectangular area measuring twenty feet north to south by eighteen feet east to west and seven large stones roughly organized into a rectangular pattern and interpreted as structural supports.

Structure 5-Outbuilding

A scatter of singular stones and stone piers loosely organized in an L-shaped pattern was interpreted as the remains of an outbuilding although no structures are visible in this location in the 1947 and 1958 aerial images of the project vicinity (Figure 18). A variety of glass beverage bottle and jar fragments produced with an automatic bottle machine, ferrous metal wire, and unidentified ferrous metal fasteners were also observed in the building location during site cleanup and suggest this area was used for the casual disposal of domestic debris during the 20th century (Figure 19).

Structure 6-Hog Scalding Pit

The remains of a structure measuring 4 feet north to south by 5.5 feet east to west and standing 12 to 18 inches above ground was identified north of the northwestern site boundary (Figure 20). Constructed of brick, it resembled the remains of a partially collapsed brick barbecue with a spherical depression approximately 3 feet in diameter centrally located within the western portion of the superstructure apparently intended to hold a circular vessel, such as a cauldron and what appeared to be the remains of a flue in the eastern third of the structure. Upon initial identification, the structure was interpreted as a possible hog scalding pit.

Phase II STP Survey

Following site clearing activities, the Phase I STPs were relocated and a 25 foot grid was established for the Phase II survey using pull tapes and compasses for increased accuracy. During the Phase II investigation, one hundred ninety three STPs were excavated at twenty-five foot intervals within and surrounding the previously defined limits of Site 44CM0136, except in the locations of Phase I test pits (Figure 21). Phase II STPs were

Figure 19: Structure 5-Surface Finds.

Figure 20: Structure 6-Hog Scalding Pit, Facing East

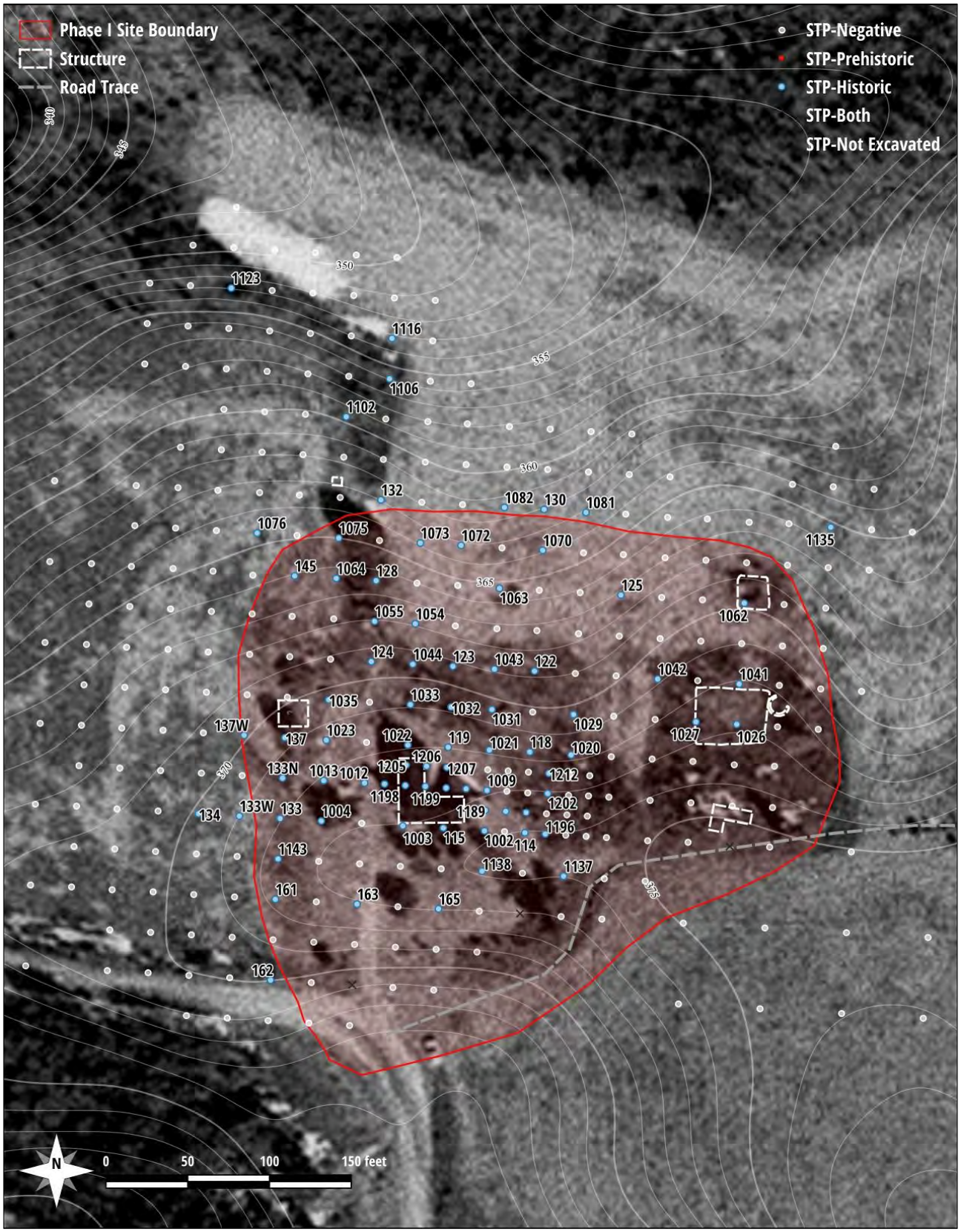

Figure 21: Results of Phase II STP Survey at Site 44CM0136 Overlain on 1947 Black and White Aerial Image.

numbered sequentially beginning with STP 999 to distinguish them from earlier testing locations. Twenty five additional STPs were excavated at 12.5 foot intervals to the north and east of Structure 1, to explore the possibility of an additional structure and/or well in this location. The closer interval STPs found no evidence of a structure or well, but helped define the extent of the modern refuse scatter observed in this area during the visual inspection.

A total of 332 artifacts were recovered from fifty five positive STPs during the Phase II STP survey. In the site interior, artifacts were primarily recovered from two distinct fill layers (Fill 1 and Fill 2) interpreted as a demolition fill (Fill 1) and occupation fill (Fill 2). Around the perimeter of the site, excavators typically encountered a plowzone (Ap) and in some areas an additional buried plowzone (Apb), above sterile subsoil (B horizon). Artifacts were recovered from both the plowzone and buried plowzone. STP 1009, excavated east of the dwelling (Structure 1) and STP 1042, located west of the barn (Structure 3), exhibited soil profiles typical of the domestic activity area and agricultural activity area, respectively. Their stratigraphic profiles are summarized below and illustrated in Figure 22.

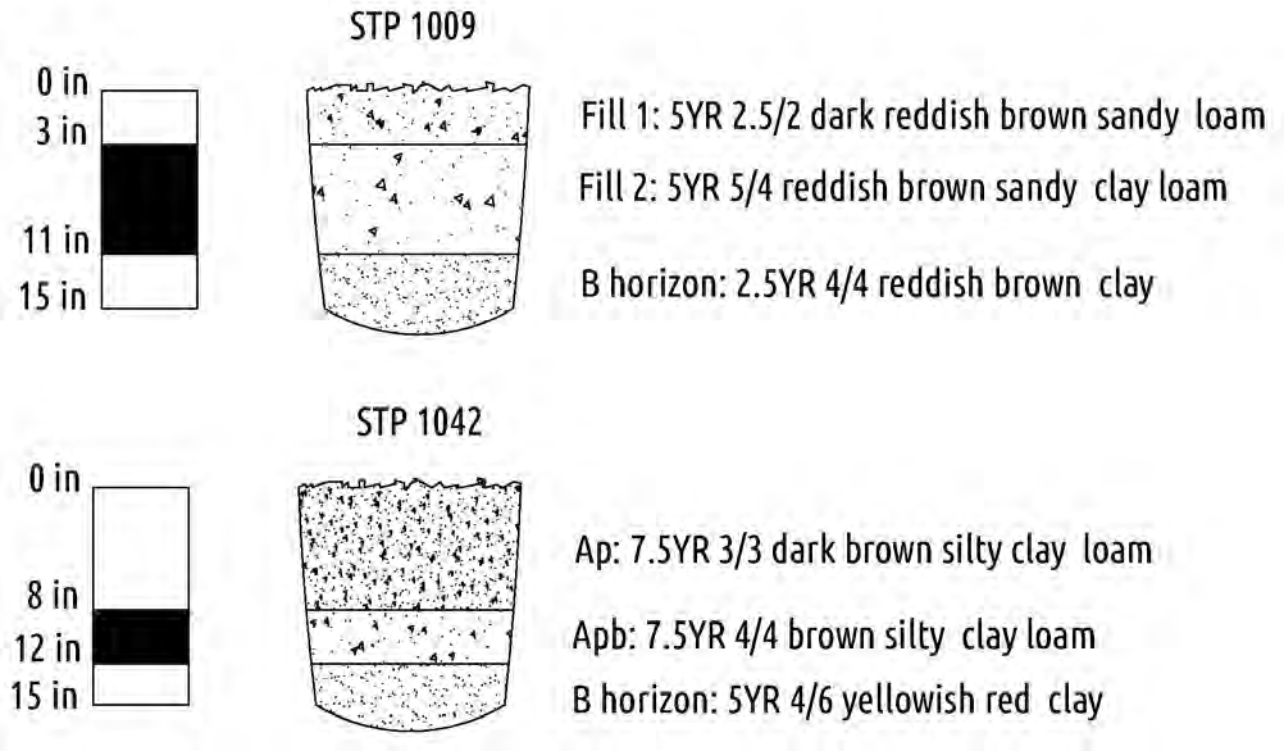

Figure 22: Typical Phase II STP Soil Profiles at the Buena Vista Site (44CM0136).

STP 1009

Fill 1: 0-3 inches-5YR 2.5/2 dark reddish brown sandy loam
Fill 2: 3-11 inches-5YR 5/4 reddish brown sandy clay loam
B horizon: 11-15 inches-2.5YR 4/4 reddish brown clay

STP 1042

Ap: 0-8 inches-7.5YR 3/3 dark brown silty clay loam
Apb: 8-12 inches-7.5YR 4/4 brown silty clay loam
B horizon: 12-15 inches-5YR 4/6 yellowish red clay

Table 3 summarizes the artifacts recovered during the Phase II shovel test investigation at site 44CM0136. In the table, artifacts are sorted by functional group, artifact type, and the soil layer from which they were recovered for ease of comparison. Full artifact descriptions can be found in the Artifact Inventory (Appendix 2).

Table 3: Artifacts from Phase II STPs

Artifact Type	Ap	Apb	Fill 1	Fill 2
Activities				
flatiron	1			
wire fencing	1			
Architecture				
brick	9	26	30	10
ceramic pipe	2		10	
escutcheon			1	
lime soda (post 1864) windowpane glass	2	4	27	
mortar			2	
plaster			38	
porcelain toilet/sink	1			
staple			2	
unidentified nail(s)	1			
wire nail(s) (1890s-present)	3	1	21	
Kitchen				
aluminum beverage can (post 1965)			1	
American Stoneware			1	
bottle, ABM (post 1907)			45	
bottle/jar		1	3	
bottle/jar, ABM (post 1907)			23	
bottle/jar, chilled iron mold (1880-1930)	1	1		
bottle/jar, freeblown (pre 1850)			1	
ferrous metal can			1	
glassware, pressed			1	
liquor bottle, ABM (post 1907)			1	
unidentified refined earthenware		1	1	
white milk glass canning jar lid liner			1	
whiteware (post 1820)			2	
Personal				
key			1	
Unidentified				
ferrous metal	14		13	
glass		2		
non-ferrous metal	1		10	
plastic		1		
unidentified ceramic		4		
Organic				
charcoal	7			
Total - Phase II STPs	**41**	**41**	**240**	**10**

Temporally diagnostic artifacts recovered during the Phase II STP survey included 2 whiteware sherds (post 1820), 1 free-blown bottle glass fragments (pre-1850), 33 lime-soda windowpane glass fragments (post 1864), 2 chilled iron mold bottle fragments (1880-1930), 25 wire nails (1890s-present), 69 ABM bottle glass fragments (post 1907), and an aluminum beverage can (post 1965). More than tow-and-a-half times as many artifacts were recovered from the demolition fill (Fill 1) as from the plowzone (Ap), buried plowzone (Apb), and the occupation fill (Fill 2) combined.

Figure 23: Mapping Metal Detector Strikes.

Phase II Metal Detector Survey

Although the visual inspection identified six structures within the site boundary, finds from the STP survey were concentrated around the dwelling (Structure 1) and provided little information with respect to the nature of historic activities at Structures 2 through 6. Thus, three areas were selected for further investigation with a metal detector. The first was a large area surrounding Structures 3, 4, and 5 along the eastern site boundary (Figure 23). The second included the area between Structures 3-5 and the dwelling, and encompassed an area that included a surface scatter of brick, stone, and daffodils, as well as two mounds of earth, thought to mark the location of a possible seventh structure. The third metal detector area encompassed Structure 2 along the western boundary of the domestic area. As mentioned previously, the area surrounding the dwelling (Structure 1) exhibited significant quantities of modern objects and architectural debris scattered across the ground surface, including mortar, plaster, brick fragments, unidentified ferrous and non-ferrous objects, and glass and plastic container fragments; and thus, was excluded from the metal detector survey.

Five hundred fifty two strikes were recorded and mapped during the metal detection of the three survey areas (Figure 24). Given the large number of strikes, it was decided that a random 20% sample would initially be excavated, and that additional strikes would be excavated in the vicinity of any significant finds. Two hundred ninety five artifacts were recovered from 137 excavated metal detector strikes (24.8% sample) during the Phase II metal detector survey. As expected, finds were concentrated in the locations of the surface debris scatters observed to the east of the dwelling (Structure 1) and in and around Structure 5, and primarily consisted of kitchen and architectural artifacts dating from the late 19th and early 20th century.

Table 4 summarizes the artifacts recovered during the Phase II metal detector survey at site 44CM0136. In the table, artifacts are sorted by functional group, artifact type, and the soil layer from which they were recovered for ease of comparison. Full artifact descriptions can be found in the Artifact Inventory (Appendix 2).

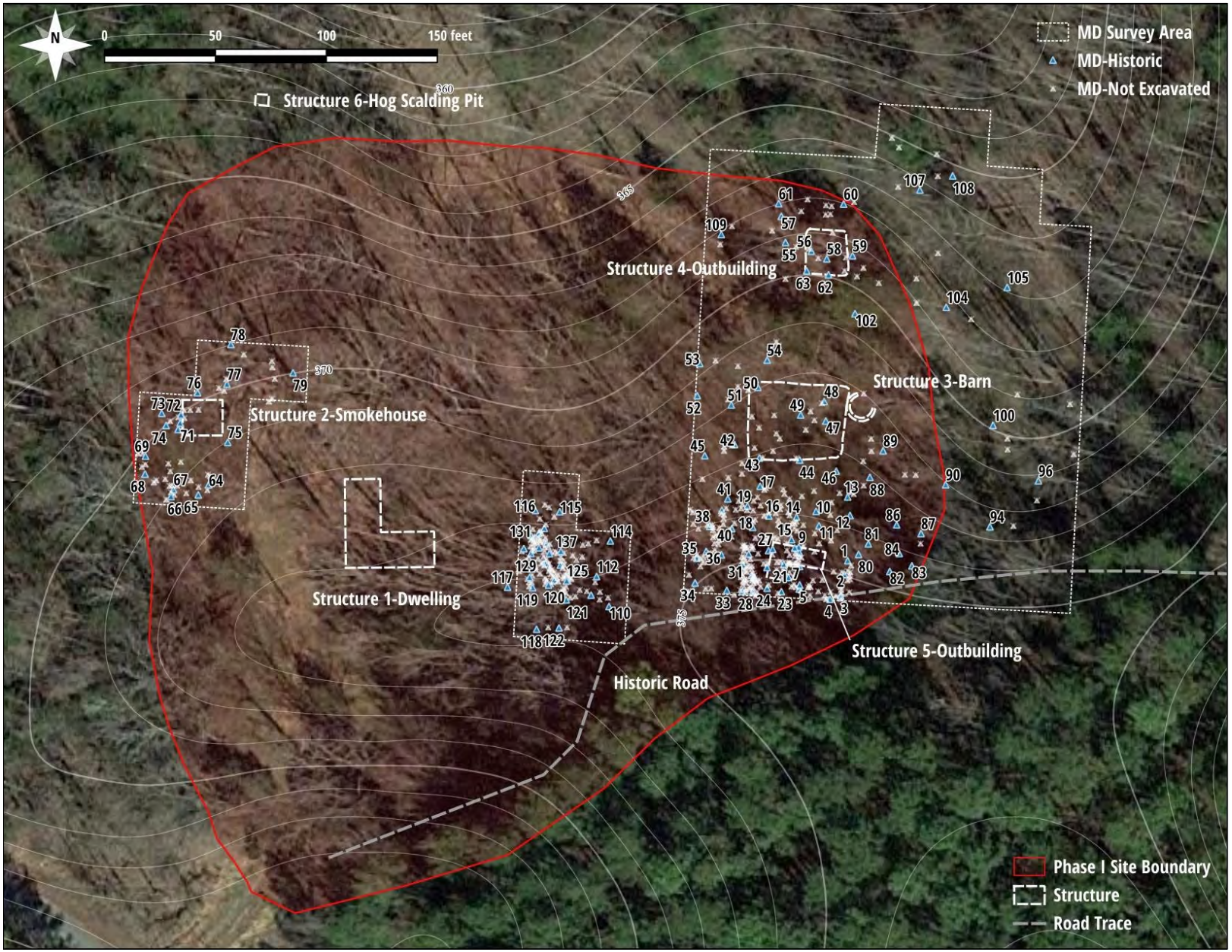

Figure 24: Results of Phase II Metal Detector Survey at Site 44CM0136.

Table 4: Artifacts from Phase II Metal Detector Survey

Artifact Type	Ap	Apb	Fill 1
Activities			
battery	3		
cultivator shoe	1		
ferrous metal bar	1		
horseshoe	1		
plowshare	2		
rake	1		
washers	1		
wire fencing	18		4
wrench	1		
Architecture			
cast iron pipe	2		
cut nail(s), machine headed (1825-present)	2		2
hinge			1
lime soda (post 1864) windowpane glass	6		1
nail(s)	2		
pintle	1		
spike(s)	1		
unidentified nail(s)	1		1
wire nail(s) (1890s-present)	41		12
Arms			
bullet	1		
shotgun shell			1
Clothing			
button	1		
Kitchen			
aluminum beverage can (post 1965)	9		3
aluminum can			1
aluminum easy open lid (post 1960)	1		
aluminum stay tab (post 1977)			1
aluminum ring tab (post 1966)			2
aluminum three-piece can	1		1
aluminum two-piece can (post 1964)	1		1
bottle			10
bottle, ABM (post 1907)	8		1
bottle/jar			3
bottle/jar, ABM (post 1907)	4		1
canning jar	1		
ferrous metal beverage can	6		3
ferrous metal can	12		15
ferrous metal three-piece can	4		6
kettle(s)	1		
liquor bottle, ABM (post 1907)			2
medicine bottle, ABM (post 1907)	1		
metal pan(s)	1		
metal pot(s)	1		
other cap/closure	1		1

unidentified ferrous metal beverage can			1
unidentified ferrous metal unidentified form	1		
whiteware (post 1820)			1
Personal			
shoes	4		
Unidentified			
ferrous metal	42	1	15
non-ferrous metal	4		5
other	7		
Organic			
animal bone	7		2
Total - Phase II MDs	**197**	**1**	**97**

Temporally diagnostic artifacts included cut (post 1825) and wire nails (post 1890), lime soda windowpane fragments (post 1864), ABM bottle and jar fragments (post 1907), and a single sherd of whiteware ceramics (post 1820). Finds were principally recovered from the plowzone (Ap) and Fill 1, with a single unidentified ferrous metal fragment found within the buried plowzone (Apb). As a whole, finds suggest a late nineteenth / twentieth century site occupation, consistent with the results of the Phase I and II STP surveys.

At the conclusion of the metal detector survey, the Phase I site boundary was adjusted to reflect Phase I and Phase II artifact distributions.

Phase I / Phase II Artifact Distribution

Artifacts recovered during the Phase I STP survey and the Phase II STP and metal detector surveys were incorporated into the project GIS and a historic artifact distribution map was generated to inform the placement of Phase II test units. Those artifacts collected during the visual inspection were excluded given the general nature of their horizontal provenience. The historic distribution map was created using the Heatmap tool in QGIS and weights were calculated using gross artifact counts with a Quartic kernel shape and a radius of 30 feet. Figure 25 shows the revised, Phase II site boundary and the distribution of historic artifacts recovered during the STP and metal detector survey overlain on the 1958 aerial image of the project vicinity.

The distribution of historic artifacts recovered during the Phase I/II STP survey and Phase II metal detector survey highlighted the areas to the east, west, and north of the dwelling, presumably the side and rear yard. Notably the area to the south of the house, which would have functioned as the front yard, was mostly devoid of artifacts.

The densest concentration of artifacts was identified along the eastern boundary of the yard, in an area where a surface scatter of artifacts and an earthen mound observed during the visual inspection were interpreted as possible evidence of an additional structure, such as a detached kitchen. A second concentration was also noted in the northwestern corner of the yard and along the western yard boundary, in an area that corresponds to the location of the smokehouse. Outside of the domestic yard, concentrations of historic artifacts were also indicated in the locations of the two outbuildings along the eastern site boundary (Structures 4 and 5).

Phase II Test Units

Test units were located to explore surface features and the concentration of historic artifacts to the east of the dwelling (TUs 1 and 2), and to provide a sample of the cultural content of the fills in and around the smokehouse (TUs 3, 4, and 5), the dwelling (TUs 6 through 12 and 16 through 19), the hog scalding pit (TUs 13 and 20), and the outbuildings along the eastern site boundary (TUs 14 and 15) (see Figure 25).

In the following discussion, the results of test unit excavations begin with TU 1 and TU 2. The remainder are presented by structure number (i.e. Structure 1: Dwelling, Structure 2: Smokehouse, Structure 4: Outbuilding, Structure 5: Outbuilding, and Structure 6: Hog Scalding Pit).

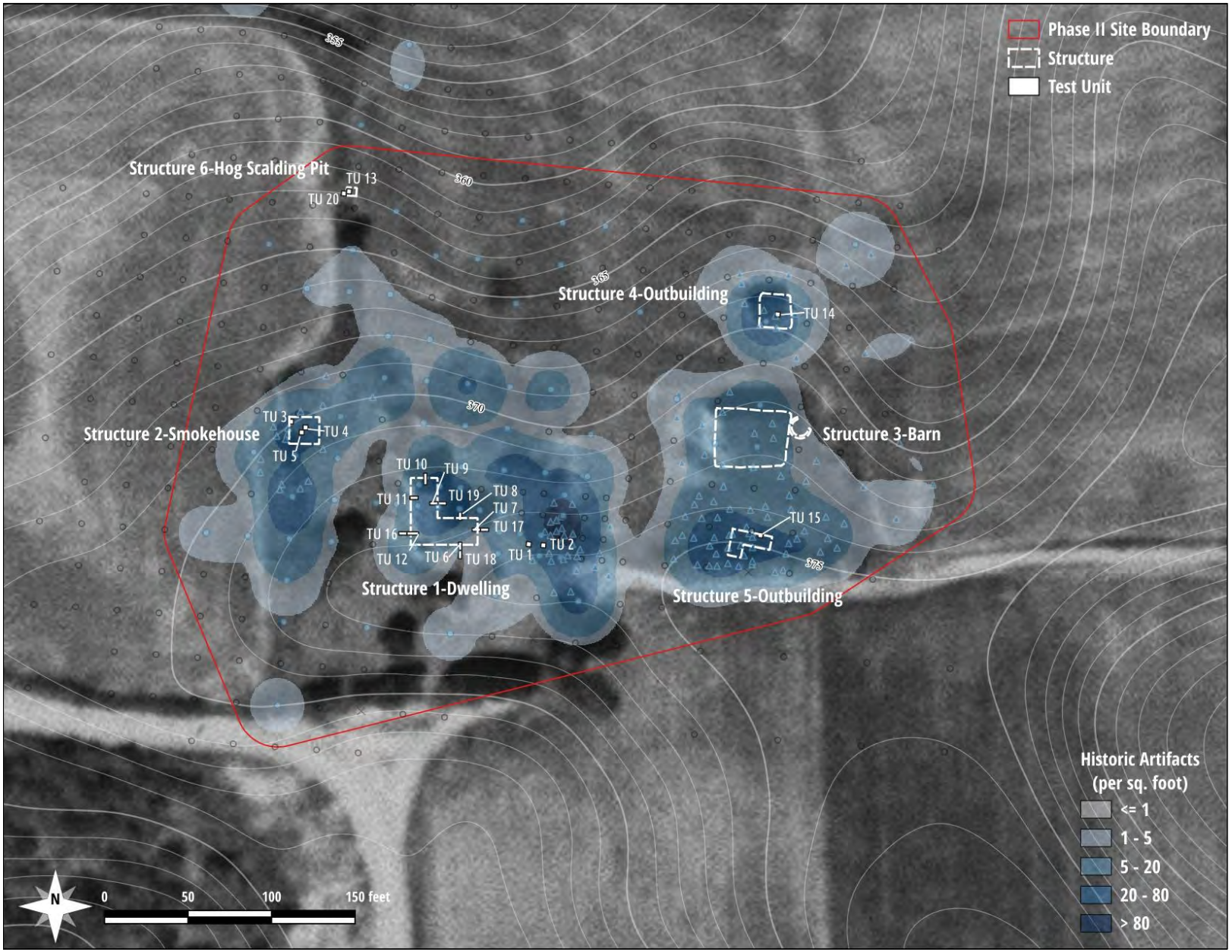

Figure 25: Distribution of Historic Artifacts from the STP and Metal Detector Investigations Showing Test Unit Locations on 1958 Black and White Aerial Imagery.

Surface Features/Possible Structure

Test Unit 1

Test Unit 1 (TU 1) measured three feet by three feet and was was cited to explore the possibility of a seventh structure. Located approximately 30 feet east of the dwelling, the unit was excavated on the western face of a mound of earth which extended approximately two feet above the surrounding ground surface and was initially suspected to the be the remains of a brick chimney. A datum stake was set 12 inches south of the southeast corner of the test unit at approximately 7 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 1.

Excavations revealed two sterile fill layers (Fill 1 and Fill 2) terminating at roughly the same elevation of the surrounding ground surface. Fill 1 was classified as a reddish brown (2.5YR 5/4) sandy loam and was described as a loose sandy fill (Figure 26). It extended from the surface to approximately seven inches below ground surface. Fill 2 extended from seven to seventeen inches below ground surface and was slightly more compact than the upper fill. Fill 2 was described as a red (2.5YR 4/8) sandy clay loam. Beneath Fill 2, excavators encountered what was described as the original ground surface, a brown (7.5YR 4/4) sandy clay loam, approximately seven inches in depth. Based on the results of previous testing, this layer was believed to date to the latter part of the site occupation or the demolition of the dwelling, circa 1979. Following the removal of Fill 3, excavations continued approximately 4 inches into sterile subsoil (B horizon), described as a yellowish red (5YR 5/6) sandy clay.

Table 5 summarizes the artifacts recovered from TU 1 by functional group and soil horizon. Complete artifact descriptions and a full inventory of finds can be found in Appendix 2.

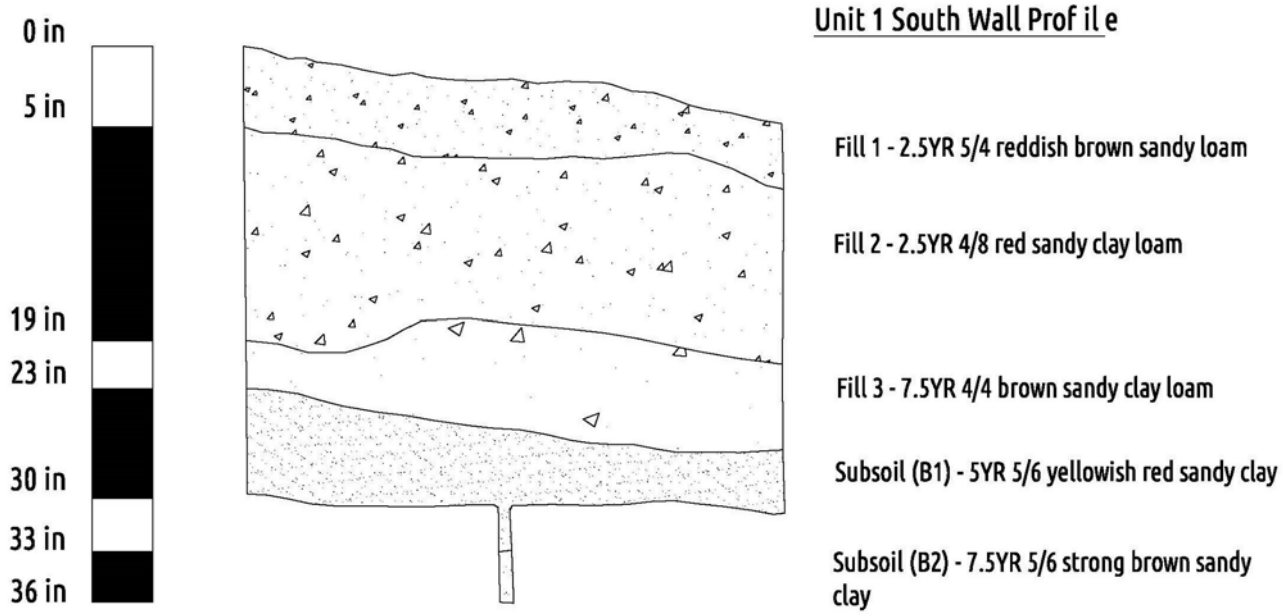

Figure 26: Test Unit 1, South Wall Profile.

Table 5: Artifacts Recovered from TU 1

Artifact Type	Fill 3
Activities	
bolt	1
Architecture	
brick	2
lime soda (post 1864) windowpane glass	11
wire nail(s) (1890s-present)	2
Kitchen	
bottle/jar, ABM (post 1907)	1
Unidentified	
ferrous metal	1
glass	1
Total – TU 1	**19**

All of the artifacts recovered during the excavation of TU 1 were found within Fill 3. Temporally diagnostic artifacts, including lime soda windowpane glass (post 1864), wire nails (1890s-present), and ABM bottle/jar fragments (post 1907) suggest a site occupation during the late nineteenth- through the twentieth- century.

Test Unit 2

TU 2 was a three foot square located on the eastern face of the same earthen mound sampled by TU 1, approximately 6 feet east of the previous test unit. Nearby finds included brick fragments, wire nails, ferrous and non-ferrous can fragments, and a white milk glass canning jar lid liner fragment recovered during the STP and metal detector surveys. As with TU 1, TU 2 was cited to explore the potential for a historic structure in this location.

A datum stake was set 12 inches south of the southeast corner of the test unit at approximately 13 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 2. Although TU 2 also contained three distinct fill layers above sterile subsoil, the layers and their cultural content varied considerably from those encountered in TU 1 (Figure 27).

Fill 1 was a very dark grayish brown (2.5Y 3/2) sandy loam and extended to an average of eight inches below ground surface. Layer depths followed surface contours, with the deepest deposits in the eastern half of the test unit. The color of Fill 2 was more typical of the subsoil encountered in other portions of the site (yellowish red sandy clay loam / 5YR 4/6), but its friable texture and the large quantities of container glass it contained suggested it had been excavated and redeposited during the twentieth century. Unlike the layer above, the depths of Fill 2 were generally consistent from the eastern to the western half of the unit, terminating at approximately twelve inches below ground surface. Beneath Fill 2, excavators encountered a third fill layer (Fill 3) approximately 6 inches in depth, described as a dark yellowish brown (10YR 3/6) sandy loam. Sterile subsoil was reached at approximately 18 inches below ground surface and was described as a strong brown (7.5YR 5/6) sandy clay. A soil core taken from the center of the unit found a gradual transition to a yellowish red (5YR 5/8) sandy clay at 27 inches below ground surface. These layers were labeled B1 and B2, respectively.

Table 6 summarizes the artifacts recovered during the excavation of TU 2. Finds from each of the fill layers included a mixture of architectural and kitchen artifacts. Although the quantities of artifacts in these functional groups were significantly higher in Fill 1 and Fill 2 than they were in Fill 3. Temporally diagnostic finds from TU 2 included lime soda windowpane glass (post 1864) and wire nails (post 1890), but the significant quantities of container glass produced with an Automatic Bottle Machine (post 1907) recovered from each of the fill layers suggest all three layers date to the twentieth century.

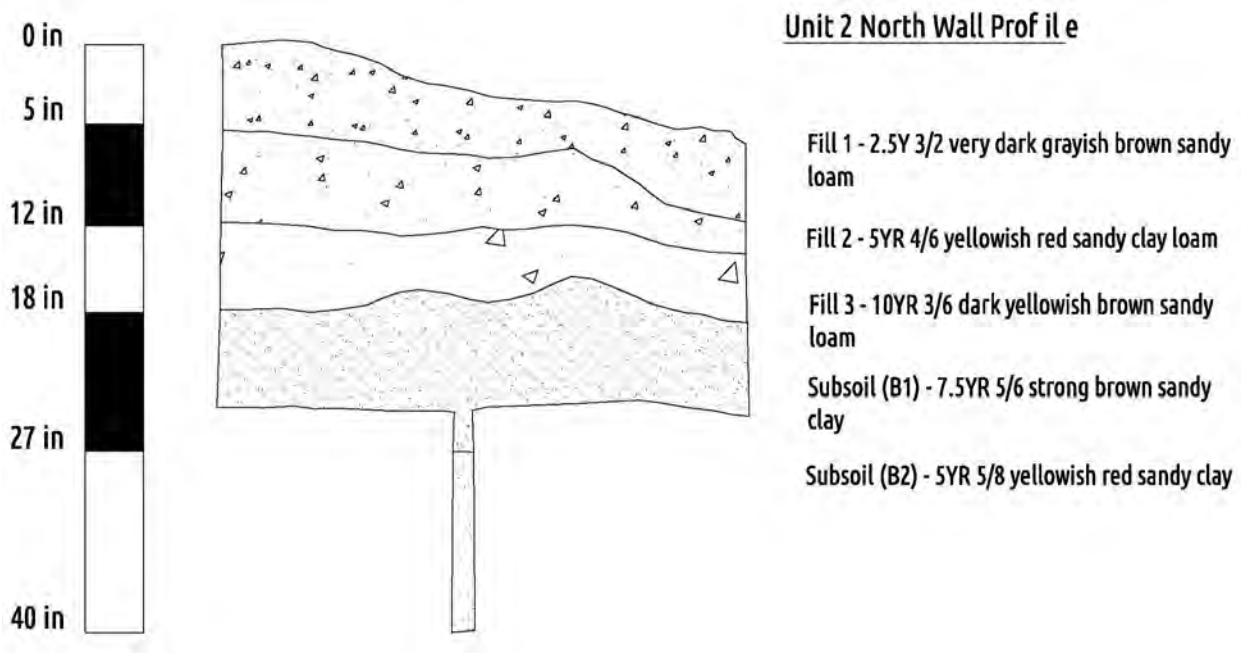

Figure 27: Test Unit 2, North Wall Profile.

Table 6: Artifacts Recovered from TU 2

Artifact Type	Fill 1	Fill 2	Fill 3
Activities			
chain	1		
sickle bar blade guard			1
Architecture			
bolts		1	
brick	47	12	2
fuse(s)	1		
lime soda (post 1864) windowpane glass	3	10	2
mortar		1	
unidentified nail(s)	1		
wire nail(s) (1890s-present)		1	1
Kitchen			
bottle		2	
bottle, ABM (post 1907)	9	33	
bottle/jar	10	14	7
bottle/jar, ABM (post 1907)	9	59	25
Bristol glaze		1	
canning jar, ABM (post 1907)		98	
ferrous metal	2	2	
ferrous metal beverage can	3		
glassware		1	
glassware, pressed	1		
jar		2	
jar, ABM (post 1907)		1	
liquor bottle, ABM (post 1907)	23		2
other cap/closure		2	

stoneware		1	
Unidentified			
ferrous metal		5	3
glass	1		
Total – TU 2	**111**	**246**	**43**

Summary

Test Units 1 and 2 were located to explore the possibility of an additional structure to the east of the dwelling; however, neither unit found evidence of intact structural remains in this location. Each test unit contained three distinct cultural layers above sterile subsoil, but the soil colors and cultural content of the upper fill layers (Fill 1 and Fill 2) were inconsistent from one unit to the next. Although the colors of Fill 3 in both test units was inconsistent, both contained a mixture of architectural and kitchen artifacts in small quantities and are interpreted as one continuous cultural layer. The presence of container glass produced with an Automatic Bottle Machine in this fill layer suggest that it (Fill 3) and the layers above (Fill 1 and Fill 2) date to the twentieth century.

Structure 1 - Dwelling

During the initial round of testing around the dwelling, one test unit was excavated along each of the structure's six walls (TUs 6 through 11) and one additional test unit (TU 12) was excavated along the structure's western wall to explore any differences between what was believed to be the older (southern) section, and later addition (northern section) (see Figure 25). Generally speaking, these units found evidence of significant twentieth century activity beginning with the collapse and reconstruction of a portion of the southern wall and ending with the demolition of the dwelling in the late twentieth century, and subsequent dumping of household debris in the cellar hole. Four additional test units were later excavated along the outer/exterior boundaries of TUs 6, 7, 9, and 12 in an effort to identify and sample soil layers dating to the earliest period of site occupation. However, these efforts proved largely unsuccessful.

In the following section, test units are discussed in the order of excavation. Where two contiguous test units were excavated, the results of excavations in both test units are presented as "Trenches".

Trench 1: (TU 6 and TU 18)

Trench 1 measured 2 feet east to west by 10 feet north to south and included TU 6 (northern half) and TU 18 (southern half) (Figure 28). Trench 1 straddled the only remaining portion of southern wall of the dwelling, composed of two parallel courses of concrete block. The block wall extended from the southeastern corner of the dwelling approximately one third of the length of the southern wall and terminated at the remains of a collapsed masonry wall that extended to the southwestern structure corner. Although the wall was known not to be an original component of the foundation, the unit was placed such that it would provide a sample of the cellar fill, builder's trench (if present), and surface deposits surrounding the structure with the intended goal of finding artifacts contemporary with the original construction of this portion of the dwelling, the site occupation, and the reconstruction of the wall. The artifacts collected during the excavation of Trench 1 are presented in Table 7.

Trench excavations identified four distinct cultural fills within the excavation area, and although the artifacts contained within the soil layers were unable to provide a chronology, the stratigraphic profile suggested Fill 1 was the most recent deposit, and was preceded by TU 6-Fill 2, TU 6-Fill 3, and TU 6-Fill 4/TU 18-Fill 2. Vertical control during excavations was provided by datum stakes set 12 inches south of the southeastern corners of each test unit.

Fill 1, described as a dark reddish brown (2.5YR 2.5/4) sandy loam was found inside and outside of the cellar hole in both test units. Within the cellar, Fill 1 extended 30 inches below the ground surface, while outside of the cellar it averaged 8 inches in depth. Architectural artifacts, principally lime soda windowpane fragments (n=148), were the dominant group and accounted for 93% of the finds (n=240) in Trench 1. Other architectural finds included sections of a brick wall, brick fragments, and cut- and wire- nails. By comparison, kitchen artifacts accounted for 4% (n=11) of the Fill 1 assemblage. Given the unusually high percentage of architectural remains, this layer is interpreted as a demolition fill, likely dating to the deconstruction of the dwelling by Warren and Aldine West in 1979.

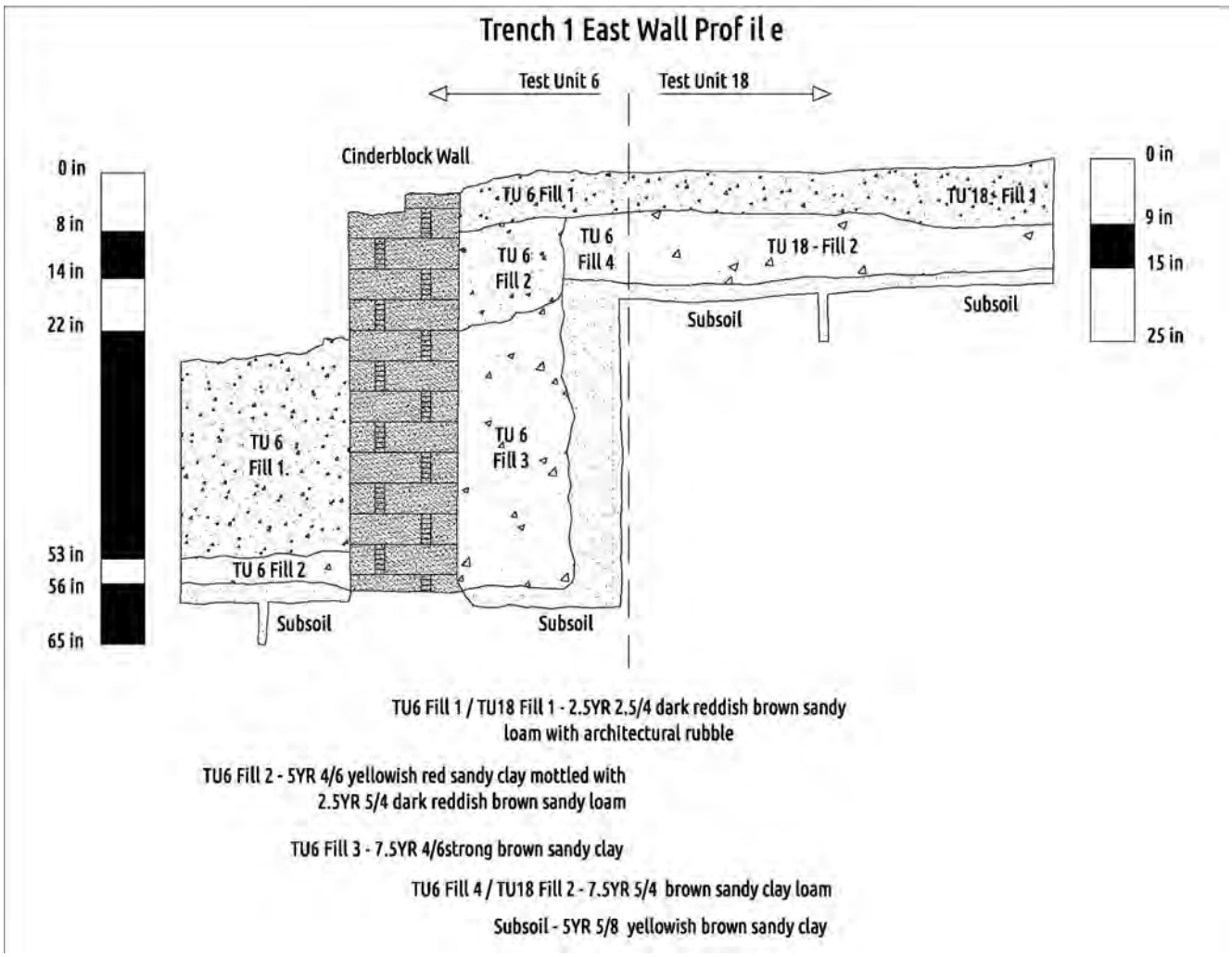

Figure 28: Trench 1, East Wall Profile.

Table 7: Artifacts Recovered from Trench 1

Artifact Type	Fill 1	TU6-Fill 2	TU 6-Fill 3	TU 6-Fill 4/ TU 18-Fill 2
Activities				
bolt	1			
chain	1			
Architecture				
brick	46	23		1
cinderblock		1		
cut nail(s)	8	2		
cut nail(s) (1790-present)	3			
ferrous metal bracket	1			
lime soda (post 1864) windowpane glass	148	8	3	3
mortar	3	3		
paint	2			
plaster		11		
unidentified nail(s)	3			

wire nail(s) (1890s-present)	26	1		
Arms				
shell casing	2			
Kitchen				
aluminum ring tab (post 1966)	2			
aluminum two-piece can (post 1964)	1			
bottle, ABM (post 1907)	1			
bottle/jar	2	2		
other coarse earthenware	1			
whiteware (post 1820)	3	1		
Organic				
animal bone	3			
Unidentified				
ceramic	1			
glass	1	1		
Total – Trench 1	**259**	**53**	**3**	**4**

TU 6-Fill 2 was discovered beneath Fill 1 both inside and outside of the cellar hole in TU 6 and is believed to date to the installation of the concrete block wall. This layer is described as a yellowish red (5YR 4/6) sandy clay mottled with a dark reddish brown 2.5YR 5/4 sandy loam. Within the cellar hole, TU 6-Fill 2 was approximately 3 inches deep and sat atop sterile subsoil (basement floor). Outside of the structure, it was approximately 14 inches in depth and only extended 16 inches south of the block wall. Outside of the cellar, it was underlain by an additional cultural fill (TU 6-Fill 3). Forty nine of the fifty three artifacts recovered from TU 6-Fill 2 were architectural remains, the most prevalent of which were brick fragments (n=23). Temporally diagnostic artifacts recovered from this layer included 8 lime soda windowpane fragments (post 1864), 1 wire nail (1890s-present), and one whiteware sherd (post 1820).

TU 6-Fill 3 was identified beneath TU 6-Fill 2 on the exterior of the dwelling. This layer also extended approximately 16 inches from the exterior of the block wall and continued to 56 inches below ground surface; roughly the same depth as the basement floor. Only 4 artifacts were recovered from this layer, including 1 brick fragment and 3 lime soda windowpane (post 1864) fragments. Based on the depth of the fill layer and its proximity to the block wall, it is interpreted as a builder's trench associated either with the construction of the original masonry wall or the reconstruction of the concrete block wall during the site occupation.

The fourth fill layer, originally identified in TU 6 (TU 6-Fill 4) was later observed to continue into TU 18 (TU 18-Fill 2). This fill layer was described as a brown (7.5YR 5/4) sandy clay loam and was only present outside of dwelling foundation. TU6-Fill 4/TU18-Fill 2 was discovered beneath Fill 1 and underlain by sterile subsoil, and was cut by TU 6-Fill 2, suggesting it pre-dates the installation of the cinder block wall. Only 3 lime soda windowpane glass fragments were recovered from this cultural layer; which may also be suggestive of an early deposition. Given the small quantity of artifacts recovered from this soil layer and its position within the stratigraphic profile, TU6-Fill 4/TU 18-Fill 2 is interpreted as cultural deposit either dating to the occupation or construction of the dwelling at site 44CM0136.

Trench 2 (TU 7 and TU 17)

Trench 2 bisected the eastern wall of the dwelling addition and was comprised of two test units (TU 7 and TU 17) measuring 2 feet by 5 feet joined along their short axis, resulting in an excavation trench measuring 2 feet north to south by 10 feet east to west (Figure 29). Coincidentally, the boundary between TU 7 and TU 17 fell along the exterior wall of the structure. The trench was placed to explore the possibility of a chimney base along the eastern wall and to provide a sample of the cellar fill, builder's trench (if present), and surface deposits surrounding the structure with the intended goal of finding artifacts contemporary with the original construction of this portion of the dwelling and the site occupation.

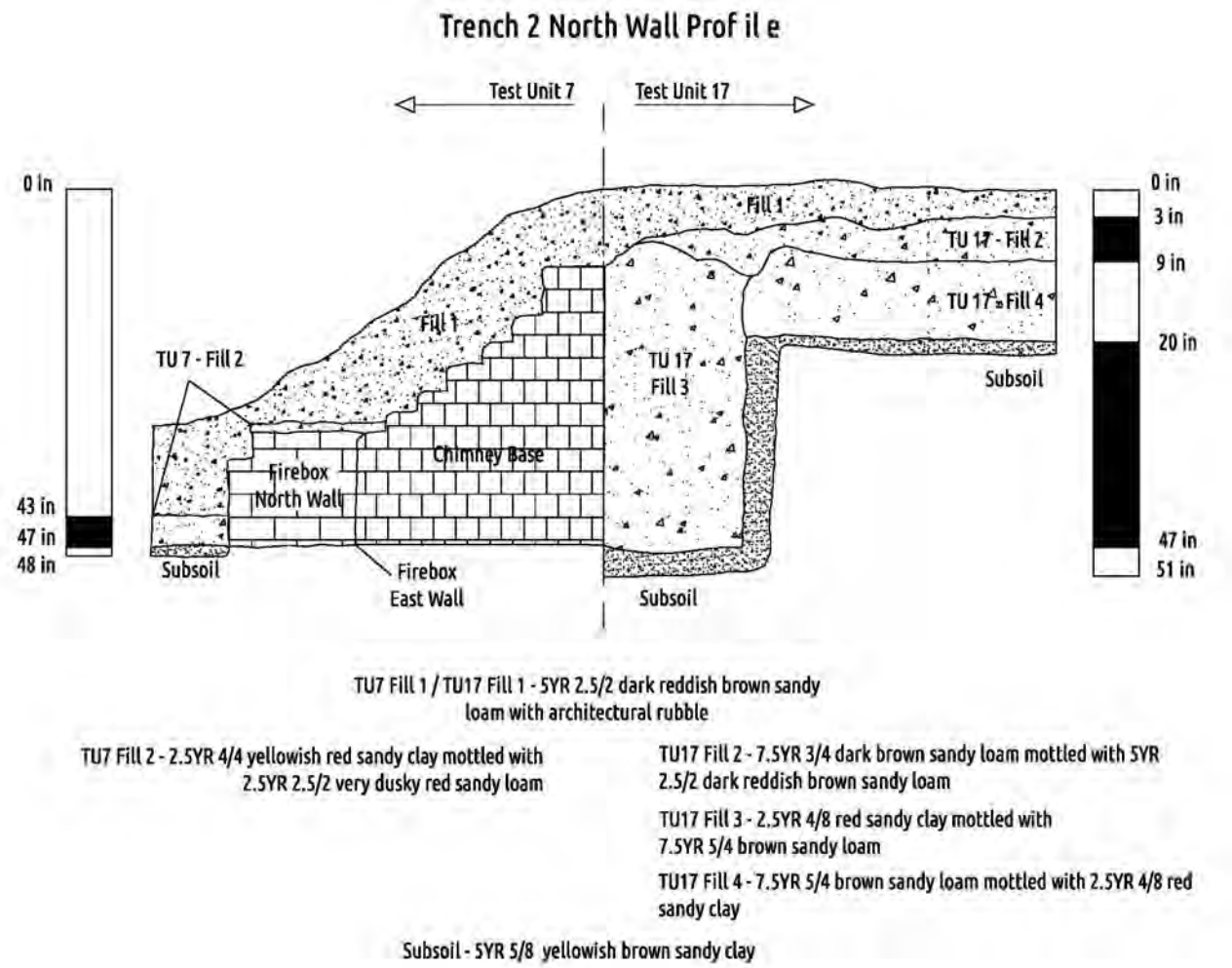

Figure 29: Trench 2, North Wall Profile.

Trench 2 excavations identified one continuous fill layer (Fill 1) extending from the interior to the exterior of the dwelling. Within the cellar, Fill 1 was underlain by the intact remains of a masonry chimney and isolated deposits of a second cultural fill (TU 7-Fill 2) on top of the northern wall of the firebox and the sterile subsoil of the basement floor. Outside of the dwelling, three additional fills were discovered and are believed to represent the demolition, occupation, and construction of this portion of the dwelling. Vertical control was provided by datum stakes set 12 inches east of the northeastern corners of each test unit.

As previously stated, Fill 1 blanketed the surface of both test units and was described as a dark reddish brown (2.5YR 2.5/4) sandy loam. Within the cellar and above the chimney base this layer averaged 12 inches in depth. Outside of the structure this layer was typically only 6 inches deep. As seen in Trench 1-Fill 1, finds within this layer were dominated by architectural remains (n=68, 76%) (Table 8). Temporally diagnostic finds suggest this layer is contemporary with Trench 1-Fill 1. Thus, it is interpreted as a demolition fill, dating to the last quarter of the twentieth century (circa 1979).

TU 7-Fill 2 was described as a yellowish red (5YR 5/8) sandy clay mottled with reddish brown (2.5YR 4/4) sandy loam and very dusky red (2.5YR 2.5/2) sandy loam. A rope eye thimble and S hook were the only items recovered from this layer. Based on its location immediately above the basement floor, this layer was initially thought to date to the site occupation. However, its presence on top of the north wall of the firebox, a location that would have been inside a masonry wall while the structure was still standing, suggests it actually dates to the site abandonment/demolition.

Table 8: Artifacts Recovered from Trench 2

Artifact Type	Fill 1	TU 7-Fill 2	TU 17-Fill 2	TU 17-Fill 3	TU 17-Fill 4
Activities					
rope eye thimble		1			
S-hook		1			
wire fencing	1				
Architecture					
brick	18		4		
cut nail(s)	1		1	2	
cut nail(s) (1790-present)	16		1		
lime soda (post 1864) windowpane glass	16		16	2	
mortar	2				
staple			1		
wire nail(s) (1890s-present)	15		7	1	
Arms					
shotgun shell			1		
Kitchen					
bottle	1				1
bottle, ABM (post 1907)	1				
bottle/jar	2		4		
canning jar, ABM (post 1907)	3				
soft drink bottle, ABM (post 1907)	1				
Organic					
charcoal	11				
Unidentified					
ferrous metal	1				
Total – Trench 2	**89**	**2**	**35**	**5**	**1**

TU 17-Fill 2 was discovered beneath Fill 1 in TU 17 and was distinguished from the upper fill by soil color, classified as a dark brown (7.5YR 3/4) sandy loam. However, this layer was mottled with the dark reddish brown (5YR 2.5/4) sandy loam of the upper fill and the finds from this layer were also primarily composed of architectural debris (n=30/85%), including brick fragments, cut- and wire- nails, and lime-soda windowpane fragments. Consequently, this layer is interpreted as a continuation of Fill 1 and was likely deposited during the demolition of Structure 1.

TU 17-Fill 3 was remarkably similar to TU6-Fill 3 both in terms of its position and dimensions in relation to the exterior wall of the dwelling and it is also interpreted as a builder's trench. Unlike the cinder block wall in Trench 1, there is no evidence of the eastern wall being reconstructed during the site occupation. Yet, TU 17-Fill 3 cuts through, and thus post-dates, TU 17-Fill 4, located beneath Fill 2 in the eastern majority of TU 17. Finds from the two cultural deposits provide little additional information with regards to site chronology. Fill 3 included 2 cut nails (post 1790), 2 lime-soda windowpane fragments (post 1864), and 1 wire nail (post 1890). Fill 4 contained a single olive green bottle glass fragment. Based solely on its location in relation to the builder's trench (Fill 3), TU 17-Fill 4 is interpreted as an occupation layer that pre-dates the construction of the eastern chimney and possibly dates to the earliest period of site occupation.

Test Unit 8

Test Unit 8 (TU 8) measured 2 feet east to west by 5 feet north to south and was positioned near the center of the northern wall of the ell. Two visually distinct cultural layers were identified within TU 8, both of which contained significant quantities of architectural debris (Figure 30). Throughout excavations vertical control was provided by a datum stake set 12 inches north of the northwestern test unit corner.

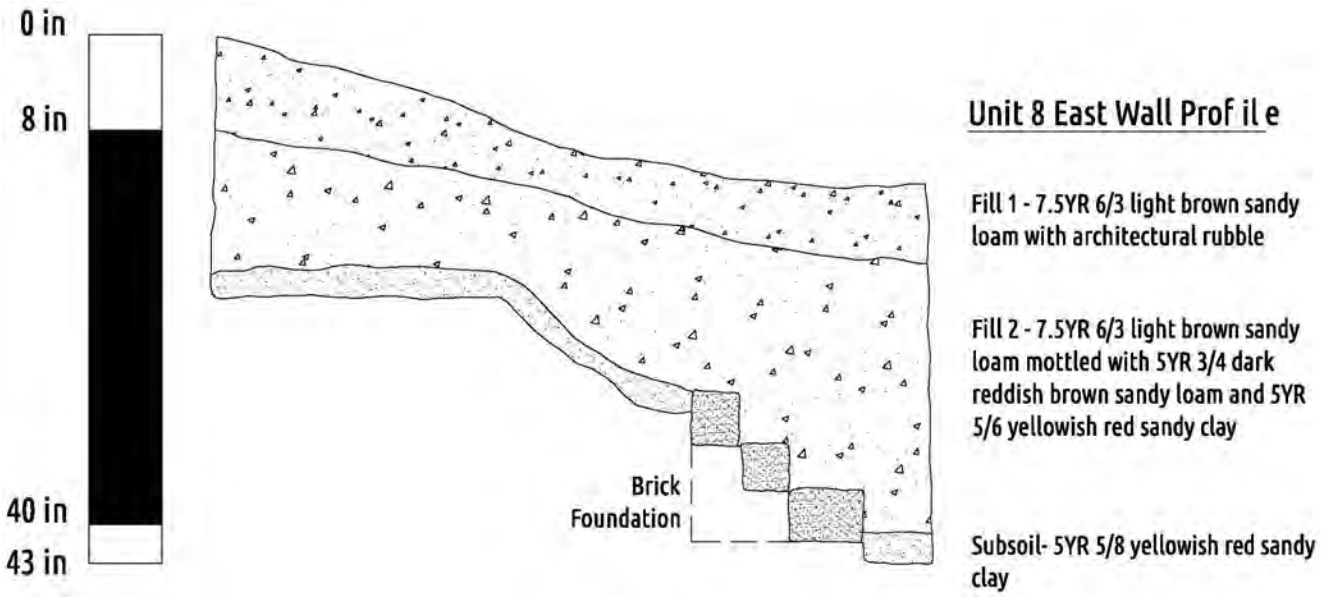

Figure 30: Test Unit 8, East Wall Profile.

Fill 1 was described as a light brown (7.5YR 6/3) sandy loam and extended to approximately 7 inches below ground surface outside of the cellar and 5 inches within. The dominant soil type that comprised Fill 2 was also a light brown (7.5YR 6/3) sandy loam, but was mottled with a dark reddish brown (5YR 3/4) sandy loam and yellowish red (5YR 5/6) sandy clay. The depth of Fill 2 varied significantly from the outside of the cellar (≈12 inches) to the inside of the cellar hole (≈23 inches). Throughout most of the test unit, sterile subsoil was encountered beneath Fill 2. The only exception being the intact remnants of a masonry wall, one-and-a-half courses wide, discovered in the southern half of the test unit.

Both fills contained significant quantities of architectural debris, as noted in the upper fill horizons of Trenches 1 and 2. However, greater quantities of kitchen group artifacts were also noted (Table 9). Although relatively few in number, the increased quantities of kitchen artifacts in this location may provide evidence of a waste disposal pattern by site inhabitants that involved the casual discard of domestic debris in the rear yard of the dwelling.

Temporally diagnostic finds from both layers were relatively consistent and indicate a deposition date during the twentieth century. Artifacts recovered from both fills include cut nails (post 1790), lime soda windowpane glass fragments (post 1864), wire nails (1890s-present), and bottle glass produced with an Automatic Bottle Machine (post 1907).

Table 9: Artifacts Recovered from TU 8

Artifact Type	Fill 1	Fill 2
Architecture		
cut nail(s) (1790-present)	17	9
lime soda (post 1864) windowpane glass	5	10
wire nail(s) (1890s-present)	8	4
wrought nail(s)		1
Arms		
clay pigeon	3	2
Kitchen		
aluminum ring tab (post 1966)		1
bottle, ABM (post 1907)		15
bottle/jar	1	
bottle/jar, ABM (post 1907)	32	

canning jar, ABM (post 1907)		10
Unidentified		
ferrous metal	2	1
glass		14
Total – TU 8	**68**	**67**

Trench 3: (TU 9 and TU 19)

Trench 3 bisected the eastern wall of the northern addition to the dwelling where the stone foundation observed along the northern wall and northern half of the eastern wall transitions to a brick foundation. Trench 3 measured 2 feet north to south by 10 feet east to west and was made up of TU 9 (western half) and TU 19 (eastern half) that were joined along their eastern/western boundary, respectively (Figure 31). The long axis of Trench 3 was cut perpendicular to the structure wall, which crossed Trench 3 slightly west of the TU 9/TU 19 division line. This testing location was selected to determine if any evidence of the evolution of Structure 1 remained in the archaeological record.

Trench excavations identified four distinct cultural fills within the excavation area and although their soil colors varied slightly from those observed in other testing locations, they are most likely a continuation of cultural fills observed in Trenches 1 and 2, and Test Unit 8. Throughout excavations in TU 9 and TU 19 vertical control was provided by datum stakes set 12 inches east of the northeastern corners of each test unit.

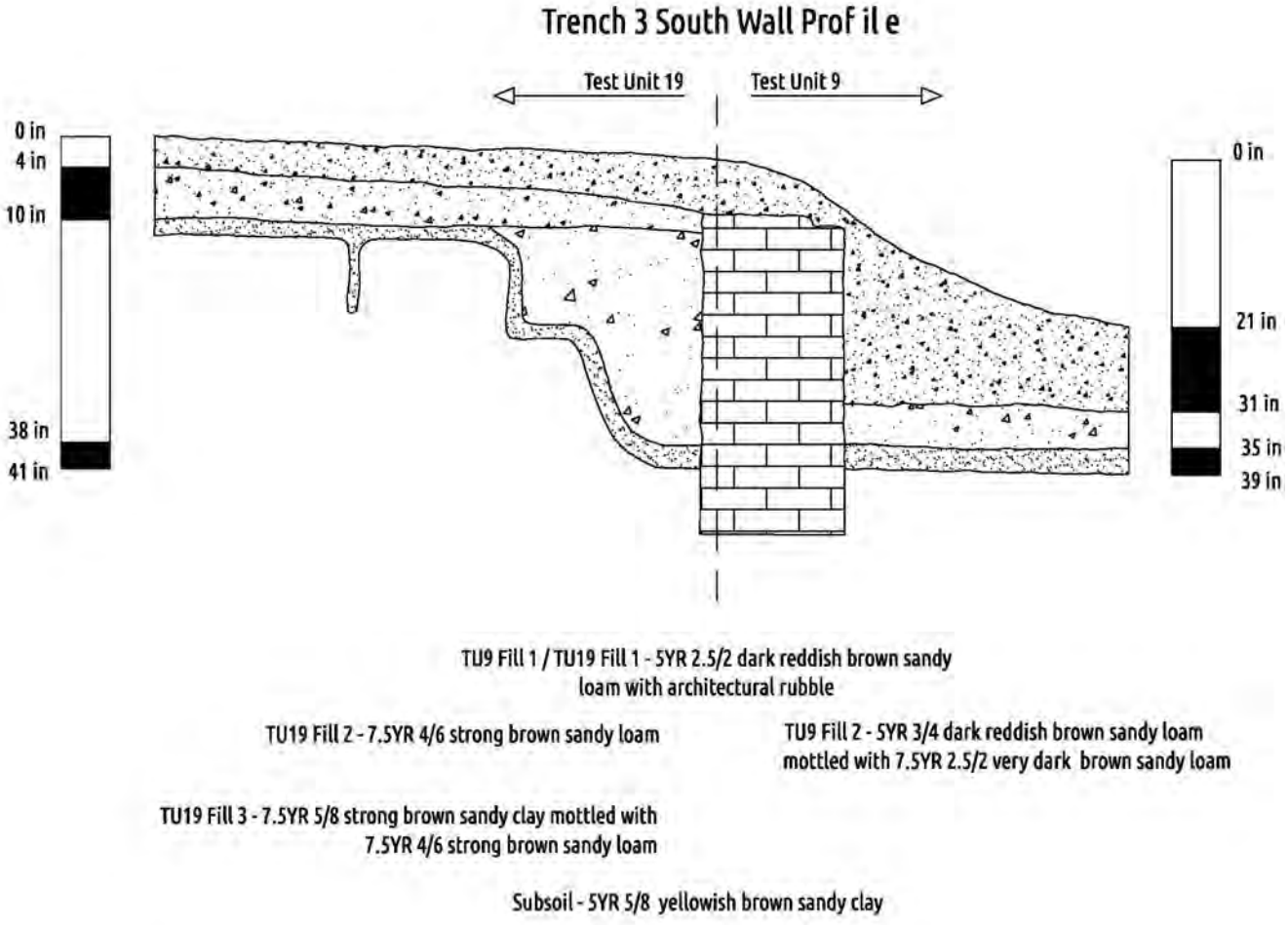

Figure 31: Trench 3, South Wall Profile.

Table 10: Artifacts Recovered from Trench 3

Artifact Type	Fill 1	TU9-Fill 2	TU19-Fill 2	TU19-Fill 3
Architecture				
brick	18			
cast iron pipe	2			
copper alloy pipe	1			
cut nail(s) (1790-present)	20	12	3	
lead fragments	2			
lime soda (post 1864) windowpane glass	27	2	35	3
locking bolts and brackets		1		
porcelain toilet/sink	1			
unidentified nail(s)			6	
wire nail(s) (1890s-present)	8	2	2	
Arms				
shell casing		1		
Kitchen				
aluminum beverage can (post 1965)		1		
bottle, ABM (post 1907)	1			
whiteware (post 1820)	1	1		
Organic				
animal bone		3		
Unidentified				
ferrous metal	4	2		
glass	1			
Total – Trench 3	**86**	**25**	**46**	**3**

Temporally diagnostic artifacts include 20 cut nails (1790-present), 1 whiteware sherd (post 1820), 27 lime-soda windowpane fragments (post 1864), 8 wire nails (post 1890), and 1 Automatic Bottle Machine bottle fragment (post 1907) (Table 10). Although at first glance the general lack of bottle glass compared to the Fill 1 in other areas might suggest an earlier deposition, soils were described as very loose with copious amounts of rotted wood, brick rubble, and plaster and mortar fragments that were observed and not collected, and based on this information, Fill 1 is interpreted as the demolition/deconstruction fill previously described in other areas surrounding the dwelling.

At approximately 31 inches below ground surface in the cellar hole, Fill 1 transitioned to a dark reddish brown (5YR 3/4) sandy loam, mottled with a very dark brown (7.5YR 2.5/2) sandy loam, classified as TU 9-Fill 2. TU 9-Fill 2 was approximately 4 inches in depth and terminated at sterile subsoil (basement floor), described as a yellowish red (5YR 5/8) sandy clay. A total of 25 artifacts were recovered from this fill layer, 68% (n=17) of which belonged to the architectural group. Temporally diagnostic finds included 12 cut nails (1790-present), 1 whiteware sherd (post 1820), 2 lime-soda windowpane fragments (post 1864), 2 wire nails (post 1890), and 1 aluminum beverage can (post 1964). Based on the presence of the beverage can, TU 9-Fill 2 is also believed to date to the demolition/deconstruction of the dwelling, circa 1979.

Outside of the cellar, Fill 1 extended to an average of 6 inches below ground surface. Beneath this layer, investigators identified a strong brown (7.5YR 4/6) sandy loam, designated TU 19-Fill 2. Although the color varied from the upper fill, the cultural content of this layer was very similar to Fill 1 and was entirely composed of architectural remains, including 3 cut nails (1790-present), 35 lime-soda windowpane fragments (post-1864), and 2 wire nails (1890s-present). Given the propensity of architectural remains and the assemblage's lack of functional variety, TU 19-Fill 2 is interpreted as a continuation of the demolition/deconstruction fill and is believed to date to 1979.

In the eastern majority of TU 19, Fill 2 was underlain by sterile subsoil described as a yellowish red (5YR 5/8) sandy clay. However, in the eastern third of the test unit, and continuing the exterior of the foundation wall in TU 9, investigators identified a third fill layer (TU 19-Fill 3). Fill 3 extended approximately 26 inches from the exterior of the foundation wall and at its deepest point (abutting the foundation), extended to approximately 35

inches below ground surface. This layer was described as a strong brown (7.5YR 5/8) sandy clay mottled with a strong brown (7.5YR 4/6) sandy loam. The fill was virtually devoid of artifacts, only producing 3 fragments of lime-soda windowpane glass (post 1864). Based on its horizontal and vertical extend and its location in relation to the foundation, TU 19-Fill 3 is interpreted as a builder's trench and is believed to date to the construction of the dwelling addition.

Test Unit 10

Test Unit 10 (TU 10) measured 2 feet east to west by 7 feet north to south and was positioned near the center of the northern wall of the dwelling. This wall was dominated by what initially appeared to be a stone stoop or hearth and this test unit location was selected to explore the intended function of this feature. Vertical control was provided by datum stakes set 12 inches north of the northeastern corner of the test unit.

Two distinct cultural layers were identified within TU 10, both of which contained significant quantities of architectural debris (Figure 32). Fill 1 was described as a dark reddish brown (5YR 2.5/2) sandy loam and was identified outside of the cellar hole at the northern edge of the stone feature and throughout the portion of the test unit that fell within the cellar. Outside of the cellar hole, Fill 1 was only about three inches in depth and was underlain by sterile subsoil. Within the cellar, Fill 1 was deepest immediately south of the foundation wall (≈14 inches), but averaged 6 inches in depth in the southern third of the test unit. Beneath Fill 1 investigators identified a second fill distinguished from from the upper fill by dark yellowish brown (10YR 3/6) mottling and sand/mortar concentrations. Fill2 extended from 14 to 27 inches below ground surface and sat atop the basement floor (sterile subsoil) classified as a yellowish red (5YR 5/8) sandy clay.

A total of 13 artifacts were recovered from Fill 1, including 7 cut nails (1790-present), 2 lime-soda windowpane fragments, a single mortar fragment, 1 bottle glass fragment, and 1 bone fragment. Fill 2 contained 26 cut nails, 4 wire nails, 4 mortar fragments, 1 bottle glass fragment, and 1 bone fragment (Table 11). Based on their cultural content these layers are interpreted as one cultural horizon, likely dating to the demolition/deconstruction of the dwelling, circa 1979.

Following the excavation of TU 10, the stone feature was exposed in an effort to provide a better understanding of its intended function (Figure 33). Excavations revealed multiple stones that had been mortared together to form a platform measuring approximately 5.5 feet east to west by 3 feet north to south. Based on the dimensions of the feature and its central location along the north wall, it is suspected to be a chimney base; however, none of the stones bore evidence of burning and increased quantities of charcoal were not identified in the fills within TU 10. At the time of this investigation, the stone feature was roughly level with the surrounding landscape and it is possible that the superstructure of the chimney, including the fire box were dismantled and removed during the deconstruction of the dwelling.

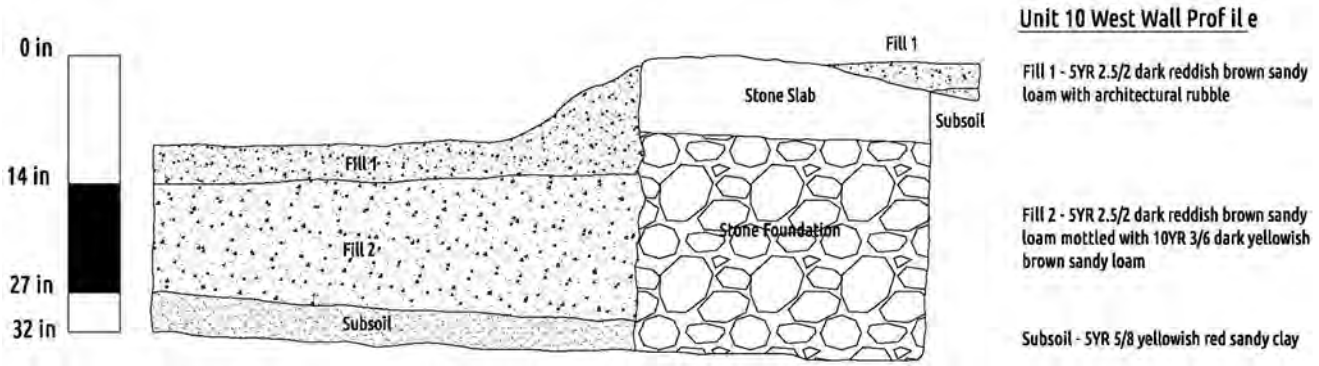

Figure 32: Trench 3, South Wall Profile.

Table 11: Artifacts Recovered from TU 10

Artifact Type	Fill 1	Fill 2
Architecture		
cut nail(s) (1790-present)	7	26
lime soda (post 1864) windowpane glass	2	
mortar	1	4
wire nail(s) (1890s-present)		4
Kitchen		
bottle	1	1
Organic		
animal bone	1	1
Unidentified		
ferrous metal	1	2
glass		2
Total – TU 10	**13**	**40**

Figure 33: Stone Platform, North Wall.

Test Unit 11

Test Unit 11 (TU 11) measured 2 feet north to south by 5 feet east to west and was intended to determine if anything remained of the northwestern segment of the dwelling foundation. Unlike other areas around the perimeter of the cellar hole, where the approximate cellar boundary was visible from the ground surface, there was no clear indication of the cellar wall between the northwestern corner of the dwelling and the chimney located near its southwestern corner (Figure 34). Thus, TU 11 was positioned to straddle the extrapolated wall

Figure 34: Structure 1, Western Wall (right), Facing South.

location. A datum stake was set 12 inches west of the northwestern corner of the test unit and provided vertical control throughout excavations.

Excavations identified two distinct cultural fills in this portion of the structure (Figure 35). Fill 1 was described as a dark reddish brown (5YR 2.5/2) sandy loam and ranged from 10 inches in depth at the western end of the test unit to 4 inches at its eastern end. At 4 inches below ground surface in the central portion of the test unit, excavators encountered a section of a brick wall. However, based on its orientation, which appeared to be tilted into the cellar hole, it was not suspected to be part of an intact foundation. Further excavation revealed a second fill layer (Fill 2) at the base of Fill 1 across the entire test unit. This layer was described as a dark yellowish brown sandy loam mottled with a dark reddish brown (2.5YR 2.5/2) sandy loam. The wall segment previously identified continued to the base of Fill 2 and was found to be resting on top of the basement floor (sterile subsoil) immediately east of what a soil probe revealed to be the bottom course of the dwelling's western foundation wall. Excavations terminated at the base of Fill 2/surface of sterile subsoil, approximately 16 inches below the current ground surface.

As seen elsewhere around the dwelling, finds from both fill layers in TU 11 were principally comprised of architectural debris (Table 12). Eleven of the sixteen artifacts recovered from Fill 1 fell into the architectural group and all of the finds from Fill 2 belonged to this group. Temporally diagnostic finds from both layers included cut nails (1790-present), lime-soda windowpane fragments (post 1864), and wire nails (1890s-present). Based on the predominance of architectural debris recovered from both of the fill layers in TU 11, they are interpreted as a single cultural deposit dating to the demolition/deconstruction of the dwelling, circa 1979.

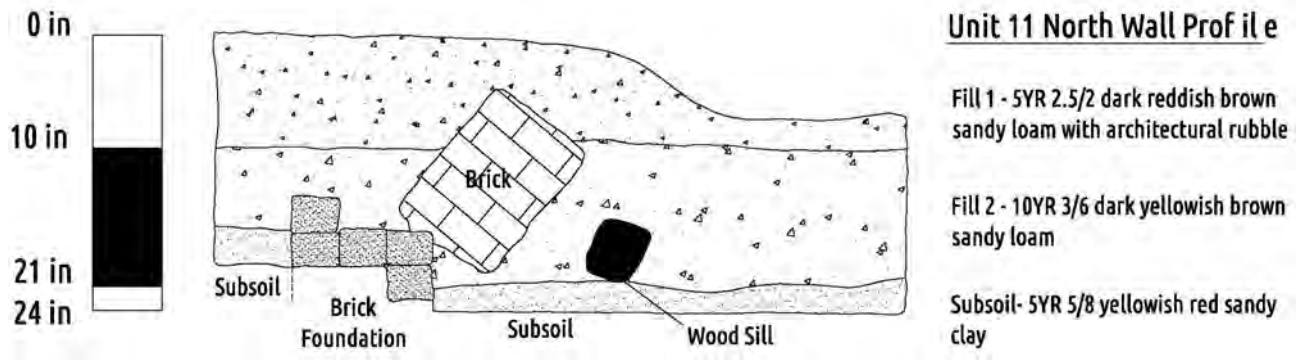

Figure 35: Test Unit 11, North Wall Profile.

Table 12: Artifacts Recovered from TU 11

Artifact Type	Fill 1	Fill 2
Architecture		
cut nail(s) (1790-present)	2	5
hinge	1	
lime soda (post 1864) windowpane glass	3	4
slate shingle(s)		1
unidentified nail(s)		1
wire nail(s) (1890s-present)	5	9
Organic		
animal bone	4	
Unidentified		
glass	1	
Total - TU 11	**16**	**20**

Trench 4 (TU 12 and TU 16)

Trench 4 bisected the western wall of the dwelling near the southwestern corner of the structure, in the suspected location of a masonry chimney base. The overall dimensions of the trench were 2 feet north to south by 12 feet east to west, comprised of on 2 foot by 7 foot test unit (TU 12) and 2 foot by 5 foot test unit (TU 16) joined along their short axis. This location was chosen to explore the possibility of a chimney base along the western wall and to provide a sample of the cellar fill, builder's trench (if present), and surface deposits surrounding the structure with the intended goal of finding artifacts contemporary with the original construction of this portion of the dwelling and the site occupation.

Trench 4 excavations identified 4 distinct fill layers, including two continuous fill layers (Fill 1 and Fill 2) extending from the interior to the exterior of the dwelling (Figure 36). Fill 1 averaged 3 inches in depth across both test units and was classified as a dark reddish brown (5YR 2.5/2) sandy loam. Within the cellar hole, Fill 2 was described as a dark yellowish brown (10YR 3/6) sandy loam mottled with a dark reddish brown (5YR 2.5/2) sandy loam and a yellowish red (5YR 5/6) sandy clay. Outside of the cellar, Fill 2 was classified as a red (2.5YR 4/8) sandy clay mottled a dark reddish brown (5YR 2.5/2) sandy loam.

The assemblages of Fill 1 and Fill 2 within and outside of the building foundation were consistent with the finds from the demolition/deconstruction fill observed in other test units and trenches surrounding the dwelling (Table 13). Architectural artifacts were the dominant group in both fills, accounting for 76% of identifiable finds from Fill 1 and 86% of identifiable finds from Fill 2. Temporally diagnostic finds from Fill 1 included 6 cut nails (1790-present), 10 lime-soda windowpane fragments (post 1864), 2 wire nails (1890s-present), 1 white milk glass canning jar lid liner (c. 1870-1950), and 2 aluminum ring tabs (post 1965). Fill 2 contained 31 cut nails (1790-present), 4 whiteware sherds (post 1820), 39 lime-soda windowpane fragments (post 1864), 15 wire nails (1890s-present), 4 Automatic Bottle Machine glass bottle fragments (post 1907), and 2 aluminum ring tabs (post 1965).

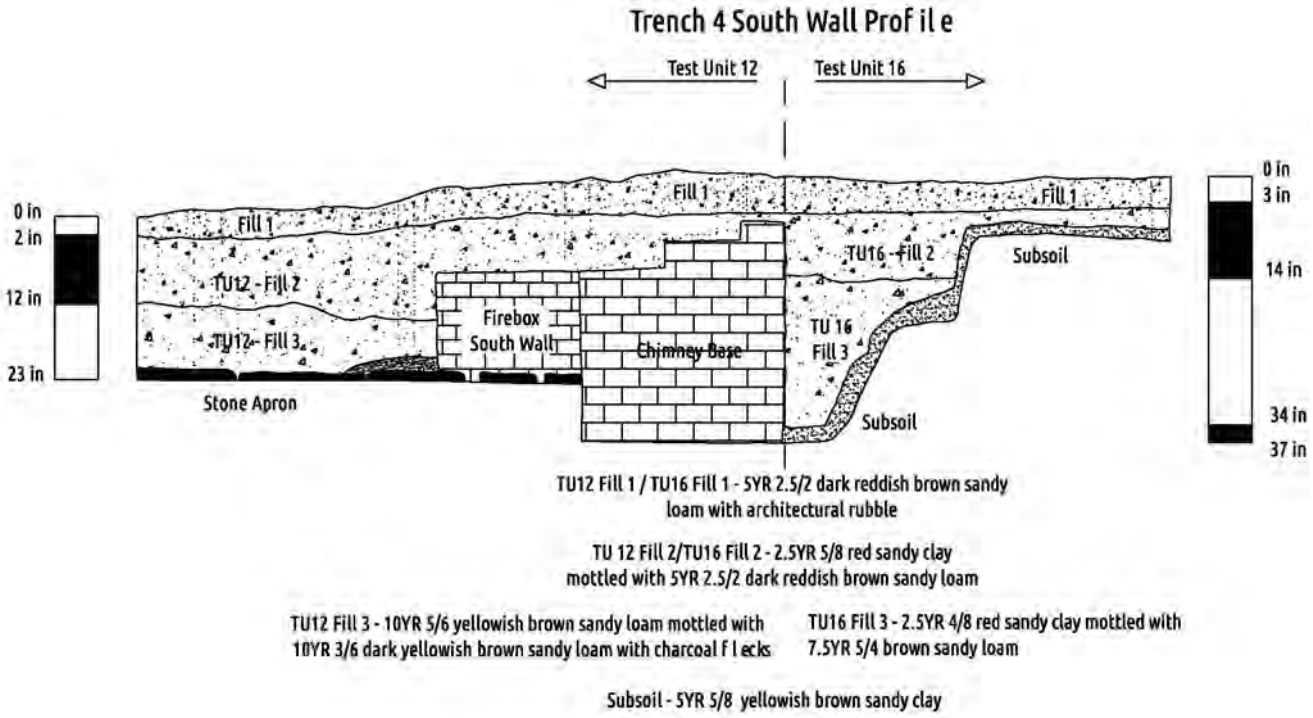

Figure 36: Trench 4, South Wall Profile.

Table 13: Artifacts Recovered from Trench 4

Artifact Type	Fill 1	Fill 2	TU 12-Fill 3	TU 16-Fill 3
Activities				
plastic poker chip			1	
Architecture				
brick	22	20		24
cast iron pipe		1		
cut nail(s)	1			
cut nail(s) (1790-present)	5	31	17	
fuse(s)		1	1	
lime soda (post 1864) windowpane glass	10	39	4	
mortar	6	2		
slate	1			
unidentified nail(s)		4	5	
wire nail(s) (1890s-present)	2	15	27	
Arms				
shell casing	1			
shotgun shell	5			
Kitchen				
aluminum ring tab (post 1966)	2	2	1	
aluminum threaded lid/cap		2		
bottle		2		
bottle/jar	5			
bottle/jar, ABM (post 1907)		4		
glassware	1			

other stoneware		1		
white milk glass (c.1870-c.1950) canning jar lid liner	1			
whiteware (post 1820)		4		
Organic				
animal bone		3	1	
Unidentified				
ferrous metal		5	4	
glass	1	89	9	
non-ferrous metal		1		
Total – Trench 4	**63**	**226**	**70**	**24**

TU 12-Fill 3, a yellowish brown (10YR 5/6) sand mottled with a dark yellowish brown (10YR 3/6) sandy loam, was discovered beneath Fill 2 in the structure interior. This layer extended from 12 to 23 inches below ground surface and terminated at the stone floor of the firebox. As with the preceding layers, identifiable finds were almost entirely comprised of architectural artifacts (n=54/95%). Temporally diagnostic artifacts included 17 cut nails (1790-present), 4 lime-soda windowpane fragments (post 1864), 27 wire nails (1890s-present), and 1 aluminum ring tab (post 1965). Additionally, a plastic poker chip was found near the base of the fill in the firebox.

Outside of the cellar, TU 16-Fill 3 was discovered extending approximately 2 feet west of the exterior of the chimney base. It was described as a red (2.5YR 4/8) sandy clay mottled with brown (7.5YR 5/4) loamy sand and brick rubble. The fill extended from 14 to 34 inches below ground surface, tapering from 2 feet to approximately 7 inches in width at the base of the chimney. Finds from TU 16-Fill 3 included 24 brick fragments.

The presence of aluminum ring tabs in Fill 1, Fill 2, and TU 12-Fill 3 indicate all of these layers could not have been deposited prior to 1965, and thus likely date to the demolition/deconstruction of the dwelling, circa 1979. This interpretation is also supported by the propensity of architectural debris documented in each of these layers. In contrast, no modern objects were recovered from TU 16-Fill 3. Based solely on the depth of TU 16-Fill 3 and its position in relation to the exterior of the chimney base, it is interpreted as a builder's trench and is believed to date to the construction of the dwelling.

Summary

Although documentary evidence suggests the site was probably first occupied by the family of John and Martha Jeffries in the middle nineteenth century, very little remains of the nineteenth century occupation in the archaeological deposits surrounding the dwelling. Test unit excavations identified evidence of significant modern disturbance to cultural deposits believed to have resulted from the demolition/ deconstruction of the dwelling by Warren and Aldine West in 1979. In all testing locations one, and sometimes two or three fill layers dating to the demolition of the structure were recorded. Within the cellar, these fills were found to extend to the sterile subsoil of the basement floor. Outside of the cellar, intact deposits believed to date to the site occupation and construction of the dwelling were encountered, but contained only minimal evidence of the site chronology or the lifeways of the site inhabitants. Complete artifact descriptions and a full inventory of finds from test units excavated around the dwelling (Structure 1) can be found in Appendix 2.

Structure 2 - Smokehouse

During the Phase II investigation, three 3 foot by 3 foot test units (TUs 3, 4, and 5) were excavated within a stone foundation located approximately 60 feet northwest of the dwelling resulting in the identification of one intact cultural feature (Feature 1) (Figure 37). Based on the structure dimensions (18 feet x 20 feet), black surface soils and a partially standing structural timber that retained the smell of smoke. This structure was preliminarily interpreted as a smokehouse.

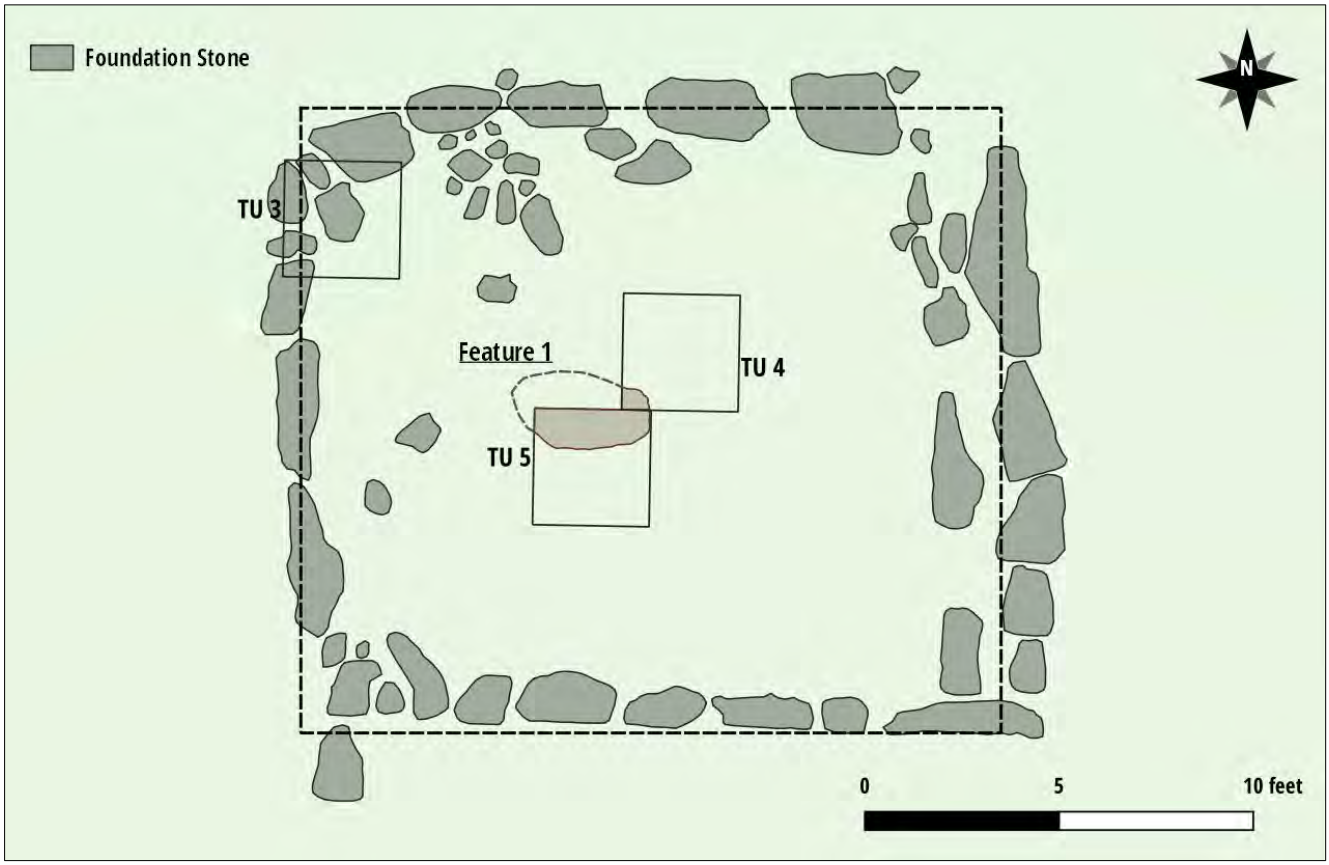

Figure 37: Structure 2 Foundation, Test Unit Locations, and Hearth Feature.

Test Unit 3

Test Unit 3 (TU 3) measured three feet by three feet and was positioned in the northwestern corner of the smokehouse and was intended to explore soil stratigraphy and provide a sample of the cultural content within the structure interior. A datum stake was set 12 inches south of the southeast corner of the test unit at 11 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 3.

Excavations revealed a dark reddish brown (5YR 2.5/2) sandy loam (Fill 1) that terminated at subsoil, approximately 6 inches below ground surface. The interface between Fill 1 and subsoil was marked by several foundation stones scattered within the unit. These stones were left *in situ* and a soil core was taken in the center of the unit, revealing a yellowish red (5YR 5/8) sandy clay subsoil beneath. Finds from the cultural fill included asphalt shingles, tar paper fragments (discarded in field), cut and wire nails, coarse earthenware sherds, and animal bone fragments.

Test Unit 4

Test Unit 4 (TU 4) was was a three foot square positioned near the center of Structure 2 and was intended to explore soil stratigraphy and provide a sample of the cultural content within the structure interior (see Figure 37). A datum stake was set 12 inches south of the southeast corner of the test unit at 11 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 4.

Two distinct fill layers (Fill 1 and Fill 2) were identified above sterile subsoil throughout most of the unit. Fill 1, described as a dark reddish brown (5YR 2.5/2) sandy loam extended to approximately 3 inches below ground surface. In all but the southwestern corner of the test unit, the transition to Fill 2 was marked by increased mottling, eventually giving way to to a red (2.5YR 4/8) sandy loam. Fill 2 was heavily compacted and approximately 4 inches in depth. In the southwestern corner of the unit, excavators noted a pit feature of

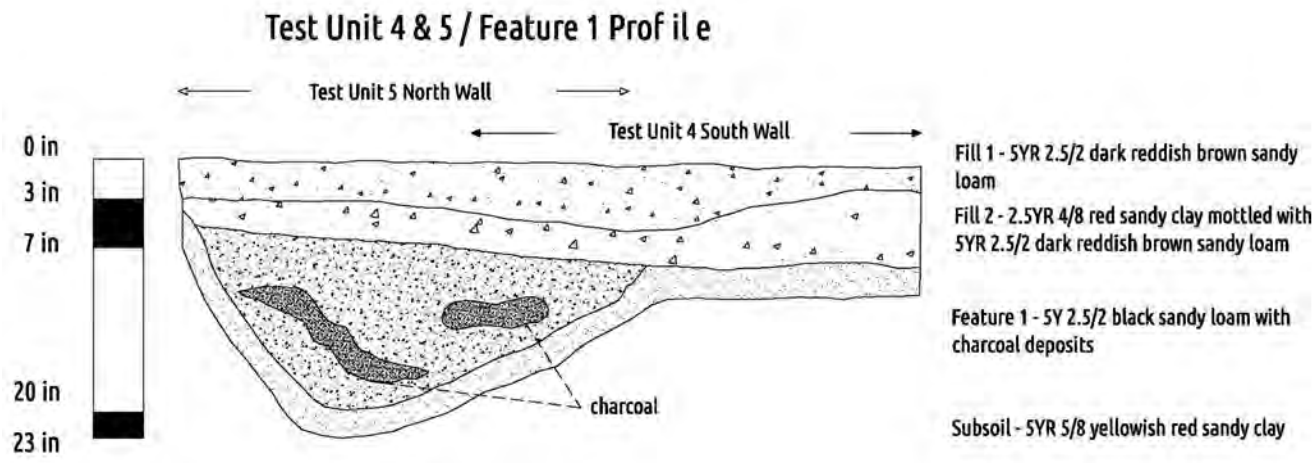

Figure 38: Structure 2, Feature 1 Profile.

unknown size (Feature 1) (Figure 38). The feature fill was friable and less mottled than the surrounding soils. Beneath Fill 2 and Feature 1, excavators identified a yellowish red (5YR 5/8) sandy clay subsoil.

Bone fragments and wire nails (post 1890) were recovered from both fill layers in Test Unit 4. Additional finds included charcoal, brick fragments, and whiteware sherds (post 1820) recovered from Fill 2.

Test Unit 5

Test Unit 5 (TU 5) was three feet by three feet and located along the southern boundary of TU 4 and was cited to provide a better understanding of the horizontal extent of Feature 1 (see Figure 37). A datum stake was set 12 inches south of the southeast corner of the test unit at 9 inches above the ground surface and was used to provide vertical control throughout excavation.

As seen in the adjacent test unit, TU 5 contained two distinct fill layers (Fill 1 and Fill 2). Beneath Fill 2 investigators found sterile subsoil (B horizon) in the southern portion of the test unit; and in the northern third of the unit, Feature 1 extended from the base of Fill 2 to subsoil (Figure 39). Fill 1 was 2 to 6 inches in depth and was described as a dark reddish brown (5YR 2.5/2) sandy loam. At approximately 5 inches below ground surface excavators encountered a red (2.5YR 4/8) sandy loam mottled with a dark reddish brown (5YR 2.5/2) sandy loam approximately 4 inches in depth. Beneath Fill 2, excavators identified a yellowish red (5YR 5/8) sandy clay subsoil. Feature 1 Fill was discovered beneath Fill 2 in the northern third of the test unit. The feature fill was described as a dark reddish brown (5YR 2.5/2) sandy loam mottled with a very dark dusky red (2.5YR 2.5/2). Copious amounts of charcoal were also noted within the feature fill.

Temporally diagnostic finds from Fill 1 in TU 5 included 2 wire nails (post 1790, 2 whiteware sherds (post 1820), and 23 wire nails (post 1890). Fill 2 contained 3 whiteware sherds (post 1820) and 1 lime soda (post 1864) windowpane fragment.

Feature 1 (Hearth)

Feature 1 was discovered cutting through Fill 2 in TU 4 and TU 5. Unlike the surrounding red (2.5YR 4/8) soils of Fill 2, Feature 1 fill was classified as a black (5Y 2.5/2) sandy loam with increased quantities of charcoal. At its deepest point, Feature 1 extended 19 inches below ground surface. During excavations, feature fill was removed in arbitrary 4 inch levels. However, the feature was found to contain a single fill deposit (Fill 1). Finds from Feature 1/Fill 1 included 5 wire nails (post 1890), 1 lime soda windowpane glass fragment (post 1864), a possible black walnut hull, charcoal fragments, and unidentified animal teeth.

Figure 39: Feature 1 Profile, Facing North.

Summary

The dimensions and roughly square shape of the foundation of Structure 2, as well as the finds recovered from Fill 1, Fill 2, and Feature 1, including charcoal and animal bone fragments, and a light scatter of kitchen and architectural artifacts support its interpretation as a smokehouse. Based on the stratigraphic profile, Fill 2 appears to be the oldest deposit associated with the structure. Four wire nails recovered from TU 4/Fill 2 indicate all of the deposits associated with the smokehouse post date 1890.

Table 14 summarizes the artifacts recovered from Structure 2 (TU 3, TU 4, TU 5, and Feature 1) by functional group and soil horizon. Complete artifact descriptions and a full inventory of finds can be found in Appendix 2.

Table 14: Artifacts Recovered from Structure 2

Artifact Type	TU 3/TU 4/TU 5 Fill 1	TU 4/TU 5 Fill 2	Feature 1 Fill
Activities			
coarse earthenware	2		
Architecture			
brick		11	
cut nail(s)	2		
cut nail(s) (1790-present)	4		
lime soda (post 1864) windowpane glass		1	1
shingle	7		
wire nail(s) (1890s-present)	100	4	5

Kitchen			
American Stoneware	1	6	
glassware, pressed		3	
whiteware (post 1820)	2	5	
Organic			
animal bone	27	5	
charcoal		34	5
hulls			2
teeth			2
Unidentified			
ferrous metal	1	1	
glass	1		
Total – TU 3, TU 4, TU 5, Feature 1	**147**	**70**	**15**

Structure 4 - Outbuilding

The "foundation" of Structure 4 was identified approximately fifty feet north of the barn (Structure 3) and consisted of seven large stones in a roughly rectangular pattern and a rectangular raised area measuring twenty feet north to south by eighteen feet east to west (Figure 40). Excavation of a single test unit near the center of the structure resulted in the discovery of an intact cultural feature (Feature 2).

Test Unit 14

Test Unit 14 (TU 14) measured three feet by three feet and was positioned near the center of an outbuilding identified during the visual inspection. The function of this outbuilding was unknown, but it is located near a

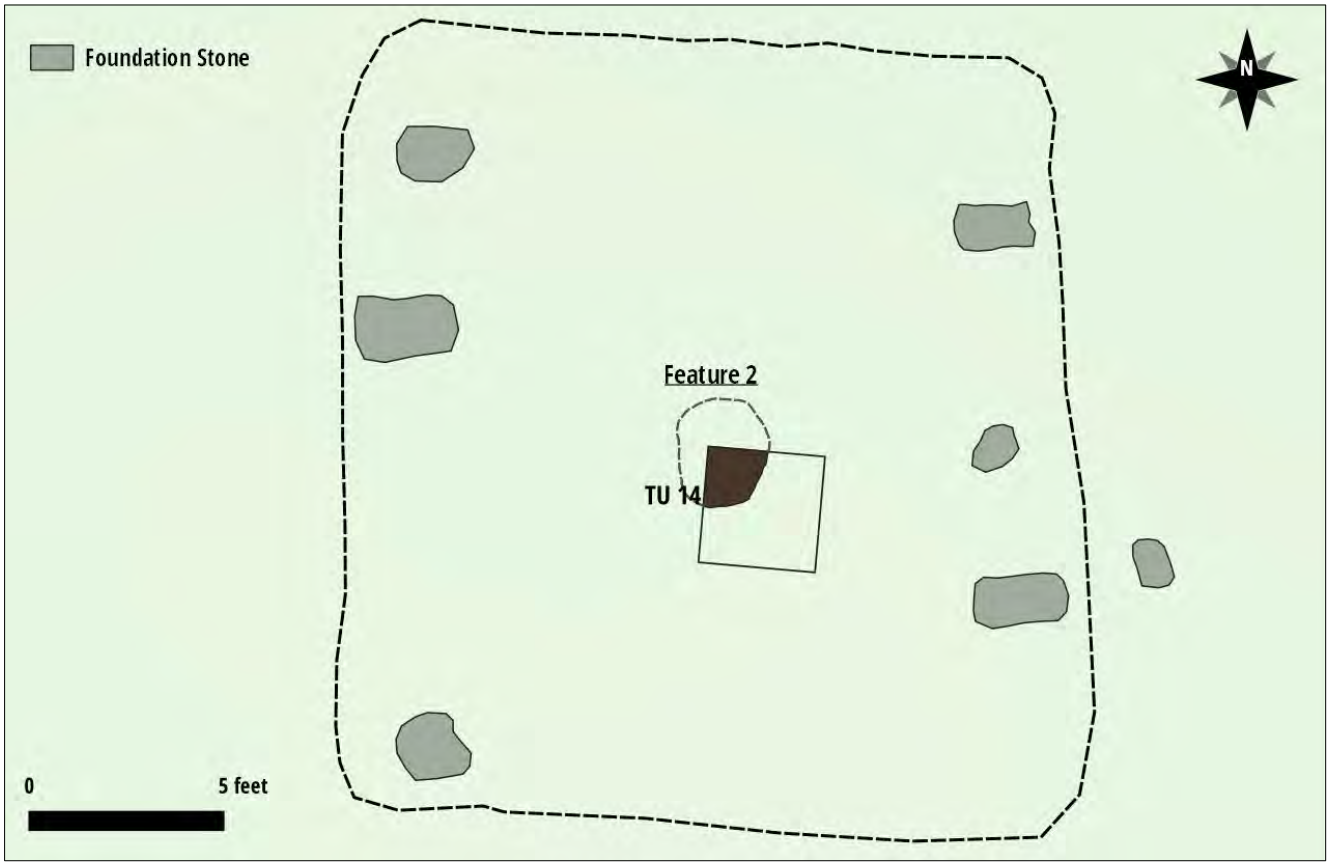

Figure 40: Structure 4 Outline, "Foundation", Test Unit Location, and Structure Post Hole (Feature 2).

property corner described as the “Orchard” on an 1892 plat of John Jeffries estate (see Figure 8) and this structure, the barn (Structure 3), and an additional outbuilding south of the barn (Structure 5) are surrounded by grassy pastures and appear to comprise the agricultural activity area on aerial images dating to the middle twentieth century. Thus, this unit was intended to provide a sample of the cultural content within the structure interior and additional evidence of its historic function.

A datum stake was set 12 inches north of the northeastern corner of the test unit at 11 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 14. Initial excavations identified a cultural fill (Fill 1) described as a dark reddish brown (5YR 2.5/2) sandy loam. At approximately 5 inches below ground surface the upper fill transitioned to a dark yellowish brown (10YR 3/6) sandy loam (Fill 2) in all but the northwestern corner of the test unit. At 8 inches below ground surface the sandy loams of the upper fills transitioned to a more yellowish red (5YR 5/6) compact clay loam (Fill 3). At 12 inches below ground surface the clay content of the soil increased and the soil color became the redder subsoil (5YR 5/8) seen in other areas of the site.

Feature 2 (Structural Post Hole)

In the northwestern corner of the unit, investigators found a circular feature (Feature 2) at the base of Fill 1 that extended into the northern and western walls (Figure 41). Unlike the surrounding yellowish brown sandy loam of Fill 2, the Feature 2 fill was a continuation of the dark reddish brown sandy loam of Fill 1. The portion of the feature that fell within TU 14 measured 18 inches east to west and north to south, and likely represents a quarter of the larger feature. The feature fill was dominated by a large, dressed stone triangular in shape, interpreted as a possible footing for a central support post.

A total of 50 artifacts were recovered during the excavation of TU 14, including the portion of Feature 2 that fell within the test unit. The types of artifacts recovered from the three fill layers and the feature fill were virtually identical. Temporally diagnostic finds included lime-soda windowpane fragments (post 1864) and wire nails (1890s-present), suggestive of late 19th/20th century construction. The presence of window glass may also indicate that the structure included at least one window. Table 15 summarizes the artifacts recovered from Structure 4 (TU 14/Feature 2) by functional group and soil horizon. Complete artifact descriptions and a full inventory of finds can be found in Appendix 2.

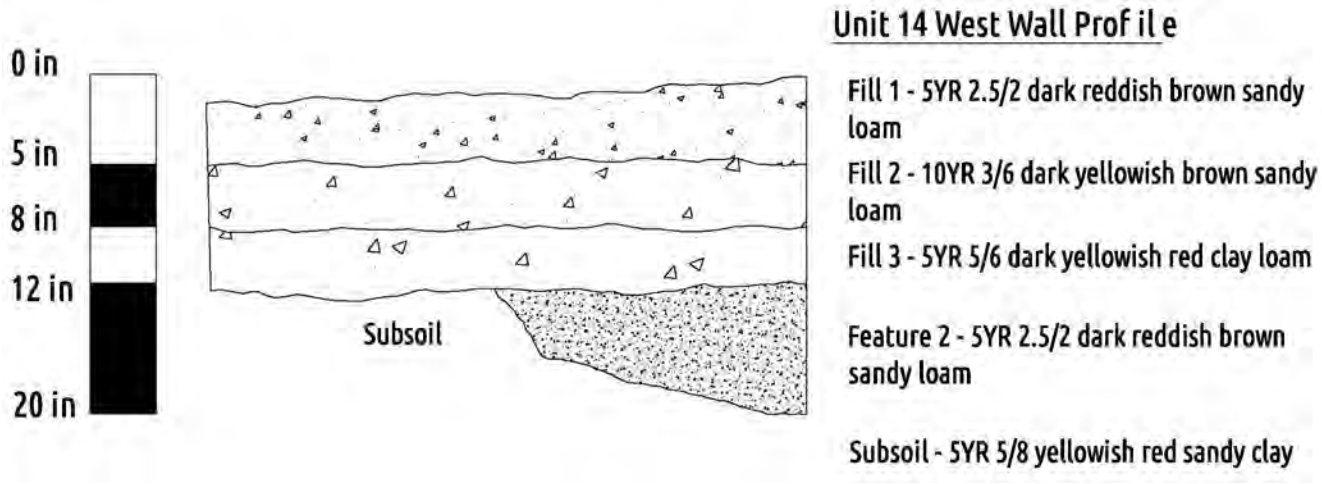

Figure 41: Structure 4, TU 14 / Feature 2 Profile.

Table 15: Artifacts Recovered from TU 14 & Feature 2

Artifact Type	Fill 1	Fill 2	Fill 3	Feature 2 Fill
wire fencing				1
Architecture				
ceramic pipe	2			4
lime soda (post 1864) windowpane glass	7	9	6	1
shingles			3	
unidentified nails				1
wire nail(s) (1890s-present)	13	5	5	1
Organic				
animal bone	2			
Total – TU 14	**24**	**14**	**14**	**8**

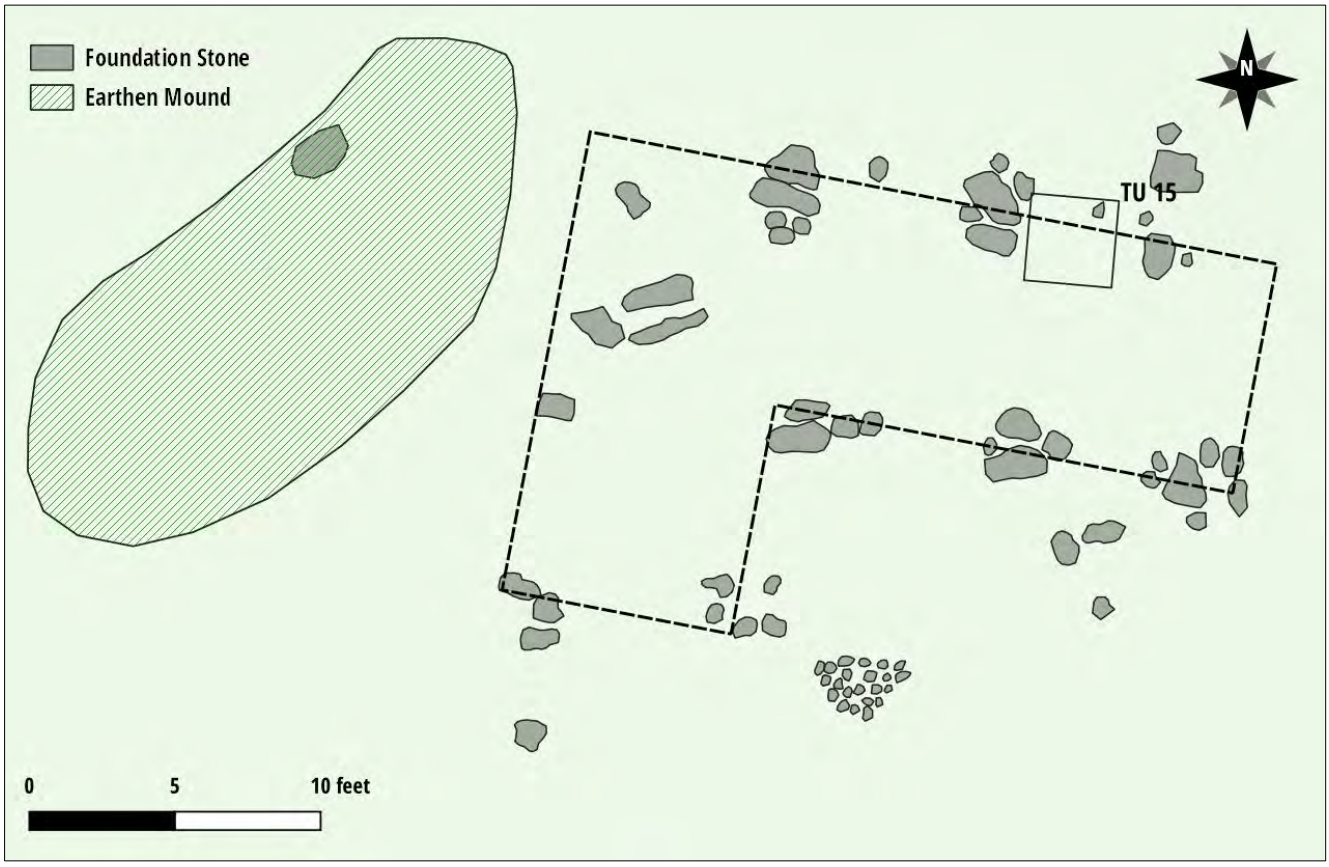

Figure 42: Structure 5 Outline, Stone Piers, the Earthen Mound, and Test Unit Location.

Structure 5 - Outbuilding

Structure 5 was identified based on a surface scatter of domestic artifacts and the remains of mechanical equipment surrounding a series of stone "piers" and earthen mounds (Figure 42). However, no structures are visible in this location in historic aerial images of the project vicinity.

Test Unit 15

Test Unit 15 (TU 15) measured three feet by three feet and was positioned along the northern boundary of what was interpreted as the remains of an "L-shaped" agricultural building during the visual inspection. Evidence of

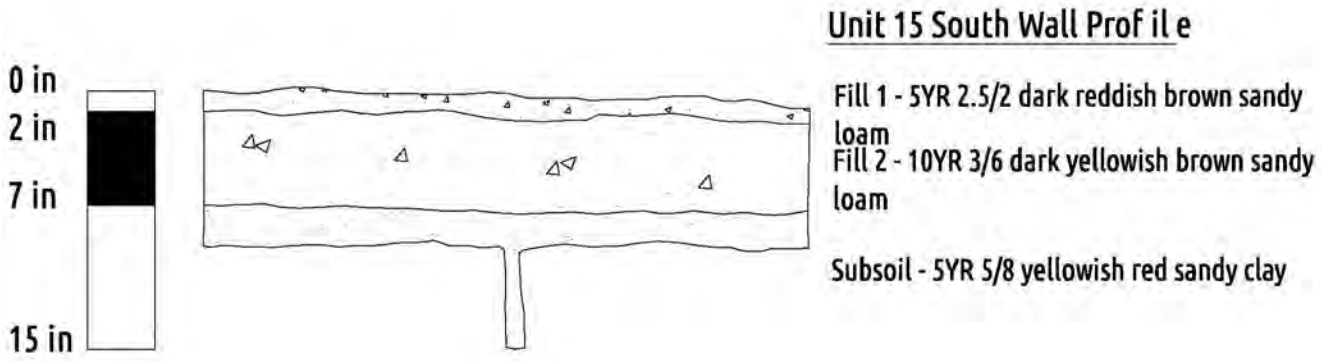

Figure 43: Test Unit 15, South Wall Profile.

the former structure included a surface scatter of twentieth century bottle glass, ferrous metal wire and fasteners and a series of stone piers roughly organized in an "L-shaped" pattern. The location of TU 15 was chosen to determine if a surface scatter of artifacts might be evidence of the intact archaeological remains of the former structure.

Prior to excavations, the surface scatter of artifacts in the test unit location were collected. Finds from the Ao horizon included 5 cut nails (1790s-present), 21 wire nails (1890s-present), and 1 bone fragment. At the outset of excavations, a datum stake was set 12 inches north of the northeast corner of the test unit at 7.5 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 15. TU 15 contained two cultural fills above sterile subsoil similar in both color and texture to Fill 1 and Fill 2 in TU 14 (Figure 43). TU 15-Fill 1 was approximately 2 inches in depth and was described as a dark reddish brown (5YR 2.5/2) sandy loam. Finds from the upper fill layer included 1 bolt, 1 lime-soda windowpane fragment (post 1864), and 3 wire nails (1890s-present). Beneath Fill 1, excavators found a brown (10YR 3/6) sandy loam mottled with a dark reddish brown (5YR 2.5/2) sandy loam, designated Fill 2. Fill 2 continued to sterile subsoil, encountered at approximately 7 inches below ground surface. No artifacts were found within the second fill. Subsoil was consistent in both color and texture to the subsoil seen elsewhere on the site and was classified as a yellowish red (5YR 5/8) sandy clay.

Table 16 summarizes the artifacts recovered from Structure 5 (TU 15) by functional group and soil horizon. Complete artifact descriptions and a full inventory of finds can be found in Appendix 2.

Table 16: Artifacts Recovered from TU 15

Artifact Type	Ao	Fill 1
Activities		
bolt		1
Architecture		
cut nail(s) (1790-present)	5	
lime soda (post 1864) windowpane glass		1
wire nail(s) (1890s-present)	21	3
Organic		
animal bone	1	
Total – TU 15	**27**	**5**

Historic aerial images do not show a structure in this location, and although visual inspection of the area found increased quantities of domestic, architectural, and activities related artifacts in this portion of the site, TU 15 excavations found little to no evidence of a structure in the archaeological record. Thus, the somewhat haphazardly organized stone piers and surface scatter of artifacts are interpreted either as the remains of an ephemeral, elevated structure or evidence of household waste disposal, perhaps during the latter part of the site occupation.

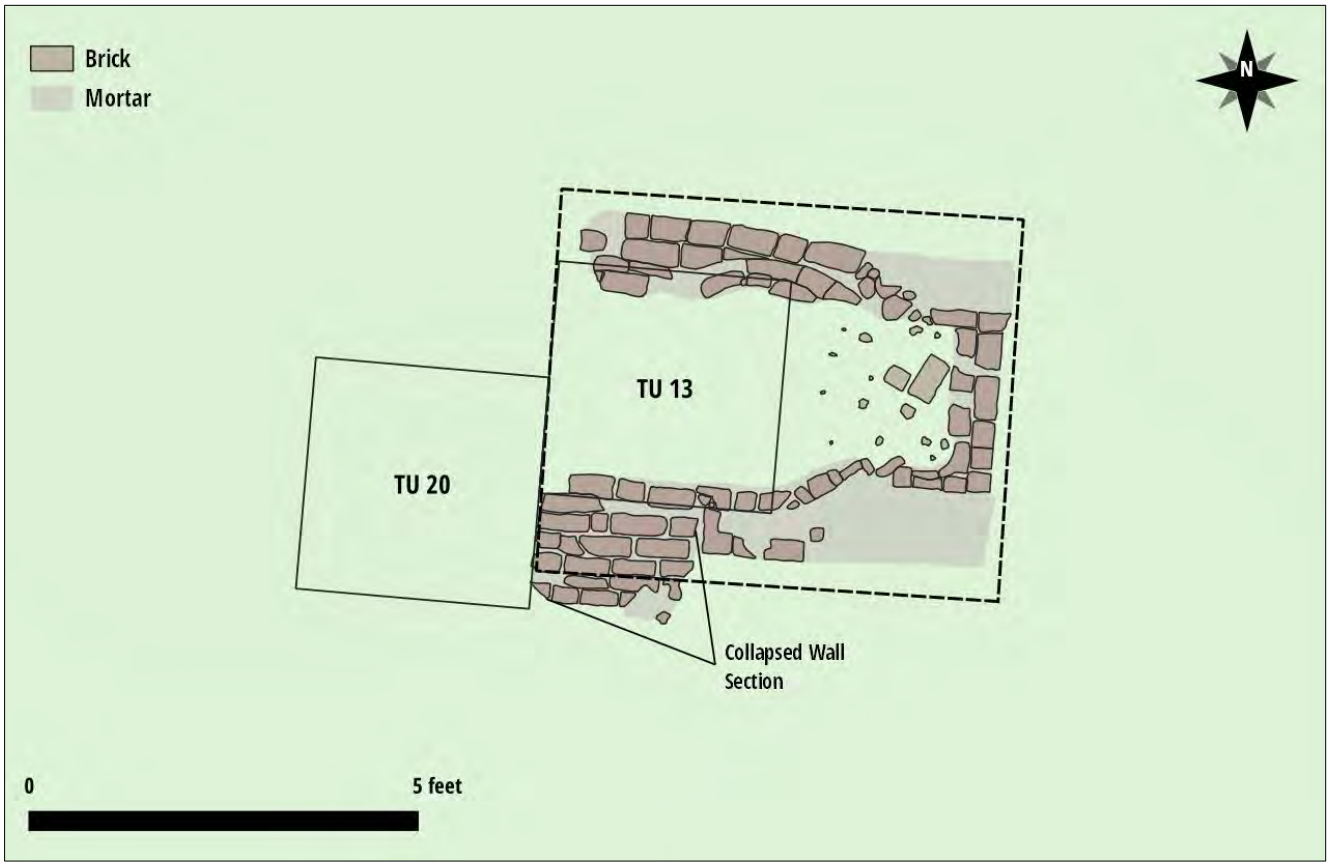

Figure 44: Structure 6 Outline, Structural Remains and Test Unit Locations.

Structure 6 – Hog Scalding Pit

Structure 6 was constructed of brick and mortar and measured 4 feet by 5.5 feet. The structure included a spherical depression above what was interpreted as a firebox and what appeared to be the remnants of a flue. Two test units were excavated inside-, and immediately outside of- the firebox during the Phase II test unit investigation (Figure 44). Given the small size of the structure, it is not visible in historic aerial imagery, nor is any other evidence of cultural activity in this location.

Test Unit 13

Test Unit 13 (TU 13) measured three feet by three feet and was positioned beneath the spherical depression in Structure 6, in the suspected location of the firebox. The goal of excavations in this location was the identification of any evidence, either stratigraphic or artifactual, that might provide a better understanding of its intended purpose.

A datum stake was set 12 inches north of the northeast corner of the test unit at 16 inches above the ground surface and was used to provide vertical control throughout the excavation of Test Unit 13. Within this test unit, four distinct cultural fills were identified above sterile subsoil (Figure 45). Fill 1, described as a dark reddish brown (5YR 2.5/2) sandy loam extended to approximately 4 inches below ground surface. Towards the bottom of the layer, the dark reddish brown soils of the upper fill became increasingly mottled with a yellowish red (5YR 4/6) sandy clay (Fill 2). Fill 2 ranged from 2 inches deep along the perimeter of the unit to 8 inches in depth in the center. Throughout Fill 2 the dark reddish brown mottling decreased giving way to the yellowish red (5YR 4/6) sandy clay of Fill 3 at 12 to 15 inches below ground surface. Fill 3 appeared to be a buried ground surface with notable quantities of charcoal. At the base of Fill 3, excavators identified a band of charcoal that included a charred wood fragment measuring approximately 4 by 10 inches. Additional charcoal deposits were noted throughout Fill 4, a dusky red (2.5YR 3/2) sandy loam mottled with a yellowish red (5YR 4/6) sandy clay

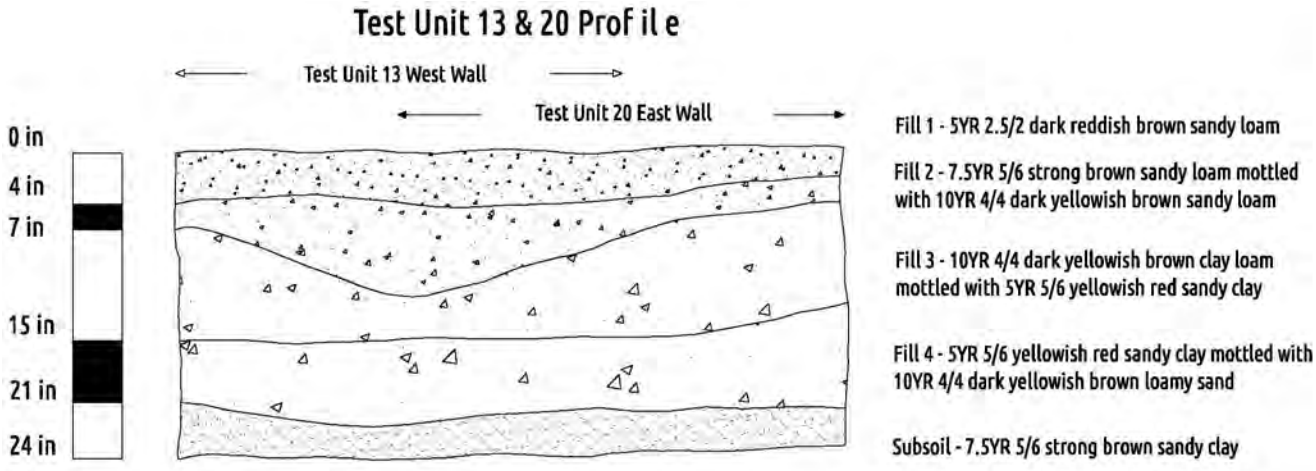

Figure 45: Test Unit 13/20 Soil Profile.

and charcoal. As with the previous fill, Fill 4 terminated with a band of charcoal. Sterile subsoil was found at 21 inches below ground surface and was classified as a strong brown (7.5YR 5/6) sandy clay.

Test Unit 20

Test Unit 20 (TU 20) was three feet by three feet and located along the western boundary of TU 13. This location was chosen to further explore the cultural fills identified in the adjacent test unit (see Figure 44).

A datum stake was set 12 inches north of the northwest corner of the test unit at 12 inches above the ground surface and was used to provide vertical control throughout excavation. Four cultural fills were identified during the excavation of TU 20 and the depths of the transitions suggest these were the same fills encountered in TU 13 (see Figure 45).

Summary

Upon initial inspection, the small size, large amounts of mortar, and spherical depression in the top of Structure 6 suggested that it was likely hastily constructed to serve a specific purpose. Test unit excavations beneath the spherical depression identified intact cultural fills believed to date to the construction and use of the structure, and suggest it served as a firebox presumably used to heat the contents of a cauldron or kettle that would have been at least 3 feet in diameter.

Based on this evidence, Structure 6 is interpreted as the remains of a hog scalding pit. Artifacts recovered from TU 13 and TU 20 also support this interpretation and suggest it is contemporary with other site structures; constructed in the late 19th / early twentieth century.

As seen in other areas of the site, architectural remains were the dominant artifact group in TU 13. Wire nails (1890s-present) were the only artifact from Fill 1 (n=12) and along with brick and mortar fragments accounted for 88% (n=14) of finds in Fill 2 and all of the finds from Fill 3. Other temporally diagnostic finds included 2 aluminum ring tabs (post 1965) in Fill 2 and 1 whiteware sherd (post 1820) in Fill 4. Perhaps most telling regarding the function of Structure 6 were the large quantities of charcoal found within the lower fills which seem to confirm this location did serve as a firebox. The presence of an aluminum ring tab in Fill 2 and wire nails in all fill layers suggest the structure was in use no earlier than the late nineteenth century and remained a location of cultural activity into the second half of the 20th century.

The artifact assemblage from TU 20 was consistent with that of TU 13. In Fills 1 through 3, architectural artifacts were the dominant group, of which brick and mortar fragments were the most common artifact type. Temporally diagnostic these layers included cut nails (1790s-present), wire nails (1890s-present) and ABM bottle glass (post 1907). Wire nails were also recovered the Fill 4, suggesting the hog scalding pit likely dates from the late 19th / 20th century.

Table 17 summarizes the artifacts recovered from Structure 6 (TU 13 and TU 20) by functional group and soil horizon. Complete artifact descriptions and a full inventory of finds can be found in Appendix 2.

Table 17: Artifacts Recovered from TU13 & TU20

Artifact Type	Fill 1	Fill 2	Fill 3	Fill 4
Architecture				
brick	23	13	16	
cut nail(s) (1790s-present)			4	
mortar	10	6	8	
wire nail(s) (1890s-present)	12	5	6	7
wrought nail(s)			1	
Kitchen				
aluminum ring tab (post 1966)		2		
bottle, ABM (post 1907)	1			
bottle/jar			6	9
whiteware (post 1820)				1
Organic				
charcoal				33
Unidentified				
ferrous metal	3			
Total – TU 13 & TU 20	**49**	**26**	**41**	**50**

Phase II Mechanical Stripping

Analysis of temporally diagnostic finds from the fills identified within the cellar hole (Structure 1) during test unit excavations revealed that each fill contained objects dating to the later part of the 20th century. Likewise, the discovery of modern objects mixed with architectural debris contained within the upper fill(s) was interpreted as evidence that they likely date to the demolition/deconstruction of the dwelling in 1979. Thus, it was decided to mechanically remove these fills to determine if any deposits dating to the site occupation remained beneath the modern fills and explore the evolution of the dwelling throughout the site occupation. Mechanical excavations identified the location of a modern, concrete-lined well southeast of the dwelling and a historic stone-lined well within 10 feet of the western wall of the dwelling. Additionally, mechanical excavations found evidence that the northern portion of the dwelling was likely a later addition (Figure 46).

Concrete Well

Excavations began in the southeastern corner of the structure and immediately identified a modern black polyethylene water pipe in the southeastern structure corner leading in an easterly direction. Excavations were halted within the cellar and the machine was relocated to follow the pipe to what was hoped to be the historic well, which remained unidentified up to this point. Trenching continued for approximately 20 feet east of the southeast structure corner and revealed a modern well encased in a concrete pipe 36 inches in diameter (see Figure 46).

Cellar Excavations

Following the discovery of the modern well, excavations resumed in the cellar. During the initial pass, only the southern and western half of the cellar fill was removed to allow excavators to explore the soil profile for the possibility of intact historic deposits. The initial pass found the foundation was indeed composed cinder block, brick, and stone wall segments as was anticipated during the visual inspection. Stripping also confirmed that the southeastern corner of the structure had been reconstructed during the site occupation and revealed that the remainder of the southern-, and much of the western- foundation walls had collapsed either during the site occupation, or the period since the site was abandoned (see Figure 45).

Following the first pass, a probe was used to explore the depths of the southern and western foundation walls in relation to the basement floor. Probing showed that the base of the foundation walls were constructed at the same

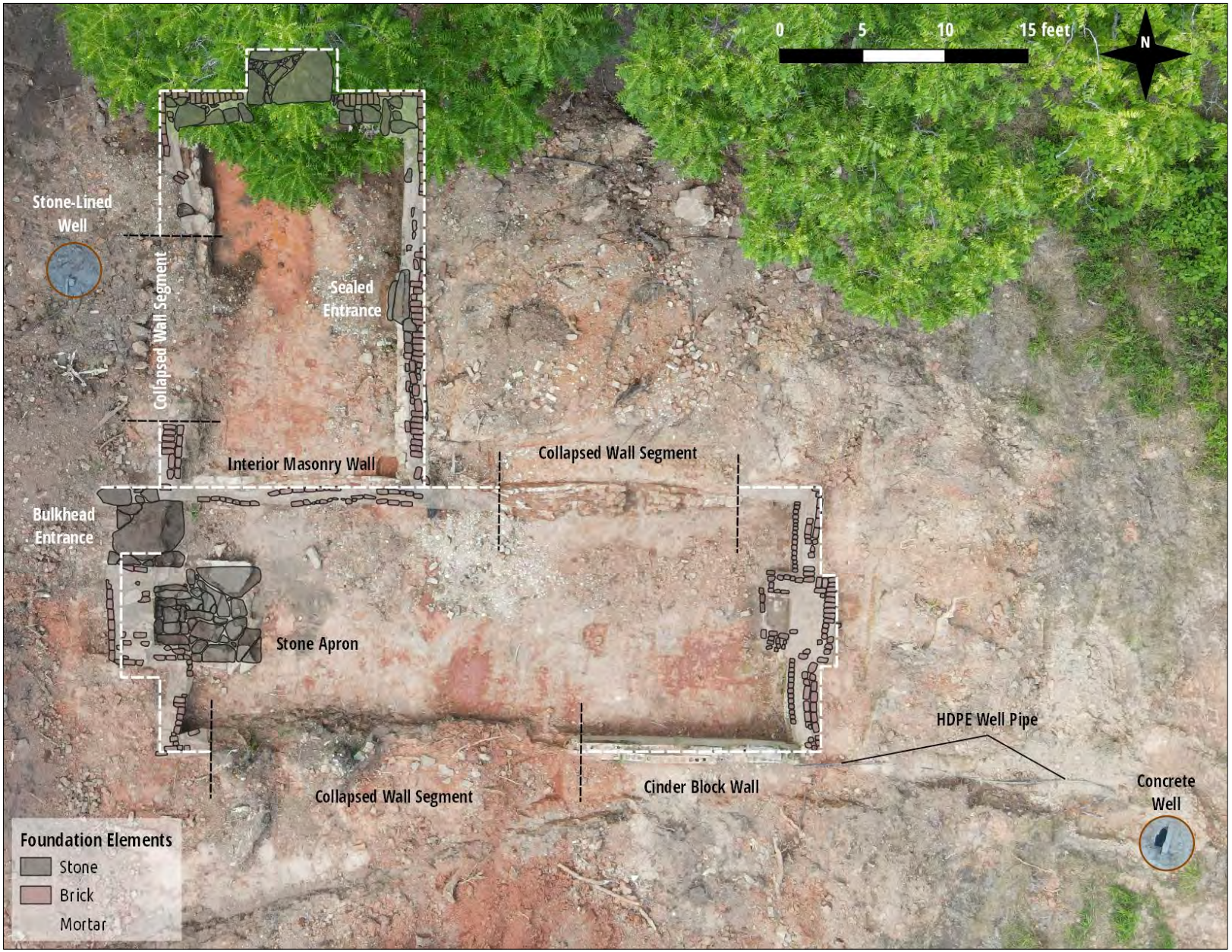

Figure 46: Results of Mechanical Stripping.

elevation of the basement floor. The only exceptions being the chimney base located in the southwestern corner of the structure, which appeared to extend approximately one foot below the basement floor. Construction of the foundation walls flush with the basement floor would have offered little resistance to the inward, lateral forces exerted by the surrounding soil and likely set up a continuous scenario of the inwardly creeping basement walls as witnessed by the bulging, unstable, and collapsed foundation walls observed at the time of this investigation.

Analysis of the stratigraphic profile within the cellar confirmed the results of test unit excavations and showed that modern fills extended to the basement floor throughout the cellar, with the exception of a brick firebox on the southeastern wall, a stone apron surrounding a brick firebox in the southwestern corner of the structure and an east/west internal masonry wall that divided the northern and southern portions of the ell (see Figure 46). With little to no chance of identifying historic deposits either in the cellar hole or in the upper fills covering the remains of the house foundation, the remaining cellar fill was mechanically removed and the top of the foundation walls were exposed to allow accurate measurement of the structure dimensions and to determine if the stone foundation elements in the northern portion of the foundation and the brick foundation of the southern portion of the structure, including the interior masonry foundation wall identified during the first pass could provide a chronology of any structural modifications during the site occupation.

The second round of excavations revealed the interior wall was entirely composed of brick and ran continuously across the structure, dividing the northern portion of the structure, measuring 16 feet east to west by 24 feet north to south, from the southern portion; which measured 16 feet north to south by 40 feet east to west. The discovery of the interior brick wall meant that the southern portion of the dwelling was supported with a continuous brick foundation. The northern portion of the structure was not as straightforward. While the northern foundation wall and the northern half of the northeastern wall were composed of stone with an exterior brick cladding, the southern half of the northeastern wall was composed entirely of brick and terminated at the southern foundation wall in a butt joint (Figures 47 and 48). The transition from stone to brick occurred at TU 9, in the location of a large stone and stoop, believed to mark a sealed entrance into the basement (see Figure 46). The western wall of the northern portion of the structure was completely collapsed. However, excavations in TU 11 identified the bottom course of an intact masonry wall and exploratory excavations at the intersection between the northern and southern portions of the structure identified a masonry butt joint as seen at the southern terminus of the northeastern wall. Thus, it is believed all but the northernmost portion of the west wall (which was constructed of stone and remains intact) was composed of brick.

As previously stated, access to the basement may have originally been provided by an entrance located at the transition from stone to brick in the northeastern foundation wall as evidenced by a stone stoop. However, a large stone had been mortared into the stone wall to block the suspected entrance and at the time the structure was demolished/dismantled it appears access was provided by a bulkhead entrance, between the southwestern chimney and the western end of the interior foundation wall. This entrance was lined with the same stone that formed an apron around the chimney base inside the basement; which was distinct from the stone used in the foundation of the northern portion of the structure. The butt joints identified at the southern termini of the northeastern and northwestern foundation walls appear to suggest the northern portion of the structure may have been a later addition, but given the numerous instances of collapse observed around the structure foundation, it is not clear whether or not the brick portions of the these walls were original components of the foundation or repairs made during the site occupation.

Stone-lined Well

During the mechanical removal of modern fills, the mini excavator entered and exited the cellar hole along the western wall. Upon exiting the cellar an underground void became visible behind the western wall of TU 11. Following the discovery, an area measuring roughly 12 feet square was scraped in 6 inch layers, revealing approximately 3 feet of modern demolition debris, composed of pipe fragments, bricks, mortar, plastic, aluminum cans, and glass bottles. The void identified to the west of TU 11 was in a particularly dense concentration of brick where soils had not completely infilled in the gaps between the bricks and brick wall fragments.

Figure 47: Structure 1-Brick Cladding on Northeastern Corner.

Figure 48: Butt Joint, Northeastern Exterior Wall (left), Interior Masonry Wall (right).

Figure 49: Stone-Lined Well Cut Into Subsoil.

Beneath the demolition fill, the excavator uncovered the remains of a stone-lined well measuring 4 feet in diameter that had been cut into sterile subsoil approximately 8 feet west of the foundation wall (Figure 49). Inspection of the well fill revealed it had been backfilled with a combination of soil, modern objects, and the demolition debris previously described. Excavations continued to approximately 10 feet below surface, the maximum depth possible with the mini excavator, and the last bucket-full contained a plastic Wonder Bread bag. Other finds included plastic bags and containers, ABM glass bottles (post 1907), ring tab aluminum beverage cans (post 1965), and stay-tab aluminum beverage cans (post 1977). Notably absent were the large quantity of architectural debris characteristic of the upper fills surrounding the dwelling.

Although excavations were not able to identify the total depth or age of the well, its proximity to the dwelling, approximately 12 feet north of the southern portion of the dwelling, and 8 feet west of the northern portion of the dwelling, in the rear yard of the house lot, and its method of construction suggest it was likely the original source of drinking water for the site's inhabitants.

Site Discussion

Built Environment

Cultural resources investigations on rural historic farmsteads throughout the Mid-Atlantic region have demonstrated a division of space that includes a house lot, composed of the dwelling, associated outbuildings, and yard, distinct from the surrounding agricultural area (Lanier and Herman 1997). The most common house lot layout, known as the "house and garden", included room for a dwelling, ancillary structures, and small family garden in the yard. In rural areas, house lots were often sited within the agricultural fields of larger farmsteads, providing comfortable on-site accommodations for farm laborers, or tenants.

Within the yard, a variety of outbuildings can be expected. Outbuildings are classified based on their purpose and typically fall into one of three categories: food storage/preparation, transportation/storage, or domestic crafts

(Lanier and Herman 1997). Typical examples of domestic outbuildings include a well house, kitchen, and smokehouse (food storage/prep); and garages, carriage houses, and sheds (transportation/storage). Outbuildings and the well were typically sited closest to the house. Beyond this area, a family garden, privy, and animal pens were also common fixtures in the house and garden layout.

House Lot

The location and dimensions of the house lot at Buena Vista were initially identified using the 1947 and 1958 black and white aerial images of the site and surrounding environs (Figures 50 and 51). Both images clearly showed that the farmstead layout conformed to the typical regional model and included a house lot that was both spatially and functionally distinct from the surrounding agricultural land. The dimensions of the house lot varied from 1947 to 1958, but roughly measured 200 feet square. The northwestern corner of the house lot was marked by an outbuilding and the southwestern and southeastern corners were marked by Pinegrove Road and an "S-turn" in the former farm road to the east of the site, respectively. In the 1947 historic aerial image, the eastern boundary and northeast corner of the house lot was marked by a fence line and the remainder of the northern boundary was marked by a row of trees. The fence line observed in the northeastern corner of the house lot likely extended around the entire yard and formed a physical barrier between the domestic and agricultural activity areas at Buena Vista.

Visual inspection and subsurface testing confirmed the boundary of the house lot. Included within the yard were the dwelling (Structure 1), a smokehouse (Structure 2), a historic well, a modern well, and decorative plantings, including daffodils and boxwoods.

Dwelling (Structure 1)

Near the center of the house lot was an "L-shaped" cellar hole, approximately 16 feet wide and measuring 40 feet along its long axes. The foundation walls bore evidence of instability, particularly along the southern and western walls that prompted the twentieth century inhabitants to replace a 15 foot section of the southern wall with cinder block to shore up the southeastern corner of the structure. And at the time of this investigation, nearly all of the southern wall and large sections of the western wall and the eastern half of the north wall had collapsed.

Mechanical stripping revealed the dwelling foundation was actually composed of two distinct foundations. The southern, and likely the earliest portion of the foundation, measured 16 feet north to south by 40 feet east to west and was composed entirely of brick, with exterior brick chimneys on the eastern/western gabled ends and a bulkhead entrance along the north side of the western chimney. The northern portion of the foundation measured 16 feet east to west by 24 feet north to south and was composed of stone with a brick veneer, and brick. The northern portion of the structure would have had a large chimney on the north wall and access to the cellar may have been provided by a bulkhead entrance on the east wall, that appears to have been sealed during the site occupation. Where the northern and southern portions of the structure met, the eastern and western walls of the northern portion butted up against the continuous masonry wall of the southern foundation, suggesting the northern portion of the foundation was a later addition. Tax records indicate the value of structures on Buena Vista increased from $800 in 1850 to $1,200 in 1851, a fitting amount for an addition that would have increased the size of the dwelling by roughly one third.

Test unit excavations identified fill layers believed to date to three different periods of site activity. The upper layer(s) was/were littered with architectural debris and is/are believed to date to the demolition/deconstruction of the dwelling in 1979. Beneath the modern fill, excavators typically found a separate fill, distinguished from the demolition fill based on soil color and the drastically reduced number of architectural artifacts. This fill was described as an occupation fill and is believed to represent the entirety of the site occupation, roughly during the period from 1840 to 1975. Additionally, nearly all of the test units and excavation trenches that straddled the foundation walls included a third fill that extended from the base of the occupation fill to the base of the cellar foundation. This fill was described as a builder's trench and is believed to date to the construction of the original dwelling and the later addition.

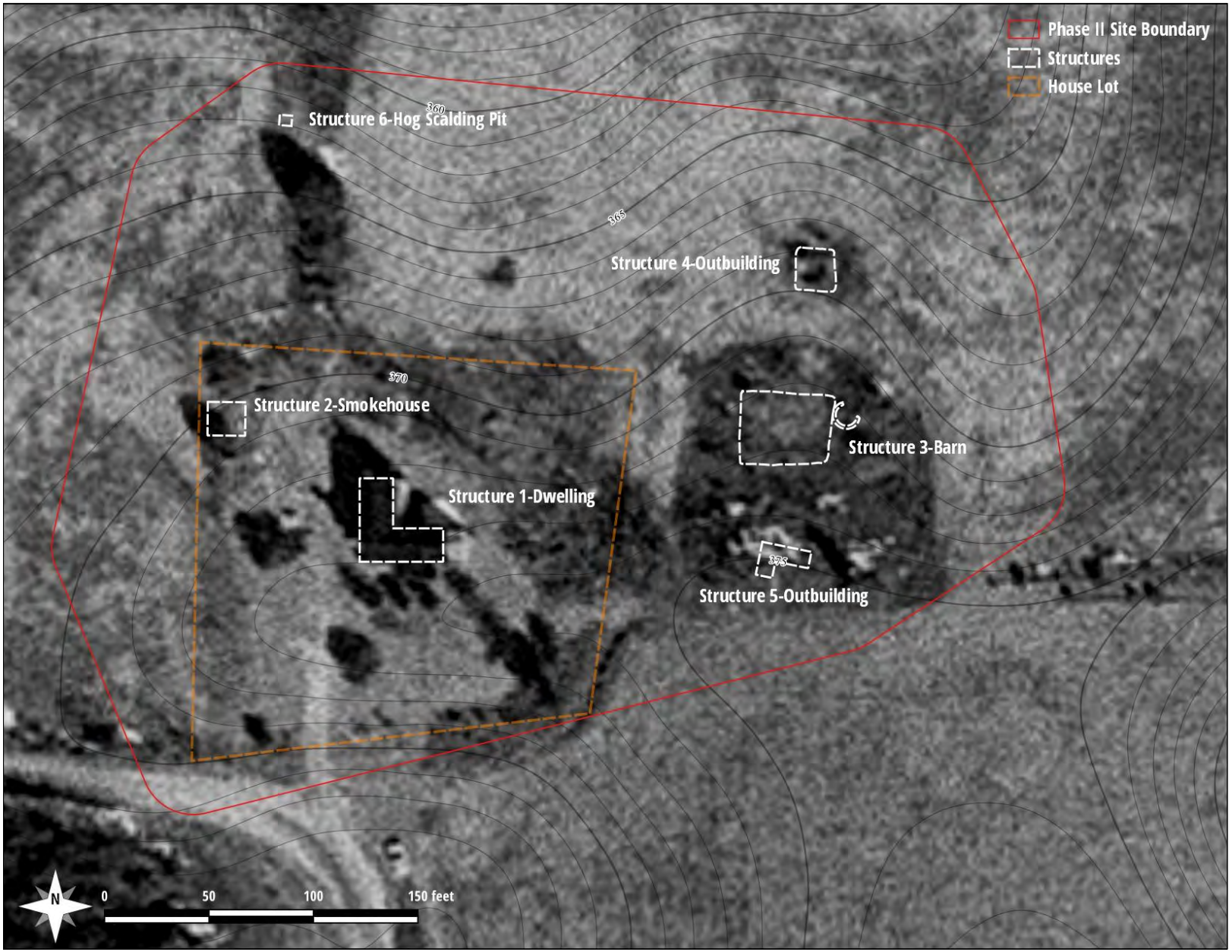

Figure 50: House Lot and Structure Locations Overlain on 1947 Black and White Aerial Image.

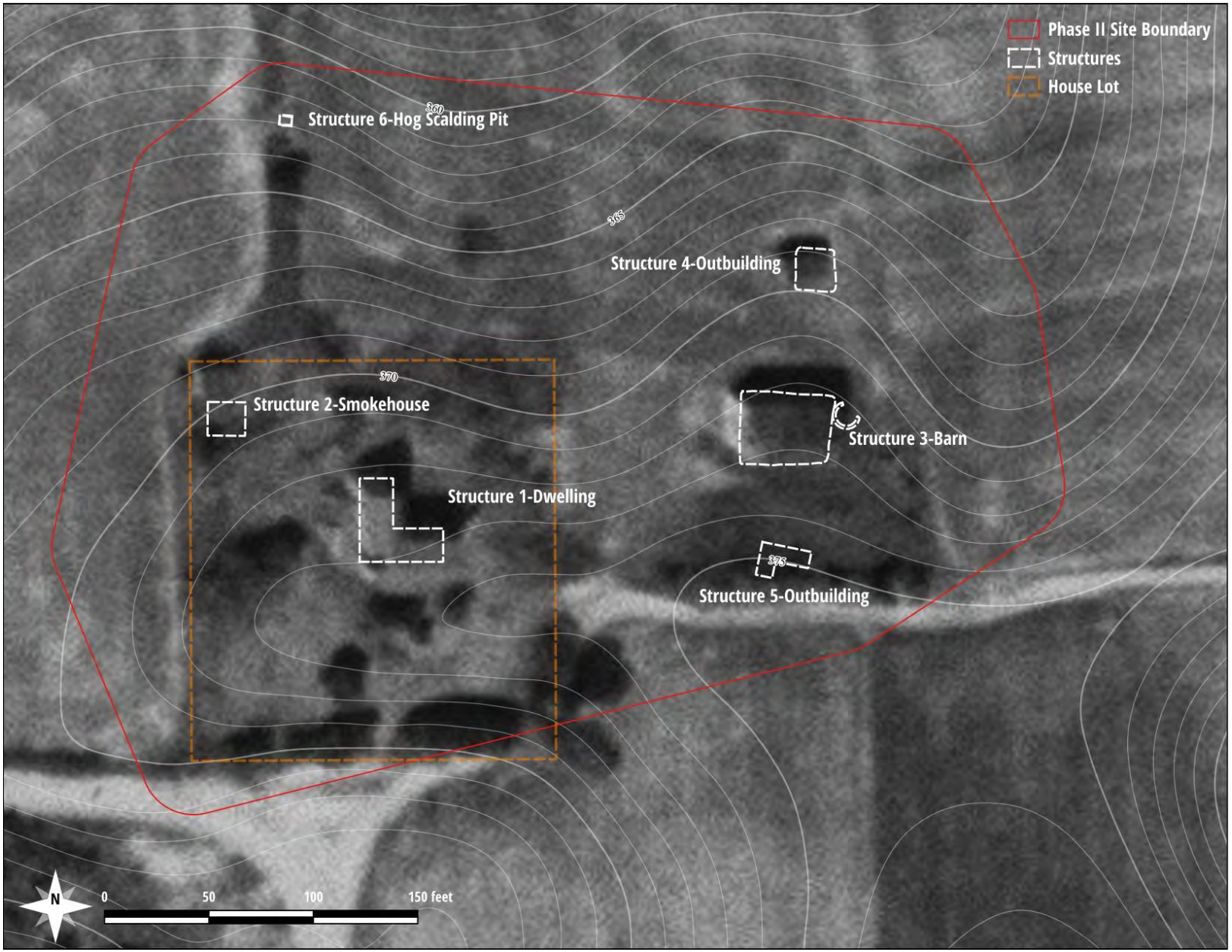

Figure 51: House Lot and Structure Locations Overlain on 1958 Black and White Aerial Image.

Generally, the finds from each layer support their interpretation. Massive quantities of architectural artifacts were observed in and recovered from the demolition fill. Smaller quantities of kitchen and architectural artifacts spanning the site occupation were found within the occupation fill, and only a hand full of artifacts were recovered from the builder's trench. However, finds from the builder's trench, including lime-soda windowpane fragments (post 1864), and one wire nail (1890s-present) suggest a construction date in the second half of the 19th century.

Smokehouse (Structure 2)

The remains of a second structure were identified in the northwest corner of the house lot, approximately 60 feet northwest of the dwelling. This structure was represented by a continuous stone foundation measuring 16 feet north to south by 18 feet east to west; and one standing mortise and tenon beam. Three test units were excavated within the structure during this investigation. Investigators noted a burned wood smell still contained in the almost black soils and identified a hearth feature (Feature 1) roughly centered within the structure. Based on this evidence, this structure was interpreted as a smokehouse.

As observed around the dwelling, the upper fill layers were dominated by architectural finds, including 100 wire nails. In contrast to the dwelling, comparatively large quantities of bone and charcoal were found within the upper and lower fills and the feature fill. Temporally diagnostic finds, including 4 cut nail (1790s-present), 7 whiteware sherds(post 1820), 2 lime-soda windowpane fragments (post 1864), and more than 100 wire nails suggest that it was contemporary with the dwelling.

Modern / Historic Well

Mechanical excavations in and around the cellar identified two wells within the house lot. The more recent well, evidenced by a high density polyethylene (HDPE) pipe protruding from the southeastern corner of the foundation was located approximately 18 feet southeast of the dwelling. This well was lined with sections of reinforced concrete pipe approximately 36 inches in diameter, encasing a well that extends approximately 40 feet below the ground surface. Based on its construction method and the HDPE water line, first introduced in the second half of the 20th century, this well is interpreted as the "modern" water well and likely satisfied the water needs of the site's most recent inhabitants.

Mechanical stripping around the northwestern corner of the dwelling later revealed a stone-lined well set approximately 8 feet west of the dwelling foundation. This well was initially identified as a void beneath the current ground surface and subsequent excavations revealed a circular stone lining measuring approximately 4 feet in diameter. During mechanical excavations, the uppermost, 9 to 10 feet of fill were mechanically removed and the backdirt pile was visually inspected for temporally diagnostic artifacts. Finds included plastic bags and containers, glass beverage bottles, and two-piece aluminum beverage cans. None of the demolition debris seen in the upper fills surrounding the dwelling were found in the well fill. This layer is interpreted as household waste deposited during the most recent period of the site occupation. Excavations did not reach the bottom of the well, and thus, provide an incomplete picture of the diagnostic artifacts contained within the well fill. However, given what was observed within the upper fill and the construction of the "modern" well southeast of the dwelling in the second half of the twentieth century, this well is interpreted as the original source of water for the site's inhabitants, replaced by the "modern" well and backfilled during the second half of the twentieth century.

Agricultural Activity Area

The agricultural activity area, depicted as pastureland in the 1947 and 1958 aerial images, surrounded the house lot on its western, northern, and eastern sides (see Figures 50 and 51). The 1947 aerial image was taken 3 years after the death of Herman Flippen. Historic records indicate that his widow Louise Cox Flippen was still living at Buena Vista but at that time, the fields surrounding the house lot appear to be fallow. Along its eastern side, the house lot is separated from an overgrown area to the east by a thin strip of pasture or possible farm road. What appears to be a partially constructed, or partially collapsed, structure is also visible to the north of the overgrown area. A survey point noted in this approximate location on an 1892 plat of the property is labeled "orchard", suggesting the overgrown area visible in the 1947 aerial may have once served in that capacity.

In the 1958 aerial, a large structure, likely a barn, is visible in the formerly overgrown area, and another, smaller structure (Structure 4) is clearly indicated in location of the partially constructed/collapsed building in the 1947 aerial image. At that time the fields surrounding the yard appear to be under cultivation.

Visual inspection and subsurface testing confirmed the presence of the barn (Structure 3) and the outbuilding (Structure 4) visible in the 1958 aerial along the eastern site boundary as well as a series of stone piers and architectural artifacts interpreted as an additional outbuilding (Structure 5) to the south of the barn. Further exploration along the northwestern site boundary revealed an additional masonry foundation measuring 4 feet by 5.5 feet, interpreted as the remains of a hog scalding pit (Structure 6).

Barn (Structure 3)

The remains of a barn were identified along the eastern site boundary during the visual inspection of site 44CM0136. This location was initially identified based on a circular, concrete silo base, measuring approximately 10 feet in diameter. However, following the removal of brush from this portion of the site, a raised rectangular area, measuring approximately 34 feet north to south by 40 feet east to west, was identified to the west of the silo base and was interpreted as the footprint of the former structure. Subsequent subsurface testing produced only minimal evidence of the former structure, including 15 wire nails, a hinge pintle, and a horseshoe. Given the low artifact density and the low expectation for culturally significant archaeological deposits, no test units were excavated in the location of the barn.

Northern Outbuilding (Structure 4)

The location of the northern outbuilding depicted in the 1947 and 1958 aerial images was confirmed during the visual inspection of the Buena Vista Site. Remnants of the structure consisted of 7 singular stones roughly organized into the shape of a rectangle and a raised area, similar to what was observed in the location of the barn. The elevated area measured roughly 18 feet by 20 and included a central depression. A two-man crosscut saw blade was observed on the ground surface within the structure interior, and 28 artifacts were recovered from a single STP (STP 1062) located in the interior of the structure. TU 14 was placed within the structure to explore the integrity of its cultural deposits and provide a sample of their cultural content. TU 14 excavations identified three cultural fills within the structure interior and identified a post hole near the center of the structure, interpreted as a central support post. Finds from subsurface testing in and around Structure 4 were dominated by wire nails (1890s-present), but included a surprisingly diverse assemblage for what was ultimately interpreted as an agricultural outbuilding, including ceramic drain pipe fragments, a flatiron, and lime-soda windowpane fragments (post 1864).

Southern Outbuilding (Structure 5)

No structure is visible in the location of the southern outbuilding in the 1947 or 1958 aerial. This location was first identified during the visual inspection of the site based on the presence of a small earthen mound, 9 stacked stone piers loosely organized into an “L-shaped” foundation, several rock piles, and a surface scatter of machinery parts and domestic artifacts.

No artifacts were recovered in the vicinity of Structure 5 during close interval STP survey. However, the area surrounding the suspected structure was littered with metal detector strikes. Twelve strikes were excavated within and surrounding the suspected building footprint, yielding finds consistent with other structures in this part of the site, including wire nails (1890s-present), a rake fragment, a battery fragment, and ABM bottle glass (post 1907).

TU 15 was excavated along the northern wall of the suspected structure, between two structural piers. Similar to the STP survey, test unit excavations produced very little below-ground evidence of Structure 5. Twenty-seven artifacts were collected from the ground surface prior to excavations, yet only 5 artifacts, including 3 wire nails (1890s-present), 1 lime-soda windowpane fragment (post 1864), and 1 bolt were recovered from the upper of two cultural fills.

Hog Scalding Pit (Structure 6)

The hog scalding pit was first identified during the visual inspection of the site and due to its small size, was completely missed during the close-interval STP survey. Evidence of the pit included the partially collapsed remains of a masonry structure that extended approximately 12 to 18 inches above the ground surface and was similar in appearance to barbeque, with a spherical depression approximately 3 feet in diameter covering the western two thirds of the surface. Two test units were excavated within (TU 13) and along the western edge (TU 20) to explore its intended function and date of construction/use.

Test unit excavations found whiteware (post 1820) in the lowest fill (Fill 4) and an aluminum ring tab (post 1865) in Fill 2 indicate that this structure was contemporary with other structures on the site. Otherwise, finds were principally comprised of brick and mortar fragments and wire nails (1890s-present). Significant quantities of burned wood and charcoal recovered from the lowest fill within and immediately west of the firebox suggest this structure was, in fact, a hog scalding pit.

Material Culture Analysis

The Buena Vista Site (44CM0136) artifact assemblage was classified based on horizontal distribution and functional variety to provide a more holistic understanding of site activities and activity areas. During the initial stage of this research, a distribution map was prepared for all historic artifacts recovered during the Phase I and Phase II investigations to determine if the distinction between the house lot and agricultural activity areas visible in historic aerial imagery was reflected in the horizontal distribution of artifacts. Artifact distribution maps were generated using the Heatmap Tool in QGIS with a Quartic kernel shape and a radius of 30 feet, and accounted for the area of soil excavated in each testing location. Metal detector strikes and shovel tests were assumed to be roughly equal in area (1 ft²). Thus, gross artifact counts were used for the weights of MD strikes and STPs. The area of test units was calculated based on their square footage (i.e 3x3 unit=9ft², 2x5 unit = 10 ft², etc.) and artifact quantities were divided by the square footage to calculate artifacts per square foot, and these values were then used as the weights for test units.

Artifact concentrations highlighted the boundaries of the house lot and the locations of the dwelling (Structure 1) and the smokehouse (Structure 2). Outside of the house lot, artifacts were clustered in the locations of the barn (Structure 3), outbuildings (Structures 4 and 5), and the hog scalding pit (Structure 6). Smaller artifact concentrations were also identified in the agricultural field north of the house lot (Figure 52).

The artifact assemblage from the Buena Vista Site (44CM0136) was then classified using the GEOGRifact functional classification system. GEOGRifact is based on the Artifact Classification Format as described in Stanley South's Method of Abstracting the Carolina Artifact Pattern and employs South's functional groups (Activities, Architecture, Arms, Clothing, Furniture, Kitchen, Personal Items, Tobacco), but is expanded to allow for the classification of more diverse cultural materials from a broader range of cultural periods (South 1977). The utility of this analyses is limited by the comparability of the datasets, but it remains a useful tool for identifying and exploring behavioral patterns on archaeological sites and provides a somewhat standardized methodology for intra-site and inter-site comparisons. Table 18 presents artifact counts and percentages for the House Lot and the Agricultural activity area organized by functional group.

Table 18: Functional Group Comparisons the Buena Vista Site

South's Functions	House Lot		Agriculture		Total	
	Quantity	Percent	Quantity	Percent	Quantity	Percent
Architecture	1359	58.13%	356	60.65%	1715	58.63%
Kitchen	617	26.39%	78	13.29%	695	23.76%
Unidentified	218	9.32%	69	11.75%	287	9.81%
Organic	97	4.15%	58	9.88%	155	5.30%
Activities	32	1.37%	21	3.58%	53	1.81%
Arms	13	< 1%	0	< 1%	13	< 1%
Personal Items	1	< 1%	4	< 1%	5	< 1%
Clothing	1	< 1%	1	< 1%	2	< 1%
Total	**2338**	**100%**	**587**	**100%**	**2925**	**0**

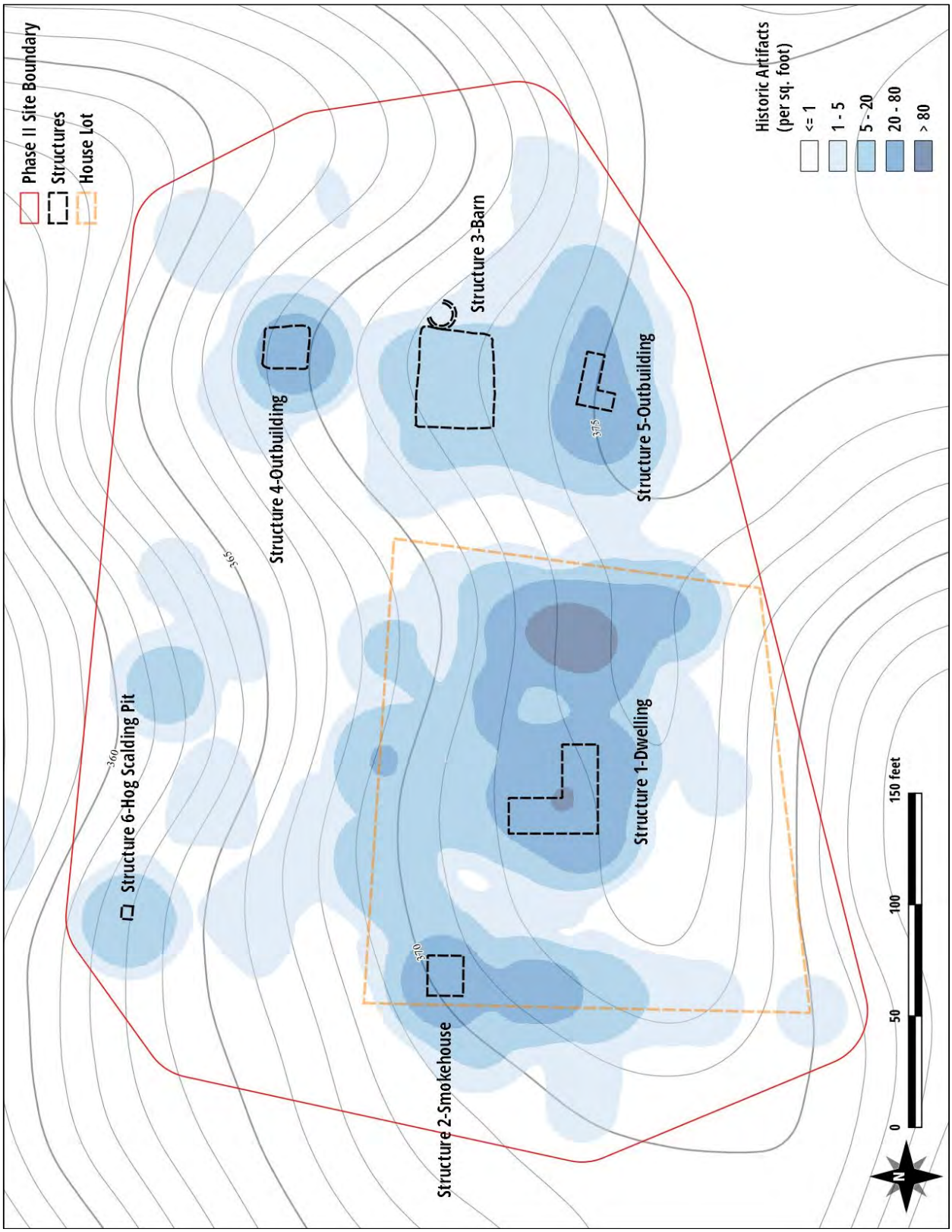

Figure 52: Distribution of Historic Artifacts.

Although the house lot only encompassed approximately 25% of the site area (0.76 acres), it contained 80% (n=2,338) of the total artifacts recovered from the Buena Vista Site. Artifact quantities varied considerably from the house lot to the agricultural area, but the percentages by functional group were relatively consistent between the areas, with the exception of the Arms group; which was not present in the agricultural area. Architectural artifacts form the largest percentage of the assemblages from both the house lot and the agricultural area, representing 58.13% (n=1,359) and 60.65% (n=356) respectively. Kitchen artifacts were the second most common group, accounting for 26.39% (n=617) of the house lot assemblage and 13.29% (n=78) of the artifacts recovered from the agricultural area. The Organic group was the third most common of the identifiable functional groups and was twice as prevalent in the agricultural area (9.88%/n=58 versus 4.15%/n=97). Likewise, the Activities group, which includes agricultural and construction tools, and miscellaneous hardware represented a larger percentage of the total assemblage in the Agricultural activity area. Taken as a whole, the artifacts recovered from the house lot and agricultural area at the Buena Vista site suggest site activities were focused on shelter and subsistence throughout the site occupation. Figures 53 through 58 present the artifacts recovered from two intact features discovered during the Phase II investigation and a sample of artifacts found in the agricultural activity area and elsewhere within the house lot.

Figure 53: Feature 1 (Structure 2) Artifact Assemblage.

Figure 54: Feature 2 (Structure 4) Artifact Assemblage.

Figure 55: Sample of Artifacts Recovered from Structure 1, Including Brick with Illegible Writing.

Figure 56: Sample of Artifacts Recovered from Structure 2.

Figure 57: Sample of Artifacts Recovered from Structure 5.

Figure 58: Sample of Artifacts Recovered from Structure 6.

Architectural Group

The Architectural group made up more than half of the total site assemblage (58.63%) and was primarily composed of lime-soda windowpane fragments, wire nails, brick fragments, and cut nails. Most of the 1,715 artifacts in this functional group were recovered in the house lot (1,359/79%) and the vast majority of those artifacts were recovered from cultural fills that are believed to date to the demolition/deconstruction of the dwelling, circa 1979. The spatial distribution of Architectural group artifacts is presented in Figures 59 through 62.

As expected, the highest concentration of architectural remains was identified in the location of the dwelling and smaller clusters were noted in the locations of each outbuilding. Wire nails were found in all of the building locations and suggest that the buildings remained in use after 1890. A concentration of cut nails was also identified in the location of the dwelling, and is suggestive of a construction date between 1790 and 1890. Lime-soda windowpane glass, commonly available after 1864 was concentrated in the location of the dwelling, with another dense concentration at STP 123 along the northern boundary of the house lot. Surprisingly, smaller concentrations are also indicated in the locations of the northern and southern outbuildings in the agricultural area and suggests these structures may have included windows.

Table 19 presents counts and assemblage percentages by Class and Type within the Architectural group.

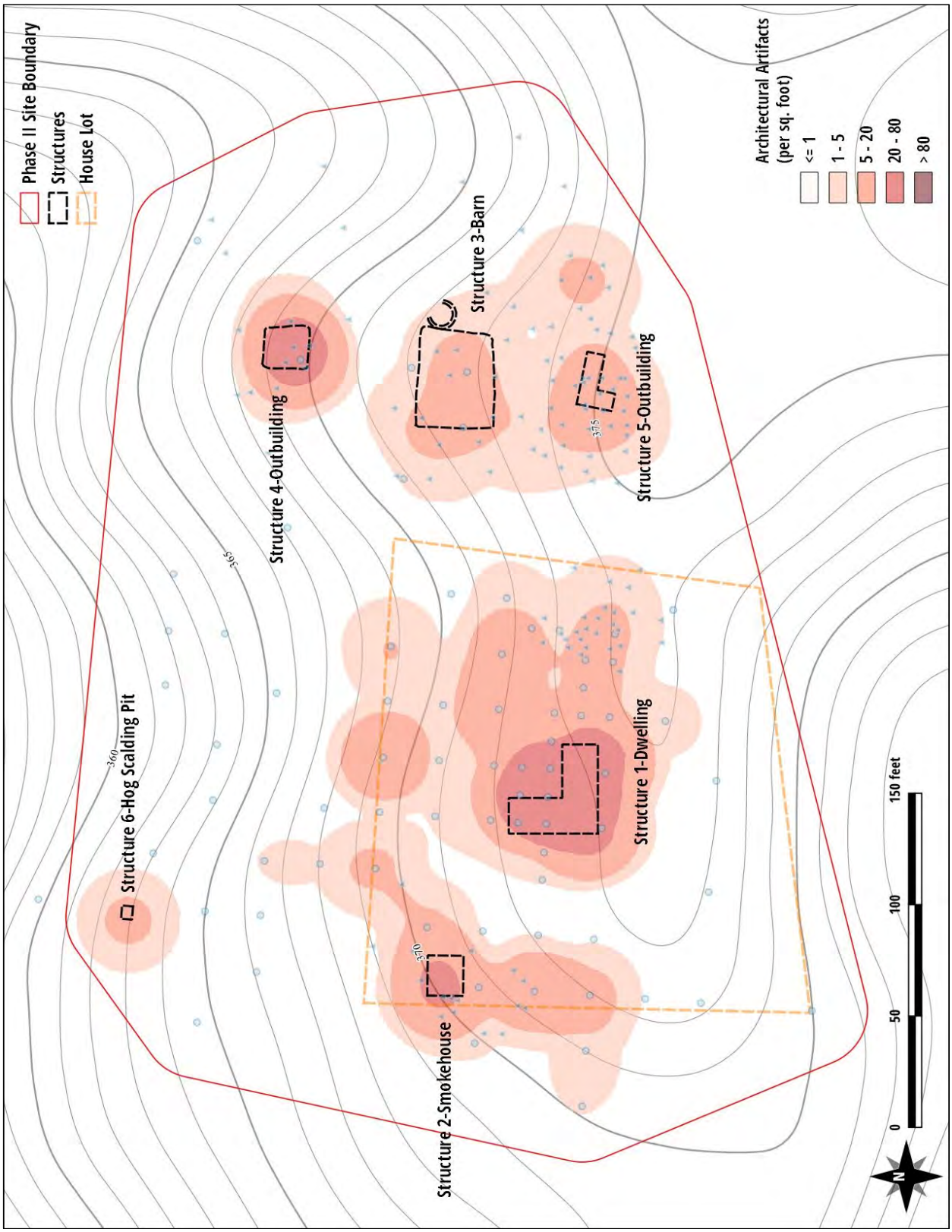

Figure 59: Distribution of Architectural Artifacts.

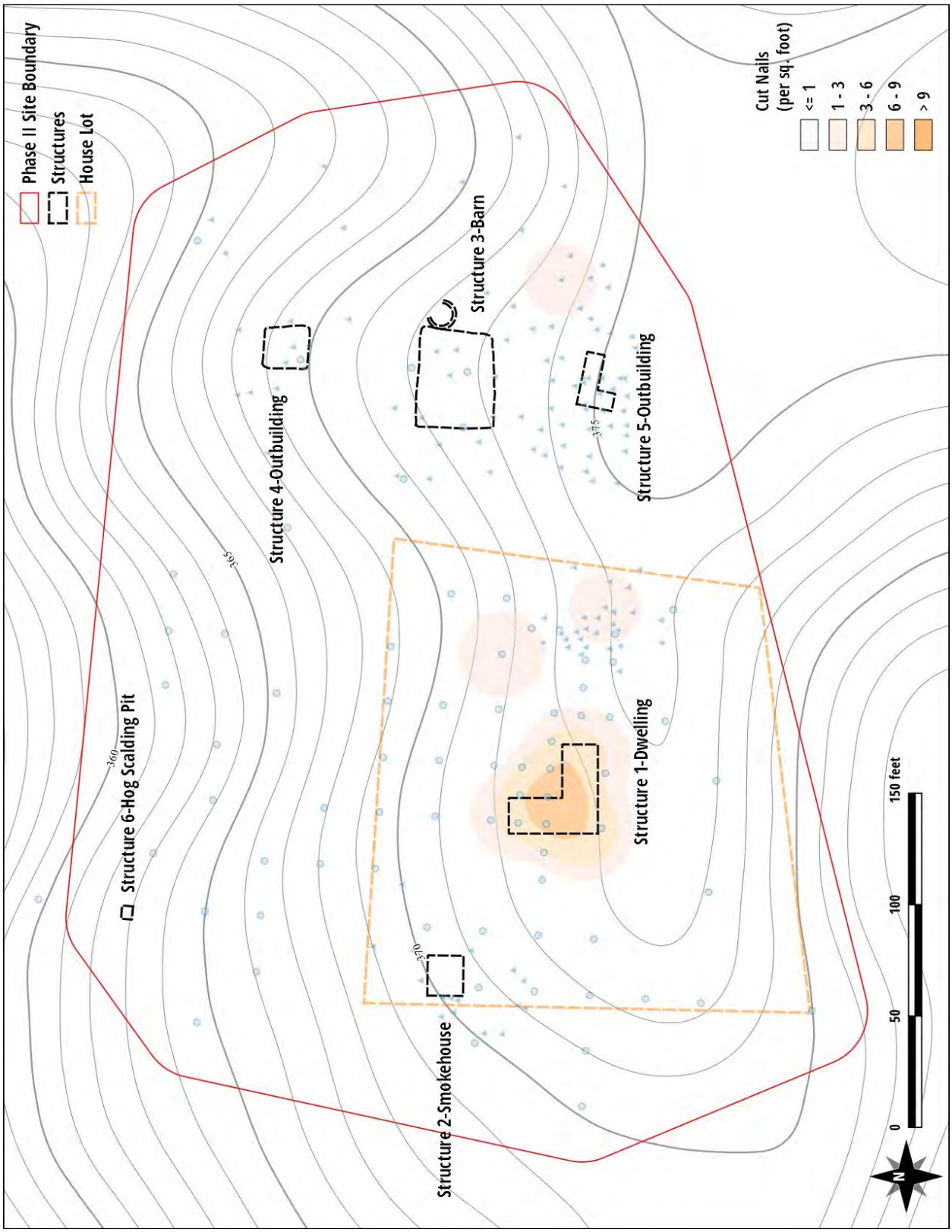

Figure 60: Distribution of Cut Nails.

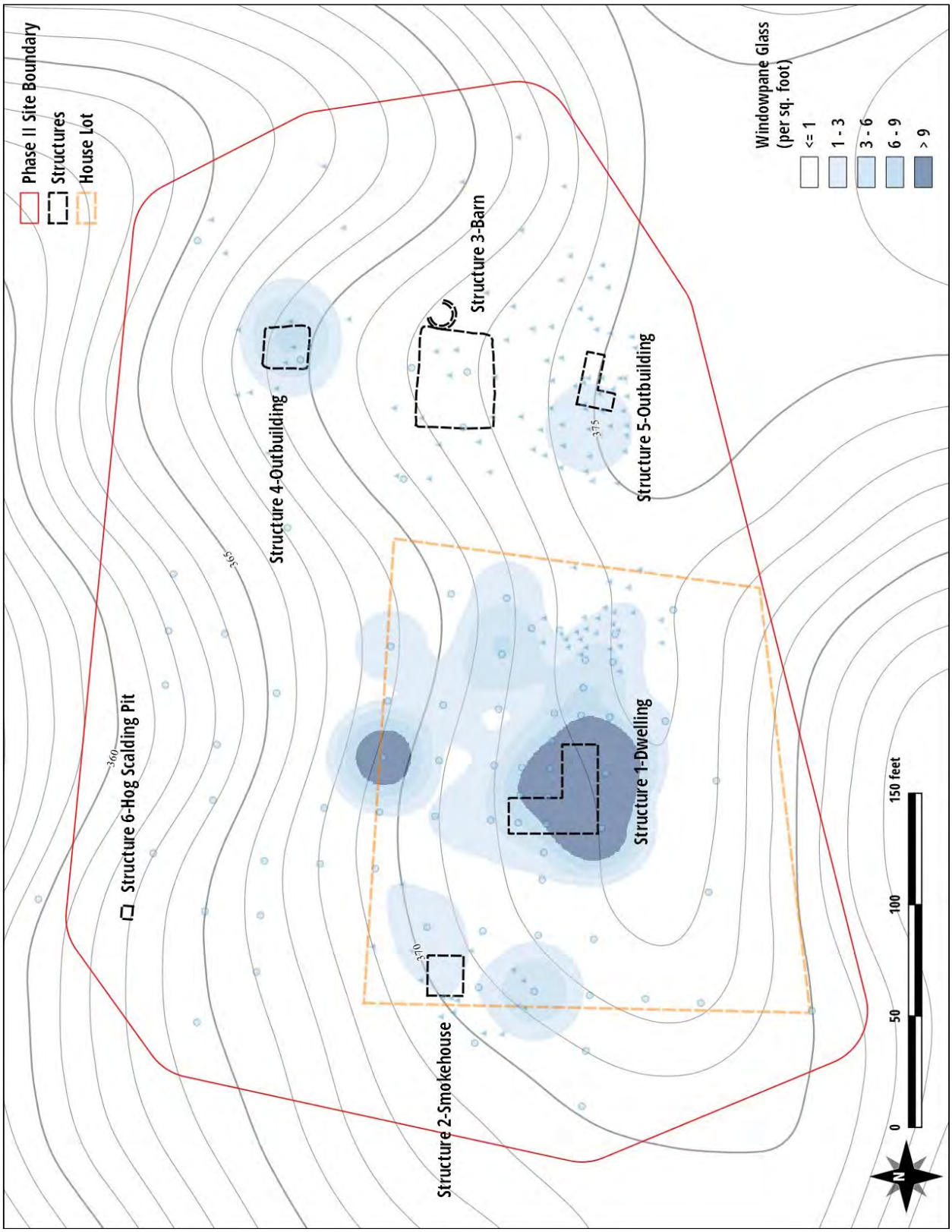

Figure 61: Distribution of Windowpane Glass.

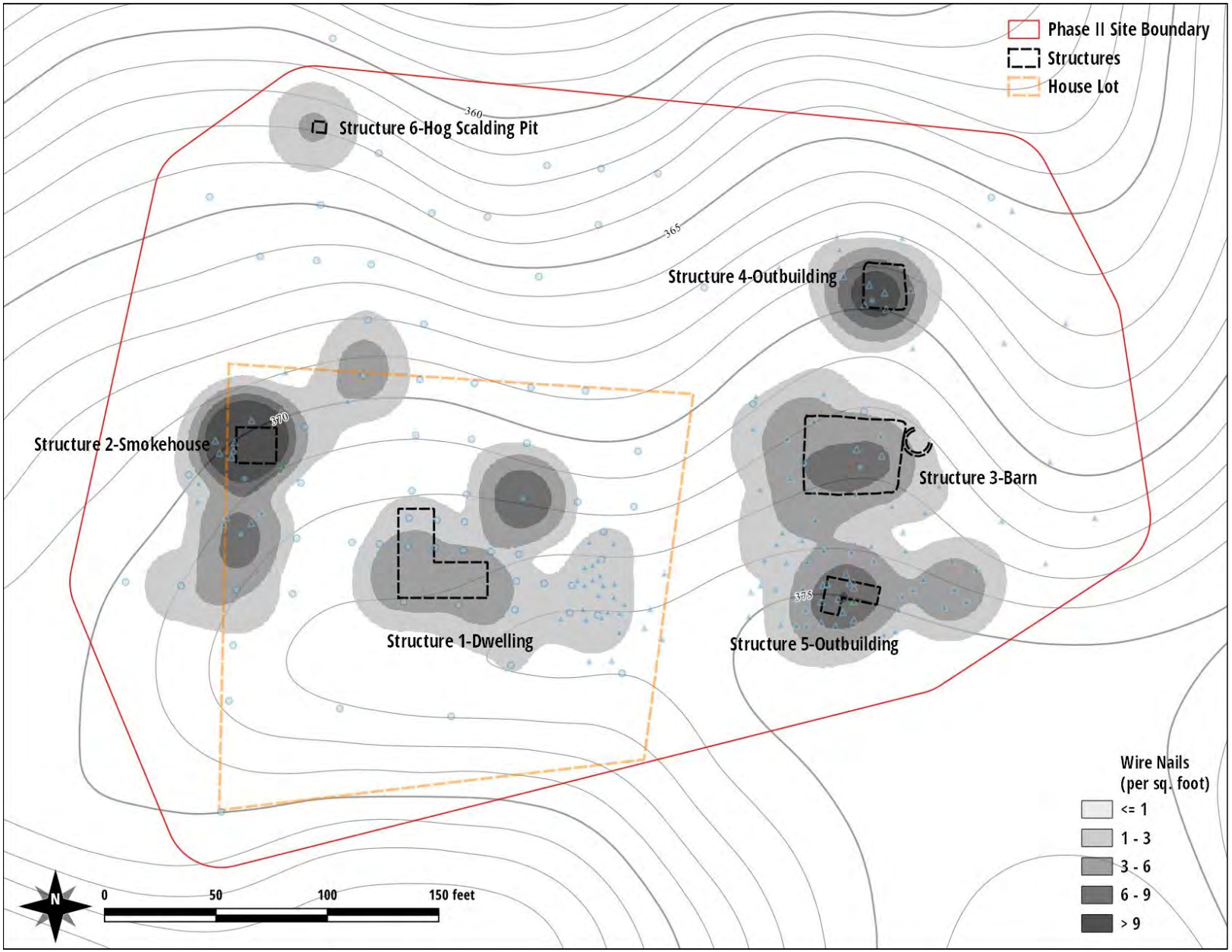

Figure 62: Distribution of Wire Nails.

Table 19: Architectural Group

Functional Group	Quantity	Percentage
Electrical	***4***	***< 1%***
fuse	4	< 1%
Glazing	***464***	***27%***
Lime-soda windowpane glass (post 1864)	464	27%
Hardware	***720***	***42%***
bolt	1	< 1%
bracket	1	< 1%
door lock parts	2	< 1%
hinge	2	< 1%
nail(s), cut (1790s-present)	150	9%
nail(s), cut nail(s), machine headed (1825-present)	67	4%
nail(s), unidentified	35	2%
nail(s), wire (1890s-present)	454	27%
nail(s), wrought	3	< 1%
pintle	1	< 1%
spike	1	< 1%
staple	3	< 1%
Masonry	***485***	***28%***
brick	391	23%
cinder block	1	< 1%
mortar	44	3%
plaster	49	3%
Plumbing	***28***	***2%***
cast iron pipe	5	< 1%
ceramic pipe	18	1%
copper pipe	1	< 1%
lead	2	< 1%
porcelain toilet/sink	2	< 1%
Roofing/Cladding	***12***	***<1%***
asphalt shingles	10	< 1%
slate shingles	2	< 1%
Total	**1713**	**100%**

Kitchen Group

The Kitchen Group accounted for 23.76% of the total site assemblage. Included within the kitchen group are 534 container glass fragments, 76 cans/fragments, and 46 ceramic sherds. The spatial distribution of Architectural group artifacts is presented in Figures 63 through 66. Table 20 presents counts and assemblage percentages by Class and Type within the Kitchen group.

The highest concentration of kitchen artifacts was located along the eastern boundary of the house lot in a location where numerous liquor bottle fragments and aluminum can fragments were identified during the STP and metal detector surveys. Additional concentrations were identified east and west of the southern outbuilding (Structure 5), where again, surface concentrations of container glass and cans were noted during the site cleanup following the visual inspection. Ceramic artifacts, which were virtually absent from the assemblage given the 135 year site occupation, were limited to six discrete locations within the house lot. Generally speaking the eastern and western limits of the house lot and the area surrounding Structure 5 appear to be the preferred locations for domestic waste disposal, at least during the latter part of the site occupation.

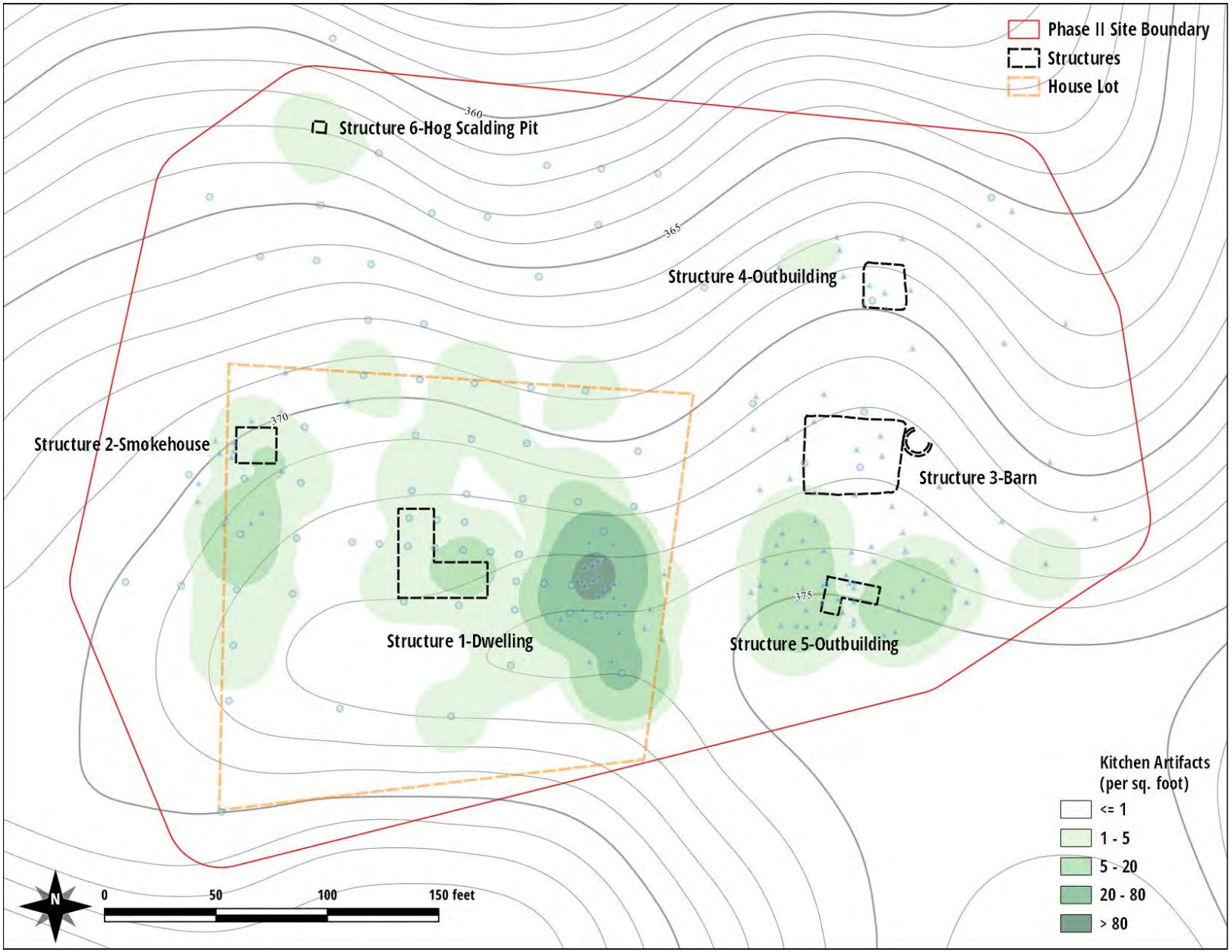

Figure 63: Distribution of Kitchen Artifacts.

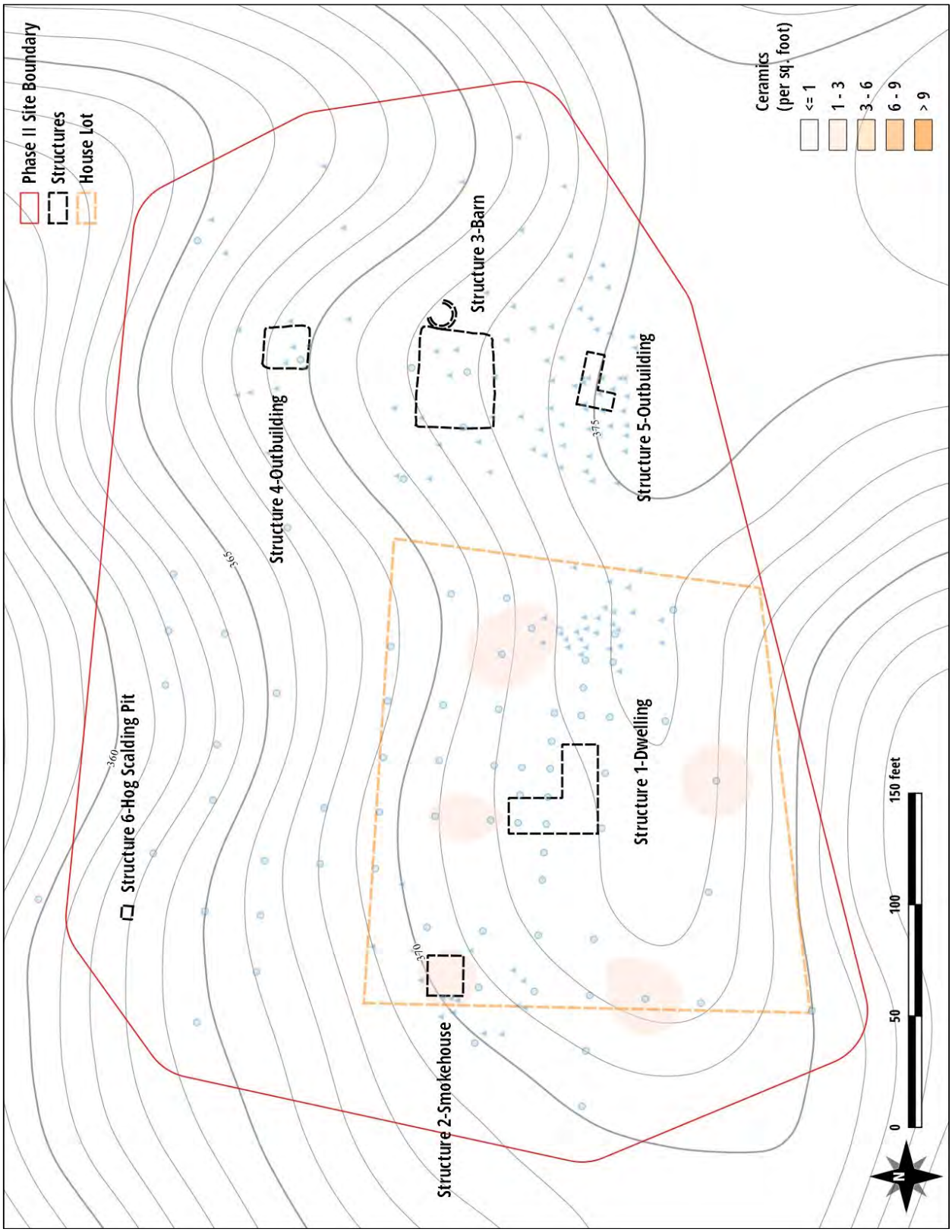

Figure 64: Distribution of Ceramic Artifacts.

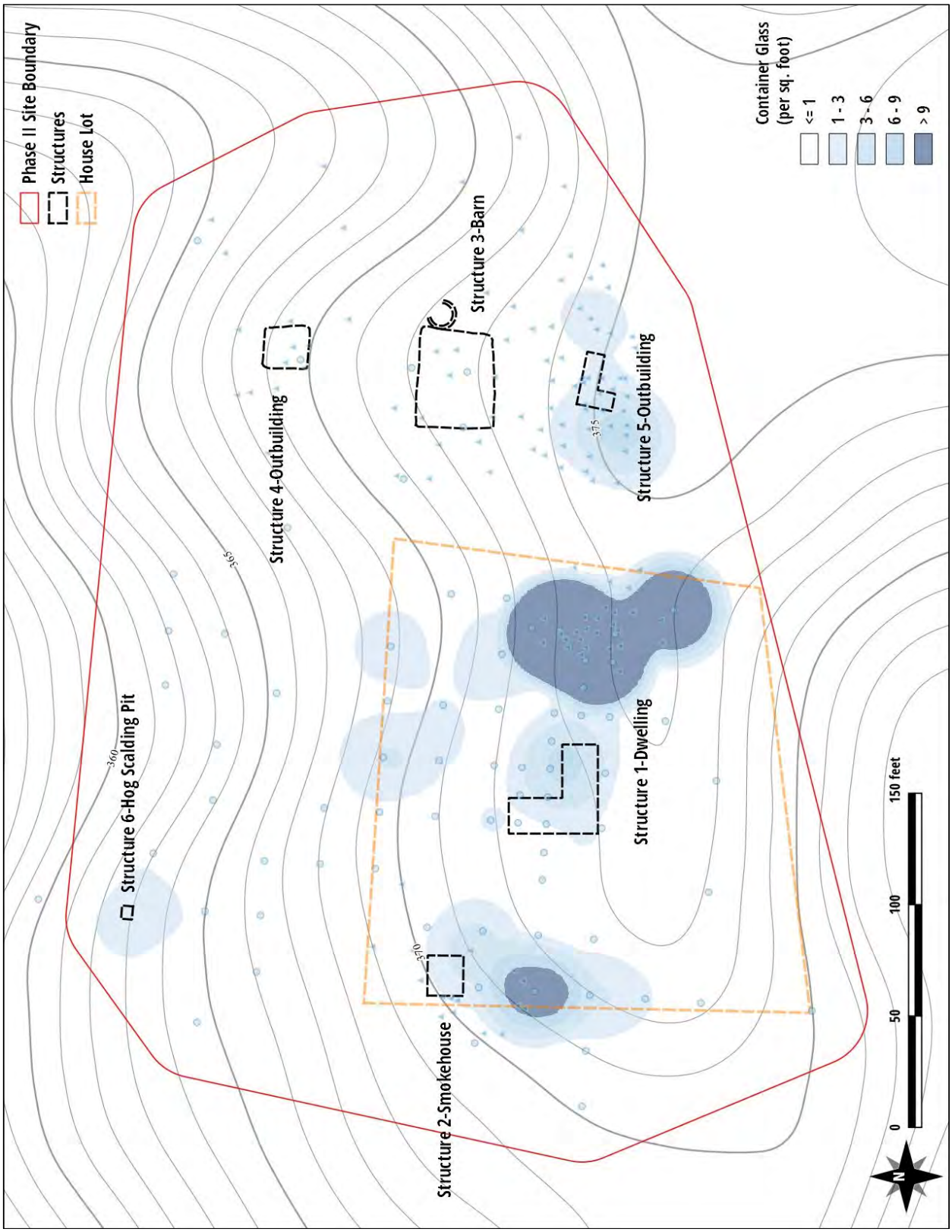

Figure 65: Distribution of Container Glass.

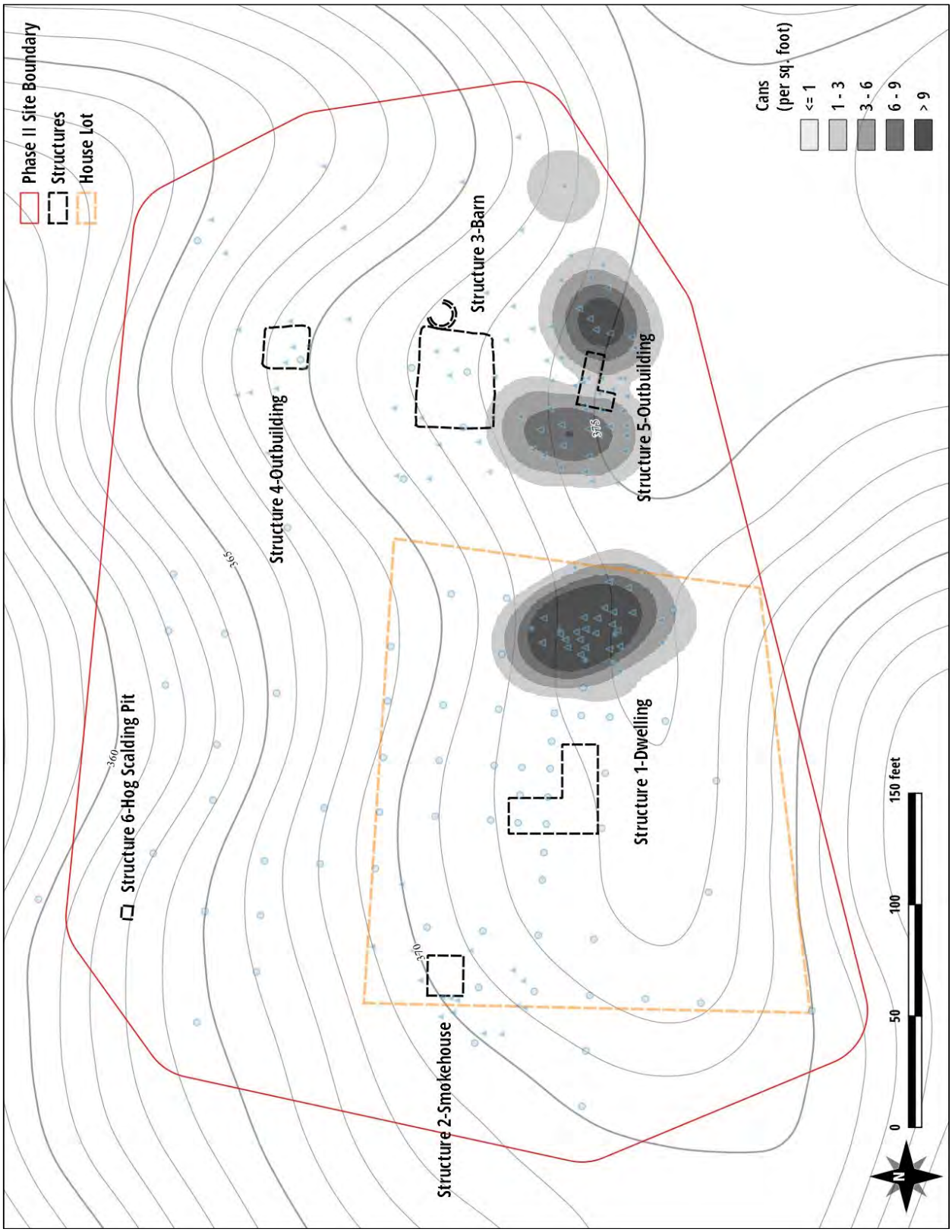

Figure 66: Distribution of Cans.

Table 20: Kitchen Group

Functional Group	Quantity	Percentage
Bottle/Can Closures	***28***	***4%***
aluminum ring tab (1965-1975)	12	2%
white milk glass canning jar lid liners (c.1870-c.1950)	7	1%
other caps/closures	4	< 1%
aluminum pull tab/stay tab (post 1975)	2	< 1%
aluminum threaded lid	2	< 1%
aluminum easy-open lid (post 1960)	1	< 1%
Cans	***76***	***11%***
ferrous cans	56	8%
aluminum beverage can (post 1965)	14	2%
aluminum 2-piece can (post 1964)	3	< 1%
aluminum 3-piece can	2	< 1%
aluminum can (post 1957)	1	< 1%
Ceramics	***46***	***6%***
whiteware (post 1820)	23	3%
American stoneware	8	1%
stoneware	5	< 1%
refined earthenware	5	< 1%
pearlware (1775-1830)	2	< 1%
coarse earthenware	1	< 1%
Bristol glaze	1	< 1%
porcelain	1	< 1%
Container Glass	***542***	***78%***
bottles/jars-Automatic Bottle Machine (post 1907)	416	60%
bottles/jars-Unidentified	115	17%
bottles/jars-Chilled Iron Mold (1880-1930)	2	< 1%
bottles/jars-Free Blown (pre-1850)	1	< 1%
Glassware	***8***	***1%***
pressed	5	< 1%
unidentified	3	< 1%
Kitchenware	***3***	***<1%***
kettle	1	< 1%
metal pot(s)	1	< 1%
metal pan(s)	1	< 1%
Total	**695**	**100%**

Container glass comprised approximately 78% of the Kitchen Group from the Buena Vista Site (44CM0136), with more than ten times as many container glass fragments as ceramic sherds. Archaeological investigations on domestic sites throughout the Mid-Atlantic region have documented a transition from a kitchen assemblage primarily composed of ceramic vessels on sites dating to the seventeenth, eighteenth, and early nineteenth centuries, to assemblages primarily comprised of glass containers following the introduction and widespread availability of machine assisted/manufactured bottles and jars beginning in the second half of the nineteenth century. Thus, high concentrations of container glass in relation to ceramic artifacts is recognized as a good indication of a site occupation dating from the late nineteenth century through the middle of the twentieth century.

Four hundred nineteen container glass fragments were identifiable with regards to manufacturing technology. Amongst datable container fragments, bottles and jars produced with an Automatic Bottle Machine (post 1907)

were the most common (n=416), followed by chilled iron mold fragments (1880-1930) (n=2), and freeblown fragments (pre 1850) (n=1).

As a technology, the use of cans for food storage dates back to the early nineteenth century, but it was the sanitary can introduced in the late 19th/early 20th century, that first made cans a viable alternative for manufacturers in search of a container less fragile than glass. Continuing innovations in the early 20th century that allowed cans to hold pressurized contents led to the introduction of portable aerosol cans, beer cans, and soft drink cans in the 1930s and early 1940s. The first aluminum cans were produced in 1957 and rapidly gained popularity, particularly in the beverage industry, which introduced the aluminum beverage can in 1965. And that same year the new, tin-free steel cans became the container of choice for many food manufacturers.

Since they were first introduced, beverage cans have primarily been opened using one of two technologies, the pull, or ring, tab and the push, or non-detachable tab. Pull tabs employ a ring that is used to tear a perforated section of the can away in order to access its contents. The push tab acts as a lever and is used to pop open a perforated section of the can. With the push tab, the tab and the perforated section remain attached to the can, resulting in its more common name, the Stay-tab.

Ermal Fraze patented the ring tab in 1963 and by 1965 75% of beer manufacturers were using this new technology. The first non-removable tab was patented by Omar L. Brown in 1967 and by 1975 the Stay-tab had replaced the ring tab as the technology of choice for opening beverage cans. In 1977, Ermal Fraze was assigned a patent for an improved version of Brown's design that was the predecessor of the modern stay tab.

Combined, cans and bottle/can closures made up 15% of the Kitchen group. Within the assemblage, ferrous cans were the most common type of can (n=56), and may suggest a deposition prior to the widespread adoption of aluminum and chromium steel cans in the late 1960s and early 1970s. However, 14 aluminum beverage cans, 12 aluminum ring tabs, and 2 aluminum stay tabs are evidence of household waste disposal extending into the 1970s.

Although more than 200 STPs were excavated within and surrounding the site boundary and 20 test units were excavated in the locations of structures and artifact concentrations, only 46 ceramic sherds were recovered during the Phase I and Phase II investigations at the Buena Vista Site. Half of the ceramic assemblage was comprised of whiteware (post 1820) (n=23). Small quantities of American stoneware (n=5), pearlware (1775-1830) (n=2), Bristol glaze (n=1), porcelain (n=1), and unidentified refined earthenwares (n=5), stonewares (n=5), and coarse earthenwares (n=1) were also recovered.

Historic ceramics are traditionally divided into utilitarian and refined ceramic types for the purpose of identifying different activity areas within the site. Utilitarian wares were more coarsely made and generally were less expensive. Such wares are thought to have been used for food preparation and storage. Whereas refined ceramics, or tablewares, were used for food presentation and were more finely potted and generally more decorative, and consequently were more expensive. Thus, the ratio of refined ceramics to utilitarian ceramics is also used to inform discussions of socioeconomic status on sites that pre-date the widespread adoption of glass containers, which assumed some of the roles of both refined and utilitarian wares. Previous research suggests the degree of decoration observed on sherds of refined ceramics may also be an indicator of the site inhabitants' socio-economic status. Originally proposed by George Miller (1980) and based on information from price lists, bills of lading, and account books from the first half of the nineteenth century, the basic premise behind the economic scaling of decoration is that the greater degree of skill needed to decorate the vessel, the greater its cost. Thus, a greater percentage of decorative wares within the ceramic assemblage represents a greater expenditure on luxury items and may speak to the inhabitants' economic class.

Refined wares made up the majority of ceramics (n=31/67%) at the Buena Vista Site and 9 of the refined ceramic sherds bore transfer printed decorations, the highest level of decoration as proposed by Miller. The remainder of the refined ceramic sherds were undecorated. However, given the small ceramic assemblage, any conclusions regarding the socio-economic status of the site inhabitants based on the ratio of refined to utilitarian wares or degree of ceramic decoration should be considered highly speculative.

Other Groups

Organic artifacts, principally comprised of charcoal (n=90) and bone (n=61), were the third most common functional group at Site 44CM0136, making up 5.3% of the total site assemblage. Unsurprisingly the highest concentrations of these artifacts were found where animals were processed (Hog Scalding Pit) and preserved (Smokehouse) (Figure 67). An additional concentration of charcoal was discovered during the excavation of STP 1041, located on the north side of the barn (Structure 3).

The Activities Group, a kind of catch all for agricultural, industrial, and non-kitchen related items made up less than 2% of the total site assemblage. Included within the activities group were 27 wire fencing fragments, a cultivator shoe, 2 plowshares, a rake, a sickle, 2 axe heads, a wrench, a battery, a flatiron, and a horseshoe.

Arms, personal items, and clothing each comprised less than one percent of the assemblage. The Arms group included 1 bullet, 5 clay pigeon fragments, 4 shell casing, and 3 shotgun shells. Personal items included a key and 4 shoe fragments. The furniture group was comprised of cast iron stove fragments (n=15) and steamer trunk fragments (n=7). The clothing group was represented by 2 buttons.

Site Chronology/Occupation

Archaeological investigations at the Buena Vista Site (44CM0136) uncovered the remains of a mid 19th-farmstead, first occupied by the family of John and Martha Jeffries around 1840. The 1850 and 1860 Slave Schedules show that John was the owner of at least 21 enslaved laborers prior to the Civil War, some of whom also likely lived at the Buena Vista site. In the latter part of the 19th century, the property was devised to John's daughter Rosa, and in 1916 was sold to his grandson Herman Flippen. Herman died in 1944, but his wife retained ownership of the property until it was sold out of the family, following her death in 1975. Very little evidence of the site's earliest inhabitants was identified during excavations. The vast majority of archaeological deposits discovered during this investigation date to the 20th century occupation and the demolition/ deconstruction of the site, circa 1979.

There are no known records of John Bennett Jeffries prior to his marriage to Martha McLaurine, the daughter of wealthy landowner James McLaurine, in 1825. John and Martha welcomed their first child James in 1829 and throughout the 1830s Martha gave birth to Virginius (1833), Eliza and John (1835), and Mariah (1837). The birthplace of each child is listed as Cumberland, yet there is no record of the Jeffries family until 1840.

In 1839, Jeffries purchased 154.5 acres "on Muddy Creek" from Reubin Simms. This parcel adjoined a 400 acre tract that first appeared in the landholdings of his father-in-law that same year. Neither tract included taxable structures in 1839; however, the following year James McLaurine's tract included $800 worth of buildings and for the first time, the household of John B. Jeffries is listed in Census records, right next to the household of James McLaurine.

James McLaurine died in 1846 and in 1849 John and Martha inherited a one half share of the 400 acre tract adjoining Jeffries previous land purchase, including "the dwelling house and buildings adjacent". The remaining half was devised to Martha's sister Eliza and was acquired by Jeffries in 1856. At the time of the inheritance, the Jeffries' parcel included $800 in buildings. In 1851 that value increased to $1,200; which, coincidentally, was the same value of buildings on McLaurine's Edgemont estate that year. The increase in building value is believed to date the northern addition to the dwelling at Buena Vista, identified during Phase II mechanical stripping.

Buena Vista was valued at $10,000 in 1850 and by 1860 that value had increased to $25,060, making him one of the wealthiest landowners in the area. How much of Jeffries's fortune was attributable to enslaved labor is not known. However, the Civil War appears to have marked the beginning of the decline of Jeffries's Buena Vista farmstead that would continue for the next century. In 1870, Jeffries was forced to sell off the northern half of his Buena Vista farmstead and much of his livestock and farm produce in to cover his debts.

In 1875, Jeffries's Beuna Vista estate had diminished to 243 acres and building values decreases to $700. That same year, Albert Frayser, the purchaser of the northern half of Buena Vista, is not taxed for buildings, suggesting the decline in building value is limited to the structures on the Jeffries property; perhaps marking the beginning of the foundation issues with the dwelling documented during the Phase II excavations.

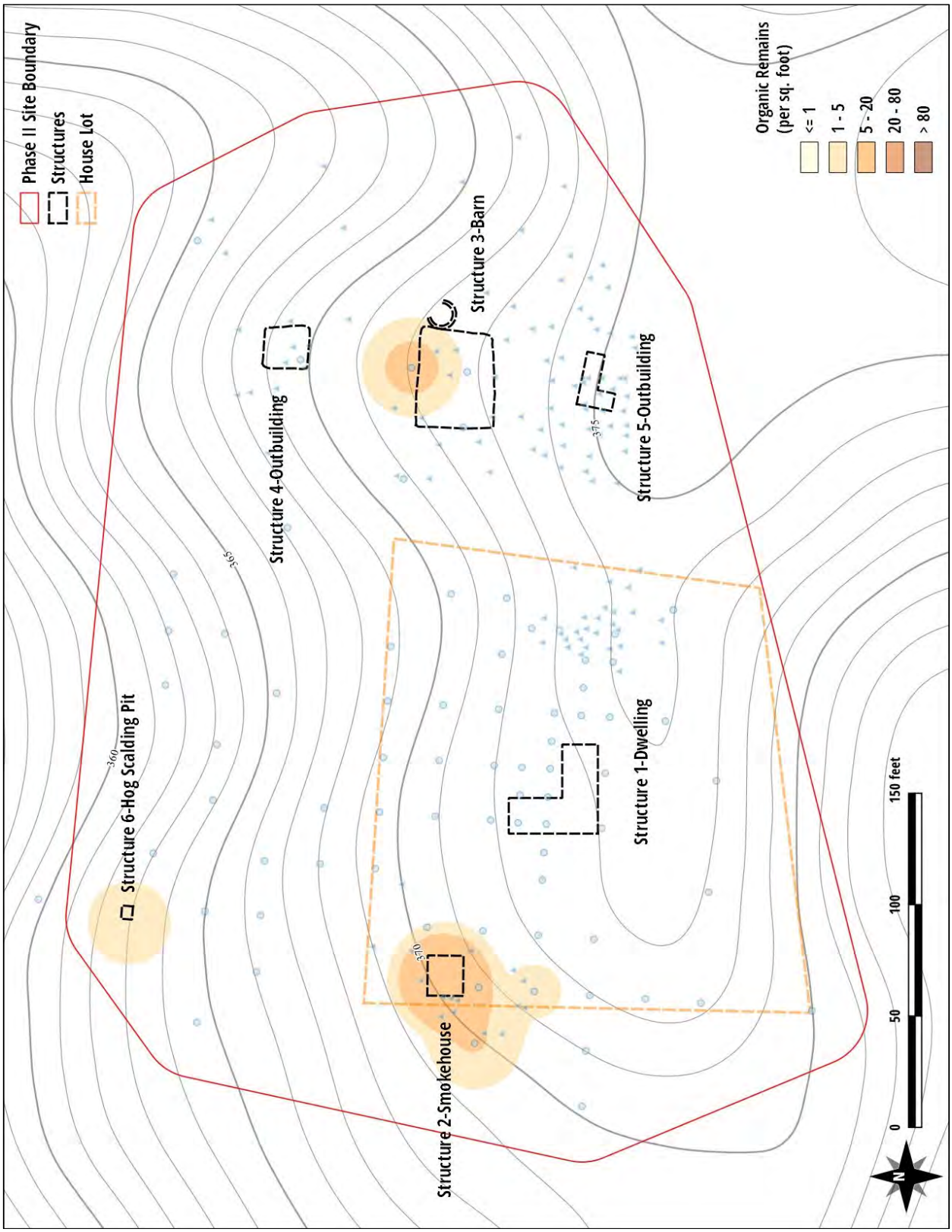

Figure 67: Distribution of Organic Artifacts.

John Jeffries died in 1880 and in 1892, Buena Vista is divided amongst three of the John and Martha's ten children. William B. Jeffries gets the dwelling and the surrounding lot encompassing 5.33 acres which included the current boundary of the Buena Vista Site (44CM0136). Their daughter Rosa Walker Jeffries (then Rosa Jones) and her children inherited 118 acres to the east of the dwelling lot; and Alice R. Jeffries (then Alice Perkins) inherited the western half of the farmstead, totaling 120.66 acres.

In 1895, the value of buildings decreased again by almost half to $400 suggesting the farmstead was in a continuing state of disrepair. In 1896, William sells the house lot to his sister Rosa, who, according to tax records, was living on a nearby parcel. The value of buildings remains constant throughout her ownership, which came to an end in 1916, when Rosa, now a widow, and her children sold their 123 acre share of the family farm to her nephew, Herman Flippen. Census records suggest Herman and his wife Louise may have been living on the farm following the purchase and it was during their ownership that the property saw its first, and only, increase in building values; from $400 to $500 dollars. In the 1940 land tax records, Herman's wife Louise is listed as the owner of the property and at the time of Herman's death in 1944, they were living in the Ballsville area of Powhatan County. Louise's address remained in Ballsville until 1954, when she relocated to Richmond. In 1959, the value of buildings was reassessed to $380 and it is not clear if anyone was living at Buena Vista at that time. Although a historic aerial image from 1958 shows the fields surrounding the house were under cultivation. In 1971, the value of structures again decreased to $270. Louise retained ownership of the property until her death in 1975. That year, the property was sold to John Wick III and his wife Mary, and in 1979, the Wicks allowed Warren and Aldine West to deconstruct the dwelling so that it could be used in the reconstruction of the relocated Edgemont house in Powhatan County.

Summary and Recommendations

A Phase II archaeological evaluation was conducted at site 44CM0136, located approximately 1,200 feet north of the intersection of Pine Grove Road and Miller Lane in Cumberland County, Virginia. The site was recorded in 2018 by Browning & Associates, of Hartfield, Virginia during a Phase I survey of the Green Ridge property. The Phase II work was carried out between July and December 2020 by Browning & Associates for Green Ridge Recycling and Disposal Facility of Midlothian, Virginia.

Site 44CM0136 was originally identified and recorded during the Phase I survey of the ±1,178 acre Green Ridge property based on a partially filled cellar hole, and stone piers, piles of stone, a circular concrete foundation, and at least 3 piles of brick and stone that appear to mark the locations of former outbuildings. At the conclusion of the Phase I investigation, additional research was recommended to establish the integrity of cultural deposits contained within the site and to assess its potential to contribute new information to our understanding of regional subsistence and agricultural practices and settlement patterns. The Phase II investigation at 44CM0136 involved documentary research, close interval shovel testing, metal detection, test unit excavation, and mechanical stripping.

Documentary research revealed site 44CM0136 contains the remains of a domestic farmstead, occupied by three generations of the Jeffries family, beginning with John and Martha Jeffries in the middle 19th century. The earliest known record of the property is an 1839 land tax record that lists the 400 acre tract with $0 in buildings in the extensive landholdings of John Jeffries's father-in-law James McLaurine. The following year, James is taxed for $800 in buildings on the tract and John Jeffries's family is enumerated in census records for the first time. Jeffries name appears immediately following James McLaurine, suggesting that the Jeffries' were living nearby.

In 1849, John and Martha inherited a one half share of the 400 acre tract, including "the dwelling and associated buildings" and in 1851, tax records indicate the original dwelling was expanded or additional buildings were added to the property. In 1856, John and Martha acquired the remaining share of the property from the estate of Martha's sister Eliza. According to tax records, Jeffries's Buena Vista farmstead included more than 550 acres in 1860 and his estate was valued at more that $25,000. At that time he is listed as the owner of 21 slaves and it is likely that the prosperity of his farmstead was in a large part dependent upon free labor as historic records suggest the Civil War marked the beginning of the decline of the farmstead that would continue for the next 100

years and end with the deconstruction of the house in 1979. Somewhat ironically, the materials obtained from Buena Vista were used to help reconstruct Edgemont, the home of John Jeffries's father-in-law James McLaurine, who likely financed the construction of the original portion of the Buena Vista house.

John Jeffries died in 1880 and it is likely his widow remained in the dwelling until her death in the early 1890s. In 1892, John and Martha's son William inherited a 5.33 acre lot that included Site 44CM0136. At that time, he was living in Alabama and opted to sell his inheritance to his sister Rosa in 1896. At the time she purchased the property, Rosa and her family were living on a nearby parcel and it is not clear, who, if anyone was living on the property. Tax records indicate that the structures on the property were in a continuing state of decay during Rosa's ownership. Rosa and her children sold her share of her father's farm and the lot she purchased from her brother, totaling 123.33 acres to her nephew Herman Flippen and his wife Louise in 1916. It seems likely that the Flippens lived on the property prior to Herman's death in 1944, as the value of buildings briefly increased shortly after they acquired the farmstead. At the time of Herman's death, he and his wife were living in the Ballsville area. Louise's address remained in Ballsville until 1953, when she relocated to Richmond, where she lived until her death in 1975. John H. Wick III and Mary R. Wick purchased a 133.18 acre tract from Louise Cox Flippen's executor following her death in 1975. At that time, the Wicks were listed as residents of Richmond and there is no evidence that they lived on the property between the time of their purchase and when the dwelling was deconstructed in 1979.

Phase II fieldwork documented the location of a dwelling, smokehouse, barn, outbuildings, and a hog scalding pit within the site boundaries and suggest that the farmstead layout included a house lot and agricultural area, typical of contemporary farmsteads throughout the Mid-Atlanic region. The boundary between the house lot and the agricultural activity area at the Buena Vista Site is visible in historic aerial images of the project vicinity and identifiable in the distribution of historic artifacts. Distribution maps of the total historic assemblage, architectural artifacts, and kitchen artifacts highlight the western, northern, and eastern boundaries of the house lot, with the densest concentrations found along the eastern boundary, in an area that was originally suspected to be the location of an external kitchen. However, intensive exploration of this area was unable to find any structural remains. The area to the south of the dwelling, which would have been the front yard, was virtually devoid of artifacts, suggesting household debris was routinely discarded along the boundary of the house lot and the agricultural activity area in the rear and side yards.

Within the house lot, investigators identified the remains of an L-shaped dwelling (Structure 1) and a continuous stone foundation measuring 18 feet by 20 feet (Structure 2), interpreted as a smokehouse. Test units bisecting each wall of the dwelling identified a continuous modern fill layer with large quantities of brick, mortar, and plaster fragments, within and surrounding the cellar hole. This fill layer is believed to date to the deconstruction of the dwelling in 1979. Within the cellar, modern fills continued to the basement floor. In most of the testing locations outside of the foundation, an occupation fill containing artifacts spanning the entire site occupation was identified beneath the modern fill layer and above a builder's trench believed to date to the construction of the dwelling/dwelling addition.

Three test units were also excavated inside of the continuous stone foundation of the smokehouse resulting in the discovery of a hearth feature near the center of the structure. Soils within the structure were almost black and notable quantities of charcoal were recovered from the feature fill, as were bone fragments and teeth. Wire nails were found within the fill of Feature 1 and in the deepest fill layer inside of the structure. Indicating none of the deposits identified predate the 1890s. In the agricultural activity area, test units were excavated in the locations of two outbuildings (Structures 4 and 5) and a hog scalding pit (Structure 6) and in all locations, wire nails (1890s-present) were also recovered from the deepest fill layers.

Excavations demonstrated that intact archaeological deposits dating to the site occupation exist in most areas of the site. However, missing from the assemblages in the house lot and the agricultural area were deposits that were clearly attributable to the site's earliest free and enslaved inhabitants. Ceramic artifacts, which are commonplace on archaeological sites that predate the widespread adoption of glass containers in the late 19th century were virtually absent from the artifact assemblage, and container glass and metal cans, indicative of early to middle 20th century occupations were found in abundance throughout the house lot. Anything that does

remain of the Jeffries or Jones tenure appears to be inseparably mixed with the much more prolific evidence of the later site occupation.

It is our opinion that the Buena Vista Site (44CM0136) is a fairly well preserved example of a type of domestic farmstead that is commonplace throughout the region. Although Phase II excavations were able to demonstrate that the site retains intact deposits dating to the site occupation, they include an indistinguishable mixture of artifacts dating to three different generations of occupants, and as such, they are believed to have limited research potential. Phase I and II archaeological excavations have provided a representative sample of the cultural content at the Buena Vista Site (44CM0136) and it is our opinion that additional research is unlikely to yield new information about the site inhabitants and their consumer behaviors or contribute to our current understanding of rural farmsteads in Cumberland County, Virginia or the surrounding region.

In our professional opinion, the Buena Vista Site (44CM0136) is not recommended eligible for the NRHP under Criterion A, B, C, or D and no additional work is recommended.

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APPENDIX 1: PARTIAL CHAIN OF TITLE
BUENA VISTA SITE (44CM0136)

Chain of Title for the Buena Vista Site (44CM0136)

2019 October 18		
John H. Wick III & Mary R. Wick	CWV Land Aquisitions, LLC	133.18 acres
Deed – Cumberland County Instrument Number 190001217		
1993 October 19		
John H. Wick III & Mary R. Wick	Commonwealth of Virginia	?? acres
Deed – Cumberland County Deed Book 201:598		
1975 July 31		
Louise Cox Flippen (deceased)	John H. Wick III & Mary	133.18 acres
Deed – Cumberland County Deed Book 134:168		
1937 August 27		
Herman Flippen	Louise Flippen	123 acres more or less
Deed – Cumberland County Deed Book 73:450		
1935 June 17		
Herman Flippen et al.	County of Cumberland	?? acres
Deed – Cumberland County Deed Book 72:72		
1916 August 31		
Rosa W. Jones & children	Herman & Louise Flippen	123.33 acres
Deed – Cumberland County Deed Book 53:455		
1896 June 23		
William B. & S. W. Jeffries	Rosa W. Jones & children	5.33 acres
Deed – Cumberland County Deed Book 37:477		
1892 August 29		
Estate of John B. Jeffries	William B. Jeffries, Rosa W. Jones, Alice R. Perkins	244 acres
Report of Division of Lands – Cumberland County Deed Book 37:144		
1874 July 7		
John & Martha Jeffries	William B. Jeffries, Rosa W. Jones, Alice R. Perkins	244 acres
Deed of Gift– Cumberland County Deed Book 30:495		

1870 April 27		
John & Martha Jeffries	Albert R. Frayser	300 acres
Deed – Cumberland County Deed Book 30:115		
1865 November 4		
John & Martha Jeffries	Daniel H. Brown (trustee)	540 acres
Indenture – Cumberland County Deed Book 29:447		
1856 September 1		
A.D., Virginia L., & Mary F. Mosby	John & Martha Jeffries	200 acres
Deed – Cumberland County Deed Book 28:517		
1849		
Martha (McLaurine) Jeffries	James W McLaurine	200 acres
Will – Cumberland County Will Book 11:406		
1839 February 20		
Ruebin J. Sims	John B. Jeffries	154.5 acres
Deed – Cumberland County Deed Book 23:375		

Appendix 2: Artifact Inventory
Buena Vista Site (44CM0136)

Artifact Inventory
Buena Vista Site
44CM0136

F 1, Fill 1

Architecture

5 wire nail(s) (1890s-present) fragments, heavily corroded (16g)
1 lime soda (post 1864) windowpane glass fragment

Organic

2 hull(s), charred walnut
5 charcoal
2 teeth, with mandible fragment

F 2, Fill 1

Activities

1 wire fencing fragment

Architecture

1 lime soda (post 1864) windowpane glass fragment
1 wire nail(s) (1890s-present) fragment
1 unidentified nail(s) fragment, heavily corroded
4 ceramic fragments, pipe

MD 1, Ap

Activities

2 wire fencing fragments

MD 2, Ap

Kitchen

1 clear medicine bottle whole/complete, ABM (post 1907), small mouth, external thread finish (post c.1875), with ferrous metal cap, embossed lettering Bayer Aspirin
7 ferrous metal can fragments, rim

MD 3, Ap

Unidentified

2 ferrous metal fragments, cast iron

MD 4, Ap

Kitchen

1 metal pot(s) fragment, cast iron, flared rim, body, attached handle

MD 5, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 6, Ap

Activities

1 plowshare

MD 7, Ap

Architecture

1 wire nail(s) (1890s-present), bent

MD 8, Ap

Unidentified

1 ferrous metal fragment

MD 9, Apb

Unidentified

1 ferrous metal fragment, possible nail

MD 10, Ap

Activities

3 wire fencing fragments

MD 11, Ap

Unidentified

1 non-ferrous metal, wire with attached ferrous metal fragment

MD 12, Ap

Unidentified

1 ferrous metal fragment, possible wire nail

MD 13, Ap

Unidentified

1 ferrous metal, attachment, flat, crimped in center with attached grommet

MD 14, Ap

Unidentified

2 ferrous metal fragments, flat, with curved end

MD 15, Ap

Activities

1 rake fragment

MD 16, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 17, Ap

Kitchen

1 aluminum beverage can, top, pull tab closure

MD 18, Ap

Activities

1 battery, cathode

Architecture

1 cast iron, pipe

MD 19, Ap

Kitchen

3 ferrous metal three-piece can, base fragments

1 aluminum three-piece can, lid, pull tab closure

1 ferrous metal three-piece can, bent, rim fragment

MD 20, Ap

Architecture

2 wire nail(s) (1890s-present)

Unidentified

2 ferrous metal fragments, possible wire nail fragments

MD 21, Ap

Activities

1 battery, cathode

Unidentified

7 other, black synthetic material, ring shaped; diameter-65mm

MD 22, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 23, Ap

Architecture

1 wire nail(s) (1890s-present), bent

MD 24, Ap

Unidentified

2 ferrous metal fragments, bent, iron strap

MD 25, Ap

Architecture

1 wire nail(s) (1890s-present)

Kitchen

2 clear bottle/jar base/body fragments, ABM (post 1907)

MD 26, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 27, Ap

Unidentified

1 ferrous metal fragment

MD 28, Ap

Architecture

1 wire nail(s) (1890s-present), bent

1 spike(s) (310g)

MD 29, Ap

Personal Items

4 shoe shoe upper fragments

Unidentified

1 ferrous metal fragment, thin, flexible

MD 30, Ap

Architecture

3 lime soda (post 1864) windowpane glass fragments

MD 31, Ap

Kitchen

5 ferrous metal beverage can fragments, lid, body and base, plastic lined, red, white, and black paint. Carling Black Label

1 aluminum beverage can fragment, lid for pull ring can, painted lettering Richbrau Beer brewed by Home Brewing Co. of Richmond 1933-1969.

MD 32, Ap

Activities

1 cultivator shoe

Architecture

1 wire nail(s) (1890s-present) fragment

Kitchen

3 clear bottle base/body fragments, ABM (post 1907)

2 blue aqua bottle base/body fragments, ABM (post 1907), embosed lettering NCHBURG, V.A.

MD 33, Ap

Kitchen

1 Ball Blue (1909-1939) canning jar fragment

Unidentified

1 ferrous metal fragment, cast iron, bent, hook shaped with hole at one end

MD 34, Ap

Unidentified

1 ferrous metal fragment, bent, possible wire nail fragment

1 ferrous metal fragment

1 ferrous metal whole/complete, bent, washer and square nut on threaded end, two holes in flatened end

MD 36, Ap

Unidentified

2 ferrous metal fragments, possible wire fencing

MD 37, Ap

Activities

1 wrench fragment

MD 38, Ap

Architecture

1 wire nail(s) (1890s-present), bent

MD 39, Ap

Kitchen

1 other cap/closure, key-wind sardine can closure

MD 40, Ap

Kitchen

1 clear bottle/jar fragment, ABM (post 1907)

1 aluminum beverage can fragment, ring tab closure

1 ferrous metal beverage can fragment, rim

Unidentified

1 ferrous metal fragment, cap

MD 41, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 42, Ap

Unidentified

2 ferrous metal fragments, thin, galvanized or enameled

MD 43, Ap

Architecture

4 wire nail(s) (1890s-present)

Unidentified

1 ferrous metal, cap or coupling, 3cm diameter

1 ferrous metal, wire fragment, possible nail

MD 44, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 45, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 46, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 47, Ap

Activities

1 horseshoe

Architecture

3 wire nail(s) (1890s-present)

MD 48, Ap

Architecture

1 wire nail(s) (1890s-present), roofing nail

MD 49, Ap

Architecture

1 wire nail(s) (1890s-present), roofing nail

MD 50, Ap

Architecture

1 pintle, heavy duty threaded gate pintle

2 wire nail(s) (1890s-present)

MD 51, Ap

Architecture

2 wire nail(s) (1890s-present) fragments

1 unidentified nail(s) fragment

MD 52, Ap

Architecture

1 wire nail(s) (1890s-present), heavily corroded

MD 53, Ap

Activities

1 ferrrous metal bar, u-shaped iron bar with four holes at each end; includes 3 wire nails

MD 54, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 55, Ap

Architecture

2 wire nail(s) (1890s-present) whole/complete, heavily corroded, likely roofing nails

MD 56, Ap

Unidentified

1 ferrous metal fragment, bent, thin metal, possibly large can body or flue pipe

MD 57, Ap

Kitchen

1 kettle(s) fragment, with handle

MD 59, Ap

Architecture

3 lime soda (post 1864) windowpane glass fragments

1 wire nail(s) (1890s-present)

MD 60, Ap

Unidentified

1 ferrous metal, cast iron, square base, possible foot or mounting bracket

MD 61, Ap

Unidentified

2 ferrous metal fragment, thin, rectangular with 3 open ended slots, small nail fasteners attached

MD 62, Ap

Architecture

1 unidentified nail(s) fragment

MD 64, Fill 1

Unidentified

1 ferrous metal, wire fragment

MD 65, Fill 1

Architecture

1 wire nail(s) (1890s-present)

Unidentified

2 non-ferrous metal fragments

MD 66, Fill 1

Unidentified

1 ferrous metal fragment, thin with folded rim

MD 68, Fill 1

Unidentified

2 non-ferrous metal fragments, possible tin can rim and body fragments

MD 69, Fill 1

Architecture

1 wire nail(s) (1890s-present)

MD 70, Fill 1

Architecture

1 wire nail(s) (1890s-present)

Organic

1 bone fragment

MD 71, Fill 1

Architecture

1 wire nail(s) (1890s-present)

Organic

1 bone fragment

Unidentified

2 unidentified ferrous metal, wire fragments

MD 72, Fill 1

Architecture

1 wire nail(s) (1890s-present)

MD 73, Fill 1

Architecture

1 wire nail(s) (1890s-present)

MD 74, Fill 1

Architecture

1 hinge fragment, strap hinge with two bent wire nails

MD 75, Fill 1

Kitchen

3 clear bottle/jar fragments

MD 76, Fill 1

Architecture

2 wire nail(s) (1890s-present)

Kitchen

1 ferrous metal can fragment

MD 77, Fill 1

Unidentified

1 ferrous metal fragment

MD 78, Ap

Arms

1 lead bullet, possible .22 caliber

MD 79, Ap

Unidentified

9 ferrous metal fragments, thin, portions of embossed lettering, possible license plate

MD 80, Ap

Activities

1 battery, D-cell

Architecture

1 wire nail(s) (1890s-present) whole/complete

Kitchen

4 ferrous metal can, lid and rim fragments

MD 81, Ap

Kitchen

1 aluminum beverage can fragments, lid for ring-pull can

1 clear bottle/jar whole/complete, ABM (post 1907), large mouth, external thread finish (post 1858), small, embossed lettering on base, CHESEBROUGH MFG. CO. CD. NEW YORK (Chesebrough produced Vaseline)

MD 82, Ap

Architecture

1 wire nail(s) (1890s-present) fragment, wood fragment attached

Kitchen

1 ferrous metal can fragment, rim

MD 83, Ap

Unidentified

1 ferrous metal fragment, cast iron

MD 84, Ap

Architecture

3 wire nail(s) (1890s-present)

Kitchen

1 aluminum two-piece can other, short, pull top, w/o lid

MD 86, Ap

Architecture

2 cut nail(s), machine headed (1825-present) fragments

MD 87, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 88, Ap

Unidentified

2 non-ferrous metal, flat, rectangular, copper fragments; one with drilled hole

MD 89, Ap

Architecture

1 wire nail(s) (1890s-present)

MD 90, Ap

Activities

1 plowshare

MD 94, Ap

Kitchen

2 aluminum beverage can fragments

MD 96, Ap

Unidentified

1 ferrous metal fragment, flat with beveled edge, cast iron

MD 100, Ap

Unidentified

1 ferrous metal fragment, flat with curved and beveled edge, cast iron

MD 102, Ap

Unidentified

1 ferrous metal fragment, iron strap, 3cm wide, tapered at one end, two attached nails or rivets, possible door hardware

MD 104, Ap

Clothing

1 copper alloy cone with wire eye (18th/early 19th century) button(s) fragment, flat, most of eye missing

MD 105, Ap

Unidentified

1 non-ferrous metal, grommet fragment

MD 107, Ap

Architecture

1 cast iron fragment, pipe

MD 108, Ap

Activities

1 washers

MD 109, Ap

Kitchen

1 aluminum easy open lid

MD 110, Ap

Activities

1 wire fencing, hog wire, not collected

MD 111, Ap

Kitchen

1 aluminum beverage can fragments, ring tab closure

Unidentified

1 ferrous metal fragment, hook shaped, with hole at one end

MD 112, Ap

Architecture

1 unidentified nail(s)

Kitchen

1 aluminum beverage can, top fragment

MD 114, Ap

Kitchen

1 metal pan(s) fragment, disposable aluminum pan

MD 115, Fill 1

Architecture

1 wire nail(s) (1890s-present)

Kitchen

1 whiteware (post 1820) body sherds, refined earthenware

Unidentified

2 ferrous metal fragments, thin

MD 116, Fill 1

Architecture

1 unidentified nail(s)

Kitchen

6 ferrous metal three-piece can fragments, lid, bottom, and body

MD 117, Fill 1

Kitchen

1 aluminum two-piece can whole/complete, Ring tab, Schlitz Can

MD 118, Fill 1

Kitchen

1 aluminum ring tab

MD 119, Fill 1

Architecture

1 wire nail(s) (1890s-present)

MD 120, Fill 1

Architecture

1 wire nail(s) (1890s-present)

Unidentified

3 ferrous metal fragments

MD 121, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment

Kitchen

3 ferrous metal can fragments, rim

MD 122, Fill 1

Kitchen

1 aluminum beverage can fragment, ring pull top

1 ferrous metal beverage can fragment, rimmed base

MD 124, Fill 1

Unidentified

1 ferrous metal fragment, round, possible can rim fragment
2 ferrous metal fragments, flat, possible can fragments

MD 125, Fill 1

Kitchen

4 ferrous metal can fragments, top/bottom rim and fragments, rim; diameter-10cm

MD 126, Fill 1

Architecture

2 cut nail(s), machine headed (1825-present) fragment

Kitchen

1 clear bottle body fragment, ABM (post 1907), embossed lettering L LAW F

MD 127, Fill 1

Activities

3 wire fencing fragments

MD 128, Fill 1

Arms

1 brass shotgun shell fragment, 12 ga. stamped J.C. Higgens on base

Kitchen

1 clear, soda-lime liquor bottle whole/complete, ABM (post 1907), small mouth, external thread finish (post c.1875), rectangular body, narrow neck, embossed lettering, 4/5 pint, with plastic cap
1 clear liquor bottle whole/complete, ABM (post 1907), small mouth, external thread finish (post c.1875), rectangular body, narrow neck, embossed lettering and dot pattern, one pint, with plastic cap
10 clear, soda-lime bottle fragments
1 aluminum beverage can fragment, ring tab top
1 ferrous metal beverage can fragment, rimmed base

Unidentified

2 ferrous metal fragments

MD 129, Fill 1

Kitchen

1 aluminum three-piece can, National Bohemian beer can, pull tab closure

MD 130, Fill 1

Kitchen

1 ferrous metal beverage can fragment, rimmed top or base, thin plastic inner lining

MD 131, Fill 1

Kitchen

1 clear bottle/jar whole/complete, ABM (post 1907), large mouth, external thread finish (post 1858), Makers mark: G.C.CO 10
1 aluminum can fragment
1 aluminum pull tab
1 other cap/closure fragment, ferrous metal

MD 132, Ap

Activities

12 wire fencing fragments

Kitchen

3 clear bottle body/shoulder/neck fragments, ABM (post 1907), ribbed pattern on neck

1 unidentified ferrous metal unidentified form fragment, rim

1 aluminum beverage can fragment, ring pull can top

MD 133, Fill 1

Kitchen

1 aluminum ring tab

MD 134, Fill 1

Architecture

1 wire nail(s) (1890s-present) fragment

Unidentified

1 non-ferrous metal fragment

MD 135, Fill 1

Kitchen

1 aluminum beverage can fragment, ring tab top with attached fragment of red and white painted, ferrous metal can body

1 unidentified ferrous metal beverage can fragment, rimmed base

MD 136, Fill 1

Activities

1 wire fencing fragment

MD 137, Fill 1

Kitchen

7 ferrous metal can fragments, rim and body

SC 1, Ao

Architecture

3 wire nail(s) (1890s-present) fragments

18 wire nail(s) (1890s-present), roofing

3 cut nail(s), machine headed (1825-present)

Organic

1 bone fragment

SC 2, Ao

Activities

1 axe head whole/complete

1 axe head whole/complete

Architecture

1 lime soda (post 1864) windowpane glass fragment

1 fuse(s), threaded metal base, 25V NU-LITE USA

4 cut nail(s) (1790-present)

12 wire nail(s) (1890s-present) fragments

1 molded brick whole/complete, hand made, possible lettering incised on one side

Kitchen

1 other porcelain body sherd, unidentified form, undecorated
2 whiteware (post 1820) sherds, unidentified form, transfer print, underglaze-blue
1 clear bottle/jar fragment
4 white milk glass canning jar lid liner fragments
1 aluminum pull tab fragment

STP 114, Fill 1

Kitchen

1 white milk glass canning jar lid liner fragment

STP 115, Fill 1

Architecture

4 brick fragments, discarded in lab (61g)

STP 118, Fill 1

Architecture

4 lime soda (post 1864) windowpane glass fragments
2 lime soda (post 1864) windowpane glass fragments
2 cut nail(s), machine headed (1825-present)
1 cut nail(s), machine headed (1825-present) fragment
1 brick fragment, discarded in lab (18g)

Kitchen

2 unidentified stoneware body sherds, flatware, undecorated
1 clear glassware fragment, unidentified form
3 pale blue aqua bottle/jar fragments

STP 119, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment
1 unidentified nail(s) fragments
5 brick fragments, discarded in lab (52g)

Clothing

1 copper alloy button(s), flat, round, missing shank, embossed lettering on back LONDON; diameter-18mm

STP 122, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment
1 lime soda (post 1864) windowpane glass fragment
3 unidentified nail(s) fragments

Kitchen

1 olive green bottle/jar fragment
1 olive amber bottle/jar fragment

STP 123, Fill 1

Activities

1 chain, link, possible spring snap link

Architecture

1 lime soda (post 1864) windowpane glass fragment
5 lime soda (post 1864) windowpane glass fragments, burned
7 lime soda (post 1864) windowpane glass fragments
1 cut nail(s) (1790-present) fragment

Kitchen

1 clear bottle/jar fragment, thin
2 clear bottle/jar fragments

Unidentified

1 glass fragment, clear
2 ferrous metal fragments, thin, corroded

STP 124, Ap

Architecture

1 lime soda (post 1864) windowpane glass fragment
1 wire nail(s) (1890s-present), roofing nail
3 wire nail(s) (1890s-present)
1 unidentified nail(s) fragment

Kitchen

1 other stoneware sherd, unidentified form, brown interior and exterior glaze
1 clear bottle/jar fragment, ABM (post 1907)

STP 125, Fill 1

Architecture

1 wire nail(s) (1890s-present) fragment

STP 128, Apb

Architecture

1 lime soda (post 1864) windowpane glass fragment

STP 132, Apb

Kitchen

1 cobalt blue bottle/jar fragment

STP 133, Fill 1

Architecture

4 unidentified nail(s) fragments
3 wire nail(s) (1890s-present)

Kitchen

1 clear, green bottle/jar fragment
2 clear bottle/jar fragments

Unidentified

4 ferrous metal fragments

STP 134, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment

Kitchen

1 unidentified refined earthenware sherd, unidentified form, spalled

STP 137, Fill 1

Kitchen

1 clear bottle/jar fragment

STP 145, Ap

Kitchen

1 unidentified refined earthenware sherd, unidentified form, undecorated

STP 161, Fill 1

Architecture

3 brick fragments, discarded in lab (95g)

STP 162, Ap

Architecture

1 wrought nail(s)

Kitchen

1 unidentified refined earthenware sherd, flatware, blue edge decoration

STP 163, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment

STP 165, Fill 1

Kitchen

2 pearlware (1775-1830) base sherds, flatware, embossed annular pattern

STP 1002, Fill 1

Activities

1 wire fencing fragment, barbed

Architecture

1 lime soda (post 1864) windowpane glass fragment

1 wire nail(s) (1890s-present)

STP 1003, Fill 1

Architecture

10 lime soda (post 1864) windowpane glass fragments

STP 1004, Fill 1

Kitchen

1 unidentified refined earthenware body sherd, holloware vessel, crazed glaze

STP 1009, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment

STP 1010, Fill 1

Architecture

3 lime soda (post 1864) windowpane glass fragment

STP 1011, Fill 1

Architecture

3 brick fragments, discarded in lab (60g)

STP 1012, Fill 2

Architecture

3 brick fragments, discarded in lab (138g)

STP 1020, Ap

Architecture

2 lime soda (post 1864) windowpane glass fragments

Unidentified

6 ferrous metal fragments

1 ferrous metal fragment, strap

1 non-ferrous metal fragment, strap with rounded end

STP 1021, Fill 1

Architecture

6 wire nail(s) (1890s-present)

2 wire nail(s) (1890s-present) fragments

1 wire nail(s) (1890s-present), roofing nail

1 staple

Kitchen

1 clear glassware fragment, holloware, pressed, embossed linear pattern on interior surface

Unidentified

10 non-ferrous metal fragments, container

STP 1022, Fill 1

Architecture

3 brick fragments

2 lime soda (post 1864) windowpane glass fragments

Kitchen

1 American Stoneware body sherd, unidentified form, unglazed/bisque, interior, salt glaze (exterior)

1 amber bottle/jar body fragment

Unidentified

1 ferrous metal fragment

STP 1023, Fill 1

Kitchen

1 clear bottle/jar body fragment

Unidentified

1 ferrous metal, wire

STP 1026, Ap

Architecture

2 wire nail(s) (1890s-present) whole/complete

STP 1027, Apb

Architecture

1 wire nail(s) (1890s-present), roofing nail

STP 1029, Apb

Architecture

3 brick fragments, discarded in lab (88g)

STP 1031, Apb

Architecture

3 brick fragments, discarded in lab (48g)

2 lime soda (post 1864) windowpane glass fragments

Kitchen

1 deep blue aqua bottle/jar base, chilled iron mold (1880-1930), embossed lettering/numbering, possible 2

STP 1032, Fill 1

Architecture

1 wire nail(s) (1890s-present)

Kitchen

1 clear bottle/jar body fragment, ABM (post 1907)

STP 1033, Apb

Architecture

3 brick fragments, discarded in lab (114g)

1 lime soda (post 1864) windowpane glass fragment

Kitchen

1 unidentified refined earthenware body sherd, holloware vessel, undecorated, crazed

Unidentified

1 plastic, brown rim fragment

STP 1035, Fill 1

Architecture

2 Portland cement fragments, with brick, weathered

2 lime soda (post 1864) windowpane glass fragments

2 wire nail(s) (1890s-present)

STP 1041, Ap

Organic

7 charcoal fragments

Unidentified

1 ferrous metal fragment

STP 1042, Ap

Unidentified

1 ferrous metal fragment, possible nail fragment

STP 1043, Ap

Architecture

1 unidentified nail(s) fragment

STP 1044, Ap

Architecture

3 brick fragments, discarded in lab (114g)

STP 1044, Apb

Unidentified

1 glass fragment, clear, thin

STP 1054, Ap

Unidentified

2 ferrous metal fragments

STP 1055, Ap

Architecture

1 wire nail(s) (1890s-present) fragment

Unidentified

1 ferrous metal fragment

STP 1062, Fill 1

Activities

1 flatiron, base with unidentified material melted on top side

Architecture

10 ceramic fragments, pipe, probable drain tile
1 lime soda (post 1864) windowpane glass fragment
1 wire nail(s) (1890s-present)
1 wire nail(s) (1890s-present) fragment
5 wire nail(s) (1890s-present), roofing nails
1 staple

Unidentified

6 ferrous metal fragments
1 ferrous metal, semi-circular bar 5 with ends bent at 45 degree angles, holes in each end ; llegible embossed lettering in center of bar possibly 303 F 16
1 ferrous metal, strap fragment 26.5cm long by 4.5cm wide, 2 small round holes, and 1 square hole

STP 1063, Apb

Architecture

1 brick fragment, discarded in lab (246g)

STP 1064, Apb

Architecture

1 brick fragment, discarded in lab (4g)

Unidentified

1 glass fragment, burned

STP 1070, Apb

Architecture

2 brick

Unidentified

1 unidentified ceramic sherd, black, sporting clay fragment

STP 1072, Ap

Kitchen

1 olive amber bottle/jar body fragment, chilled iron mold (1880-1930)

STP 1073, Apb

Architecture

3 brick fragments, discarded in lab (292g)

STP 1075, Apb

Kitchen

1 olive green bottle/jar body fragment

STP 1076, Ap

Architecture

1 porcelain fragment, toilet/sink

STP 1081, Ap

Architecture

2 brick fragments, discarded in lab (578g)

STP 1082, Apb

Architecture

10 brick fragment, discarded in lab (266g)

1 lime soda (post 1864) windowpane glass fragment

STP 1102, Ap

Architecture

1 brick fragment, discarded in lab (476g)

STP 1106, Ap

Architecture

3 brick fragments, discarded in lab (504g)

1 ceramic sherd, pipe, probable drain tile

STP 1116, Ap

Architecture

1 ceramic fragment, pipe, probable drain tile

STP 1123, Ap

Unidentified

2 ferrous metal fragments, flat

STP 1135, Apb

Unidentified

3 unidentified ceramic sherds, black, sporting clay fragments

STP 1137, Fill 1

Kitchen

21 clear bottle/jar body fragments, ABM (post 1907)

STP 1138, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment

1 wire nail(s) (1890s-present) fragment

Kitchen

1 white milk glass canning jar lid liner fragment

1 clear bottle/jar body fragment

STP 1143, Fill 1

Kitchen

2 whiteware (post 1820) body sherds, unidentified form, undecorated, spalled

1 clear bottle/jar base, freeblown (pre 1850), with pontil mark

Personal Items

1 ferrous metal cylindrical key(s), rectangular teeth

STP 1189, Fill 1

Architecture

2 brick fragments (30g)

1 lime soda (post 1864) windowpane glass fragment

STP 1190, Fill 1

Architecture

2 lime soda (post 1864) windowpane glass fragments

Kitchen

1 clear bottle/jar fragment, ABM (post 1907)

STP 1191, Fill 2

Architecture

1 brick fragment, burned

6 brick fragments (5884g)

STP 1196, Fill 1

Activities

2 wire fencing fragments

STP 1198, Fill 1

Architecture

1 brick fragment, weighed, counted, and discarded in field (78g)

1 lime soda (post 1864) windowpane glass fragment

STP 1199, Fill 1

Architecture

30 plaster fragments, weighed, counted, and discarded in field (484g)

3 brick fragments, weighed, counted, and discarded in field (422g)

STP 1200, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment

STP 1202, Fill 1

Kitchen

44 clear bottle base/body/shoulder/neck fragments, ABM (post 1907), M.N.I - 2 bottles

1 clear liquor bottle finish fragment, ABM (post 1907), small mouth, external thread finish (post c.1875), with embossed aluminum cap Jim Beam, Since 1795

1 clear bottle whole/complete, ABM (post 1907), small mouth, external thread finish (post c.1875), half-round; stippling and vertical and horizontal decoration on rounded side; metal wire inside bottle

1 aluminum beverage can, ring tab/pull tab closure

1 ferrous metal can fragment, possible base

Unidentified

3 ferrous metal fragments, possible fencing fragments

STP 1206, Fill 1

Architecture

5 plaster fragments, weighed, counted, and discarded in field (100g)

STP 1207, Fill 1

Architecture

3 plaster fragments, weighed, counted, and discarded in field (64g)
1 lime soda (post 1864) windowpane glass fragment
1 escutcheon, plate

STP 1212, Fill 1

Architecture

18 brick fragments, weighed, counted, and discarded in field (906g)

STP 133N, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragment
1 lime soda (post 1864) windowpane glass fragment
3 lime soda (post 1864) windowpane glass fragments
4 wire nail(s) (1890s-present) fragments
2 wire nail(s) (1890s-present)

Kitchen

3 clear bottle/jar fragments
9 Ball Blue (1909-1939) canning jar fragments

Organic

2 bone fragments

Unidentified

3 ferrous metal fragments

STP 133W, Fill 1

Architecture

1 wire nail(s) (1890s-present) fragment
1 wire nail(s) (1890s-present)

STP 137W, Fill 1

Organic

5 bone fragments

TU 1, Fill 3

Activities

1 bolt fragment, with attached nut

Architecture

6 lime soda (post 1864) windowpane glass fragments
1 wire nail(s) (1890s-present)
1 wire nail(s) (1890s-present) fragment, staple
4 lime soda (post 1864) windowpane glass fragments
2 brick fragments, discarded in lab (8g)

1 lime soda (post 1864) windowpane glass fragments

Kitchen

1 7-up green bottle/jar fragment, ABM (post 1907)

Unidentified

1 glass fragment, clear, etched
1 ferrous metal fragment, small, flattened, u-shaped, possible staple

TU 2, Fill 1

Activities

1 chain fragment, 3 links

Architecture

1 lime soda (post 1864) windowpane glass fragment
14 brick fragments, discarded in lab (5900g)
21 brick fragments, discarded in lab (694g)
2 lime soda (post 1864) windowpane glass fragments
1 fuse(s), glass with ferrous metal base, external threads
12 brick fragments (7230g)
1 unidentified nail(s) fragment

Kitchen

9 clear bottle base/body fragments, ABM (post 1907), Hazel Atlas Glass co. makers mark on base
1 blue aqua bottle/jar fragment
3 clear bottle/jar fragments
3 ferrous metal beverage can fragments, aluminum, ring top lid, ferrous metal body and bottom, red paint on body
23 clear liquor bottle body fragments, ABM (post 1907), embossed lettering BEAM
6 clear bottle/jar fragments
2 pale blue aqua bottle/jar base/body fragments, ABM (post 1907), embossed 8 and A on base
1 clear glassware fragment, unidentified form, pressed
2 ferrous metal fragments, top or bottom
7 clear bottle/jar fragments, ABM (post 1907), stippling on one fragment

Unidentified

1 glass, bent glass tube; diameter-1cm

TU 2, Fill 2

Architecture

1 lime soda (post 1864) windowpane glass fragment
1 lime mortar fragment, discarded in lab (12g)
6 lime soda (post 1864) windowpane glass fragments
3 lime soda (post 1864) windowpane glass fragments
8 brick fragments, discarded in lab
1 large lag bolt
1 wire nail(s) (1890s-present) fragment
4 brick fragments, discarded in lab (276g)

Kitchen

10 clear bottle/jar fragments, ABM (post 1907), large mouth, external thread finish (post 1858)
3 Ball Blue (1909-1939) canning jar , ABM (post 1907)

9 clear canning jar fragments, ABM (post 1907), large mouth, external thread finish (post 1858), embossed lettering SELF
1 clear bottle/jar fragment, ABM (post 1907), stippled pattern
1 pale blue aqua bottle/jar fragment
1 clear canning jar base/body/shoulder/neck/finish whole/complete, ABM (post 1907), large mouth, external thread finish (post 1858), makers mark for Hazel-Atlas glass co.
2 clear bottle fragments, ABM (post 1907), base/body, red paint on body fragment, stippling on base
2 clear bottle base/body fragments
2 clear bottle/jar body fragments, ABM (post 1907), molded linear bands around body
4 clear bottle base/body fragments, ABM (post 1907), very light pink hue, embossed dots on body
1 pale blue aqua jar finish/neck/shoulder fragment, ABM (post 1907), patent/extract/flat finish (post 1850), large mouth
8 Ball Blue (1909-1939) canning jar body fragments, ABM (post 1907), includes fragments with BALL script
47 clear canning jar base/body/shoulder/neck/finish fragments, ABM (post 1907), large mouth, external thread finish (post 1858), includes fragments with portions of Ball script, Perfect Mouth and embossed grape pattern
1 clear glassware fragment, drinking glass, rim and body, vertical linear pattern on body
1 stoneware body sherd, jug, Bristol glaze (interior), Bristol glaze (exterior), from large jug or jar
1 Bristol glaze body sherd, unidentified form, undecorated (interior), Bristol glaze (exterior)
1 clear jar base/body/shoulder/neck/finish whole/complete, straight sided, slightly raised rim
1 clear bottle finish/neck/shoulder fragment, ABM (post 1907), small mouth, external thread finish (post c.1875), portion of ferrous metal cap attached
6 clear bottle/jar base/body fragment, ABM (post 1907), hammered texture
26 clear bottle base/body/shoulder/neck/finish fragments, ABM (post 1907), capseat/common sense finish (1889-1950s), milk bottle
1 clear jar, lid for clamp-lid jar; diameter-70mm, embossed lettering DIAMOND FRUIT JAR
7 clear canning jar body fragments, ABM (post 1907), Kerr mason jar, embossed grape motif
1 amber bottle/jar base/body fragment, ABM (post 1907), small, possible medicine bottle
11 Ball Blue (1909-1939) canning jar base/body fragments, ABM (post 1907), embossed MASON
1 clear bottle/jar fragment
2 ferrous metal fragments, small paint can with lid, dried paint within
2 other cap/closure fragments, ferrous metal, threaded canning jar lid
5 Ball Blue (1909-1939) canning jar body fragments, ABM (post 1907), embossed E
1 amber bottle/jar body fragment
10 clear bottle/jar body fragments
10 clear bottle/jar body fragments, ABM (post 1907), portion of embossed A and E
29 clear bottle/jar base/body fragments, ABM (post 1907), portions of red, painted lettering
7 clear canning jar body/finish fragments, ABM (post 1907), large mouth, external thread finish (post 1858), embossed grape motif, possible Kerr mason
1 amber bottle/jar

Unidentified

1 possible degraded leather fragment
1 ferrous metal, cylinder; diameter-1.25cm; length-4cm length; flared end
2 ferrous metal fragments, thin metal strap with holes, rounded ends, one attached nail

2 ferrous metal fragments, thin metal strap with holes, rounded ends, one attached nail

TU 2, Fill 3

Activities

1 sickle bar blade guard

Architecture

2 lime soda (post 1864) windowpane glass fragments
1 wire nail(s) (1890s-present)
2 brick fragments, discarded in lab (394g)

Kitchen

7 clear bottle/jar body fragments, includes fragment with red paint
16 clear bottle/jar base/body fragments, ABM (post 1907), embossed lettering, stippled pattern
7 clear bottle/jar body fragments, ABM (post 1907), molded horizontal bands
2 blue aqua bottle/jar body fragments, ABM (post 1907), embossed lettering, RON
2 amber liquor bottle base/body fragments, ABM (post 1907), embossed lettering ONE PINT Owens Illinois makers mark on base

Unidentified

3 ferrous metal fragments, cylindrical tube; diameter-1cm, one fragment closed at one end

TU 3, Fill 1

Activities

1 coarse earthenware fragment
1 coarse earthenware fragment

Architecture

5 asphalt fragments, shingle or tar paper
1 cut nail(s) (1790-present) fragment
19 wire nail(s) (1890s-present), roofing
11 wire nail(s) (1890s-present)
2 asphalt fragments, shingle or tar paper
13 wire nail(s) (1890s-present), roofing
14 wire nail(s) (1890s-present) fragments
1 cut nail(s) (1790-present)

Organic

2 bone fragments
5 bone fragments, includes long bone with cut marks and sawed end

TU 4, Fill 1

Architecture

5 wire nail(s) (1890s-present) fragment, roofing
12 wire nail(s) (1890s-present) fragments
1 wire nail(s) (1890s-present), roofing
2 wire nail(s) (1890s-present)

Organic

2 bone fragments, includes long bone with cut marks
7 bone fragments, with cut marks and sawed ends

Unidentified

1 ferrous metal fragment

TU 4, Fill 2

Architecture

1 wire nail(s) (1890s-present) fragment, tar paper or shingle attatched to base of nailhead
1 wire nail(s) (1890s-present) fragment
1 brick fragment, discarded in lab (222g)
2 wire nail(s) (1890s-present)
4 brick fragments, discarded in lab (86g)

Kitchen

2 whiteware (post 1820) rim fragments, refined earthenware, transfer print, underglaze-blue

Organic

3 bone fragments
1 bone fragment, with cut marks
1 bone fragment
34 charcoal fragments

Unidentified

1 ferrous metal fragment

TU 5, Fill 1

Architecture

4 wire nail(s) (1890s-present) fragments, roofing
2 cut nail(s), machine headed (1825-present)
17 wire nail(s) (1890s-present) fragments
2 cut nail(s) (1790-present) fragments
2 wire nail(s) (1890s-present) fragments

Kitchen

2 whiteware (post 1820) body/base sherds, unidentified form, transfer print, underglaze-blue
1 American Stoneware body/base sherd, unidentified form, salt-glazed, exterior, undecorated (interior),

Organic

8 bone fragments, with cut marks and sawed ends
3 bone fragments, with cut/sawed ends

Unidentified

1 glass fragment, similar in form to a lid liner

TU 5, Fill 2

Architecture

1 lime soda (post 1864) windowpane glass fragment
6 brick fragments, discarded in lab (1538g)

Kitchen

1 clear glassware fragment, unidentified form, pressed
1 whiteware (post 1820) sherd, unidentified form, undecorated, body
1 whiteware (post 1820) body sherd, unidentified form, transfer print, underglaze-blue
1 whiteware (post 1820) rim sherd, unidentified form, transfer print, underglaze-blue
6 American Stoneware body sherds, unidentified form, salt-glazed, exterior, gray in color
2 clear glassware fragments, unidentified form, pressed

TU 6, Fill 1

Architecture

63 lime soda (post 1864) windowpane glass fragments
2 light blue paint fragments
1 ferrous metal bracket
18 wire nail(s) (1890s-present), assorted sizes
1 wire nail(s) (1890s-present), fragment of wood attached
2 cut nail(s) (1790-present), L headed, fragments of wood attached
5 cut nail(s), machine headed (1825-present) fragments
1 cut nail(s) (1790-present), heavily corroded

Arms

1 other shell casing whole/complete, 38 SPL R-P on base

Kitchen

1 7-up green bottle whole/complete, ABM (post 1907), small mouth, external thread finish, 10 oz bottle, embossed lettering, stippling at shoulder and base
1 clear bottle/jar fragment
1 aluminum two-piece can, potted meat can

Organic

2 bone, long bones, possibly deer

Unidentified

1 glass fragment, very thin sheet glass

TU 6, Fill 2

Architecture

6 lime soda (post 1864) windowpane glass fragments
1 cut nail(s), machine headed (1825-present)
20 brick fragments, discarded in lab (4845g)
4 plaster fragments, discarded in lab (50g)
1 cinder block, discarded in lab (354g)
2 lime soda (post 1864) windowpane glass fragments
1 cut nail(s), machine headed (1825-present) fragment
1 wire nail(s) (1890s-present), roofing nail
3 brick fragments, discarded in lab (32g)
7 plaster fragments, discarded in lab (42g)
3 lime mortar, discarded in lab (130g)

Kitchen

1 clear bottle/jar fragment
1 clear bottle/jar fragment
1 whiteware (post 1820) rim sherd, unidentified form, undecorated

Unidentified

1 glass fragment, very thin sheet glass, possibly windowpane

TU 6, Fill 3

Architecture

3 lime soda (post 1864) windowpane glass fragment

TU 7, Fill 1

Activities

1 wire fencing fragment

Architecture

8 lime soda (post 1864) windowpane glass fragments
1 cut nail(s) (1790-present), L-headed
15 cut nail(s) (1790-present) fragments
15 wire nail(s) (1890s-present) fragments

Kitchen

1 7-up green soft drink bottle whole/complete, ABM (post 1907), small mouth, external thread finish, 10 fl. oz.
3 clear canning jar base/body fragments, ABM (post 1907), embossed lettering TED 1913

Organic

11 charcoal fragments

Unidentified

1 ferrous metal fragment, thin, crushed/deformed

TU 7, Fill 2

Activities

1 S-hook whole/complete
1 rope eye thimble whole/complete

TU 8, Fill 1

Architecture

5 lime soda (post 1864) windowpane glass fragments
17 cut nail(s) (1790-present) fragments
8 wire nail(s) (1890s-present) fragments

Arms

3 other clay pigeon fragments, clay pigeon

Kitchen

32 clear bottle/jar base/body fragments, ABM (post 1907), round base, square sided
1 amber bottle/jar fragment

Unidentified

2 ferrous metal fragments, thin, bent

TU 8, Fill 2

Architecture

10 lime soda (post 1864) windowpane glass fragments
1 wrought nail(s)
9 cut nail(s) (1790-present) fragments
4 wire nail(s) (1890s-present)

Arms

2 other clay pigeon fragments, clay pigeon

Kitchen

10 clear canning jar base/body/shoulder/neck/finish fragments, ABM (post 1907), large mouth, external thread finish (post 1858), embossed Ball script letter B on one fragment
15 clear bottle base/body fragments, ABM (post 1907), embossed lettering MADE IN US on base

1 aluminum ring tab whole/complete

Unidentified

14 glass fragments, flat, possibly windowpane
1 ferrous metal fragment, thin, bent

TU 9, Fill 1

Architecture

1 porcelain fragment, toilet/sink
19 lime soda (post 1864) windowpane glass fragments
1 cut nail(s) (1790-present), L-headed
6 cut nail(s) (1790-present) fragments
4 wire nail(s) (1890s-present)

Kitchen

1 whiteware (post 1820) body sherd, unidentified form, undecorated

Unidentified

3 ferrous metal fragments, thin, bent

TU 9, Fill 2

Architecture

2 lime soda (post 1864) windowpane glass fragments
1 locking bolts and brackets fragment, broken, 4 attached screws, possible door latch (40g)
12 cut nail(s) (1790-present) fragments
2 wire nail(s) (1890s-present)

Arms

1 brass shell casing whole/complete, stamped lettering on base TZZ 87

Kitchen

1 whiteware (post 1820) rim sherd, plate, undecorated
1 aluminum beverage can fragment, top for ring pull can

Organic

3 bone fragments

Unidentified

2 ferrous metal fragments, thin metal strap with holes and 3 attached wire nails, bent/deformed

TU 10, Fill 1

Architecture

2 lime soda (post 1864) windowpane glass fragments
7 cut nail(s), machine headed (1825-present), small, all approx. 30mm in length
1 lime mortar fragment

Organic

1 bone fragment, small animal

Unidentified

1 ferrous metal fragment, thin sheet metal, folded over/crimped along edges

TU 10, Fill 2

Architecture

26 cut nail(s), machine headed (1825-present) fragments
4 wire nail(s) (1890s-present) fragments

Kitchen

1 olive green bottle fragment

Organic

1 bone fragment, small animal

Unidentified

1 glass fragment, amber in color with white patina

1 glass fragment, melted, thin, possibly windowpane

TU 11, Fill 1

Architecture

3 lime soda (post 1864) windowpane glass fragments

1 hinge fragment, pintle hinge one attached screw

2 cut nail(s), machine headed (1825-present)

5 wire nail(s) (1890s-present) fragments

Organic

4 bone fragments

Unidentified

1 glass fragment, thin, possibly windowpane

TU 11, Fill 2

Architecture

4 lime soda (post 1864) windowpane glass fragments

1 slate fragment, shingle(s)

5 cut nail(s) (1790-present) fragments

9 wire nail(s) (1890s-present) fragments

1 unidentified nail(s) fragment

TU 12, Fill 1

Architecture

9 lime soda (post 1864) windowpane glass fragments

1 slate fragment

5 cut nail(s) (1790-present) fragments

2 wire nail(s) (1890s-present)

Kitchen

5 clear bottle/jar fragments

1 white milk glass (c.1870-c.1950) glassware fragment, unidentified form

1 aluminum ring tab whole/complete

TU 12, Fill 2

Architecture

39 lime soda (post 1864) windowpane glass fragments

1 fuse(s) fragments, ferrous metal base, exterior threads, embossed lettering on glass top (125V NU-LITE U.S.A.)

1 cast iron, pipe, external threads and internal threads at opposite ends

31 cut nail(s) (1790-present) fragments

13 wire nail(s) (1890s-present) fragments

4 unidentified nail(s) fragments

2 brick fragments, burned, burnt/charred

Kitchen

1 whiteware (post 1820) sherd, unidentified form, transfer print, underglaze-blue
1 whiteware (post 1820) rim sherd, unidentified form, undecorated
2 whiteware (post 1820) rim sherds, unidentified form, undecorated
1 olive green bottle body fragment
1 olive green bottle body fragment
4 clear bottle/jar base/body fragments, ABM (post 1907), includes fragment with hammered texture
1 other stoneware rim/body, jug, Albany slip (interior), salt glaze (exterior)
2 aluminum ring tab whole/complete
2 aluminum threaded lid/cap whole/complete, painted, National Bohemian

Organic

3 bone fragments

Unidentified

1 glass fragment, clear
1 glass fragment, clear, oxidized
87 glass fragments, thick, clear
1 non-ferrous metal fragment, with teeth
5 ferrous metal fragments, thin sheet metal

TU 12, Fill 3

Activities

1 game piece, red plastic poker chip

Architecture

4 lime soda (post 1864) windowpane glass fragments
1 fuse(s) fragment, ferrous metal top, ceramic body, non-ferrous metal external threads
17 cut nail(s) (1790-present) fragments
27 wire nail(s) (1890s-present) fragments
5 unidentified nail(s) fragments

Kitchen

1 aluminum ring tab whole/complete

Organic

1 bone fragment

Unidentified

9 glass fragments, thick, clear
4 ferrous metal fragments, thin sheet metal

TU 13, Fill 1

Architecture

12 wire nail(s) (1890s-present) fragments (5599g)

TU 13, Fill 2

Architecture

5 wire nail(s) (1890s-present)
8 brick fragments, discarded in lab (536g)
1 lime mortar fragment, discarded in lab (216g)

Kitchen

2 aluminum ring tab fragments

TU 13, Fill 3

Architecture

1 cut nail(s) (1790-present)
2 wire nail(s) (1890s-present) fragments
8 brick fragments, discarded in lab

TU 13, Fill 4

Architecture

1 wire nail(s) (1890s-present) fragment

Kitchen

1 whiteware (post 1820) spall, unidentified form, unidentified type

TU 14, Fill 1

Architecture

2 ceramic fragments, pipe, brown
7 lime soda (post 1864) windowpane glass fragments
2 wire nail(s) (1890s-present), roofing
5 wire nail(s) (1890s-present)
1 wire nail(s) (1890s-present), roofing
5 wire nail(s) (1890s-present)

Organic

2 bone fragments, with cut/saw marks

TU 14, Fill 2

Architecture

9 lime soda (post 1864) windowpane glass fragments
2 wire nail(s) (1890s-present), roofing
3 wire nail(s) (1890s-present) fragments

TU 14, Fill 3

Architecture

6 lime soda (post 1864) windowpane glass fragments
1 wire nail(s) (1890s-present), roofing
4 wire nail(s) (1890s-present)
3 asphalt fragments

TU 15, Ao

Architecture

1 cut nail(s) (1790-present) fragment
2 cut nail(s), machine headed (1825-present)
18 wire nail(s) (1890s-present)
3 wire nail(s) (1890s-present), roofing nails

Organic

1 bone fragment, unidentified species

TU 15, Fill 1

Activities

1 bolt fragment

Architecture

1 lime soda (post 1864) windowpane glass fragment
3 wire nail(s) (1890s-present) fragments

TU 16, Fill 1

Architecture

1 lime soda (post 1864) windowpane glass fragments
1 cut nail(s), machine headed (1825-present)
2 wire nail(s) (1890s-present) fragment
22 brick fragments, discarded in field (7830g)
6 lime mortar fragments, discarded in field (744g)

Arms

1 steel shell casing fragment, .22 cal, rimfire, PETERS HV
1 plastic shotgun shell fragments, FEDERAL MAXIMUM LOAD 0 BUCK

Kitchen

1 aluminum ring tab fragments

Unidentified

1 glass fragment, thick, clear

TU 16, Fill 2

Architecture

18 brick fragments, discarded in field (6700g)
2 lime mortar fragments, discarded in field (2440g)

Kitchen

1 white milk glass (c.1870-c.1950) canning jar lid liner fragment

TU 16, Fill 3

Architecture

24 brick fragments, discarded in field (4052g)

TU 17, Fill 1

Architecture

8 lime soda (post 1864) windowpane glass fragments
1 cut nail(s), machine headed (1825-present) fragments
18 brick fragments, discarded in lab (4560g)
2 lime mortar fragments, discarded in lab (97g)

Kitchen

2 clear bottle/jar fragments
1 amber bottle fragment, ABM (post 1907)
1 olive green bottle fragments

TU 17, Fill 2

Architecture

16 lime soda (post 1864) windowpane glass fragments
1 cut nail(s) (1790-present) fragment

1 cut nail(s), machine headed (1825-present) fragments
7 wire nail(s) (1890s-present) fragment
1 staple fragment
4 brick fragments, discarded in lab (1444g)

Arms

1 brass/paper shotgun shell fragment, base portion, 12 ga. REM-UMC

Kitchen

2 clear bottle/jar body fragments
2 clear bottle/jar fragments

TU 17, Fill 3

Architecture

2 lime soda (post 1864) windowpane glass fragment
2 cut nail(s), machine headed (1825-present)
1 wire nail(s) (1890s-present)

TU 17, Fill 4

Kitchen

1 olive green bottle fragments

TU 18, Fill 1

Activities

1 chain fragment, broken/bent chain link
1 bolt fragment, bent, attached nut and washer

Architecture

85 lime soda (post 1864) windowpane glass fragments
3 cut nail(s), machine headed (1825-present)
7 wire nail(s) (1890s-present) fragment
3 unidentified nail(s) fragments
46 brick fragments, discarded in lab (9077g)
3 mortar fragments (94g)

Arms

1 brass shell casing fragment, .22 cal

Kitchen

1 other coarse earthenware fragments, unidentified form, tan/brown paste, possible lid for jar
3 whiteware (post 1820) unidentified sherds, unidentified form, undecorated, fragment of makers mark
1 clear bottle/jar fragments
2 aluminum ring tab fragment

Organic

1 bone

Unidentified

1 ceramic fragments, thick, slightly curved edge, possibly from ceramic fixture

TU 18, Fill 2

Architecture

3 lime soda (post 1864) windowpane glass fragments
1 brick fragment, discarded in lab (26g)

TU 19, Fill 1

Architecture

8 lime soda (post 1864) windowpane glass sherd
1 copper alloy whole/complete, pipe, escutcheon
2 cast iron whole/complete, pipe
2 lead fragments, other, pipe seal
13 cut nail(s) (1790-present) fragments
4 wire nail(s) (1890s-present) fragment
18 brick fragments (1100g)

Kitchen

1 amber bottle finish/neck/shoulder fragments, ABM (post 1907), small mouth, external thread finish

Unidentified

1 glass fragments, clear, flat
1 ferrous metal whole/complete, thin, flat

TU 19, Fill 2

Architecture

35 lime soda (post 1864) windowpane glass fragments
3 cut nail(s) (1790-present)
2 wire nail(s) (1890s-present) fragment
6 unidentified nail(s) fragments

TU 19, Fill 3

Architecture

3 lime soda (post 1864) windowpane glass fragment

TU 20, Fill 1

Architecture

23 brick fragments, weighed and discarded in field (13315g)
10 lime mortar fragments, weighed and discarded in field (1395g)

Kitchen

1 clear bottle base fragment, ABM (post 1907), embossed lettering decipherable as QUAR

Unidentified

1 ferrous metal fragment, thin sheet metal
1 ferrous metal fragment, cast iron bar, rounded top, flat bottom, tapered along length, flattened end
1 ferrous metal fragment, cast iron bar, rounded top, flat bottom, tapered along length, flattened end

TU 20, Fill 2

Architecture

5 brick fragments, weighed and discarded in field (1414g)
5 lime mortar fragments, weighed and discarded in field

TU 20, Fill 3

Architecture

1 wrought nail(s), rose head, fragment
3 cut nail(s), machine headed (1825-present)
4 wire nail(s) (1890s-present) fragments
8 brick fragment, weighed and discarded in field (1170g)

8 lime mortar fragments, weighed and discarded in field (796g)

Kitchen

1 clear bottle/jar body fragment

5 amber bottle/jar fragments, burned

TU 20, Fill 4

Architecture

6 wire nail(s) (1890s-present) fragments, one with melted glass attached

Kitchen

9 amber bottle/jar fragments, burned

Organic

33 charcoal fragments

Agencies contacted during the preparation of this Landfill Impact Statement and Part A Application include:

Cumberland County, Virginia
~~Mr. James P. Duncan~~
~~Planning Director/Zoning Administrator~~
~~1 Courthouse Circle~~
~~P.O. Box 110~~
~~Cumberland, VA 23040~~
~~(804) 492-3800~~

Ms. Stephany S. Johnson
~~Deputy Clerk/FOIA Officer~~Planning Director/Zoning
1 Courthouse Circle
P.O. Box 110
Cumberland, VA 23040
(804) 492-3800

Ms. Vivian Giles (left County employ)
County Administrator/County Attorney

Mr. ~~Brian Butler~~Kemper Beasley (County Attorney)
1 Courthouse Circle
P.O. Box 110
Cumberland, VA 23040
(804) 492-3625

Mr. Don Unmussig (~~County Administrator~~Left County employ)

Mr. Derek Stamey (County Administrator)
1 Courthouse Circle
P.O. Box 110
Cumberland, VA 23040
(804) 492-3625

U.S. Army Corps of Engineers
~~Mr. Steve Vanderploeg~~
Andy Beaudet, District Chief
Richmond Field Office

9100 Arboretum Parkway, Suite 235
Richmond, VA 23236
(804) 323-3781

U.S. Fish and Wildlife Service
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
(804) 693-6694

USFWS: Endangered Species
https://www.fws.gov/endangered/

iPAC: Information for Planning and Consultation
https://ecos.fws.gov/ipac/

Virginia Department of Aviation
Mr. S. Scott Denny
Senior Aviation Planner
5702 Gulfstream Road
Richmond, VA 23250-2422
(804) 236-3624

Virginia Department of Conservation and Recreation
Ms. René Hypes
Natural Heritage Project Review Coordinator
600 East Main Street
Richmond, VA 23219
(804) 786-6124

DCR: Natural Heritage Definitions
http://www.dcr.virginia.gov/natural-heritage/help

Virginia Dam Safety and Floodplain Management
600 East Main Street
Richmond, VA 23219
(804) 786-6124

Virginia Department of Environmental Quality
Jaime Robb
Deputy Regional Director

DEQ – Piedmont Regional Office
804-527-5086

Virginia Department of Environmental Quality – Land Protection and Revitalization
~~Mr. Jason Miller (retired)~~
Mr. Shawn Weimer
Mr. Dean Starook
Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060
(804) 527-5020

Sanjay V. Thirunagari
Manager
Division of Land Protection & Revitalization
Department of Environmental Quality
(804) 698-4193

DEQ: Water Quality
https://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityAssessments/IntegratedReport/2018/ir18_Appendix1a_Category5_List.pdf

Mr. Bryan Jones
Virginia Water Protection Program Manager
4949-A Cox Road
Glen Allen, VA 23060
804-712-4001

Virginia Department of Game and Inland Fisheries

https://vafwis.dgif.virginia.gov/maps/

Virginia Department of Health
Joseph Hilbert
VDH FOIA Officer
109 Governor Street
Richmond, Virginia 23219
(804) 864-7006

James Reynolds, PE
Field Director

Office of Drinking Water- Richmond Field Office
109 Governor Street, Suite UB23
Richmond, VA 23219
Office: (804)864-7444

Mr. Duane Roadcap
Office Director
Office of Drinking Water
109 Governor Street, Suite UB23
Richmond, VA 23219
Office: (804) 864-7522

Mr. Walter Hennessey
Environmental Health Specialist
Piedmont Health District
Cumberland Health Department
Cumberland, VA
Office: (804) 892-4661

Virginia Department of Historic Resources
Mr. Roger W. Kirchen, Director
Review and Compliance Division
2801 Kensington Avenue
Richmond, VA 23221
(804) 482-6091

Quatro Hubbard
Archivist, Survey & Register Division
2801 Kensington Avenue
Richmond, VA 23221
(804) 482-6102

Lauren Leake
2801 Kensington Avenue
Richmond, VA 23221
Archives Coordinator
Survey & Register Division
(804) 482-6440

VCRIS: Cultural Resource Information System
https://vcris.dhr.virginia.gov/vcris/MapViewer/Account/Logon?returnUrl=%2Fvcris%2FMapviewer%2F

Virginia Marine Resources Commission
Ms. Allison Lay
Environmental Engineer, Habitat Management
380 Fenwick Road, Bldg. 96
Fort Monroe, VA 23651-1064
(757) 247-2200

Virginia Department of Transportation
Mr. ~~Harley E. Joseph, Jr., P.E.~~Scott D. Frederick, P.E.
~~Transportation & Land Use Director~~Resident Engineer
Lynchburg District
637 Commerce Road
Farmville, VA 23901
(434) ~~505-3447~~394-8684

Contributors to the preparation of this Landfill Impact Statement and Part A Application include:

Draper Aden Associates/TRC
Michael D. Lawless, PG, Principal
2200 S. Main Street, Suite A
Blacksburg, VA 24060
540-557-1319

Browning & Associates, LTD
Lyle Browning, RPA
138 Scoggins Creek Trail
Hartfield, VA 23071
(804) 379-1666

Daguna Consulting, LLC
Bret J.K. Ostby
B.B. Beaty
7509 Pin Oak Circle
Bristol, VA 24202
(276) 608-6508

Koontz, Bryant, Johnson, Williams Group (KBJW)
Brent Johnson, P.E., P.G., AOSE, Chief Operating Officer
~~Shannon Hill~~
~~Hannah Miller~~
David Kwasniewski, PWD, Team Leader
~~11901 Old Stage Road~~7511 Whitepine Road
~~Chester, VA 23836~~N. Chesterfield, VA 23237
~~(804) 541-1436~~804-541-1436

Joyner Commercial
Jay Ashcraft
Dale Smith

Woods Rogers Vandeventer Black PLC
William H. Shewmake, Counsel
John K. Byrum, Jr., Principal, Counsel
901 East Byrd Street, Suite 1550
Richmond VA 23219
(804) 343-5035

Schnabel Engineering (Geotechnical Design)
Arif Bhuiyan, PhD, PE, Project Engineer
480 Four Seasons Drive
Charlottesville, VA 22901
434-975-3200

Gorove Slade (Transportation Planners and Engineers)
Carl Hultgren, PE, PTOE
4951 Lake Brook Drive, Suite 250
Glen Allen, 23060
804–362-0578

KOONTZ BRYANT JOHNSON WILLIAMS

Green Ridge Recycling and Disposal Facility
Threatened and Endangered Species Technical Memorandum
April 21, 2023

Background

Federal- and state-listed species that are found in Virginia generally require specialized habitat for continued survival. A total of eight (8) protected species are known, potentially known, and/or likely to occur within Cumberland County, Virginia. Listed species include the Northern Long-Eared Bat (*Myotis septentrionalis*), Tricolored Bat (*Perimyotis subflavus*), Atlantic Pigtoe (*Fusconaia masoni*), James Spinymussel (*Parvaspina collina*), Yellow Lance (*Elliptio lanceolata*), Green Floater (*Lasmigona subviridis)*, Loggerhead Shrike (*Lanius ludovicianus*) and Brook Floater (*Alasmidonta varicosa*) (***Table 1***). The Monarch Butterfly (*Danaus plexippus*) is listed in the US Fish and Wildlife Service database as a candidate species. Candidate species do not require consultation with U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act. Listed bivalve (mussel) species have been documented in the James River and Appomattox River. According to the Virginia Department of Wildlife Resources (VDWR), no observations have been confirmed in their associated tributaries. Database search results for Cumberland County can be found in ***Exhibit 1***.

Table 1: Threatened and Endangered Species Evaluation Matrix for Cumberland County

Common Name	Scientific Name	Legal Status	IPAC	DCR-DNH (12 Digit HUC)	VAFWIS
Northern Long-Eared Bat	*Myotis septentrionalis*	FE/ST	X		
Tricolored Bat	*Perimyotis subflavus*	PFE/SE	X		
Atlantic Pigtoe	*Fusconaia masoni*	FT/ST	X	X	P
James Spinymussel	*Parvaspina collina*	FE/SE	X		
Yellow Lance	*Elliptio lanceolata*	FT/ST		X	
Green Floater	*Lasmigona subviridis*	ST		X	P
Loggerhead Shrike	*Lanius ludovicianus*	ST		X	
Brook Floater	*Alasmidonta varicosa*	SE			P
Monarch Butterfly	*Danaus plexippus*	FC	X		
Total	***9 listed species***		**5**	**4**	**3**

FE = Federally Endangered, PFE = Proposed Federally Endangered, FT = Federally Threatened, FC = Federal Candidate, SE = State Endangered, ST = State Threatened
X = Confirmed within the County, P = Potential

Under 50 CFR 402.12€ the accuracy of the species list should be verified after 90 days, therefore, on April 18, 2023 Koontz Bryant Johnson Williams (KBJW) environmental scientists reviewed the Green Ridge Recycling and Disposal Facility "Project" to verify the occurrence of threatened and endangered species. Details of this desktop analysis are summarized below.

Desktop Analysis

KBJW conducted database searches and used best professional judgement to assess potential impacts that may occur to threatened and endangered species as a result of the Project. Database searches included: the USFWs IPaC, Virginia Fish and Wildlife Information Service (VAFWIS) of the VDWR, and the Virginia Department of Conservation and Recreation Division of Natural Heritage (DCR-DNH). Searches were conducted within a five (5)-mile radius of the project boundary and/or within sub-watersheds, dependent on database allowable input parameters.

As part of the IPaC environmental review process, a five (5)-mile search radius around the project boundary was used as the action area to determine the presence and/or absence of listed species. Listed species and resources under the Endangered Species Act that should be considered for protection were displayed and are included in ***Exhibit 2***.

VAFWIS of the VDWR (formerly Virginia Department of Game and Inland Fisheries (VDGIF)), maintains the most current comprehensive information about Virginia's wildlife resources including protected species. According to the VDGIF Interagency Coordination Recommendations, only species noted as 'Confirmed' on the VAFWIS database should be carried forward for further analysis. The coordinates of the project/parcel boundary were entered as Latitude/Longitude (decimal degrees) and a five (5)-mile search buffer around this was used to generate a list of protected species known or likely to occur within the buffer. The database search results are included in ***Exhibit 2,*** no species were identified as confirmed within the search results.

Under the Virginia Endangered Plant and Insect Act (Section: 3.1-1020 -1030, Code of Virginia), the Virginia Department of Agriculture and Consumer Services (VDACS) has regulatory responsibility of listing and protecting endangered and/or threatened plants and insects. An agreement between DCR-DNH and VDACS allows DCR-DNH to recommend species for listing to the regulatory agencies. DCR-DNH's database query limits its search to the County and sub-watershed (12-digit HUC) boundary. The database search results are included in ***Exhibit 2.***

Bald eagles (*Haliaeetus leucocephalus*) are protected under the Bald and Golden Eagle Protection Act which prohibits the take, possession, sale, purchase, barter, offer to sell, or transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. A search of the nearest nesting location and concentration area is included as part of this memorandum to determine if this species would be affected by the project, as shown in ***Exhibit 3.***

The VAFWIS of the VDWR has documented species occurrence as known or likely to occur within the 6th order hydrologic unit boundary. Based on this information, only mussel species are known or likely to occur within sub-watershed JM71, which encompasses the Green Ridge parcel boundary. Listed species occurrences are shown on ***Exhibit 4*** by sub-watershed where they are known and/or likely to occur. Generally, these species are associated with the James River which is located approximately 13.7 river miles north/northeast of the Project. None of the listed mussel species have been documented as confirmed within a 5-mile search radius of the Project.

Species identified in the database search were carried forward for further analysis, with the exception of those identified in the Virginia Fish and Wildlife Information Service database. According to the VDGIF Interagency Coordination Recommendations, only species with a confirmed 'Yes' on the Virginia Fish and Wildlife Information Service database should be carried forward for further analysis. Species carried forward for further analysis are depicted in ***Table 2***.

Table 2: Threatened and Endangered Species Evaluation Matrix for the Green Ridge Recycling and Disposal Facility

Common Name	Scientific Name	Legal Status	IPAC	DCR-DNH (12 Digit HUC)	VAFWIS
Northern Long-Eared Bat	*Myotis septentrionalis*	FE/ST	X		
Tricolored Bat	*Perimyotis subflavus*	PFE/SE	X		
Atlantic Pigtoe	*Fusconaia masoni*	FT/ST	X	X	
James Spinymussel	*Parvaspina collina*	FE/SE	X		
Yellow Lance	*Elliptio lanceolata*	FT/ST		X	
Green Floater	*Lasmigona subviridis*	ST		X	
Loggerhead Shrike	*Lanius ludovicianus*	ST		X	
Brook Floater	*Alasmidonta varicosa*	SE			
Monarch Butterfly	*Danaus plexippus*	FC	X		
Total	***9 listed species***		**5**	**4**	**0**

Federally Endangered, PFE = Proposed Federally Endangered, FT = Federally Threatened, FC = Federal Candidate, SE = State Endangered, ST = State Threatened
X = Confirmed within the County, P = Potential

Species Backgrounds

Northern Long-eared Bat (*Myotis septentrionalis*)

The northern long-eared bat was originally listed by the USFWS as threatened on April 2, 2015 and upgraded to endangered on November 29, 2022. The listing became effective on March 31, 2023. The northern long-eared bat is found in the U.S. from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma and north through the Dakotas, extending southward to parts of southern states from Georgia to Louisiana, even reaching into eastern Montana and Wyoming. Virginia is within the native range of the northern long-eared bat.

Suitable winter habitat (hibernacula) for the northern long-eared bat includes underground caves and cave-like structures (e.g., abandoned or active mines, railroad tunnels). These hibernacula typically have large passages with significant cracks and crevices for roosting; relatively constant, cool temperatures (0-9 degrees Celsius or 32-48.2 degrees Fahrenheit) with high humidity and minimal air currents. Northern long-eared bats will typically hibernate between mid-fall through mid-spring each year.

During the summer, northern long-eared bats roost singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and/or snags (typically ≥3 inches diameter at breast height [DBH]). Northern long-eared bats have also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). Northern long-eared bats emerge at dusk to forage in upland and lowland woodlots and tree-lined corridors, feeding on insects, which they catch while in flight using echolocation. Suitable summer habitat for northern long-eared bats consists of a wide variety of forested/wooded habitats, where they roost, forage, and travel, and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields, and pastures. Northern long-eared bats typically occupy their summer habitat from mid-May through mid-August each year.

The greatest and most immediate threat for the northern long-eared bat is the disease white-nose syndrome (WNS). Declines due to WNS have significantly reduced the number and size of northern long-eared bat populations in some areas of its range. This disease has reduced these populations to the extent that they may be increasingly vulnerable to other stressors that they may have previously had the ability to withstand.

Tricolored Bat (*Perimyotis subflavus)*
The tricolored bat was proposed as endangered by the USFWS on September 13, 2022. The tricolored bat is found east of the Rocky Mountains, up to southern Canada, as well as portions of eastern Mexico, and South America. Virginia is within the native range of the tricolored bat, and it has been documented in 39 U.S states. This bat is considered one of the smallest bats known in North America.

Suitable winter habitat (hibernacula) for the tricolored bat includes caves and cave-like structures (e.g., abandoned mines, active mines, railroad tunnels). In some southern locations, these bats will hibernate in unlikely places such as tree cavities, abandoned water wells, and roadside culverts. Tricolored bats have exhibited high fidelity in which they return to the same hibernaculum used in previous years.

In summer (non-hibernating) seasons, tricolored bats roost among live/dead leaf clusters, live/dead deciduous trees, Spanish moss (*Tillandsia usneoides),* and lichen (*Usnea trichodea*). These bats have also been observed using artificial summer roosts such as barns, bridges, and concrete bunkers but are unlikely to be found in caves.

Female tricolored bats tend to form maternity colonies to which they return every year. Often these females switch roost trees throughout the non-hibernating season. Male tricolored bats roost singly. Tricolored bat's diet consists of small insects such as caddisflies, moths, beetles and wasps, which they prey upon in early evening-late evening. In early evening they emerge from treetop level. Throughout the evening these bats forage over waterways and forest edges closer to the ground.

Similar to the northern long-eared bat, the largest threat to the tricolored bat species is the fungal disease white-nose syndrome. The fungus grows in bat's muzzles and wings and thrives in damp, cold places much like the hibernacula that the bats typically hibernate in. This fungus has been confirmed in 38 U.S states and 8 Canadian provinces.

Atlantic Pigtoe (*Fusconaia masoni*)
The Atlantic pigtoe was listed as federally threatened on December 17, 2021. In Virginia, its historical range included the James and Chowan River basins. The Atlantic pigtoe is a freshwater mussel species that prefers coarse sand and gravel of relatively fast-moving waters of small creeks to larger rivers and is rarely found in silt and detritus. Generally, it can be found inhabiting rivers with excellent water quality with a silt-free substrate. This species is being threatened by water pollution coming directly from sites such as sewage treatment plants, road drainage runoff, and private wastewater discharges; erosion; or dams that affect mussel populations by disrupting natural flow patterns, scouring river bottoms, changing water temperatures, and fragmenting habitat. To successfully reproduce it relies on host fish where the glochidia must attach to gills or fins to continue to develop. This mussel species is considered a short-term breeder.

James Spinymussel (*Parvaspina collina)*
The James Spinymussel was listed as federally endangered on July 22, 1988. It is a freshwater mussel found in the James River, Dan/Mayo River, and Roanoke River drainage in Virginia, West Virginia, and North Carolina. They are typically less than 3 inches in length and have a brown shell with short spines on each valve.

Yellow Lance (*Elliptio lanceolata*)
The yellow lance was federally listed as threatened on May 3, 2018 and state listed as threatened on July 1, 2019. It is known to occur in Maryland, Virginia, and North Carolina. No stable populations are known in Virginia. The yellow lance is a freshwater mussel that prefers clean, coarse to medium sized sands as stream bed substrate and is sometimes found in a gravel substrate of medium sized to smaller streams. The species is dependent on clean, moderate flowing water with high dissolved oxygen. It is found buried deep and moves with shifting sands at the downstream end of stable sand and gravel bars. To successfully reproduce it relies on host fish where the glochidia must attach to gills or fins to continue to develop. Some of the conservation challenges that contribute to the decline of this species are pollution, sedimentation, and dams.

Green Floater (*Lasmigona subviridis*)
The green floater has been listed as state threatened on July 1, 2006. It can be found from New York, south to Georgia, and west to Tennessee. This species inhabits small to medium-sized streams with sand and gravel bottoms and low current with water depths of one (1) to four (4) feet. It occurs in calm water areas with low to medium gradient, such as pools, and is intolerant of strong currents, flooding, or droughts. Good water quality is important to this species existence. The introduction of non-native mussel species, including zebra mussels and Asian clams, has negatively impacted green floater populations.

Loggerhead Shrike (*Lanius ludovicianus*)
The loggerhead shrike was state listed as threatened in Virginia in January 1992. This small bird species was once common throughout the United States; however, the species has undergone a substantial decline. It is believed that the population decline of the species is due to loss of habitat, pesticide contamination, disease, climate change, and competition with kestrels or starlings.

Loggerhead shrike foraging habitat includes areas of open country with grasslands having scattered shrubs and trees where it can perch on fence posts, telephone poles or open tree limbs. Most of the time it forges in areas of short grass. It relies on thorns, barbed wire, or other sharp objects to impale its prey since they do not have talons like a raptor. Its primary food source includes invertebrates, but it will also feed on snakes and small birds. It breeds in more open spaces and avoids dense deciduous woods as nesting areas. Loggerhead shrikes have been found nesting in conifers, spruces, firs, pines, apple trees and other low trees, elms, cottonwoods, hawthorns, and oaks and are never far from farmed lands.

Brook Floater (*Alasmidonta varicosa)*
The brook floater was listed as State Threatened in 1987 and State Endangered in January 1992. The range for this species is from Canada to Georgia, it is one of the rarest species in Virginia and may be locally extinct, as an alive individual has not been noted in more than 15 years. They depend on streams with clear, moving water and are sensitive to pollution, invasive species, and changes in climate.

Monarch Butterfly (*Danaus plexippus*)
The monarch butterfly was warranted for listing by the US Fish and Wildlife Service on December 15, 2020. Its current status under the Endangered Species Act is a candidate for listing and will be reviewed yearly until a listing decision is made. This species is one of the most recognizable species in North America with its orange and black markings. The population numbers of monarchs have declined over the past two decades due to habitat loss, fragmentation, and pesticide use which can destroy milkweed, a plant necessary for its survival. Additionally, a changing climate and weather events may have an impact on monarch populations.

Bald Eagle (*Haliaeetus leucocephalus*)
Bald eagles are no longer federally- or state-listed. Bald eagles were removed from the federal list in 2007 and from the state list in 2013. The bald eagle is common throughout Virginia where there is suitable habitat. They are a common summer and winter visitor in the Chesapeake Bay region and nearby

counties. The bald eagle forages along coastal areas, rivers, and large bodies of water. Nesting sites are commonly located in large, forested areas adjacent to marshes, on farmland, or in seed tree cut-over areas. Although some threats, such as contaminants or habitat loss may occur on a localized basis, none of the existing or potential threats are likely to cause the bald eagle to become in danger of extinction within the foreseeable future throughout all or any significant portion of its range.

Findings

Northern Long-eared Bat (Myotis septentrionalis)

The Project does not contain documented hibernacula for the northern long-eared bat, as shown on ***Exhibit 5***. The nearest known winter hibernacula is approximately 79.3 miles away from the study area. Suitable summer roosting and foraging habitat does exist in the study area, although the closest known maternity roost is approximately 87 miles away from the Green Ridge Project boundary.

Tricolored Bat (*Perimyotis subflavus)*

The Project does not contain suitable winter hibernacula or habitat for the tricolored bat, as shown on ***Exhibit 6***. The nearest known hibernacula is approximately 53-miles west of the Project.

On-Site Mussel Survey

The five protected mussel species detailed above were identified by the database searches, although none were identified as confirmed by the VAFWIS search. On-site surface waters flow to threatened and endangered waters (James River), located approximately 13.7 river miles away. Therefore, as part of due diligence, on May 25th and 26th, 2019, biologists Brett Ostby and Braven Beaty of Daguna Consulting, LLC visited the Green Ridge property to assess potential mussel habitat in streams and conduct surveys for freshwater mussels where necessary. Surveys were conducted to meet the requirements of "Abbreviated Surveys" as defined in "Freshwater Mussel Guidelines for Virginia (USFWS and VDGIF 2013)." Most efforts focused on Muddy Creek and Maple Swamp Creek. "None of the Muddy Creek tributaries draining the Green Ridge property appeared to provide suitable habitat for native mussels. We found no evidence to suggest Maple Swamp Creek or its tributaries were inhabited by native mussels" (see Daguna Consulting, "Surveys for Protected Freshwater Mussels at the Proposed Green Ridge Recycling and Disposal Facility in Cumberland County, VA Report" dated May 29th, 2019, Revised and Executive Summary Added March 27th, 2021) (***Exhibit 7***).

Loggerhead Shrike (*Lanius ludovicianus*)

The Project is unlikely to contain suitable habitat for the loggerhead shrike. Historically, the majority of the Project area appeared to be dense woodlands with planted pine used for timber production. Based off the most recent aerial imagery as shown on Google Earth, the parcel has large areas that have been managed for timber production. VAFWIS has not confirmed this species as being within a five (5) mile search radius. Open areas with hunting perches may exist within portions of the area. However, the landscape has been altered and is continually being managed for timber production and is in an early successional phase of regrowth. No suitable grasslands have been identified within the parcel boundary.

Monarch Butterfly (*Danaus plexippus*)

Consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act is not required for candidate species.

Bald Eagle (*Haliaeetus leucocephalus*)

The nearest known bald eagle nest is located approximately 7.6 miles from the Project; therefore, it is unlikely that the project will disturb nesting bald eagles. Additionally, the nearest bald eagle concentration area is approximately 44.5 miles from this project site which will not be intersected.

Exhibits

Exhibit 1

Cumberland County Database Search Results

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Cumberland County, Virginia

Local office

Virginia Ecological Services Field Office

(804) 693-6694
(804) 693-9032

6669 Short Lane
Gloucester, VA 23061-4410

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat Perimyotis subflavus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Clams

NAME	STATUS
Atlantic Pigtoe Fusconaia masoni Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5164	Threatened
James Spinymussel Parvaspina collina Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2212	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

NOT FOR CONSULTATION

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Jul 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 28 to Jul 20
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

NOT FOR CONSULTATION

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Wetland information is not available at this time

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Virginia Department of Game and Inland Fisheries

4/19/2023 1:11:21 PM

Fish and Wildlife Information Service

VaFWIS Search Report (Option: show as IPA Report) Compiled on 4/19/2023, 1:11:21 PM

Help

Database Search found in **(049) Cumberland [County], VA;**

View Map of Site Location

399 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 22) (22 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
050022	FEST	Ia	Bat, northern long-eared	Myotis septentrionalis		BOVA
060017	FESE	Ia	Spinymussel, James	Parvaspina collina		BOVA
060003	FESE	Ia	Wedgemussel, dwarf	Alasmidonta heterodon		BOVA
060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Potential	HU6,TEWater,Habitat
060029	FTST	IIa	Lance, yellow	Elliptio lanceolata		BOVA,HU6
050020	SE	Ia	Bat, little brown	Myotis lucifugus		BOVA
050034	SE	Ia	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		HU6
050027	FPSE	Ia	Bat, tri-colored	Perimyotis subflavus		BOVA
060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Potential	Habitat
040293	ST	Ia	Shrike, loggerhead	Lanius ludovicianus		BOVA
060081	ST	IIa	Floater, green	Lasmigona subviridis	Potential	HU6,TEWater,Habitat
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
030063	CC	IIIa	Turtle, spotted	Clemmys guttata	Yes	BOVA,HU6,SppObs
030012	CC	IVa	Rattlesnake, timber	Crotalus horridus		HU6
060084		Ib	Pigtoe, Virginia	Lexingtonia subplana		BOVA
040213		Ic	Owl, northern saw-whet	Aegolius acadicus	Yes	BOVA,HU6,SppObs
040052		IIa	Duck, American black	Anas rubripes		BOVA,HU6

040320		IIa	Warbler, cerulean	Setophaga cerulea		BOVA,HU6
040140		IIa	Woodcock, American	Scolopax minor	Yes	BOVA,HU6,BBA,SppObs
040105		IIb	Rail, king	Rallus elegans		BOVA
060019		IIc	Pebblesnail, panhandle	Somatogyrus virginicus	Yes	SppObs
100166		IIc	Skipper, Dotted	Hesperia attalus slossonae		HU6

To view **All 399 species** View 399

*FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; CC=Collection Concern

**I=VA Wildlife Action Plan - Tier I - Critical Conservation Need;
II=VA Wildlife Action Plan - Tier II - Very High Conservation Need;
III=VA Wildlife Action Plan - Tier III - High Conservation Need;
IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need
Virginia Widlife Action Plan Conservation Opportunity Ranking:
a - On the ground management strategies/actions exist and can be feasibly implemented.;
b - On the ground actions or research needs have been identified but cannot feasibly be implemented at this time.;
c - No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

View Map of All Query Results from All Observation Tables

Anadromous Fish Use Streams (2 records)

View Map of All Anadromous Fish Use Streams

Stream ID	Stream Name	Reach Status	Anadromous Fish Species			View Map
			Different Species	Highest TE*	Highest Tier**	
P180	Willis river	Potential	0			Yes
P189	James River 4	Potential	0			Yes

Impediments to Fish Passage (41 records - displaying first 20)

View Map of All Fish Impediments

ID	Name	River	View Map
821	ARROWHEAD LAKE DAM	TR-WILLIS RIVER	Yes
1060	ATKINS DAM	TR-DRY CREEK	Yes
706	BARRETT DAM	TR-WILLIS RIVER	Yes
1048	BEAR CREEK DAM	BEAR CREEK	Yes
695	BENELLI DAM	BUCK AND GAME CREEK	Yes
699	BISH DAM	BEAR CREEK	Yes
686	BLANTON DAM	TR-ANGOLA CREEK	Yes
705	BONBROOK LAKE DAM		Yes
1056	CA IRA DAM	WILLIS RIVER	Yes
1050	CLAYTON DAM	MAXEY MILL CREEK	Yes
1051	CLEMENTS DAM	TEAR WALLET CREEK	Yes
700	COLLINS LOWER DAM	TR-WALLET CREEK	Yes

1049	COLLINS UPPER DAM	TR-TEAR WALLET CREEK	Yes
1053	FLIPPEN DAM	MUDDY CREEK	Yes
704	FROST DAM	BROAD BRANCH	Yes
1052	GARRETT DAM	LITTLE GUINEA CREEK	Yes
698	GNEGY DAM	TEAR WALLET CREEK	Yes
1057	INGLE DAM	GREEN CREEK	Yes
696	JONES DAM	DOE BRANCH	Yes
688	KNORR DAM	TR-JAMES RIVER	Yes

To view **All 41 Fish Impediment records** View 41

Colonial Water Bird Survey

N/A

Threatened and Endangered Waters (68 Reaches - displaying first 20)

View Map of All Threatened and Endangered Waters

Stream Name	T&E Waters Species						View Map
	Highest TE*	BOVA Code, Status*, Tier**, Common & Scientific Name					
(0238080)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
(0242413)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
(0245920)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
(0247486)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
(0248285)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
(0249650)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0233100)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0233754)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0234546)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0235090)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes

		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0237296)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0238317)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0238627)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0239971)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0241156)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0241335)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0241700)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0242736)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0243348)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0243521)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0244490)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (0245815)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (0246024)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes

To view **All 68 Threatened and Endangered Waters records** View 68

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests (2 records)

View Map of All Query Results
Bald Eagle Nests

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
CM0401	2	May 1 2004	HISTORIC	Yes
CM1001	1	May 10 2010	UNKNOWN	Yes

Displayed 2 Bald Eagle Nests

Species Observations (348 records - displaying first 20 , 1 Observation with Threatened or Endangered species)

View Map of All Query Results
Species Observations

obsID	class	Date Observed	Observer	N Species			View Map
				Different Species	Highest TE*	Highest Tier**	
315204	SppObs	Jun 30 2004	Stephen Ritchie, Rob Ritchie, James Ritchie	1	CC	III	Yes
612446	SppObs	Nov 19 2011	Robert; Reilly	1		I	Yes
602529	SppObs	Nov 27 2009	Risa; Elliot	1		I	Yes
606775	SppObs	Nov 20 2009	Risa; Elliot	1		I	Yes
606869	SppObs	Nov 17 2009	Risa; Elliot	1		I	Yes
607352	SppObs	Nov 16 2009	Risa; Elliot	1		I	Yes
607307	SppObs	Nov 15 2009	Risa; Elliot	1		I	Yes
601196	SppObs	Nov 14 2009	Risa; Elliot	1		I	Yes
607329	SppObs	Dec 25 2008	Risa; Elliot	1		I	Yes
608051	SppObs	Nov 23 2008	Risa; Elliot	1		I	Yes
601448	SppObs	Nov 22 2008	Risa; Elliot	1		I	Yes
602406	SppObs	Nov 12 2008	Risa; Elliot	1		I	Yes

601385	SppObs	Nov 10 2008	Risa; Elliot	1		I	Yes
604556	SppObs	Nov 1 2008	Risa; Elliot	1		I	Yes
603564	SppObs	Oct 30 2008	Risa; Elliot	1		I	Yes
605654	SppObs	Oct 29 2008	Risa; Elliot	1		I	Yes
602298	SppObs	Mar 2 2008	Risa; Elliot	1		I	Yes
600711	SppObs	Feb 9 2008	Risa; Elliot	1		I	Yes
602675	SppObs	Feb 8 2008	Risa; Elliot	1		I	Yes
600438	SppObs	Jan 11 2008	Risa; Elliot	1		I	Yes

Displayed 20 Species Observations

Selected 348 Observations View all 348 Species Observations

Habitat Predicted for Aquatic WAP Tier I & II Species (16 Reaches)

View Map Combined Reaches from Below of Habitat Predicted for WAP Tier I & II Aquatic Species

Stream Name	Tier Species						View Map
	Highest TE*	BOVA Code, Status*, Tier**, Common & Scientific Name					
Appomattox River (20802071)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (20802071)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
Appomattox River (20802072)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Appomattox River (20802072)	FTST	060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	Yes
James River (20802031)	FTSE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes
		060081	ST	IIa	Floater, green	Lasmigona subviridis	
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
James River (20802032)	FTSE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes
		060081	ST	IIa	Floater, green	Lasmigona subviridis	
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	

James River (20802051)	FTSE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes
		060081	ST	IIa	Floater, green	Lasmigona subviridis	
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
James River (20802052)	FTSE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes
		060081	ST	IIa	Floater, green	Lasmigona subviridis	
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Randolph Creek (20802051)	ST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
Randolph Creek (20802052)	ST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
Rivanna River (20802042)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Tongue Quarter Creek (20802051)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
Tongue Quarter Creek (20802051)	ST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
tributary (20802051)	ST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
tributary (20802052)	FTST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni	
tributary (20802052)	ST	060081	ST	IIa	Floater, green	Lasmigona subviridis	Yes

Habitat Predicted for Terrestrial WAP Tier I & II Species

N/A

Virginia Breeding Bird Atlas Blocks (9 records)

View Map of All Query Results
Virginia Breeding Bird Atlas Blocks

BBA ID	Atlas Quadrangle Block Name	Breeding Bird Atlas Species	View Map

		Different Species	Highest TE*	Highest Tier**	
44106	Arvonia, SE	59		III	Yes
43074	Farmville, CE	27		IV	Yes
44096	Gold Hill, SE	46		II	Yes
44083	Hillcrest, CW	53		II	Yes
44086	Hillcrest, SE	59		III	Yes
45106	Lakeside Village, SE	64		III	Yes
45105	Lakeside Village, SW	44		III	Yes
45096	Whiteville, SE	55		III	Yes
43086	Willis Mtn., SE	63		II	Yes

Public Holdings: (2 names)

Name	Agency	Level
Bear Creek Lake State Park	VA Dept. of Conservation and Recreation	State
Cumberland State Forest	VA Dept. of Forestry	State

USGS National 6th Order Watersheds Summary of Wildlife Action Plan Tier I, II, III, and IV Species:

HU6 Code	USGS 6th Order Hydrologic Unit	Different Species	Highest TE	Highest Tier
JA05	Appomattox River-Ducker Creek	54	FTST	I
JA09	Appomattox River-Bad Luck Branch	46	FTST	I
JA16	Appomattox River-Angola Creek	49		I
JA17	Appomattox River-Sandy Creek	49	SS	I
JA18	Big Guinea Creek	36		II
JA19	Appomattox River-Little Guinea Creek	51	SE	I
JM58	James River-Bear Garden Creek	55	FTST	I
JM62	James River-Hooper Rock Creek	56	FTST	I
JM64	Willis River-Whispering Creek	50	SS	II
JM65	Little Willis River	47	SS	II
JM66	Willis River-Buffalo Creek	50	SS	II
JM67	Hatcher Creek	46	SS	II
JM68	Willis River-Bonbrook Creek	49	ST	II
JM69	Randolph Creek	46	ST	II
JM70	Willis River-Trice Lake	43	FTST	I
JM71	Muddy Creek	51	FTSE	I
JM72	James River-Picketts Creek	60	FTSE	I
JM73	Deep Creek-Maxey Mill Creek	49	SE	I

Compiled on 4/19/2023, 1:11:22 PM I1482957.1 report=DB searchType= R dist= poi= 741384 4156478

Database Search Timing: initialize=0.03, BOVA=0.21, HU6=0.48, BBA=0.41, SppObs=1.40, BAEANests=0.06, CWB=0.06, Trout=0.02, TEWater=0.14, BECAR=0.02, TierReaches=0.11, TierTerrestrial=0.02, Anadromous=0.03, Impediments=0.05, PublicLand=0.03, Total=4.20

audit no. 1482957 4/19/2023 1:11:22 PM Virginia Fish and Wildlife Information Service

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Natural Heritage Resources

Your Criteria

Taxonomic Group: Select All

Global Conservation Status Rank: Select All

State Conservation Status Rank: Select All

Federal Legal Status: Select All

State Legal Status: Select All

County: Cumberland

Search Run: 4/18/2023 14:02:52 PM

Result Summary

Total Species returned: 4

Total Communities returned: 0

Click scientific names below to go to NatureServe report.

Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Scientific Name Linked	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
Cumberland								
BIRDS								
Loggerhead Shrike	Lanius ludovicianus	Lanius ludovicianus	G4	S1B,S2N	None	LT	41	N
BIVALVIA (MUSSELS)								
Yellow Lance	Elliptio lanceolata	Elliptio lanceolata	G2	S2	LT	LT	46	N
Atlantic Pigtoe	Fusconaia masoni	Fusconaia masoni	G1	S2	LT	LT	30	N
Green Floater	Lasmigona subviridis	Lasmigona subviridis	G3	S2	None	LT	67	N

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.

For Additional Information on locations of Natural Heritage Resources please submit an information request.

Exhibit 2

Green Ridge Recycling and Disposal Facility Database Search Results

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Cumberland and Powhatan counties, Virginia

Local office

Virginia Ecological Services Field Office

(804) 693-6694
(804) 693-9032

6669 Short Lane
Gloucester, VA 23061-4410

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat Perimyotis subflavus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

NOT FOR CONSULTATION

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Jul 31
Cerulean Warbler Dendroica cerulea This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 28 to Jul 20
Chimney Swift Chaetura pelagica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Kentucky Warbler Oporornis formosus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prairie Warbler Dendroica discolor This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler Protonotaria citrea This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird Euphagus carolinus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

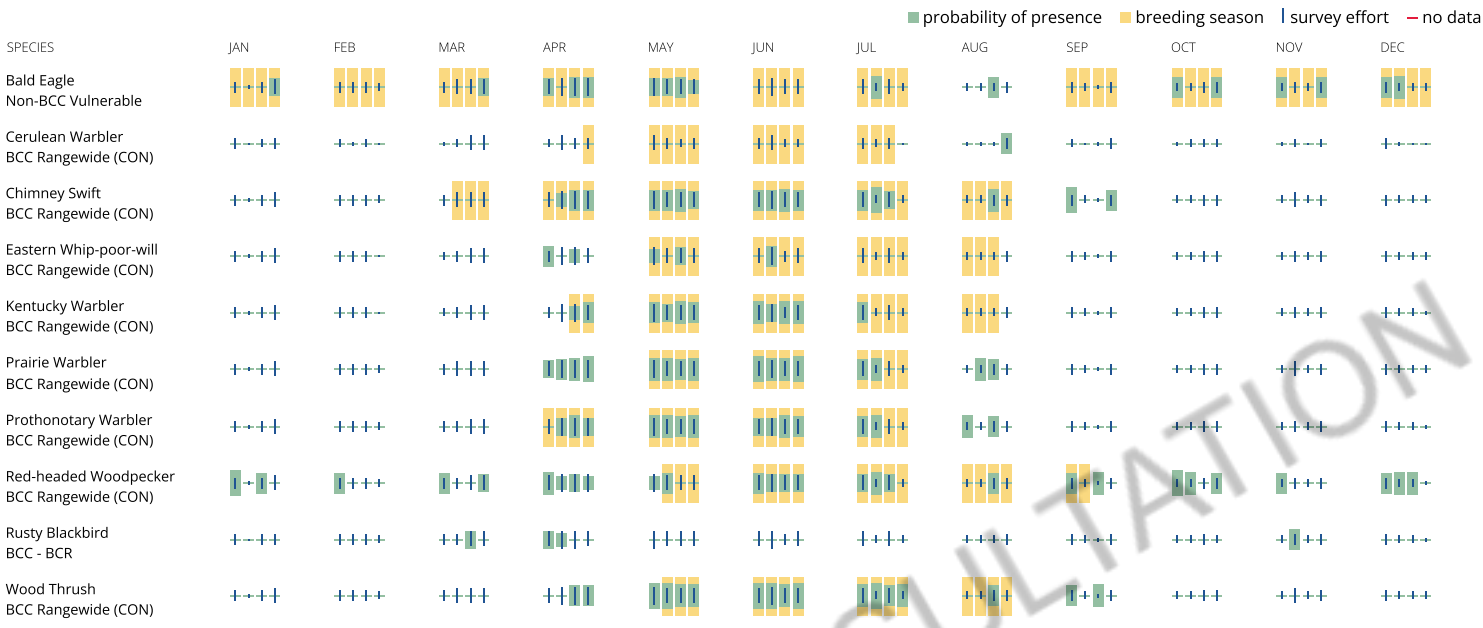
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

NOT FOR CONSULTATION

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

The area of this project is too large for IPaC to load all NWI wetlands in the area. The list below may be incomplete. Please contact the local U.S. Fish and Wildlife Service office or visit the NWI map for a full list.

FRESHWATER EMERGENT WETLAND

- PEM1Eb
- PEM1/SS1Eb
- PEM1/SS1Cb
- PEM1Cb
- PEM1F
- PEM1E
- PEM1Fb
- PEM1C
- PEM1A
- PEM1Ch
- PEM1Eh
- PEM1/SS1C
- PEM1/UBFb
- PEM1/SS1A
- PEM1Ah
- PEM1/FO1Eb
- PEM1Fh
- PEM1/SS1E
- PEM1Ab
- PEM1/SS1Fh

NOT FOR CONSULTATION

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1A
- PFO1C
- PFO1E
- PFO1Eb
- PFO1/SS1Eb
- PSS1Eb
- PSS1/EM1Eb
- PFO1/SS1E
- PFO1/SS1C
- PSS1A
- PFO1Cb
- PSS1C
- PSS/EM1Eb
- PSS1Cb
- PFO1/SS1Cb
- PSS1E
- PSS1/EM1E
- PSS1/FO1Eb
- PSS/EM1Cb
- PFO1/EM1Eb
- PSS1/EM1C
- PFO1Eh
- PSS1/EM1Cb
- PFO1/SS1A
- PSS1/FO1E
- PSS1/FO1Cb
- PSS1F
- PSS1/EM1Ed
- PSS1/EM1F
- PFO1Fb
- PFO1D
- PSS1/EM1Fb
- PFO1/EM1E
- PFO5/EM1Fb
- PSS1/FO1C
- PFO1/4A
- PSS1/FO1A
- PFO1/4C
- PFO/EM1A
- PSS1/UBFb
- PSS1Fb
- PFO1Ab
- PSS1/EM1A
- PSS1Fh
- PFO5Fb
- PFO5Fh
- PFO1Ch
- PSS1Ch
- PSS/EM1F

FRESHWATER POND

- PUBHh
- PABHh
- PUBHb
- PABFh
- PABHb
- PUBFb
- PUBFh
- PUBH

LAKE

- L1UBHh
- L2EM2F
- L2ABHh
- L2EM2Fh

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

NOT FOR CONSULTATION

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

Site Location

37,34,43.0 -78,07,52.3
is **the Search Point**

Show Position Rings
○ Yes ◉ No
4 miles and 1 mile at the **Search Point**

Show Search Area
◉ Yes ○ No
5 Search distance miles radius

Search Point is at map center

Base Map Choices
Topography

Map Overlay Choices
Current List: Search, BECAR, BAEANests, TEWaters, TierII, Habitat, Trout, Anadromous

Map Overlay Legend

T & E Waters
Federal
State

Predicted Habitat WAP Tier I & II
Aquatic
Terrestrial

Trout Waters
Class I - IV
Class V - VI

Anadromous Fish Reach
Confirmed
Potential

Impediment

5 mile radius Search Area

Bald Eagle Concentration Areas and Roosts

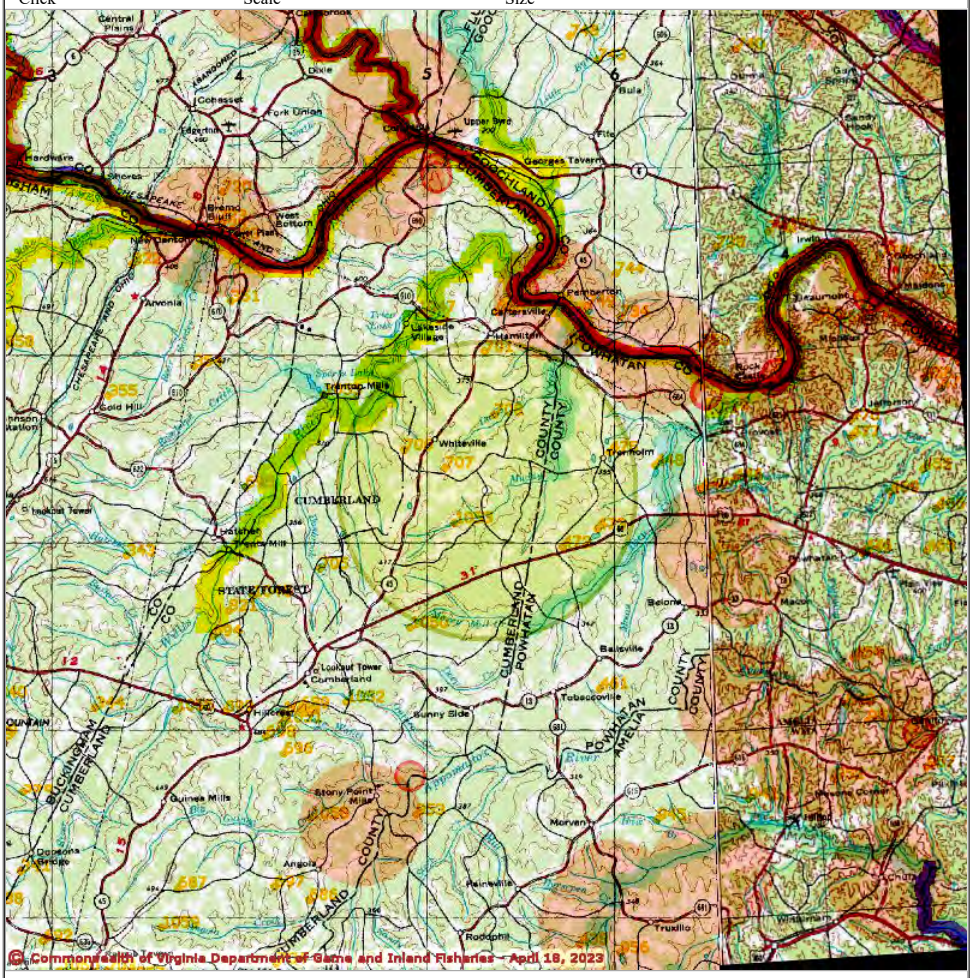
Bald Eagle Nests

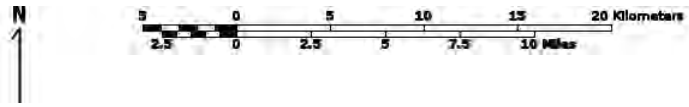
Data Observation Site

Virginia Fish and Wildlife Information Service

back 37,44,05.8 -77,50,28.5 Refresh Browser Page

Map Click Pan Id M Map Scale In Zoom Out Screen Size Small Size Big Help





Point of Search 37,34,43.0 -78,07,52.3
Map Location 37,34,43.0 -78,07,52.3

Select **Coordinate System:**
◉ Degrees,Minutes,Seconds Latitude - Longitude
○ Decimal Degrees Latitude - Longitude
○ Meters UTM NAD83 East North Zone
○ Meters UTM NAD27 East North Zone

Base Map source: USGS 1:250,000 topographic maps (see Microsoft terraserver-usa.com for details)

Map projection is UTM Zone 17 NAD 1983 with left 727735 and top 4188532. Pixel size is 64 meters . Coordinates displayed are Degrees, Minutes, Seconds North and West. Map is currently displayed as 800 columns by 800 rows for a total of 640000 pixles. The map display represents 51200 meters east to west by 51200 meters north to south for a total of 2621.4 square kilometers. The map display represents 168007 feet east to west by 168007 feet north to south for a total of 1012.4 square miles.

A UTM Zone change occurs within the image.The right-hand side of the image is a pseudo projection from UTM Zone 18 into UTM Zone 17 resulting in reduced spatial accuracy within the portion of the image occurring in UTM Zone 18.

Topographic maps and Black and white aerial photography for year 1990+-
are from the United States Department of the Interior, United States Geological Survey.
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic
http://www.national.geographic.com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries.

map assembled 2023-04-18 14:11:25 (qa/qc March 21, 2016 12:20 - tn=1482655.0 dist=8045 I)
$poi=37.5786111 -78.1311944

© 1998-2023 Commonwealth of Virginia Department of Game and Inland Fisheries

VaFWIS Initial Project Assessment Report Compiled on 4/18/2023, 2:10:09 PM

Help

Known or likely to occur within a **5 mile radius around point 37,34,43.0 -78,07,52.3** in **049 Cumberland County, 145 Powhatan County, VA**

View Map of Site Location

421 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 20) (20 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
050022	FEST	Ia	Bat, northern long-eared	Myotis septentrionalis		BOVA
060017	FESE	Ia	Spinymussel, James	Parvaspina collina		BOVA
060003	FESE	Ia	Wedgemussel, dwarf	Alasmidonta heterodon		BOVA
060173	FTST	Ia	Pigtoe, Atlantic	Fusconaia masoni		BOVA,Habitat
060029	FTST	IIa	Lance, yellow	Elliptio lanceolata		BOVA
050020	SE	Ia	Bat, little brown	Myotis lucifugus		BOVA
050034	SE	Ia	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		BOVA
050027	FPSE	Ia	Bat, tri-colored	Perimyotis subflavus		BOVA
060006	SE	Ib	Floater, brook	Alasmidonta varicosa		BOVA
040293	ST	Ia	Shrike, loggerhead	Lanius ludovicianus		BOVA
060081	ST	IIa	Floater, green	Lasmigona subviridis		BOVA,Habitat
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
030063	CC	IIIa	Turtle, spotted	Clemmys guttata		BOVA
060084		Ib	Pigtoe, Virginia	Lexingtonia subplana		BOVA
040213		Ic	Owl, northern saw-whet	Aegolius acadicus		BOVA
040052		IIa	Duck, American black	Anas rubripes		BOVA
040029		IIa	Heron, little blue	Egretta caerulea caerulea		BOVA
040320		IIa	Warbler, cerulean	Setophaga cerulea		BOVA
040140		IIa	Woodcock, American	Scolopax minor		BOVA
040105		IIb	Rail, king	Rallus elegans		BOVA

To view **All 421 species** View 421

*FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; CC=Collection Concern

**I=VA Wildlife Action Plan - Tier I - Critical Conservation Need; II=VA Wildlife Action Plan - Tier II - Very High Conservation Need; III=VA Wildlife Action Plan - Tier III - High Conservation Need; IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need
Virginia Widlife Action Plan Conservation Opportunity Ranking:
a - On the ground management strategies/actions exist and can be feasibly implemented.; b - On the ground actions or research needs have been identified but cannot feasibly be implemented at this time.;
c - No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

Bat Colonies or Hibernacula: **Not Known**

Anadromous Fish Use Streams (1 records)

View Map of All Anadromous Fish Use Streams

Stream ID	Stream Name	Reach Status	Anadromous Fish Species			View Map
			Different Species	Highest TE*	Highest Tier**	
P180	Willis river	Potential	0			Yes

Impediments to Fish Passage (9 records)

View Map of All Fish Impediments

ID	Name	River	View Map
706	BARRETT DAM	TR-WILLIS RIVER	Yes
472	BEVINS POND DAM	TR-DEEP CREEK	Yes
1050	CLAYTON DAM	MAXEY MILL CREEK	Yes
1053	FLIPPEN DAM	MUDDY CREEK	Yes
708	L. G. ATKINS DAM	TR-DAVIS CREEK	Yes
473	NIXONS DAM	HORSEPEN BRANCH	Yes
701	ROBERTSON DAM	TR-DEEP RUN	Yes
707	SANDERSON DAM	DAVIS CREEK	Yes
475	WILLIS DAM	TR-DEEP CREEK	Yes

Colonial Water Bird Survey

N/A

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests

N/A

Habitat Predicted for Aquatic WAP Tier I & II Species (4 Reaches)

View Map Combined Reaches from Below of Habitat Predicted for WAP Tier I & II Aquatic Species

Stream Name	Tier Species					View Map
	Highest TE*	BOVA Code, Status*, Tier**, Common & Scientific Name				
Deep Creek (20802051)	ST	060081	ST	IIa	Floater, green Lasmigona subviridis	Yes
Tongue Quarter Creek (20802051)	FTST	060081	ST	IIa	Floater, green Lasmigona subviridis	Yes
		060173	FTST	Ia	Pigtoe, Atlantic Fusconaia masoni	
tributary (20802051)	ST	060081	ST	IIa	Floater, green Lasmigona subviridis	Yes
tributary (20802052)	ST	060081	ST	IIa	Floater, green Lasmigona subviridis	Yes
tributary (20802052)	ST	060081	ST	IIa	Floater, green Lasmigona subviridis	Yes

Habitat Predicted for Terrestrial WAP Tier I & II Species

N/A

Public Holdings:

N/A

Compiled on 4/18/2023, 2:10:09 PM I1482655.0 report=IPA searchType= R dist= 8045 poi= 37,34,43.0 -78,07,52.3

PixelSize=64; Anadromous=0.030394; BECAR=0.024259; Bats=0.022912; Buffer=0.370269; County=0.064971; Impediments=0.025115; Init=0.400708; PublicLands=0.037461; SppObs=0.373424; TEWaters=0.030654; TierReaches=0.054929; TierTerrestrial=0.086755; Total=1.341998; Tracking_BOVA=0.15382; Trout=0.032378

Natural Heritage Resources

Your Criteria

Taxonomic Group: Select All

Watershed (8 digit HUC): 02080205 - Middle James-Willis River

Subwatershed (12 digit HUC): JM71 - Muddy Creek-Davis Creek

Search Run: 4/18/2023 13:45:01 PM

Result Summary

Total Species returned: 4

Total Communities returned: 0

Click scientific names below to go to NatureServe report.

Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Scientific Name Linked	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
Middle James-Willis								
Muddy Creek-Davis Creek								
BIRDS								
Loggerhead Shrike	Lanius ludovicianus	Lanius ludovicianus	G4	S1B,S2N	None	LT	41	N
BIVALVIA (MUSSELS)								
Yellow Lance	Elliptio lanceolata	Elliptio lanceolata	G2	S2	LT	LT	46	N
Atlantic Pigtoe	Fusconaia masoni	Fusconaia masoni	G1	S2	LT	LT	30	N
Green Floater	Lasmigona subviridis	Lasmigona subviridis	G3	S2	None	LT	67	N

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.

For Additional Information on locations of Natural Heritage Resources please submit an information request.

To Contribute information on locations of natural heritage resources, please fill out and submit a rare species sighting form.

Exhibit 3

Bald Eagle Information

https://ccbbirds.org/maps/#eagles

The CENTER for CONSERVATION BIOLOGY

About Us | What We Do | Resources | News Room | Give to CCB

CCB MAPPING PORTAL

Help / FAQ

Toggle Draw Tools | Generate Link | Print Report | Search

Leaflet | © OpenStreetMap contributors, CartoDB attribution

Layers

Bald Eagle
- VA Eagle Nest Locator

Zoom to Extents

Most recent data CCB has on bald eagle nest locations in Virginia. Data is largely from two annual aerial flights conducted in winter and spring of all tributaries of the lower Chesapeake Bay and other prominent bodies of water. Reported ground survey data is also included.

More info

- VA Eagle Nest Buffers
- Eagle Roosts
- Eagle Roost Polygons
- Eagle Roost Buffers
- Eagle Roosts by Topoquad

Waterbirds
- Shorebird Roost Registry
- Colonial Waterbirds 2018
- Colonial Waterbirds 2013
- Chesapeake Bay Herons 2013
- Colonial Waterbirds 2008
- Colonial Waterbirds 2003

Osprey
- OspreyWatch Nests
- Chesapeake Bay Osprey Nests 1995-1996

Nightjars
- Nightjar Survey Network Routes

5 km
3 mi

Measure Distances and Areas

Last Point
37° 37' 21.09" N / 78° 00' 30.01" W
37.622526 / -78.008337

Path Distance 40,046 Feet (7.58 Miles)

Cancel | Finish Measurement

Glen Allen
Short Pump
Lakeside
Tuckahoe
Powhatan
Bon Air
Midlothian
Cumberland
Chester
Farmville

BALD EAGLE

Toggle Legends | VA Eagle Nest Locator

https://www.arcgis.com/home/webmap/viewer.html?webmap=8fa548ea54f543a2b2dbe9c9853a81d1

ArcGIS | USFWS Bald Eagle Concentration Areas - Virginia

Modify Map | Sign In

Details | Basemap | Share | Print | Measure | Bookmarks | Find address or place

About | Content | Legend

Legend

Bald Eagle Concentration Areas

- December 15 to March 15
- May 15 to August 31 and December 15 to March 15

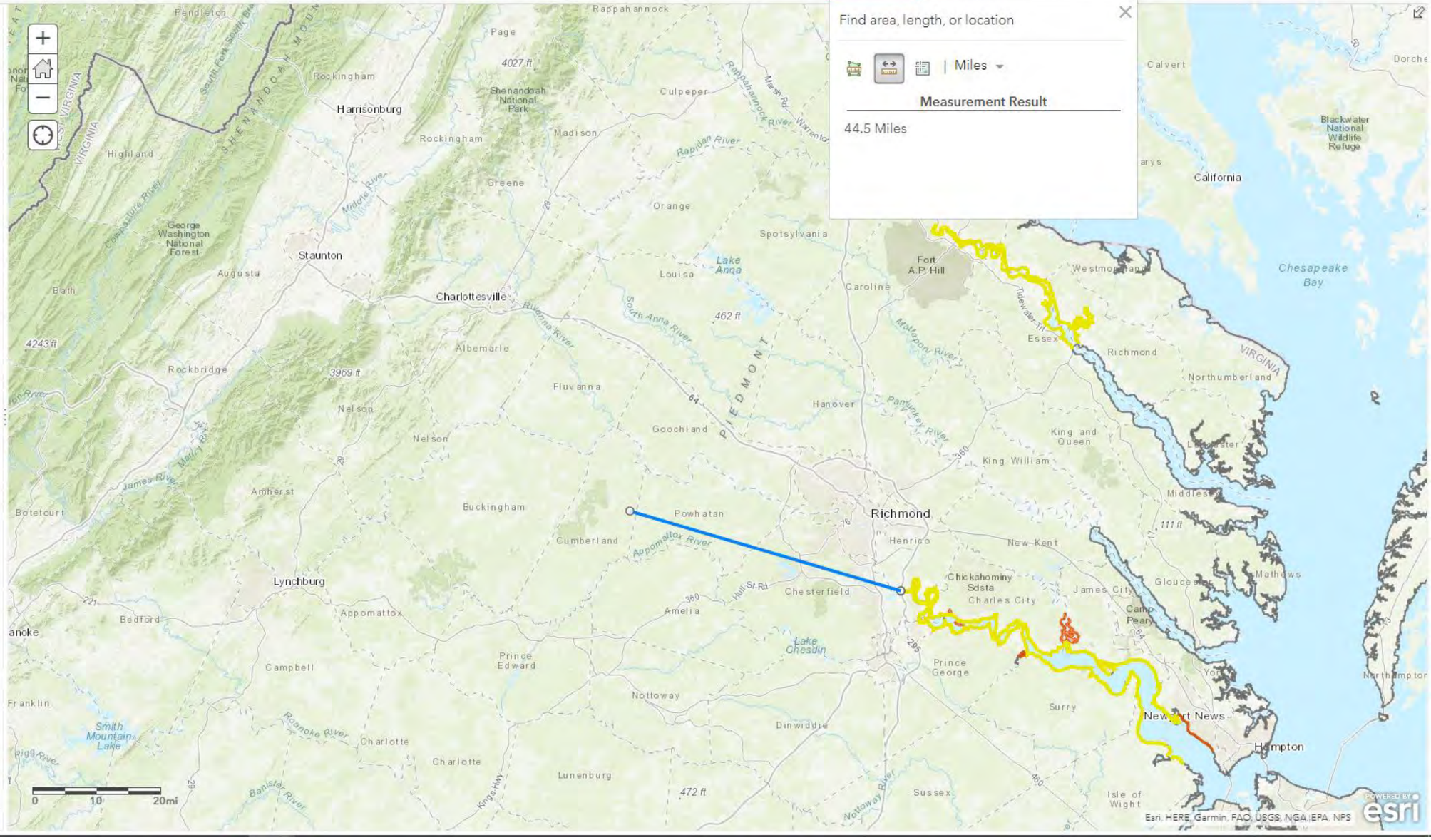
Virginia

Find area, length, or location

Miles

Measurement Result

44.5 Miles



Trust Center | Legal | Contact Esri | Report Abuse

Exhibit 4

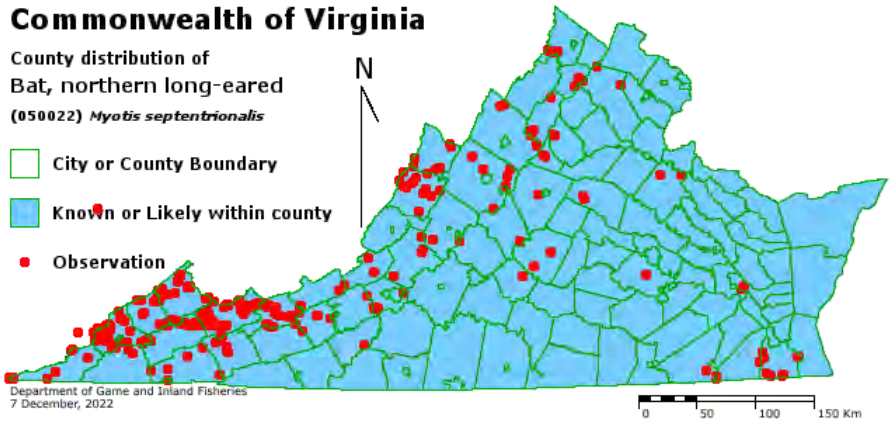
Species Occurrences

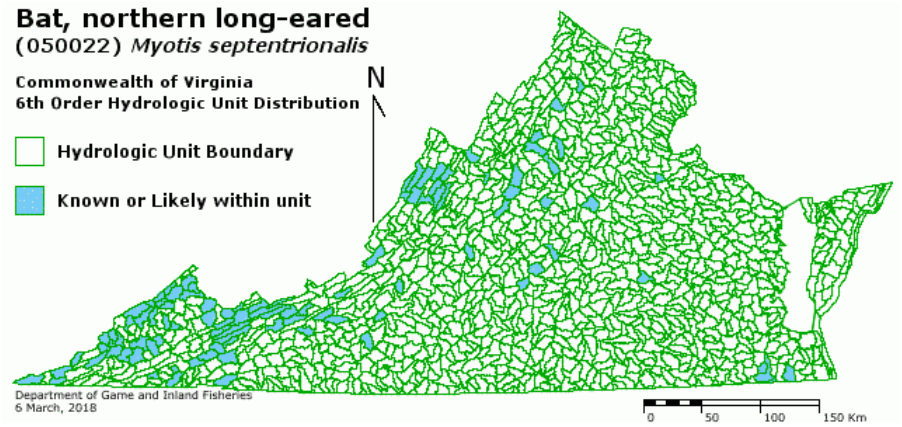
Virginia Department of Game and Inland Fisheries

4/18/2023 7:18:22 PM

Fish and Wildlife Information Service

Occurence chapter for Bat, northern long-eared (050022)





County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
001	Accomack	2 - Likely		
003	Albemarle	1 - Known		
005	Alleghany	2 - Likely		
007	Amelia	2 - Likely		
009	Amherst	2 - Likely		
011	Appomattox	1 - Known		
013	Arlington	2 - Likely		
015	Augusta	1 - Known	1 - Known	
017	Bath	1 - Known	1 - Known	
019	Bedford	2 - Likely		
021	Bland	1 - Known	1 - Known	
023	Botetourt	1 - Known		
025	Brunswick	2 - Likely		
027	Buchanan	1 - Known		
029	Buckingham	1 - Known		
031	Campbell	2 - Likely		
033	Caroline	1 - Known		

035	Carroll	2 - Likely		
036	Charles City	2 - Likely		
037	Charlotte	2 - Likely		
041	Chesterfield	1 - Known		
043	Clarke	2 - Likely		
045	Craig	1 - Known	1 - Known	
047	Culpeper	2 - Likely		
049	Cumberland	2 - Likely		
051	Dickenson	1 - Known	1 - Known	
053	Dinwiddie	2 - Likely		
057	Essex	2 - Likely		
059	Fairfax	2 - Likely		
061	Fauquier	1 - Known		
063	Floyd	1 - Known		
065	Fluvanna	2 - Likely		
067	Franklin	2 - Likely		
069	Frederick	1 - Known		
071	Giles	1 - Known	1 - Known	
073	Gloucester	2 - Likely		
075	Goochland	2 - Likely		
077	Grayson	2 - Likely		
079	Greene	1 - Known		
081	Greensville	2 - Likely		
083	Halifax	2 - Likely		
085	Hanover	2 - Likely		
087	Henrico	2 - Likely		
089	Henry	2 - Likely		
091	Highland	1 - Known	1 - Known	
093	Isle of Wight	2 - Likely		
095	James City	2 - Likely		
097	King and Queen	2 - Likely		
099	King George	2 - Likely		
101	King William	2 - Likely		
103	Lancaster	2 - Likely		
105	Lee	1 - Known	1 - Known	
107	Loudoun	2 - Likely		
109	Louisa	1 - Known		
111	Lunenburg	2 - Likely		
113	Madison	1 - Known		
115	Mathews	2 - Likely		
117	Mecklenburg	2 - Likely		
119	Middlesex	2 - Likely		
121	Montgomery	2 - Likely		
125	Nelson	1 - Known		
127	New Kent	1 - Known		
131	Northampton	2 - Likely		
133	Northumberland	2 - Likely		
135	Nottoway	2 - Likely		
137	Orange	2 - Likely		
139	Page	1 - Known		

141	Patrick	2 - Likely		
143	Pittsylvania	2 - Likely		
145	Powhatan	2 - Likely		
147	Prince Edward	2 - Likely		
149	Prince George	2 - Likely		
153	Prince William	2 - Likely		
155	Pulaski	1 - Known		
157	Rappahannock	2 - Likely		
159	Richmond	2 - Likely		
161	Roanoke	1 - Known		
163	Rockbridge	1 - Known	1 - Known	
165	Rockingham	1 - Known	1 - Known	
167	Russell	1 - Known		
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173	Smyth	1 - Known		
175	Southampton	1 - Known		
177	Spotsylvania	2 - Likely		
179	Stafford	2 - Likely		
181	Surry	2 - Likely		
183	Sussex	2 - Likely		
185	Tazewell	1 - Known	1 - Known	
187	Warren	1 - Known		
191	Washington	1 - Known		
193	Westmoreland	2 - Likely		
195	Wise	1 - Known	1 - Known	
197	Wythe	1 - Known		
199	York	1 - Known		
510	Alexandria City	2 - Likely		
515	Bedford City	2 - Likely		
520	Bristol City	2 - Likely		
530	Buena Vista City	2 - Likely		
540	Charlottesville City	2 - Likely		
550	Chesapeake City	1 - Known		
560	Clifton Forge City	2 - Likely		
570	Colonial Heights City	2 - Likely		
580	Covington City	2 - Likely		
590	Danville City	2 - Likely		
595	Emporia City	2 - Likely		
600	Fairfax City	2 - Likely		
610	Falls Church City	2 - Likely		
620	Franklin City	2 - Likely		
630	Fredericksburg City	2 - Likely		
640	Galax City	2 - Likely		
650	Hampton City	2 - Likely		
660	Harrisonburg City	2 - Likely		
670	Hopewell City	2 - Likely		
678	Lexington City	2 - Likely		
680	Lynchburg City	2 - Likely		
683	Manassas City	2 - Likely		
685	Manassas Park City	2 - Likely		

690	Martinsville City	2 - Likely		
700	Newport News City	1 - Known		
710	Norfolk City	2 - Likely		
720	Norton City	2 - Likely		
730	Petersburg City	2 - Likely		
735	Poquoson City	2 - Likely		
740	Portsmouth City	2 - Likely		
750	Radford City	2 - Likely		
760	Richmond City	2 - Likely		
770	Roanoke City	2 - Likely		
775	Salem City	2 - Likely		
780	South Boston City	2 - Likely		
790	Staunton City	1 - Known	1 - Known	
800	Suffolk City	1 - Known		
810	Virginia Beach City	2 - Likely		
820	Waynesboro City	1 - Known		
830	Williamsburg City	2 - Likely		
840	Winchester City	2 - Likely		

General Occurrence Comments: Most of the bat surveying has been done in the caves of western Virginia and therefore the list of confirmed counties occurs in those counties. Most sources say that this bat is statewide (11321,147,152) but there is very little data to back this up. It is not collected often mainly because the habit of roosting singly or in very small groups in the very darkest cracks and crevices makes them difficult to survey *9261*.

Resident Occurrence Comments: Most of the bat surveying has been done in the caves of southwestern Virginia and therefore that is where the concentration of confirmed counties is. Most sources say that this bat is statewide (11321,147,152) but there is very little data to back this up. It is not collected often mainly because its habits of roosting singly or in very small groups in the very darkest cracks and crevices, makes them difficult to survey *9261*.

Seasonal Occurrence Comments: Most of the bat surveying has been done in the caves of southwestern Virginia and therefore that is where the concentration of confirmed counties is. Most sources say that this bat is statewide (11321,147,152) but there is very little data to back this up. It is not collected often mainly because its habits of roosting singly or in very small groups in the very darkest cracks and crevices, makes them difficult to survey *9261*. This species is found year round in all the counties previously mentioned *8867*.

References for County Occurrence

Ref.Id	Citation
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89	Douglas, H.H., 1964, Caves of Virginia, 761 pgs., VA Reg. of the Nat'l Speleological Soc.
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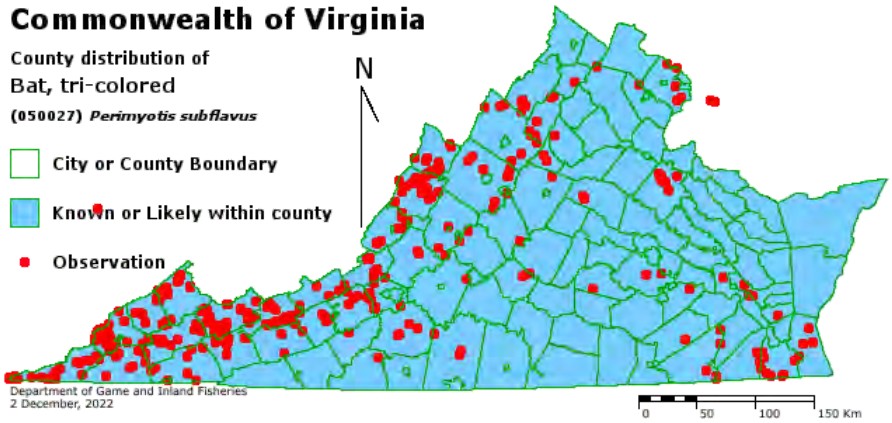
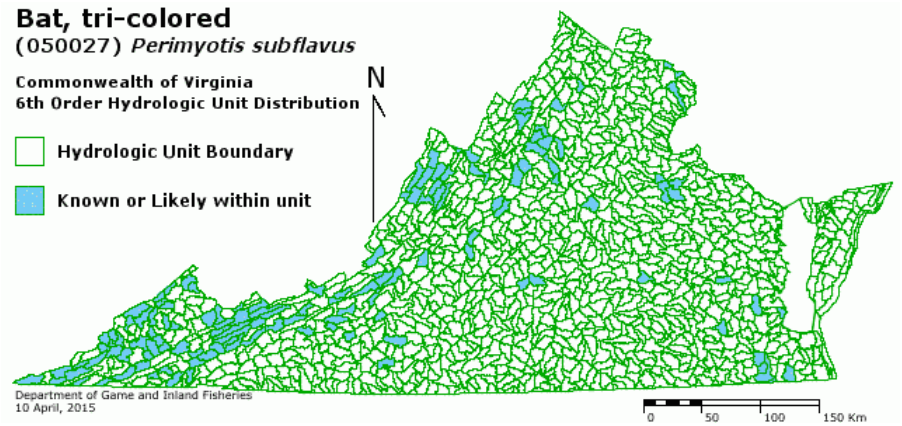
Fish and Wildlife Information Service

Occurence chapter for Bat, tri-colored (050027)





County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
001	Accomack	2 - Likely		
003	Albemarle	1 - Known	1 - Known	
005	Alleghany	1 - Known	1 - Known	
007	Amelia	1 - Known	1 - Known	
009	Amherst	1 - Known		
011	Appomattox	1 - Known		
013	Arlington	1 - Known	1 - Known	
015	Augusta	1 - Known	1 - Known	
017	Bath	1 - Known	1 - Known	
019	Bedford	1 - Known	1 - Known	
021	Bland	1 - Known	1 - Known	
023	Botetourt	1 - Known	1 - Known	
025	Brunswick	1 - Known		
027	Buchanan	1 - Known		
029	Buckingham	2 - Likely		
031	Campbell	2 - Likely		
033	Caroline	1 - Known		

035	Carroll	2 - Likely		
036	Charles City	2 - Likely		
037	Charlotte	2 - Likely		
041	Chesterfield	1 - Known		
043	Clarke	2 - Likely		
045	Craig	1 - Known	1 - Known	
047	Culpeper	2 - Likely		
049	Cumberland	2 - Likely		
051	Dickenson	1 - Known		
053	Dinwiddie	2 - Likely		
057	Essex	2 - Likely		
059	Fairfax	1 - Known	1 - Known	
061	Fauquier	1 - Known	1 - Known	
063	Floyd	1 - Known		
065	Fluvanna	2 - Likely		
067	Franklin	1 - Known		
069	Frederick	2 - Likely		
071	Giles	1 - Known	1 - Known	
073	Gloucester	1 - Known		
075	Goochland	2 - Likely		
077	Grayson	2 - Likely		
079	Greene	1 - Known		
081	Greensville	1 - Known		
083	Halifax	2 - Likely		
085	Hanover	1 - Known	1 - Known	
087	Henrico	2 - Likely		
089	Henry	2 - Likely		
091	Highland	1 - Known	1 - Known	
093	Isle of Wight	1 - Known		
095	James City	1 - Known		
097	King and Queen	2 - Likely		
099	King George	2 - Likely		
101	King William	2 - Likely		
103	Lancaster	2 - Likely		
105	Lee	1 - Known	1 - Known	
107	Loudoun	2 - Likely		
109	Louisa	1 - Known		
111	Lunenburg	2 - Likely		
113	Madison	1 - Known		
115	Mathews	2 - Likely		
117	Mecklenburg	2 - Likely		
119	Middlesex	2 - Likely		
121	Montgomery	1 - Known	1 - Known	
125	Nelson	1 - Known		
127	New Kent	2 - Likely		
131	Northampton	2 - Likely		
133	Northumberland	2 - Likely		
135	Nottoway	1 - Known		
137	Orange	2 - Likely		
139	Page	1 - Known	1 - Known	

141	Patrick	2 - Likely		
143	Pittsylvania	1 - Known		
145	Powhatan	2 - Likely		
147	Prince Edward	2 - Likely		
149	Prince George	1 - Known		
153	Prince William	1 - Known	1 - Known	
155	Pulaski	1 - Known		
157	Rappahannock	2 - Likely		
159	Richmond	2 - Likely		
161	Roanoke	1 - Known	1 - Known	
163	Rockbridge	1 - Known	1 - Known	
165	Rockingham	1 - Known	1 - Known	
167	Russell	1 - Known	1 - Known	
169	Scott	1 - Known	1 - Known	
171	Shenandoah	1 - Known	1 - Known	
173	Smyth	1 - Known	1 - Known	
175	Southampton	1 - Known	1 - Known	
177	Spotsylvania	2 - Likely		
179	Stafford	2 - Likely		
181	Surry	2 - Likely		
183	Sussex	1 - Known		
185	Tazewell	1 - Known	1 - Known	
187	Warren	1 - Known	1 - Known	
191	Washington	1 - Known	1 - Known	
193	Westmoreland	2 - Likely		
195	Wise	1 - Known	1 - Known	
197	Wythe	1 - Known		
199	York	1 - Known		
510	Alexandria City	2 - Likely		
515	Bedford City	2 - Likely		
520	Bristol City	2 - Likely		
530	Buena Vista City	2 - Likely		
540	Charlottesville City	2 - Likely		
550	Chesapeake City	1 - Known	1 - Known	
560	Clifton Forge City	1 - Known	1 - Known	
570	Colonial Heights City	2 - Likely		
580	Covington City	2 - Likely		
590	Danville City	2 - Likely		
595	Emporia City	2 - Likely		
600	Fairfax City	2 - Likely		
610	Falls Church City	2 - Likely		
620	Franklin City	2 - Likely		
630	Fredericksburg City	2 - Likely		
640	Galax City	2 - Likely		
650	Hampton City	1 - Known	1 - Known	
660	Harrisonburg City	1 - Known		
670	Hopewell City	2 - Likely		
678	Lexington City	2 - Likely		
680	Lynchburg City	2 - Likely		
683	Manassas City	1 - Known	1 - Known	
685	Manassas Park City	2 - Likely		

690	Martinsville City	2 - Likely		
700	Newport News City	1 - Known		
710	Norfolk City	1 - Known	1 - Known	
720	Norton City	2 - Likely		
730	Petersburg City	2 - Likely		
735	Poquoson City	2 - Likely		
740	Portsmouth City	2 - Likely		
750	Radford City	2 - Likely		
760	Richmond City	1 - Known		
770	Roanoke City	2 - Likely		
775	Salem City	2 - Likely		
780	South Boston City	2 - Likely		
790	Staunton City	2 - Likely		
800	Suffolk City	1 - Known	1 - Known	
810	Virginia Beach City	1 - Known		
820	Waynesboro City	2 - Likely		
830	Williamsburg City	2 - Likely		
840	Winchester City	2 - Likely		

General Occurrence Comments: This species has been found in the following caves during surveys conducted over the past five years -1983-84- Ann Davies 1, Barnes Dry 4, Cauliflower 29, Chimney Rock 10, Fallen Rock 3, Fiddlers 3, Glenwood Church 66, Jingling 10, MBC 10, Stonleys 124, Ward Cove 161, Wolf Arbor 8 -1984-85- Blowing 93, Breathing 79, Buchanan Saltpetre 44, Cauliflower 17, Elvas 2, Green Chapel 2, Leffel 17, Marble 2, Marshalls 9, MBC 4, Perrys Saltpetre 82, Rocky Hollow 36, Starr Chapel 90, Three dead cows 3 -1985-86- Arbegast Saltpetre 40, Catawba Muder Hole 35, Clarks 187, Gully 30, Kelly 71, Leather Rock 24, Millers Cove 54, Mossy Hole 1, Mt. Grove Saltpetre 40, Newberry-bane 62, Newcastle Murder Hole 372, Perkins 7, Repass Saltpetre 65, Shenandoah Caverns 1, Tawneys 390, Truck 3, Varners 9, Witheros 629, Wood 1 -1986-87- Buchanan Saltpetre 33, Bundys No. 2 83, Clarks 58, Crackers Net Saltpetre 8, Cumberland Gap Saltpetre 12, Franklins Pit 3, Grassy Spring 36, Hairy Hole 20, Little Saltpetre 29, Maddens 7, McFadden 4, McIntyres 6, Mustoe Ulcer 5, Parsonage 135, Parsons 10, Powell Mt. Saltpetre 4, Roy Lyle 24, Saltpetre 6, Seabolt 10, Shavers 5, Siphon No. 1 172, Siphon No. 2 13, Speers Ferry 4, Spence 2, Starr Chapel 121, Starr Chapel Little 99, Staunton Aqueduct 150, Woods-Terry 113 -1987-88- Big Kennedy 13, Bucket 2, Carter 6, Cattle 42, Clarks 160, Curve Saltpetre 21, Gilly 7, Hamilton 79, Hupmans Saltpetre 92, Johnson 3, Jones Saltpetre 41, Kerns Saltpetre 1, Little Kennedy 2, Neals 1, Paul Penley's 86, Reasors 7, Rufe Caldwell 126, Shires 44, Sinking Springs Saltpetre 1, Spangler 45, Starr Chapel 94, Witheros 256 *8867*.

Resident Occurrence Comments: In the past five years, the following sitings have been made in the corresponding caves -1983-84- Ann Davies 1, Barnes Dry 4, Cauliflower 29, Chimney 10, Fallen Rock 3, Fiddlers 3, Glenwood Church 66, Jingling 10, MBC 10, Stonleys 124, Ward Cove 161, Wolf Arbor 8 -1984-85- Blowing 93, Breathing 79, Buchanan Saltpetre 44, Cauliflower 17, Elvas 2, Green Chapel 2, Leffel 17, Marble 2, Marshalls 9, MBC 4, Perrys Saltpetre 82, Rocky Hollow 36, Starr Chapel 90, Three Dead Cows 3 -1985-86- Arbegast Saltpetre 40, Catawba Muder Hole 35, Clarks 187, Gully 30, Kelly 71, Leather Rock 24, Millers Cove 54, Mossy Hole 1, Mt. Grove Saltpetre 40, Newberry-Bane 62, Newcastle Murder Hole 372, Perkins 7, Repass Saltpetre 65, Shenandoah Caverns 1, Tawneys 390, Truck 3, Varners 9, Witheros 629, Wood -1986-87- Buchanan Saltpetre 33, Bundys No.2 83, Clarks 58, Crackers Nest Saltpetre 8, Cumberland Gap Saltpeter 12, Franklins Pit 3, Grassy Springs 36, Hairy Hole 20, Little Saltpetre 29, Maddens 7, McFadden 4, McIntyres 6, Mustoe Ulcer 5, Parsonage 135, Parsons 10, Powell Mt. Saltpetre 4, Roy Lyle 24, Saltpetre 6, Seabolt 10, Shavers 5, Siphon No.1 172, Sipon No.2 172, Speers Ferry 4, Spence 2, Starr Chapel 121, Starr Chapel Little 99, Staunton Aqueduct 150, Woods-Terry 113 -1987-88- Big Kennedy 13, Bucket 2, Carter 6, Cattle 42, Clarks 160, Curve Saltpetre 21, Gilley 7, Hamilton 79, Hupmans Saltpetre 92, Johnsons 3, Jones Saltpetre 41, Kern's Saltpetre 1, Little Kennedy 2, Neals 1, Paul Penley,s 86, Reasor 7, Rufe Caldwell 126, Shires 44, Sinking Springs Saltpetre 1, Spangler 45, Starr Chapel 94, Witheros 256 *8867*.

Seasonal Occurrence Comments: The summer and winter ranges of this species coincide *19*.

References for County Occurrence

Ref.Id	Citation
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134	Hall, E.R., 1981, The Mammals of North America, Vol. 1,2, 1271 pgs., John Wiley and Sons, New York
152	Handley, C.O., Jr., Patton, C.P., 1947, Wild Mammals of Virginia, 220 pgs., Virginia Commission of Game and Inland Fisheries, Richmond, VA
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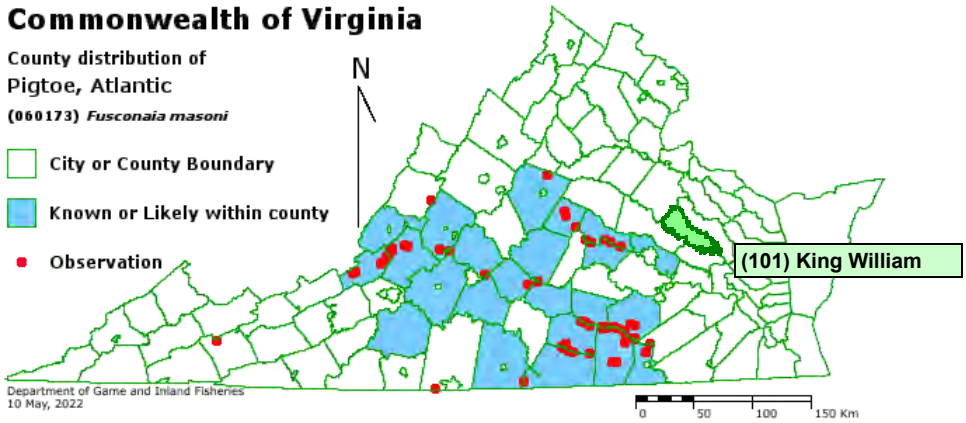
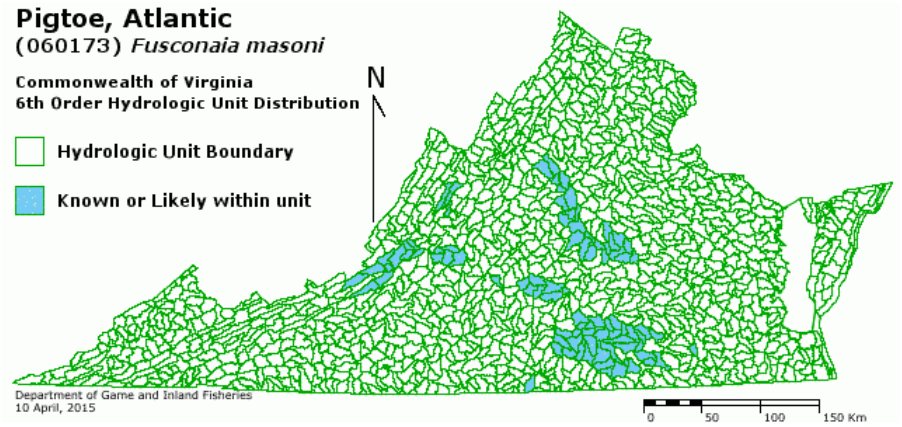
Fish and Wildlife Information Service

Occurence chapter for Pigtoe, Atlantic (060173)





County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
003	Albemarle	1 - Known		
005	Alleghany	1 - Known		
009	Amherst	1 - Known		
011	Appomattox	1 - Known		
019	Bedford	1 - Known		
023	Botetourt	1 - Known		
025	Brunswick	1 - Known		
029	Buckingham	1 - Known		
031	Campbell	1 - Known		
045	Craig	1 - Known		
053	Dinwiddie	1 - Known		
065	Fluvanna	1 - Known		
067	Franklin	1 - Known		
075	Goochland	1 - Known		
081	Greensville	1 - Known		
083	Halifax	1 - Known		
087	Henrico	1 - Known		

111	Lunenburg	1 - Known		
117	Mecklenburg	1 - Known		
135	Nottoway	1 - Known		
145	Powhatan	1 - Known		
147	Prince Edward	1 - Known		
163	Rockbridge	1 - Known		

General Occurrence Comments: The Atlantic pigtoe is known from the James, Roanoke and Nottoway river systems in Virginia, south to the Ogeechee River system in Georgia. Recent records include tributaries of the James River between Albermarle and Henrico counties, the Craig Creek drainage in Craig, Alleghany and Botetourt counties and the Appomattox River, Prince Edward County; Roanoke River drainage in Franklin and Bedford counties; and Meherrin River, Mecklenburg County *9286*.

Seasonal Occurrence Comments: Mussels are very sedentary, therefore seasonal occurrence and general occurrence are the same *8825*.

References for County Occurrence

Ref.Id	Citation
9286	Terwilliger, K.T., 1991, Virginia's endangered species: Proceedings of a symposium. Coordinated by the Virginia Dept. of Game and Inland Fisheries, Nongame and Endangered Species Program, 672 pp. pgs., McDonald and Woodward Publ. Comp., Blacksburg, VA

USGS National 6th Order Watershed Occurrences

HU6	6th Order Watershed Name
CM01	Middle Meherrin River
CM02	South Meherrin River-Finneywood Creek
CM03	South Meherrin River-Blackstone Creek
CM05	North Meherrin River-Big Juniper Creek
CM06	Couches Creek
CM07	North Meherrin River-Reedy Creek
CM08	Meherrin River-Mason Creek
CM09	Meherrin River-Crooked Creek
CM10	Flat Rock Creek
CM11	Meherrin River-Stony Creek
CM12	Meherrin River-Taylors Creek
CM13	Genito Creek
CM14	Meherrin River-Allen Creek
CM16	Great Creek
CM17	Meherrin River-Coldwater Creek
CU01	Nottoway River-Dry Creek
CU02	Modest Creek
CU03	Big Hounds Creek
CU04	Nottoway River-Falls Creek
CU06	Little Nottoway River-Whetstone Creek
CU07	Nottoway River-Cedar Creek
CU08	Hurricane Branch-Long Branch
CU09	Nottoway River-Red Oak Creek
CU10	Tommeheton Creek
CU11	Nottoway River-Beaver Pond Creek
CU12	Waqua Creek
CU13	Nottoway River-Turkey Egg Creek
CU14	Sturgeon Creek
CU15	Nottoway River-Indian Creek
CU16	Buckskin Creek
CU23	Upper Sappony Creek
CU24	Lower Sappony Creek

CU36	Nottoway River-Parker Run
CU37	Three Creek-Slagles Lake
CU38	Maclins Creek
CU39	Three Creek-Otterdam Swamp
JA01	Appomattox River-Wolf Creek
JA02	Appomattox River-Suanee Creek
JA03	Appomattox River-Fishpond Creek
JA04	Vaughans Creek
JA05	Appomattox River-Ducker Creek
JA08	Buffalo Creek-Locket Creek
JA09	Appomattox River-Bad Luck Branch
JM01	James River-Otter Creek
JM13	James River-Beck Creek
JM58	James River-Bear Garden Creek
JM62	James River-Hooper Rock Creek
JM70	Willis River-Trice Lake
JM71	Muddy Creek
JM72	James River-Picketts Creek
JM74	Deep Creek-Sallee Creek
JM75	James River-Solomons Creek
JM77	Big Lickinghole Creek
JM78	James River-Mohawk Creek
JM79	Beaverdam Creek
JM80	James River-Fine Creek
JM81	Norwood Creek
JM82	James River-Little River
JM83	James River-Bernards Creek
JR09	North Fork Rivanna River-Lynch River
JR10	Swift Run
JR11	North Fork Rivanna River-Jacobs Run
JR12	Preddy Creek
JR13	North Fork Rivanna River-Flannigan Branch
JR17	Rivanna River-Carroll Creek
JR18	Mechunk Creek
JR19	Rivanna River-Stigger Creek
JR20	Cunningham Creek
JR21	Ballinger Creek
JR22	Rivanna River-Carys Creek
JU40	James River-Black Lick
JU41	Craig Creek-Trout Creek
JU43	Craig Creek-Broad Run
JU44	Upper Johns Creek
JU45	Lower Johns Creek
JU46	Craig Creek-Rolands Run Branch
JU47	Barbours Creek
JU48	Craig Creek-Mill Creek
JU49	Patterson Creek
JU50	Craig Creek-Roaring Run
JU51	James River-Lapsley Run
JU58	James River-Roaring Run
JU59	Cedar Creek-Spring Gap Creek

JU60	James River-Elk Creek
JU65	Calfpasture River-Fridley Branch
JU66	Mill Creek-Cabin Creek
JU68	Calfpasture River-Guys Run
JU86	Maury River-Poague Run
RD75	Aarons Creek-John H Kerr Reservoir

6th Order Hydrologic Unit Comments: 6th order hydrologic unit distribution reviewed in year 2009 by Virginia Department of Game and Inland Fisheries Taxonomic Advisory Committees.

References for 6th Order Hydrologic Unit

Ref.Id	Citation
12325	VDGIF, 2009, Tiered Species Distributions by 6th Order Watershed, as Reviewed by VDGIF's Taxonomic Advisory Committees

audit no. 1482722 4/18/2023 7:20:06 PM Virginia Fish and Wildlife Information Service

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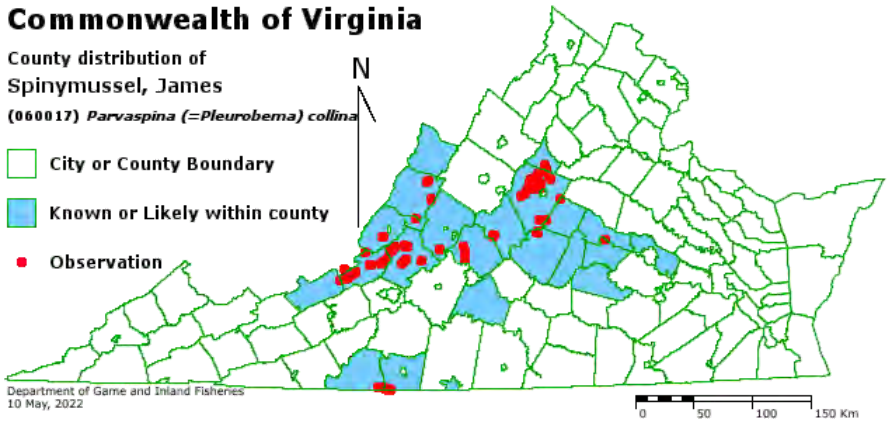
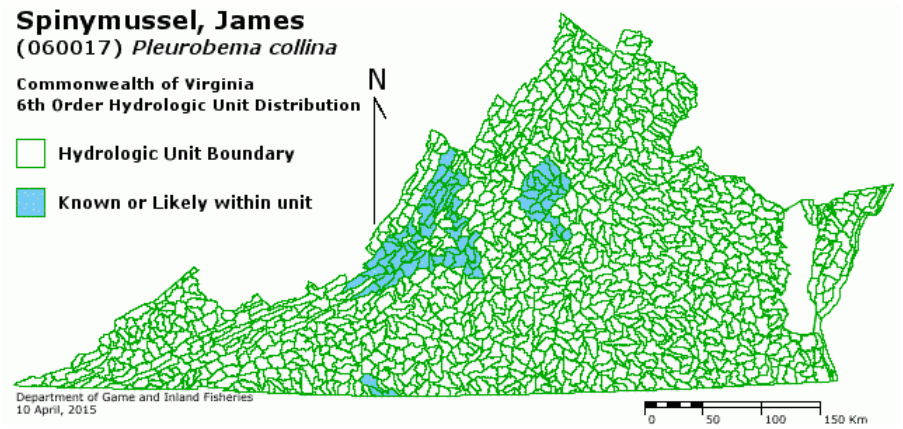
Fish and Wildlife Information Service

Occurence chapter for Spinymussel, James (060017)





County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
003	Albemarle	1 - Known	1 - Known	
005	Alleghany	1 - Known		
007	Amelia	1 - Known		
009	Amherst	1 - Known	1 - Known	
017	Bath	1 - Known		
023	Botetourt	1 - Known	1 - Known	
029	Buckingham	1 - Known		
031	Campbell	1 - Known		
045	Craig	1 - Known	1 - Known	
049	Cumberland	1 - Known		
065	Fluvanna	1 - Known		
071	Giles	1 - Known	1 - Known	
075	Goochland	1 - Known		
079	Greene	1 - Known		
087	Henrico	1 - Known		
089	Henry	1 - Known		
091	Highland	1 - Known		

125	Nelson	1 - Known		
141	Patrick	1 - Known		
145	Powhatan	1 - Known		
163	Rockbridge	1 - Known		
590	Danville City	1 - Known		

General Occurrence Comments: This species is endemic to the James River drainage and is know to occur in the following streams: Craig, Johns, Dicks, Patterson and Catawba, and Potts creeks in Craig and Botetourt counties; Mechums River and Rocky Run, and Licking Hole Creek. Albermarle County; and Pedlar River, Amherst County, Virginia *9286*.

Resident Occurrence Comments: This species is endemic to the James River drainage and is known to occur in the following streams: Craig, Johns, Dicks, Patterson and Catawba creeks in Craig and Botetourt counties; Mechums River and Rocky Run, Albermarle County; and Pedlar River, Amherst County, Virginia *9286*.

Seasonal Occurrence Comments: Mussels are very sedentary, therefore seasonal occurrence and general occurrence are the same *8825*.

References for County Occurrence

Ref.Id	Citation
2098	Beetle, D.E., 1973, A checklist of the land and freshwater mollusks of Virginia, Sterkiana, Vol. 49, pg. 21-25
8823	Program, VA Natural Heritage, 1988, Heritage Program mussel locations.
9286	Terwilliger, K.T., 1991, Virginia's endangered species: Proceedings of a symposium. Coordinated by the Virginia Dept. of Game and Inland Fisheries, Nongame and Endangered Species Program, 672 pp. pgs., McDonald and Woodward Publ. Comp., Blacksburg, VA

USGS National 6th Order Watershed Occurrences

HU6	6th Order Watershed Name
JM01	James River-Otter Creek
JM03	James River-Thomas Mill Creek
JM04	Pedlar River-Lynchburg Reservoir
JM05	Pedlar River-Browns Creek
JM06	Pedlar River-Horsley Creek
JM07	James River-Judith Creek
JM45	James River-Little George Creek
JM46	North Fork Hardware River
JM47	South Fork Hardware River
JM48	Hardware River-Turkey Run
JM49	Hardware River-Woodson Creek
JM50	James River-Bremo Creek
JR01	Mechums River-Stockton Creek
JR02	Mechums River-Beaver Creek
JR03	Moormans River-North Moormans River
JR04	Doyles River
JR05	Moormans River-Wards Creek
JR06	Buck Mountain Creek
JR07	Ivy Creek-Little Ivy Creek
JR08	South Fork Rivanna River
JR09	North Fork Rivanna River-Lynch River
JR10	Swift Run
JR11	North Fork Rivanna River-Jacobs Run
JR12	Preddy Creek
JR13	North Fork Rivanna River-Flannigan Branch
JR14	Rivanna River-Meadow Creek
JR15	Moores Creek
JU17	Potts Creek-Trout Branch
JU18	Potts Creek-Mill Branch

JU19	Potts Creek-Cast Steel Run
JU20	Potts Creek-Hays Creek
JU21	Jackson River-Pounding Mill Creek
JU24	Jackson River-Smith Creek
JU27	Cowpasture River-Benson Run
JU28	Bullpasture River-Davis Run
JU29	Bullpasture River-Crab Run
JU30	Cowpasture River-Scotchtown Draft
JU31	Dry Run
JU32	Cowpasture River-Thompson Creek
JU33	Stuart Run-Lick Run
JU34	Cowpasture River-Mill Creek
JU35	Pads Creek
JU36	Cowpasture River-Simpson Creek
JU37	James River-Big Creek
JU40	James River-Black Lick
JU41	Craig Creek-Trout Creek
JU42	Meadow Creek
JU43	Craig Creek-Broad Run
JU44	Upper Johns Creek
JU45	Lower Johns Creek
JU46	Craig Creek-Rolands Run Branch
JU47	Barbours Creek
JU48	Craig Creek-Mill Creek
JU49	Patterson Creek
JU50	Craig Creek-Roaring Run
JU51	James River-Lapsley Run
JU52	Catawba Creek-Little Catawba Creek
JU53	Catawba Creek-Town Branch
JU54	James River-Hickory Hollow Branch
JU56	James River-Purgatory Creek
JU58	James River-Roaring Run
JU60	James River-Elk Creek
JU63	Calfpasture River-Holloway Draft
JU64	Hamilton Branch
JU65	Calfpasture River-Fridley Branch
JU66	Mill Creek-Cabin Creek
JU68	Calfpasture River-Guys Run
JU70	Lower Little Calfpasture River
JU71	Maury River-Taylor Branch
JU74	Maury River-Alone Mill Creek
JU76	Maury River-Mill Creek
JU81	Maury River-Bennetts Run
JU86	Maury River-Poague Run
RD06	Upper South Mayo River-Poorhouse Creek
RD07	Russell Creek
RD09	Lower South Mayo River-Crooked Creek

6th Order Hydrologic Unit Comments: 6th order hydrologic unit distribution reviewed in year 2009 by Virginia Department of Game and Inland Fisheries Taxonomic Advisory Committees.

References for 6th Order Hydrologic Unit

Ref.Id	Citation
12325	VDGIF, 2009, Tiered Species Distributions by 6th Order Watershed, as Reviewed by VDGIF's Taxonomic Advisory Committees

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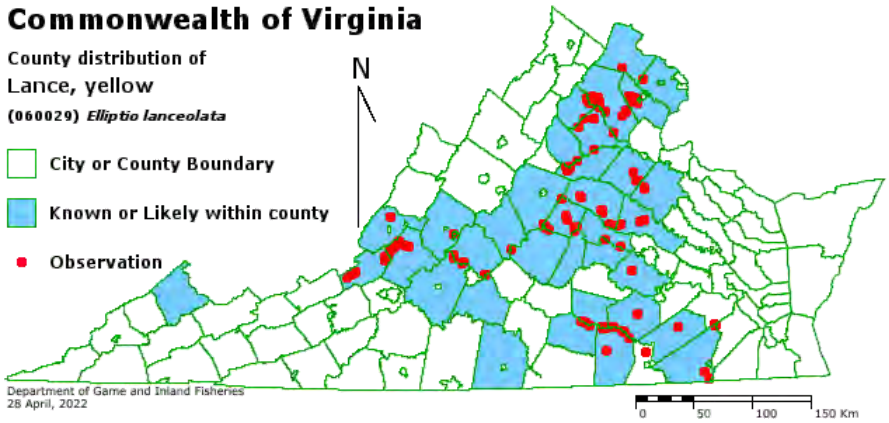
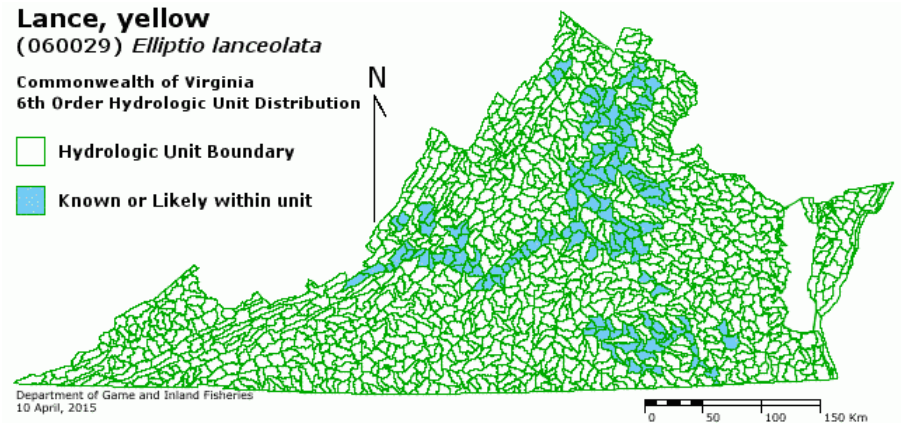
Fish and Wildlife Information Service

Occurence chapter for Lance, yellow (060029)





County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
003	Albemarle	1 - Known		
005	Alleghany	1 - Known		
009	Amherst	1 - Known		
019	Bedford	1 - Known		
023	Botetourt	1 - Known		
025	Brunswick	1 - Known		
027	Buchanan		1 - Known	
029	Buckingham	1 - Known		
031	Campbell	1 - Known	1 - Known	
033	Caroline	1 - Known		
041	Chesterfield	1 - Known		
045	Craig	1 - Known		
047	Culpeper	1 - Known	1 - Known	
049	Cumberland	1 - Known	1 - Known	
053	Dinwiddie	1 - Known		
059	Fairfax	1 - Known	1 - Known	
061	Fauquier	1 - Known	1 - Known	

065	Fluvanna	1 - Known	1 - Known	
075	Goochland	1 - Known	1 - Known	
083	Halifax	1 - Known	1 - Known	
085	Hanover	1 - Known	1 - Known	
107	Loudoun	1 - Known		
109	Louisa	1 - Known	1 - Known	
111	Lunenburg	1 - Known		
113	Madison	1 - Known		
125	Nelson	1 - Known		
135	Nottoway	1 - Known		
137	Orange	1 - Known	1 - Known	
145	Powhatan	1 - Known	1 - Known	
153	Prince William	1 - Known	1 - Known	
157	Rappahannock	1 - Known		
163	Rockbridge	1 - Known	1 - Known	
175	Southampton	1 - Known		
177	Spotsylvania	1 - Known		
183	Sussex	1 - Known		
530	Buena Vista City	1 - Known	1 - Known	
600	Fairfax City	1 - Known	1 - Known	
610	Falls Church City	1 - Known	1 - Known	
620	Franklin City	1 - Known	1 - Known	
678	Lexington City	1 - Known	1 - Known	

Seasonal Occurrence Comments: Mussels ar every sedentary, therefore seasonal occurrence and general occurrence are the same *8825*.

References for County Occurrence

Ref.Id	Citation
2098	Beetle, D.E., 1973, A checklist of the land and freshwater mollusks of Virginia, Sterkiana, Vol. 49, pg. 21-25

USGS National 6th Order Watershed Occurrences

HU6	6th Order Watershed Name
CM16	Great Creek
CM17	Meherrin River-Coldwater Creek
CM19	Meherrin River-Douglas Run
CM20	Meherrin River-Falling Run
CU03	Big Hounds Creek
CU04	Nottoway River-Falls Creek
CU06	Little Nottoway River-Whetstone Creek
CU07	Nottoway River-Cedar Creek
CU08	Hurricane Branch-Long Branch
CU09	Nottoway River-Red Oak Creek
CU11	Nottoway River-Beaver Pond Creek
CU13	Nottoway River-Turkey Egg Creek
CU14	Sturgeon Creek
CU15	Nottoway River-Indian Creek
CU17	Nottoway River-Harris Swamp
CU18	Nottoway River-Island Swamp
CU22	Stony Creek-Chamberlains Bed
CU24	Lower Sappony Creek
CU25	Stony Creek-Southwest Swamp

CU30	Nottoway River-Cabin Point Swamp
CU31	Nebletts Mill Run-Joseph Swamp
CU32	Nottoway River-Austin Branch
CU36	Nottoway River-Parker Run
CU37	Three Creek-Slagles Lake
CU43	Nottoway River-Buckhorn Swamp
CU48	Nottoway River-Courtland
CU51	Nottoway River-Round Gut
CU59	Blackwater River-Terrapin Swamp
CU62	Blackwater River-Antioch Swamp
JA42	Swift Creek-Third Branch
JA44	Swift Creek-Franks Branch
JM01	James River-Otter Creek
JM02	Reed Creek
JM03	James River-Thomas Mill Creek
JM06	Pedlar River-Horsley Creek
JM07	James River-Judith Creek
JM10	Blackwater Creek
JM11	James River-Opossum Creek
JM13	James River-Beck Creek
JM14	James River-Stonewall Creek
JM15	James River-Christian Mill Creek
JM17	James River-Allens Creek
JM20	James River-Alabama Creek
JM34	James River-Mallorys Creek
JM35	James River-Sycamore Creek
JM42	James River-Ballinger Creek
JM43	James River-Rock Island Creek
JM45	James River-Little George Creek
JM50	James River-Bremo Creek
JM58	James River-Bear Garden Creek
JM62	James River-Hooper Rock Creek
JM71	Muddy Creek
JM72	James River-Picketts Creek
JM75	James River-Solomons Creek
JM78	James River-Mohawk Creek
JM79	Beaverdam Creek
JM80	James River-Fine Creek
JM82	James River-Little River
JM83	James River-Bernards Creek
JM84	Tuckahoe Creek
JR18	Mechunk Creek
JR19	Rivanna River-Stigger Creek
JR22	Rivanna River-Carys Creek
JU10	Jackson River-Falling Spring Creek
JU11	Jackson River-Indian Draft
JU34	Cowpasture River-Mill Creek
JU35	Pads Creek
JU36	Cowpasture River-Simpson Creek
JU44	Upper Johns Creek
JU45	Lower Johns Creek

JU46	Craig Creek-Rolands Run Branch
JU48	Craig Creek-Mill Creek
JU49	Patterson Creek
JU50	Craig Creek-Roaring Run
JU51	James River-Lapsley Run
JU54	James River-Hickory Hollow Branch
JU56	James River-Purgatory Creek
JU58	James River-Roaring Run
JU60	James River-Elk Creek
JU76	Maury River-Mill Creek
JU80	Lower South River
JU81	Maury River-Bennetts Run
JU86	Maury River-Poague Run
PL13	Little River
PL14	Goose Creek-Big Branch
PL33	Kettle Run
PL34	Broad Run-Rocky Branch
PL36	Cedar Run-Owl Run
PL37	Licking Run
PL38	Cedar Run-Walnut Branch
PL42	Upper Bull Run
PL44	Middle Bull Run
PL45	Cub Run
PS69	North Fork Shenandoah River-Toms Brook
PS70	North Fork Shenandoah River-Tumbling Run
PS75	Cedar Creek-Meadow Brook
RA01	Rappahannock River-Buck Run
RA02	Jordan River
RA03	Rappahannock River-Lake Mosby
RA04	Thumb Run
RA05	Rappahannock River-Glascock Run
RA06	Carter Run
RA07	Rappahannock River-Great Run
RA10	Hazel River-Devils Run
RA14	Thornton River-Mill Run
RA16	Hazel River-Indian Run
RA17	Marsh Run
RA18	Rappahannock River-Ruffans Run
RA21	Mountain Run-Flat Run
RA22	Rappahannock River-Rock Run
RA27	Rapidan River-Marsh Run
RA28	Blue Run
RA30	Rapidan River-Poplar Run
RA37	Rapidan River-Rapidan
RA38	Cedar Run
RA39	Rapidan River-Potato Run
RA41	Mine Run
RA42	Rapidan River-Fields Run
YO01	South Anna River-Dove Fork
YO03	South Anna River-Roundabout Creek

YO04	South Anna River-Harris Creek
YO05	South Anna River-Fork Creek
YO07	South Anna River-Owens Creek
YO08	Taylors Creek
YO09	South Anna River-Turkey Creek
YO11	South Anna River-Cedar Creek
YO12	North Anna River-Mountain Run
YO16	Pamunkey Creek-Lake Anna-Clear Creek
YO17	Terrys Run-Lake Anna
YO39	Po River-Robertson Run
YO40	Glady Run
YO41	Po River-Lake Pocahontas
YO43	Mat River
YO44	Ta River
YO45	Matta River
YO46	South River
YO47	Mattaponi River-Campbell Creek
YO48	Polecat Creek

6th Order Hydrologic Unit Comments: 6th order hydrologic unit distribution reviewed in year 2009 by Virginia Department of Game and Inland Fisheries Taxonomic Advisory Committees.

References for 6th Order Hydrologic Unit

Ref.Id	Citation
12325	VDGIF, 2009, Tiered Species Distributions by 6th Order Watershed, as Reviewed by VDGIF's Taxonomic Advisory Committees

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Virginia Department of Game and Inland Fisheries

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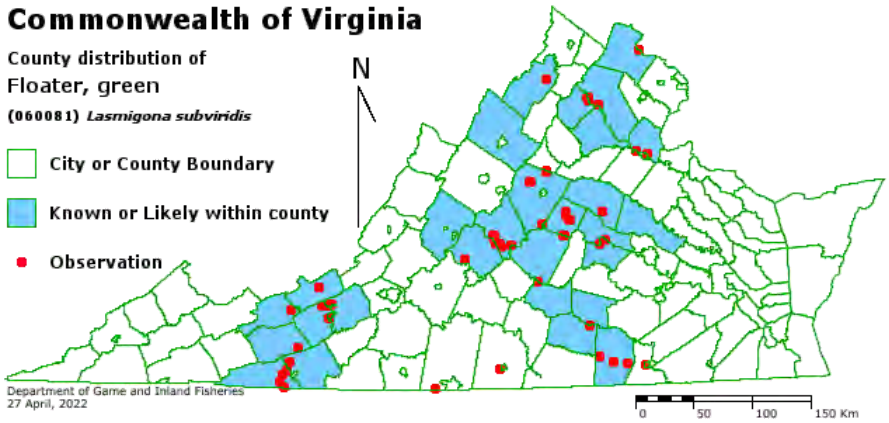
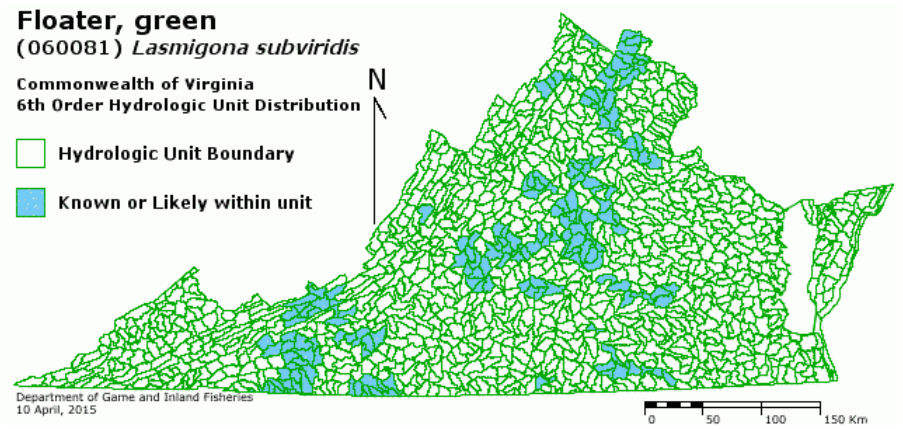
Fish and Wildlife Information Service

Occurence chapter for Floater, green (060081)





County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
003	Albemarle	1 - Known	1 - Known	
009	Amherst	1 - Known		
021	Bland	1 - Known		
025	Brunswick	1 - Known		
029	Buckingham	1 - Known		
035	Carroll	1 - Known	1 - Known	
047	Culpeper	1 - Known		
061	Fauquier	1 - Known		
065	Fluvanna	1 - Known		
071	Giles	1 - Known		
075	Goochland	1 - Known		
077	Grayson	1 - Known	1 - Known	
085	Hanover	1 - Known	1 - Known	
107	Loudoun	1 - Known	1 - Known	
109	Louisa	1 - Known		
111	Lunenburg	1 - Known		
121	Montgomery	1 - Known		

125	Nelson	1 - Known	1 - Known	
135	Nottoway	1 - Known		
145	Powhatan	1 - Known		
147	Prince Edward	1 - Known		
155	Pulaski	1 - Known	1 - Known	
157	Rappahannock	1 - Known		
163	Rockbridge	1 - Known	1 - Known	
165	Rockingham	1 - Known	1 - Known	
171	Shenandoah	1 - Known	1 - Known	
179	Stafford	1 - Known		
197	Wythe	1 - Known	1 - Known	
595	Emporia City	1 - Known		

General Occurrence Comments: This species occurs in the Potomac, Shenandoah, Pamunkey, James and New rivers of Virginia *9286*.

Resident Occurrence Comments: This species occurs in the Potomac, Shenandoah, Pamunkey, James, and New rivers in Virginia *9286*.

Seasonal Occurrence Comments: Mussels are very sedentary, therefore seasonal occurrence and general occurrence are the same *8825*.

References for County Occurrence

Ref.Id	Citation
3907	Blood, F.B., M.B. Riddick, 1974, Unionidae of the Pamunkey River system, Virginia, Nautilus, Vol. 88, Num. 2, pg. 65
9286	Terwilliger, K.T., 1991, Virginia's endangered species: Proceedings of a symposium. Coordinated by the Virginia Dept. of Game and Inland Fisheries, Nongame and Endangered Species Program, 672 pp. pgs., McDonald and Woodward Publ. Comp., Blacksburg, VA

USGS National 6th Order Watershed Occurrences

HU6	6th Order Watershed Name
CM12	Meherrin River-Taylors Creek
CM13	Genito Creek
CM14	Meherrin River-Allen Creek
CM16	Great Creek
CM17	Meherrin River-Coldwater Creek
CM19	Meherrin River-Douglas Run
CM20	Meherrin River-Falling Run
CM21	Meherrin River-Greensville/Southampton Co. Border
CU04	Nottoway River-Falls Creek
JA01	Appomattox River-Wolf Creek
JA02	Appomattox River-Suanee Creek
JA03	Appomattox River-Fishpond Creek
JA04	Vaughans Creek
JA05	Appomattox River-Ducker Creek
JA27	Flat Creek-Haw Branch
JA28	Appomattox River-Smacks Creek
JA34	Appomattox River-Winticomack Creek
JA36	Appomattox River-Lake Chesdin-Nooning Creek
JA39	Appomattox River/Lake Chesdin-Cattle Creek
JA40	Appomattox River-Oldtown Creek
JA44	Swift Creek-Franks Branch
JA45	Appomattox River-Ashton Creek
JM01	James River-Otter Creek
JM03	James River-Thomas Mill Creek
JM04	Pedlar River-Lynchburg Reservoir

JM05	Pedlar River-Browns Creek
JM06	Pedlar River-Horsley Creek
JM07	James River-Judith Creek
JM08	Harris Creek
JM09	Ivy Creek-Cheese Creek
JM10	Blackwater Creek
JM11	James River-Opossum Creek
JM20	James River-Alabama Creek
JM22	Tye River-Cub Creek
JM23	Hat Creek
JM24	Tye River-Black Creek
JM26	Piney River-Naked Creek
JM27	Tye River-Brown Creek
JM29	Buffalo River-Stonewall Creek
JM31	Buffalo River-Rocky Creek
JM32	Rucker Run
JM33	Tye River-Joe Creek
JM34	James River-Mallorys Creek
JM35	James River-Sycamore Creek
JM42	James River-Ballinger Creek
JM43	James River-Rock Island Creek
JM45	James River-Little George Creek
JM50	James River-Bremo Creek
JM57	Slate River-Hunts Creek
JM58	James River-Bear Garden Creek
JM59	Upper Byrd Creek
JM60	Middle Byrd Creek
JM62	James River-Hooper Rock Creek
JM68	Willis River-Bonbrook Creek
JM69	Randolph Creek
JM70	Willis River-Trice Lake
JM71	Muddy Creek
JM72	James River-Picketts Creek
JM73	Deep Creek-Maxey Mill Creek
JR02	Mechums River-Beaver Creek
JR03	Moormans River-North Moormans River
JR04	Doyles River
JR05	Moormans River-Wards Creek
JR06	Buck Mountain Creek
JR08	South Fork Rivanna River
JR16	Buck Island Creek
JR17	Rivanna River-Carroll Creek
JR18	Mechunk Creek
JR19	Rivanna River-Stigger Creek
JR20	Cunningham Creek
JR21	Ballinger Creek
JR22	Rivanna River-Carys Creek
JU34	Cowpasture River-Mill Creek
JU81	Maury River-Bennetts Run
NE04	New River-Grassy Creek

NE07	New River-Bridle Creek
NE08	New River-Saddle Creek
NE09	Peach Bottom Creek
NE10	New River-Brush Creek-Little Brush Creek
NE11	Little River-Crab Creek
NE12	New River-Rock Creek
NE14	Elk Creek-Turkey Fork
NE15	New River-Meadow Creek
NE16	New River-Eagle Bottom Creek
NE17	Chestnut Creek
NE18	New River-Brush Creek-Bournes Branch
NE20	Crooked Creek-Cranberry Creek
NE21	New River-Poor Branch
NE24	Cripple Creek-Slate Spring Branch
NE25	New River-Shorts Creek
NE26	Reed Creek-Hutson Branch
NE28	Reed Creek-South Fork Reed Creek
NE29	Reed Creek-Muskrat Branch
NE30	Cove Creek
NE31	Reed Creek-Miller Creek
NE32	New River-Pine Run
NE34	Lower Little Reed Island Creek
NE48	Little River-Beaverdam Creek
NE49	Little River-Pine Creek
NE51	West Fork Little River-Dodd Creek
NE52	Little River-Brush Creek
NE53	Little River-Lost Bent Creek
NE55	Little River-Big Laurel Creek
NE57	New River-Connellys Run
NE59	New River-Stroubles Creek
NE62	New River-Dry Branch
NE63	New River-Bear Spring Branch
NE67	Walker Creek-Helveys Mill Creek
NE68	Kimberling Creek-East Wilderness Creek
NE69	Nobusiness Creek
NE70	Kimberling Creek-Dismal Creek
NE71	Walker Creek-Flat Hollow
NE73	Walker Creek-Sugar Run
NE74	New River-Little Stony Creek
NE81	Lower Wolf Creek
NE83	New River-Bluestone Lake-Clendennin Creek
NE84	East River
NE85	New River/Bluestone Lake-Adair Run
PL01	Potomac River-Piney Run-Dutchman Creek
PL02	South Fork Catoctin Creek
PL03	Catoctin Creek
PL04	Potomac River-Tuscarora Creek
PL07	Goose Creek-Crooked Run-Gap Run
PL08	Panther Skin Creek
PL10	Goose Creek-Wancopin Creek
PL11	Beaverdam Creek

PL12	North Fork Goose Creek
PL13	Little River
PL14	Goose Creek-Big Branch
PL15	Sycolin Creek
PL16	Goose Creek-Cattail Branch
PS68	North Fork Shenandoah River-Narrow Passage Creek
PS69	North Fork Shenandoah River-Toms Brook
PS70	North Fork Shenandoah River-Tumbling Run
PS78	North Fork Shenandoah River-Molly Booth Run
PU19	Opequon Creek-Turkey Run
RA01	Rappahannock River-Buck Run
RA02	Jordan River
RA03	Rappahannock River-Lake Mosby
RA04	Thumb Run
RA05	Rappahannock River-Glascock Run
RA06	Carter Run
RA07	Rappahannock River-Great Run
RA16	Hazel River-Indian Run
RA18	Rappahannock River-Ruffans Run
RA22	Rappahannock River-Rock Run
RA23	Rappahannock River-Deep Run
RA27	Rapidan River-Marsh Run
RA28	Blue Run
RA29	Beautiful Run
RA30	Rapidan River-Poplar Run
RA36	Robinson River-Great Run
RA37	Rapidan River-Rapidan
RA44	Rapidan River-Hazel Run
RA45	Rappahannock River-Motts Run
RA46	Rappahannock River-Hazel Run
RD02	Dan River-Archies Creek
RD03	Little Dan River
RD04	Dan River-Elk Creek
RD05	Dan River-Peters Creek
RD06	Upper South Mayo River-Poorhouse Creek
RD07	Russell Creek
RD08	Spoon Creek
RD09	Lower South Mayo River-Crooked Creek
RD12	North Mayo River-Koger Creek
RD77	Dan River/John H Kerr Reservoir-Buffalo Creek
RU94	Roanoke River/John H Kerr Reservoir-Sandy Creek
YO04	South Anna River-Harris Creek
YO05	South Anna River-Fork Creek
YO06	Cub Creek
YO07	South Anna River-Owens Creek
YO12	North Anna River-Mountain Run
YO13	Hickory Creek
YO15	North Anna River-Lake Anna-Christopher Creek

6th Order Hydrologic Unit Comments: 6th order hydrologic unit distribution reviewed in year 2009 by Virginia Department of Game and Inland Fisheries Taxonomic Advisory Committees.

References for 6th Order Hydrologic Unit

Ref.Id	Citation
12325	VDGIF, 2009, Tiered Species Distributions by 6th Order Watershed, as Reviewed by VDGIF's Taxonomic Advisory Committees

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Virginia Department of Game and Inland Fisheries

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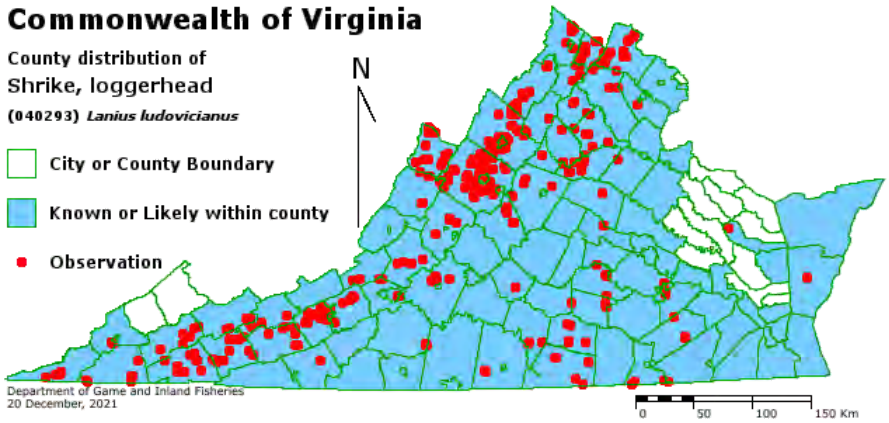
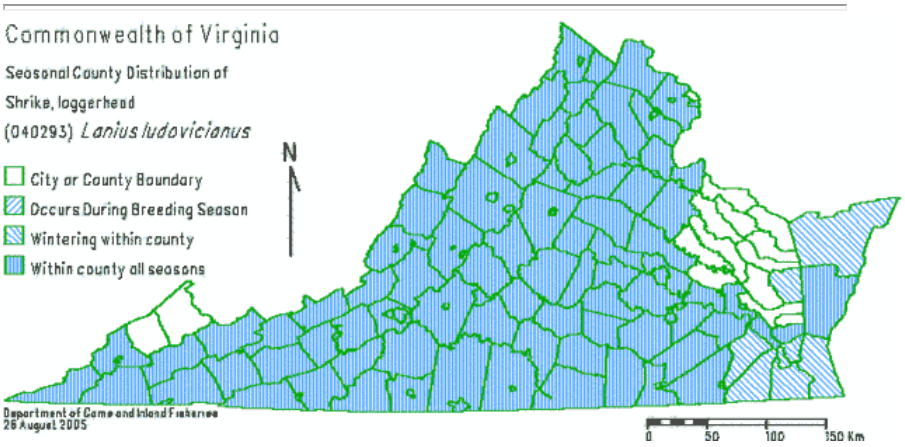
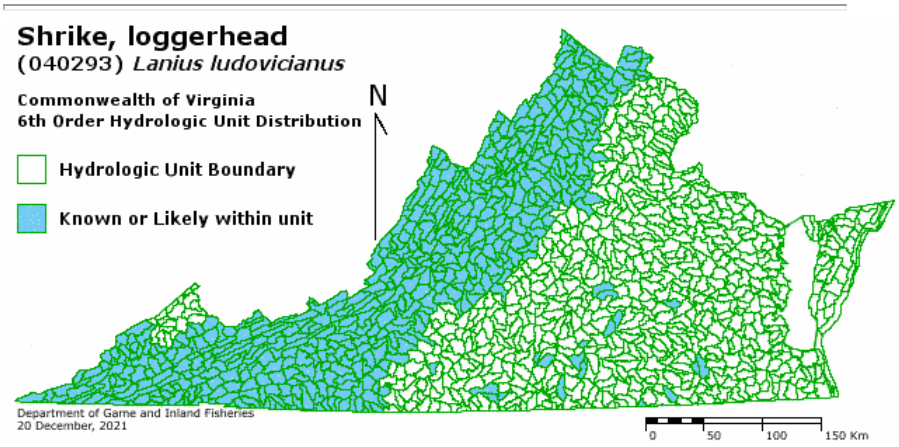
Fish and Wildlife Information Service

Occurence chapter for Shrike, loggerhead (040293)







County Occurrences

County	County Name	General Occurrence	Resident Occurrence	Seasonal Occurrence
001	Accomack	1 - Known	1 - Known	
003	Albemarle	1 - Known	1 - Known	
005	Alleghany	1 - Known	1 - Known	

007	Amelia	1 - Known	1 - Known	
009	Amherst	1 - Known	1 - Known	
011	Appomattox	1 - Known	1 - Known	
015	Augusta	1 - Known	1 - Known	
017	Bath	1 - Known	1 - Known	
019	Bedford	1 - Known	1 - Known	
021	Bland	1 - Known	1 - Known	
023	Botetourt	1 - Known	1 - Known	
025	Brunswick	1 - Known	1 - Known	
029	Buckingham	1 - Known	1 - Known	
031	Campbell	1 - Known	1 - Known	
033	Caroline	1 - Known	1 - Known	
035	Carroll	1 - Known	1 - Known	
036	Charles City	1 - Known	1 - Known	
037	Charlotte	1 - Known	1 - Known	
041	Chesterfield	1 - Known	1 - Known	
043	Clarke	1 - Known	1 - Known	
045	Craig	1 - Known	1 - Known	
047	Culpeper	1 - Known	1 - Known	
049	Cumberland	1 - Known	1 - Known	
053	Dinwiddie	1 - Known	1 - Known	
059	Fairfax	1 - Known	1 - Known	
061	Fauquier	1 - Known	1 - Known	
063	Floyd	2 - Likely		
065	Fluvanna	1 - Known	1 - Known	
067	Franklin	1 - Known	1 - Known	
069	Frederick	1 - Known	1 - Known	
071	Giles	1 - Known	1 - Known	
075	Goochland	1 - Known	1 - Known	
077	Grayson	1 - Known	1 - Known	
079	Greene	1 - Known	1 - Known	
081	Greensville	1 - Known	1 - Known	
083	Halifax	1 - Known	1 - Known	
085	Hanover	1 - Known	1 - Known	
087	Henrico	1 - Known	1 - Known	
089	Henry	2 - Likely		
091	Highland	1 - Known	1 - Known	
093	Isle of Wight	2 - Likely		
095	James City	1 - Known	1 - Known	
099	King George	1 - Known	1 - Known	
105	Lee	1 - Known	1 - Known	
107	Loudoun	1 - Known	1 - Known	
109	Louisa	1 - Known	1 - Known	
111	Lunenburg	1 - Known	1 - Known	
113	Madison	1 - Known	1 - Known	
115	Mathews	1 - Known	1 - Known	
117	Mecklenburg	1 - Known	1 - Known	
119	Middlesex	1 - Known		
121	Montgomery	1 - Known	1 - Known	
125	Nelson	1 - Known	1 - Known	
131	Northampton	1 - Known	1 - Known	

135	Nottoway	1 - Known	1 - Known	
137	Orange	1 - Known	1 - Known	
139	Page	1 - Known	1 - Known	
141	Patrick	2 - Likely		
143	Pittsylvania	1 - Known	1 - Known	
145	Powhatan	1 - Known	1 - Known	
147	Prince Edward	2 - Likely		
149	Prince George	1 - Known	1 - Known	
153	Prince William	1 - Known	1 - Known	
155	Pulaski	1 - Known	1 - Known	
157	Rappahannock	1 - Known	1 - Known	
161	Roanoke	1 - Known	1 - Known	
163	Rockbridge	1 - Known	1 - Known	
165	Rockingham	1 - Known	1 - Known	
167	Russell	1 - Known	1 - Known	
169	Scott	1 - Known	1 - Known	
171	Shenandoah	1 - Known	1 - Known	
173	Smyth	1 - Known	1 - Known	
175	Southampton	1 - Known	1 - Known	
177	Spotsylvania	1 - Known	1 - Known	
179	Stafford	1 - Known	1 - Known	
181	Surry	1 - Known	1 - Known	
183	Sussex	1 - Known	1 - Known	
185	Tazewell	1 - Known	1 - Known	
187	Warren	1 - Known	1 - Known	
191	Washington	1 - Known	1 - Known	
195	Wise	1 - Known	1 - Known	
197	Wythe	1 - Known	1 - Known	
510	Alexandria City	1 - Known	1 - Known	
515	Bedford City	2 - Likely		
520	Bristol City	2 - Likely		
530	Buena Vista City	2 - Likely		
540	Charlottesville City	2 - Likely		
550	Chesapeake City	2 - Likely		
560	Clifton Forge City	2 - Likely		
570	Colonial Heights City	1 - Known	1 - Known	
580	Covington City	2 - Likely		
590	Danville City	2 - Likely		
595	Emporia City	2 - Likely		
600	Fairfax City	2 - Likely		
610	Falls Church City	2 - Likely		
620	Franklin City	2 - Likely		
630	Fredericksburg City	2 - Likely		
640	Galax City	2 - Likely		
650	Hampton City	1 - Known	1 - Known	
660	Harrisonburg City	1 - Known	1 - Known	
670	Hopewell City	1 - Known	1 - Known	
678	Lexington City	2 - Likely		
680	Lynchburg City	1 - Known	1 - Known	
683	Manassas City	1 - Known	1 - Known	

685	Manassas Park City	2 - Likely		
690	Martinsville City	2 - Likely		
700	Newport News City	1 - Known	1 - Known	
710	Norfolk City	1 - Known	1 - Known	
720	Norton City	2 - Likely		
730	Petersburg City	1 - Known	1 - Known	
740	Portsmouth City	2 - Likely		
750	Radford City	2 - Likely		
760	Richmond City	1 - Known	1 - Known	
770	Roanoke City	1 - Known	1 - Known	
775	Salem City	2 - Likely		
780	South Boston City	2 - Likely		
790	Staunton City	1 - Known	1 - Known	
800	Suffolk City	1 - Known	1 - Known	
810	Virginia Beach City	1 - Known	1 - Known	
820	Waynesboro City	2 - Likely		
830	Williamsburg City	2 - Likely		
840	Winchester City	1 - Known	1 - Known	

General Occurrence Comments: This subspecies reaches the northern limit of its range in central and eastern Virginia *691*. Only this subspecies breeds in the Piedmont and Coastal Plain Provinces, but both this subspecies and the other subspecies resident in Virginia, "migrans", as well as intermediate forms, may breed in the Ridge and Valley province of the state *8886,9333* Both subspecies may be winter residents in Virginia *8886*. The two subspecies can only be distinguished reliably morphometrically, so that field identification to subspecies distribution is rarely reported. The major sources of data for shrike distribution in Virginia *9333, 8510* do not distinguish the two subspecies in their records, and occurrences listed in this report may be either subspecies. Records for this species exist from every part of the state, but the Shenandoah Valley population, consisting primarily of "migrans" appears to be the most significant and stable in Virginia *9333*. Species is a permanent resident near the Fall Line but rare farther east *8511*, with only one report of the species from Northampton County *10949*. It is an uncommon permanent resident in the Piedmont and a rare to uncommon permanent resident in the Mountains and Valleys, being more numerous in the winter *8511*.

Resident Occurrence Comments: This subspecies reaches the northern limit of its range in central and eastern Virginia *691*. Only this subspecies breeds in the Piedmont and Coastal Plain Provinces, but both this subspecies and the other subspecies resident in Virginia, "migrans", as well as intermediate forms, may breed in the Ridge and Valley province of the state *8886,9333*. Both subspecies may be winter residents in Virginia *8886*. The two subspecies can only be distinguished reliably morphometrically, so that field identification to subspecies is rarely reported. The major sources of data for shrike distribution in Virginia *9333,8510* do not distinguish the two subspecies in their records, and occurrences listed in this report may be either subspecies. Records for this species exist from every part of the state, but resident occurrences in this list are based only on records since 1980, since shrikes clearly appear to be losing ground. The Shenandoah Valley population, consisting primarily of "migrans" appears to be the most significant and stable in Virginia *9333*. Species is an uncommon permanent resident near the fall line but rare farther east *8511*, with only one reported sighting in Northampton County *10949*. The species is an uncommon permanent resident in the Piedmont. It is a rare to uncommon permanent resident and more numerous in the winter in the Mountain and Valleys *8511*.

Seasonal Occurrence Comments: This subspecies is a permanent resident in central and eastern Virginia *691, 700*. This species is believed to breed between 20 April and 20 July *8510*. Some breeding birds may be migratory and some winter birds may migrate into Virginia from northern breeding areas *8886*. This species is rare, if not absent, on the Eastern Shore of Virginia. No recent records have appeared for this species on the Eastern Shore *11627*.

References for County Occurrence

Ref.Id	Citation
8510	Virginia Society of Ornithology and the, Virginia Dept. of Game and Inland Fisheries, VSO Atlas Committee (Ed.), 1989, The Breeding Bird Atlas Project Handbook and Data, 1984-1989, 20 pgs., VSO
8886	Luukkonen, D.R., Fraser, J.D., 1987, Status and distribution of the loggerhead shrike in Virginia., Virginia J. Sci., Vol. 38, Num. 4, pg. 342-350
10949	Virginia Department of Game and Inland Fisheries, 1995, Collections Database
11627	Day, H. F., III, 2001, Personal Communication, Expert Review for GAP Analysis Project
11850	Simpson, R.C., 2000, Salvage Permit No. 015434

USGS National 6th Order Watershed Occurrences

HU6	6th Order Watershed Name
BS01	Jacobs Fork

BS02	Upper Dry Fork
BS08	Garden Creek
BS09	Levisa Fork-Grassy Creek
BS10	Upper Dismal Creek
BS16	Russell Fork-Hurricane Creek
BS17	Indian Creek-Cane Creek
BS22	Open Fork
BS23	McClure Creek-Roaring Fork
BS24	Caney Creek
BS28	North Fork Pound River-South Fork Pound River
BS29	Pound River-Indian Creek
BS30	Pound River-John W Flannagan Reservoir-Cane Creek
BS31	Cranesnest River-Trace Fork
BS32	Birchfield Creek
BS33	Cranesnest River-John W Flannagan Reservoir-Lick Fork
CM07	North Meherrin River-Reedy Creek
CM08	Meherrin River-Mason Creek
CM21	Meherrin River-Greensville/Southampton Co. Border
CM25	Beaverpond Creek
CU02	Modest Creek
CU36	Nottoway River-Parker Run
CU46	Assamoosick Swamp-Mill Run
JA21	Appomattox River-Bent Creek
JA27	Flat Creek-Haw Branch
JA30	Cellar Creek
JA32	Deep Creek-Sweathouse Creek
JA45	Appomattox River-Ashton Creek
JM01	James River-Otter Creek
JM02	Reed Creek
JM03	James River-Thomas Mill Creek
JM04	Pedlar River-Lynchburg Reservoir
JM05	Pedlar River-Browns Creek
JM06	Pedlar River-Horsley Creek
JM07	James River-Judith Creek
JM08	Harris Creek
JM09	Ivy Creek-Cheese Creek
JM14	James River-Stonewall Creek
JM21	North Fork Tye River-South Fork Tye River
JM22	Tye River-Cub Creek
JM23	Hat Creek
JM24	Tye River-Black Creek
JM25	Piney River-Little Piney River
JM26	Piney River-Naked Creek
JM27	Tye River-Brown Creek
JM28	Buffalo River-North Fork Buffalo River
JM29	Buffalo River-Stonewall Creek
JM30	Rutledge Creek
JM31	Buffalo River-Rocky Creek
JM32	Rucker Run
JM36	North Fork Rockfish River
JM37	South Fork Rockfish River

JM38	Rockfish River-Buck Creek
JM39	Cove Creek-Hickory Creek
JM40	Rockfish River-Dutch Creek
JM41	Rockfish River-Beaver Creek
JM46	North Fork Hardware River
JM47	South Fork Hardware River
JR01	Mechums River-Stockton Creek
JR02	Mechums River-Beaver Creek
JR03	Moormans River-North Moormans River
JR04	Doyles River
JR05	Moormans River-Wards Creek
JR06	Buck Mountain Creek
JR07	Ivy Creek-Little Ivy Creek
JR08	South Fork Rivanna River
JR09	North Fork Rivanna River-Lynch River
JR10	Swift Run
JR11	North Fork Rivanna River-Jacobs Run
JR12	Preddy Creek
JR15	Moores Creek
JU01	Jackson River-Dry Branch
JU02	Jackson River-Bolar Run
JU03	Jackson River-Warm Springs Run
JU04	Back Creek-East Back Creek
JU05	Back Creek-Jim Dave Run
JU06	Little Back Creek
JU07	Back Creek-Cummings Run
JU08	Jackson River/Lake Moomaw
JU09	Cedar Creek-Hot Springs Run
JU10	Jackson River-Falling Spring Creek
JU11	Jackson River-Indian Draft
JU12	Cove Creek-Sweet Springs Creek
JU13	Dunlap Creek-Cove Run
JU14	Ogle Creek-Johnsons Creek
JU15	Dunlap Creek-Jerrys Run
JU16	North Fork Potts Creek-South Fork Potts Creek
JU17	Potts Creek-Trout Branch
JU18	Potts Creek-Mill Branch
JU19	Potts Creek-Cast Steel Run
JU20	Potts Creek-Hays Creek
JU21	Jackson River-Pounding Mill Creek
JU22	White Rock Creek-Karnes Creek
JU23	Wilson Creek
JU24	Jackson River-Smith Creek
JU25	Cowpasture River-Wolfe Draft
JU26	Shaws Fork
JU27	Cowpasture River-Benson Run
JU28	Bullpasture River-Davis Run
JU29	Bullpasture River-Crab Run
JU30	Cowpasture River-Scotchtown Draft
JU31	Dry Run

JU32	Cowpasture River-Thompson Creek
JU33	Stuart Run-Lick Run
JU34	Cowpasture River-Mill Creek
JU35	Pads Creek
JU36	Cowpasture River-Simpson Creek
JU37	James River-Big Creek
JU38	Sinking Creek
JU39	Mill Creek-Smith Branch
JU40	James River-Black Lick
JU41	Craig Creek-Trout Creek
JU42	Meadow Creek
JU43	Craig Creek-Broad Run
JU44	Upper Johns Creek
JU45	Lower Johns Creek
JU46	Craig Creek-Rolands Run Branch
JU47	Barbours Creek
JU48	Craig Creek-Mill Creek
JU49	Patterson Creek
JU50	Craig Creek-Roaring Run
JU51	James River-Lapsley Run
JU52	Catawba Creek-Little Catawba Creek
JU53	Catawba Creek-Town Branch
JU54	James River-Hickory Hollow Branch
JU55	Looney Creek-Mill Creek
JU56	James River-Purgatory Creek
JU57	Jennings Creek-North Creek
JU58	James River-Roaring Run
JU59	Cedar Creek-Spring Gap Creek
JU60	James River-Elk Creek
JU61	Calfpasture River-Chair Draft
JU62	Ramseys Draft
JU63	Calfpasture River-Holloway Draft
JU64	Hamilton Branch
JU65	Calfpasture River-Fridley Branch
JU66	Mill Creek-Cabin Creek
JU67	Brattons Run
JU68	Calfpasture River-Guys Run
JU69	Upper Little Calfpasture River
JU70	Lower Little Calfpasture River
JU71	Maury River-Taylor Branch
JU72	Walker Creek
JU73	Hays Creek
JU74	Maury River-Alone Mill Creek
JU75	Kerrs Creek
JU76	Maury River-Mill Creek
JU77	Saint Marys River
JU78	Upper South River
JU79	Irish Creek
JU80	Lower South River
JU81	Maury River-Bennetts Run
JU82	South Buffalo Creek

JU83	North Buffalo Creek
JU84	Colliers Creek
JU85	Buffalo Creek
JU86	Maury River-Poague Run
NE01	Big Horse Creek-Whitetop Creek
NE02	Helton Creek
NE03	Wilson Creek
NE04	New River-Grassy Creek
NE05	Fox Creek-Laurel Creek
NE06	Fox Creek-Middle Fox Creek
NE07	New River-Bridle Creek
NE08	New River-Saddle Creek
NE09	Peach Bottom Creek
NE10	New River-Brush Creek-Little Brush Creek
NE11	Little River-Crab Creek
NE12	New River-Rock Creek
NE13	Elk Creek-Stone Creek
NE14	Elk Creek-Turkey Fork
NE15	New River-Meadow Creek
NE16	New River-Eagle Bottom Creek
NE17	Chestnut Creek
NE18	New River-Brush Creek-Bournes Branch
NE19	Crooked Creek-East Fork Crooked Creek
NE20	Crooked Creek-Cranberry Creek
NE21	New River-Poor Branch
NE22	Cripple Creek-Blue Spring Creek
NE23	Cripple Creek-Francis Mill Creek
NE24	Cripple Creek-Slate Spring Branch
NE25	New River-Shorts Creek
NE26	Reed Creek-Hutson Branch
NE27	Stony Fork
NE28	Reed Creek-South Fork Reed Creek
NE29	Reed Creek-Muskrat Branch
NE30	Cove Creek
NE31	Reed Creek-Miller Creek
NE32	New River-Pine Run
NE33	Upper Little Reed Island Creek
NE34	Lower Little Reed Island Creek
NE35	Laurel Fork
NE36	Big Reed Island Creek-Stone Mountain Creek
NE37	Snake Creek
NE38	Burks Fork
NE39	Big Reed Island Creek-Road Creek
NE40	Greasy Creek
NE41	Big Reed Island Creek-Rock Creek
NE42	Big Macks Creek
NE43	New River-Upper Claytor Lake
NE44	Peak Creek-Gatewood Reservoir
NE45	Tract Fork
NE46	Peak Creek-Thorne Springs Branch

NE47	New River/Lower Claytor Lake
NE48	Little River-Beaverdam Creek
NE49	Little River-Pine Creek
NE50	West Fork Little River-Howell Creek
NE51	West Fork Little River-Dodd Creek
NE52	Little River-Brush Creek
NE53	Little River-Lost Bent Creek
NE54	Big Indian Creek
NE55	Little River-Big Laurel Creek
NE56	Little River-Meadow Creek
NE57	New River-Connellys Run
NE58	Crab Creek
NE59	New River-Stroubles Creek
NE60	Toms Creek-Poverty Creek
NE61	Back Creek
NE62	New River-Dry Branch
NE63	New River-Bear Spring Branch
NE64	Upper Sinking Creek
NE65	Lower Sinking Creek
NE66	Walker Creek-Crab Orchard Creek
NE67	Walker Creek-Helveys Mill Creek
NE68	Kimberling Creek-East Wilderness Creek
NE69	Nobusiness Creek
NE70	Kimberling Creek-Dismal Creek
NE71	Walker Creek-Flat Hollow
NE72	Little Walker Creek
NE73	Walker Creek-Sugar Run
NE74	New River-Little Stony Creek
NE75	Stony Creek
NE76	Burkes Garden Creek
NE77	Hunting Camp Creek
NE78	Upper Wolf Creek
NE79	Clear Fork
NE80	Laurel Creek-Dry Fork
NE81	Lower Wolf Creek
NE82	Rich Creek
NE83	New River-Bluestone Lake-Clendennin Creek
NE84	East River
NE85	New River/Bluestone Lake-Adair Run
NE86	Bluestone River-Brush Fork
NE87	Mud Fork
NE88	Bluestone River-Laurel Fork
PL01	Potomac River-Piney Run-Dutchman Creek
PL02	South Fork Catoctin Creek
PL03	Catoctin Creek
PL04	Potomac River-Tuscarora Creek
PL05	Potomac River-Limestone Branch
PL06	Goose Creek-Mitchells Branch
PL07	Goose Creek-Crooked Run-Gap Run
PL08	Panther Skin Creek
PL10	Goose Creek-Wancopin Creek

PL11	Beaverdam Creek
PL12	North Fork Goose Creek
PL15	Sycolin Creek
PL16	Goose Creek-Cattail Branch
PS01	Middle River-Edison Creek
PS02	Middle River-Buffalo Branch
PS03	Jennings Branch
PS04	Middle River-Bell Creek
PS05	Moffett Creek
PS06	Lewis Creek
PS07	Middle River-Falling Spring Run
PS08	Christians Creek-Folly Mills Creek
PS09	Christians Creek-Barterbrook Branch
PS10	Meadow Run
PS11	Middle River-Broad Run
PS12	North River-Skidmore Fork
PS13	Little River
PS14	Briery Branch
PS15	Mossy Creek
PS16	North River-Thorny Branch
PS17	Dry River-Skidmore Fork
PS18	Dry River-Black Run
PS19	Muddy Creek
PS20	Dry River-Honey Run
PS21	Long Glade Creek
PS22	Blacks Run
PS23	Cooks Creek
PS24	Naked Creek-North Fork Naked Creek
PS25	North River-Pleasant Run
PS26	North River-Mill Creek
PS27	South River-Stony Run
PS28	South River-Canada Run
PS29	Back Creek-Inch Branch
PS30	South River-Porterfield Run
PS31	South River-Paine Run
PS32	South Fork Shenandoah River-Big Run
PS33	Cub Run-Keezletown
PS34	South Fork Shenandoah River-Hawksbill Creek
PS35	South Fork Shenandoah River-Elk Run-Boone Run
PS36	Naked Creek-South Branch
PS37	South Fork Shenandoah River-Fultz Run
PS38	Cub Run-Pitt Spring Run
PS39	South Fork Shenandoah River-Stony Run
PS40	South Fork Shenandoah River-Hawksclaw Creek
PS41	South Fork Shenandoah River-Mill Creek
PS42	Hawksbill Creek-East Hawksbill Creek
PS43	Hawksbill Creek-Pass Run
PS44	South Fork Shenandoah River-Jeremys Run
PS45	South Fork Shenandoah River-Brown Hollow Run
PS46	Gooney Run

PS47	South Fork Shenandoah River-Punches Run
PS48	Happy Creek
PS49	German River
PS50	Crab Run
PS51	North Fork Shenandoah River-Capon Run
PS52	Little Dry River
PS53	Shoemaker River
PS54	North Fork Shenandoah River-Runion Creek
PS55	North Fork Shenandoah River-Turley Creek
PS56	Linville Creek
PS57	North Fork Shenandoah River-Long Meadow
PS58	North Fork Shenandoah River-Holmans Creek
PS59	Dry Fork
PS60	Smith Creek-Mountain Run
PS61	Smith Creek-War Branch
PS62	Smith Creek-Gap Creek
PS63	Mill Creek-Crooked Run
PS64	North Fork Shenandoah River-Mt Jackson
PS65	Stony Creek-Riles Run
PS66	Stony Creek-Yellow Spring Run
PS67	Stony Creek-Painter Run
PS68	North Fork Shenandoah River-Narrow Passage Creek
PS69	North Fork Shenandoah River-Toms Brook
PS70	North Fork Shenandoah River-Tumbling Run
PS71	Cedar Creek-Paddy Run
PS72	Cedar Creek-Duck Run
PS73	Fall Run
PS74	Cedar Creek-Froman Run
PS75	Cedar Creek-Meadow Brook
PS76	Upper Passage Creek
PS77	Lower Passage Creek
PS78	North Fork Shenandoah River-Molly Booth Run
PS79	Crooked Run
PS80	Shenandoah River-Manassas Run
PS81	Shenandoah River-Borden Marsh Run
PS82	Shenandoah River-Long Branch
PS83	Spout Run
PS84	Shenandoah River-Chapel Run
PS85	Shenandoah River-Dog Run
PS86	Long Marsh Run
PS87	Bullskin Run
PU01	North Fork South Branch Potomac River-Laurel Fork
PU02	South Branch Potomac River-Frank Run
PU03	Strait Creek
PU04	South Branch Potomac River-East Dry Run
PU05	Thorn Creek-Whitehorn Creek
PU06	South Fork South Branch Potomac River-Brushy Fork
PU08	Upper Sleepy Creek
PU09	Middle Fork Sleepy Creek
PU10	Back Creek-Mine Spring Run
PU11	Back Creek-Isaacs Creek

PU12	Hogue Creek
PU13	Back Creek-Brush Creek
PU14	Babbs Run
PU15	Back Creek-Warm Springs Hollow
PU16	Opequon Creek-Sulphur Spring Run
PU17	Abrams Creek
PU18	Opequon Creek-Redbud Run
PU19	Opequon Creek-Turkey Run
PU20	Mill Creek
RA01	Rappahannock River-Buck Run
RA02	Jordan River
RA03	Rappahannock River-Lake Mosby
RA04	Thumb Run
RA08	Hughes River
RA09	Hazel River-Sams Run
RA10	Hazel River-Devils Run
RA11	Thornton River-Piney River
RA12	Covington River
RA13	Battle Run
RA14	Thornton River-Mill Run
RA19	Mountain Run-Hiders Branch
RA24	Rapidan River-Garth Run
RA25	Conway River
RA26	Rapidan River-South River
RA27	Rapidan River-Marsh Run
RA28	Blue Run
RA29	Beautiful Run
RA30	Rapidan River-Poplar Run
RA31	Robinson River-Rose River
RA32	Robinson River-Leathers Run
RA33	White Oak Run
RA34	Robinson River-Deep Run
RA35	Crooked Run
RA36	Robinson River-Great Run
RD01	Dan River-Ivy Creek
RD02	Dan River-Archies Creek
RD03	Little Dan River
RD04	Dan River-Elk Creek
RD05	Dan River-Peters Creek
RD06	Upper South Mayo River-Poorhouse Creek
RD07	Russell Creek
RD08	Spoon Creek
RD10	North Mayo River-Polebridge Creek
RD15	Smith River-Rock Castle Creek
RD16	Sycamore Creek-Little Sycamore Creek
RD17	Smith River-Widgeon Creek
RD18	Rennet Bag Creek-Otter Creek
RD46	Dan River-Big Toby Creek
RD47	Birch Creek
RD49	Dan River-Chalmers Creek

RL07	Butcher Creek/John H Kerr Reservoir
RU01	Goose Creek-Lick Fork
RU02	Bottom Creek
RU03	South Fork Roanoke River-Purgatory Creek
RU04	Elliott Creek
RU05	South Fork Roanoke River-Brake Branch
RU06	North Fork Roanoke River-Dry Run
RU07	North Fork Roanoke River-Wilson Creek
RU08	North Fork Roanoke River-Bradshaw Creek
RU09	Roanoke River-Sawmill Hallow
RU10	Mason Creek
RU11	Tinker Creek-Buffalo Creek
RU12	Carvin Creek
RU13	Tinker Creek-Glade Creek
RU14	Roanoke River-Peters Creek
RU15	Back Creek
RU16	Roanoke River/Smith Mountain Lake-Lynville Creek
RU17	Beaverdam Creek
RU20	North Fork Blackwater River
RU21	South Fork Blackwater River
RU22	Blackwater River-Madcap Creek
RU23	Maggodee Creek
RU25	Gills Creek
RU29	Pigg River-Turners Creek
RU35	Snow Creek-Gourd Creek
RU39	Goose Creek-North Fork Goose Creek
RU40	Bore Auger Creek
RU49	Big Otter River-Stony Creek
RU50	North Otter Creek
RU51	Elk Creek-Chestnut Branch
RU52	Big Otter River-Roaring Run
RU85	Horsepen Creek
RU86	Roanoke Creek-Lipscomb Branch
TC01	Clinch River-Cavitts Creek
TC02	Clinch River-Pounding Mill Branch
TC03	Indian Creek-Laurel Branch
TC04	Clinch River-Middle Creek
TC05	Clinch River-Swords Creek
TC06	Maiden Spring Creek
TC07	Little River-Liberty Creek
TC08	Indian Creek-Hogwallow Branch
TC09	Little River-Katie Branch
TC10	Lewis Creek-Laurel Branch
TC11	Clinch River-Dilly Branch
TC12	Elk Garden Creek-Loop Creek
TC13	Big Cedar Creek
TC14	Clinch River-Thompson Creek
TC15	Dumps Creek
TC16	Clinch River-Big Spring Branch
TC17	Lick Creek-Honey Branch
TC18	Clinch River-Bull Run

TC19	Guest River-Rocky Fork
TC20	Bear Creek
TC21	Guest River-Toms Creek
TC22	Clinch River-Sinking Creek
TC23	Clinch River-Little Stony Creek
TC24	Stony Creek-Straight Fork
TC25	Cove Creek
TC26	Stock Creek
TC27	Clinch River-Mill Creek
TC28	Copper Creek-Grassy Creek
TC29	Copper Creek-Valley Creek
TC30	Copper Creek-Obeys Creek
TC31	Upper North Fork Clinch River
TC32	Lower North Fork Clinch River
TC33	Clinch River-Powers Branch
TC34	Blackwater Creek
TC35	Panther Creek
TH01	South Fork Holston River-Dickey Creek
TH02	South Fork Holston River-Rowland Creek
TH03	South Fork Holston River-Mill Creek
TH04	Whitetop Laurel Creek-Big Laurel Creek
TH05	Laurel Creek-Elliot Branch
TH06	Laurel Creek-Beaverdam Creek
TH07	South Fork Holston River-Rockhouse Run
TH08	Middle Fork Holston River-Nicks Creek
TH09	Bear Creek
TH10	Middle Fork Holston River-Staley Creek
TH11	Hungry Mother Creek
TH12	Middle Fork Holston River-Walker Creek
TH13	Middle Fork Holston River-Hutton Creek
TH14	Middle Fork Holston River-Cedar Creek
TH15	Fifteenmile Creek
TH16	Wolf Creek-Spoon Gap Creek
TH17	South Holston River/South Holston Lake
TH18	Spring Creek
TH19	South Holston River/South Holston Lake-Painter Spring Branch
TH20	South Fork Holston River-Beidleman Creek
TH21	Beaver Creek-Little Creek
TH22	Beaver Creek-Steele Creek
TH23	Reedy Creek
TH24	North Fork Holston River-McDonald Branch
TH25	Lick Creek-Lynn Camp Creek
TH26	North Fork Holston River-Sprouts Creek
TH27	North Fork Holston River-Locust Cove Creek
TH28	Laurel Creek
TH29	North Fork Holston River-Robertson Branch
TH30	Tumbling Creek
TH31	North Fork Holston River-Big Creek
TH32	Wolf Creek
TH33	North Fork Holston River-Logan Creek

TH34	Brumley Creek
TH35	North Fork Holston River-Little Creek
TH36	Smith Creek
TH37	North Fork Holston River-Nordyke Creek
TH38	Abrams Creek
TH39	North Fork Holston River-Livingston Creek
TH40	Cove Creek
TH41	North Fork Holston River-Roberts Creek
TH42	Big Moccasin Creek-Carr Creek
TH43	Big Moccasin Creek-Little Moccasin Creek
TH44	Possum Creek
TH45	North Fork Holston River-Newland Hollow
TH46	Big Creek
TP01	Roaring Fork
TP02	Powell River-Black Creek
TP03	Callahan Creek
TP04	Powell River-Pigeon Creek
TP05	South Fork Powell River-Butcher Fork
TP06	Powell River-Camp Creek
TP07	North Fork Powell River-Reeds Creek
TP08	Stone Creek
TP09	North Fork Powell River-Cane Creek
TP10	Powell River-Station Creek
TP11	Wallen Creek
TP12	Hardy Creek
TP13	Powell River-Yellow Creek
TP14	Martin Creek
TP15	Mulberry Creek
TP16	Powell River-Fourmile Creek
TP17	Powell River-Cox Creek
TP18	Indian Creek
TP19	Powell River-Gap Creek
YA01	Headwaters Fisher River
YA02	Little Fisher River
YA03	Headwaters Ararat River
YA04	Johnson Creek
YA05	Lovills Creek
YA06	Headwaters Stewart Creek
YA07	Pauls Creek
YO01	South Anna River-Dove Fork
YO12	North Anna River-Mountain Run

6th Order Hydrologic Unit Comments: 6th order hydrologic unit distribution reviewed in year 2009 by Virginia Department of Game and Inland Fisheries Taxonomic Advisory Committees.

References for 6th Order Hydrologic Unit

Ref.Id	Citation
12325	VDGIF, 2009, Tiered Species Distributions by 6th Order Watershed, as Reviewed by VDGIF's Taxonomic Advisory Committees

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Exhibit 5

Northern long-eared bat information

https://dgif-virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41ddcd19e5ec5

NLEB Winter Habitat and Roost Trees va dept. game & inland fisheries

Find address or place

Measurement

Miles

Measurement Result

87 Miles

Clear

Press CTRL to enable snapping

-83.941 39.031 Degrees

30mi

Esri, HERE, Garmin, FAO, USGS, EPA, NPS

https://dgif-virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41ddcd19e5ec5

NLEB Winter Habitat and Roost Trees va dept. game & inland fisheries

Find address or place

Measurement

Miles

Measurement Result

79.3 Miles

Clear

Press **CTRL** to enable snapping

-83.316 38.767 Degrees

30mi

Esri, HERE, Garmin, FAO, USGS, EPA, NPS

Exhibit 6

Tri-color bat information

MYLU PESU Habitat va dept. game & inland fisheries

Find address or place

Measurement

Miles

Measurement Result

52.8 Miles

Clear

Press CTRL to enable snapping

-84.196 38.481 Degrees

30mi

Esri, HERE, Garmin, FAO, USGS, EPA, NPS

Exhibit 7

Surveys for Protected Freshwater Mussels at the Proposed Green Ridge Recycling and Disposal Facility in Cumberland County, VA Report

REVISED FINAL REPORT

Surveys for Protected Freshwater Mussels at the Proposed Green Ridge Recycling and Disposal Facility in Cumberland County, VA

by

Brett J. K. Ostby and B. B. Beaty
Daguna Consulting, LLC
7509 Pin Oak Circle
Bristol, VA 24202

for

Koontz, Bryant, Johnson, Williams Group
11901 Old Stage Road
Chester, VA

May 29th, 2019
Revised and Executive Summary Added March 27th, 2021

7509 Pin Oak Circle Bristol, VA 24202
Contact: 276-608-6508 or 540-230-1042
DagunaConsulting@gmail.com

EXECUTIVE SUMMARY

The proposed Green Ridge Recycling and Disposal Facility would impact tributaries to the James River. Streams in the James River basin are inhabited by the federally endangered James Spinymussel (*Parvaspina=Pleurobema collina*), the federally threatened Yellow Lance (*Elliptio lanceolata*), the state-threatened Green Floater (*Lasmigona subviridis*), and the state-threatened and now candidate for federal listing, Atlantic Pigtoe (*Fusconaia masoni*). The nearest occurrence of a federally listed mussel species was in neighboring Buckingham County. In May 2019 biologists with Daguna Consulting, LLC surveyed at least 19,000 m^2 of suitable habitat in Muddy Creek and 5,400 m^2 in Maple Swamp Creek. Several other feeding tributaries were assessed for suitability. Surveys and assessments were precisely georeferenced and habitats qualitatively documented. Live mussels and habitat were photographed. Efforts were sufficient to detect all mussel species (including James Spinymussel, Yellow Lance, Atlantic Pigtoe and Green Floater) present at densities ≥ 0.01 m^{-2}.

Muddy Creek supports a low-density mussel assemblage comprised of three common species: Eastern Ellipito (*E. complanata*), Northern Lance (*E. fisheriana*) and Eastern Floater (*Pyganodon cataracta*). No mussels were detected in Maple Swamp Creek. Small tributaries feeding Muddy Creek and Maple Swamp Creek were too small to support freshwater mussels. No federally listed or state-protected freshwater mussels were located within or directly downstream of the proposed Green Ridge Recycling and Disposal Facility.

INTRODUCTION

The proposed Green Ridge Recycling and Disposal Facility is planned for rural Cumberland County, Virginia. Preliminary review of the property indicated that streams potentially containing freshwater mussels may be present. Therefore, the project developer requested a survey for the imperiled freshwater mussels to better understand any potential impact. Nearby perennial streams include Muddy Creek and Maple Swamp Creek. These perennial streams border and, in some places, flow through the Green Ridge property (Figure 1). Many unnamed tributaries to these streams drain the property.

The James River Basin is inhabited by the federally endangered James Spinymussel (*Pleurobema collina*), the federally threatened Yellow Lance (*Elliptio lanceolata*), the state-threatened Green Floater (*Lasmigona subviridis*), and the state-threatened Atlantic Pigtoe (*Fusconaia masoni*). The state-listed Green Floater is known from the James River upstream and downstream of the Muddy Creek confluence (The Catena Group 2010, Chazal et al. 2012). Relic shell material of the Atlantic Pigtoe was recently detected in the Powhatan County reach of the James River by Chazal et al. (2012). The James Spinymussel is known from nearby Rock Island Creek (~ 40 km to the northwest, Chazal et al. 2012). Small populations of Yellow Lance persist in the headwaters of the James River, far to the west. Ostby (2007) detected a significant population of a common mussel species (Eastern Elliptio, *Elliptio complanata*) in a small unnamed stream in Powhatan County (~20 km to the east). That small unnamed stream was comparable to the perennial streams on the Green Ridge site. Chazal et al. (2012) conducted 2

surveys of Davis Creek, a tributary to Muddy Creek entering downstream of the Green Ridge site. They identified suitable habitat but detected no native mussels in those surveys.

On May 25 and 26, 2019, biologists Brett Ostby and Braven Beaty of Daguna Consulting, LLC visited the Green Ridge property to assess potential mussel habitat in streams and conduct surveys for freshwater mussels where necessary. Surveys were conducted to meet the requirements of "Abbreviated Surveys" as defined in "Freshwater Mussel Guidelines for Virginia (USFWS and VDGIF 2013)". Most efforts focused on Muddy Creek and Maple Swamp Creek.

METHODS

Stream Assessment

We either visited streams by hiking through the site or assessed streams as they entered either Muddy Creek or Maple Swamp Creek. Assessments determined whether sufficient flow and suitable substrate were present to support freshwater mussels. We also assessed overall stream conditions. In some streams with sufficient flow, we searched for mussels.

Stream Surveys

The perennial streams (Muddy Creek and Maple Swamp Creek) were surveyed for mussels to qualitatively assess species composition, abundance, and the possible presence of protected species. Surveys were designed to detect all mussel species present in Virginia. In accordance with the published Virginia freshwater mussel survey guidelines, we searched reaches of stream extending from 400 downstream to 100 m upstream of proposed impacts. Because most habitats were shallow (<0.5 m), we used viewscopes and unaided visual inspection. In some areas tactile searches were employed. All stream reaches were surveyed unless the habitat was deemed "unsuitable" for mussels based on the site visit. The "unsuitability" of any stream reach(es) as habitat for mussels was fully documented. We searched stream banks and exposed shoals for mussel shells to obtain a complete list of species at the site. Surveys were conducted when water level and clarity were suitable to locate shells and live individuals with ease. Sufficient effort was expended to visually inspect a sufficient amount of suitable habitat so that we could state with reasonable confidence that endangered and/or threatened species did or did not occur in the reach sampled. Representative specimens of each species detected were photographed. Geographical Information System (GIS) programs were used to georeference survey boundaries, location of protected species, and location of other pertinent features.

RESULTS

Weather and Stream Conditions

Skies were clear on both May 25th and May 26th. Air temperature reached a high of 29 ºC (85 ºF) on May 25th and 32 ºC (90 ºF) on May 26th. Flows were assumed to be near median in Muddy Creek and Maple Swamp Creek based on information from nearby gages, including USGS 02036500 on Fine Creek at Fine Creek Mills, VA and USGS 02039500 on the Appomattox River at Farmville, VA. Little to no rain had fallen in the area over the preceding week. Water clarity in Muddy Creek was limited due to tannins and turbidity from an unknown

source. In general, the streambed was clearly visibly in laminar flows less than 0.4 m depth. Water temperature in Muddy Creek was 22 ºC (76 ºF) when surveyed on May 25th. Maple Swamp Creek had no evidence of tannins and was considerably clearer, with all streambed habitats visible from the water surface in laminar flow. Water in Maple Swamp Creek was 18ºC (64 ºF) during the May 26th survey.

Muddy Creek Habitat and Species Observations

We surveyed Muddy Creek from the abandoned Miller Lane bridge (37.584320, -78.106711) to upstream of the Pine Grove culvert crossing (37.567270, -78.138347), with the exception of a 100 m reach directly downstream of the Pine Grove crossing (Figure 2). The total surveyed reach was approximately 3,800 m. Muddy Creek flowed through a corridor of mature bottomland forests, with extensive marshes in the 1000 m reach upstream of the abandoned bridge (Figure 3). Its average bankfull width was 7 m with wetted width usually 5-6 m. Bankfull height was 1 to 1.5 m throughout, with sand banks forming a natural dike between the channel and marsh areas. In forested areas, banks were steep but stable and usually vegetated (Figure 4).

Instream habitat in Muddy Creek was 95% run habitat with a sand streambed (see Figure3). The sand streambed ranged from firm to soft. All instream habitat structure in the lower 3,400 m of the surveyed reach was formed by large woody debris. Approximately 5% of the habitat was pool. Exposed bedrock, boulders, cobble and gravel were only observed starting 300 m downstream of the Pine Grove crossing. From 400 m downstream to 200 m upstream of the Pine Grove crossing, a few riffles were noted (Figure 5). Overall the streambed was 99% sand, with some patches being unstable and soft. Maximum water depth was 1.25 m with most habitats less than 0.4 m deep.

In a 9 person-hour effort, we detected 12 live Eastern Ellipito (*E. complanata*), 5 live Northern Lance (*E. fisheriana*) and 1 live Eastern Floater (*Pyganodon cataracta*) in the main channel of Muddy Creek. Figures 6-8 are photographs of example specimens. We detected live mussels only from the start point to approximately 1000 m upstream. We observed recent shell material on exposed banks nearer the Pine Grove crossing, but no live specimens were detected in the vicinity. Non-native Asian Clams (*Corbicula fluminea*) were present throughout the stream but not common. There was little habitat for aquatic insects except near the Pine Grove crossing where we observed a few mayfly larvae under cobbles. We also observed some water scorpions (*Ranatra*) in large woody debris closer to the survey start point. We observed cyprinids, mostly dace, and centrarchids. Several centrarchid nests were noted near the survey start point. Three frog species were abundant in Muddy Creek and its associated wetlands including Green Frogs, Cricket Frogs and Leopard Frogs. Tadpole of American Toads and calls of Grey Treefrogs were also noted.

We noted several tributaries entering Muddy Creek (marked as Trib 1-3 and 5-6 in Figure 2 and geo-referenced as Trib 1-6 in Table 1) but none appeared suitable for freshwater mussels, being either too small or unstable (Figures 9-14, see Table 1 for locations). We extensively searched a tributary flowing from the south which eventually dissipated into a marsh but found no evidence

of mussels (Trib 1, see Figures 9 and 10). The largest tributary flowing through the Green Ridge property into Muddy Creek from the northwest had a significantly incised channel clogged by sand with little flow (Trib 3, 37.5744, -78.12536, see Figure 12). Upstream of the Pine Grove Road crossing, we assessed and surveyed an unnamed tributary draining from the south. This stream showed evidence of recent catastrophic disturbance, with a newly incised channel cut into clay banks (Figure 14). There was also a copious amount of gravel, likely originating from Brown Road, in the stream bed (see Figure 5). Further survey of this stream was not warranted. Other tributaries flowing off the Green Ridge site into the surveyed reach of Muddy Creek as marked on the topographic map by dotted blue lines (see Figure 2) were not detected during the survey of Muddy Creek because they were likely dry on May 25th.

Maple Swamp Creek Habitat and Species Observations

At the survey start point (37.55975, -78.10566), Maple Swamp Creek flowed along a marsh on its left ascending side and a mature forest on the other (Figure 15 and 16). This reach had low banks (<0.5 m). It was exclusively run habitat with a sand stream bed. Some patches of sand were extremely soft. Large woody debris was common. Bankfull width was 3-4 m and mostly wetted. Water depth was usually less than 0.3 m.

Moving from downstream to upstream the character of Maple Swamp Creek gradually changed. Further upstream, this stream flowed through a mature forested corridor with higher banks. Upstream of the unnamed tributary labeled Trib 7, riffles and larger streambed particles became more common. For approximately the upstream 600 m of the surveyed reach, bankfull height was usually 1 to 1.5 m, reaching a maximum of 2 m. For the upstream 600 m of the surveyed reach habitat was 75% run, 10% riffle and 5% pool (Figure 17). While most of the streambed remained sand (75%), boulder, cobble and gravel were more common. Some habitats had an exposed bedrock streambed.

In a 5 person-hour effort, we surveyed an approximately 1,800 m reach, detecting no evidence of native mussels. No Asian Clams (*C. fluminea*) were detected either. Fish were more common in Maple Swamp Creek than in Muddy Creek, with dace, central stone rollers, and darters observed. Aquatic insects were more frequently encountered in Maple Swamp Creek than in Muddy Creek, including mayfly larvae, whirligig beetles, caddis fly larvae and water pennies. Several frog species were abundant in Maple Swamp Creek and its associated wetlands including Green Frogs, Cricket Frogs and Leopard Frogs. Calls of Grey Treefrogs were also noted.

Two apparently perennial tributaries (Trib 7 and 8 on Figure 15) were assessed. No evidence of mussels was detected though suitable habitat and habitat complexity were noted near Maple Swamp Creek in both cases (Figures 18 and 19).

CONCLUSION

Muddy Creek supports a low-density mussel assemblage comprised of three common species. We found no evidence to suggest additional species inhabited the surveyed reach. None of the Muddy Creek tributaries draining the Green Ridge property appeared to provide suitable habitat

for native mussels. We found no evidence to suggest Maple Swamp Creek or its tributaries were inhabited by native mussels. Disturbances to any stream flowing off the Green Ridge property might impact native mussels living downstream in Muddy Creek. Maple Swamp Creek is also a tributary to Muddy Creek.

An adequate amount of habitat was searched to detect extremely low-density populations of protected species. Using a sampling equation from Smith (2006), we calculated post hoc detection probabilities based on total area searched and assumed detection of an individual mussel when present (or search efficacy, Table 2). We surveyed at least 19,000 m^2 of habitat in Muddy Creek and 5,400 m^2 in Maple Swamp Creek. Generally, detection of an individual mussel is 0.2 on a scale from 0 to 1, where "0" means an individual was present but not detected and "1" means an individual was detected. An individual detection rate of 0.1 was more appropriate for Muddy Creek due to tannins and turbidity, whereas 0.2 was appropriate for Maple Swamp Creek. We had an extremely high probability (>0.99) to detect mussels present at 0.01 m^{-2} in both Maple Swamp Creek and Muddy Creek.

Densities in Muddy Creek were so low that it would require large areas be surveyed to detect existing populations, so it should be no surprise that Department of Conservation and Recreation, Division of Natural Heritage surveys conducted by Chazal et al (2012) failed to detect mussels in the Muddy Creek drainage.

LITERATURE CITED

Ostby, B. J. K. 2007. Stream Survey for Protected Mussels in Unnamed Tributaries to Fine Creek, Powhatan County, Virginia. Report for Balzer and Associates, Powhatan, VA. 13 pp.

Chazal, A. C., B. T. Watson and B. C. Flower. 2012. Results of James Spinymussel Surveys in the James River and Tributaries of Central and Eastern Virginia. Report for Virginia Department of Game and Inland Fisheries, Richmond, VA. 222 pp.

Smith, D. R. 2006. Survey design for detecting rare freshwater mussels. Journal of the North American Benthological Society 25(3): 701-711.

The Catena Group. 2010. Freshwater Mussel Survey Report for Proposed Water Intake, James River, Powhatan Co, VA. Report for Malcom Pirnie, Inc. Newport News, VA. 15 pp.

U. S. Fish and Wildlife Service and Virginia Department of Game and Inland Fisheries. 2013. Freshwater Mussel Guidelines for Virginia. Gloucester, VA. 9 pp.

Table 1. Latitude and longitude markers (WGS84) for mussel surveys and assessments.

Label	Lattitude	Longitude	Figure
Assessment Trib 1 upstream	37.57729	-78.11288	
Assessment Trib 1 and photo	37.57812	-78.11368	9
Assessment Trib 1 downstream and photo	37.58120	-78.11529	10
Muddy Creek survey start	37.58423	-78.10672	
Assessment Trib 2 and photo	37.57520	-78.12201	11
Assessment Trib 3 and photo	37.57440	-78.12536	12
Larger substrate and exposed bed upstream	37.57089	-78.12895	
Assessement Trib 4 and first riffle	37.57006	-78.12954	
Shells on exposed bar	37.56992	-78.13188	
Assessment Trib 5 and photo	37.56804	-78.13322	13
Road gravel noted in streambed	37.56740	-78.13779	5
Upstream Assessement Trib 6 and photo	37.56806	-78.13294	14
Muddy Creek survey end	37.56729	78.13835	
Upstream Assessement Trib 7	37.55895	-78.11561	
Assessment Trib 7 and photo	37.55569	-78.11260	17
Maple Swamp Creek survey start	37.55971	-78.10574	15
Assessement Trib 8 and photo	37.55217	-78.11458	18
Upstream Assessement Trib 8	37.55216	-78.11551	
Maple Swamp Creek survey end	37.54780	-78.11513	

Table 2. Probability of detecting a species (p) using Smith (2006) equation, $p = 1 - e^{-\beta\alpha\mu}$, given search efficacy (β), actual area covered in a survey (α), and a theoretical density (μ). We also present a theoretical population size for a survey reach for a given density (0.01 or 0.005 individuals per meter square). For example, if we were only able to detect 1 in 10 *L. subviridis* present in Muddy Creek and there were only 94 in the entire surveyed reach, we had a 0.9913 probably to detect at least a single individual.

	p	**β**	**α**	**μ**	
Stream	Probability of populuation detection	Probability of Individual Detection	Area Visually Searched	Poulation Density	Population Size in Survey Reach
Muddy Creek	0.9999	0.05	19000	0.01	190
	1.0000	0.1	19000	0.01	190
	0.9913	0.05	19000	0.005	95
	0.9999	0.1	19000	0.005	95
Maple Swamp Creek	1.0000	0.2	5400	0.01	54
	0.9955	0.1	5400	0.01	54
	0.9328	0.05	5400	0.01	54
	0.9955	0.2	5400	0.005	27
	0.9328	0.1	5400	0.005	27
	0.7408	0.05	5400	0.005	27

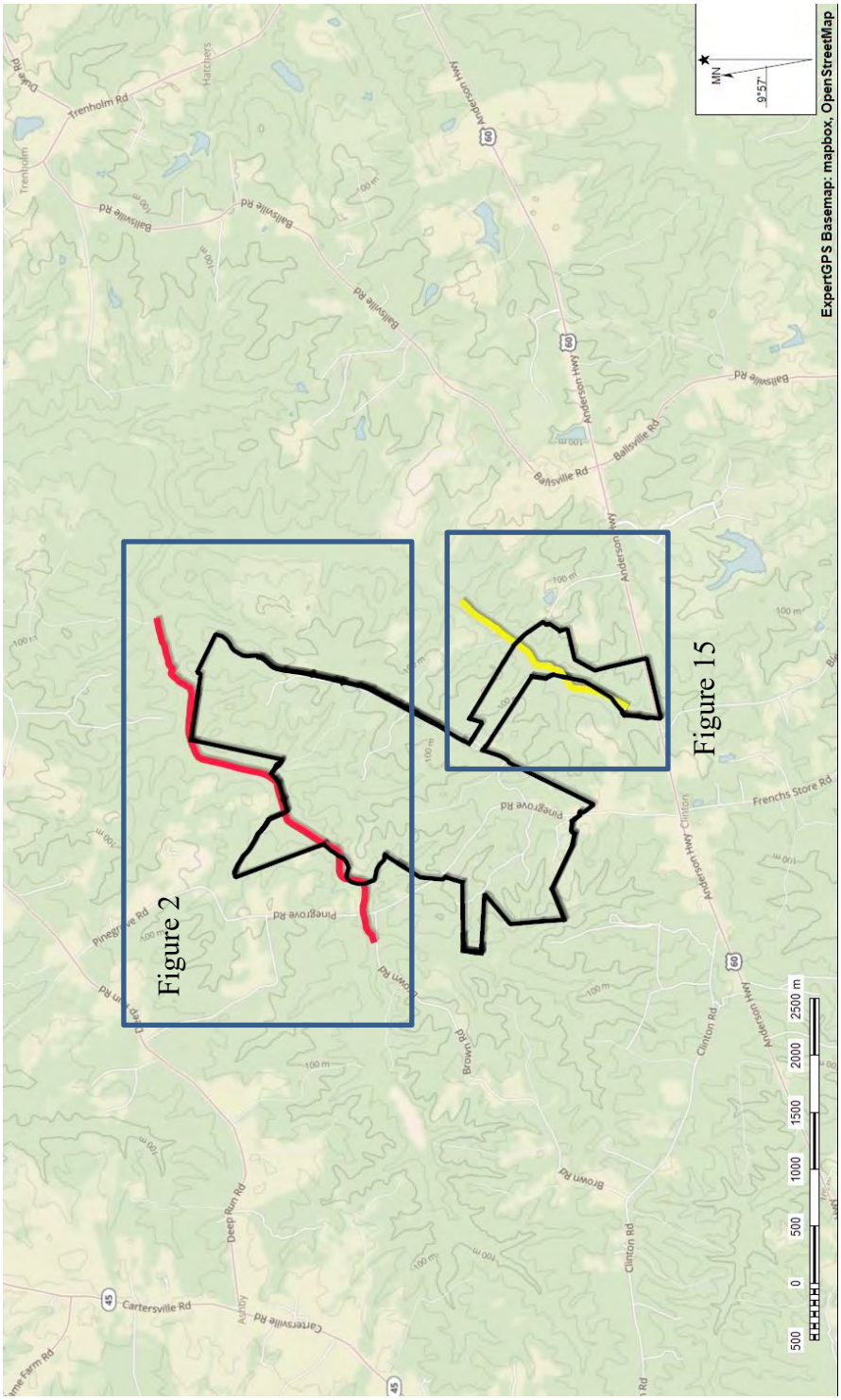


Figure 1. Area road map illustrating the reaches of Muddy Creek (red) and Maple Swamp Creek (yellow) that were surveyed for freshwater mussels. Property boundaries are marked in black.

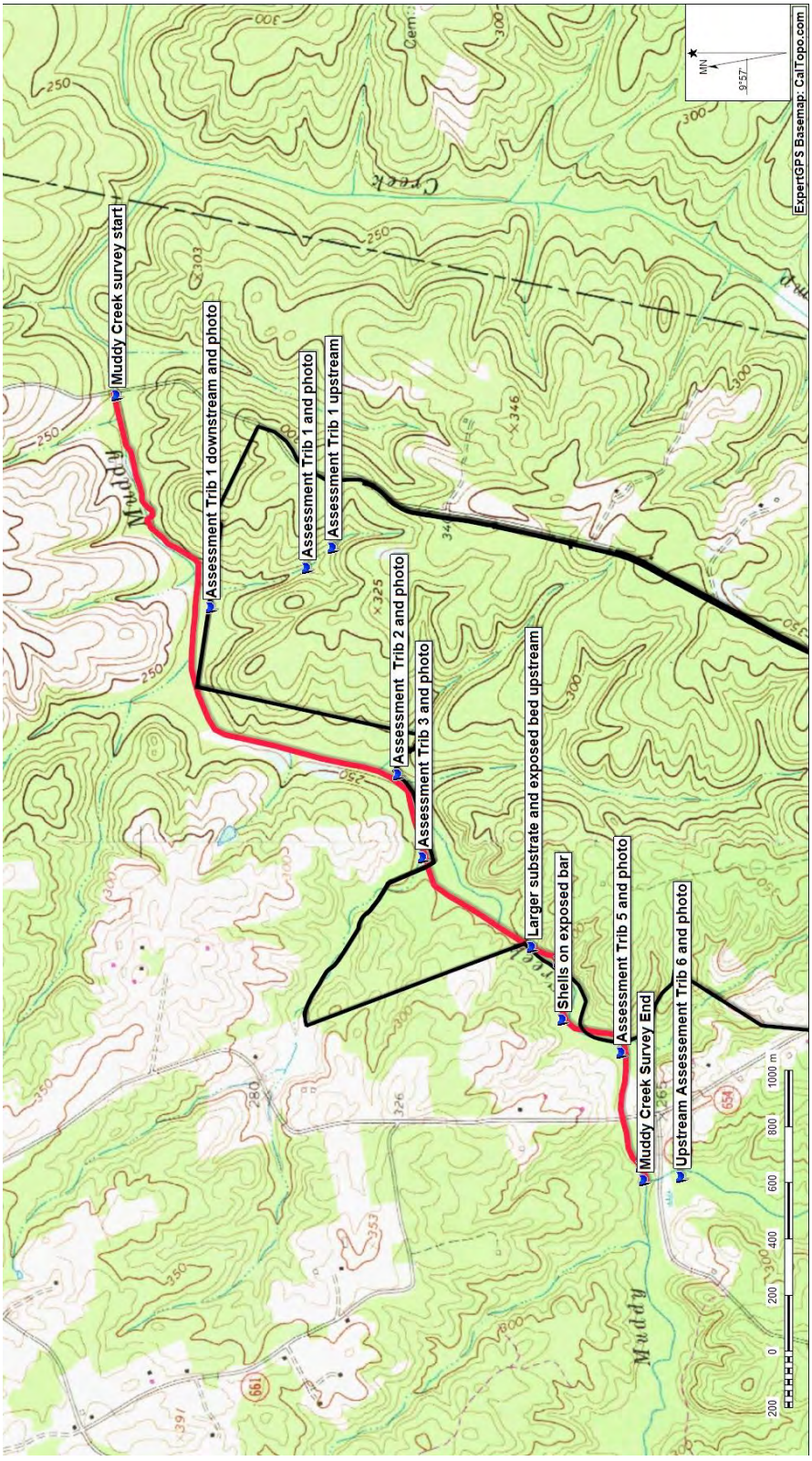


Figure 2. Topographic map illustrating survey reach of Muddy Creek (red) and its tributaries that were assessed. Property boundaries are marked in black. Tributary 4 was not marked here due to label overlap. All assessment are geo-referenced in Table 1.

Figure 3. Marsh bordering Muddy Creek near the survey start point. The most extensive marsh was present along the right ascending side.

Figure 4. Typical run habitat in Muddy Creek flowing through the forested corridor.

Figure 5. Muddy Creek upstream of Pine Grove crossing with gravel bar. Bar material appears to have originated from a gravel road and did not resemble stream bed material observed elsewhere in Muddy Creek or its tributaries.

Figure 6. The Eastern Elliptio (*E. complanata*) was the most frequently encountered species. Most were greater than 90 mm, with ages approximately 10 years or greater.

Figure 7. Northern Lance (*E. fisheriana*) were found in clay banks. Shell material of specimens as young as 3 years old were detected just downstream of the Pine Grove stream crossing on exposed bars.

Figure 8. We observed only a single specimen of Eastern Floater (*P. cataracta*) in Muddy Creek. It was 4 years old.

Figure 9. Stream feeding Muddy Creek from the south (Trib 1) was deeply incised in some locations. It was likely too small to support native mussels but did harbor dace.

Figure 10. Forested marsh near the Muddy Creek channel where the unnamed tributary channel (Trib 1) pictured in Figure 9 dissipated.

Figure 11. A beaver dam blocked this small tributary draining the Green Ridge site from the south (37.57520, -78.12201). This stream was too small to support freshwater mussels, so no further survey was warranted.

Figure 12. Unnamed tributary feeding Muddy Creek from the northwest had little flow and contributed large amounts of sand to the stream (37.5744, -78.12536). This stream drains the Green Ridge site and was not surveyed. Flow was only a few mm deep and filled less than half the channel, suggesting it may be ephemeral.

Figure 13. We followed this unnamed tributary as we exited Muddy Creek and made several checks (37.56804, -78.13322). Like other feeding tributaries it was too small to support mussels.

Figure 14. A recently incised channel within an older channel upstream of the new Brown Road crossing. This stream recently suffered a catastrophic event forming a new and deeper channel.

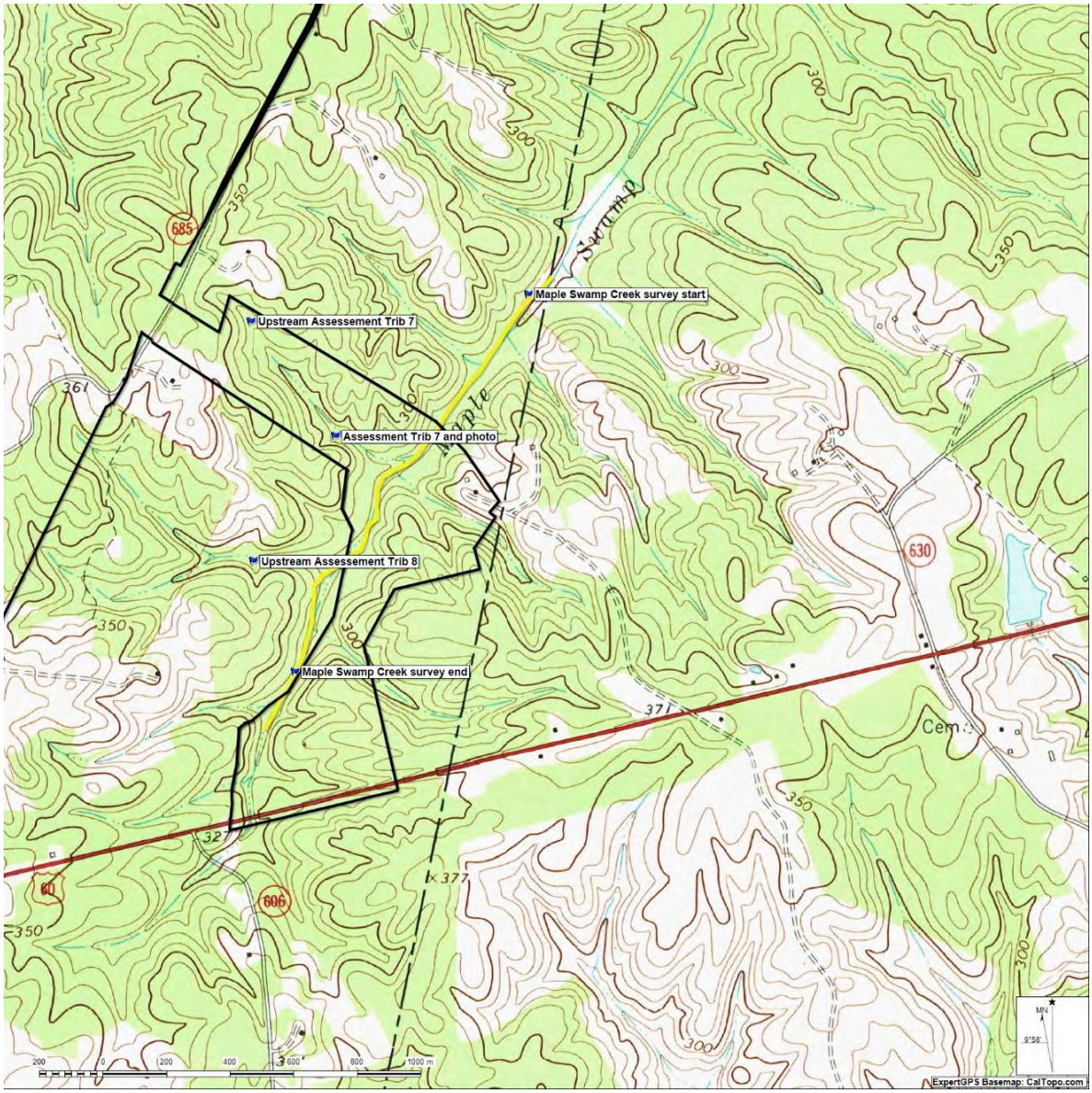


Figure 15. Topographic map illustrating survey reach of Maple Swamp Creek (yellow) and its tributaries that were assessed. Property boundaries are marked in black.

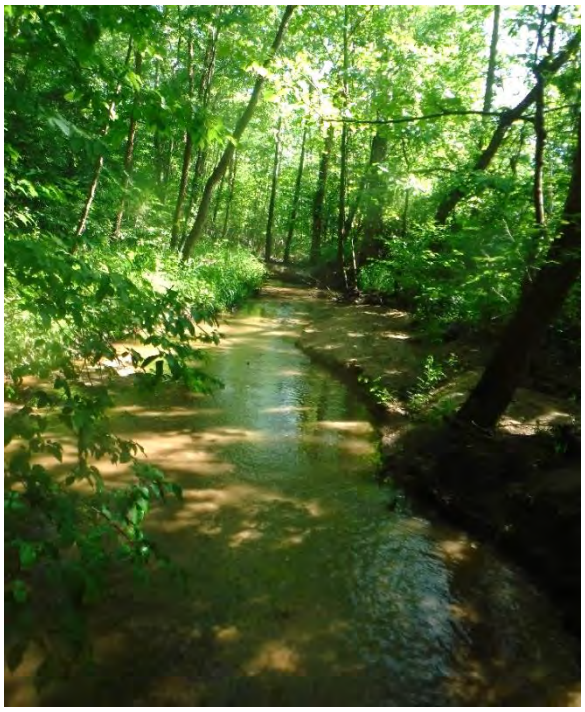


Figure 16. Run habitat with a sand streambed in Maple Swamp Creek near survey start.

Figure 17. More complex meandering instream habitat farther upstream in Maple Swamp Creek. Boulders and cobble in the streambed here were absent downstream. We observed more fish, including darters in this habitat.

Figure 18. While hiking in from Miller Road, we searched approximately 200 m of a tributary feeding Maple Swamp Creek, finding suitable habitat but failing to detect any evidence of mussels (37.55569, -78.11260).

Figure 19. We searched an approximately 200 m reach of a small tributary feeding Maple Swamp Creek from its mouth upstream finding no evidence of mussels (37.5521, -78.11458).

Survey Record #1

Site #: DAGUNA05252019.1

Stream: Muddy Creek

County: Cumberland

Description: Surveyed 3,800 m reach of main channel and assessed several feeding tributaries

Drainage: James

USGS Quadrangle Map: Whiteville/Trenholm

Projection: WGS 84

Survey Start: 37.58423, -78.10672

Survey End: 37.56729, -78.13835

Survey Date: 5/25/2019 and 5/26/2019

Survey Effort: 9 person-hours

Personnel: B. J. K. Ostby, B. B. Beaty

Mollusks Observed:

12 Live *Elliptio complanta*
5 Live *E. fisheriana*
1 Live *Pyganodon cataracta*
Live *Corbicula fluminea* (uncommon)

7509 Pin Oak Circle Bristol, VA 24202
Contact: 276-608-6508 or 540-230-1042
DagunaConsulting@gmail.com

Survey Record #2

Site #: DAGUNA05262019.1

Stream: Maple Swamp Creek

County: Cumberland

Description: Surveyed 1,800 m of main channel and assessed 2 feeding tributaries

Drainage: James

USGS Quadrangle Map: Trenholm

Projection: WGS 84

Survey Start: 37.55971, -78.10574

Survey End: 37.547796, -78.11513

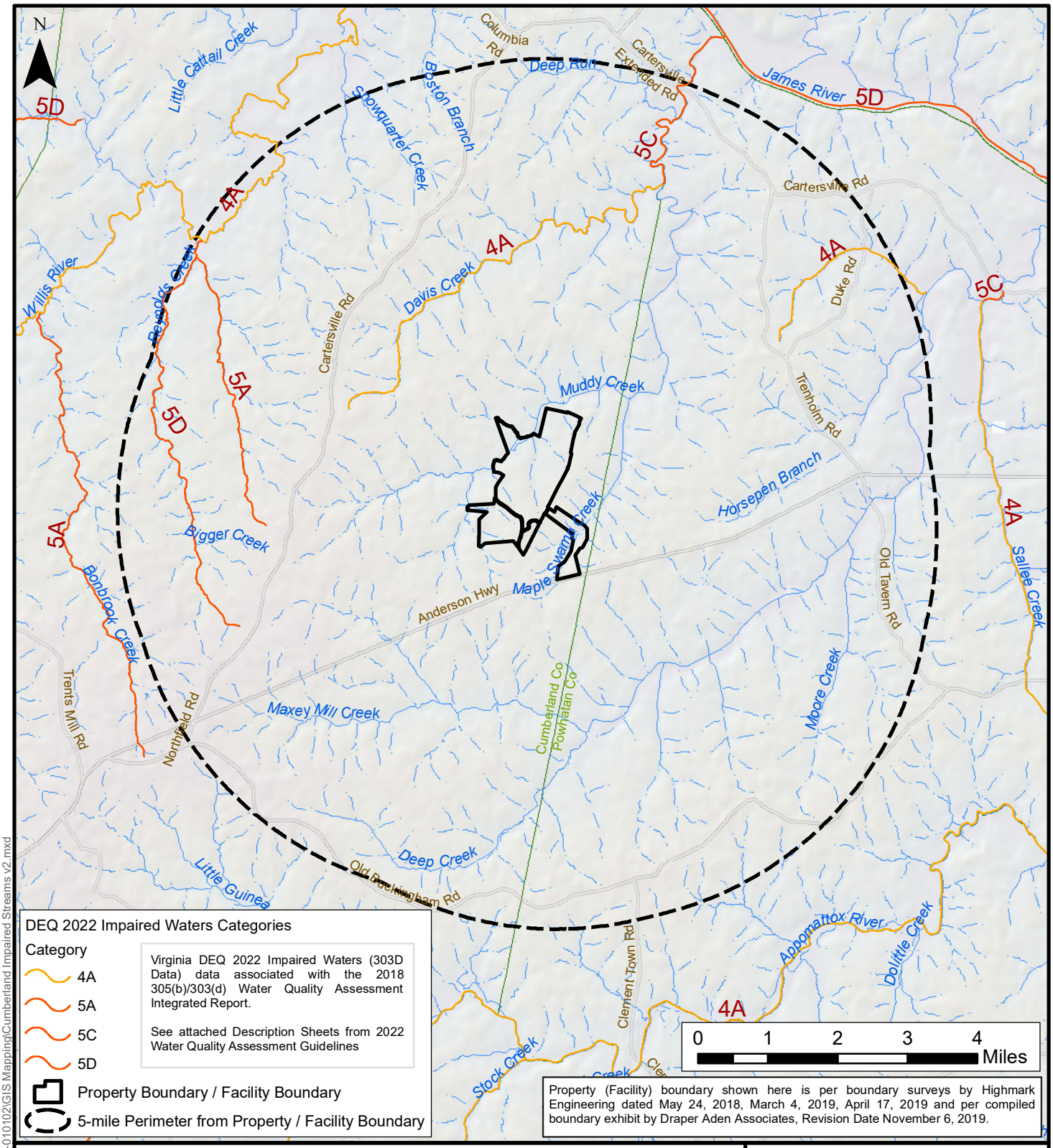
Survey Date: 5/26/2019

Survey Effort: 5 person-hours

Personnel: B. J. K. Ostby, B. B. Beaty

Mollusks Observed:

None



Surface Water Resources

Green Ridge Recyling and Disposal Facility
Cumberland County, Virginia

SCALE: 1:125,000

PROJECT: 18020117-030102

TR 2 response –05/12/2023 – Updated to DEQ 2022 data, no changes noted.

Draper Aden Associates
Engineering ◆ Surveying ◆ Environmental Services
1030 Wilmer Avenue, Suite 100
Richmond, VA 23227
804-264-2228 Fax: 804-264-8773
Blacksburg, VA
Charlottesville, VA
Hampton Roads, VA
Raleigh, NC
Fayetteville, NC
Northern Virginia

DESIGNED: LPK
DRAWN: SMF
CHECKED: BHH
DATE: 02-24-23

FIGURE
LIS-4H-1

Path: P:\2018\18021\0100\18020117\18020117-010102\GIS Mapping\Cumberland Impaired Streams v2.mxd

ATTACHMENT PTA-XVIII - ADJACENT PROPERTY OWNER NOTIFICATION

As required by §9 VAC 20-81-460.I., a written notice has been sent to all adjacent property owners or occupants. A signed statement, a typical copy of the notice, and the names and addresses of those to whom the notice were sent are included. In addition, Cumberland County notified adjacent property owners during the conditional use and rezoning process. This information is also included for reference.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. TR 1 had one comment on notification as follows:

4.) *Attachment XVIII includes a list of the parcels and addresses whose owners or occupants were notified of the proposed landfill, in accordance with 9 VAC 20-81-460.I. However, the following twenty-two parcels appear to be adjacent to the proposed landfill and could not be located in Attachment XVIII:*

38-A6-A	*44-A-24*	*45-1-39*	*45-A-12-D*
44-A-16	*44-A-23*	*45-1-35*	*45-A-12-E*
45-A-2	*44-A-31*	*45-1-34*	*45-A-12-A*
45-A-2-D	*44-A-35-A*	*45-A-15-A*	**Unidentified Parcel SE of Jones Site*
45-A-11	*44-A-38*	*45-A-15-B*	
45-2-3-D	*44-A-37*	*45-A-16*	

Please verify that these parcels were notified as necessary, in accordance with 9 VAC 20-81-460.I.

The response to this comment was provided on October 1, 2021. The response referenced Letter Attachment 4 which is included in this current submittal (along with the appropriate Part A documents). See list below.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. No comments specific to this Attachment were received.

The following is a list of documents that are associated with this section (including information from the original Part A and TR 1 response):

TR 1 – Response – 10/01/2021:

- Letter Attachment 4 – Certification of Supplemental Notice to Adjacent Property Owners, dated 10/01/2021 signed by Jerry Cifor

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- Letter Attachment 4 – Supplemental Notice – Exhibit A – example letter submitted

Part A – Original submittal - Attachment PTA-XVIII – 01/22/2020

- Signed Certification of Notification dated 01/14/2020 signed by Jerry Cifor
- Cumberland list – all adjacent property owners
- Example letter submitted, dated 12/12/2019
- Cumberland County – Planning Commission – REZ – list of notifications, mailed 06/01/2018
- Cumberland County – Planning Commission – CUP – list of notifications, mailed 06/01/2018
- Cumberland County – Board of Supervisors – CUP – list of notifications, mailed 06/12/2018

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ATTACHMENT PTA-XIX - PUBLIC INTEREST SERVED

Per Submission Instruction No. 1, the applicant is to provide a discussion on how the public interest will be served by the proposed facility based on one or more of the conditions listed under 9 VAC 20-81-460.K.1. through K.7.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. No comments were received on Attachment PTA-XIX under TR 1.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. Again, no comments specific to this Attachment were received.

Since the original submittal, several additional localities have expressed their support for the project, specifically the Counties of Bedford and Prince George. Letters are included in this attachment.

A. REGULATORY REQUIREMENTS

Under the Part A submittal requirements (9VAC20-81-460.K) the applicant for a new solid waste management facility must provide indication that the public interest will be served in one or more of the categories identified in the regulation which include:

1. Cost effective waste management for the public within the service area comparing costs of a new facility or facility expansion to waste transfer, or other disposal option;
2. The facility provides protection of human health and safety and the environment;
3. The facility provides alternatives to disposal including reuse or reclamation;
4. The facility allows for the increased recycling opportunities for solid waste;
5. The facility provides for energy recovery or the subsequent use of solid waste, or both thereby reducing the quantity of solid waste disposed;
6. The facility will support the waste management needs expressed by the host community; or
7. Any additional factors that indicate that the public interest would be served by the facility.

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The service area for this facility (Facility) is defined via the Host Agreement between the Cumberland County Board of Supervisors and Green Ridge Recycling and Disposal Facility LLC (Green Ridge) approved by the Board on August 2, 2018 as amended on July 11, 2019. In that agreement, the service area is identified as by a 500-mile radius from the Facility excluding the states of New York and New Jersey. After further consideration, the service area has been revised to include Virgina waste only.

Cumberland County as the host community has indicated its approval of the proposed Facility believing that it will be beneficial to the community and that it will serve the public. Specifically, three items have been cited in the benefits to the community:

Item 1: Cost Effective Waste Management

Cumberland County has been seeking options to mitigate the expenses of its solid waste program for years. In 2006, the County believed that it had an opportunity with Republic Waste Industries to mitigate these costs with Republic opening a landfill in Cumberland. The County also built a new school in anticipation of the Republic landfill. However, this opportunity fell through and Repbulic has withdrawn its permits. As a result, the County sought options to offset its costs and replace the expected revenue from the proposed Republic landfill upon which it was so heavily relying.

To highlight the need, reference is made here to the County's solid waste management plan which outlines the need for cost effective waste management. The local solid waste management plan (SWMP) covers a region defined as Prince Edward County and Cumberland County. Key statements from the SWMP relevant to this discussion include the following:

- "*The planning district within which Prince Edward and Cumberland Counties are part of is described as: "one of the most economically challenged regions in the State of Virginia."* (Page 6)
- *"Both Prince Edward County and Cumberland County are largely rural with few large industries and manufacturing facilities."* (Page 6)
- *"Scarcity of higher paying salaries continues to impact in a negative manner, a locality's or region's primary source of income – its tax base. This in turn, often inhibits growth in the locality or region because investments in needed infrastructures do not happen or are slow to occur."* (Page 7)

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- *Environmentally-sound solid waste management within the two counties remains a significant public function that demands a continuing allocation of resources.* (Page 7)
- *"Along with highways, railroads, water, wastewater, schools and healthcare providers, well run and funded waste management facilities are an attraction to industrial, commercial and residential development. "* (underlining added for emphasis) (Page 7)

As reflected in the County's SWMP, Cumberland County needs the Green Ridge Facility because it will provide the County with substantial and much needed revenues, jobs, and relief for the solid waste expenses of Cumberland County, thereby serving the local public interest.

In addition, the County's Host Agreement with Green Ridge outlines numerous ways in which the Cumberland County public will be served. Some of the ways that the public will be served as identified in the Host Agreement include (but are not limited to) the following:

- Section 1.6 – Convenience Center at landfill for free disposal by residents; drop off recycling center
- Section 1.7 – Free disposal for County government facilities
- Section 2.1 – Host Fees – based on tonnage and unit cost per ton
- Section 2.2 – Initial fees of $100,000 to defray costs for negotiations
- Section 2.3 – Annual contribution - $25,000 for environmental and science public education or other activity as may be agreed upon by both parties.
- Section 2.4 – Recreational Facilities Contribution and Economic Opportunities – reversion of at least 25 acres to the County at the time of closure for public use; annual payment of $25,000/year for promotion of economic development; promotion of a training program with the community college system
- Section 3.1 – Landfill Liaison – reimbursement of up to $100,000 per year for an employee who will inspect landfill operations

(Green Ridge would note that the anticipated total annual revenue to Cumberland County from the Green Ridge facility should be approximately 3 million dollars, which represents almost 20% of the County's current annual budget.)

Item 4: Increased Recycling

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Cumberland County will be working with Green Ridge to enhance the County's recycling program. Funding under Section 2.3 of the Host Agreement and additional recycling at the landfill will allow the County to broaden its vision for recycling and expand services to the community. Without the support of Green Ridge (monetarily and operationally), Cumberland County simply could not afford to consider such enhancements. The increased recycling opportunities that Green Ridge would support will serve the public well.

Item 6: Facility Will Support Waste Management Need of Host Community

The Cumberland County Comprehensive Plan outlines a number of goals and objectives for theCumberland community. Under Community Facilities, Objective 6 states*: "Develop and maintain appropriate public utilities to support current and future growth of all types in Cumberland County."* (Page 103) Policy 6.e states, *"Develop and maintain appropriate and cost effective solid waste management facilities, services and programs to serve the needs of citizens, businesses, industries and the environment."* The Green Ridge project (convenience center, recycling and disposal), as well as revenues generated by the project will help the County meet these objectives in addition to other goals outlined in the Cumberland Comprehensive Plan.

In short, Cumberland County firmly believes that the interests of the public will be served through the implementation of this project and has therefore supported it through the rezoning and conditional use permit approvals as well as a letter of written support urging DEQ's approval of Green Ridge's permit request.

B. LOCAL SUPPORT

In support of this project the following communities have provided letters of support or expressed interest in future capacity:

- Cumberland County – July 13, 2019
- CVWMA – June 28, 2019
- Hanover County – September 9, 2019
- Ashland – December 2, 2019
- Chesterfield County – December 3, 2019
- Rappahannock Regional Solid Waste Board – December 6, 2019
- Botetourt County – December 10, 2019
- Appomattox County – December 1, 2019
- Amherst County – March 3, 2020

- Dinwiddie County – February 14, 2020
- Madison County – February 12, 2020
- Colonial Heights – January 30, 2020
- Bedford County – April 22, 2020
- Prince George County – April 20, 2020

Copies of these letters are attached.

C. BROADER INTEREST SERVED

The public interest in the broader service area will alsobe well served by the Green Ridge Facility as outlined in the Preliminary Statement and Demonstration of Need included in Green Ridge's Notice of Intent. Key ways in which the broader public interest will be served include:

- As indicated in the Preliminary Statement and Demonstration of Need in the Notice of Intent, solid waste disposal for Cumberland County is a drain on its limited resources. The Green Ridge facility will offer relief to the County in a number of ways, including reduced disposal and recycling costs, as well as substantial revenues from the host fee and jobs. Cumberland County needs this project and actively supports it.

- Relative to the Cumberland/Prince Edward Region, Cumberland County currently transfers to the Shoosmith Landfill whose future expansion is under litigation; Prince Edward County operates its own landfill with a reported remaining life of 6 years. Thus, the Green Ridge landfill will support this region's solid waste plan once permitted and constructed.

- Contiguous solid waste regions rely heavily on private sector facilities which may or may not be able to support their 20 year goals. Region 2000 has less than 20 years of remaining life and at this time it appears highly doubtful that an expansion will be allowed by the host community. Green Ridge will support this region. In addition, members of the Central Virginia Waste Management Authority, which includes Henrico, Hanover, Goochland, Powhatan, Chesterfield Counties (to name a few), rely heavily on the Shoosmith and Old Dominion landfills, which will reach capacity in the next 20 years (Shoosmith will likely close within the next 3-4 years in light of a recent adverse court decision). The CVWMA therefore has expressed interest in the guaranteeing disposal capacity in the Green Ridge landfill.

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- From Initiation of a project to its construction, an increase in landfill capacity can take at least 5–6 years (or longer depending on the project). Capacity is always being consumed. New capacity will always be needed. Green Ridge will provide that needed capacity.

- Several major disposal facilities are currently struggling with local politics and land use issues relative to expansions, including the Shoosmith Landfill, the East End Landfill, and Region 2000. In addition, DEQ has revoked the permit of the Tri-Cities Landfill because of reoccurring violations. Many are rightly concerned about the loss of Shoosmith capacity and its ripple effects through Central Virginia because Shoosmith lost a recent circuit court case involving Chesterfield County's denial of a local certification needed to expand into Shoosmith's proposed quarry cell. Other localities, such as Amherst County, have determined not to utilize their remaining capacity, but to move to a transfer operation followed by landfill closure. There may be other facilities making decisions that impact available capacity. Green Ridge's capacity will therefore serve the greater good as capacity continues to be lost.

- Many public sector landfills have defined (restricted) service areas and cannot accept waste from out of their service area. This capacity is therefore not available to others in Virginia and should not be a factor in the 20 year calculation. Green Ridge will fill such voids in capacity.

- Tipping fees and disposal costs for local governments are determined by competition and available capacity. Currently, only two companies control almost all of the private waste disposal capacity in Virginia. The Green Ridge facility is needed to increase competition.

- County Waste of Virginia, which will utilize the Green Ridge Recycling and Disposal Facility, currently serves over 237,000 residential accounts as well as VCU, University of Richmond, Liberty University, Lynchburg University, Frito Lay, DuPont, Altria and a plethora of Central Virginia home builders and home owner associations. Without the Green Ridge facility, costs to these entities will increase with the increased distance to a disposal facility and increased tipping fees because of the loss of competition. Indeed, this is already happening. VCU just procured disposal services which increased in 2019 from $18.89/ton to $44.30/ton, a reflection purely of cost increased in disposal and the loss of competition in the industry in Virginia.

- Fuel costs will continue rising. Each additional mile traveled will cost citizens of the Commonwealth dollars and increase carbon footprints. The Green Ridge Facility is

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exceptionally positioned to effectively and efficiently serve the Central and Southwest Virginia region.

- The Green Ridge facility will be open to all localities in Virginia. It is not exclusive like most public landfills. As public landfills reach capacity and as the costs to own and operate a public landfill increase, localities in Virginia will be seeking alternative disposal capacity that is cost effective. Green Ridge will be able to provide such cost effective capacity.

- An assured, cost effective waste disposal system is needed for economic development. Green Ridge will expand the options for commercial and industrial development through its hauling, recycling, and disposal operations.

- The Northeast is in the midst of a crisis vis a vis its disposal capacity, and will need additional options for disposal of its waste. Virginia is likely to get inundated by out-of-state waste as a result, making the need for the Green Ridge project that much more stark.

- As explained at length in Green Ridge's Preliminary Statement to the Demonstration of Need, it is anticipated that within 3-4 years, 99% of Virginia's private landfill capacity will be controlled by just two companies. The Green Ridge facility will not only provide much needed waste disposal capacity, but also will create much needed competition, lowering waste disposal costs for local and state governments as well as citizens and businesses in the Commonwealth.

The following is a list of documents that are associated with this section:

Letters of Support [For the May 12, 2023 Draft Document for DEQ review, we are including only the additional letters of support received since the original Part A submission]

DRAFT

COUNTY OF BEDFORD, VIRGINIA
County Administration Building
122 East Main Street, Suite 202
Bedford, Virginia 24523
Tel: (540) 586.7601

ROBERT HISS
COUNTY ADMINISTRATOR

OFFICE OF THE COUNTY ADMINISTRATOR

April 22, 2020

Jerry Cifor
County Waste, Inc.
12230 Deergrove Rd.
Midlothian, VA 23112

RE: Support for the Green Ridge Disposal and Recycling Facility

Dear Mr. Cifor:

On behalf of Bedford County, I am writing in support of the Green Ridge project in Cumberland County. Bedford County currently operates its own permitted municipal solid waste landfill that is quickly nearing its capacity. The County currently disposes of nearly 50,000 tons per year and will need options to dispose of this waste in the future. Since other affordable and convenient alternatives are in short supply, the Green Ridge facility represents an important option for Bedford County as we strive to meet our future solid waste disposal needs. In addition, this proposed facility represents an opportunity to increase waste disposal capacity significantly in Central Virginia, and increase competition, thus providing a potential cost benefit to our county, its residents, and businesses in connection with their waste disposal needs.

We appreciate the opportunity to be considered as a potential future user of the Green Ridge facility. In conclusion, Bedford County strongly supports your company's request for a DEQ permit to construct and operate a municipal solid waste landfill in Cumberland County.

Sincerely,

Robert Hiss
County Administrator

COUNTY OF PRINCE GEORGE, VIRGINIA

Percy C. Ashcraft
County Administrator
Phone: (804) 722-8600
Facsimile: (804) 732-3604

BOARD OF SUPERVISORS
Floyd M. Brown, Jr.
Alan R. Carmichael
Donald R. Hunter
Marlene J. Waymack
T. J. Webb

April 20, 2020

Mr. Jay Zook
County Waste, Inc.
12230 Deerhill Road
Midlothian, VA 23112

Re: Green Ridge Recycling and Disposal Facility Permit Application

Dear Mr. Zook:

The County of Prince George currently generates approximately 1,916 tons of municipal solid waste annually. We anticipate the amount of solid waste generated by our County will continue to increase annually. Our current contract for disposal and hauling services runs through January 10, 2022. Before the current contracts ends, we will need to go through the procurement process for both the operation of our transfer station and for hauling services.

The County would appreciate having the option of using the Green Ridge Recycling and Disposal Facility for municipal solid waste disposal needs as we go through the competitive bid process. We do have a need regionally for more landfills in the future and having options for competitive bids keeps pricing down for our citizens.

We appreciate being considered as a potential future user of the Green Ridge Recycling and Disposal Facility and would like to preserve the option of disposal at that facility for future procurement. We also respect state and local approval processes for any such facility, and will follow the permitting process for your proposed facility as it moves forward.

Sincerely,

Percy C. Ashcraft
County Administrator

ATTACHMENT PTA-XX - AIRPORT PROXIMITY AND AGENCY COORDINATION

Per Submission Instruction 1, the applicant is to provide copies of the notification sent in accordance with 9 VAC 20-81-120.I.2 concerning the proposed facility's proximity to the airport and correspondence received from the affected airport, local aviation authority, and the FAA in response.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. No comments were received on Attachment PTA-XX under TR 1.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. Again, no comments specific to this Attachment were received.

The information provided below, and attachments were submitted with the original Part A application.

Distance

A Regional Map (**Figure PTA-3**, **Attachment PTA-IX**) with 1-mile, 3-mile, and 5-mile radii lines showing the locations of airports has been developed. As shown on the Regional Map, there are no airports located inside the 5-mile radius of the Green Ridge facility. The nearest airport, Plainview Airport (VA94), is located approximately 13 miles from the Facility.

Public Use

In order to determine the nearest public-use airport, DAA contacted the Virginia Department of Aviation. In a response letter (dated May 6, 2019), Mr. S. Scott Denny, Senior Aviation Planner confirmed that the nearest airport (Plainview) is not a public-use airport. He stated, "*The closest public-use airport is Farmville Regional Airport which is located approximately 20+/- miles southwest of the proposed landfill site*". The letter of inquiry and Virginia Department of Aviation response letter are included in **Attachment PTA-XX**.

Increased Bird Hazard

Not applicable.

Estimation of Likelihood of Increased Risk

Not applicable.

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As shown on the Regional Map, the Facility boundary is not located within 10,000 feet of any airport runway end used by turbojet aircraft, or within 5,000 feet of any airport runway end used by only piston-type aircraft. Therefore, in accordance with §9 VAC 20-81-120.I.2, it is not required to demonstrate that the units are designed and operated so that the Facility does not pose a bird hazard.

The following is a list of documents that are associated with this section:

Letter (email) of Inquiry for Nearest Public-Use Airport
Virginia Department of Aviation Response Letter

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ATTACHMENT PTA-XXI - FEMA FLOOD INSURANCE RATE MAP

In accordance with §9 VAC 20-81-120.A, owners or operators of all sanitary landfills located in the 100-year floodplains shall demonstrate that the site will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment. And pursuant to §10.-1408.4.B.1, no new municipal solid waste landfill shall be constructed in a 100-year floodplain.

To evaluate the applicability of the requirements of §9 VAC 20-80-250.A.2, the waste management boundary of the proposed site was compared with the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Cumberland County, Virginia. Based on information from the FEMA FIRM, no portion of the waste management boundary is located within the 100-year floodplain. See Near Vicinity Map (**PTA-IX Figure 2**) relative to this.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. TR 1 had two comments relating to FEMA. The response to these comments was provided on October 1, 2021. The comments and responses are provided below:

6.) *It appears that the proposed waste management boundary depicted on the Near Vicinity Map encroaches slightly on delineated wetlands and the FEMA 1% chance annual floodplain along Muddy Creek. Please clarify or revise the proposed waste management boundary to avoid the wetlands and floodplain.*

Mapping was updated under TR 1 to address this.

7.) *The Department understands that the FEMA 1% chance annual floodplain is currently being revised for this area. Please coordinate with FEMA and include the updated FEMA maps in the Part A Permit Application.*

Contact was made with FEMA and data received and added to the drawings. See **LETTER ATTACHMENT 7, Figure LA-7**, entitled *"Comparison of published FEMA flood plain against pending FEMA update"* dated 9/24/21 as prepared by Draper Aden Associates which provides a comparative analysis of the published FEMA floodplain versus the pending update to the FEMA floodplain data. The Near Vicinity Map has been revised to incorporate the pending FEMA update information. It should be noted that this information is not available to the public and has not been formally published.

Thus, we have identified it as "in progress" or "pending". The information was generally similar to the original floodplain information along Muddy Creek, but significantly different along Maple Swamp Creek. However, none of the pending updates impact the Waste Management Boundary which was adjusted to the new FEMA information.

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Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with a supplement to TR 2 issued on October 25, 2022. No comments specific to this Attachment were received.

Attachment PTA-XXI under this TR 2 response includes the following documents for reference:

- Part A – Figure XXI-1 – Flood Map – 24K (previously published data)
- Part A – Figure XXI-2 – Flood Map – 80K (previously published data)
- TR 1 – Flood map comparison (using additional FEMA information)

Note that all mapping provided to DEQ in this Part A application utilizes the TR 1 FEMA information.

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ATTACHMENT PTA-XXIII - PROXIMITY TO GEOLOGIC HAZARDS OR SEISMIC ZONES

In accordance with *Virginia Solid Waste Management Regulations* (*VSWMR*) 9VAC20-81-120 - Siting Requirements, subsection 9VAC20-81-120.B.2, a municipal solid waste landfill may not be sited where on-site or local geological or man-made features or events may result in sudden or non-sudden events and subsequent failure of structural components or containment structures.

The Part A Application including this attachment was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued by DEQ on April 8, 2021. TR 1 had 22 comments with three of the comments (Comments 14, 15 and 16) specifically related to seismic zones and design (i.e., Ground Shaking Hazard Levels and Landfill Containment Structure Design Considerations) as follows:

14.) *The proposed landfill is located within the Central Virginia Seismic Zone. 9 VAC 20-81-120.C.3.b.(1) restricts siting of a landfill within a seismic impact zone unless the owner or operator demonstrates that all containment structures are designed to resist the maximum horizontal acceleration in lithified earth material for the site. Attachment XXIII indicates that the peak ground acceleration may be as much as 20% gravity for the landfill site. However, according to the USGS Unified Hazard Tool, the peak ground acceleration to be used for design purposes at this site location is 22.5% gravity, or 0.225g. Please note that the USGS updated the U.S. Seismic Hazard Long-Term Model in 2018. The applicant should use the updated data as appropriate in the Part A Permit Application.*

15.) *The proposed base grades depicted in Attachment XV of the Part A Permit Application are shown constructed into the bedrock in some areas, and atop as much as 35 feet of silts and sands in other areas of the site. Attachment XXIII indicates that the proposed landfill will incorporate a design seismic coefficient of 0.10g, or one-half the peak ground acceleration. However, it is not appropriate to set the seismic coefficient as one-half the peak bedrock acceleration at this stage, since the seismic coefficient is related to the peak acceleration at the ground surface, which may be amplified by the overlying soils and be different than the peak acceleration in bedrock.*

16.) *An assessment of the Liquefaction Potential should be performed based upon the geotechnical and hydrogeological data gathered from the site investigations (in particular in those areas with more extensive silts and sands, e.g., DAA-4sb and DAA-36pz). In addition, a preliminary seismic stability analysis should be performed for both conditions that may be present (i.e., landfill constructed into bedrock, and landfill constructed atop 35 feet or more of silts and sands), in order to demonstrate that the landfill can be designed to resist the maximum horizontal acceleration in bedrock, as required by 9 VAC 20-81-120.C.3.b.(2). Guidance for*

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performing these assessments can be found in document EPA/600/R-95/051, RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.

Green Ridge's responses to the TR 1 comments were addressed in two phases:

- Phase 1 was a response to all comments although the responses to Comment 11 (deep boring into bedrock), and Comments 14, 15, and 16 indicated that additional field work with technical evaluation was necessary to provide the requested information. In support of this effort, the response indicated that Schnabel Engineering had been retained by Green Ridge to address Comments 14 through 16. The Phase 1 response was submitted to DEQ on October 1, 2021 and included Letter Attachment 12 which contained a preliminary memorandum from Schnabel Engineering dated August 26, 2021.

- Phase 2 was submitted on April 13, 2022 as a supplement to the October 1, 2021 submittal and provided the results of the required additional field investigations and technical evaluation. Key to this submittal was a final report by Schnabel Engineering dated April 8, 2022 which fully addressed responses to Comments 14 through 16 and which superseded the preliminary memorandum included in Letter Attachment 12 of the first TR 1 submittal.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022, with a supplement to TR 2 issued on October 25, 2022. No comments specific to this Attachment were received.

The following discussion includes information previously provided with the original Part A, outlines Comments 14 through 16 from TR 1, and references the TR 1 supplement response.

DISCUSSION

In accordance with *Virginia Solid Waste Management Regulations* (*VSWMR*) 9VAC20-81-120 - Siting Requirements, *VSWMR* 9VAC20-81-120.C.3.B.1 and 9VAC20-81-120.C.3.B.2) provide siting criteria regarding geologic faults and seismic impact zones:

> (1) Within 200 feet of a fault that has had displacement in Holocene time unless the owner or operator demonstrates to the director that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the facility and will be protective of human health and the environment; or
>
> (2) Within seismic impact zones, unless the owner or operator demonstrates to the director that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

The following discussion addresses the siting criteria for young faults and seismic impact zones.

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Ground Displacement by Young Geologic Faults

VSWMR 9VAC20-81-120.C.3.b(1) restricts siting of landfills within 200 feet of a geologic fault that demonstrated movement within the Holocene epoch (i.e., young faults). The Holocene epoch spans from 11.7 thousand years ago to today, and is part of the Quaternary Period. The Quaternary Period is divided into two epochs: the earlier Pleistocene (2.588 million years ago to 11.7 thousand years ago) and the later Holocene (11.7 thousand years to today).

The U.S. Geological Survey (USGS) documented faults or fault-related features in the United States with movement known or suspected to have occurred in the Quaternary (USGS, 2006). This resource presents a conservative assessment of the potential for young faults to be present within 200 feet of the proposed landfill and related containment features, because it increases the criteria for fault identification from the Holocene (11,700 years ago) to the entire Quaternary (2,588,000 years ago).

Table PTA-XXIII-1, below, summarizes the USGS assessment of known or potential Quaternary faults in the region surrounding the proposed Facility (USGS, 2006). **Figure PTA-XXIII-1** illustrates the proposed landfill location and the approximate location of the potential fault or fault-like features identified by USGS (2006).

Table PTA-XXIII-1 **Summary of Known or Inferred Quaternary age Faults or Fault-like Features (USGS, 2006). See Figure PTA-XXIII-1 for Referenced # Feature Location**	
1	**Feature Identity**: Central Virginia seismic zone **CEUS Class (see note)**: A **Description**: Moderate level of diffuse seismicity. 5.8 M earthquake occurred on August 23, 2011. Hypocenter was in Louisa County, 5 miles SSW of Mineral and 37 miles NW of Richmond. Thought to be of tectonic origin with liquefaction fields caused by moderate to large historical and Holocene earthquakes.
2	**Feature Identity**: Pembroke faults **CEUS Class (see note)**: B **Description**: Small, normal faults with up to 11 m displacement. Non-tectonic origin. Fault trace fillings contain delicate grain-scale textures precluding sudden slip. Likely caused by dissolution of underlying carbonate bedrock.

Table PTA-XXIII-1 **Summary of Known or Inferred Quaternary age Faults or Fault-like Features (USGS, 2006). See Figure PTA-XXIII-1 for Referenced # Feature Location**	
3	**Feature Identity**: Linside fault zone **CEUS Class (see note)**: C **Description**: Located on northwest edge of the Giles County Seismic Zone (see earlier discussion). Normal fault zone displacing Devonian folded bedrock. No Quaternary movement of the fault zone is demonstrated.
4	**Feature Identity**: Everona fault – Mountain Run fault zone **CEUS Class (see note)**: C **Description**: Faults appear to have reactivated with Mesozoic extension of the Culpeper Basin. Quaternary age movement has not been demonstrated for the fault zone.
5	**Feature Identity**: Lebanon Church fault **CEUS Class (see note)**: C **Description**: Reverse fault offsets base of gravels overlying Precambrian bedrock. No Quaternary movement of the fault is demonstrated.
6	**Feature Identity**: Old Hickory faults **CEUS Class (see note)**: C **Description**: Small reverse faults with up to 6 m of throw placing Coastal Plain gravels over Paleozoic metamorphic bedrock. Faulting was coeval with deposition of faulted Coastal Plain sediment of Pliocene age. No Quaternary movement of the fault zone is demonstrated.
7	**Feature Identity**: Stanleytown – Villa Heights faults **CEUS Class (see note)**: C **Description**: Both faults are short (<300 m) with steep dip and <6 m slip. Both faults appear to be related to landslides.

Table PTA-XXIII-1 Notes on CEUS feature class designation (USGS, 2006):

- Class A fault = Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features.

- Class B fault = Geologic evidence demonstrates the existence of a fault or suggests Quaternary deformation, but either (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.

- Class C fault = Geologic evidence is insufficient to demonstrate (1) the existence of tectonic fault, or (2) Quaternary slip or deformation associated with the feature.

As illustrated in Figure PTA-XXIII-1, the closest identified young fault or fault-like feature with possible Quaternary movement is associated with the Central Virginia Seismic Zone (Reference #1 in Table PTA-XXIII-1; CEUS Class A). The center of this zone is located approximately 20 miles from the proposed landfill, which does not contravene the siting criteria under 9VAC20-81-120.C.3.b(1).

In conclusion, the proposed landfill is not located within 200 feet of a geologic fault that demonstrated movement within the Holocene epoch.

Seismic Hazards

VSWMR 9VAC20-81-120.C.3.b(1) restricts siting of landfills within a seismic impact zone unless the owner or operator demonstrates that all containment structures are designed to resist the maximum anticipated seismically-induced horizontal ground acceleration in lithified earth material. Note that the following assessment incorporates potential soil amplification that could increase the horizontal acceleration from deeper lithified earth material. The information presented below to address seismic impact zones is generally consistent with the 1993 (most recently available) Virginia Department of Environmental Quality (VDEQ) Guidance Document LPR-SW-02-1993 for evaluating landfill Part A demonstration requirements.

The USGS updated ~~since~~ the 1993 the probabilistic earthquake-induced ground motion model most recently in 2018 (Rezaeian et al, 2021), ~~Petersen, et al.; 2014),~~ which was used to identify seismic impact zones and estimate peak horizontal ground acceleration with a 2,500-year recurrence period. ~~Note that the 1993 Guidance references a 10% probability of occurrence over 250 years, while the 2014 model references 2% probably of occurrence over 50 years, but this is an equivalent recurrence period of 2,500 years.~~

Summary of Seismic Impact Area

~~Probabilistic earthquake-induced ground motion was evaluated for the proposed landfill based on the 2018 update to the National Seismic Hazard Model (Rezaeian et al, 2021)work completed~~

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~~by the USGS.~~ The proposed landfill is located within the Central Virginia Seismic Zone, which approximately corresponds to probabilistic ground acceleration exceeding 0.1-g (10% of gravity) shown in **Figure PTA-XXIII-2**~~(darker blue to yellow shaded area) (taken from USGS, 2014~~). Probabilistic earthquake-induced ground motion was evaluated for the proposed landfill based on the 2018 update to the National Seismic Hazard Model (Rezaeian et al, 2021).

Ground Shaking Hazard Levels

The original Part A discussion is shown deleted below and is replaced by the attached Schnabel Engineering report dated April 8, 2022.

~~Based on the USGS (2014) modeling, peak ground acceleration estimates for the proposed landfill may range up to 0.2-g with a 2% probability of occurring in 50 years (i.e., mean return period of approximately 2,500 years) (Figure PTA-XXIII-2).~~

~~The peak horizontal ground acceleration estimate taken from USGS (2014) incorporates potential soil amplification based on sites between class B (rock) and C (dense soil). This site class criteria corresponds to an average shear wave velocity of 760 m/sec in the top 30 meters of soil, which is considered to be representative of conditions underlying the proposed landfill consisting of relatively shallow bedrock and saprolite with overburden.~~

Landfill Containment Structure Design Considerations

The original Part A discussion is shown deleted below and is replaced by the attached Schnabel Engineering report dated April 8, 2022.

~~In general, earthquake-induced seismic hazards for the proposed landfill are considered to be moderate to low, based on probabilistic estimates of ground motion discussed above. The proposed landfill design will incorporate a seismic coefficient resulting from potential earthquake-induced peak horizontal ground acceleration as discussed below.~~

~~Seismic stability studies prepared for the U.S. Army Corps of Engineers (Hynes-Griffin and Franklin, 1984) demonstrated the efficacy in designing waste disposal facilities for one-half the estimated peak acceleration (i.e., 50% of 0.2-g), which represents more sustained (i.e., potentially damaging) ground motion, rather than the near-instantaneous transient peak acceleration. Therefore, the Part B permit application for the proposed landfill will incorporate a design seismic coefficient of 0.10-g.~~

~~Soil liquefaction is a phenomenon often associated with seismic activity in which saturated, non-cohesive soils temporarily lose their strength and liquefy (i.e., behave like viscous liquid) when subjected to forces such as intense and prolonged ground shaking. Areas susceptible to~~

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~~liquefaction may include soils that are generally sandy or silty and are generally located along rivers, streams, lakes, and shorelines or in areas with shallow groundwater. Soil, overburden and saprolite underlying the proposed landfill containment structures do not demonstrate characteristics that are susceptible to liquefaction, and therefore seismically-induced soil liquefaction should not be considered further in the containment structure design components.~~

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~~Hynes-Griffin, M. E. and Franklin, A. G., 1984. Rationalizing the Seismic Coefficient Method. Miscellaneous Paper GL-41-18. Army Engineer Waterways Experiment Station, Vicksburg, MS. Pp 41~~

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The following is a list of documents that are associated with this section:

Figure XXIII-1 Quarternary Age Fault or Possible Fault Features, Draper Aden Associates, Dated December 9, 2019

Figure XXIII-2 Seismic Hazards: Probabilistic Peak Ground Acceleration, Draper Aden Associates, Dated March 1, 2023

Revision 02 – VDEQ Comment Resolution Support – Comments No. 14 through 16, Green Ridge Recycling and Disposal Facility – Part A Permit Application, Cumberland County, Virginia, Schnabel, Dated April 7, 2022.

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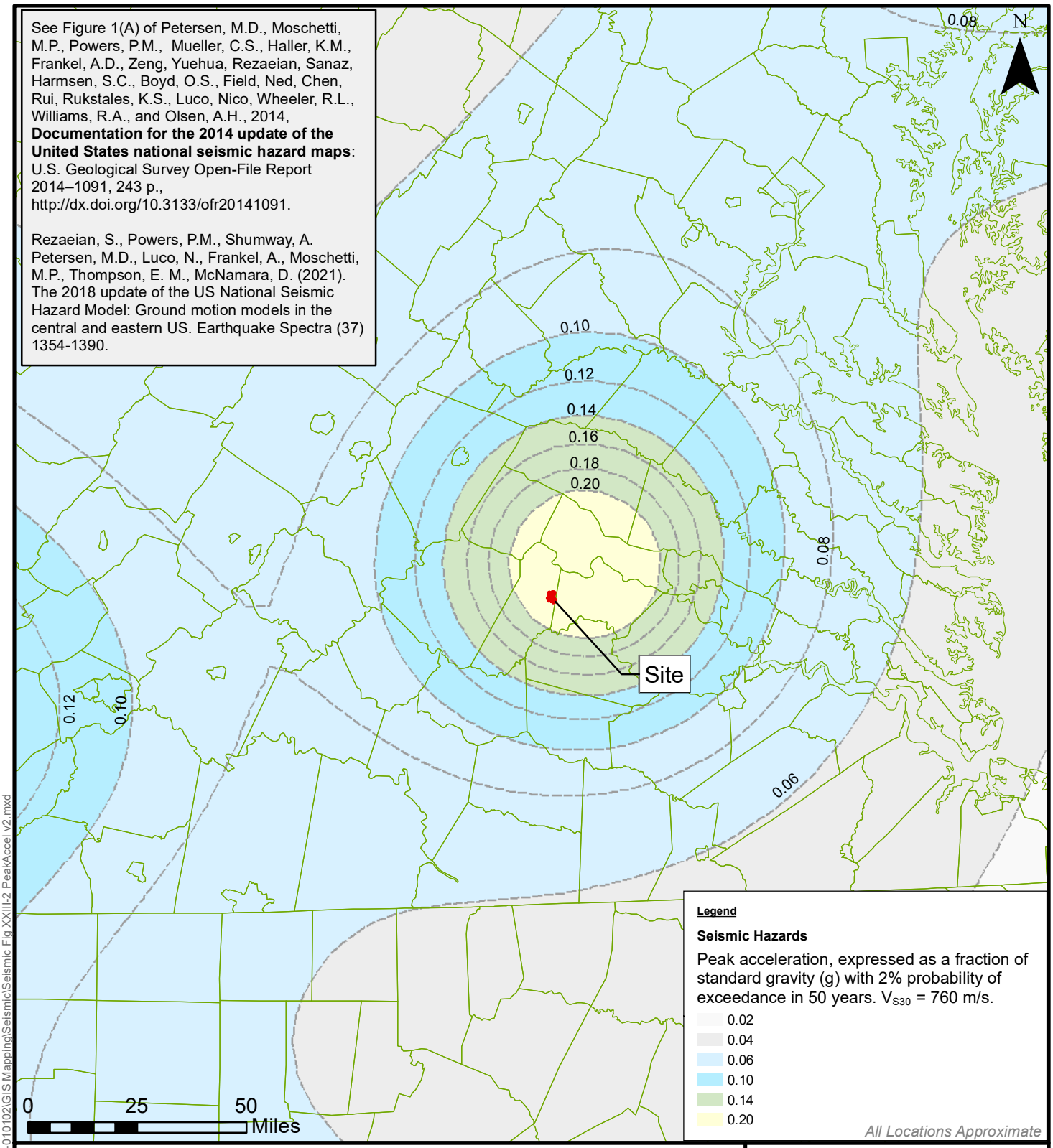

Path: P:\2018\1802\0100\18020117\18020117-010102\GIS Mapping\Seismic\Seismic Fig XXIII-2 PeakAccel v2.mxd

Seismic Hazards:
Probabilistic Peak Ground Acceleration

Green Ridge Recycling and Disposal Facility
Cumberland Co., Virginia

SCALE: 1:2,000,000

PROJECT: 18020117-010102

Draper Aden Associates
Engineering ◆ Surveying ◆ Environmental Services
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA
Raleigh, NC
Fayetteville, NC
Northern Virginia

DESIGNED: WDN
DRAWN: SMF
CHECKED: KEB
DATE: 03-01-23

FIGURE
XXIII-2