SUBSURFACE EXPLORATION

(GeoConcepts Engineering, Inc.)

Preliminary Geotechnical Engineering Report

City Homes at Fort Lincoln

Fort Lincoln Drive and Eastern Avenue, N.E.

Washington, D.C.

GeoConcepts Engineering, Inc.

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December 27, 2007

Mr. Will Collins
Concordia Group
6707 Democracy Boulevard, Suite 910
Bethesda, Maryland 20817

Subject: ***Preliminary Geotechnical Engineering Report, City Homes at Fort Lincoln, Fort Lincoln Drive and Eastern Avenue, N.E., Washington, D.C. (Our 27190)***

Dear Mr. Collins:

GeoConcepts Engineering, Inc. (GeoConcepts) is pleased to present this preliminary geotechnical engineering report for the above referenced project. These services have been performed in accordance with our proposal dated October 30, 2007.

1.0 Scope of Services

This preliminary geotechnical engineering report presents the results of the field investigation, soil laboratory testing, and engineering analysis of the geotechnical data. This report specifically addresses the following:

- An evaluation of subsurface conditions within the proposed site development, including a seismic site classification.
- Preliminary foundation recommendations for support of the proposed buildings and lower floor slabs on grade.
- Comments on permanent subdrainage to be included during final design.
- Comments regarding soil subgrade conditions for pavement areas.
- Comments on earthwork including an assessment of on-site soils to be excavated for re-use as fill.
- Recommendations for final geotechnical engineering services required for final design.

Services not specifically identified in the contract for this project are not included in the scope of services.

2.0 Site Description and Proposed Construction

The City Homes at Fort Lincoln site is located at the intersection of Eastern Avenue and Fort Lincoln Drive, in N.E., Washington, D.C. The site currently consists of cleared grass land with trees located in the middle of the parcel. Based on the site plan received from VIKA, Inc., site topography slopes from south to north with a topographic high of approximately EL 128 in the southern corner and a topographic low of approximately EL 90 in the northern corner of the site. A site vicinity map is presented as Figure 1 at the end of this report.

It is our understanding the proposed development will consist of 62 town home units with associated driveways and site utilities. In addition, a retaining wall is proposed along the southern portion of the site. It is our understanding that there will be no basement levels and finished floor levels will be at approximately existing grades.

3.0 Subsurface Conditions

Subsurface conditions were investigated by drilling a total of five soil test borings in the proposed site development area. Test boring logs and a boring location plan are presented in Appendix A.

3.1 ***Stratification***

The subsurface materials encountered have been stratified for purposes of our discussions herein. These stratum designations do not imply that the materials encountered are continuous across the site. Stratum designations have been established to characterize similar subsurface conditions based on material gradations and parent geology. The subsurface materials encountered in the test pits completed at the site have been assigned to the following strata:

Stratum A (Existing Fill)	sandy silt FILL, with concrete fragments, moist, brown
Stratum B (Potomac Group)	loose to firm, sandy SILT (ML), SILT (ML), with sand, sandy LEAN CLAY (CL), LEAN CLAY (CL) with sand, sandy FAT CLAY (CH), FAT CLAY (CH), moist, with rock fragments, brown, gray, dark gray, dark green, red

The two letter designations included in the strata descriptions presented above and on the test boring logs represent the Unified Soil Classification System (USCS) designations for the samples based on visual classifications conducted in the field during the subsurface investigation. Visual classifications were made using the methods described in ASTM D-2488, and may not match classifications determined by laboratory testing per ASTM D-2487.

3.2 Geology

The City Homes at Fort Lincoln site is located within the Coastal Plain Physiographic Province of Washington, D.C. The Coastal Plain consists of a seaward thickening wedge of unconsolidated to semi-consolidated sedimentary deposits from the Cretaceous Geologic Period to the Holocene Geologic Epoch. These deposits represent marginal-marine to marine sediments consisting of interbedded sands and clays. The Coastal Plain is bordered to the east by the Atlantic Ocean and to the west by the Piedmont Physiographic Province. The dividing line between the Coastal Plain and the Piedmont is locally referred to as the "Fall Line". This name comes from the waterfalls that form as a result of the differential erosion that occurs as streams cross the Piedmont/Coastal Plain contact.

The Potomac Group sediments are the oldest sedimentary deposits in the Washington, D.C. area. These soils are known to be highly over-consolidated as a result of the weight of a substantial thickness of overlying soils that have since been eroded away. As a result of over-consolidation, Potomac Group soils have been pre-loaded and are capable of supporting substantial loads. The Potomac Group clays are well documented with problems associated with slope instability and excessive shrink/swell characteristics.

3.3 Ground Water

Ground water level observations were made in the field during drilling and up to 24 hours after the completion of the test borings. All borings were dry upon completion; however, 24 hour water level observations indicated ground water at depths below the existing ground surface of 9.2 feet in boring B-3 and 6.6 feet in boring B-4, or at about EL 94 and EL 107, respectively. Accordingly, ground water may be an issue for proposed site development such as utility construction.

The ground water observations presented herein are considered to be an indication of the ground water levels at the dates and times indicated. Where more impervious Stratum B clay soils are encountered, the amount of water seepage into the borings is limited, and it is generally not possible to establish the location of the ground water table through short term water level observations. Accordingly, the ground water information presented herein should be used with caution. Also, fluctuations in ground water levels should be expected with seasons of the year, construction activity, changes to surface grades, precipitation, or other similar factors.

3.4 Soil Laboratory Test Results

Selected soil samples obtained from the field investigation were tested for grain size distribution, Atterberg limits, and natural moisture contents. A summary of soil laboratory test results is presented as Appendix B. The results of natural moisture content tests are presented on the test boring logs in Appendix A.

Samples tested from Stratum B classified as SILT (ML) with sand, LEAN CLAY (CL), and LEAN CLAY (CL) with sand, in accordance with the USCS, with about 78 to 97 percent fines passing the U.S. Standard No. 200 sieve. Liquid limits and plasticity indices for the samples tested were 25 to 44 and non-plastic to 23, respectively. Natural moisture contents ranged from 13.8 to 22.5 percent.

4.0 Preliminary Engineering Analysis

4.1 Spread Footing Foundations

Spread footings founded in natural soils or new compacted fill may be considered for support of the proposed new buildings. The existing fill of Stratum A, where encountered, is not expected to be suitable for direct support of spread footings. Accordingly, it will be necessary to remove the existing fill down to natural soils in building areas and replace it with new compacted fill. The footings can then be constructed at normal design depths on the new compacted fill. Spread footings founded in natural soils or new compacted fill may be designed for allowable bearing pressures of 2,500 psf.

Exterior footing subgrades should be located at least 2.5 feet below final exterior grades for frost considerations, except where fat clay (CH) soils are present at footing subgrades. In this case, footings should be lowered to a depth of 4 feet below final exterior grade or until the fat clay material is no longer present, whichever is less. Interior footings may be placed at normal structural depths where Potomac Group fat clay soils are encountered.

4.2 *Floor Slabs on Grade*

Floor slabs supported by firm natural soils, existing fill, or new compacted fill are considered feasible at the site. Where floor subgrades consist of Potomac Group fat clay soils, these clay soils should be undercut to a depth of at least 2 feet or until the clay is no longer present, whichever is less, and backfilled with new compacted fill. As indicated previously, ground water was encountered at depths of up to 6.6 feet below existing grades. Based on the assumption that the development will not include basements, ground water should not be an issue for building construction. However, a more thorough analysis of ground water issues should be completed once final grades are established.

4.3 *Pavements*

Pavement subgrades are expected to consist of new compacted fill, natural soils, or existing fill. These materials are generally considered suitable for support of planned roadways and parking areas; however, we suggest budgeting for reworking and recompaction of the existing fill where it is present at pavement subgrades. Based on the materials expected at pavement subgrades, a preliminary California Bearing Ratio (CBR) value of 4 is recommended for preliminary design of pavements. Final pavement sections should be based on CBR tests taken on subgrade soils at the time of construction.

4.4 *Earthwork*

New fill will likely be required for site grading in building and pavement areas. Materials used for compacted fill for support of footings, floor slabs, and pavements should consist of soils classifying CL, ML, SC, SM, SP, SW, GC, GM, GP, or GW per ASTM D-2487, with a maximum dry density greater than 105 pcf. Materials used for backfill against walls below grade should consist of soils classifying ML, SM, SP, SW, GM, GP, or GW, with a liquid limit and plasticity index less than 40 and 15, respectively. It is expected that the majority of soils excavated from Strata A and B will be suitable for re-use as fill based on classification, except for the fat clay (CH) soils of Stratum B. Also, some portions of the Stratum A existing fill may not be suitable for re-use as new compacted fill due to deleterious man-made materials in the fill.

Due to the fine-grained nature of the site soils, drying of excavated soils by spreading and aerating may be necessary to obtain proper compaction, especially if the lean clay soils of

Stratum B are to be re-used as fill. This may not be practical during the wet period of the year. Accordingly, earthwork operations should be planned for early Spring through late Fall, when drier weather conditions can be expected.

5.0 Recommendations for Additional Studies

The recommendations presented herein have been based on preliminary site development information and a limited number of test borings completed at the site. Additional subsurface investigations and engineering analysis will be required to develop the final geotechnical engineering recommendations. However, the final geotechnical engineering study should not be completed until site development plans are finalized.

The comprehensive geotechnical engineering analysis and report should contain foundation recommendations for support of the buildings based on final building layouts, floor grades, and structural loads. The report should also include recommendations for foundation bearing pressures, subdrainage, pavements, and earthwork.

6.0 General Limitations

The intent of this report is to provide preliminary geotechnical engineering information for planning and budgeting purposes only. It does not reflect conditions that may occur between the points investigated and between sampling events in the test borings. This study is not adequate to use for final design purposes.

This preliminary report was prepared in accordance with generally accepted geotechnical engineering practices. No warranties, expressed or implied, are made as to the professional services included in this preliminary report.

We appreciate the opportunity to be of service for this project. Please contact the undersigned if you require clarification of any aspect of this report.

Sincerely,

GEOCONCEPTS ENGINEERING, INC.

June Chokechaitanasin
Project Engineer

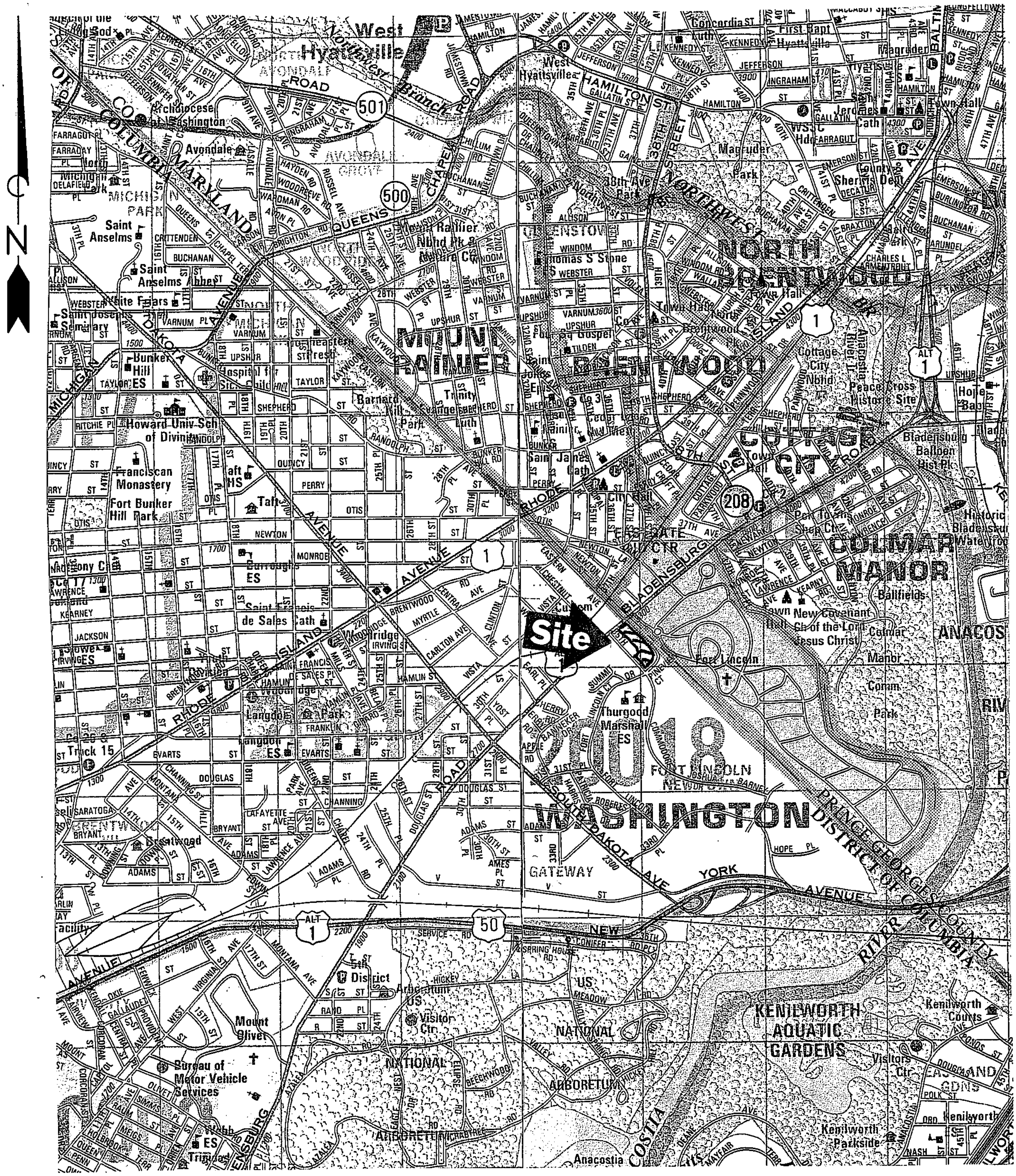
Tadeusz W. Lewis, P.E.
Principal

DISTRICT OF COLUMBIA
TADEUSZ W. LEWIS
No. 900450
REGISTERED
PROFESSIONAL ENGINEER

Figure 1: Site Vicinity Map

Appendix A: Subsurface Investigation Report
Appendix B: Soil Laboratory Test Report

DN/JC/TWL/shm
N:\PROJECTS\27190\WP\Preliminary GER.doc



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CITY HOMES AT FORT LINCOLN, FT. LINCOLN & EASTERN AVE., N.E., WASHINGTON, D.C.

SITE VICINITY MAP		Scale: 1" = 2,000'	Fig. 1
Date: DECEMBER 2007	Checked By: T.W.L.	Project No.: 27190	

Appendix A
Contract No. 27190

Subsurface Investigation Report

Subsurface Investigation Procedures (1 page)
Identification of Soil (1 page)
Test Boring Notes (1 page)
Test Boring Logs (5 pages)
Boring Location Plan – Figure 2 (1 page)

Subsurface Investigation Procedures

1. ***Test Boring – Hollow Stem Augers***
   The borings are advanced by turning an auger with a center opening of 2-¼ inches. A plug device blocks off the center opening while augers are advanced. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger, by standard methods, after removal of the plug. Usually, no water is introduced into the boring using this procedure.

2. ***Standard Penetration Tests***
   Standard penetration tests are performed by driving a 2 inch O.D., 1-⅜ inch I.D. sampling spoon with a 140-pound hammer falling 30 inches, according to ASTM D-1586. After an initial 6 inches penetration to assure the sampling spoon is in undisturbed material, the number of blows required to drive the sampler an additional 12 inches is generally taken as the N value. In the event 30 or more blows are required to drive the sampling spoon the initial 6 inch interval, the sampling spoon is driven to a total penetration resistance of 100 blows or 18 inches, whichever occurs first. The sampling operation is terminated after a total of 100 hammer blows and the depth of penetration is recorded.

3. ***Test Boring Stakeout***
   The test boring stakeout was provided by the project civil engineer.

GeoConcepts Engineering, Inc.

IDENTIFICATION OF SOIL

I. DEFINITION OF SOIL GROUP NAMES

		ASTM D-2487	Symbol	Group Name
Coarse-Grained Soils More than 50% retained on No. 200 sieve	**Gravels -** More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines	**GW**	WELL GRADED GRAVEL
			GP	POORLY GRADED GRAVEL
		Gravels with Fines More than 12% fines	**GM**	silty GRAVEL
			GC	clayey GRAVEL
	Sands - 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	**SW**	WELL GRADED SAND
			SP	POORLY GRADED SAND
		Sands with fines More than 12% fines	**SM**	silty SAND
			SC	clayey SAND
Fine-Grained Soils 50% or more passes the No. 200 sieve	**Silts and Clays -** Liquid Limit less than 50	Inorganic	**CL**	LEAN CLAY
			ML	SILT
		Organic	**OL**	ORGANIC CLAY
				ORGANIC SILT
	Silts and Clays - Liquid Limit 50 or more	Inorganic	**CH**	FAT CLAY
			MH	ELASTIC SILT
		Organic	**OH**	ORGANIC CLAY
				ORGANIC SILT
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		**PT**	PEAT

II. DEFINITION OF MINOR COMPONENT PROPORTIONS

Minor Component	**Approximate Percentage of Fraction by Weight**
Adjective Form	
Gravelly, Sandy	30% or more coarse grained
With	
Sand, Gravel	15% to 29% coarse grained
Silt, Clay	5% to 12% fine grained

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS - Unified Soil Classification Symbols are shown above as group symbols. Use "A" Line Chart for laboratory identification. Dual symbols are used for borderline classification.

BOULDERS & COBBLES - Boulders are considered pieces of rock larger than 12 inches, while cobbles range from 3 to 12 inches.

DISINTEGRATED ROCK - Residual rock material with a standard penetration test (SPT) resistance between 60 blows per foot and refusal.

ROCK - Rock material with a standard penetration test (SPT) resistance of 100 blows for 2 inches or 50 blows for 0 inches, or less penetration

DECOMPOSED ROCK - Residual rock material exhibiting rock-like properties that can be excavated by backhoe equipment. Similar to Disintegrated Rock, but cannot be classified as such because SPT N-Values were not obtained.

ROCK FRAGMENTS - Angular pieces of rock, distinguished from rounded transported gravel, which have separated from original vein or strata and are present in a soil matrix.

QUARTZ - A hard silicate mineral often found in residual soils. Only used when describing residual soils.

CEMENTED SAND - Usually localized rock-like deposits within a soil stratum composed of sand grains cemented by calcium carbonate, iron oxide, or other minerals. Commonly encountered in Coastal Plain sediments, primarily in the Potomac Group sands (Kps).

MICA - A plate-like phyllosilicate mineral found in many rocks, and in residual or transported soil derived therefrom.

ORGANIC MATERIALS (Excluding Peat) **-** Topsoil - Surface soils that support plant life and contain organic matter.
Lignite - Hard, brittle decomposed organic matter with low fixed carbon content (a low grade of coal).

FILL - Man made deposit containing soil, rock, and other foreign matter.

PROBABLE FILL - Soils which contain no visually detected foreign matter but which are suspect with regard to origin.

LAYERS - ½ to 12 inch seam of minor soil component.

COLOR - Two most predominant colors present should be described.

MOISTURE CONDITIONS - Wet, moist, or dry to indicate visual appearance of specimen.

Test Boring Notes

1. Classification of soil is by visual inspection and is in accordance with the Unified Soil Classification System.

2. Estimated ground water levels are indicated on the logs. These are only estimates from available data and may vary with precipitation, porosity of soil, site topography, etc.

3. Sampling data presents standard penetrations for 6 inch intervals or as indicated with graphic representations adjacent to the sampling data. Where undisturbed tube samples are taken, they are designated "Shelby Tube" on the soil test boring log. The length of insertion and recovery for tube samples in inches are also provided on the soil test boring log.

4. The logs and related information depict subsurface conditions at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at the test locations. Also, the passage of time may result in a change in the subsurface conditions at the test locations.

5. The stratification lines represent the approximate boundary between soil types as determined in the sampling operation. Some variation may be expected vertically between samples taken. The soil profile, ground water level observations and penetration resistances presented on the logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.

6. Disintegrated rock is defined as residual earth material with a penetration resistance between 60 blows per foot and refusal. Spoon refusal at the surface of rock, boulders, or obstructions is defined as a penetration resistance of 100 blows for 2 inches penetration or less. Auger refusal is taken as the depth at which further penetration of the auger is not possible without risking significant damage to the drilling equipment.

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Ashburn, Va. 20147

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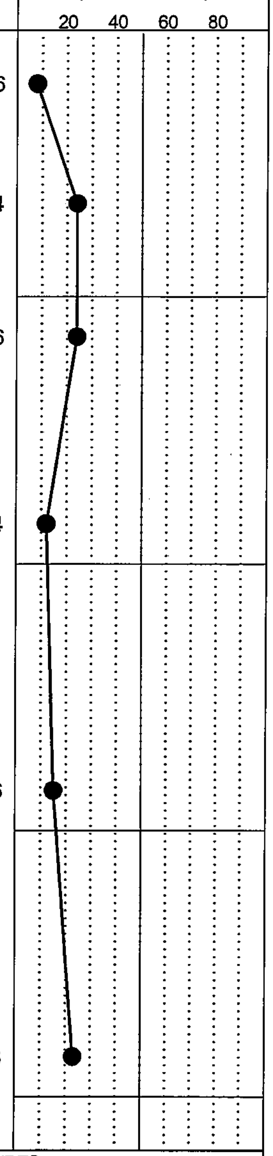
PROJECT:	LOGGED BY:	BORING NUMBER:
City Homes at Fort Lincoln	J. Zwickl	**B-1**
LOCATION: Eastern Ave. and Fort Lincoln Dr., N.E., Washington, D.C.	DRILLING CONTRACTOR: Connelly and Associates, Inc.	SHEET 1 OF 1

OWNER/CLIENT:	DRILLER:	DATE STARTED:
Concordia Group	D. Pao	11/19/07

PROJECT NUMBER:	GROUND SURFACE ELEVATION (ft):	DRILLING METHOD:	DATE COMPLETED:
27190	97.1	2.25" I.D. HSA	11/19/07

ELEV. (ft)	DEPTH (ft)	STRATUM	MATERIAL DESCRIPTION	MC (%)	SAMPLE TYPE	SPT BLOW COUNTS	RECOVERY (in)
			LEAN CLAY (CL), moist, brown, gray	16.4	X	2+3+5+8	16
			with sand, brown, red below 2.5 ft.	13.8	X	5+12+12	14
	5		no sand below 5 ft.		X	6+10+14	16
			brown, gray below 8.5 ft.	18.2	X	4+5+7	14
	10	B					
					X	4+6+9	16
	15						
78.6			sandy FAT CLAY (CH), moist, brown		X	6+8+15	18
77.1	20		Bottom of Boring at 20.0 ft				

STANDARD PENETRATION TEST RESISTANCE (BLOWS/FOOT)



GROUND WATER LEVELS:

ENCOUNTERED:	None			
UPON COMPLETION:	Dry	CAVED: 9.0 ft	ELEV. 88.1	
11/20/2007	Dry	CAVED: 9.8 ft	ELEV. 87.3	

SAMPLE TYPES:

X Split Spoon

REMARKS:

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES. THE TRANSITION MAY BE GRADUAL.

BOREHOLE/TEST PIT 27190, CITY HOMES AT FT LINCOLN.GPJ GEOCONCEPTS.GDT 12/21/07

GeoConcepts Engineering, Inc.

19955 Highland Vista Dr. #170
Ashburn, Va. 20147

703-726-8030
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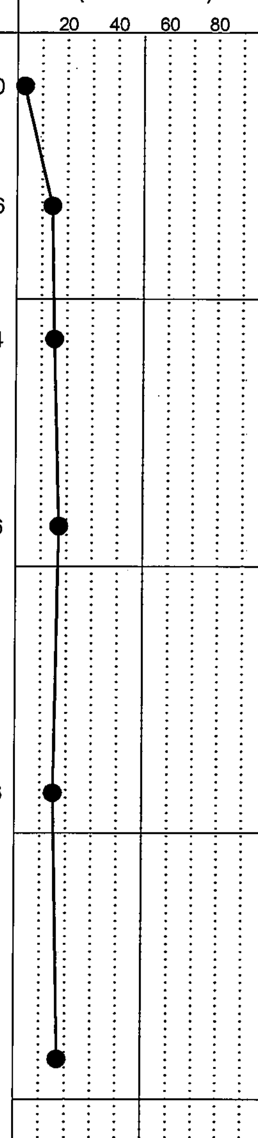
PROJECT:	LOGGED BY:	BORING NUMBER:
City Homes at Fort Lincoln	J. Zwickl	**B-2**
LOCATION:	DRILLING CONTRACTOR:	
Eastern Ave. and Fort Lincoln Dr., N.E., Washington, D.C.	Connelly and Associates, Inc.	SHEET 1 OF 1

OWNER/CLIENT:		DRILLER:	DATE STARTED:
Concordia Group		D. Pao	11/19/07
PROJECT NUMBER:	GROUND SURFACE ELEVATION (ft):	DRILLING METHOD:	DATE COMPLETED:
27190	95.9	2.25" I.D. HSA	11/19/07

ELEV. (ft)	DEPTH (ft)	STRATUM	MATERIAL DESCRIPTION	MC (%)	SAMPLE TYPE	SPT BLOW COUNTS	RECOVERY (in)
			sandy SILT (ML), moist, brown		X	1+1+2+2	10
94.4			FAT CLAY (CH), with sand, moist, tan brown, gray below 2.5 ft.		X	4+6+8	16
	5				X	8+6+9	14
	10	B			X	5+7+10	16
	15				X	4+6+9	16
77.4			sandy FAT CLAY (CH), with rock fragments, moist, brown, gray		X	5+8+9	18
75.9	20		Bottom of Boring at 20.0 ft				

STANDARD PENETRATION TEST RESISTANCE (BLOWS/FOOT)



GROUND WATER LEVELS:

ENCOUNTERED:	None				
UPON COMPLETION:	Dry	CAVED:	9.5 ft	ELEV.	86.4
11/20/2007	Dry	CAVED:	8.0 ft	ELEV.	87.9

SAMPLE TYPES:

☒ Split Spoon

REMARKS:

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES. THE TRANSITION MAY BE GRADUAL.

GeoConcepts Engineering, Inc.
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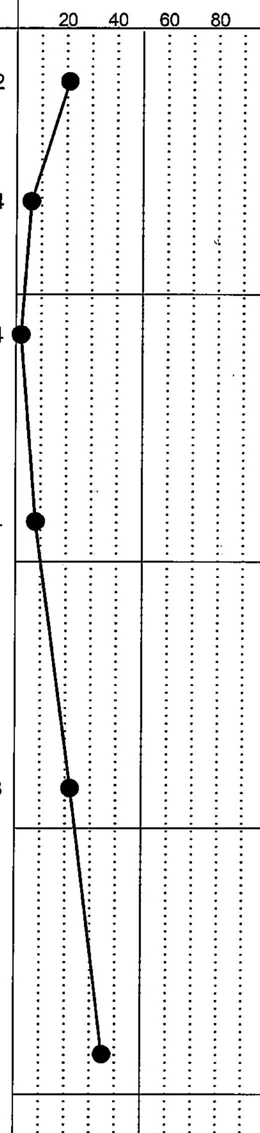
PROJECT:	LOGGED BY:	BORING NUMBER:
City Homes at Fort Lincoln	J. Zwickl	**B-3**
LOCATION:	DRILLING CONTRACTOR:	
Eastern Ave. and Fort Lincoln Dr., N.E., Washington, D.C.	Connelly and Associates, Inc.	SHEET 1 OF 1

OWNER/CLIENT:	DRILLER:	DATE STARTED:
Concordia Group	D. Pao	11/19/07

PROJECT NUMBER:	GROUND SURFACE ELEVATION (ft):	DRILLING METHOD:	DATE COMPLETED:
27190	102.9	2.25" I.D. HSA	11/19/07

ELEV. (ft)	DEPTH (ft)	STRATUM	MATERIAL DESCRIPTION	MC (%)	SAMPLE TYPE	SPT BLOW COUNTS	RECOVERY (in)
		A	sandy silt FILL, with concrete fragments, moist, brown		Split Spoon	4+8+13+12	12
101.9		B	sandy SILT (ML), moist, brown		Split Spoon	3+3+3	14
97.9	5	B	sandy LEAN CLAY (CL), moist, brown		Split Spoon	2+1+1	14
94.4		B	FAT CLAY (CH), moist, brown, gray		Split Spoon	2+3+5	14
	10	B					
	15	B			Split Spoon	5+8+14	18
84.4		B	sandy LEAN CLAY (CL), moist, brown		Split Spoon	9+13+22	18
82.9	20		Bottom of Boring at 20.0 ft				

STANDARD PENETRATION TEST RESISTANCE (BLOWS/FOOT)



GROUND WATER LEVELS:

ENCOUNTERED:	None			
UPON COMPLETION:	Dry		CAVED: 9.0 ft	ELEV. 93.9
▼ 11/20/2007	9.2 ft	ELEV. 93.7	CAVED: 9.9 ft	ELEV. 93.0

SAMPLE TYPES:

☒ Split Spoon

REMARKS:

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES. THE TRANSITION MAY BE GRADUAL.

BOREHOLE/TEST PIT 27190, CITY HOMES AT FT LINCOLN.GPJ GEOCONCEPTS.GDT 12/21/07

GeoConcepts Engineering, Inc.

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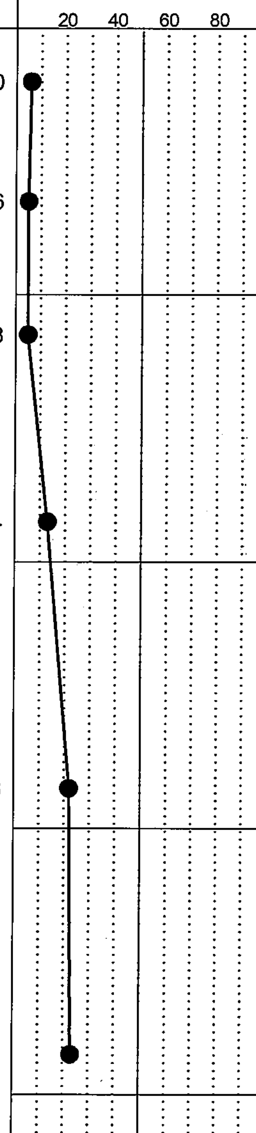
PROJECT: City Homes at Fort Lincoln	LOGGED BY: J. Zwickl	BORING NUMBER: **B-4**
LOCATION: Eastern Ave. and Fort Lincoln Dr., N.E., Washington, D.C.	DRILLING CONTRACTOR: Connelly and Associates, Inc.	SHEET 1 OF 1
OWNER/CLIENT: Concordia Group	DRILLER: D. Pao	DATE STARTED: 11/19/07
PROJECT NUMBER: 27190 / GROUND SURFACE ELEVATION (ft): 114.0	DRILLING METHOD: 2.25" I.D. HSA	DATE COMPLETED: 11/19/07

ELEV. (ft)	DEPTH (ft)	STRATUM	MATERIAL DESCRIPTION	MC (%)	SAMPLE TYPE	SPT BLOW COUNTS	RECOVERY (in)
			SILT (ML), moist, brown with sand below 1.5 ft.		X	1+3+3+5	10
111.5			sandy LEAN CLAY (CL), moist, brown		X	3+2+3	16
109.0	5		LEAN CLAY (CL), with sand, moist, brown		X	2+2+3	18
105.5			FAT CLAY (CH), moist, brown, red		X	3+5+8	14
	10	B					
					X	5+10+12	18
	15						
					X	7+10+13	16
94.0	20		Bottom of Boring at 20.0 ft				

STANDARD PENETRATION TEST RESISTANCE (BLOWS/FOOT)



GROUND WATER LEVELS:

ENCOUNTERED: None

UPON COMPLETION: Dry — CAVED: 8.0 ft — ELEV. 106.0

11/20/2007 — 6.6 ft — ELEV. 107.4 — CAVED: 8.6 ft — ELEV. 105.4

SAMPLE TYPES:

☒ Split Spoon

REMARKS:

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES. THE TRANSITION MAY BE GRADUAL.

BOREHOLE/TEST PIT 27190, CITY HOMES AT FT LINCOLN.GPJ GEOCONCEPTS.GDT 12/21/07

GeoConcepts Engineering, Inc.

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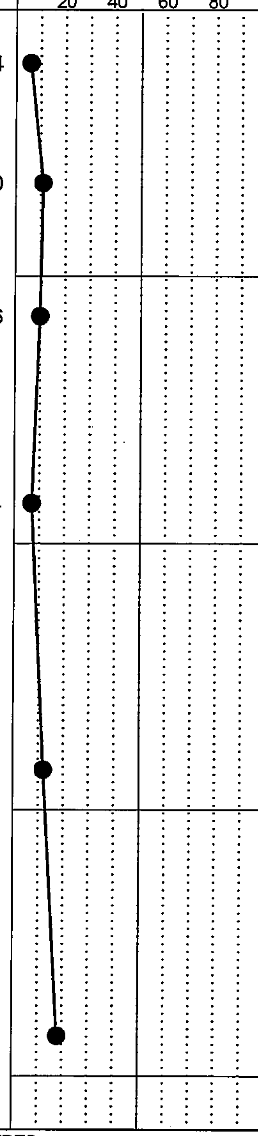
PROJECT:	LOGGED BY:	BORING NUMBER:
City Homes at Fort Lincoln	J. Zwickl	**B-5**
LOCATION: Eastern Ave. and Fort Lincoln Dr., N.E., Washington, D.C.	DRILLING CONTRACTOR: Connelly and Associates, Inc.	SHEET 1 OF 1
OWNER/CLIENT: Concordia Group	DRILLER: D. Pao	DATE STARTED: 11/19/07
PROJECT NUMBER: 27190 / GROUND SURFACE ELEVATION (ft): 116.6	DRILLING METHOD: 2.25" I.D. HSA	DATE COMPLETED: 11/19/07

ELEV. (ft)	DEPTH (ft)	STRATUM	MATERIAL DESCRIPTION	MC (%)	SAMPLE TYPE	SPT BLOW COUNTS	RECOVERY (in)
		A	sandy silt FILL, moist, brown		Split Spoon	2+2+4+6	14
114.1		B	SILT (ML), with sand, moist, brown, gray	15.8	Split Spoon	8+7+4	10
	5		brown below 5 ft.		Split Spoon	2+4+6	16
108.1			LEAN CLAY (CL), moist, brown, gray	22.5	Split Spoon	3+4+3	14
	10						
103.1			FAT CLAY (CH), with sand, moist, brown, gray		Split Spoon	4+5+7	16
	15						
			no sand, dark green below 18.5 ft.		Split Spoon	5+8+10	18
96.6	20		Bottom of Boring at 20.0 ft				

STANDARD PENETRATION TEST RESISTANCE (BLOWS/FOOT)



GROUND WATER LEVELS:

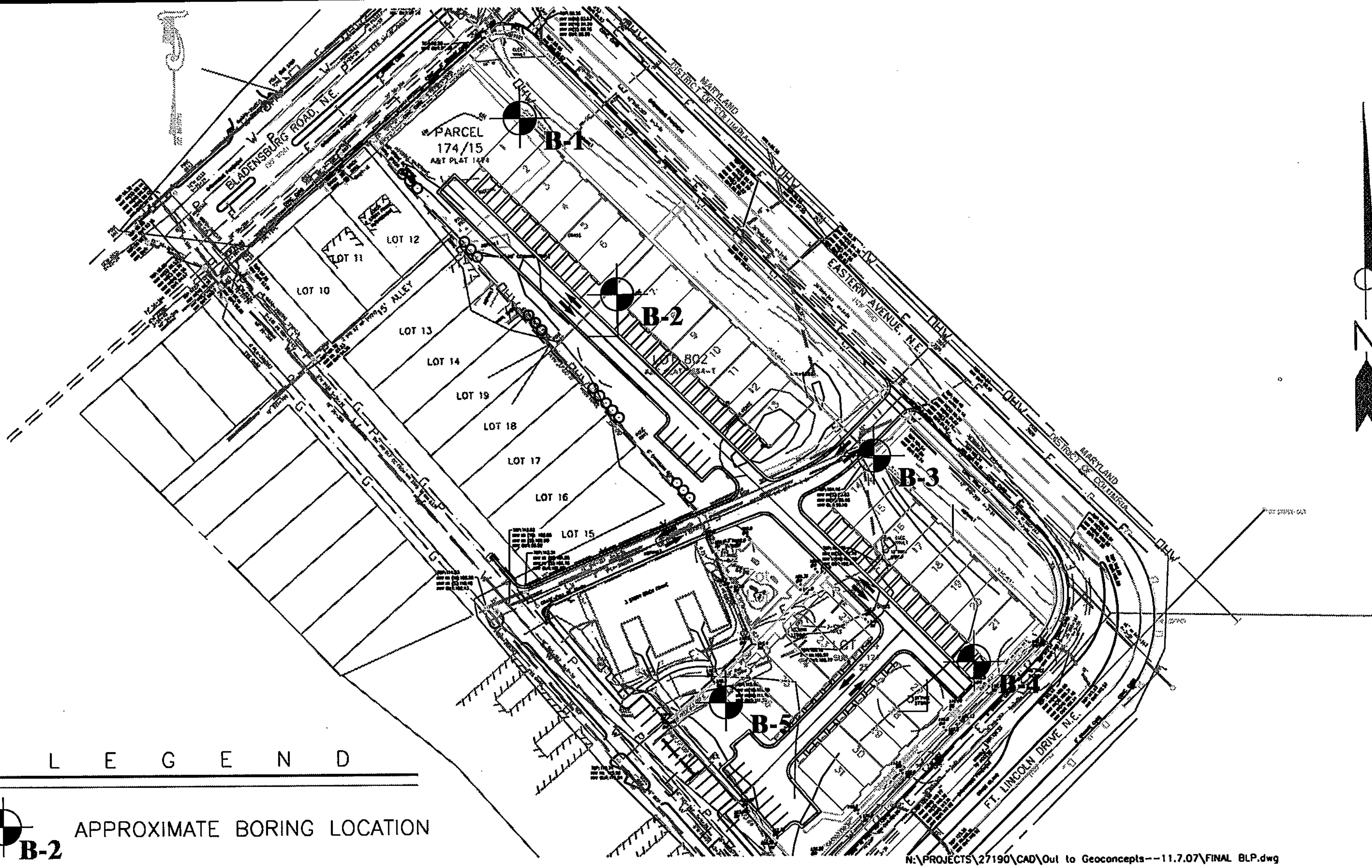
ENCOUNTERED:	None				
UPON COMPLETION:	Dry	CAVED:	9.0 ft	ELEV.	107.6
11/20/2007	Dry	CAVED:	9.2 ft	ELEV.	107.4

SAMPLE TYPES:

☒ Split Spoon

REMARKS:

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES. THE TRANSITION MAY BE GRADUAL.



L E G E N D

B-2 APPROXIMATE BORING LOCATION

GeoConcepts Engineering, Inc.

19955 Highland Vista Dr., Suite 170 (703) 726-8030
Ashburn, Virginia 20147 (703) 726-8032 fax

CITY HOMES AT FORT LINCOLN, FT. LINCOLN & EASTERN AVE., N.E., WASHINGTON, D.C.			Fig. 2
BORING LOCATION PLAN		Scale: 1"= 120'	
Date: DECEMBER 2007	Checked By: T.W.L.	Project No.: 27190	

Soil Laboratory Test Report

Summary of Soil Laboratory Test Results (1 page)

Summary of Soil Laboratory Test Results

Project: **City Homes at Fort Lincoln** **Contract No.: 27190**

Boring	Depth (ft.)	Sample Type	Stratum	Description of Soil Specimen	Sieve Results		Atterberg Limits			Natural Moisture Content (%)	Remarks
					Percent Retained # 4 Sieve	Percent Passing # 200 Sieve	LL	PL	PI		
B-1	1.5'-2'	Jar	B	LEAN CLAY (CL)	0.0	91.0	37	22	15	16.4	
B-1	2.5'-4'	Jar	B	LEAN CLAY (CL), with sand	1.4	84.3	31	18	13	13.8	
B-1	8.5'-10'	Jar	B	LEAN CLAY (CL)	0.0	97.4	44	21	23	18.2	
B-5	2.5'-4'	Jar	B	SILT (ML), with sand	0.0	77.8	25	NP	NP	15.8	
B-5	8.5'-10'	Jar	B	LEAN CLAY (CL)	0.0	87.6	42	20	22	22.5	

Notes:
1. Soil tests are in accordance with applicable ASTM standards.

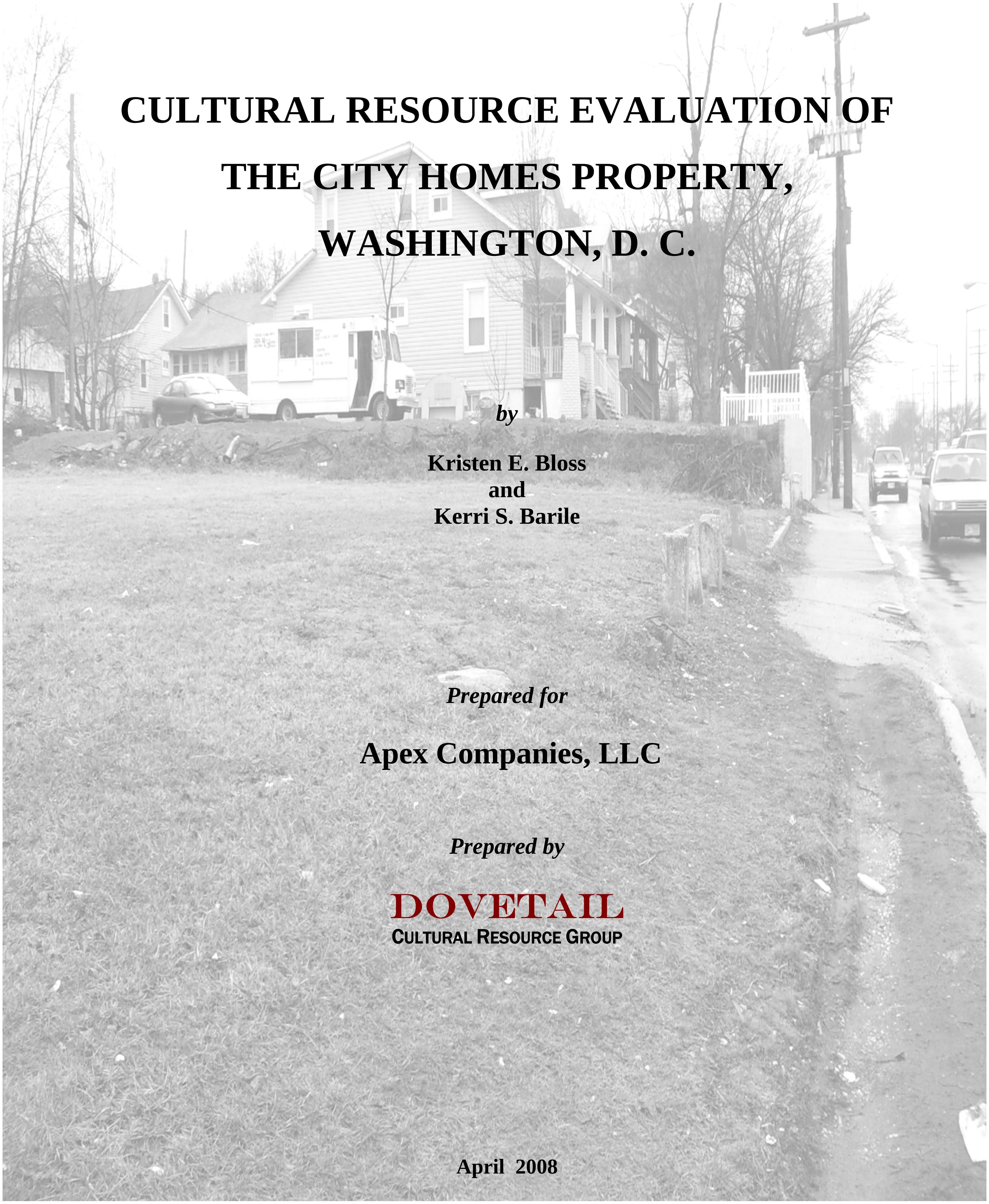
2. Soil classification symbols are in accordance with Unified Soil Classification System.

3. Visual identification of samples is in accordance with ASTM D-2488.

4. Key to abbreviations: LL= Liquid Limit; PL= Plastic Limit; PI= Plasticity Index; NP= Nonplastic; N/T = Not Tested

CULTURAL RESOURCES EVALUATION

(Dovetail Cultural Resources Group)



CULTURAL RESOURCE EVALUATION OF THE CITY HOMES PROPERTY, WASHINGTON, D. C.

by

Kristen E. Bloss
and
Kerri S. Barile

Prepared for

Apex Companies, LLC

Prepared by

DOVETAIL
CULTURAL RESOURCE GROUP

April 2008

Cultural Resource Evaluation of the City Homes Property, Washington, D. C.

by

Kristen E. Bloss
and
Kerri S. Barile

Prepared for

Apenx Companies, LLC
8809 Sudley Road, Suite 101
Manassas, Virginia 20110

Prepared by

Dovetail Cultural Resource Group
510 Kenmore Avenue
Fredericksburg, Virginia 22401

Dovetail Job #08-012

April 2008

ABSTRACT

On behalf of Apex Companies, LLC (Apex), Dovetail Cultural Resource Group (Dovetail) conducted a Phase 1A cultural resource evaluation of the City Homes property, located at the corner of Bladensburg Road NE and Eastern Avenue NE, Washington, D. C. in February 2008. The project area is located on the south side of Bladensburg Road NE, approximately 1.3 miles (2.1 km) southwest of the town of Bladensburg, Maryland. The survey included an examination of approximately 3.8 acres (1.5 hectares) through surface observation. The goals of the survey were to identify the potential for archaeological or architectural remains on the property and make recommendations on the need for any subsurface investigations.

Documents found during a brief map review of the project area show that the project area is located approximately 0.5 miles (0.8 km) northwest of historic Fort Lincoln, an important defensive position during the Civil War. The project area was also once part of a large reform school, however no buildings stood on the current project area. More recently, the project area was part of a park.

During the field survey, it was found that the majority of the project area is open fields that have been landscaped or heavily altered during the recent construction of roads and housing. The central portion of the project area is moderately wooded with young hardwood growth and moderate amounts of undergrowth, but the ground showed evidence of recent disturbances. No historic artifacts or features were noted on the surface, and it is recommended that the entire parcel has no to very low potential to contain intact archaeological sites. Although a collection of 1940s Bungalows are located just south of the project area, the homes are all in poor to moderate condition. Moreover, they are a style of home that is ubiquitous in this area of the district. Therefore, it is recommended that no additional cultural resource investigations are warranted.

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INTRODUCTION

Dovetail Cultural Resource Group (Dovetail) conducted a Phase IA cultural resource evaluation of the City Homes property at the corner of Bladensburg Road NE and Eastern Avenue NE, Washington, D. C. The project was completed at the request of Apex Companies, LLC (Apex). Apex is submitting a development application, thus necessitating compliance with guidelines set forth by the Washington D. C. Planning Department. The Phase 1A survey was completed as part of the application process.

The Phase 1A survey was completed to identify any potential archaeological or architectural remains located on the property and make recommendations on the need for additional work. The cultural resource survey was conducted on February 26, 2008. The work was conducted by Kerri S. Barile, Principal Investigator, and Kristen E. Bloss. Dr. Barile meets the standards established for archaeologist, architectural historian, and historian by the Secretary of the Interior.

PROJECT AREA DESCRIPTION

The project area is located in northeast Washington D. C. approximately 1.3 miles (2.1 km) southwest of the town of Bladensburg, Maryland (Figure 1, p. 2). The 3.8 acre (1.5 hectare) parcel is situated near the border of Washington D. C. and Maryland. The land is bounded by Bladensburg Road NE on the northwest, Eastern Avenue NE on the northeast, private property on the southwest, Fort Lincoln Drive NE on the southeast, and Pineview Road (35th Street NE) (Figure 2, p. 2). The northwest half of the parcel is bordered by Bungalow-style houses from Bladensburg Road NE through the wooded portion of the parcel. Southeast of the houses lies an apartment building, and southeast of that lies Pineview Road (35th Street NE).

The majority of the project area is open fields that have been landscaped or otherwise heavily altered. The central portion of the project area is wooded with young hardwood growth and moderate amounts of undergrowth. While landscaped and cut by a small drainage, the project area is predominantly flat.

The purpose of the current survey was to identify areas with the potential for intact subsurface deposits and located above-ground resources over 50 years of age within the project Area of Potential Effect. The project's APE for archaeology is defined as the entire proposed construction footprint, including any easements associated with the project. The APE for architecture is defined as all areas within the viewshed of the project area where alterations to the setting and feeling may occur

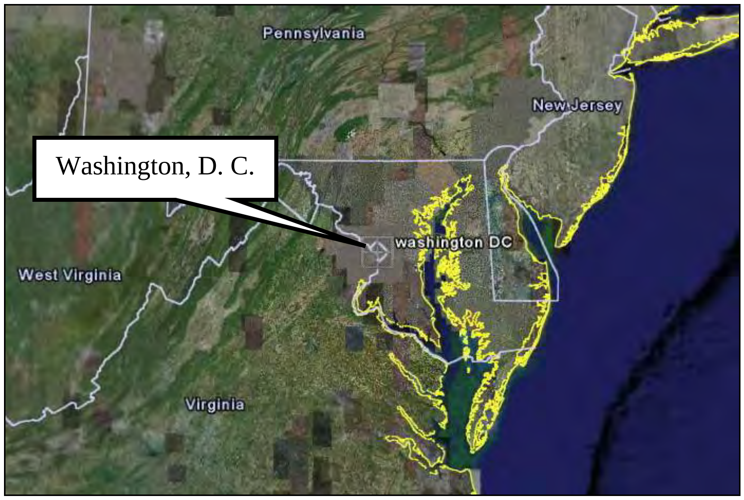

Figure 1: Map of Washington, D. C, Virginia, and Maryland.

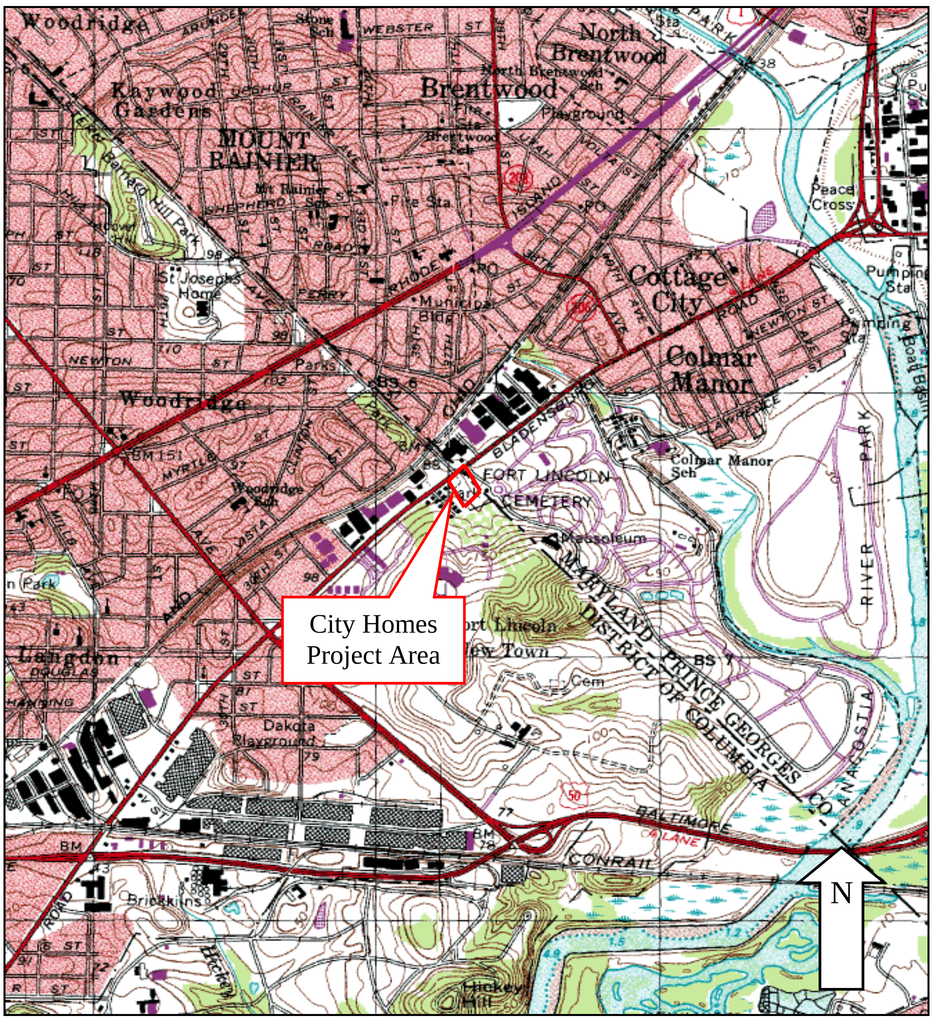

Figure 2: Location of the City Homes Property on a 7.5-Minute United States Geological Survey (USGS) Marshall Education Center, Washington East (DC, MD) Quadrangle (USGS 1990).

Geology

The District of Columbia encompasses 68.3 square miles (177 sq km) and borders the Commonwealth of Virginia to the south and southwest and Maryland to the north and northeast. The project area is located within the Coastal Plain physiographic region. The Coastal Plain is typified by a terraced landscape that steps down from the Appalachian Mountains to the west to the Atlantic Coast and its tributaries (College of William and Mary 2006). Much of the landscape was formed over several million years as sea levels adjusted to the cycle of growth and melting of large continental glaciers.

Soils

Soils within the project area comprise Christiana silt loam, Christiana-Urban land complex, and Sunnyside fine sandy loam (National Resource Conservation Service [NRCS] 2006). Christiana silt loam comprises nearly 90 percent of the project area. It is a moderately deep, well drained soil found at elevations of 150–350 feet (45.7–106.7 m). The northern half of the parcel has 0 to 8 percent slopes, while the southern half has 8 to 15 percent slopes. Christiana-Urban land complex is found in a small northwestern portion of the project area running adjacent with a row of houses. This soil type is moderately deep, well drained combination of the Christiana silt loam described above and Urban Land. Urban land soil is shallow and has 0 to 8 percent slope. Sunnyside fine sandy loam is found in a small corner of the project area where Fort Lincoln Drive NE turns into Eastern Avenue NE. This soil is also moderately deep, well drained, and found at 0 to 8 percent slope (NRCS 2006).

HISTORIC CONTEXT

Prehistoric Periods

The prehistoric cultural sequence within the District of Columbia parallels that of the other areas of the Middle Atlantic Region. It is generally divided into three periods, Paleoindian (13,000–10,000 B.P.), Archaic (10,000–3200 B.P.) and Woodland (3200–400 B.P.). These periods are often divided into Early, Middle and Late periods. While this sequence represents a cultural continuum, archaeologists have noted that periods of adaptational stability are punctuated by periods of rapid change that do not necessarily correlate with the traditional cultural periods (Custer 1984; Smith 1986).

Prehistoric sites of all periods have been located within the District of Columbia. A number of sites have been located in the vicinity of the National Arboretum along the banks of the Anacostia River (Chase et al. 1988). One prehistoric site, identified as a prehistoric village site of the Necochtanke (Nacostin) Indians, is recorded on the Arboretum property near Hickey Hill (51NE12). A large number of these community sites have been identified on the east side of the river (Humphrey and Chambers 1977). This relative lack of sites may be due in part to the difference in topographic conditions on either side of the Anacostia. The broad alluvial terraces of the east side provide attractive village sites. The west side has a narrow band of floodplain, probably mostly a marsh in prehistoric times, cut off by steep bluffs, leaving few locations conducive to village occupation (Giedel 1993).

Paleoindian Period (13,000–10,000 B.P.)

The Native American occupation of the eastern portion of North America dates to approximately 13,000 to 10,000 B.P. The Paleoindian settlement-subsistence pattern revolved around hunting and foraging in small nomadic bands. These bands focused on hunting caribou, elk, deer, and now extinct mega-fauna (Goodyear et al. 1979; Meltzer 1988; Smith 1986). Evidence for this occupation is manifest in fluted projectile points used for hunting. Fluted points are rare and often identified as isolated occurrences. While these discoveries are infrequent, the eastern half of the United States has some of the highest concentrations of these finds. Almost 1,000 known fluted projectile points have been discovered in Virginia (Anderson and Faught 1998). While the fluted Clovis and Folsom projectile points are the best known of the Paleoindian point types, others include Hardaway-Dalton and Hardaway Side-Notched (Barber and Barfield 1989). Paleoindian stone tools are usually made from high quality cryptocrystalline lithic material. The Paleoindian tool kit included scrapers, gravers, unifacial tools, wedges, hammerstones, abraders, and other tools used for chopping and smashing (Gardner 1989).

Archaic Period (10,000–3200 B.P.)

The Archaic Period is generally divided into three phases, Early (10,000–8800 B.P.), Middle (8800–5500 B.P.), and Late (5500–3200 B.P.). There does not appear to be a dramatic change in the tool kits of the Early Archaic and their Paleoindian predecessors. Actually, their settlement and subsistence patterns appear to be very similar (Anderson et al. 1996; Cable 1996). The transition into the Archaic Period is marked by an increase in site size and artifact quantity, as well as an increase in the number of sites (Egloff and McAvoy 1990). Diagnostic artifacts of the Early Archaic Period include the Kirk Corner-Notched and Palmer Corner-Notched projectile points (Coe 1964; Custer 1990). In addition, some bifurcated stem points such as St. Albans and LeCroy appear to be associated with the increased use of hafted endscapers (Coe 1964). The Early Archaic also marks the first appearance of ground stone tools such as axes, celts, adzes and grinding stones. At the close of this period, we see a shift to an increased reliance on a wider range of lithic resources.

While there appears to be a relatively high degree of cultural continuity between the Early and Middle Archaic Periods, sites dating to the Middle Archaic Period are more numerous suggesting an increase in population, and sites appear to be occupied for longer periods of time. The Middle Archaic Period coincides with a relatively warm and dry period that may have resulted in widespread population movements (Delcourt and Delcourt 1987; Stoltman and Baerreis 1983). Mouer (1991:10) sees the primary cultural attributes of the Middle Archaic as "small-group band organization, impermanent settlement systems, infrequent aggregation phases, and low levels of regional or areal integration and interaction." Projectile points diagnostic of the Middle Archaic Period include Stanley Stemmed, Morrow Mountain Stemmed, Guilford Lanceolate, and Halifax Side-Notched.

The Late Archaic Period is often seen as the culmination of trends that began during the Early and Middle Archaic (Dent 1995:178). Dent (1995:178) suggests that the Late Archaic is "a time that contains both the ends of one way of life and the beginnings of a significant redirection." The artifact assemblage is dominated by bifacial tools; however, expedient flake scrapers, drills, perforators and utilized flakes are characteristic of these assemblages. Groundstone tools, including adzes, celts, gourges and axes are seen during this period, with the grooved axe making its first appearance during the Late Archaic (Dent 1995:181–182). Diagnostic projectile points of the narrow blade tradition, often viewed as the early portion of the Late Archaic Period, include the Vernon, Bare Island/Lackawaxen, Clagett, and Holmes (Dent 1995; Mouer 1991).

The period of time from approximately 4500 B.P. to 3200 B.P. is referred to as the Transitional Period by some (Mouer 1991), while others argue that due to the lack of pottery, it is more accurately classified as an extension of the Late Archaic (Dent 1995:180). By the early portion of this time period, glacial retreat had led to higher sea levels on the Atlantic seaboard. This allowed for the development of large estuaries and tidal wetlands that were conducive to the development of coastal resources such as fish and shellfish. Sites dating to this time period are often located in areas where populations can exploit these types of resources, such as river valleys, the lower portion of the coastal plain tributaries of major rivers, and near swamps. This has lead archaeologists to postulate that fish began to play a larger role in the subsistence system. Platform hearths seen during this period are interpreted as being associated with fish processing (Dent 1995:185). The first definitive evidence of shellfish exploitation is seen during this period on the lower reaches of the Potomac (Potter 1982).

Transitional Period sites tend to be larger than those of the Archaic Periods, likely reflecting an increase in population; however, there is still no evidence for year-round occupation. Dent (1995) argues that the larger sites may be misinterpreted as reflecting longer term occupation and may simply be sites that were revisited for short period on many occasions. Material culture associated with the Transitional Period includes steatite or soapstone vessels as well as the groundstone tools discussed above. Broad-blade points associated with the later portion of the Late Archaic or Transitional Period include the Savannah River, Susquehanna, Perkiomen, Dry Brook, and Orient Fishtail projectile points (Dent 1995; Mouer 1991).

Woodland Period (3200–400 B.P.)

The Woodland Period is divided into three phases, Early (3200 B.P.–2300 B.P.), Middle Woodland (2300–1100 B.P.), and Late (1100–400 B.P.). The introduction of pottery, agriculture, and a more sedentary lifestyle mark the emergence of the Woodland Period. The population surge that began in the Archaic continues in this period. The concurrent development of agriculture and pottery led early theorists to posit that they were linked; however, few still support this position. Alternatively, the evolution of technological and subsistence systems as well as various aspects of pan-Eastern interaction are currently believed to underlie the evolution of ceramic vessels (Egloff 1991).

Steatite-tempered Marcey Creek pottery, dating to the Early Woodland Period, are thought to be the earliest ceramic wares in Virginia’s Piedmont. Marcey Creek wares, considered experimental, are typically shallow, slab built forms (Dent 1995; McLearen 1991). Another steatite-tempered ware, Selden Island, followed Marcey Creek and soon other temper types appear in the archaeological record (McLearen 1991). Approximately 1100 B.P., there is a shift from the earlier slab construction techniques to coil and conoidal or globular vessels. This shift is accompanied by the introduction of surface treatments such as cord marking and net impression (Dent 1995; McLearen 1991). Projectile points associated with the Early Woodland Period include Rossville Stemmed and possibly Piscataway Stemmed (Dent 1995).

The Middle Woodland is marked by the rise of certain sociocultural characteristics that include “interregional interaction spheres, including the spread of religious and ritual behaviors which appear in locally transformed ways; localized stylistic developments that sprung up independently alongside interregional styles increased sedentism and evidence of ranked societies or incipient ranked societies” (McLearen 1992:55). While there is a degree of commonality among Middle Woodland peoples, one of the striking characteristics of this period is the rise of regional trends, particularly in pottery. Coastal

Plain and Piedmont ceramic styles can be distinguished, as well as north–south differences that correspond to river drainages that drain into the Chesapeake Bay or Albemarle Sound. The diversity of surface treatments increase after 1500 B.P. and analysis of the regional pottery indicates that the Potomac, the Rappahannock, and Upper Dan were slightly different cultural subareas in the physiographic province of the Piedmont (Hantman and Klein 1992). The Middle Woodland Period also sees the introduction of the triangular or Levanna projectile point.

The Late Woodland Period is marked by an increased reliance on agriculture, attendant population growth, larger villages and increased sociocultural complexity (Turner 1992). Ceramic types of the Late Woodland Period in the Piedmont include the quartz-tempered Gaston Simple Stamped and sand/crushed rock-tempered Dan River pottery (Hantman and Klein 1992). The trend towards sedentary settlements continues throughout the Late Woodland Period. In the early portion of this period, settlements consist of small clusters of houses with little to no internal organization. However, by 300 B.P., larger villages are observed. Features associated with these villages include palisades, houses, hearths, storage pits, and burials (Hantman and Klein 1992). The smaller Madison triangular projectile point is generally associated with the Late Woodland Period.

Contact Period

The Contact and early historic period refer to the time period during which the native groups had their first contact with Europeans and European goods. Native adaptations to the changing social and political environment of the Piedmont are poorly understood. The Piedmont was occupied by several Siouan-speaking groups during the late prehistoric and Contact Periods (Mouer 1983). The material culture of the period is characterized by sand- and grit-tempered pottery decorated with simple stamped decorative motifs, often similar and likely derived from Late Woodland styles (Potter 1993). The introduction of European goods is a distinguishing characteristic of this period. Depopulation related to European born disease and changed trade dynamics are the two primary factors often cited in cultural changes during this period.

During the period of initial European intrusion, the District of Columbia was inhabited by the Canoy, a tribal confederacy of the Algonquin-speaking people of the north. There are thought to have been at least four Indian villages within the present city that date from the early seventeenth century, including one near the C&O Canal and MacArthur Boulevard and a large village called Nacochtanke on the east bank of the Anacostia River (Humphrey and Chambers 1977). The Nacotchtanke, a branch of the Piscataway, would have gathered and hunted on lands throughout the area. The Piscataway were the largest group of Algonquian speakers in southern Maryland, and they were the dominant group within the chiefdom that was called “Conoy” by their Iroquoian speaking enemies, the Five Nation Iroquois.

Historic Period

Settlement to Society

Prior to European arrival in the Potomac, the area was already home to a complex network of Algonquin settlements and chiefdoms. Early exploration of modern-day Washington D. C. area essentially begins with Captain John Smith's treks up the rivers of the Chesapeake Bay from 1607–1609 although previous endeavors into the Potomac River Valley has been documented. As European colonization gained a foothold in the New World, the profitable cultivation of tobacco encourages settlement throughout the area.

In 1630 King Charles I of England granted a charter for the exclusive right of the colony of Maryland to George Calvert (Geidel 1993). By 1633 St. Mary's City, Maryland was established as the first settlement with 150 colonists living on the new land. Because prior settlements, primarily in the southern Chesapeake Bay area, had already established tobacco as the main crop, the early Maryland colonist also adopted this agricultural venture (Chappelle et al. 1986). Even though the colonial assembly tried to promote some grain production, tobacco remained the primary crop and even served as a means of exchange until the time of the Revolutionary War (Giedel 1993).

By the turn of the eighteenth century a garrison had been established at the mouth of Rock Creek under the command of Colonel John Addison. Ninian Beall, commander of the Potomac troop of Rangers, received a land grant of 765 acres (309.6 hectares) on the west side of Rock Creek. Later, surveyed and patented land grants would delineate the boundaries of the District of Columbia.

Early National Period

By the time of the Revolutionary War the soon-to-be Washington D.C. was encompassed by large plantations. The presence of these large plantations drew tenant farmers and independent farmers to the region who made their living selling their crops to the already working larger plantations. The growing number of large and small farms established at this time drew artisans, craftsmen, mechanics, and laborers to the area. In 1790, the Residence Bill established an area along the Potomac River to be the nation's capital. This federal district was originally termed the Territory of Columbia and the federal city was called the City of Washington. The name was changed to the District of Columbia in 1793.

A temporary battery known at Barney's Battery was constructed in the city during the War of 1812. This defense consisted of five dismounted Naval guns used to oppose the British on August 24, 1814 during the Battle of Bladensburg (Young 1968). This battery was located on a ridge extending east from Bladensburg Road to a point north at the location where the National Training School for Boys once stood, just south of the current project area (Young 1968:4).

On August 25, 1814 the British neared Washington. They made their way down Constitution Avenue bearing a flag of truce and demanding surrender (Pitch 1998:99). It is reported that the flag of truce was fired upon from a residence and immediately British troops rushed to the home and burned it to the ground. The British continued their rampage by burning and destroying every building connected to the government (Pitch 1998:101). They remained in Washington for two nights while the city laid smoldering. After the war Washington began its reconstruction process, which was finally completed by 1819.

Civil War

> Washington itself was riding the crest of the wave thrown up by the boom, its ante-bellum population of 60,000 having nearly quadrupled under the pressure from the throng of men and women rushing in to fill the partial vacuum created by the departure of the Southerners who formerly had set the social tone (Foote 1963:152)

In 1861 Fort Lincoln (located just south of the current project area) was already constructed and served to protect the Baltimore turn-pike, the B & O Railroad, and many auxiliary roads which lead into Washington (Young 1968:4) (Figure 3). Fort Lincoln was supplied with four 24 pound siege guns, two 24 pound howitzers in embrasure, four 12 pound field pieces, and eight 6 pound field pieces (Mahan 1860:136). By 1862 a considerable defense system was in place in Washington D.C. At the time, the nation's capital was less than sixty years old and was about to witness yet another round of devastation. Still under construction, the city served as the National Union Headquarters; because of its political significance, the northern states poured troops south to protect it. It did not take long for Washington to become a military camp housing thousands of men and the site of an impressive supply depot.

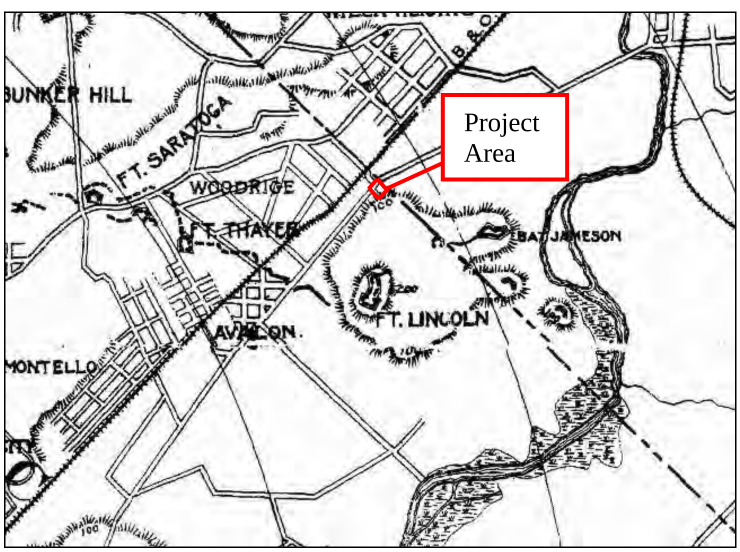

Figure 3: Map of Fort Lincoln (National Oceanic and Atmospheric Administration [NOAA] 1892).

The city itself was encompassed by strong fortresses and entrenchments, complete with huge artillery pieces weighing up to twenty-five tons (Konstam 2003). One of these fortifications, Fort Stevens, was the target of the only serious Confederate move against the Capital. In 1864 General Jubal Early staged an attack on July 11 but was held off. It was during this battle that President Lincoln witnessed rifle fire during his visit to the battle field (CWSAC 1997).

By the end of the war Washington had 68 enclosed forts and batteries, 93 unarmed batteries, three blockhouses, and 20 miles of trenches connecting the main defense works. In addition there were emplacements for 1,501 guns of which 900 were in place (Konstam 2003). This was a very impressive defense system for the time. Without these fortifications Washington may have not survived.

Reconstruction

Throughout the Civil War, Washington had served as a staging ground for raiders and troops by both sides of the conflict. This depleted much of the areas resources, and by 1870, the city was described as "the ugliest city in the whole country" by one senator (Fogle 1991). Overrun by beggars and animals wandering through the streets, Congress gave serious consideration to relocating the nation's capitol. In 1870, in an attempt to keep Washington as the capitol city, a group of citizens petitioned Congress to initiate a city government. In 1871, the District Territorial Act was passed creating a council of 22 elected members, a governor, and a board of public works (Fogle 1991).

In the late 1880s, Washington saw a tremendous construction and rebuilding boom. In 1888, the construction of a new State, War, and Navy building was completed near the White House and was, at the time, the world's largest office building (Fogle 1991). New schools, markets, hotels, and office building were erected, followed swiftly by new neighborhoods. Roads and a trolley system extended suburban growth to Maryland and northern Virginia.

The Twentieth Century

The twentieth century, particularly the first half, saw an explosion of economic, social, and cultural development. Museums, concert halls, and parks sprung up throughout the city to accommodate the dramatic population influx. The Smithsonian Institution, the Freer Gallery, the National Gallery, Constitution Hall, the Belasco Theater, and the National Theater were among the numerous buildings constructed at this time.

With America's entry into World War I, new government agencies were established furthering economic development and construction in the city. World War II cemented Washington as the "command center" of the country (Fogle 1991). During this time, the city was once again fortified—the first time since the Civil War. In the decades following the two world wars, Washington thrived and continued its development as a modern city. The security and growth of government institutions and jobs allowed continued growth and expansion of the city's population. Infrastructure continued to grow with the construction of major highways and the Metrorail system, which broke ground in December 1969 (Washington Metropolitan Area Transit Authority 2008).

Beginning in the mid-1950s, Washington became a forerunner in urban renewal. Many of the older and/or dilapidated buildings in Washington were bulldozed in order to make way for new buildings and complexes. While this renewal was seen throughout the city, much of the work was concentrated in southeast Washington.

PROJECT METHODOLOGY

The goals of the survey were to identify any previously recorded historic properties within the project area, conduct a brief historic map review of the parcel, and locate areas with the potential to contain cultural resources. The survey methodology employed to meet these goals was chosen with regard to the project's scope (i.e., the project's potential to affect significant resources, should they be present), local field conditions, and requirements set forth by the Washington D. C. Planning Department on cultural resource investigations. Based on the environmental setting, the project area was judged to have low potential for prehistoric resources and high potential for historic resources.

Dovetail conducted a background literature and records review of the project area at the Washington D. C. Office of Planning (DCOP), including an investigation of records on previous cultural resource investigations and previously recorded archaeological sites and architectural properties within a one-mile radius (1.6 km) of the project area. The purpose of this work was to attain information to complete a context of the property and surrounding area.

Following this research, a historic map review was conducted to look for evidence of previous occupation of the property. During the review, Dovetail examined map collections held by the Library of Congress and the National Park Service. Other archival records investigated during the review were Civil War records and maps.

The documents attained during the review were then used during a field inspection of the property. The field survey consisted of Dovetail archaeologists examining the entire 3.8 acre (1.5 hectare) project area. The entire parcel was inspected through a pedestrian survey. Field notes were taken to record the current condition of the property, and color digital photographs were captured for visual documentation of the features. No subsurface investigations were conducted during this work.

BACKGROUND RESEARCH

Prior to conducting fieldwork, the potential of the project area to contain significant archaeological resources and NRHP-eligible architectural properties was assessed by searching the DCOP site file maps and records, as well as examining the Civil War Sites Advisory Commission (CWSAC) maps for the area. The CWSAC maps showed that there is one recorded Civil War battle site and three forts within the general vicinity of the project area. Early's Raid and Operations against the B&O Railroad took place on July 11–12, 1864 and is located approximately 4.3 miles (6.9 km) northwest of the current project area (CWSAC 1997). On July 11, Lt. General Jubal A. Early's Confederate troops sent skirmishers to test Forts Stevens and DeRussey. These fortifications were not heavily armed at the time. Overnight, however, veteran units from the Union VI Corps were sent to bolster defenses. On July 12, Early made a strong advance on these forts hoping to eventually take the Union Capitol. President Lincoln watched the battle from Fort Stevens and came under fire from Confederate sharpshooters. The veteran Union troops quickly drove back Early's troops, and he was forced to retreat to White's Ford that night (CWSAC 1997).

The background research revealed that there are three previously-recorded architectural properties and six previously-recorded archaeological sites within one mile (1.6 km) of the project area (Table 1, p. 16). All six previously-recorded archaeological sites are prehistoric camp sites dating to an unknown period of occupation (Thunderbird 2002).

The architectural resources include the Boundary Stones of D. C., Fort Lincoln, and the National Arboretum. The Boundary Stones of Washington D. C. were the first monuments erected by the United States government. In 1792, Major Andrew Ellicott, principle surveyor of the city, placed twenty-six stones along the D. C./Maryland border. Twenty-three still stand today, two of which are within one mile (1.6 km) of the project area.

Fort Lincoln, located just south of the current project area, was constructed by 1861 and served to protect the Baltimore turn-pike, the B&O Railroad, and many auxiliary roads that lead into Washington (Young 1968:4). Fort Lincoln was supplied with four 24 pound siege guns, two 24 pound howitzers in embrasure, four 12 pound field pieces, and eight 6 pound field pieces (Mahan 1860:136). A previous archaeological investigation of Fort Lincoln and the surrounding area found that nearly all of the fort was destroyed during the construction of the National Training School (Young 1968). The National Training School has been destroyed in the time since Young's archaeological investigation.

The National Arboretum, a 400 acre (161.9 hectare) center for research, education, and plant propagation, was established by Congress in 1927. One of the nation's largest urban arboretum's, it is home to numerous gardens, groves, collections, and plantings of both native and non-native trees, shrubs, and perennials.

Table 1: Previously Identified Cultural Resource Sites
Within a 1-Mile Radius of the Project Area

Property No.	Site Type	Temporal Period	Description/Artifacts
71	Historic	1792	Boundary Stones of Washington D. C.
96i	Historic	c. 1861	Fort Lincoln
212	Historic	1927	National Arboretum
51NE001	Prehistoric	unknown	lithic debris
51NE004	Prehistoric	unknown	lithic debris
51NE005	Prehistoric	unknown	lithic debris
51NE006	Prehistoric	unknown	lithic debris
51NE012	Prehistoric	unknown	lithic debris
51NE017	Prehistoric	unknown	lithic debris

PROJECT RESULTS

Historic Map Review

Located in northeast Washington D. C. on the border with Maryland and approximately 3,600 feet (1,097.3 m) north of the Anacostia River, the project parcel is in an area that has long been inhabited. Prior to European arrival in the Potomac, the area was already home to a complex network of Algonquin settlements and chiefdoms. Early exploration of modern-day Washington D. C. essentially begins with Captain John Smith's treks up the rivers of the Chesapeake Bay from 1607–1609, although previous endeavors into the Potomac River Valley has been documented. In 1790, the Residence Bill established an area along the Potomac River to be the capital of the young country.

In 1830, the B&O Railroad became the first railroad authorized to run through Washington D. C., lying parallel with today's Bladensburg Road (Baltimore & Ohio Railroad Historical Society 2008). In 1861 Fort Lincoln was already constructed and served to protect the Baltimore turn-pike (historic Bladensburg Road) and the B&O Railroad (Young 1968:4). A large network of entrenchments surrounded the fort, the northernmost of which was located immediately south of the project area.

In 1872, 150 acres (60.7 hectares) was purchase for a National Training School for boys (National Training School for Boys n.d.). The current project area is located in the northernmost corner of this plot. The exact number of buildings on the property at this time is unclear. However, a map from 1888 shows over eight buildings on the training school property, none of which are within the current project area (Figure 4, p. 18). The construction of these buildings seems to have destroyed nearly all remains of Fort Lincoln. The property's acreage and construction activity grew at a moderate pace throughout the late nineteenth and early twentieth centuries, however, none of this expansion appears to have affected the current project area (Figure 5, p. 18).

By 1919, the United States Reform School Farm was situated on 266 acres (Baist 1919). At this time 23 buildings sat on the property of which there were frame and brick buildings, greenhouses, and stables. Sometime between 1919 and 1921 the property grew to over 323 acres with no apparent new buildings. In 1924 three new buildings were added (Figure 6, p. 19). The Baist Real Estate Maps from 1931 shows that the total acreage for the property diminished to 316 acres. The map also illustrates the addition of nine more buildings in the southern portion of the property.

By 1945 the property contained the same number of buildings and the same amount of acreage as it did in 1931. Just over thirty years later the school closed at the direction of the Attorney General. Shortly after the school closed, a small park was established that encompassed the current project area (Figure 7, p. 19). Around the same time, a small community of Bungalows was constructed immediately to the west of the project area and remain today. The park was still open as of 1990, but was closed sometime between then and 2008 (Figure 8, p. 20). Today the property is unused.

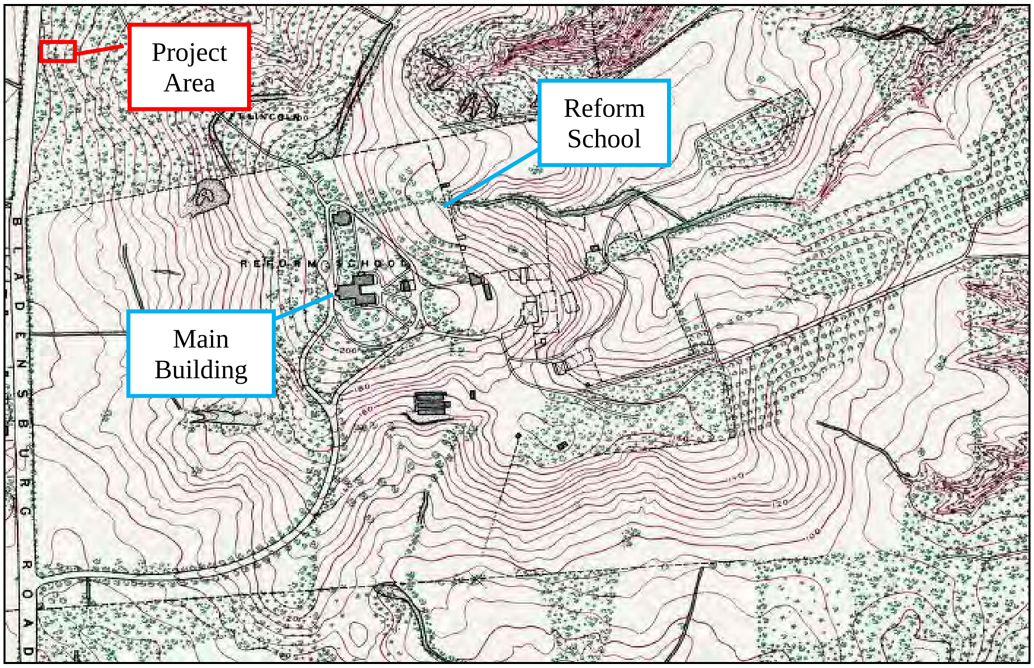

Figure 4: Circa 1888 Topographic Map Showing Project Area (NOAA 1888).

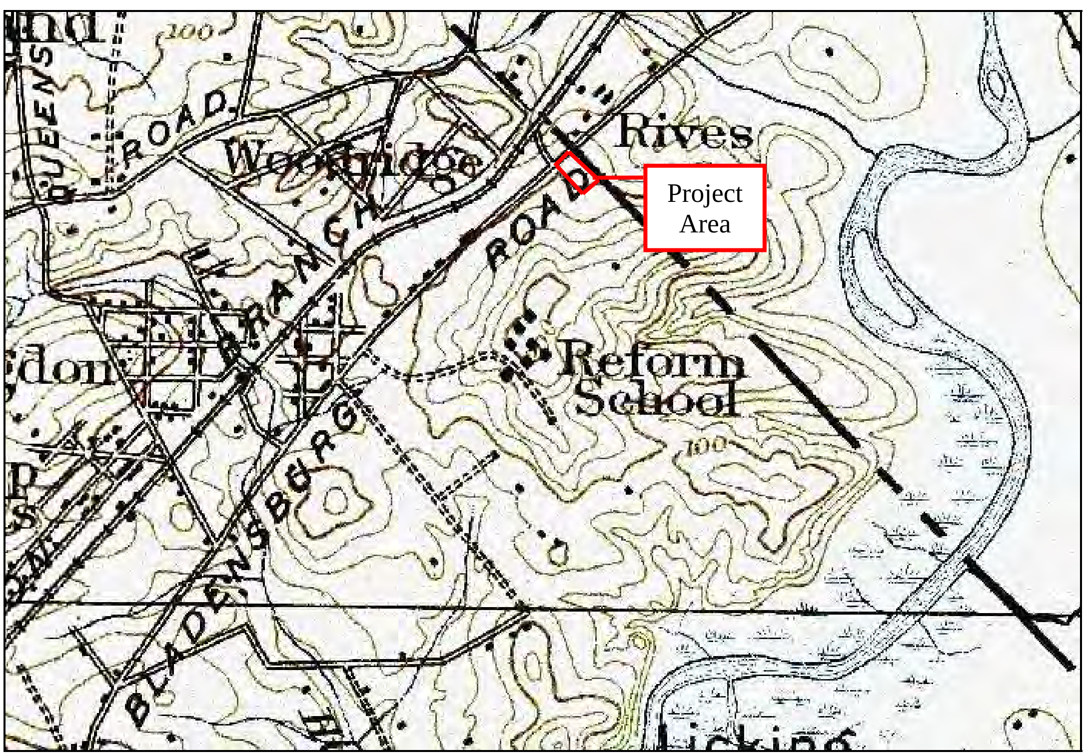

Figure 5: Circa 1914 Map Showing Project Area (NOAA 1914).

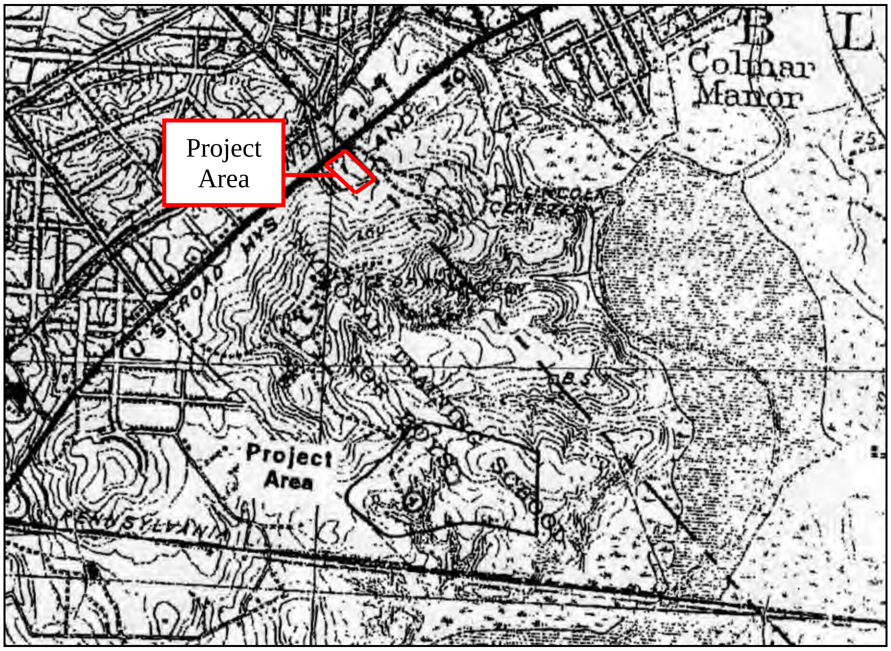

Figure 6: Circa 1929 Map Showing Project Area (USGS 1929).

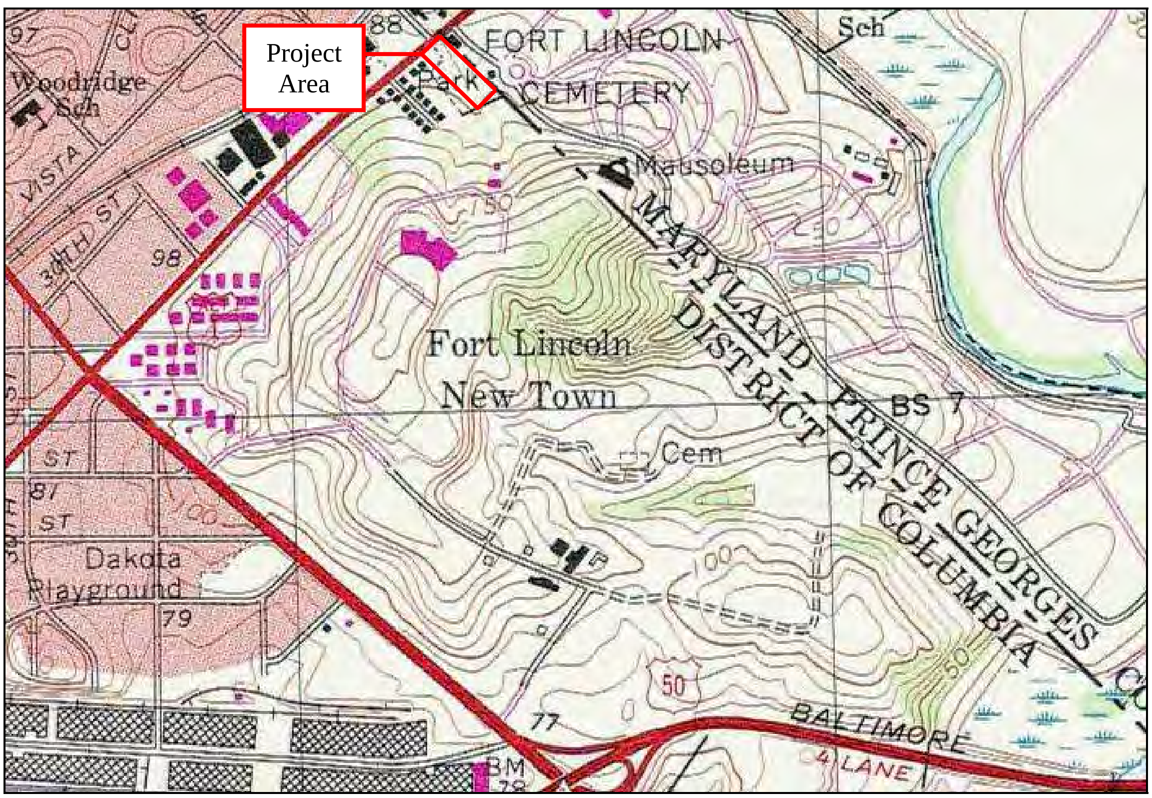

Figure 7: Circa 1979 Map Showing Project Area (NOAA 1979).

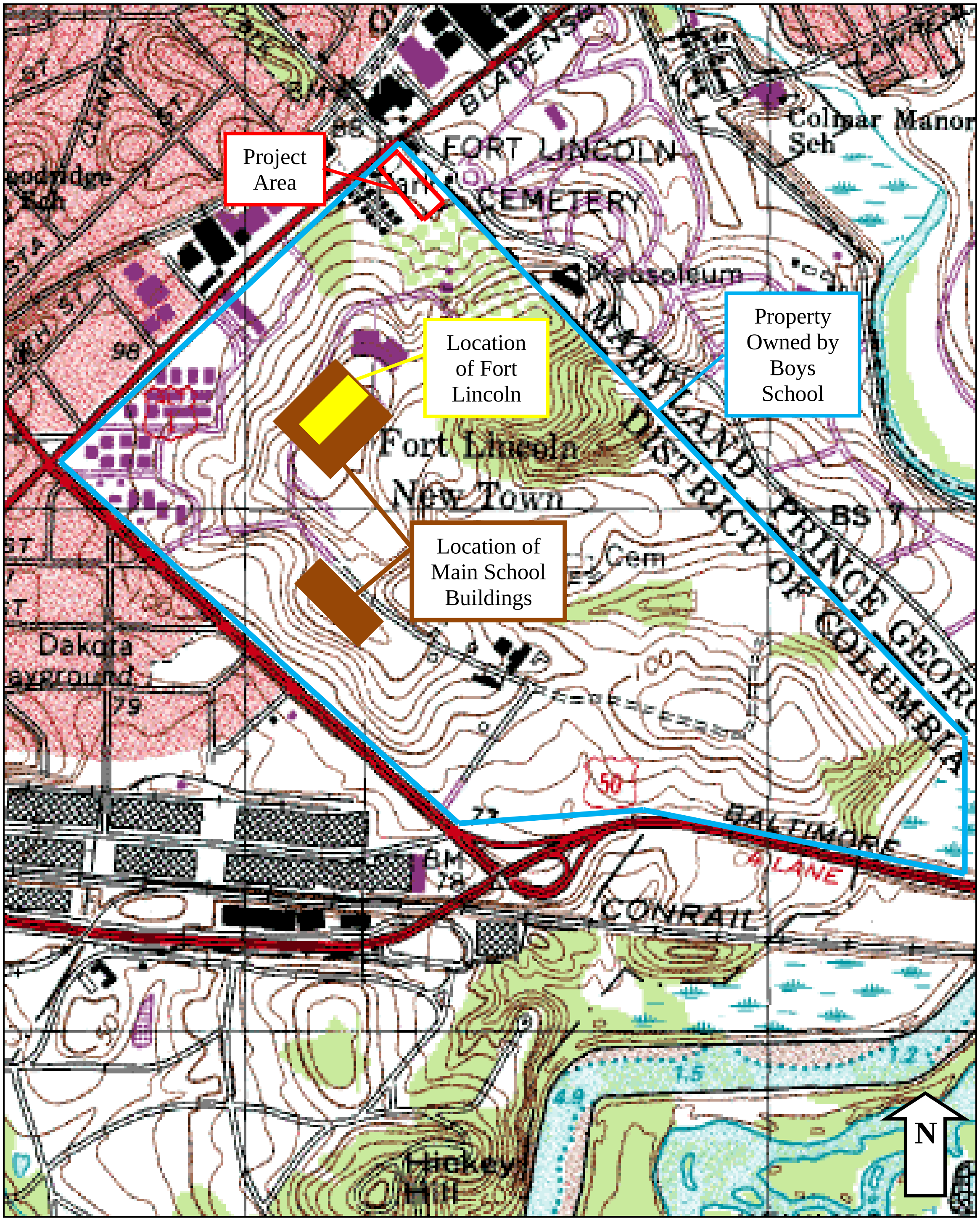

Figure 8: Map Showing the Project Area, Location of Reform School Buildings and Property Boundaries, and Location of Fort Lincoln (USGS 1990).

Pedestrian Survey

Based on the results of the background review and the brief map review, Dovetail conducted a reconnaissance survey of the City Homes property. The survey included a pedestrian evaluation of the 3.8 acre (1.5 hectare) project parcel and a brief inspection of the above-ground remains on the property. The survey of the property revealed that the majority of the project area is relatively flat, open field (Figure 9). The central portion of the project area is wooded with young hardwood growth and moderate amounts of undergrowth. The ground surface is currently covered with sparse detritus. The ground surface visibility is high in the fields and moderate (approximately 50 percent) in the wooded portion of the parcel. Modern trash was seen on the surface throughout the project area and is likely attributable to the proximity of roads and housing (Photo 1, p. 22).

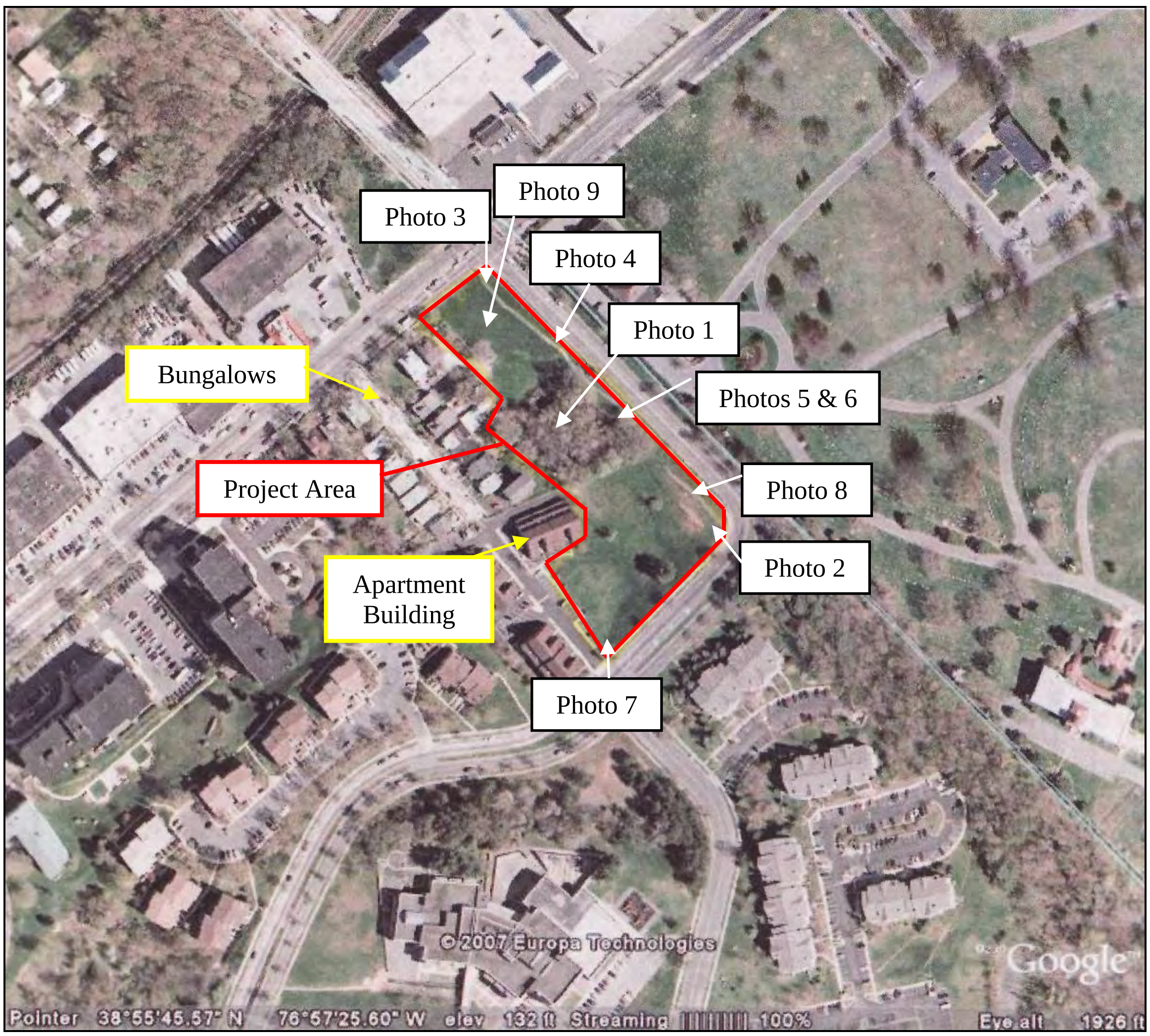

Figure 9: Project Area Showing Location of Photographs Taken.

Photo 1: View of Modern Yard Trash in Wooded Area, Facing Southwest.

During the visual inspection, it was found that the majority of the project area has been developed or altered in some way. Roads border nearly all of the project area, the construction of which probably disturbed the outskirts of the parcel. An asphalt sidewalk runs adjacent to a concrete sidewalk through most of the project area (Photo 2).

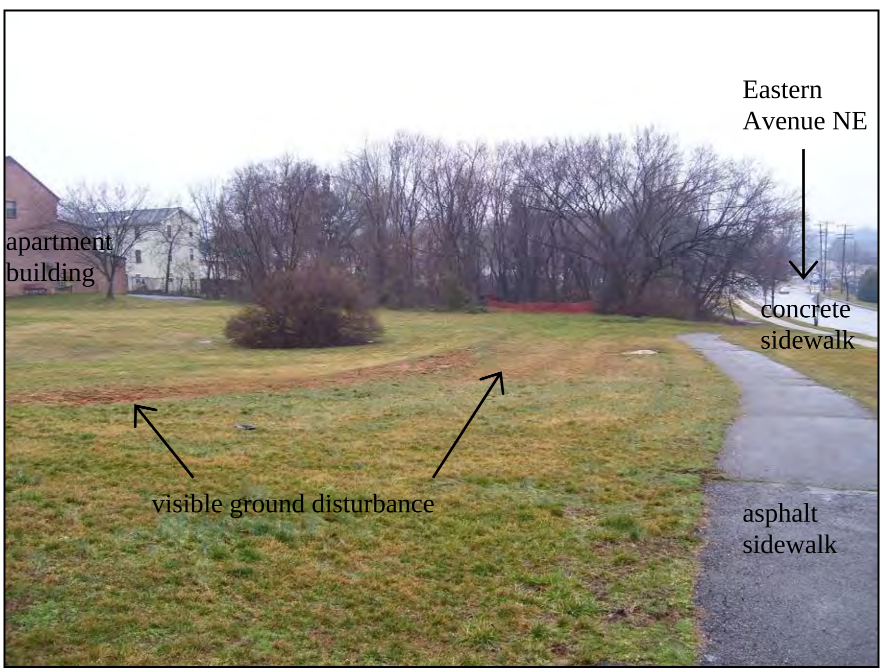

Photo 2: Overview of Southern Portion of Project Area Showing Sidewalks and Soil Disturbance, Facing West.

The northeastern half of the parcel is bordered by a small community of Bungalow-style houses running from Bladensburg Road NE down to and including the wooded portion of the parcel (Photo 3; Photo 4, p. 23). In the open field east of these houses, disturbance was noted. This area was once part of a park. It is possible that a building once stood on this portion of the project area. Several large push piles of construction material and miscellaneous domestic trash were noted near the bungalows. A utility pole was identified near Eastern Avenue NE that may have been associated with the park once located on the property and an old park entrance off of Bladensburg Avenue NE that runs southeast onto the project area. Asphalt was seen on the surface, covered by patches of grass, in the southern portion of this field near the wooded area. This asphalt is in line with the presumed path of the park entrance.

The wooded portion of the parcel contains remnants of building materials and appears to have been bulldozed. A large pushpile of poured concrete, fencing, and other building materials was located next to a small cleared area within the woods (Photo 5, p. 24). Disturbed soils were seen on the surface of the cleared area, and push piles were seen throughout the northern portion of the wooded area (Photo 6, p. 25).

Photo 3: Northern Portion of Project Area Showing Bungalows, Facing Southwest.

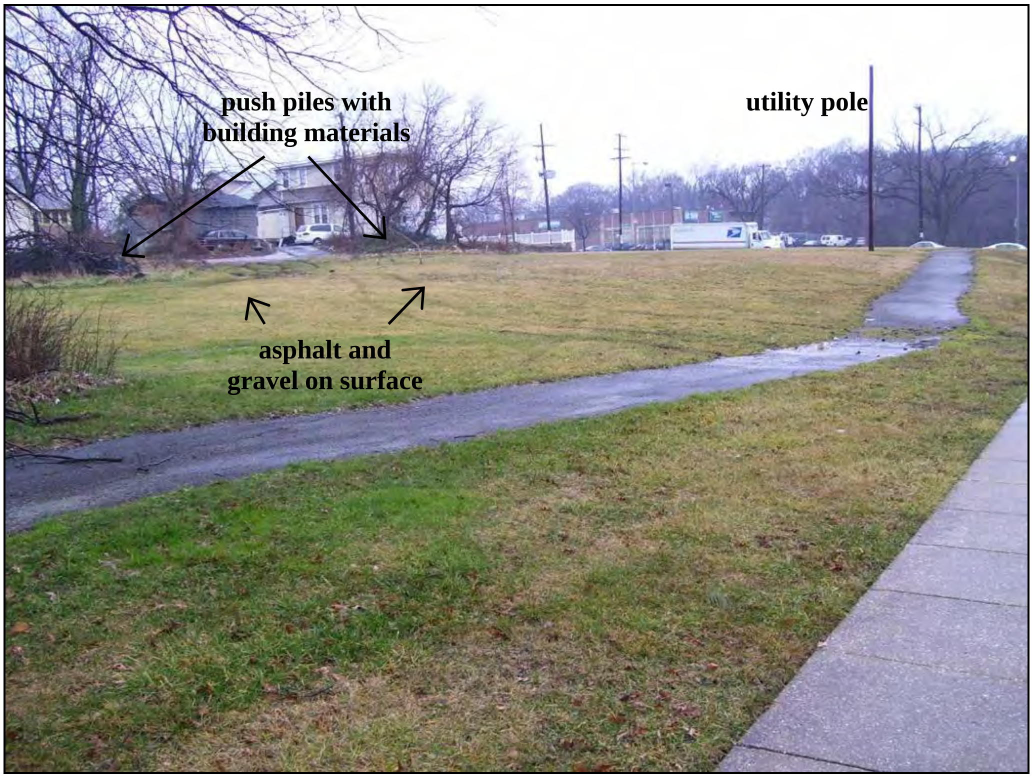

Photo 4: Overview of Northern Portion of Project Area, Facing Northwest.

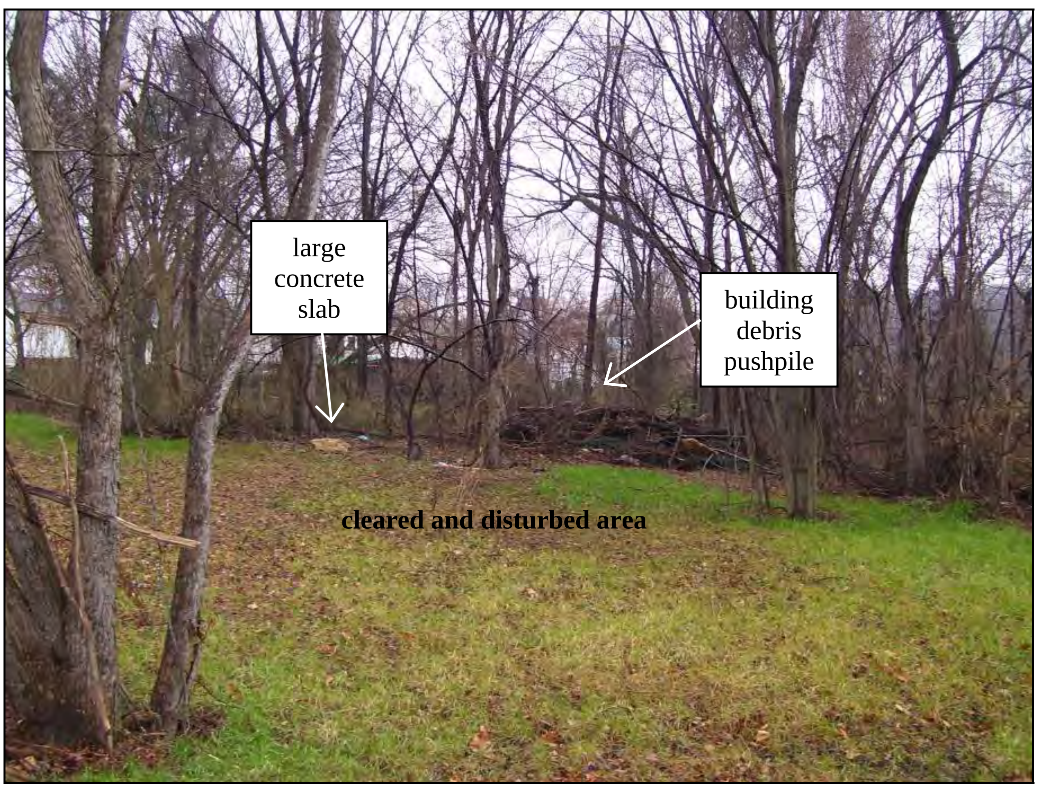

Photo 5: Cleared Area and Pushpile of Building Debris Within Wooded Area, Facing Northwest.

Photo 6: Disturbed Soil in Cleared Area of Woods.

South of the houses lies an apartment building, and south of that lies Pineview Road (35th Street NE). The disturbance for the construction of the apartment building covers the entire southern portion of the project area. The land has been landscaped for drainage, and utilities are found throughout this area (Photo 7; Photo 8, p. 26). Subsoil was observed on the surface throughout the area as well. Additionally, the eastern boundary was likely disturbed during the construction of Eastern Avenue NE and two parallel sidewalks.

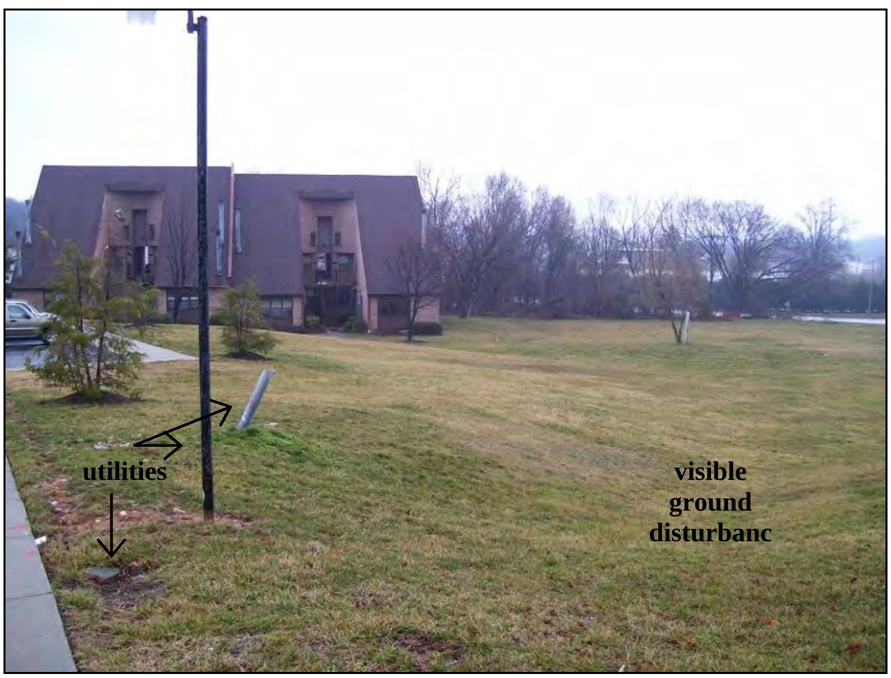

Photo 7: Overview of Southern Portion of Project Area Showing Disturbance, Facing West.

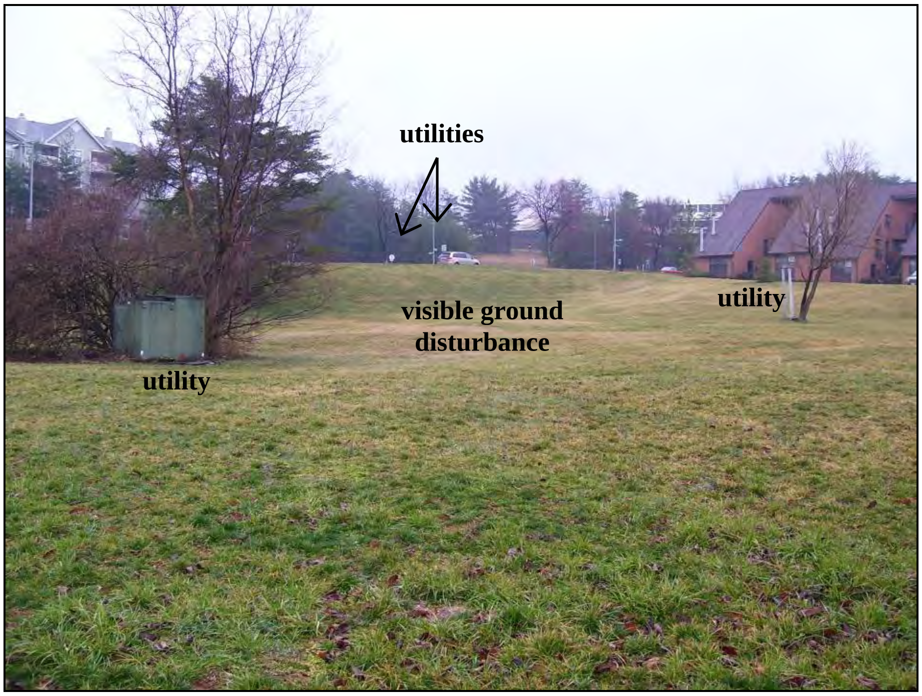

Photo 8: Overview of Southern Portion of Project Area Showing Disturbance and Utilities, Facing West.

Architectural Survey

Although a formal architectural survey was not completed during this project, Dovetail conducted an informal reconnaissance to identify the presence of architectural properties over 50 years in age within the project area and gather information on these resources to make preliminary recommendations on additional work. The field survey revealed that no architectural properties over 50 years in age are located to the west, north, or east of the project parcel. Construction in these areas is limited to modern commercial and residential development.

To the south of the project parcel is a narrow street lined with approximately twelve Bungalow-style homes (see Figure 9, p. 21). Two homes front Bladensburg Road while the remaining ten face 35th Street NE (see Photo 3, p. 23; Photo 9, p. 27). Based on the map review and the brief field inspection, this group of homes was built in the 1940s. All buildings were constructed as one and a half story Bungalows with one story front porches. Almost all of the homes have undergone modifications since originally constructed including structural additions, changes to the porch configuration, new siding, new windows, and new roofs. In addition to their poor to moderate historic integrity, the majority of the buildings currently have poor to moderate physical integrity, as several are missing sections of siding, have foundation issues, or exhibit other structural or cosmetic deficiencies.

Although the neighborhood has not received a formal architectural survey, it is recommended that these buildings are not eligible for the NRHP as they do not represent a notable historic event (Criterion A), they have no association with a notable individual (Criterion B), and they are not exceptional or unique examples of architecture (Criterion C). In addition, they have poor to moderate historic and physical integrity. Bungalows are ubiquitous in this area of Washington D.C., and many intact examples can be found in surrounding neighborhoods.

Photo 9: The Rear of the Bungalows as seen from the Current Project Area.

Recommendations on Future Work

Based on the field inspection, it appears that the project area comprises two distinct areas: the heavily disturbed southern two-thirds and the once parkland in the northern one third. The southern two-thirds of the project area has been thoroughly altered to accommodate drainage from, and utilities to, the apartment buildings. In addition, the construction of Eastern Avenue NE and two adjacent sidewalks have caused disturbance in the eastern portion of this area. The wooded central potion has been bulldozed and is currently a trash repository for local residents. It is recommended that the probability for intact soils in this area is very low.

The northern one-third of the project area is currently an open, grassy field. Based on the map review, no buildings have been recorded on this portion of the project area, and it has been undeveloped or a park for at least the past 100 years. Although there is no visible evidence of disturbance on the surface in this area, the entire section is lined with earthen push piles. In addition, several utility poles and concrete walkways and pads are visible on the surface, remnants of the park that once was located in this area. Due to the push piles along the perimeter of the area and the known use of this parcel as a park, it is believed that the probability for intact cultural deposits in this portion of the project area is low to moderate.

Due to large-spread disturbances of soils throughout the project area and the poor to moderate integrity of the adjacent Bungalows, it is recommended that no additional cultural resource work is warranted in this project area.

SUMMARY AND RECOMMENDATIONS

On behalf of Apex, Dovetail conducted a Phase 1A cultural resource evaluation of the City Homes property, located at the corner of Bladensburg Road NE and Eastern Avenue NE, Washington, D. C. in February 2008. The project area is located on the south side of Bladensburg Road NE, approximately 1.3 miles (2.1 km) southwest of the town of Bladensburg, Maryland. The survey included an examination of approximately 3.8 acres (1.5 hectares) through surface observation. The goals of the survey were to identify the potential for archaeological or architectural remains located on the property and make recommendations on the need for any subsurface investigations.

Documents found during a brief map review of the project area show that the project area is located approximately 0.5 miles (0.8 km) northwest of historic Fort Lincoln, an important defensive position during the Civil War. The project area was also once part of a large reform school, however no buildings stood on the current project area. More recently, the project area was part of a park.

During the field survey, it was found that the majority of the project area is open fields that have been landscaped or heavily altered during the recent construction of roads and housing. The central portion of the project area is moderately wooded with young hardwood growth and moderate amounts of undergrowth, but the ground showed evidence of recent disturbances. No historic artifacts or features were noted on the surface, and it is recommended that the entire parcel has no to very low potential to contain intact archaeological sites. Although a collection of 1940s Bungalows are located just south of the project area, the homes are all in poor to moderate condition. Moreover, they are a style of home that is ubiquitous in this area of the district. Therefore, it is recommended that no additional cultural resource investigations are warranted.

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TRANSPORTATION IMPACT STUDY

(Wells + Associates, Inc.)

CITY HOMES AT FORT LINCOLN
TRANSPORTATION IMPACT STUDY
WASHINGTON, D.C.

Prepared on behalf of:
The Concordia Group

Prepared by:
Wells + Associates, Inc.

March 2008

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Section I
INTRODUCTION

OVERVIEW

The Concordia Group has submitted a special exception application (BZA Application No. 17741) to construct a residential community consisting of 56 condominiums on a 2.517-acre tract of land. The site is bounded by Bladensburg Road to the north and west, Eastern Avenue to the north and east, Fort Lincoln Drive to the east, and Pineview Court to the south and west in northeast Washington, D.C. The site location map is shown on Figure I-1.

The proposed site currently is undeveloped and is split-zoned, with a portion subject to R-5A zoning and a portion subject to R-5D zoning. The proposed site plan for the development is shown on Figure I-2.

STUDY AREA

The study area was selected based on those intersections that potentially could be affected by the proposed development. The Bladensburg Road/ Eastern Avenue intersection was selected for detailed analysis.

STUDY OBJECTIVES AND METHODOLOGY

The purpose of this transportation impact study is to determine the impacts of the proposed development on the surrounding roadway network.

Accordingly, this report presents an analysis of existing transportation conditions and 2010 conditions without and with the proposed development.

Tasks undertaken in this study included the following:

1. Review of development plans prepared by VIKA.
2. Correspondence with DDOT staff regarding the traffic study scope (see Appendix A).
3. A field reconnaissance of existing roadway and intersection geometrics, traffic controls, and speed limits.
4. Turning movement counts at the study intersection during the AM and PM peak periods.
5. Analysis of existing and projected levels of service at the study intersection.
6. Estimation of the number of AM and PM peak hour trips that would be generated by the City Homes at Fort Lincoln development and the other planned developments in the Fort Lincoln area.
7. Identification of traffic operations and/or road improvements, if any, required to adequately accommodate future traffic forecasts with the proposed development.

The conclusions and recommendations of this study are as follows:

1. Currently, the northbound left turn movement at the Bladensburg Road/Eastern Avenue intersection operates at capacity during the AM peak hour, and the eastbound left turn movement operates at a failing level of service during the PM peak hour.

2. Under 2010 background conditions without the proposed residential development, the northbound left turn movement would continue to operate at capacity during the AM peak hour and the eastbound left turn movement would continue to fail during the PM peak hour. Additionally, the overall intersection would drop to a LOS "E" during the PM peak hour.

3. The proposed City Homes at Fort Lincoln residential development is anticipated to generate 29 AM peak hour vehicular trips and 33 PM peak hour vehicular trips.

4. According to the District of Columbia Municipal Regulations,[1] 37 on-site parking spaces would be required for the 56 residential units. A total of 121 on-site parking spaces, including garage spaces, driveway spaces, and visitor spaces, are proposed.

5. In 2010, less than one (1) percent of the total AM and PM peak hour traffic volumes at the Bladensburg Road/ Eastern Avenue intersection would be attributable to the City Homes at Fort Lincoln development.

6. In order to mitigate the impact of the proposed City Homes at Fort Lincoln development, traffic signal timings should be optimized at the Bladensburg Road/Eastern Avenue intersection during the AM peak hour.

7. The westbound Eastern Avenue approach of the Bladensburg Road/Eastern Avenue intersection could be restriped to include only one receiving lane and exclusive left-turn, through, and right-turn lanes to help alleviate the sight distance restrictions currently created by the offset opposing left turn lanes on Eastern Avenue. These improvements are not necessary to mitigate the impact of the proposed City Homes at Fort Lincoln development. This improvement, along with the optimized traffic signal timings, also would provide improved levels of service.

Section 2
EXISTING CONDITIONS

LAND USE

The subject site is part of the residential neighborhood originally planned in the 1960s as a federally funded urban renewal community. Known as the Fort Lincoln Urban Renewal Area, the surrounding community, including the subject site, is guided by the Fort Lincoln Urban Renewal Plan. The Plan calls for the development of the community as a mixed use area including townhouses, high-rise apartments, condominiums, recreational areas, retail areas, offices, preserved natural areas, and historic landmarks.

Currently, the subject site is undeveloped. The area surrounding the site is mainly residential. Apartments and townhouses are located south and east between Bladensburg Road and Fort Lincoln Drive. The Thurgood Marshall Elementary School and Theodore R. Hagans, Jr. Cultural Center are located to the east of the site, and the Fort Lincoln Cemetery is located to the north of the site.

ROADWAY NETWORK

Bladensburg Road is a six-lane divided minor arterial roadway with a posted speed limit of 25 miles per hour in the study area. Between South Dakota Avenue and Eastern Avenue, Bladensburg Road carries an average daily traffic volume of 28,500 vehicles per day.[2]

Fort Lincoln Drive is a four-lane, divided roadway that serves the Fort Lincoln area. This facility has a posted speed limit of 25 miles per hour. Sidewalks are located on both sides of Fort Lincoln Drive. Near the Bladensburg Road/Eastern Avenue intersection, Fort Lincoln Drive carries an average daily traffic volume of 11,100 vehicles per day.[3]

Eastern Avenue is a two-lane, undivided roadway that connects Bladensburg Road to Rhode Island Avenue.

The existing lane use and traffic control for the study intersection is shown on Figure 2-1.

PUBLIC TRANSPORTATION FACILITIES AND SERVICES

The Bladensburg Road – Anacostia Line (Metrobus Route B2) and the Fort Lincoln Shuttle Line (Metrobus Routes B8 and B9) currently provide bus service in the study area. Route B2 provides service to the Anacostia, Potomac Avenue, and Stadium-Armory Metro Stations. Routes B8 and B9 provide service to the Rhode Island Metro Station. Bus stops are located on Fort Lincoln Drive at its intersection with Commodore Joshua Barney Drive/Pineview Court. Bus stops also are located on Bladensburg Road south of the study area.

Metrobus service is shown on Figure 2-2.

PEDESTRIAN ROUTES

Sidewalks are present along both sides of Fort Lincoln Drive from 31st Place to Commodore Joshua Barney Drive, along the west and south side of Fort Lincoln Drive/Eastern Avenue from Commodore Joshua Barney Drive to Bladensburg Road, along both sides of Eastern Avenue west of Bladensburg Road, and along both sides of Bladensburg Road. Sidewalks adjacent to the proposed internal streets would be provided to serve the local community.

The Bladensburg Road/Eastern Avenue intersection includes painted crosswalks and pedestrian signals that promote safe pedestrian crossing maneuvers. The crosswalks at this intersection are handicap accessible.

TRAFFIC VOLUMES

Turning movement counts were conducted at the Bladensburg Road/Eastern Avenue intersection on Thursday, February 8, 2007 from 6:00 AM to 9:00 AM and from 4:00 PM to 7:00 PM.

The AM peak hour occurred from 7:45 AM to 8:45 AM and the PM peak hour occurred from 4:30 PM to 5:30 PM.

These peak hour traffic volumes were factored by a one (1) percent annual growth rate to obtain 2008 baseline peak hour traffic volumes. Baseline peak hour traffic volumes are summarized on Figure 2-3. Traffic count data are included in Appendix B.

OPERATIONAL ANALYSIS

Capacity/level of service (LOS) analyses were conducted at the study intersection based on the existing lane use and traffic control shown on Figure 2-1, baseline vehicular traffic volumes shown on Figure 2-3, and existing DDOT traffic signal timings provided in Appendix C.

Synchro software (Version 6, Build 614) was used to evaluate levels of service at the study intersection during the AM and PM peak hours.

Synchro is a macroscopic model used to evaluate the effects of changing intersection geometrics, traffic demands, traffic control, and/or traffic signal settings and to optimize traffic signal timings. The levels of service reported for the signalized intersections were taken from the Highway Capacity Manual 2000[4] (HCM) reports generated by Synchro.

The Synchro results are presented in Appendix D and summarized in Table 2-1. Level of service descriptions are provided in Appendix E.

As shown in Table 2-1, the northbound left turn movement currently operates at capacity during the AM peak hour and the eastbound left turn movement currently fails during the PM peak hour under existing conditions.

Table 2-1
Existing Levels of Service

Approach	AM Peak	PM Peak
Bladensburg Road/Eastern Avenue		
EBL	C (33.2)	F (165.7)
EBTR	C (28.8)	C (29.4)
WBL	C (25.1)	C (20.4)
WBTR	C (25.0)	C (24.8)
NBL	E (58.8)	C (21.1)
NBTR	D (39.1)	C (33.7)
SBL	B (13.0)	B (13.7)
SBTR	D (42.8)	C (23.8)
OVERALL	**D (37.3)**	**D (47.4)**

(23.3) = signalized intersection control delay in sec/veh
Note: For purposes of the analyses, Eastern Avenue was assumed as an east-west roadway and Bladensburg Road was assumed as a north-south roadway.

CRASH DATA ANALYSIS

Crash data from January 1, 2000 through December 31, 2006 were obtained from DDOT for the study intersection and have been included in Appendix F. The data included crashes occurring within 150 feet of the intersection. The number of crashes is shown in Table 2-2.

Table 2-2
Crash Data Summary

Crash Type	Number of Crashes
Right Angle	6
Left Turn	14
Right Turn	0
Rear End	11
Sideswipe	7
Head On	1
Parked	0
Fixed Object	1
Ran Off Road	0
Pedestrian	0
Backing	1
Non-Collision	0
Other	0
Total:	**43**

As shown in Table 2-2, approximately one fourth of the crashes were rear end crashes, and approximately one half of the crashes were angle collisions. This may be attributable to the fact that the opposing left turn lanes on Eastern Avenue are misaligned, thereby restricting the sight distance for drivers waiting to turn left onto Bladensburg Road looking for oncoming vehicles from the opposing approach.

Section 3
FUTURE BACKGROUND CONDITIONS

LAND USE

The Fort Lincoln Urban Renewal Area is planned as a mixed-use community including a variety of residential uses, recreational areas, retail uses, and office uses. In addition to the City Homes at Fort Lincoln, the Village at Washington Gateway residential development, the Washington Gateway commercial development, and the Wesley House active-adult residential development are other planned projects in the area. Additionally, Dakota Crossing, a 209-unit residential development, currently is under construction and partially occupied.

The Village at Washington Gateway is a residential development consisting of 183 townhouses and 174 condominiums and is bounded by Fort Lincoln Drive to the west, 33rd Place to the south, Commodore Joshua Barney Drive to the north, and an unnamed road to the east. A Planned Unit Development (PUD) for the site was approved in April 2007.

Washington Gateway is a 500,000-square foot shopping center proposed in the northwest quadrant of the New York Avenue/South Dakota Avenue interchange.

Dakota Crossing is a residential community consisting of 209 townhouses currently under construction on the tract of land bounded by South Dakota Avenue, 31st Place, 33rd Place, and Fort Lincoln Drive. At the time the counts were conducted, 42 of the 209 units proposed for the Dakota Crossing project were occupied. Therefore, traffic associated with the remaining 167 residential units was included in the background traffic forecasts.

The Wesley House is an active-adult residential community consisting of 127 apartments proposed on a tract of land north of Commodore Joshua Barney Drive and located northwest of the Village at Washington Gateway.

TRAFFIC VOLUMES

In order to develop 2010 traffic forecasts without the proposed development, traffic associated with other area developments was considered as well as a general regional traffic growth.

Regional Growth

In order to account for regional traffic growth outside the immediate site vicinity, a one (1) percent growth rate, compounded annually over two years, was applied to the baseline traffic volumes. The resulting 2010 volumes are shown on Figure 3-1.

Pipeline Developments

Traffic volumes from four (4) planned developments were included in the future traffic forecasts. The number of trips that would be generated by Dakota Crossing and the Village at Washington Gateway were taken from their respective traffic impact studies.[5,6] Because 42 of the 209 Dakota Crossing townhouses were occupied at the time the counts were conducted, the number of trips generated by the development was adjusted accordingly. The number of trips that would be generated by the Wesley House was taken from the Village at Washington Gateway Transportation Impact Study.[7] The number of trips that would be generated by the Washington Gateway retail development was estimated based on the Institute of Transportation Engineers' (ITE) Trip Generation.[8]

The trip generation for the pipeline developments is summarized in Table 3-1. As shown, a portion of the trips generated by each of the residential developments would occur internally within the Fort Lincoln neighborhood. The proximity of the residential developments to the retail development would create a naturally occurring synergy. These trips were assumed to be made by foot.

Additionally, a portion of the residential trips would be made by public transportation, as shown in Table 3-1. The non-auto mode split was based on the availability of public transportation in the Fort Lincoln area (as described in the traffic impact study for each development).

The Washington Gateway retail development is projected to generate 588 AM peak hour trips, 2,555 PM peak hour trips, and 26,375 daily trips, based on standard ITE rates/equations, as shown in Table 3-1.

A portion of these site-generated trips would be captured internally between the retail uses. By its nature and character of uses, the proposed development would experience a naturally occurring synergy. For example, a portion of the shopping center trips may utilize the proposed discount club use. As a result of this naturally occurring synergy, the volume of external trips generated by the site would be reduced. For purposes of this analysis, the internal capture rates outlined in the ITE Trip Generation Handbook[10] were used during the PM peak hour. Based on ITE, 786 PM peak hour trips are projected to occur internally among the retail uses.

As with each residential development, a portion of the trips generated by the retail component would occur within the Fort Lincoln neighborhood. According to ITE, 107 PM peak hour trips are projected to occur between the retail and the residential developments. These trips were assumed to be made by foot.

Appendix G provides the calculations used to determine the number of captured trips used in the analysis.

The resulting traffic assignments associated with the build-out of the pipeline developments are shown on Figure 3-2. The location and individual assignments associated with the pipelines are provided in Appendix H.

The factored traffic volumes shown on Figure 3-1 were combined with the pipeline development traffic assignments shown on Figure 3-2 to yield the 2010 future background traffic forecasts shown on Figure 3-3.

Table 3-1
Pipeline Trip Generation Summary[1]

	AM Peak Hour			PM Peak Hour			Average Daily Traffic
	In	Out	Total	In	Out	Total	
The Village at Washington Gateway LUC 230, Residential Condominium/Townhouse (357 Dwelling Units)							
Total Trips	24	119	143	115	56	171	1,893
Internal Capture (Retail to Residential)	-	-	-	*36*	*30*	*66*	*672*
External Trips	24	119	143	79	26	105	1,221
Modal Split (7%)[2]	*2*	*8*	*10*	*6*	*2*	*7*	*85*
External Vehicle Trips	**22**	**111**	**133**	**73**	**24**	**98**	**1,136**
Dakota Crossing LUC 230, Residential Condominium/Townhouse (167 Dwelling Units)							
Total Trips	13	65	78	62	30	92	993
Internal Capture (Retail to Residential)	-	-	-	*19*	*16*	*35*	*352*
External Trips	13	65	78	43	14	57	641
Modal Split (12%)[2]	*2*	*8*	*9*	*5*	*2*	*7*	*77*
External Vehicle Trips	**11**	**57**	**69**	**38**	**12**	**50**	**564**
Wesley House LUC 252, Senior Adult Housing – Attached (127 Dwelling Units)							
Total Trips	5	5	10	9	5	14	442
Internal Capture (Retail to Residential)	-	-	-	*3*	*2*	*6*	*157*
External Trips	5	5	10	6	2	8	285
Modal Split	-	-	-	-	-	-	-
External Vehicle Trips	**5**	**5**	**10**	**6**	**2**	**8**	**285**
Washington Gateway Retail LUC 820, Shopping Center (281,000 SF)							
Total Trips	178	113	291	594	644	1,238	13,292
Internal Capture (Retail to Retail)	-	-	-	*130*	*133*	*263*	*3,793*
Internal Capture (Retail to Residential)	-	-	-	*26*	*33*	*59*	*742*
External Trips	178	113	291	438	478	916	8,757
Modal Split (5% AM; 10% PM)	*9*	*6*	*15*	*44*	*48*	*92*	-
External Vehicle Trips	169	107	276	394	430	824	8,757
Pass-by Trips (27%)[3]	-	-	-	*106*	*116*	*222*	-
Net New Trips	**169**	**107**	**276**	**287**	**314**	**601**	**8,757**

Notes:
[1] Trips generated using Institute of Transportation Engineers (ITE) Trip Generation, Seventh Edition.
[2] Modal split taken from the respective traffic impact study.
[3] Pass-by percentage based on standard ITE rates and equations.

Table 3-1 (continued)
Pipeline Trip Generation Summary[1]

	AM Peak Hour			PM Peak Hour			Average Daily Traffic
	In	Out	Total	In	Out	Total	
Washington Gateway Retail LUC 861, Discount Club (154,000 SF)							
Total Trips	61	25	86	327	326	653	6,437
Internal Capture (Retail to Retail)	-	-	-	*130*	*130*	*260*	*3,697*
Internal Capture (Retail to Residential)	-	-	-	*11*	*13*	*24*	*214*
External Trips	61	25	86	186	183	369	2,526
Modal Split	-	-	-	-	-	-	-
External Vehicle Trips	61	25	86	186	183	369	2,526
Pass-by Trips (27%)[3]	-	-	-	*50*	*50*	*100*	-
Net New Trips	**61**	**25**	**86**	**136**	**134**	**270**	**2,526**
Washington Gateway Retail LUC 850, Grocery Store (65,000 SF)							
Total Trips	129	82	211	339	325	664	6,646
Internal Capture (Retail to Retail)	-	-	-	*133*	*130*	*263*	*3,758*
Internal Capture (Retail to Residential)	-	-	-	*12*	*13*	*24*	*225*
External Trips	129	82	211	194	182	377	2,663
Modal Split (5% AM; 10% PM)	*6*	*4*	*11*	*19*	*18*	*38*	-
External Vehicle Trips	123	78	200	175	164	339	2,663
Pass-by Trips (27%)[3]	-	-	-	*47*	*44*	*92*	-
Net New Trips	**123**	**78**	**200**	**128**	**120**	**248**	**2,663**
Washington Gateway Retail Total							
Total Trips	368	220	588	1,260	1,295	2,555	26,375
Internal Capture (Retail to Retail)	-	-	-	*393*	*393*	*786*	*11,248*
Internal Capture (Retail to Residential)	-	-	-	*49*	*58*	*107*	*1,181*
External Trips	368	220	588	818	844	1,662	13,946
Modal Split	*15*	*10*	*26*	*63*	*66*	*130*	-
External Vehicle Trips	353	210	562	755	778	1,532	13,946
Pass-by Trips (27%)[3]	-	-	-	*204*	*210*	*414*	-
Net New Trips	**353**	**210**	**562**	**551**	**568**	**1,119**	**13,946**
Total Pipeline Trips							
Net New External Vehicle Trips	**391**	**383**	**774**	**668**	**606**	**1,274**	**15,931**

Notes:
[1] Trips generated using Institute of Transportation Engineers (ITE) Trip Generation, Seventh Edition.
[2] Modal split taken from the respective traffic impact study.
[3] Pass-by percentage based on standard ITE rates and equations.

OPERATIONAL ANALYSIS

Capacity/level of service (LOS) analyses were conducted at the study intersection based on the existing lane use and traffic control shown on Figure 2-1, future background traffic forecasts shown on Figure 3-3, and existing traffic signal timings (shown in Appendix C).

Synchro software (Version 6, Build 614) was used to evaluate levels of service at the study intersection during the AM and PM peak hours. The levels of service were taken from the Highway Capacity Manual 2000[11] (HCM) reports generated by Synchro.

The Synchro results are presented in Appendix I and summarized in Table 3-2.

Table 3-2
2010 Background Levels of Service

Approach	AM Peak	PM Peak
Bladensburg Road/Eastern Avenue		
EBL	D (52.0)	F (323.1)
EBTR	C (30.4)	C (33.1)
WBL	C (26.8)	C (21.1)
WBTR	C (28.0)	C (27.4)
NBL	E (60.2)	C (21.5)
NBTR	D (39.2)	C (33.9)
SBL	B (13.3)	B (14.9)
SBTR	D (46.2)	C (24.0)
OVERALL	**D (40.2)**	**E (68.0)**

(23.3) = signalized intersection control delay in sec/veh
Note: For purposes of the analyses, Eastern Avenue was assumed as an east-west roadway and Bladensburg Road was assumed as a north-south roadway.

As shown in Table 3-2, the northbound left turn movement would continue to operate at capacity during the AM peak hour and the eastbound left turn movement would continue to fail during the PM peak hour under 2010 conditions without the proposed residential development. Additionally, the overall intersection would drop to a LOS "E" during the PM peak hour.

QUEUE ANALYSIS

Using the Synchro queuing reports, a queue analysis was performed for the Bladensburg Road/Eastern Avenue intersection under background conditions. The 95th percentile queues from Synchro have been tabulated in Table 3-3. Queuing reports are included in Appendix J.

Table 3-3
Background Queue Analysis

Approach	Available Storage	Queue Length (ft.)	
		AM Peak	PM Peak
Bladensburg Road/Eastern Avenue			
EBL	625	219	525
EBTR	>1,000	307	350
WBL	>1,000	77	24
WBTR	>1,000	292	269
NBL	130	85	153
NBTR	>1,000	107	276
SBL	125	43	54
SBTR	>1,000	603	148

As shown in Table 3-3, none of the queues during background conditions spill back beyond the available storage.

Section 4
SITE ANALYSIS

TRIP GENERATION ANALYSIS

The number of trips anticipated to be generated by the proposed residential development (56 condominiums) was estimated based on ITE's Trip Generation.[12] Land Use Code 230, Residential Condominium/Townhouse, was used with the number of units as the independent variable.

As shown in Table 4-1, the City Homes at Fort Lincoln residential development is projected to generate an estimated 32 total AM peak hour trips and 37 total PM peak hour trips.

Existing bus service in the study area, with bus stops proximate to the proposed development, provides access to the nearby Anacostia, Potomac Avenue, and Stadium-Armory Metro Stations. Therefore, a portion of the generated trips would be made via public transit. An estimated 10 percent of the trips generated by the proposed development would be non-auto trips.

Accordingly, non-auto trips are projected to account for three AM peak hour trips and four PM peak hour trips, as shown in Table 4-1.

Taking into account the non-auto mode share, the City Homes at Fort Lincoln residential development would generate an estimated 29 AM peak hour vehicular trips and 33 PM peak hour vehicular trips, as shown on Table 4-1.

SITE TRIP DISTRIBUTION

The distribution of peak hour trips generated by the proposed development was based on existing traffic patterns in the study area and the premise that commuters will select routes that minimize travel time.

An estimated 45 percent of the site-generated traffic would approach/depart the site to/from the southwest via Bladensburg Road, while approximately 10 percent would approach/depart the site to/from the southeast via Fort Lincoln Drive. Approximately 30 percent of site-generated traffic would approach/depart the site to/from the northwest via Eastern Avenue, while an estimated 15 percent would approach/depart the site to/from the northeast on Bladensburg Road.

SITE TRAFFIC ASSIGNMENTS

The site-generated traffic volumes were assigned to the public roadway network according to the directional distribution described above. The resulting site traffic assignments are shown on Figure 4-1.

Table 4-1
Site Trip Generation

Land Use/Trip Type	AM Peak Hour			PM Peak Hour			Weekday ADT
	IN	OUT	TOTAL	IN	OUT	TOTAL	
RESIDENTIAL CONDOMINIUM/TOWNHOUSE – 62 DWELLING UNITS							
Vehicle Trips	5	27	32	25	12	37	392
Non-Auto Mode Split (10%)	*1*	*3*	*3*	*3*	*1*	*4*	*39*
External Vehicle Trips	4	24	29	22	11	33	353

PROPOSED SITE ACCESS

Vehicular access to the site would be provided via two full access driveways: one on Eastern Avenue and one on Pineview Court. Direct access to each condominium would be provided to/from the internal roadway network; none of the condominiums would directly access Eastern Avenue or Pineview Court.

Pedestrian access and circulation would be facilitated by sidewalks along the fronts of the dwelling units and along the visitor parking areas. These site sidewalks would connect to the public sidewalks located along the property's perimeter with Fort Lincoln Drive, Eastern Avenue, and Bladensburg Road.

PARKING REQUIREMENTS

According to the District of Columbia Municipal Regulations (DCMR),[13] one (1) parking space for each dwelling unit is required in the R-5-A zoning district, and one (1) parking space for each three (3) dwelling units is required in the R-5-D zoning district. A total of 37 parking spaces is required for the City Homes at Fort Lincoln development. The proposed development would provide a total of 121 parking spaces including 56 garage spaces, 56 driveway spaces, and 9 visitor spaces.

Section 5
TOTAL FUTURE CONDITIONS

TRAFFIC VOLUMES

The future background peak hour traffic forecasts shown on Figure 3-3 were combined with the site trip assignments shown on Figure 4-1 to yield the 2010 total future traffic forecasts shown on Figure 5-1.

Traffic generated by the proposed development would account for less than one (1) percent of all 2010 AM and PM peak hour traffic at the Bladensburg Road/Eastern Avenue intersection.

OPERATIONAL ANALYSIS

Capacity/level of service (LOS) analyses were conducted at the study intersection based on the existing lane use and traffic control shown on Figure 2-1, total future traffic forecasts shown on Figure 5-1, and existing traffic signal timings (shown in Appendix C).

Synchro software (Version 6, Build 614) was used to evaluate levels of service at the study intersection during the AM and PM peak hours. The levels of service were taken from the Highway Capacity Manual 2000[14] (HCM) reports generated by Synchro.

The Synchro results are presented in Appendix K and summarized in Table 5-1

As shown in Table 5-1, under 2010 conditions with the proposed residential development, the northbound left turn movement would continue to operate at a LOS "E" during the AM peak hour, the eastbound left turn movement would continue to operate at a LOS "F" during the PM peak hour, and the overall intersection would continue to operate at a LOS "E" during the PM peak hour. Additionally, the eastbound left turn movement would drop to LOS "E" during the AM peak hour. The average vehicular delay for this movement would increase by just 5.3 seconds per vehicle.

Table 5-1
Total Future Levels of Service

Approach	AM Peak	PM Peak
Bladensburg Road/Eastern Avenue		
EBL	E (57.3)	F (332.4)
EBTR	C (30.5)	C (33.5)
WBL	C (28.7)	C (21.8)
WBTR	C (28.5)	C (27.5)
NBL	E (60.2)	C (21.5)
NBTR	D (39.3)	C (34.1)
SBL	B (13.3)	B (15.1)
SBTR	D (46.2)	C (24.0)
OVERALL	**D (40.5)**	**E (68.9)**

(23.3) = signalized intersection control delay in sec/veh
Note: For purposes of the analyses, Eastern Avenue was assumed as an east-west roadway and Bladensburg Road was assumed as a north-south roadway.

With the development of the proposed project, the Bladensburg Road/Eastern Avenue intersection would be impacted slightly during the AM peak hour under the existing traffic signal timings. However, traffic signal timings at the intersection could be optimized to accommodate the future traffic volumes and mitigate the impact of the proposed development during the AM peak hour.

The resulting levels of service with the proposed signal timing adjustments are summarized in Table 5-2. Synchro worksheets and a summary of the recommended timing adjustments are included in Appendix L.

Table 5-2
Total Future Levels of Service with Signal Timing Adjustments

Approach	AM Peak	PM Peak
Bladensburg Road/Eastern Avenue		
EBL	D (50.0)	F (332.4)
EBTR	C (29.3)	C (33.5)
WBL	C (27.1)	C (21.8)
WBTR	C (27.4)	C (27.5)
NBL	E (61.6)	C (21.5)
NBTR	D (44.5)	C (34.1)
SBL	B (13.9)	B (15.1)
SBTR	D (52.3)	C (24.0)
OVERALL	**D (43.2)**	**E (68.9)**

(23.3) = signalized intersection control delay in sec/veh
Note: For purposes of the analyses, Eastern Avenue was assumed as an east-west roadway and Bladensburg Road was assumed as a north-south roadway.

At the request of DDOT, an analysis also was conducted to examine overall improvements at the intersection to improve both operations and safety.

Currently, opposing left turn lanes on Eastern Avenue are misaligned, thereby restricting the sight distance for drivers waiting to turn left onto Bladensburg Road looking for oncoming vehicles from the opposing approach.

In order to alleviate this situation, the westbound Eastern Avenue approach of the intersection was modeled assuming conversion of one of the eastbound receiving lanes (there currently are two receiving lanes) to an exclusive left-turn lane. The existing left turn lane would be converted to a through lane, and the existing shared/through lane would be converted to an exclusive right turn lane.

The future lane use is shown on Figure 5-2. This modification would allow the opposing left turn lanes to align, thereby improving sight distance for eastbound and westbound left-turning vehicles on Eastern Avenue.

Capacity/level of service (LOS) analyses were conducted at the study intersection based on the lane use and traffic control shown on Figure 5-2, total future traffic forecasts shown on Figure 5-1, and optimized traffic signal timings (shown in Appendix C).

The Synchro results are presented in Appendix M and summarized in Table 5-3.

Table 5-3
Total Future Levels of Service with Recommended Future Lane Use and Traffic Control

Approach	AM Peak	PM Peak
Bladensburg Road/Eastern Avenue		
EBL	D (51.5)	D (53.6)
EBTR	D (36.7)	C (24.5)
WBL	D (38.9)	B (16.5)
WBT	C (29.5)	B (18.6)
WBR	C (22.4)	B (15.9)
NBL	D (53.5)	C (25.0)
NBTR	C (20.5)	D (37.9)
SBL	B (11.3)	B (19.8)
SBTR	C (32.7)	C (30.1)
OVERALL	**C (32.9)**	**C (31.6)**

(23.3) = signalized intersection control delay in sec/veh
Note: For purposes of the analyses, Eastern Avenue was assumed as an east-west roadway and Bladensburg Road was assumed as a north-south roadway.

As shown in Table 5-3, under 2010 conditions with the proposed residential development and the modified westbound approach, all lane groups would operate at acceptable LOS "D" or better during both peak the AM and PM peak hours with optimized signal timings.

Queue Analysis

Using the Synchro queuing reports, queue analyses were performed for the Bladensburg Road/Eastern Avenue intersection under total future conditions with the above-discussed improvements. The 95th percentile queues from Synchro have been tabulated in Table 5-4. Queuing reports are included in Appendix J.

As shown in Table 5-4, the proposed development would have little or no measurable impact on the queues at the intersection during both the AM and PM peak hours.

Table 5-4
Total Future Queue Analyses

Approach	Available Storage	Queue Length (ft.)			
		2010 Total Future Conditions with Signal Timing Adjustments		2010 Total Future Conditions with Recommended Lane Use and Traffic Control	
		AM Peak	PM Peak	AM Peak	PM Peak
Bladensburg Road/Eastern Avenue					
EBL	625	217	526	214	407
EBTR	>1,000	303	358	333	310
WBL	>1,000/350	87	29	103	25
WBT	>1,000	296	273	253	164
WBR				32	31
NBL	130	86	153	80	159
NBTR	>1,000	115	280	78	290
SBL	125	44	56	39	66
SBTR	>1,000	615	148	515	173

Section 6
CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of this study are as follows:

1. Currently, the northbound left turn movement at the Bladensburg Road/Eastern Avenue intersection operates at capacity during the AM peak hour, and the eastbound left turn movement operates at a failing level of service during the PM peak hour.

2. Under 2010 background conditions without the proposed residential development, the northbound left turn movement would continue to operate at capacity during the AM peak hour and the eastbound left turn movement would continue to fail during the PM peak hour. Additionally, the overall intersection would drop to a LOS "E" during the PM peak hour.

3. The proposed City Homes at Fort Lincoln residential development is anticipated to generate 29 AM peak hour vehicular trips and 33 PM peak hour vehicular trips.

4. According to the District of Columbia Municipal Regulations,[15] 37 on-site parking spaces would be required for the 56 residential units. A total of 121 on-site parking spaces, including garage spaces, driveway spaces, and visitor spaces, are proposed.

5. In 2010, less than one (1) percent of the total AM and PM peak hour traffic volumes at the Bladensburg Road/ Eastern Avenue intersection would be attributable to the City Homes at Fort Lincoln development.

6. In order to mitigate the impact of the proposed City Homes at Fort Lincoln development, traffic signal timings should be optimized at the Bladensburg Road/Eastern Avenue intersection during the AM peak hour.

7. The westbound Eastern Avenue approach of the Bladensburg Road/Eastern Avenue intersection could be restriped to include only one receiving lane and exclusive left-turn, through, and right-turn lanes to help alleviate the sight distance restrictions currently created by the offset opposing left turn lanes on Eastern Avenue. These improvements are not necessary to mitigate the impact of the proposed City Homes at Fort Lincoln development. This improvement, along with the optimized traffic signal timings, also would provide improved levels of service.

REFERENCES

[1] District of Columbia Municipal Regulations, Title 11-Zoning, Section 2101.1, 2001 Edition.

[2] 2002 Traffic Volumes, District Department of Transportation, Traffic Services Administration, Washington, D.C., [http://ddot.dc.gov/ddot/frames.asp?doc=/ddot/lib/ddot/information/maps/2002_citywide.pdf].

[3] Ibid.

[4] Highway Capacity Manual, Transportation Research Board, Washington D.C., 2000.

[5] Fort Lincoln New Town Townhomes Traffic Impact Study, Wells & Associates, LLC, July 2004.

[6] The Village at Washington Gateway Transportation Impact Study, Wells & Associates, LLC, August 2006.

[7] Ibid.

[8] Trip Generation, 7th Edition, Institute of Transportation Engineers, Washington, D.C., 2003.

[10] Trip Generation Handbook, Institute of Transportation Engineers, Washington, D.C., March 2001.

[11] Highway Capacity Manual, Transportation Research Board, Washington D.C., 2000.

[12] Trip Generation, 7th Edition, Institute of Transportation Engineers, Washington, D.C., 2003.

[13] District of Columbia Municipal Regulations, Title 11-Zoning, Section 2101.1, 2001 Edition.

[14] Highway Capacity Manual, Transportation Research Board, Washington D.C., 2000.

[15] District of Columbia Municipal Regulations, Title 11-Zoning, Section 2101.1, 2001 Edition.

FIGURES

WELLS + ASSOCIATES

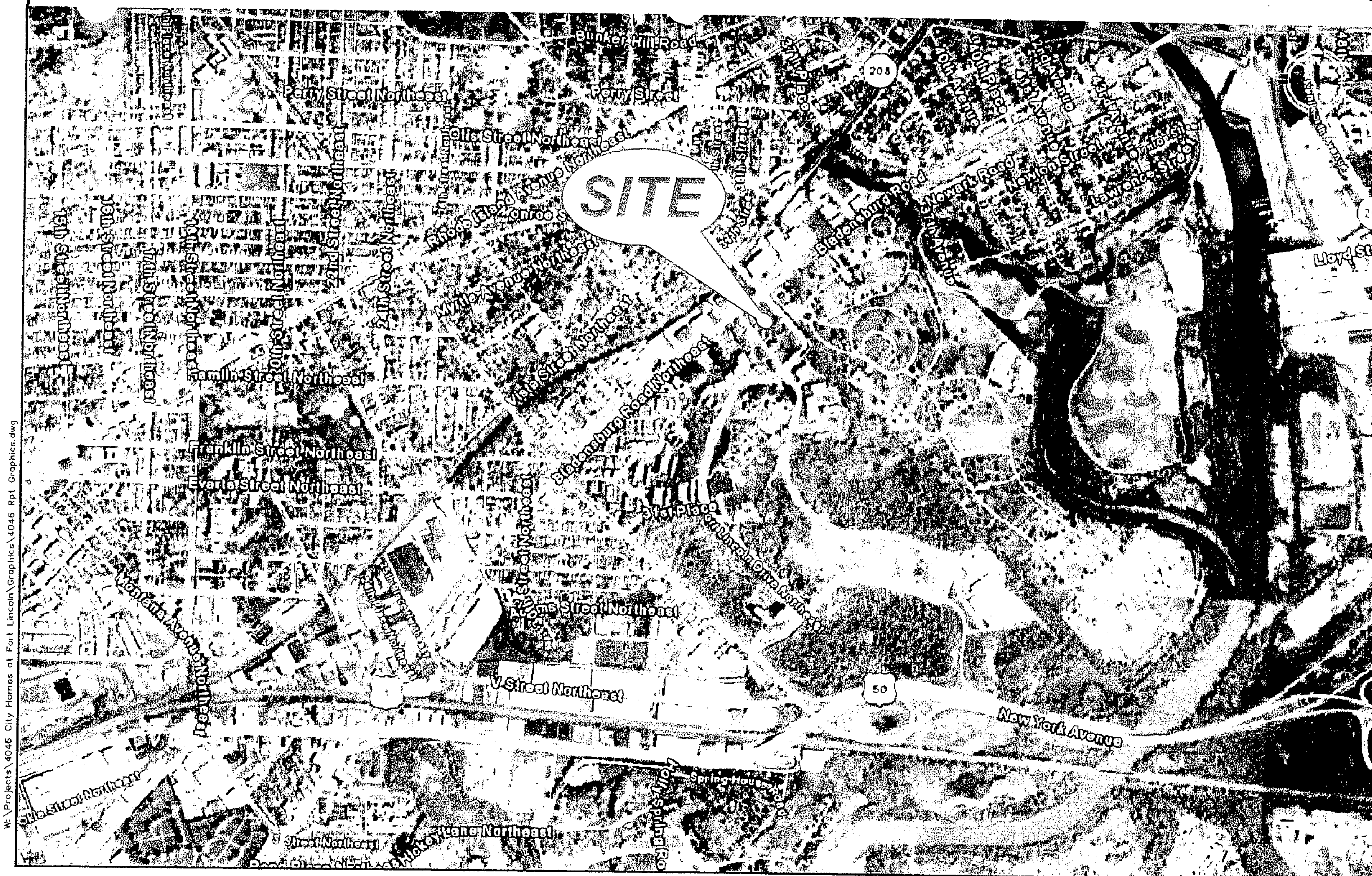


Figure 1—1
Site Location Map

North

City Homes at Fort Lincoln
Washington, D.C.

Wells + Associates, Inc.

W:\Projects\4046 City Homes at Fort Lincoln\Graphics\4046 Rpt Graphics.dwg

W:\Projects\4046 City Homes at Fort Lincoln\Graphics\4046 Rpt Graphics.dwg

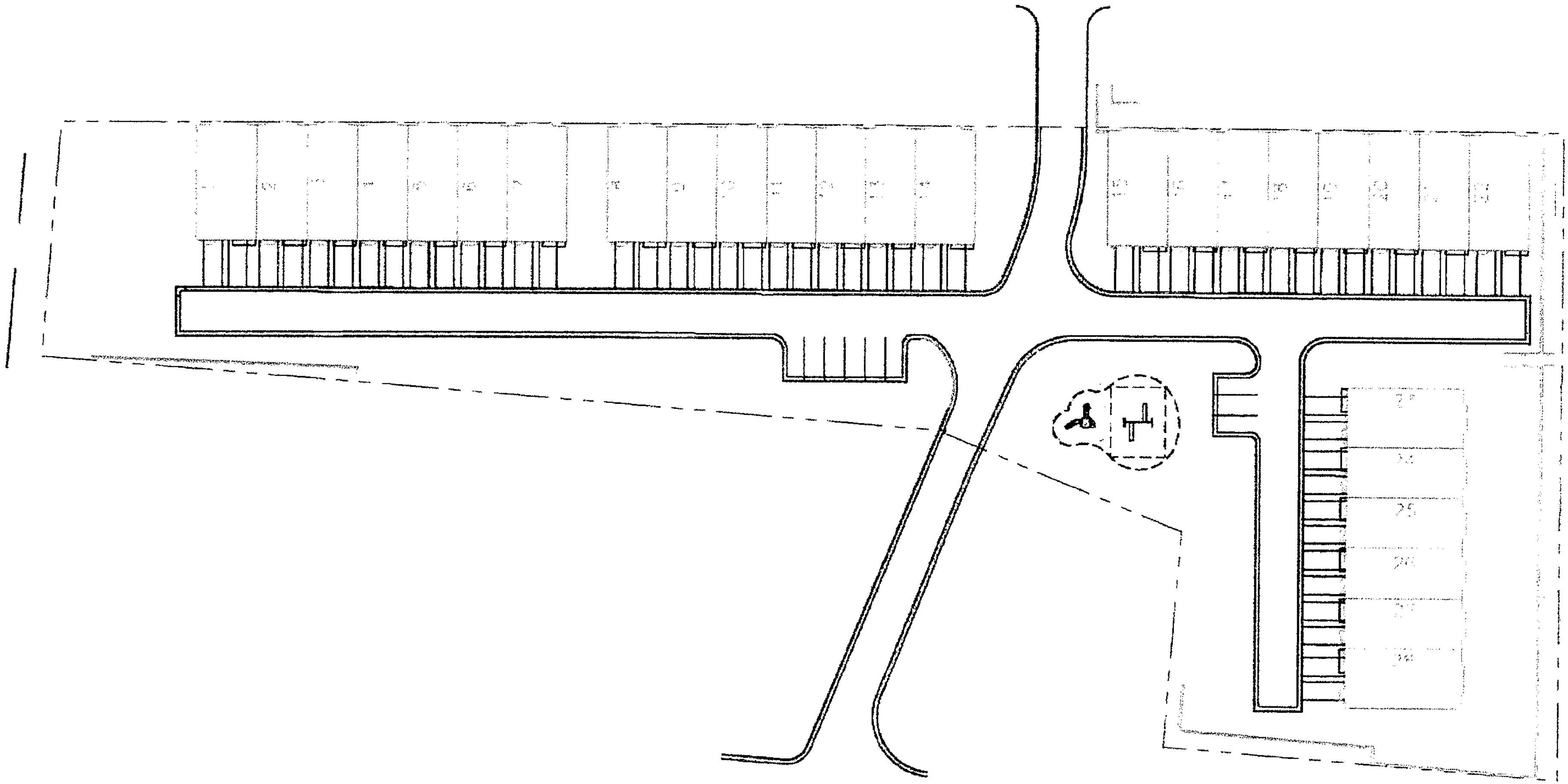


Figure 1—2
Site Plan Reduction

City Homes at Fort Lincoln
Wash n, D.C.

Wells ociates, Inc.

Figure 2–1
Existing Lane Use and Traffic Control

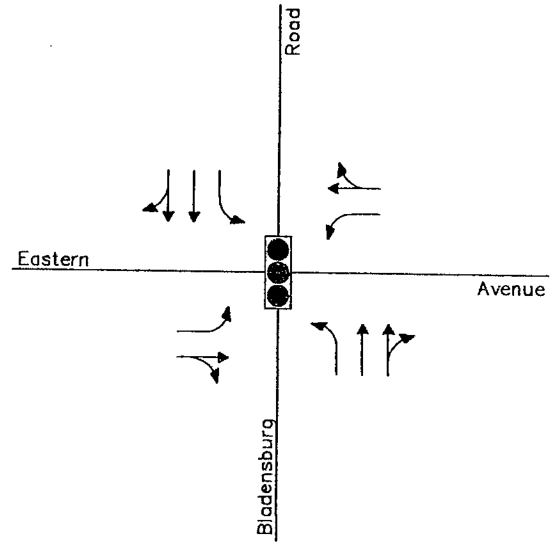
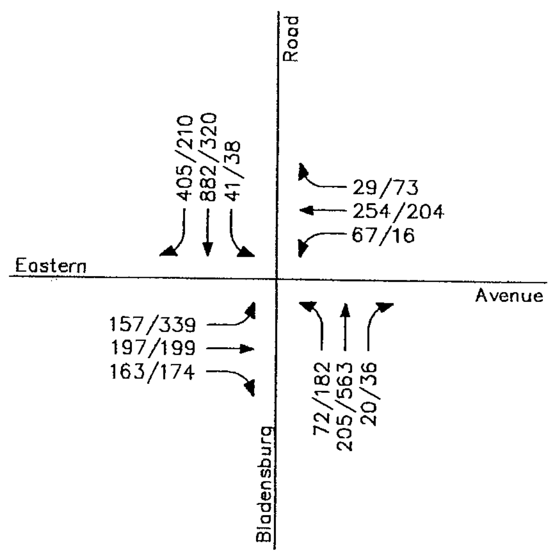


Figure 2–3
2008 Baseline Peak Hour Traffic Volumes

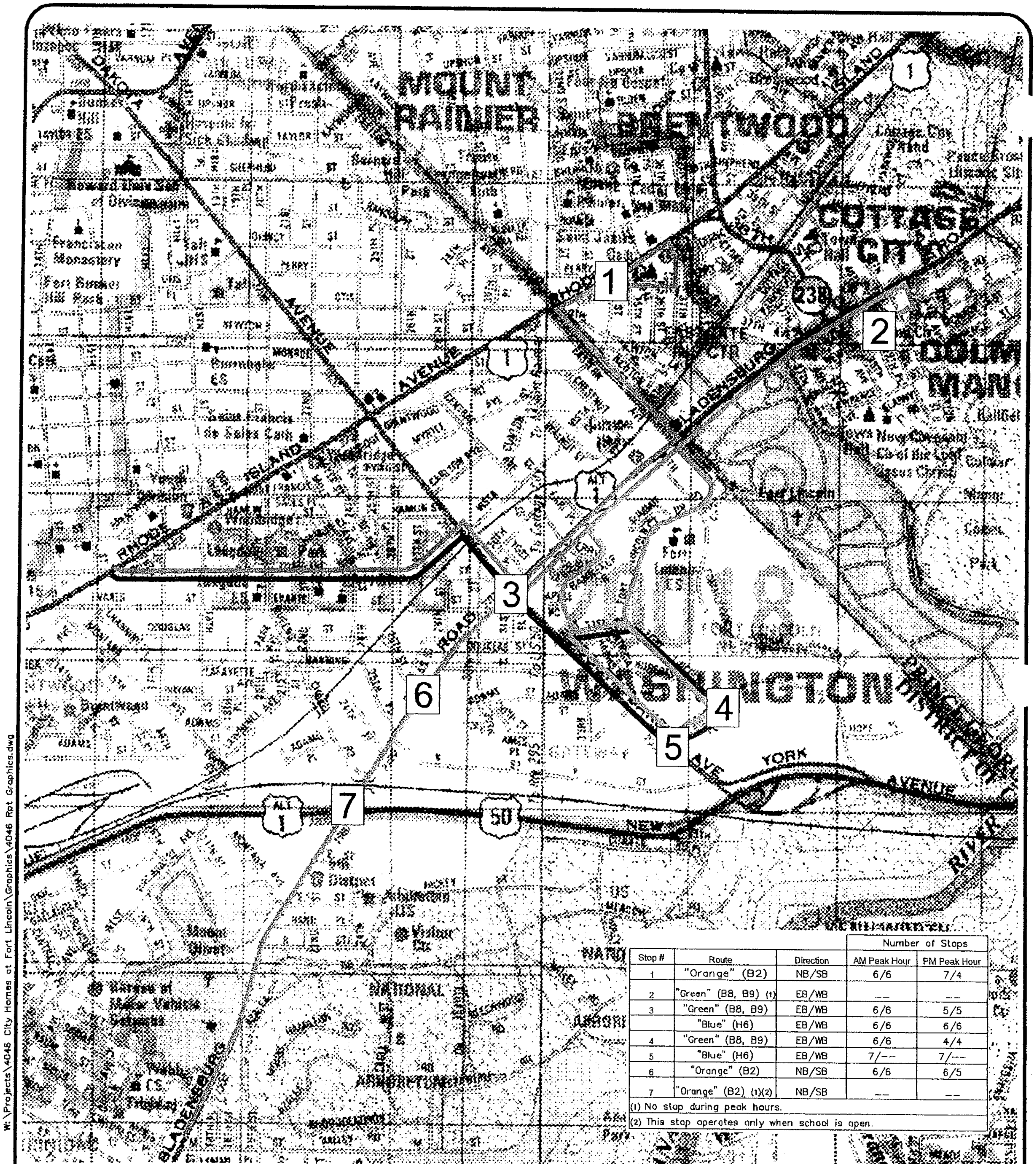


Existing Conditions

← Represents One Travel Lane
Signalized Intersection

AM PEAK HOUR
PM PEAK HOUR
000/000

North



Stop #	Route	Direction	Number of Stops	
			AM Peak Hour	PM Peak Hour
1	"Orange" (B2)	NB/SB	6/6	7/4
2	"Green" (B8, B9) (1)	EB/WB	--	--
3	"Green" (B8, B9)	EB/WB	6/6	5/5
	"Blue" (H6)	EB/WB	6/6	6/6
4	"Green" (B8, B9)	EB/WB	6/6	4/4
5	"Blue" (H6)	EB/WB	7/--	7/--
6	"Orange" (B2)	NB/SB	6/6	6/5
7	"Orange" (B2) (1)(2)	NB/SB	--	--

(1) No stop during peak hours.
(2) This stop operates only when school is open.

Figure 2–2
Metrobus Service

North

Figure 3–1
Baseline Peak Hour Traffic Volumes with Regional Growth

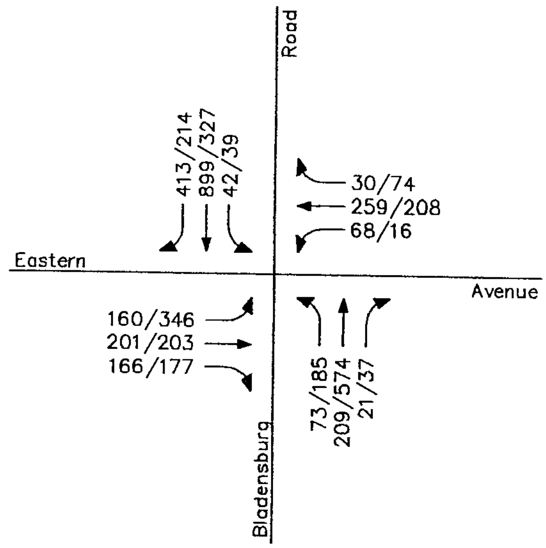


Figure 3–2
Pipeline Development Traffic Assignments

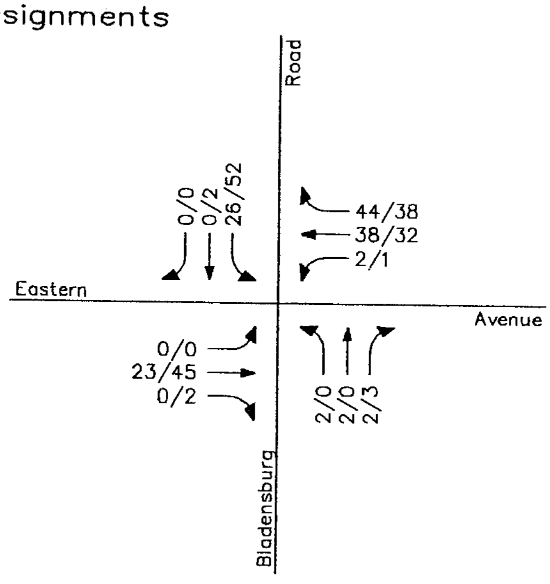
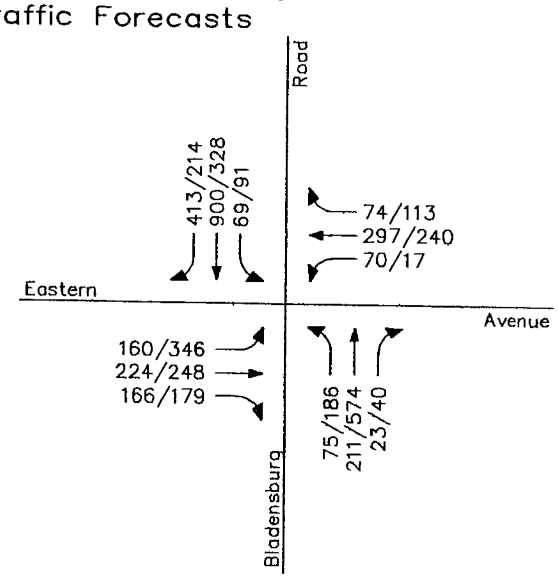


Figure 3–3
2010 Future Background Peak Hour Traffic Forecasts



Future Conditions without Proposed Development

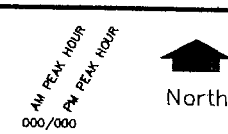


Figure 4–1
Site Trip Distribution and Assignments

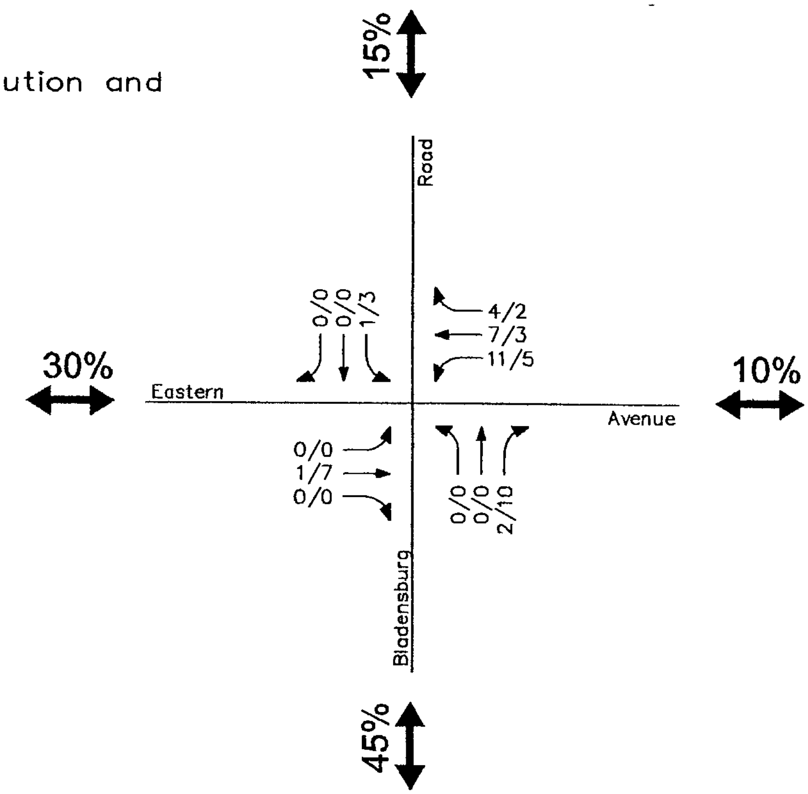


Figure 5–1
2010 Total Future Peak Hour Traffic Forecasts

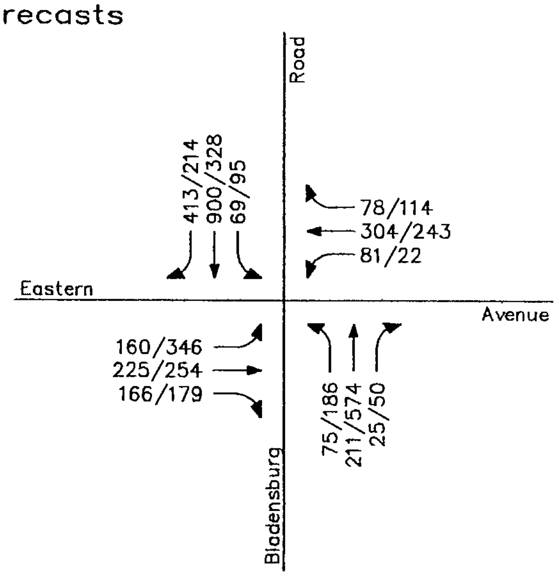
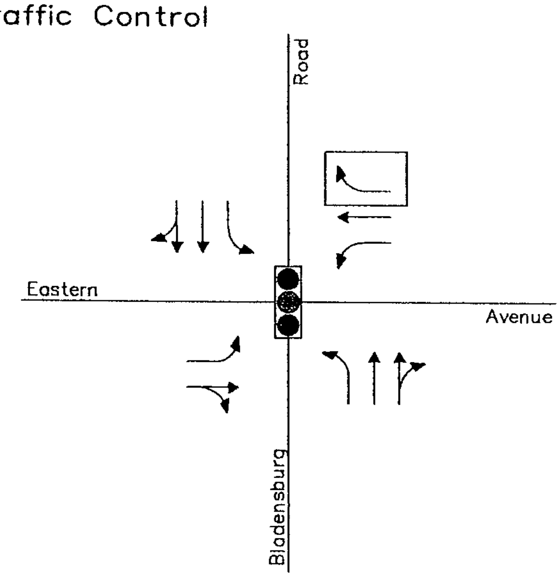


Figure 5–2
Recommended Future Lane Use and Traffic Control



Note: The proposed lane use is not necessary to mitigate site impacts.

← Represents One Travel Lane

W:\Projects\4046 City Homes at Fort Lincoln\Graphics\4046 Rpt Graphics.dwg

Future Conditions with Development

XX%

Signalized Intersection
Recommended Improvement

AM PEAK HOUR
PM PEAK HOUR
000/000

North

City Homes at Fort Lincoln
Washington, D.C.

Wells + Associates, Inc.

APPENDIX A

Scoping Documentation

WELLS + ASSOCIATES

February 1, 2008

Abdoulaye Bah
District Department of Transportation
2000 14th Street, NW
7th Floor
Washington, DC 20009

RE: Traffic Study – Washington Gateway
Northeast Washington, DC

Dear Mr. Bah:

I am providing herein an outline of our proposed scope of work for the Fort Lincoln area per a recent phone conversation with Sharlene Reed on Tuesday, January 29th. Our scope of work addresses the following: (1) a traffic impact study for the proposed Eastern Avenue residential development and (2) a traffic impact study for the Washington Gateway retail development located in Northeast Washington, DC.

The proposed residential site generally is bounded by Bladensburg Road to the north and west, Fort Lincoln Drive to the north and east, and Pineview Court to the south and east. The site is planned to be developed with approximately 62 condominium units on a 2.517 acre tract of land. The proposed site currently is undeveloped and is split-zoned, with a portion subject to R-5A zoning and a portion subject to R-5D zoning. Access to the residential development would be provided via an entrance along Eastern Avenue and an entrance on Pineview Court.

The proposed retail site generally is bounded by 33rd Place to the west, Fort Lincoln Drive to the north, New York Avenue to the south and east, and South Dakota Avenue to the south and west. The site is planned to be developed with approximately 500,000 SF of retail development. The proposed retail site currently is undeveloped and is zoned C-2-B. Access to the retail development is proposed via two full-movement intersections: one at the Fort Lincoln Drive/33rd Place intersection and one at the Fort Lincoln Drive/Unnamed Road intersection. In addition, a new site driveway providing ingress only is proposed from the southbound New York Avenue Off-Ramp between the diverge point of Fort Lincoln Drive and its intersection with South Dakota Avenue.

11420 Spring Hill Road, Suite 600 - McLean, Virginia 22102 - 703/917-6620 - Fax: 703/917-0739

The following outline is a summary of our proposed scope of work for the traffic studies.

I. Traffic Impact Study for the Eastern Avenue Residential Development

1. Study Area: The study will focus on the following intersection:

    a. Bladensburg Road/Eastern Avenue

2. Traffic Counts: AM and PM peak period traffic counts conducted in February 2007 will be used. Counts will be factored by one percent to reflect 2008 conditions.

3. Trip Generation: Standard Institute of Transportation Engineer trip generation rates/equations will be utilized to evaluate the number of trips generated by the proposed 62 condominium units.

4. Traffic Volume Projections: The study will provide existing and projected weekday AM peak hour and PM peak hour traffic volumes for the projected build out year, 2010. A growth factor of one percent, which is consistent with other studies in the area, will be used to account for regional growth in the area. Additionally, site traffic for the following specific planned developments, which are anticipated to be completed in the next few years, will be included in the future traffic projections:

    - The Washington Gateway retail development – generally bounded by 33rd Place to the west, Fort Lincoln Drive to the north, New York Avenue to the south and east, and South Dakota Avenue to the south and west, the site is planned to be developed with approximately 500,000 SF of retail development.

- The Village at Washington Gateway residential development – bounded by Fort Lincoln Drive to the west, 33rd Place to the south, Commodore Joshua Barney Drive to the north, and an unnamed road to the east, the proposed residential development will consist of 183 townhouses and 174 condominiums.
- The Wesley House development – located north of Commodore Joshua Barney Drive and northwest of the Village at Washington Gateway residential development, the Wesley House development will consist of 127 active-adult apartments.
- Dakota Crossing – bounded by South Dakota Avenue to the west, Fort Lincoln Drive to the east, 31st Place to the north and 33rd Place to the south, the residential development consists of 209 townhouse units. At the time the counts were conducted, only 42 units were occupied. Therefore, traffic associated with the remaining 167 units will be included in the background traffic forecasts.

Trip assignments for the Village at Washington Gateway and Wesley House developments will be taken from the traffic impact study for the Village at Washington Gateway, dated August 2006, prepared by Wells & Associates. Standard Institute of Transportation Engineer trip generation rates/equations will be utilized to evaluate the number of trips generated by the Washington Gateway retail development. The resulting trips will be distributed based on existing traffic counts, local knowledge, and engineering judgment.

5. Trip Distributions: Site-generated traffic will be assigned to the surrounding street system based on existing traffic counts, local knowledge, and engineering judgment.

6. LOS Analysis: Level of service calculations for existing and projected conditions will be provided. Synchro software (version 6, build 612) will be used to calculate the levels of service. Existing signal timings obtained from DDOT will be used for existing conditions.

7. Mode Split: A transit reduction of ten percent will be assumed based on the proximity of bus stops and the availability of routes providing service to the Rhode Island Metro Station.

8. Identification of Potential Impacts: The impact to the study intersection resulting from additional traffic generated by the proposed residential development will be identified. If necessary, improvements required to mitigate the impact will be identified.

9. Documentation: Given the minimal number of trips anticipated to be generated by the proposed 62 unit condominium development (35 AM peak hour trips and 41 PM peak hour trips, without any mode-split reduction), results of the analyses, conclusions, and recommendations will be summarized in a technical memorandum with appropriate graphics and appendices.

II. Traffic Impact Study for the Washington Gateway Retail Development

1. Study Area: The study will focus on the following intersections:

   a. Fort Lincoln Drive/Eastern Drive/Bladensburg Road
   b. Bladensburg Road/South Dakota Avenue
   c. Bladensburg Road/V Street/25th Place
   d. South Dakota Avenue/V Street
   e. South Dakota Avenue/33rd Place
   f. South Dakota Avenue/31st Place
   g. Fort Lincoln Drive/31st Place
   h. Fort Lincoln Drive/33rd Place
   i. 33rd Place/Unnamed Road
   j. New York avenue/South Dakota Avenue On/Off Ramps

2. Traffic Counts: AM and PM peak period traffic counts conducted in February 2007 will be used for the study intersections. These counts will be factored by one percent to reflect 2008 conditions.

3. Trip Generation: Standard Institute of Transportation Engineer trip generation rates/equations will be utilized to evaluate the number of trips generated by the proposed retail development.

4. Trip Reduction: Internal capture rates will be applied for the AM, PM, and daily trip generation in accordance with the ITE Trip Generation Handbook to account for the interaction between the proposed retail uses.

5. Traffic Volume Projections: The study will provide existing and projected weekday AM peak hour and PM peak hour traffic volumes for the projected build out year of the Washington Gateway retail development, 2010. In addition, a 2013 analyses will be conducted to evaluate the future levels of service with the development of a proposed apartment complex just east of the Wesley House development. A growth factor of one percent, which is consistent with other studies in the area, will be used to account for regional growth in the area.

   Additionally, site traffic for the following specific planned developments, which are anticipated to be completed in the next few years, will be included in the future traffic projections:

   - The Village at Washington Gateway residential development – bounded by Fort Lincoln Drive to the west, 33rd Place to the south, Commodore Joshua Barney Drive to the north, and an unnamed road to the east, the proposed residential development will consist of 183 townhouses and 174 condominiums.
   - The Wesley House development – located north of Commodore Joshua Barney Drive and northwest of the Village at Washington Gateway residential development, the Wesley House development will consist of 127 active-adult apartments.
   - The Eastern Avenue residential development – bounded by Bladensburg Road to the north and west, Fort Lincoln Drive to the north and east, and Pineview Court to the south and east, the proposed residential development will consist of 62 condominium units.
   - Dakota Crossing – bounded by South Dakota Avenue to the west, Fort Lincoln Drive to the east, 31st Place to the north and 33rd Place to the south, the residential development consists of 209 townhouse units. At the time the counts were conducted, only 42 units were occupied. Therefore, traffic associated with the remaining 167 units will be included in the background traffic forecasts.

Trip assignments for the Village at Washington Gateway and Wesley House developments will be taken from the traffic impact study for the Village at Washington Gateway, dated August 2006, prepared by Wells & Associates. Standard Institute of Transportation Engineer trip generation rates/equations will be utilized to evaluate the number of trips generated by the Eastern Avenue residential development. The resulting trips will be distributed based on existing traffic counts, local knowledge, and engineering judgment.

6. Trip Distributions: Site-generated traffic will be assigned to the surrounding street system based on existing traffic counts, local knowledge, and engineering judgment.

7. LOS Analysis: Level of service calculations for existing and projected conditions will be provided. Synchro software (version 6, build 612) will be used to calculate the levels of service. Existing signal timings obtained from DDOT will be used for existing conditions.

8. Mode Split: Mode-split reductions for the residential developments will be taken from their respective studies. Given the number of residential developments that are planned in the Fort Lincoln area within walking distance and the availability of bus service in the area, a five percent non-auto mode split will be taken for the AM peak hour and a ten percent non-auto mode split will be taken for the PM peak hour.

9. Identification of Potential Impacts: The impact to the study area resulting from additional traffic generated by the proposed retail development will be identified. If necessary, improvements required to mitigate the impact will be identified.

10. Documentation: Results of the analyses, conclusions, and recommendations will be summarized in a technical report with appropriate graphics and appendices.

Please advise if you are in agreement with our understanding of the scope for the respective traffic studies as outlined above. Your timely review and comments on the scope are respectfully requested.

Should you require any additional information, please do not hesitate to call me at (724) 933-9010.

Sincerely,

Jami L. Milanovich

Jami L. Milanovich, P.E.
Senior Associate

cc: Sharlene Reed, District Department of Transportation
Said Cherifi, District Department of Transportation
Derrick Hardy, District Department of Transportation
Will Collins, The Concordia Group

APPENDIX B

Traffic Count Data

Wells + Associates, Inc.

McLean, Virginia

Existing Traffic Count

PROJECT: Washington Gateway
W & A JOB NO.: 1778
INTERSECTION: Bladensburg Rd. & Eastern Ave.
LOCATION: Washington, D.C.

DATE: 2/8/2007
DAY: Thursday
WEATHER: cold
COUNTED BY: Hugo & Lucia
INPUTED BY: Agan

SOUTHBOUND ROAD: Eastern Avenue
NORTHBOUND ROAD: Eastern Avenue
WESTBOUND ROAD: Bladensburg Road
EASTBOUND ROAD: Bladensburg Road

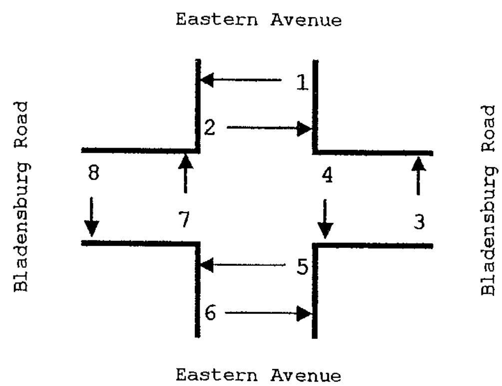
Time Period	Turning Movements																		Total	PHF	Time Period
	Southbound Eastern Avenue				Westbound Bladensburg Road				Northbound Eastern Avenue				Eastbound Bladensburg Road				North & South	East & West			
	1 Right	2 Thru	3 Left	Total	4 Right	5 Thru	6 Left	Total	7 Right	8 Thru	9 Left	Total	10 Right	11 Thru	12 Left	Total					
AM																					
6:00-6:15	14	20	7	41	50	73	0	123	3	23	3	29	1	22	15	38	70	161	231		6:00-6:15
6:15-6:30	22	21	15	58	50	89	1	140	1	25	1	27	0	26	10	36	85	176	261		6:15-6:30
6:30-6:45	35	20	15	70	101	120	1	222	3	30	4	37	1	29	9	39	107	261	368		6:30-6:45
6:45-7:00	31	26	18	75	96	130	5	231	2	36	7	45	1	25	20	46	120	277	397		6:45-7:00
7:00-7:15	33	36	25	94	111	166	4	281	7	52	5	64	0	42	24	66	158	347	505		7:00-7:15
7:15-7:30	30	36	23	89	110	159	5	274	4	60	9	73	2	43	18	63	162	337	499		7:15-7:30
7:30-7:45	33	46	40	119	107	193	11	311	3	71	18	92	3	42	25	70	211	381	592		7:30-7:45
7:45-8:00	45	48	37	130	104	210	6	320	5	68	13	86	3	44	17	64	216	384	600		7:45-8:00
8:00-8:15	40	48	28	116	96	216	12	324	12	72	19	103	3	52	19	74	219	398	617		8:00-8:15
8:15-8:30	39	52	45	136	108	237	10	355	4	62	18	84	7	54	14	75	220	430	650		8:15-8:30
8:30-8:45	37	47	45	129	93	210	13	316	8	49	16	73	7	53	21	81	202	397	599		8:30-8:45
8:45-9:00	43	44	35	122	88	180	14	282	12	58	9	79	2	67	23	92	201	374	575		8:45-9:00
3 Hour Totals	402	444	333	1,179	1,114	1,983	82	3,179	64	606	122	792	30	499	215	744	1,971	3,923	5,894		
1 Hour Totals																					
6:00-7:00	102	87	55	244	297	412	7	716	9	114	15	138	3	102	54	159	382	875	1,257	0.79	6:00-7:00
6:15-7:15	121	103	73	297	358	505	11	874	13	143	17	173	2	122	63	187	470	1,061	1,531	0.76	6:15-7:15
6:30-7:30	129	118	81	328	418	575	15	1,008	16	178	25	219	4	139	71	214	547	1,222	1,769	0.88	6:30-7:30
6:45-7:45	127	144	106	377	424	648	25	1,097	16	219	39	274	6	152	87	245	651	1,342	1,993	0.84	6:45-7:45
7:00-8:00	141	166	125	432	432	728	26	1,186	19	251	45	315	8	171	84	263	747	1,449	2,196	0.92	7:00-8:00
7:15-8:15	148	178	128	454	417	778	34	1,229	24	271	59	354	11	181	79	271	808	1,500	2,308	0.94	7:15-8:15
7:30-8:30	157	194	150	501	415	856	39	1,310	24	273	68	365	16	192	75	283	866	1,593	2,459	0.95	7:30-8:30
7:45-8:45	161	195	155	511	401	873	41	1,315	29	251	66	346	20	203	71	294	857	1,609	2,466	0.95	7:45-8:45
8:00-9:00	159	191	153	503	385	843	49	1,277	36	241	62	339	19	226	77	322	842	1,599	2,441	0.94	8:00-9:00
AM Peak 7:45-8:45	**161**	**195**	**155**	**511**	**401**	**873**	**41**	**1,315**	**29**	**251**	**66**	**346**	**20**	**203**	**71**	**294**	**857**	**1,609**	**2,466**	**0.95**	**AM Peak 7:45-8:45**
PM																					
4:00-4:15	45	46	81	172	45	81	4	130	17	44	8	69	9	140	38	187	241	317	558		4:00-4:15
4:15-4:30	40	51	83	174	44	82	14	140	12	51	8	71	5	120	35	160	245	300	545		4:15-4:30
4:30-4:45	37	52	87	176	51	78	8	137	17	43	3	63	11	123	42	176	239	313	552		4:30-4:45
4:45-5:00	56	44	91	191	51	76	8	135	19	47	4	70	4	143	33	180	261	315	576		4:45-5:00
5:00-5:15	35	53	82	170	55	89	8	152	16	62	4	82	10	156	44	210	252	362	614		5:00-5:15
5:15-5:30	44	48	76	168	51	74	14	139	20	50	5	75	11	135	61	207	243	346	589		5:15-5:30
5:30-5:45	32	55	96	183	54	58	6	118	15	54	4	73	9	142	39	190	256	308	564		5:30-5:45
5:45-6:00	36	53	85	174	54	73	8	135	14	48	4	66	4	138	45	187	240	322	562		5:45-6:00
6:00-6:15	39	69	80	188	45	71	9	125	12	50	6	68	5	122	30	157	256	282	538		6:00-6:15
6:15-6:30	40	52	73	165	47	68	11	126	17	47	7	71	5	102	44	151	236	277	513		6:15-6:30
6:30-6:45	35	55	52	142	54	63	14	131	12	39	3	54	5	100	35	140	196	271	467		6:30-6:45
6:45-7:00	31	59	62	152	33	65	6	104	16	42	0	58	4	117	31	152	210	256	466		6:45-7:00
3 Hour Totals	470	637	948	2,055	584	878	110	1,572	187	577	56	820	82	1,538	477	2,097	2,875	3,669	6,544		
1 Hour Totals																					
4:00-5:00	178	193	342	713	191	317	34	542	65	185	23	273	29	526	148	703	986	1,245	2,231	0.97	4:00-5:00
4:15-5:15	168	200	343	711	201	325	38	564	64	203	19	286	30	542	154	726	997	1,290	2,287	0.93	4:15-5:15
4:30-5:30	172	197	336	705	208	317	38	563	72	202	16	290	36	557	180	773	995	1,336	2,331	0.95	4:30-5:30
4:45-5:45	167	200	345	712	211	297	36	544	70	213	17	300	34	576	177	787	1,012	1,331	2,343	0.95	4:45-5:45
5:00-6:00	147	209	339	695	214	294	36	544	65	214	17	296	34	571	189	794	991	1,338	2,329	0.95	5:00-6:00
5:15-6:15	151	225	337	713	204	276	37	517	61	202	19	282	29	537	175	741	995	1,258	2,253	0.96	5:15-6:15
5:30-6:30	147	229	334	710	200	270	34	504	58	199	21	278	23	504	158	685	988	1,189	2,177	0.96	5:30-6:30
5:45-6:45	150	229	290	669	200	275	42	517	55	184	20	259	19	462	154	635	928	1,152	2,080	0.93	5:45-6:45
6:00-7:00	145	235	267	647	179	267	40	486	57	178	16	251	19	441	140	600	898	1,086	1,984	0.92	6:00-7:00
PM Peak 4:45-5:45	**167**	**200**	**345**	**712**	**211**	**297**	**36**	**544**	**70**	**213**	**17**	**300**	**34**	**576**	**177**	**787**	**1,012**	**1,331**	**2,343**	**0.95**	**PM Peak 4:45-5:45**

Wells + Associates, Inc.
McLean, Virginia

Pedestrian Volume Survey

North

Project Name:	Washington Gateway
Project Number:	1778
Location:	Washington, D.C.
Intersection:	Bladensburg Rd. & Eastern Ave.
Weather:	cold
Date:	2/8/2007
Surveyor:	Hugo & Lucia



TIME	Movement							
	1	2	3	4	5	6	7	8
AM								
6:00-6:15								
6:15-6:30								
6:30-6:45	1							
6:45-7:00		1				4		
7:00-7:15								
7:15-7:30		1						
7:30-7:45								
7:45-8:00	1							
8:00-8:15								
8:15-8:30						1		
8:30-8:45	1				1			
8:45-9:00					1	2		1
PM								
4:00-4:15	1	1				2		
4:15-4:30	2					2		
4:30-4:45	2					1		
4:45-5:00					3			
5:00-5:15	4	1				1		
5:15-5:30	1	2			2	1		
5:30-5:45	1							
5:45-6:00					1			
6:00-6:15								
6:15-6:30								
6:30-6:45					1			
6:45-7:00								

Wells + Associates, Inc.
McLean, Virginia

Project Name: Washington Gateway

Project Number: 1778

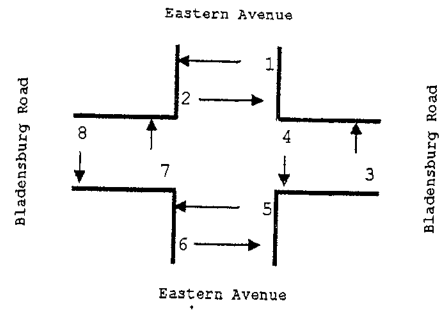
Location: Washington, D.C.

Intersection: Bladensburg Rd. & Eastern Ave.

Weather: cold

Date: 2/8/2007

Surveyor: Hugo & Lucia



Hourly Pedestrian Count

			1	2	3	4	5	6	7	8					
Time Period		From: / To:	SE / NE	NE / SE	SW / SE	SE / SW	SW / NW	NW / SW	NW / NE	NE / NW	Total	1 & 2	3 & 4	5 & 6	7 & 8
AM PEAK															
6:00	7:00		1	1	0	0	0	4	0	0	6	2	0	4	0
6:15	7:15		1	1	0	0	0	4	0	0	6	2	0	4	0
6:30	7:30		1	2	0	0	0	4	0	0	7	3	0	4	0
6:45	7:45		0	2	0	0	0	4	0	0	6	2	0	4	0
7:00	8:00		1	1	0	0	0	0	0	0	2	2	0	0	0
7:15	8:15		1	1	0	0	0	0	0	0	2	2	0	0	0
7:30	8:30		1	0	0	0	0	1	0	0	2	1	0	1	0
7:45	8:45		2	0	0	0	1	1	0	0	4	2	0	2	0
8:00	9:00		1	0	0	0	2	3	0	1	7	1	0	5	1
PM PEAK															
16:00	17:00		5	1	0	0	3	5	0	0	14	6	0	8	0
16:15	17:15		8	1	0	0	3	4	0	0	16	9	0	7	0
16:30	17:30		7	3	0	0	5	3	0	0	18	10	0	8	0
16:45	17:45		6	3	0	0	5	2	0	0	16	9	0	7	0
17:00	18:00		6	3	0	0	3	2	0	0	14	9	0	5	0
17:15	18:15		2	2	0	0	3	1	0	0	8	4	0	4	0
17:30	18:30		1	0	0	0	1	0	0	0	2	1	0	1	0
17:45	18:45		0	0	0	0	2	0	0	0	2	0	0	2	0
18:00	19:00		0	0	0	0	1	0	0	0	1	0	0	1	0

APPENDIX C

DDOT Traffic Signal Timings

TIMING PLAN SCHEDULE			TS- 252-G	EASTERN AVENUE AND BLADENSBURG ROAD, N.E. (LOCATION)
PLAN	PERIOD	DATE		S-DRAWING NO: S-298-E; SHEET: 1
1	OFF PEAK - 70			
2	AM PEAK - 80			
3	PM PEAK - 80			
4	OFF PEAK - 100			
5	AM PEAK - 100			
6	PM PEAK - 100			
7	AM PEAK - 120			
8	PM PEAK - 120			

DEPARTMENT OF PUBLIC WORKS

WASHINGTON, D.C.

BUREAU OF TRAFFIC SERVICES

CONTROLLER	ISNUM	ACISA
170	612	3141

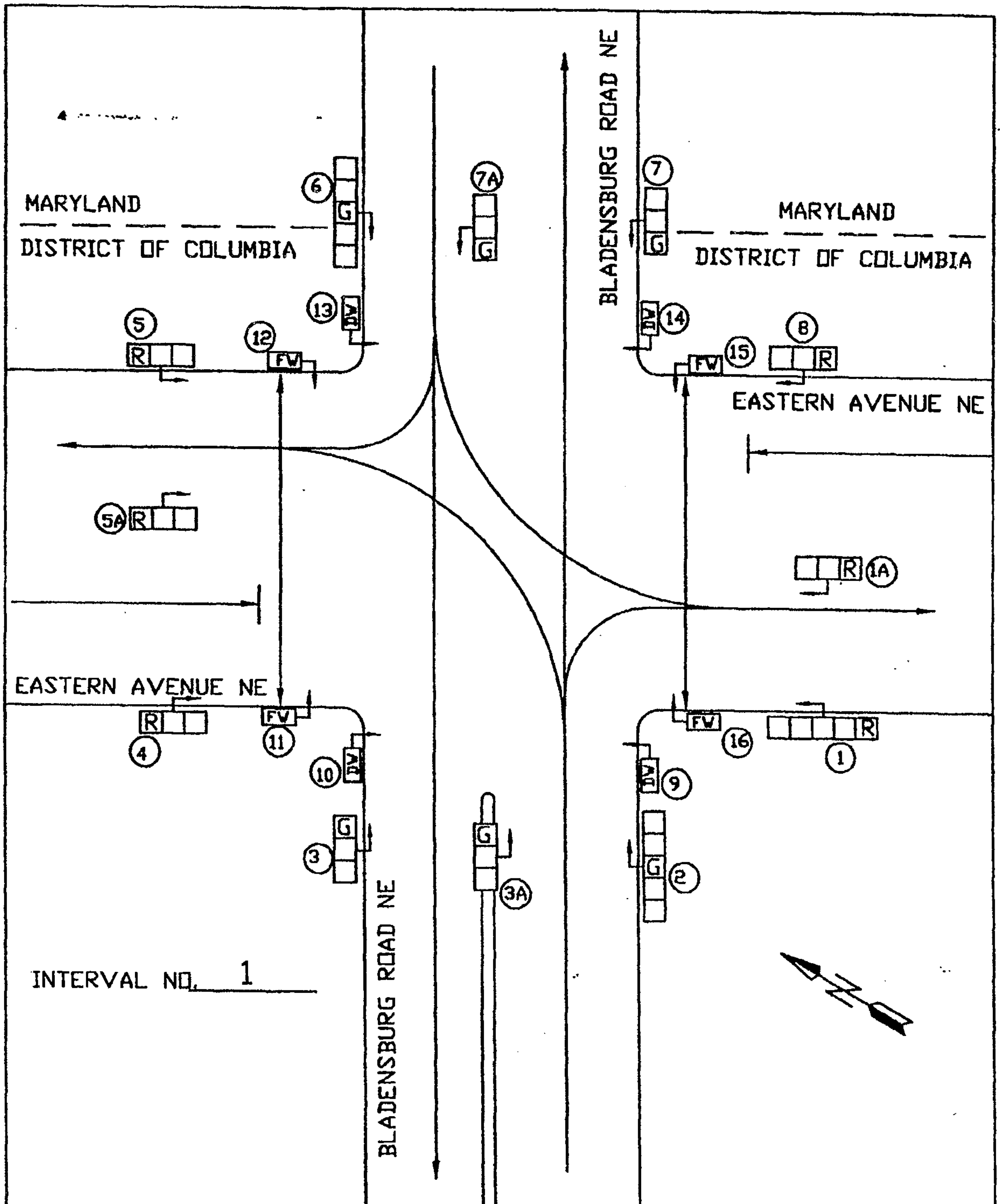
Int. Sketch

TIMING PLAN NUMBER

DESCRIPTION (INTERSECTION / STREET / DIRECTION)	INTERVAL TYPE	INTERVAL NUMBER	1 S	1 C	2 S	2 C	3 S	3 C	4 S	4 C	5 S	5 C	6 S	6 C	7 S	7 C	8 S	8 C	S	C	S	C
BLADENSBURG ROAD NBG, SBG + FW (ES,WS)	F	1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7				
BLADENSBURG ROAD NBG, SBG + FW (ES,WS)	V	2	7	14	14	21	10	17	22	29	24	31	20	27	34	41	30	37				
BLADENSBURG ROAD NBG, SBG + FDW (ES,WS)	F	3	9	23	9	30	9	26	9	38	9	40	9	36	9	50	9	46				
BLADENSBURG ROAD NBY, SBY + DW (ES,WS)	F	4	4	27	4	34	4	30	4	42	4	44	4	40	4	54	4	50				
ALL RED + DW (ES,WS)	F	5	1	28	1	35	1	31	1	43	1	45	1	41	1	55	1	51				
EASTERN AVE EBG, WBG + FW (NS,SS)	F	6	6	34	6	41	6	37	6	49	6	51	6	47	6	61	6	57				
EASTERN AVE EBG, WBG + FW (NS,SS)	V	7	0	34	2	43	2	39	15	64	12	63	12	59	22	83	22	79				
EASTERN AVE EBG, WBG + FDW (NS,SS)	F	8	19	53	19	62	19	58	19	83	19	82	19	78	19	102	19	98				
EASTERN AVE EBY, EBRG, WBY+ DW (NS)	F	9	4	57	4	66	4	62	4	87	4	86	4	82	4	106	4	102				
EASTERN AVE EBR, EBRG, WBR + DW (NS)	F	10	1	58	1	67	1	63	1	88	1	87	1	83	1	107	1	103				
BLADENSBURG ROAD NBR, NBLG, SBR, SBLG, EASTERN AVE. EBRG	F	11	6	64	6	73	6	69	6	94	6	93	6	89	6	113	6	109				
BLADENSBURG ROAD NBR, NBLG, SBR, SBLG, EASTERN AVE. EBRG	V	12	1	65	2	75	6	75	1	95	2	95	6	95	2	115	6	115				
BLADENSBURG ROAD NBR, NBLY, SBR, SBLY, EASTERN AVE. EBRY	F	13	5	70	5	80	5	80	5	100	5	100	5	100	5	120	5	120				
CYCLE LENGTH			70		80		80		100		100		100		120		120					
OFFSET			26		74		62		56		66		24		43		15					
PREPARED BY:			J.E.A.		J.E.A		J.E.A.		J.E.A.		J.E.A		J.E.A.		J.E.A.		J.E.A.					
DATE TO SHOP:																						
WORK OR SHOP ORDER NO.			S08-03-55		S08-03-55		S08-03-55		S08-03-55		S08-03-55		S08-03-55		S08-03-55		S08-03-55					
APPROVED BY:			Wwm		Wwm		Wwm		Wwm		Wwm		Wwm		Wwm		Wwm					
DATE INSTALLED:																						
INSTALLED BY:																						

S=Seconds C=Cummulative secs F=Fixed interval V=Variable interval ◯ = Force Off (circle the interval)

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

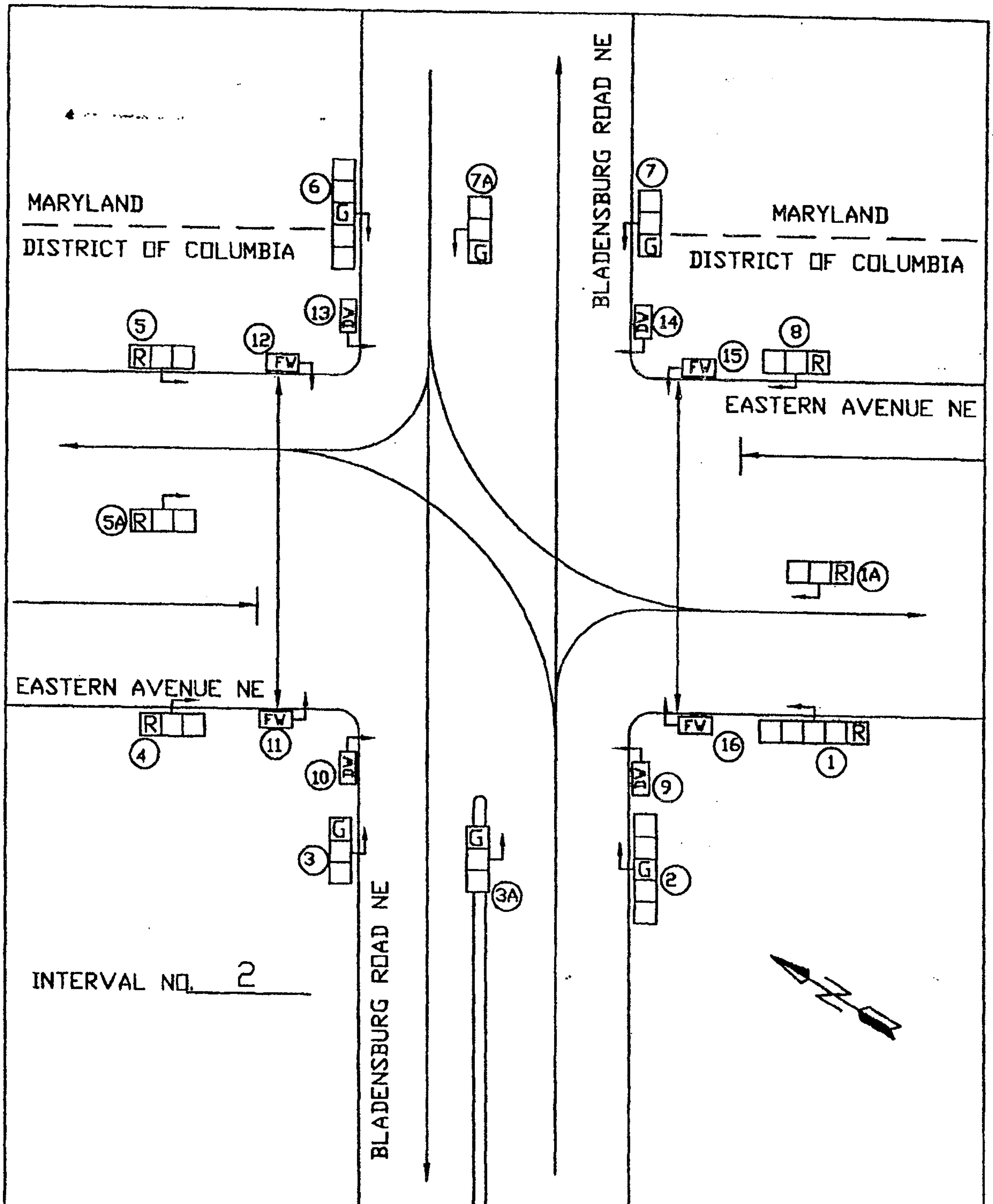


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY: Nawwafi	T.S. 252-G
CHECK BY: J.E.ANIAGBOSO 10/23/02	SUBMITTED BY: Johnny Aniagboso 10/23/02 CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH 9/5/02 IN SERVICE:	APPROVED BY: William W. McGhee 10/25/02 DIVISION CHIEF	1 OF 13

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

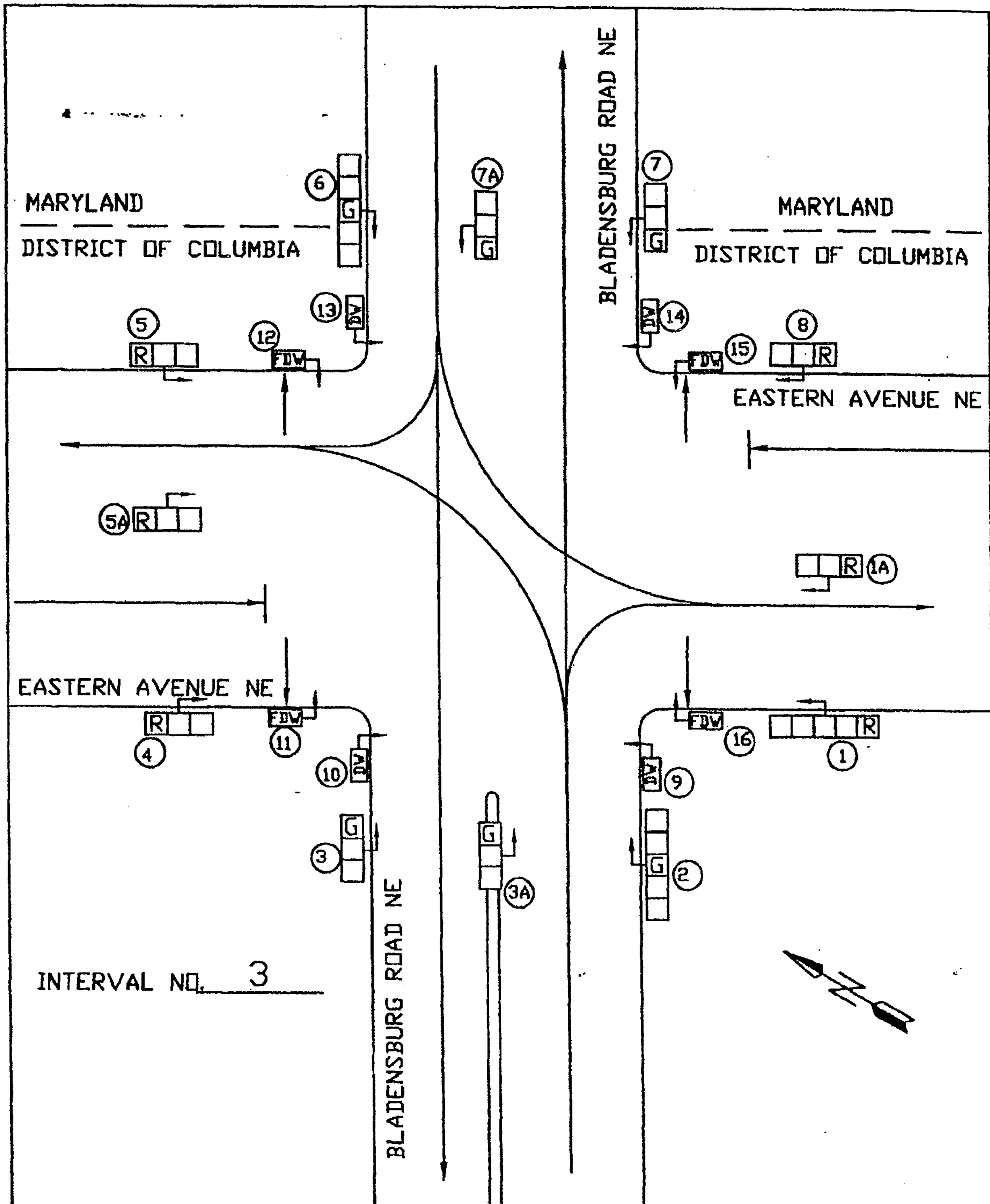


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : ______ CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : ______ DIVISION CHIEF	
IN SERVICE:		2 OF 13

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS



TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS
BUREAU OF TRAFFIC SERVICES
TRAFFIC SIGNAL SYSTEM DIVISION

CHECK BY:
DRAWN BY: TH
IN SERVICE:

DESIGNED BY : ____________

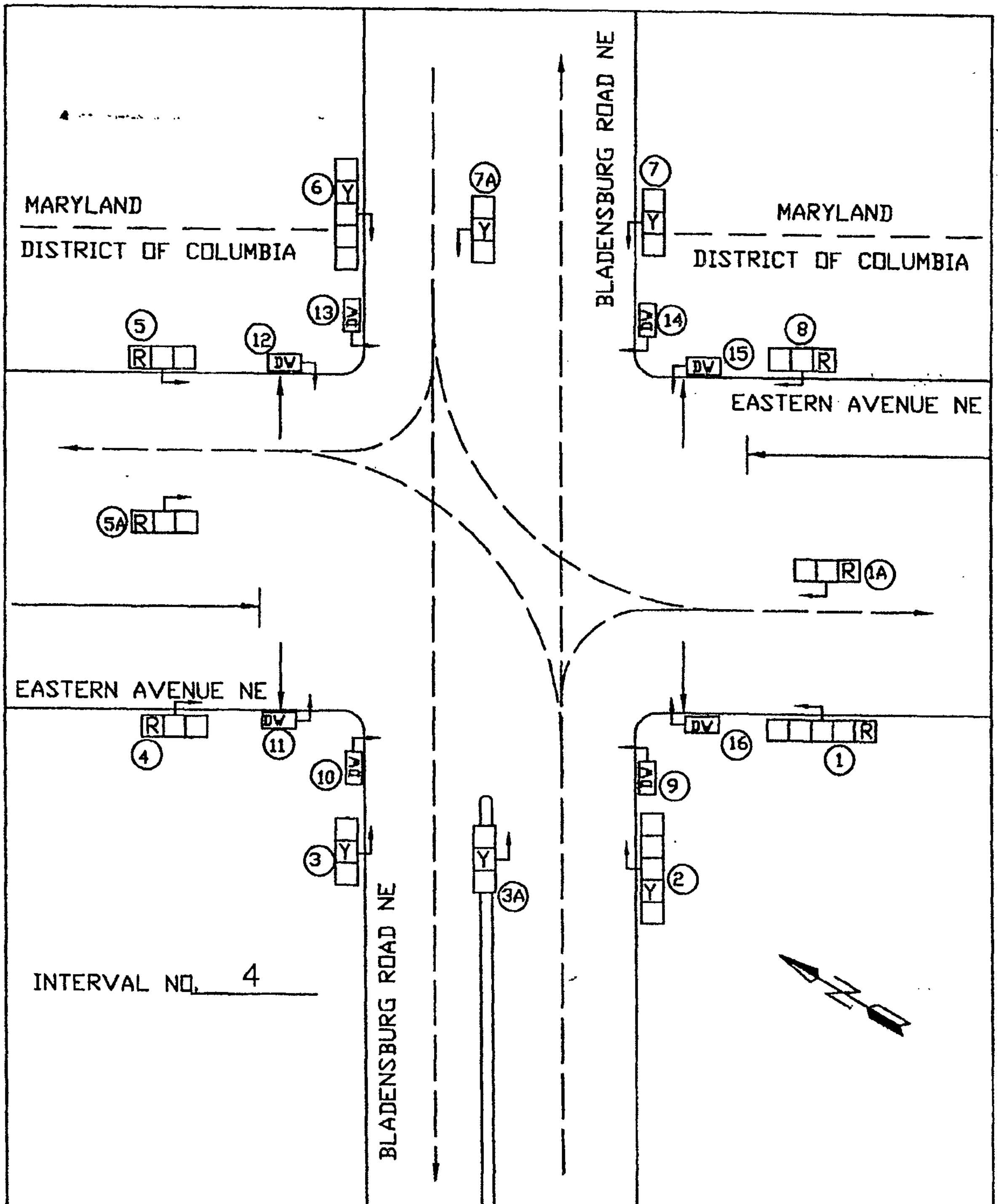
SUBMITTED BY : ____________
CHIEF OF SIGNAL DESIGN BRANCH

APPROVED BY : ____________
DIVISION CHIEF

T.S. 252-G

SHEET 3 OF 13

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

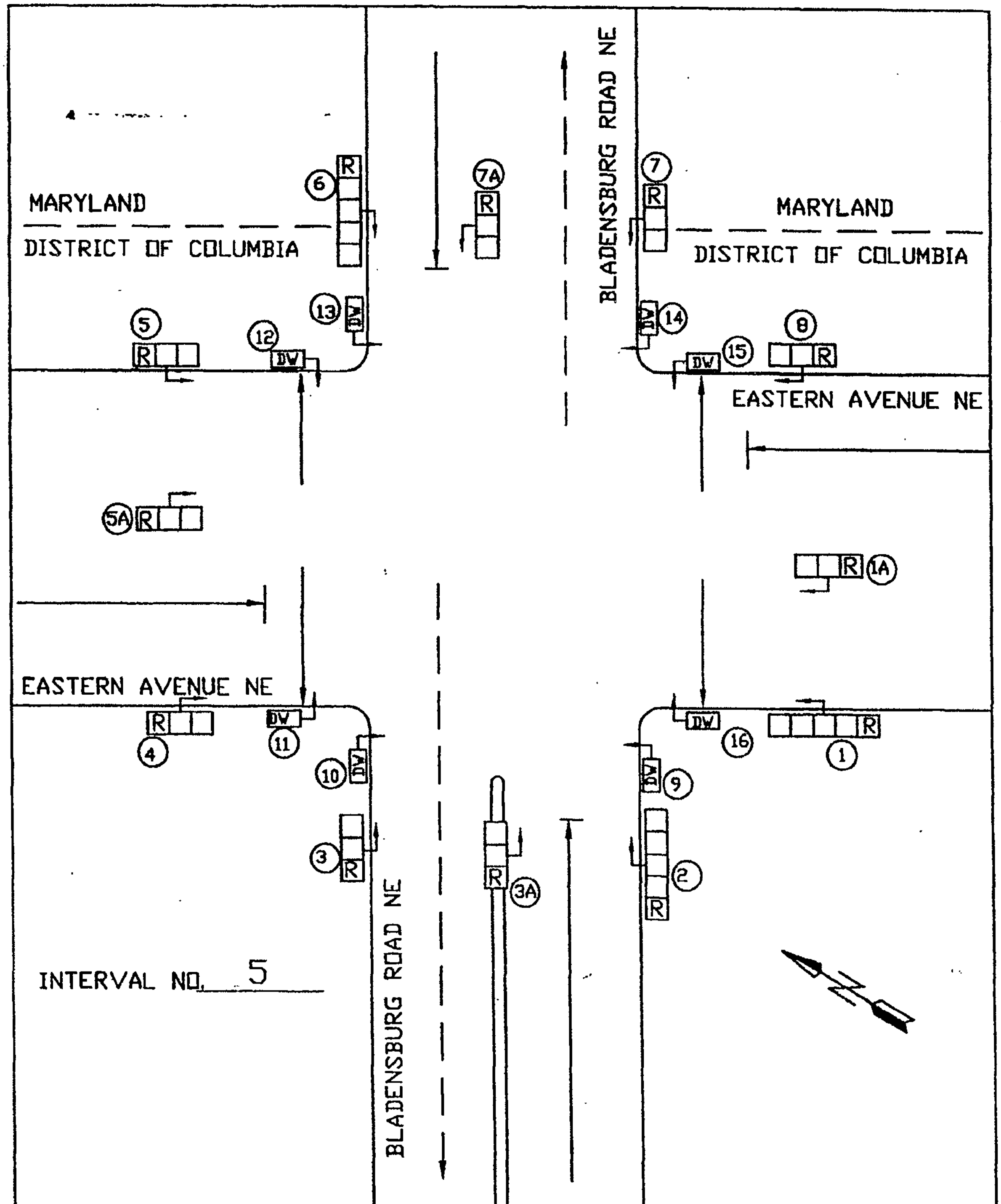


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	4 OF 13
IN SERVICE:		

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

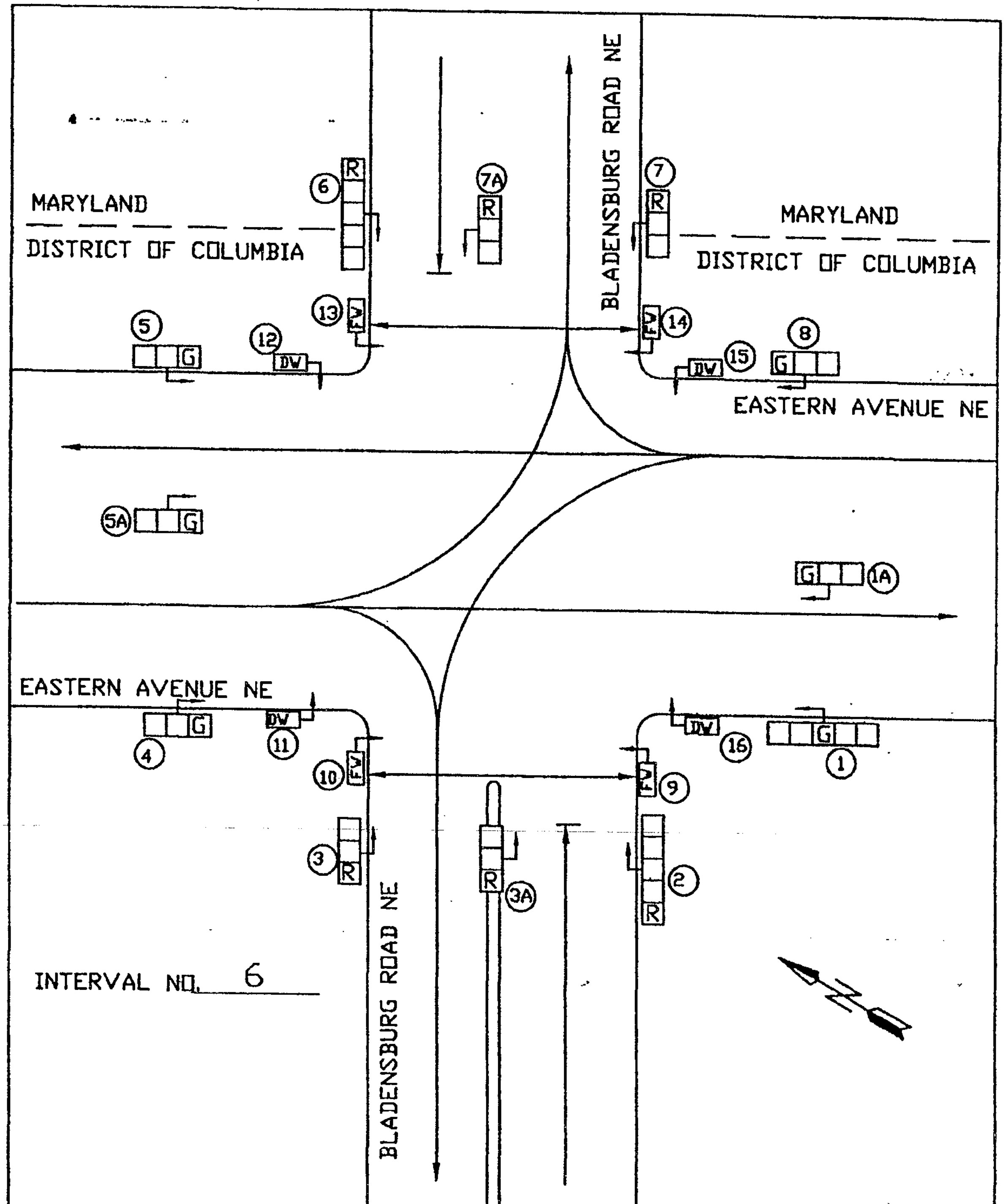


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	5 OF 13
IN SERVICE:		

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

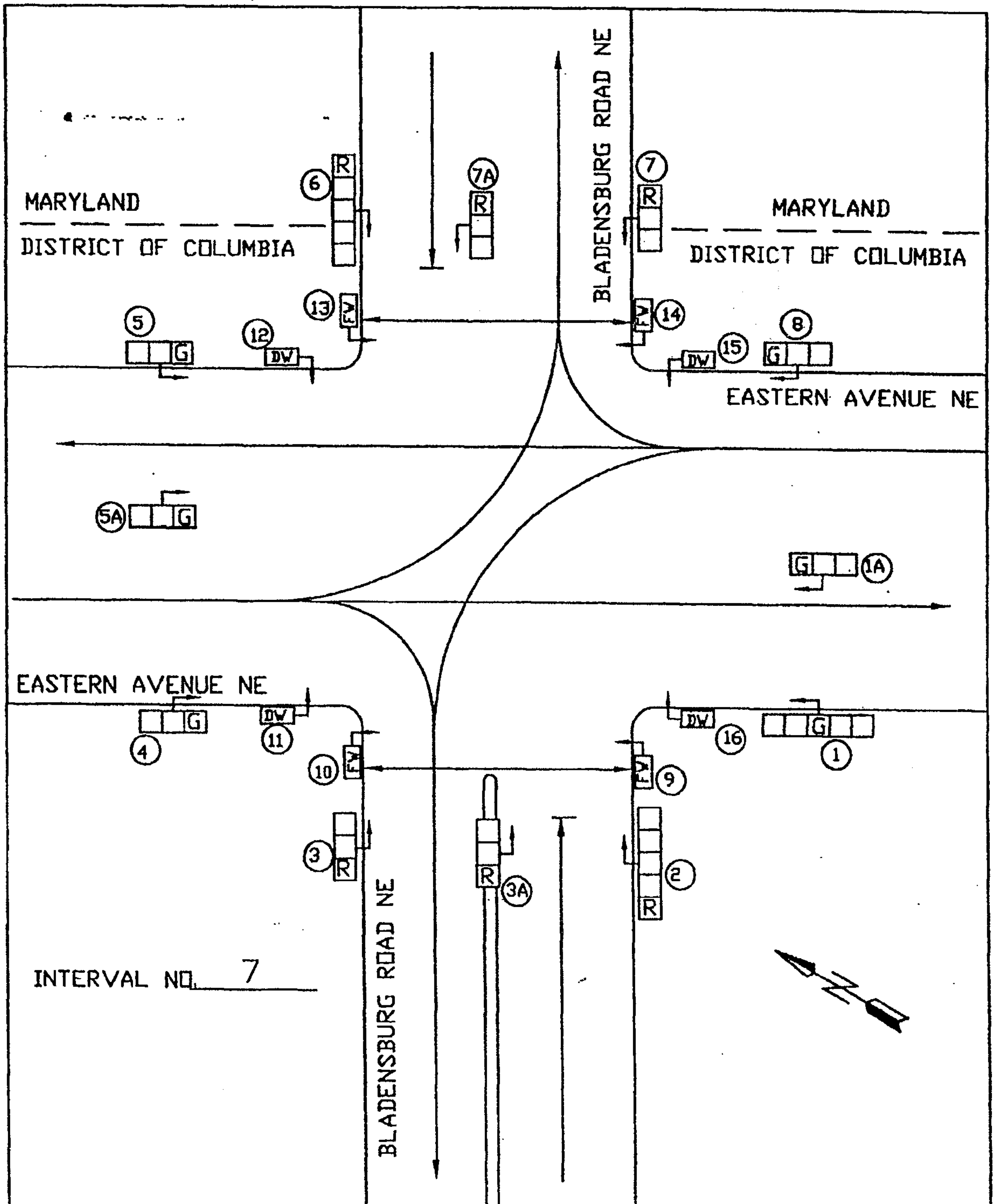


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	
IN SERVICE:		6 OF 13

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

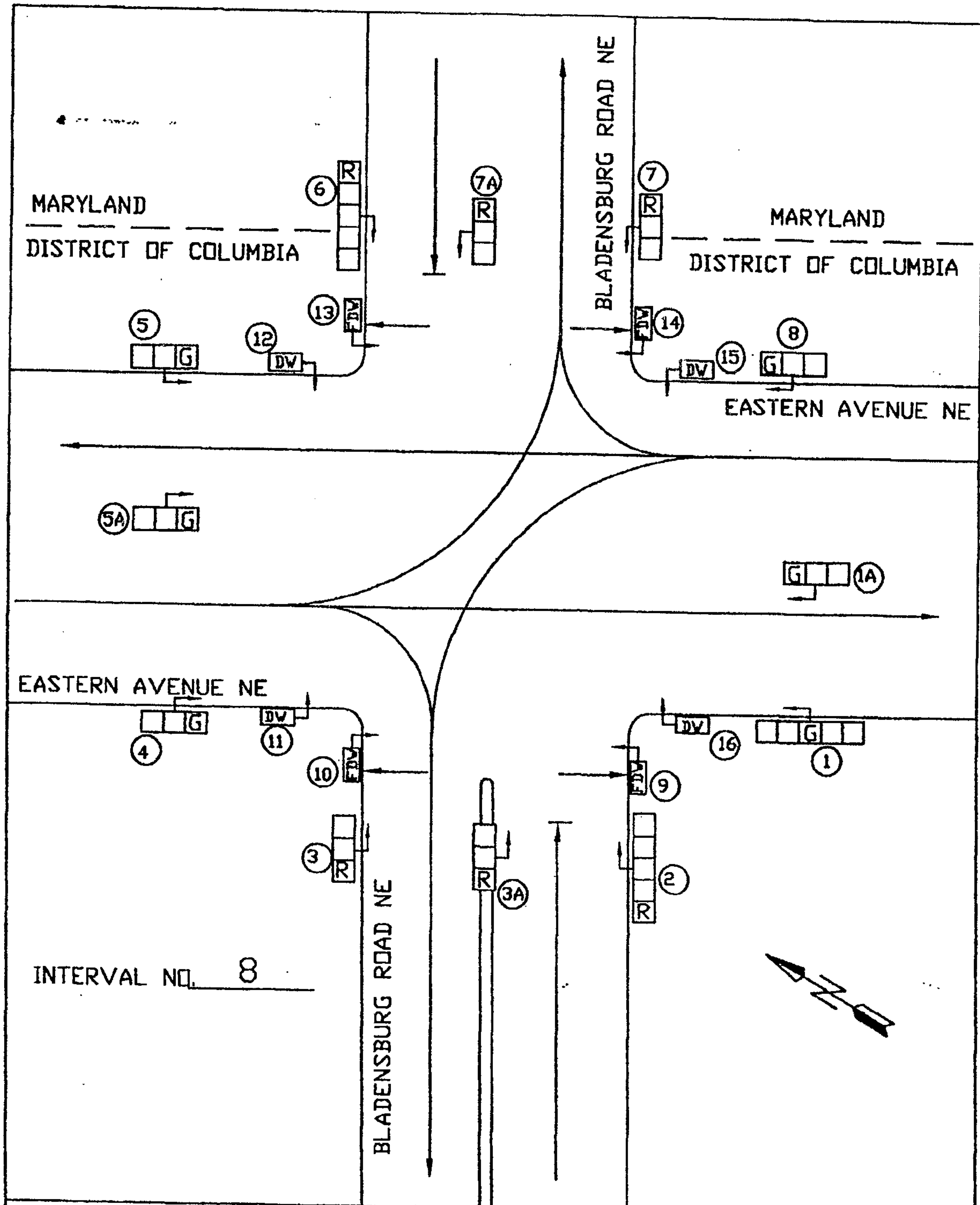


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	7 OF 13
IN SERVICE:		

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS



TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

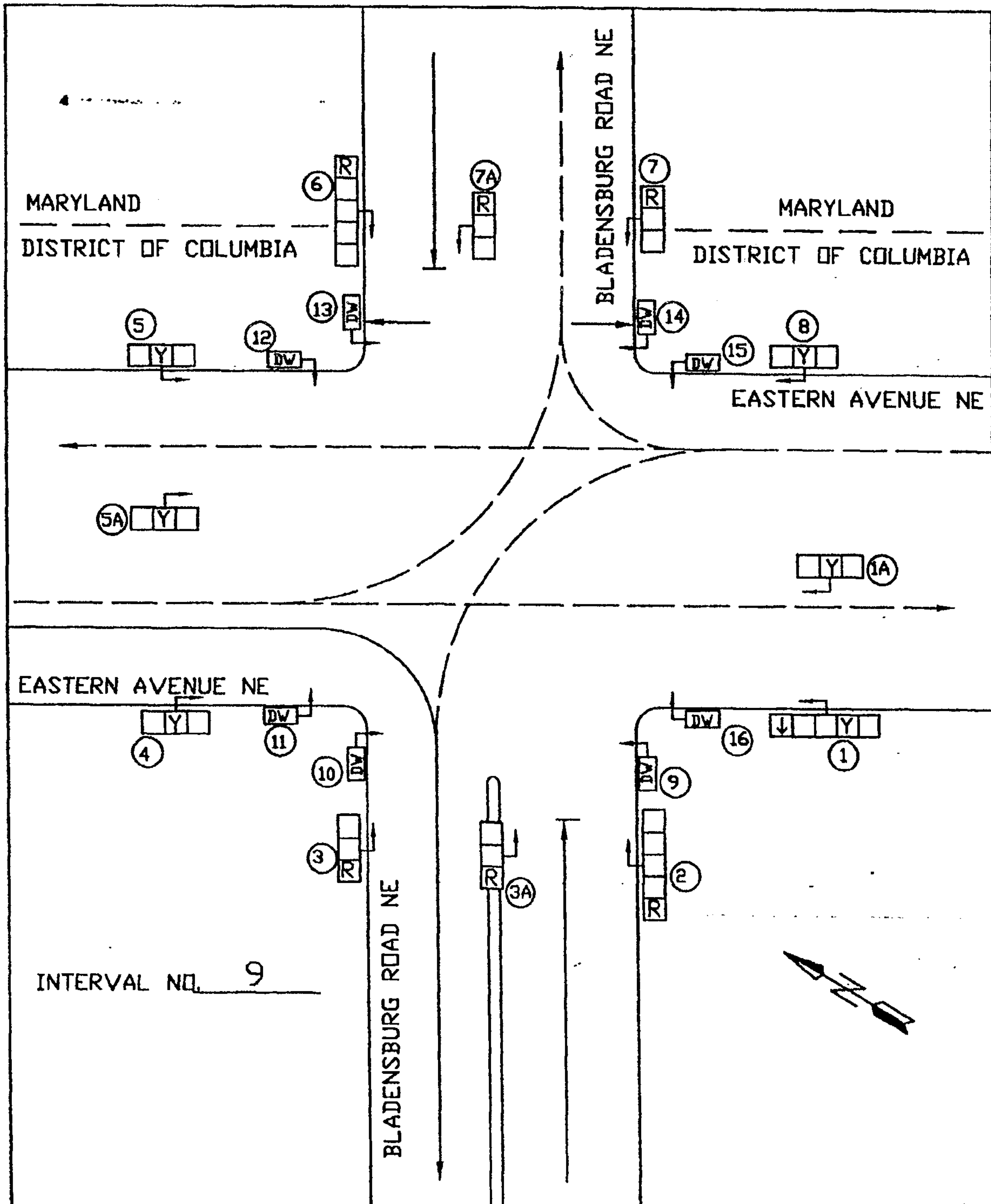
D.C. DEPARTMENT OF PUBLIC WORKS
BUREAU OF TRAFFIC SERVICES
TRAFFIC SIGNAL SYSTEM DIVISION

CHECK BY:
DRAWN BY: TH
IN SERVICE:

DESIGNED BY :
SUBMITTED BY :
CHIEF OF SIGNAL DESIGN BRANCH
APPROVED BY :
DIVISION CHIEF

T.S. 252-G
SHEET 8 OF 13

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

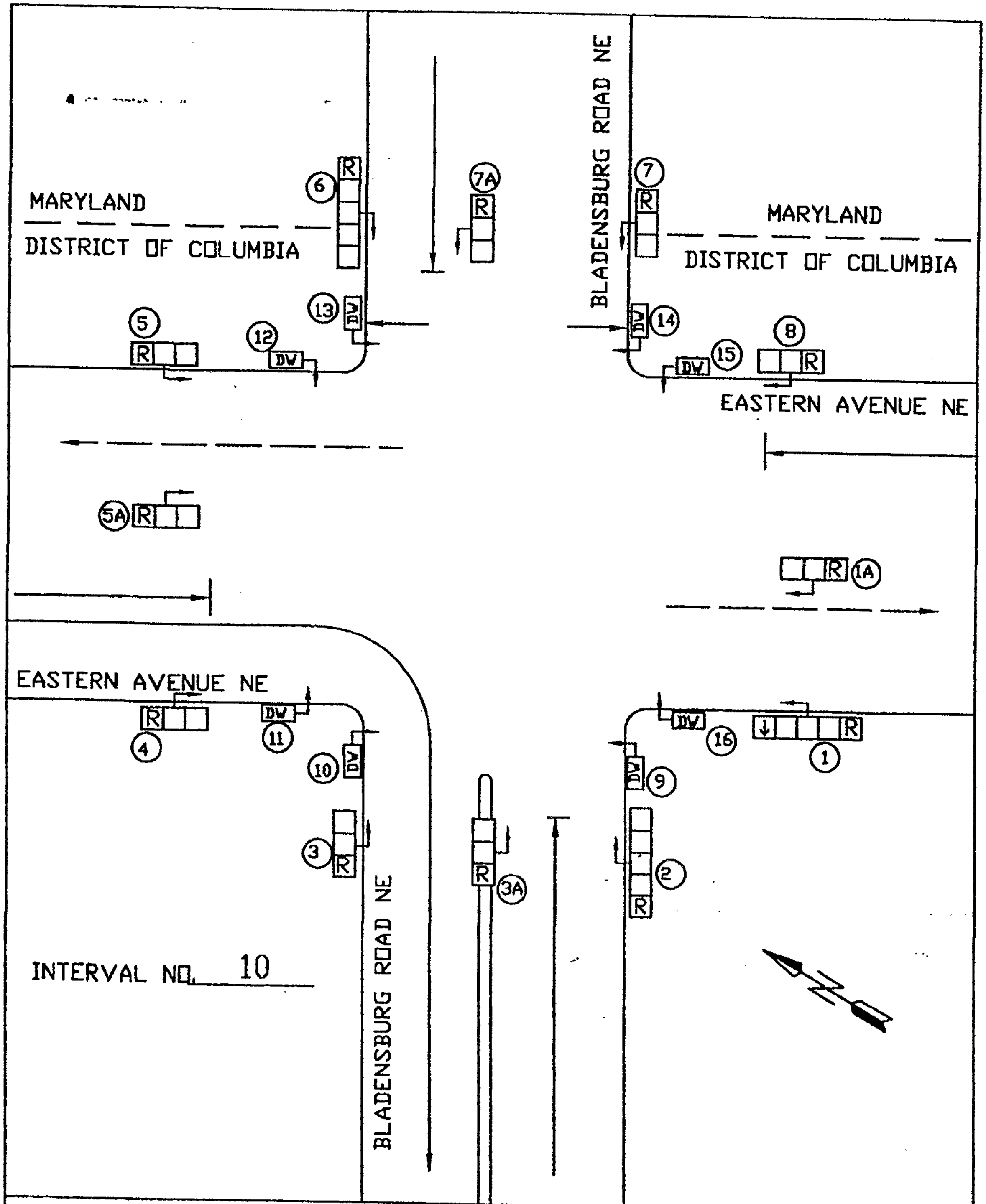


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	9 OF 13
IN SERVICE:		

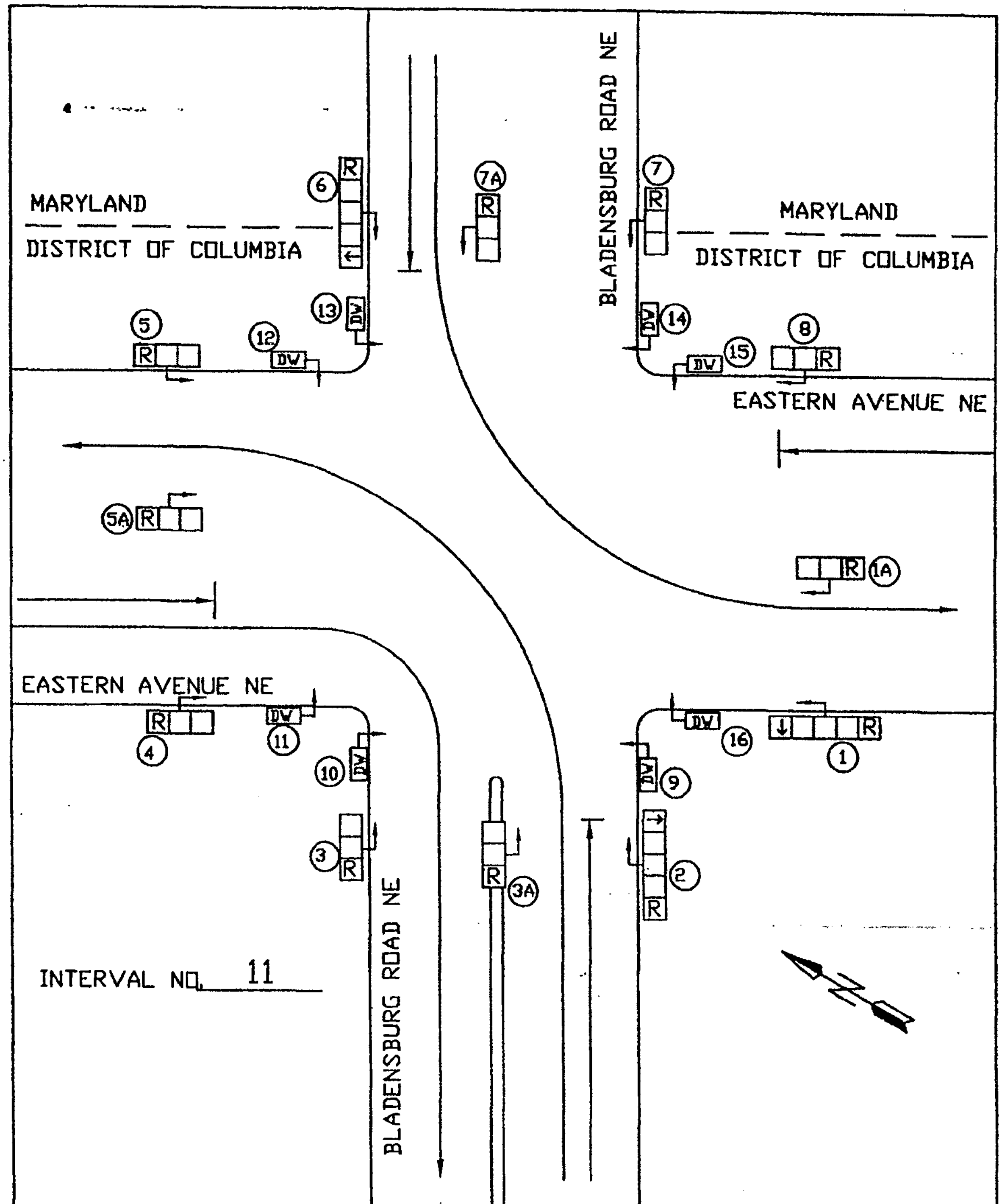
SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS



TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : ____ CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : ____ DIVISION CHIEF	10 OF 13
IN SERVICE:		



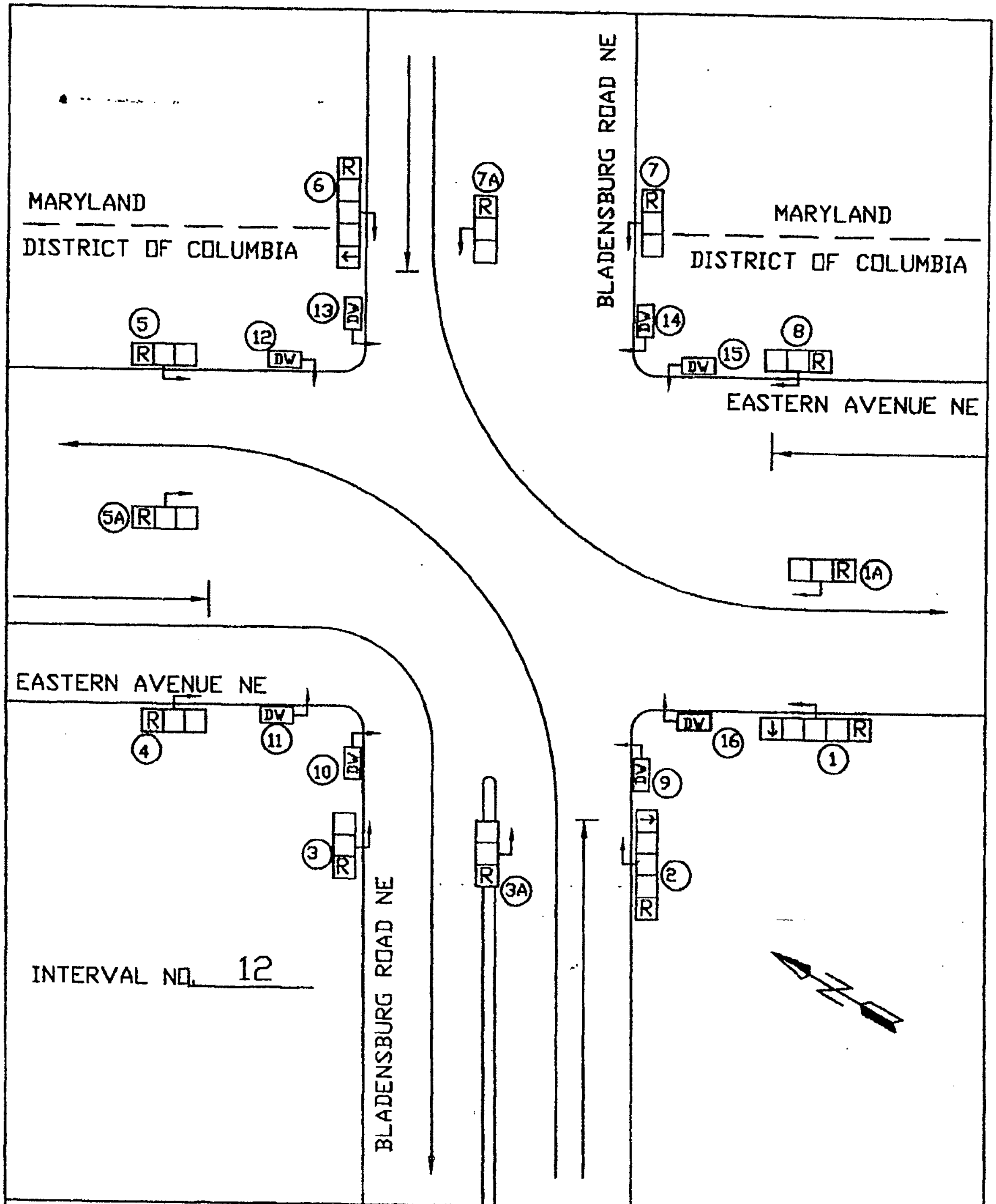
SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	11 OF 13
IN SERVICE:		

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

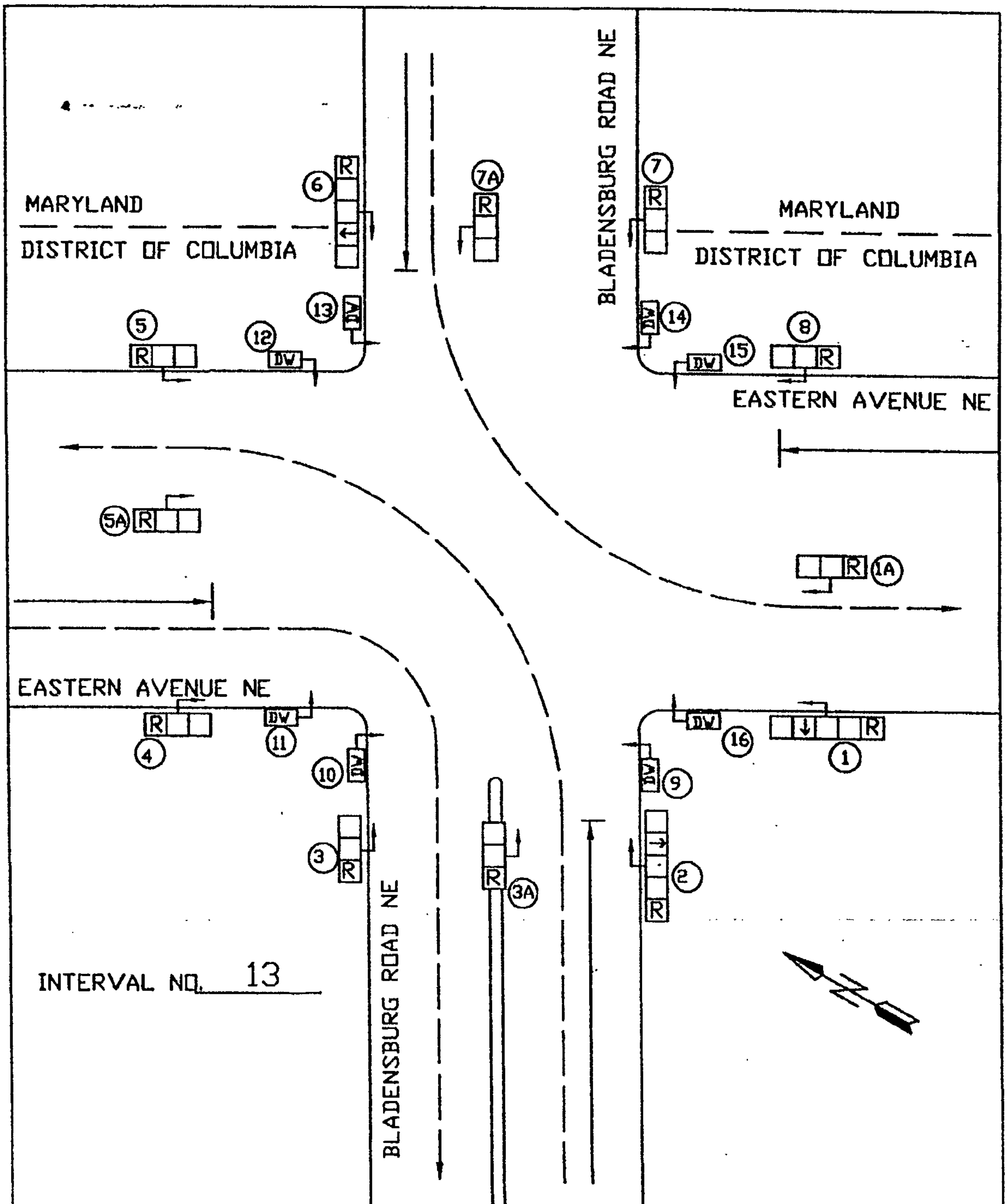


TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH	APPROVED BY : DIVISION CHIEF	12 OF 13
IN SERVICE:		

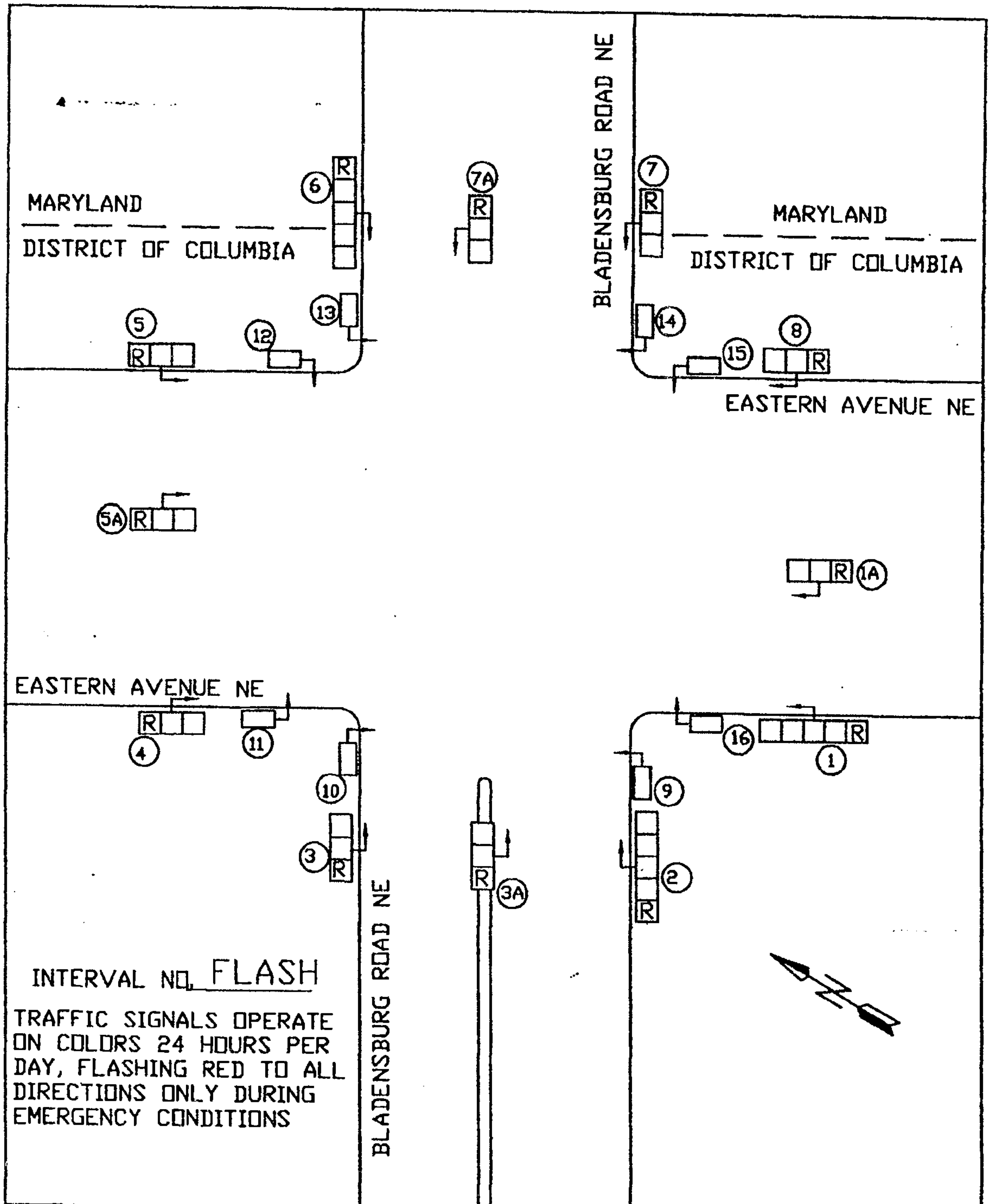
SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS



TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS BUREAU OF TRAFFIC SERVICES TRAFFIC SIGNAL SYSTEM DIVISION	DESIGNED BY :	T.S. 252-G
CHECK BY:	SUBMITTED BY : CHIEF OF SIGNAL DESIGN BRANCH	SHEET
DRAWN BY: TH		
IN SERVICE:	APPROVED BY : DIVISION CHIEF	13 OF 13



INTERVAL NO. FLASH

TRAFFIC SIGNALS OPERATE ON COLORS 24 HOURS PER DAY, FLASHING RED TO ALL DIRECTIONS ONLY DURING EMERGENCY CONDITIONS

SIGNAL HEAD NO. 1A, 3A, 5A, AND 7A ARE MOUNTED ON 8 FOOT LONG MAST ARMS

TRAFFIC SIGNAL OPERATION

EASTERN AVENUE AND BLADENSBURG ROAD, N.E.

D.C. DEPARTMENT OF PUBLIC WORKS
BUREAU OF TRAFFIC SERVICES
TRAFFIC SIGNAL SYSTEM DIVISION

CHECK BY:
DRAWN BY: TH
IN SERVICE:

DESIGNED BY :

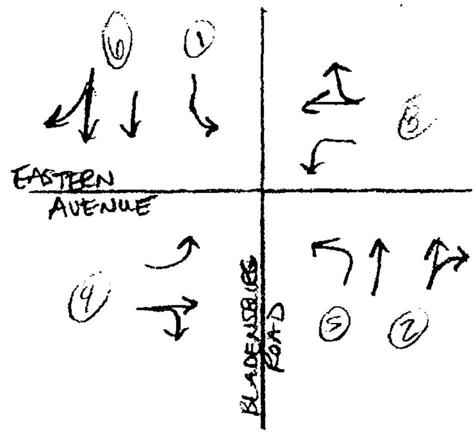
SUBMITTED BY :
CHIEF OF SIGNAL DESIGN BRANCH

APPROVED BY :
DIVISION CHIEF

T.S.
252-G

SHEET
FLASH

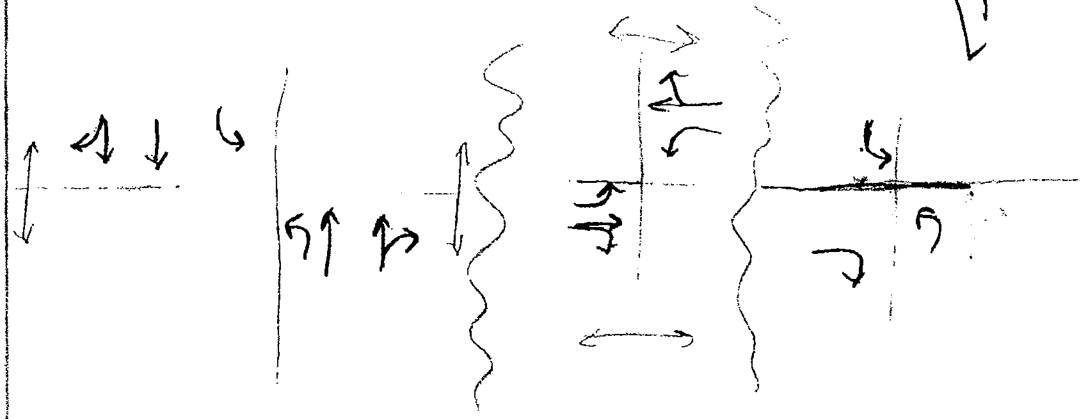
2921 FORT LINCOLN PHASE 2 / WASHINGTON D.C. 10/24/05



CYCLE LENGTH
AM - 100 sec.
PM - 100 sec.

OFFSET
AM - 66 sec.
PM - 24 sec.

[NEW TIMINGS]



AM	GREEN	40	37	8
	YELLOW	4	4	5
	RED	1	1	0
	FW	31	18	0
	FDW	9	19	0
PM	GREEN	36	37	12
	YELLOW	4	4	5
	RED	1	1	0
	FW	27	18	0
	FDW	9	19	0

ANM 6/6/06

APPENDIX D

Existing Capacity Analyses

WELLS + ASSOCIATES

Lane Configurations	↰	↱		↰	↱		↰	↑↑↱		↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	0.98		1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1621		1711	1834		1711	3371		1945	3460	
Flt Permitted	0.44	1.00		0.35	1.00		0.10	1.00		0.59	1.00	
Satd. Flow (perm)	765	1621		624	1834		176	3371		1211	3460	
Volume (vph)	157	197	163	67	254	29	72	205	20	41	882	405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	171	214	177	73	276	32	78	223	22	45	959	440
RTOR Reduction (vph)	0	30	0	0	4	0	0	8	0	0	54	0
Lane Group Flow (vph)	171	361	0	73	304	0	78	237	0	45	1345	0
Confl. Peds. (#/hr)							2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	37.0	37.0		37.0	37.0		48.0	40.0		48.0	40.0	
Effective Green, g (s)	38.0	38.0		38.0	38.0		50.0	41.0		50.0	41.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.41		0.50	0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	291	616		237	697		226	1382		672	1419	
v/s Ratio Prot		0.22			0.17		c0.03	0.07		0.01	c0.39	
v/s Ratio Perm	c0.22			0.12			0.14			0.03		
v/c Ratio	0.59	0.59		0.31	0.44		0.35	0.17		0.07	0.95	
Uniform Delay, d1	24.7	24.7		21.8	23.0		20.2	18.7		12.8	28.5	
Progression Factor	1.00	1.00		1.00	1.00		2.72	2.07		1.00	1.00	
Incremental Delay, d2	8.4	4.1		3.3	2.0		3.8	0.2		0.2	14.3	
Delay (s)	33.2	28.8		25.1	25.0		58.8	39.1		13.0	42.8	
Level of Service	C	C		C	C		E	D		B	D	
Approach Delay (s)		30.1			25.0			43.8			41.9	
Approach LOS		C			C			D			D	

HCM Average Control Delay	37.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Configurations	↰	↱		↰	↱		↰	↑↑↱		↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	0.96		1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1617		1711	1789		1708	3387		1945	3394	
Flt Permitted	0.45	1.00		0.33	1.00		0.33	1.00		0.29	1.00	
Satd. Flow (perm)	779	1617		596	1789		597	3387		586	3394	
Volume (vph)	339	199	174	16	204	73	182	563	36	38	320	210
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	368	216	189	17	222	79	198	612	39	41	348	228
RTOR Reduction (vph)	0	32	0	0	13	0	0	4	0	0	110	0
Lane Group Flow (vph)	368	373	0	17	288	0	198	647	0	41	466	0
Confl. Peds. (#/hr)							10		8	8		10
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	37.0	37.0		37.0	37.0		48.0	36.0		48.0	36.0	
Effective Green, g (s)	38.0	38.0		38.0	38.0		50.0	37.0		50.0	37.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.37		0.50	0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	296	614		226	680		443	1253		470	1256	
v/s Ratio Prot		0.23			0.16		c0.06	c0.19		0.01	0.14	
v/s Ratio Perm	c0.47			0.03			0.17			0.03		
v/c Ratio	1.24	0.61		0.08	0.42		0.45	0.52		0.09	0.37	
Uniform Delay, d1	31.0	25.0		19.8	22.9		14.7	24.5		13.4	23.0	
Progression Factor	1.00	1.00		1.00	1.00		1.27	1.33		1.00	1.00	
Incremental Delay, d2	134.7	4.4		0.6	1.9		2.5	1.2		0.4	0.8	
Delay (s)	165.7	29.4		20.4	24.8		21.1	33.7		13.7	23.8	
Level of Service	F	C		C	C		C	C		B	C	
Approach Delay (s)		94.3			24.6			30.8			23.2	
Approach LOS		F			C			C			C	

HCM Average Control Delay	47.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX E

Level of Service Descriptions

Level of Service Criteria[1]

Level of service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Specifically, level of service criteria is stated in terms of the average control delay per vehicle. The criteria for signalized intersections are given in Table I. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio and the volume to capacity ratio for the lane group in question.

Table I
Level-of-Service Criteria for Signalized Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (SEC/VEH)
A	≤10.0
B	> 10.0 and ≤ 20.0
C	> 20.0 and ≤ 35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	> 80.0

LOS A describes operations with very low delay, up to 10 seconds per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

LOS B describes operations with delay greater than 10 and up to 20 seconds per vehicle. This level generally occurs with good progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average delay.

LOS C describes operations with delay greater than 20 and up to 35 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with delay greater than 35 and up to 55 seconds per vehicle. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from a combination of unfavorable progression, long cycle lengths or high volume to capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with delay greater than 55 and up to 80 seconds per vehicle. These high delay values generally indicate poor progression, long cycle lengths and high volume to capacity ratios. Individual cycle failures are frequent occurrences.

LOS F describes operations with delay in excess of 80 seconds per vehicle. This level, considered to be unacceptable to most drivers, often occurs with over saturation, that is, when arrival flow rates exceed the capacity of the intersection. It also may occur at high volume to capacity ratios with many individual cycle failures. Poor progression and long cycle lengths also may be major contributing causes to such delay levels.

The level of service criteria for stop controlled intersections is given in Table 2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue. The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation.

Table 2
Level of Service Criteria for Stop Controlled Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (SEC/VEH)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

The level of service criteria for stop controlled intersections is somewhat different from the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, several driver behavior considerations combine to make delays at signalized intersections less onerous than at unsignalized intersections.

For example, drivers at signalized intersections are able to relax during the red interval, where drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized intersections than signalized intersections. For these reasons, it is considered that the total delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection.

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[1] Highway Capacity Manual, Transportation Research Board, Washington D.C., 2000.

APPENDIX F

DDOT Crash Data

DDOT: Accident Summary Report (R-4)

Date: 2/26/2008
Prepared by: Pam

Location:
BLADENSBURG RD And FORT LINCOLN DR

Quadrant:
NE

Summary for the time period of: 01/01/2004 To 12/31/2004
Total Number of Accident: 1
Total Number of Injuries: 1

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
0	0.00%	0	0.00%	0	0.00%	1	100.00%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
0	0	0	0	0	0	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
1	0	0	0	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	1	100.00%
09:30-11:30	0	0.00%
11:30:13:30	0	0.00%
13:30-16:00	0	0.00%
16:00-18:30	0	0.00%
18:30-07:30	0	0.00%
Weekday	0	0.00%
Weekend	1	100.00%

Day of Week	# ACC	Percent
Sunday	1	100.00%
Monday	0	0.00%
Tuesday	0	0.00%
Wednesday	0	0.00%
Thursday	0	0.00%
Friday	0	0.00%
Saturday	0	0.00%

Road Condition	# ACC	Percent
Dry	0	0.00%
Wet	1	100.00%
Repairing	0	0.00%
Ice/Snow	0	0.00%
Unknown	0	0.00%

Light Condition	# ACC	Percent
Daylight	1	100.00%
Dawn/Dusk	0	0.00%
Dark	0	0.00%
Unknown	0	0.00%

DDOT: Accident Summary Report (R-4)

Date: 2/26/2008
Prepared by: Pam

Location:
BLADENSBURG RD And **FORT LINCOLN DR**

Quadrant:
NE

Summary for the time period of: 01/01/2006 To 12/31/2006
Total Number of Accident: 0
Total Number of Injuries: 0

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
0	0.00%	0	0.00%	0	0.00%	0	0.00%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
0	0	0	0	0	0	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
0	0	0	0	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	0	0.00%
09:30-11:30	0	0.00%
11:30:13:30	0	0.00%
13:30-16:00	0	0.00%
16:00-18:30	0	0.00%
18:30-07:30	0	0.00%
Weekday	0	0.00%
Weekend	0	0.00%

Day of Week	# ACC	Percent
Sunday	0	0.00%
Monday	0	0.00%
Tuesday	0	0.00%
Wednesday	0	0.00%
Thursday	0	0.00%
Friday	0	0.00%
Saturday	0	0.00%

Road Condition	# ACC	Percent
Dry	0	0.00%
Wet	0	0.00%
Repairing	0	0.00%
Ice/Snow	0	0.00%
Unknown	0	0.00%

Light Condition	# ACC	Percent
Daylight	0	0.00%
Dawn/Dusk	0	0.00%
Dark	0	0.00%
Unknown	0	0.00%

DDOT: Accident Summary Report (R-4)

Date: 2/28/2008
Prepared by: Pam

Location:
BLADENSBURG RD And **FORT LINCOLN DR**

Quadrant:
NE

Summary for the time period of: 01/01/2005 To 12/31/2005
Total Number of Accident: 0
Total Number of Injuries: 0

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
0	0.00%	0	0.00%	0	0.00%	0	0.00%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
0	0	0	0	0	0	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
0	0	0	0	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	0	0.00%
09:30-11:30	0	0.00%
11:30:13:30	0	0.00%
13:30-16:00	0	0.00%
16:00-18:30	0	0.00%
18:30-07:30	0	0.00%
Weekday	0	0.00%
Weekend	0	0.00%

Day of Week	# ACC	Percent
Sunday	0	0.00%
Monday	0	0.00%
Tuesday	0	0.00%
Wednesday	0	0.00%
Thursday	0	0.00%
Friday	0	0.00%
Saturday	0	0.00%

Road Condition	# ACC	Percent
Dry	0	0.00%
Wet	0	0.00%
Repairing	0	0.00%
Ice/Snow	0	0.00%
Unknown	0	0.00%

Light Condition	# ACC	Percent
Daylight	0	0.00%
Dawn/Dusk	0	0.00%
Dark	0	0.00%
Unknown	0	0.00%

DDOT: Accident Summary Report (R-4)

Date: 2/26/2008
Prepared by: Pam

Location:
BLADENSBURG RD And **EASTERN AVE**

Quadrant:
NE

Summary for the time period of: 01/01/2004 To 12/31/2004
Total Number of Accident: 15
Total Number of Injuries: 5

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
6	40.00%	0	0.00%	1	6.67%	8	53.33%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
2	8	0	4	0	0	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
1	0	0	0	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	0	0.00%
09:30-11:30	1	6.67%
11:30:13:30	1	6.67%
13:30-16:00	1	6.67%
16:00-18:30	2	13.33%
18:30-07:30	10	66.67%
Weekday	7	46.67%
Weekend	6	40.00%

Day of Week	# ACC	Percent
Sunday	1	6.67%
Monday	0	0.00%
Tuesday	2	13.33%
Wednesday	0	0.00%
Thursday	2	13.33%
Friday	3	20.00%
Saturday	5	33.33%

Road Condition	# ACC	Percent
Dry	11	73.33%
Wet	2	13.33%
Repairing	0	0.00%
Ice/Snow	1	6.67%
Unknown	1	6.67%

Light Condition	# ACC	Percent
Daylight	6	40.00%
Dawn/Dusk	0	0.00%
Dark	9	60.00%
Unknown	0	0.00%

DDOT: Accident Summary Report (R-4)

Date: 2/26/2008
Prepared by: Pam

Location:
BLADENSBURG RD And **EASTERN AVE**

Quadrant
NE

Summary for the time period of: 01/01/2005 To 12/31/2005
Total Number of Accident: 11
Total Number of Injuries: 8

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
7	63.64%	0	0.00%	1	9.09%	3	27.27%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
0	2	0	5	2	0	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
0	0	0	0	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	0	0.00%
09:30-11:30	0	0.00%
11:30:13:30	0	0.00%
13:30-16:00	0	0.00%
16:00-18:30	6	54.55%
18:30-07:30	5	45.45%
Weekday	10	90.91%
Weekend	1	9.09%

Day of Week	# ACC	Percent
Sunday	1	9.09%
Monday	0	0.00%
Tuesday	2	18.18%
Wednesday	0	0.00%
Thursday	3	27.27%
Friday	5	45.45%
Saturday	0	0.00%

Road Condition	# ACC	Percent
Dry	9	81.82%
Wet	2	18.18%
Repairing	0	0.00%
Ice/Snow	0	0.00%
Unknown	0	0.00%

Light Condition	# ACC	Percent
Daylight	5	45.45%
Dawn/Dusk	2	18.18%
Dark	4	36.36%
Unknown	0	0.00%

DDOT: Accident Summary Report (R-4)

Date: 2/26/2008
Prepared by: Pam

Location:
BLADENSBURG RD And **EASTERN AVE**

Quadrant:
NE

Summary for the time period of: 01/01/2006 To 12/31/2006
Total Number of Accident: 10
Total Number of Injuries: 9

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
6	60.00%	0	0.00%	1	10.00%	2	20.00%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
1	2	0	1	4	1	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
0	0	0	1	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	1	10.00%
09:30-11:30	0	0.00%
11:30:13:30	1	10.00%
13:30-16:00	3	30.00%
16:00-18:30	3	30.00%
18:30-07:30	2	20.00%
Weekday	6	60.00%
Weekend	3	30.00%

Day of Week	# ACC	Percent
Sunday	0	0.00%
Monday	1	10.00%
Tuesday	1	10.00%
Wednesday	0	0.00%
Thursday	3	30.00%
Friday	1	10.00%
Saturday	3	30.00%

Road Condition	# ACC	Percent
Dry	8	80.00%
Wet	1	10.00%
Repairing	1	10.00%
Ice/Snow	0	0.00%
Unknown	0	0.00%

Light Condition	# ACC	Percent
Daylight	8	80.00%
Dawn/Dusk	0	0.00%
Dark	2	20.00%
Unknown	0	0.00%

DDOT: Accident Summary Report (R-4)

Date: 6/20/2006
Prepared by: Yusuf

Location:
BLADENSBURG RD And **EASTERN AVE**

Quadrant:
NE

Summary for the time period of: 01/01/2000 To 12/31/2005
Total Number of Accident: 33
Total Number of Injuries: 20

Contributing Factors:

Diver:		Vehicle:		Roadway:		Unknown:	
15	45.45%	0	0.00%	3	9.09%	15	45.45%

Collision Types:

Right Angle:	Left Turn:	Right Turn:	Rear End:	Side Swiped:	Head On:	Parked:
5	12	0	10	3	0	0

Fixed Object:	Ran Off Road:	Pedestrian:	Backing:	Non Collision:	Other:
1	0	0	0	0	0

Accident Times:

Time	# ACC	Percent
07:30-09:30	0	0.00%
09:30-11:30	1	3.03%
11:30:13:30	2	6.06%
13:30-16:00	3	9.09%
16:00-18:30	10	30.3%
18:30-07:30	17	51.52%
Weekday	21	63.64%
Weekend	10	30.3%

Day of Week	# ACC	Percent
Sunday	3	9.09%
Monday	2	6.06%
Tuesday	5	15.15%
Wednesday	0	0.00%
Thursday	6	18.18%
Friday	8	24.24%
Saturday	7	21.21%

Road Condition	# ACC	Percent
Dry	26	78.79%
Wet	4	12.12%
Repairing	0	0.00%
Ice/Snow	1	3.03%
Unknown	2	6.06%

Light Condition	# ACC	Percent
Daylight	15	45.45%
Dawn/Dusk	5	15.15%
Dark	13	39.39%
Unknown	0	0.00%

APPENDIX G

Internal Trip Worksheets

Table 3-1
Pipeline Trip Generation Summary [1]

Land Use	ITE Code	Size	Units	AM Peak Hour IN	AM Peak Hour OUT	AM Peak Hour TOTAL	PM Peak Hour IN	PM Peak Hour OUT	PM Peak Hour TOTAL	Weekday ADT
The Village At Washington Gateway										
Residential Condominium/Townhouse	230	357	DU							
Vehicle Trips				24	119	143	115	56	171	1,893
Internal Capture (Retail to Residential)				-	-	-	36	30	66	672
External Trips (Total - Internal)				24	119	143	79	26	105	1,221
- modal split (7% non-auto mode) [2]				2	8	10	6	2	7	85
External Vehicle Trips (External - Transit)				*22*	*111*	*133*	*73*	*24*	*98*	*1,136*
Dakota Crossing										
Residential Condominium/Townhouse	230	167	DU							
Vehicle Trips				13	65	78	62	30	92	993
Internal Capture (Retail to Residential)				-	-	-	19	16	35	352
External Trips (Total - Internal)				13	65	78	43	14	57	641
- modal split (12% non-auto mode) [2]				2	8	9	5	2	7	77
External Vehicle Trips (External - Transit)				*11*	*57*	*69*	*38*	*12*	*50*	*564*
Wesley House										
Senior Adult Housing - Attached	252	127	DU							
Vehicle Trips				5	5	10	9	5	14	442
Internal Capture (Retail to Residential)				-	-	-	3	3	6	157
External Trips (Total - Internal)				5	5	10	6	2	8	285
- modal split				-	-	-	-	-	-	-
External Vehicle Trips (External - Transit)				*5*	*5*	*10*	*6*	*2*	*8*	*285*
Washington Gateway										
Shopping Center	820	281,000	SF							
Vehicle Trips				178	113	291	594	644	1,238	13,292
Internal Capture (Retail to Retail)				-	-	-	130	133	263	3,793
Subtotal 1 (Total - Internal)				178	113	291	464	511	975	9,499
Internal Capture (Retail to Residential)				-	-	-	26	33	59	742
External Trips (Subtotal 1 - Internal)				178	113	291	438	478	916	8,757
- modal split (5% non-auto mode - AM; 10% non-auto mode - PM)				9	6	15	44	48	92	-
External Vehicle Trips (External - Transit)				169	107	276	394	430	824	8,757
- Pass-by Trips [3]		27%		-	-	-	106	116	222	-
Shopping Center Subtotal Net New Trips				169	107	276	287	314	601	8,757
Discount Club	861	154,000	SF							
Vehicle Trips				61	25	86	327	326	653	6,437
Internal Capture (Retail to Retail)				-	-	-	130	130	260	3,697
Subtotal 1 (Total - Internal)				61	25	86	197	196	393	2,740
Internal Capture (Retail to Residential)				-	-	-	11	13	24	214
External Trips (Subtotal 1 - Internal)				61	25	86	186	183	369	2,526
- modal split				-	-	-	-	-	-	-
External Vehicle Trips (External - Transit)				61	25	86	186	183	369	2,526
- Pass-by Trips [3]		27%		-	-	-	50	50	100	-
Discount Club Subtotal Net New Trips				61	25	86	136	134	270	2,526
Grocery Store	850	65,000	SF							
Vehicle Trips				129	82	211	339	325	664	6,646
Internal Capture (Retail to Retail)				-	-	-	133	130	263	3,758
Subtotal 1 (Total - Internal)				129	82	211	206	195	401	2,888
Internal Capture (Retail to Residential)				-	-	-	12	13	24	225
External Trips (Subtotal 1 - Internal)				129	82	211	194	182	377	2,663
- modal split (5% non-auto mode - AM; 10% non-auto mode - PM)				6	4	11	19	18	38	-
External Vehicle Trips (External - Transit)				123	78	200	175	164	339	2,663
- Pass-by Trips [3]		27%		-	-	-	47	44	92	-
Discount Club Subtotal Net New Trips				123	78	200	128	120	248	2,663
Washington Gateway Total		500,000	SF							
Vehicle Trips				368	220	588	1,260	1,295	2,555	26,375
Internal Capture (Retail to Retail)				-	-	-	393	393	786	11,248
Subtotal 1 (Total - Internal)				368	220	588	867	902	1,769	15,127
Internal Capture (Retail to Residential)				-	-	-	49	58	107	1,181
External Trips (Subtotal 1 - Internal)				368	220	588	818	844	1,662	13,946
- modal split				15	10	26	63	66	130	-
External Vehicle Trips (External - Transit)				353	210	562	755	778	1,532	13,946
- Pass-by Trips [3]				-	-	-	204	210	414	-
Washington Gateway Net New Trips				353	210	562	551	568	1,119	13,946
Total										
Vehicle Trips				410	409	819	1,446	1,386	2,832	29,703
Internal Capture (Retail to Retail)				-	-	-	393	393	786	11,248
Subtotal 1 (Total - Internal)				410	409	819	1,053	993	2,046	18,455
Internal Capture (Retail to Residential)				-	-	-	107	107	214	2,362
External Trips (Subtotal 1 - Internal)				410	409	819	946	886	1,832	16,093
- modal split				19	26	45	74	70	144	162
External Vehicle Trips (External - Transit)				391	383	774	872	816	1,688	15,931
- Pass-by Trips				-	-	-	204	210	414	-
Net New Trips				391	383	774	668	606	1,274	15,931

Notes:
[1] Trip generation based on the Institute of Transportation Engineers' Trip Generation, 7th Edition.
[2] Modal split taken from the respective traffic impact study.
[3] Pass-by percentage based on standard ITE rates and equations.

Analyst AMS
Date 2/21/2008

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Job Number 4046
Time Period AM Peak

Background

LAND USE A Residential
ITE LU Code 230
Size 357 DU

	Total	Internal	External
Enter	24		24
Exit	119		119
Total	143		143
%	100%		100%

Demand Balanced Demand

Demand Balanced Demand

LAND USE B Residential
ITE LU Code 230
Size 167 DU

	Total	Internal	External
Enter	13		13
Exit	65		65
Total	78		78
%	100%		100%

Demand
Balanced
Demand

Demand
Balanced
Demand

Demand
Balanced
Demand

Demand
Balanced
Demand

Demand
Balanced
Demand

Demand
Balanced
Demand

Demand
Balanced
Demand

Demand
Balanced
Demand

LAND USE C Retail
ITE LU Code 820/850/861
Size 500,000 SF

	Total	Internal	External
Enter	368		368
Exit	220		220
Total	588		588
%	100%		100%

Demand Balanced Demand

Demand Balanced Demand

LAND USE D Senior Adult
ITE LU Code 252
Size 127 DU

	Total	Internal	External
Enter	5		5
Exit	5		5
Total	10		10
%	100%		100%

Analyst AMS
Date 2/21/2008

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Job Number 4046
Time Period PM Peak

Background

LAND USE A
ITE LU Code
Size

	Total	Internal	External
Enter			
Exit			
Total			
%	#DIV/0!	#DIV/0!	#DIV/0!

LAND USE B Grocery Store
ITE LU Code 850
Size 65,000 SF

	Total	Internal	External
Enter	339	133	206
Exit	325	130	195
Total	664	263	401
%	100%	40%	60%

LAND USE C Shopping Center
ITE LU Code 820
Size 281,000 SF

	Total	Internal	External
Enter	594	130	464
Exit	644	133	511
Total	1238	263	975
%	100%	21%	79%

LAND USE D Discount Club
ITE LU Code 861
Size 154,000 SF

	Total	Internal	External
Enter	327	130	197
Exit	326	130	196
Total	653	260	393
%	100%	40%	60%

A–B: Demand | Balanced | Demand ; Demand | Balanced | Demand

A–C: Demand | Balanced | Demand ; Demand | Balanced | Demand

A–D: Demand | Balanced | Demand ; Demand | Balanced | Demand

B–C: Demand 20% 65 | Balanced 65 | Demand 20% 119 ; Demand 20% 68 | Balanced 68 | Demand 20% 129

B–D: Demand 20% 65 | Balanced 65 | Demand 20% 65 ; Demand 20% 68 | Balanced 65 | Demand 20% 65

C–D: Demand 20% 119 | Balanced 65 | Demand 20% 65 ; Demand 20% 129 | Balanced 65 | Demand 20% 65

Analyst AMS
Date 2/21/2008

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Job Number 4046
Time Period PM Peak

Background

LAND USE A Residential
ITE LU Code 230
Size 357 DU

	Total	Internal	External
Enter	115	36	79
Exit	56	30	26
Total	171	66	105
%	100%	39%	61%

LAND USE B Residential
ITE LU Code 230
Size 167 DU

	Total	Internal	External
Enter	62	19	43
Exit	30	16	14
Total	92	35	57
%	100%	38%	62%

Demand | Balanced | Demand
Demand | Balanced | Demand

Demand 53% 16
Balanced 16

Demand
Demand 53% 30
Balanced 30
Demand 9% 78

Demand 31% 36
Balanced 36
Demand 12% 108

Balanced
Demand

Demand 9% 78
Demand

Demand 31% 19
Balanced 19
Balanced
Demand

Demand 12% 108

Demand | Demand
Balanced | Balanced
Demand | Demand

LAND USE C Retail
ITE LU Code 820/850/861
Size 500,000 SF

	Total	Internal	External
Enter	867	49	818
Exit	902	58	844
Total	1769	107	1,662
%	100%	6%	94%

Demand 9% 78 | Balanced 3 | Demand 53% 3
Demand 12% 108 | Balanced 3 | Demand 31% 3

LAND USE D Senior Adult
ITE LU Code 252
Size 127 DU

	Total	Internal	External
Enter	9	3	6
Exit	5	3	2
Total	14	6	8
%	100%	43%	57%

Analyst AMS
Date 2/21/2008

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Job Number 4046
Time Period ADT

Background

LAND USE A
ITE LU Code
Size

	Total	Internal	External
Enter			
Exit			
Total			
%	#DIV/0!	#DIV/0!	#DIV/0!

Demand | |
Balanced
Demand | |

Demand | |
Balanced
Demand | |

Demand | |
Balanced
Demand | |

LAND USE B Grocery Store
ITE LU Code 850
Size 65,000 SF

	Total	Internal	External
Enter	3323	1,860	1,463
Exit	3323	1,898	1,425
Total	6646	3,758	2,888
%	100%	57%	43%

Demand | |
Balanced
Demand | |

Demand 30% | 997
Balanced 997
Demand 28% | 1861

Demand | |
Balanced
Demand | |

Demand 30% | 997
Balanced 901
Demand 28% | 901

Demand 28% | 930
Balanced 930
Demand 30% | 965

Demand 28% | 930
Balanced 930
Demand 30% | 1994

LAND USE C Shopping Center
ITE LU Code 820
Size 281,000 SF

	Total	Internal	External
Enter	6646	1,962	4,684
Exit	6646	1,831	4,815
Total	13292	3,793	9,499
%	100%	29%	71%

Demand 28% | 1861
Balanced 965
Demand 30% | 965

30% | 1994
Demand
901
Balanced
28% | 901
Demand

LAND USE D Discount Club
ITE LU Code 861
Size 154,000 SF

	Total	Internal	External
Enter	3219	1802	1417
Exit	3218	1895	1323
Total	6437	3697	2740
%	100%	57%	43%

Analyst AMS
Date 2/21/2008

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Job Number 4046
Time Period ADT

Background

LAND USE A Residential
ITE LU Code 230
Size 357 DU

	Total	Internal	External
Enter	947	313	634
Exit	946	359	587
Total	1893	672	1,221
%	100%	35%	65%

LAND USE B Residential
ITE LU Code 230
Size 167 DU

	Total	Internal	External
Enter	497	164	333
Exit	496	188	308
Total	993	352	641
%	100%	35%	65%

LAND USE C Retail
ITE LU Code 820/850/861
Size 500,000 SF

	Total	Internal	External
Enter	7564	631	6,933
Exit	7563	550	7,013
Total	15127	1,181	13,946
%	100%	8%	92%

LAND USE D Senior Adult
ITE LU Code 252
Size 127 DU

	Total	Internal	External
Enter	221	73	148
Exit	221	84	137
Total	442	157	285
%	100%	36%	64%

Demand 38% 359
Balanced 359
Demand 9% 681

Demand 33% 313
Balanced 313
Demand 11% 832

Demand 38% 188
Balanced 188
Demand 9% 681

Demand 33% 164
Balanced 164
Demand 11% 832

Demand 9% 681
Balanced 84
Demand 38% 84

Demand 11% 832
Balanced 73
Demand 33% 73

APPENDIX H

Pipeline Development Trip Assignments

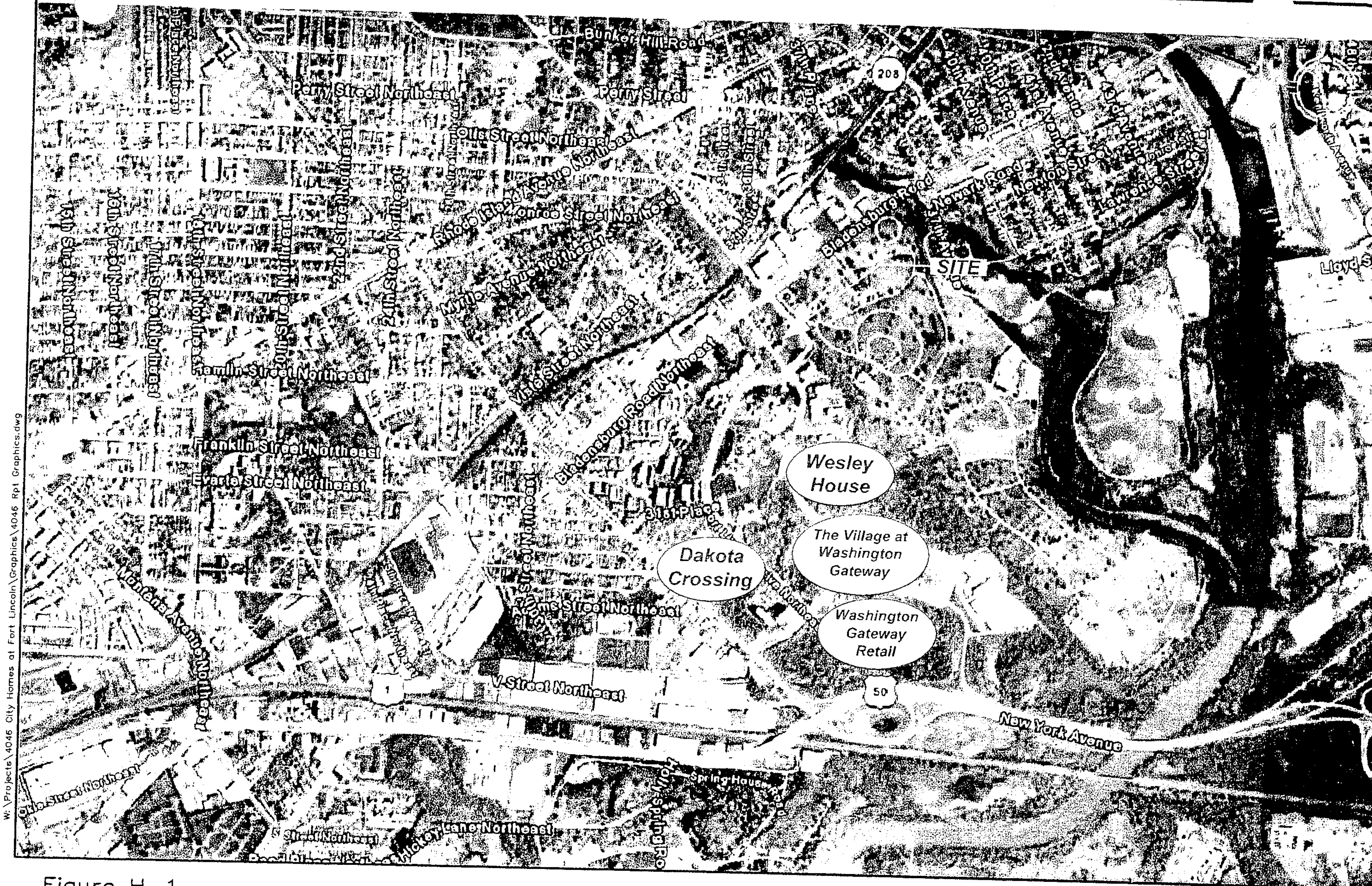


Figure H–1
Location of Pipeline Developments

City Homes at Fort Lincoln
Washington, D.C.

Wells + Associates, Inc.

W:\Projects\4046 City Homes at Fort Lincoln\Graphics\4046 Rpt Graphics.dwg

Figure H-2
Village at Washington Gateway
Site Trips

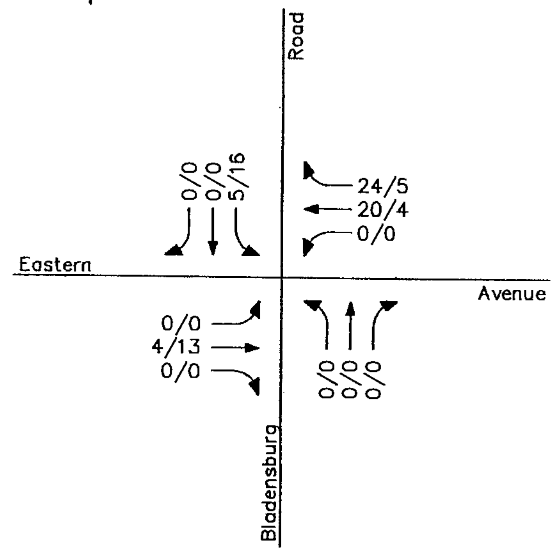


Figure H-3
Dakota Crossing Site Trips

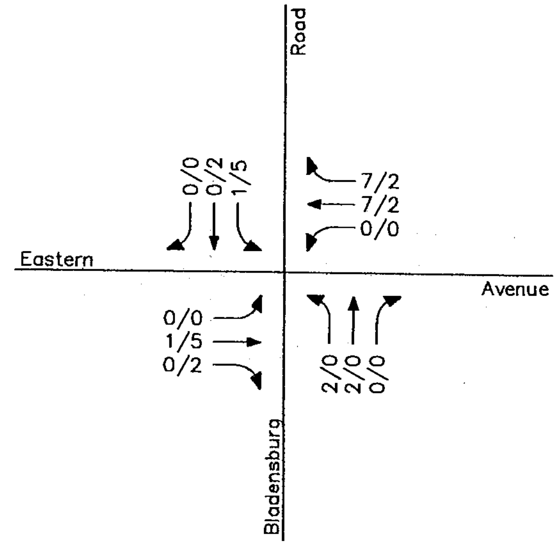


Figure H-4
Wesley House Site Trips

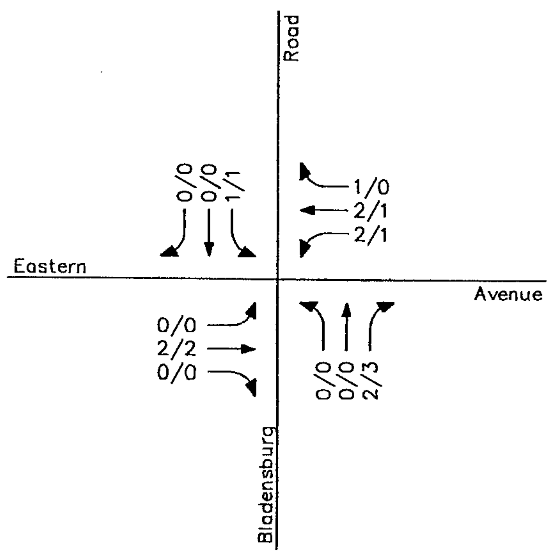
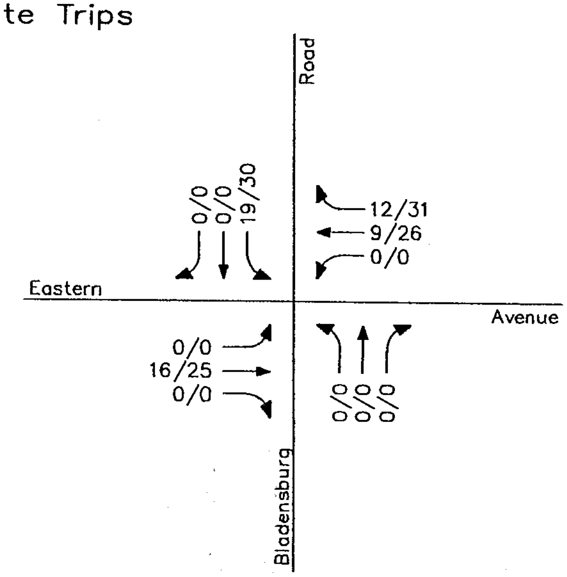
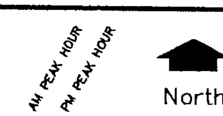


Figure H-5
Washington Gateway Retail
Site Trips



Pipeline Development Site Trips



City Homes at Fort Lincoln
Washington, D.C.

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APPENDIX I

2010 Background Capacity Analyses

Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.97		1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1628		1711	1807		1711	3366		1945	3460	
Flt Permitted	0.33	1.00		0.31	1.00		0.10	1.00		0.58	1.00	
Satd. Flow (perm)	579	1628		561	1807		176	3366		1196	3460	
Volume (vph)	160	224	166	70	297	74	75	211	23	69	900	413
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	243	180	76	323	80	82	229	25	75	978	449
RTOR Reduction (vph)	0	27	0	0	9	0	0	8	0	0	54	0
Lane Group Flow (vph)	174	396	0	76	394	0	82	246	0	75	1373	0
Confl. Peds. (#/hr)							2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	37.0	37.0		37.0	37.0		48.0	40.0		48.0	40.0	
Effective Green, g (s)	38.0	38.0		38.0	38.0		50.0	41.0		50.0	41.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.41		0.50	0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	220	619		213	687		226	1380		665	1419	
v/s Ratio Prot		0.24			0.22		c0.03	0.07		0.01	c0.40	
v/s Ratio Perm	c0.30			0.14			0.15			0.05		
v/c Ratio	0.79	0.64		0.36	0.57		0.36	0.18		0.11	0.97	
Uniform Delay, d1	27.5	25.4		22.2	24.6		20.7	18.8		13.0	28.9	
Progression Factor	1.00	1.00		1.00	1.00		2.71	2.07		1.00	1.00	
Incremental Delay, d2	24.5	5.0		4.6	3.5		4.1	0.3		0.3	17.4	
Delay (s)	52.0	30.4		26.8	28.0		60.2	39.2		13.3	46.2	
Level of Service	D	C		C	C		E	D		B	D	
Approach Delay (s)		36.7			27.9			44.3			44.6	
Approach LOS		D			C			D			D	

HCM Average Control Delay	40.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.95		1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1629		1711	1773		1708	3384		1946	3395	
Flt Permitted	0.35	1.00		0.27	1.00		0.32	1.00		0.28	1.00	
Satd. Flow (perm)	616	1629		479	1773		581	3384		567	3395	
Volume (vph)	346	248	179	17	240	113	186	574	40	91	328	214
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	270	195	18	261	123	202	624	43	99	357	233
RTOR Reduction (vph)	0	26	0	0	17	0	0	5	0	0	108	0
Lane Group Flow (vph)	376	439	0	18	367	0	202	662	0	99	482	0
Confl. Peds. (#/hr)							10		8	8		10
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	37.0	37.0		37.0	37.0		48.0	36.0		48.0	36.0	
Effective Green, g (s)	38.0	38.0		38.0	38.0		50.0	37.0		50.0	37.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.37		0.50	0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	234	619		182	674		437	1252		463	1256	
v/s Ratio Prot		0.27			0.21		c0.06	c0.20		0.03	0.14	
v/s Ratio Perm	c0.61			0.04			0.17			0.08		
v/c Ratio	1.61	0.71		0.10	0.54		0.46	0.53		0.21	0.38	
Uniform Delay, d1	31.0	26.3		20.0	24.2		14.7	24.7		13.9	23.1	
Progression Factor	1.00	1.00		1.00	1.00		1.27	1.32		1.00	1.00	
Incremental Delay, d2	292.1	6.7		1.1	3.1		2.7	1.2		1.1	0.9	
Delay (s)	323.1	33.1		21.1	27.4		21.5	33.9		14.9	24.0	
Level of Service	F	C		C	C		C	C		B	C	
Approach Delay (s)		162.7			27.1			31.0			22.7	
Approach LOS		F			C			C			C	

HCM Average Control Delay	68.0	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX J

Queuing Analyses

	↗	→	↙	←	↖	↑	↘	↓
Lane Group Flow (vph)	174	423	76	403	82	254	75	1427
v/c Ratio	0.79	0.66	0.36	0.58	0.36	0.18	0.11	0.97
Control Delay	54.9	28.6	28.3	27.8	35.6	37.4	11.6	44.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.9	28.6	28.3	27.8	35.6	37.4	11.6	44.9
Queue Length 50th (ft)	97	197	34	194	46	70	22	436
Queue Length 95th (ft)	#219	307	77	292	m85	m107	43	#603
Internal Link Dist (ft)		468		1141		3067		464
Turn Bay Length (ft)							125	
Base Capacity (vph)	220	645	213	695	226	1388	665	1473
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.66	0.36	0.58	0.36	0.18	0.11	0.97

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

	↗	→	↙	←	↖	↑	↘	↓
Lane Group Flow (vph)	376	465	18	384	202	667	99	590
v/c Ratio	1.61	0.72	0.10	0.56	0.46	0.53	0.21	0.43
Control Delay	318.3	31.5	21.9	26.3	18.5	33.9	12.5	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	318.3	31.5	21.9	26.3	18.5	33.9	12.5	17.4
Queue Length 50th (ft)	~346	228	7	176	101	218	29	101
Queue Length 95th (ft)	#525	350	24	269	m153	276	54	148
Internal Link Dist (ft)		468		1141		3067		464
Turn Bay Length (ft)							125	
Base Capacity (vph)	234	645	182	690	437	1257	463	1364
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.61	0.72	0.10	0.56	0.46	0.53	0.21	0.43

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

	↗	→	↙	←	↖	↑	↘	↓
Lane Group Flow (vph)	174	425	88	415	82	256	75	1427
v/c Ratio	0.78	0.64	0.39	0.58	0.36	0.19	0.12	0.99
Control Delay	52.8	27.5	28.6	27.1	36.7	42.3	12.1	50.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.8	27.5	28.6	27.1	36.7	42.3	12.1	50.8
Queue Length 50th (ft)	96	195	40	198	46	77	22	445
Queue Length 95th (ft)	#217	303	87	296	m86	m115	44	#615
Internal Link Dist (ft)		468		1141		3067		464
Turn Bay Length (ft)							125	
Base Capacity (vph)	223	661	224	713	226	1354	651	1438
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.64	0.39	0.58	0.36	0.19	0.12	0.99

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

	↗	→	↙	←	↖	↑	↘	↓
Lane Group Flow (vph)	376	471	24	388	202	678	103	590
v/c Ratio	1.63	0.73	0.13	0.56	0.46	0.54	0.22	0.43
Control Delay	327.3	32.0	22.9	26.4	18.5	34.0	12.6	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	327.3	32.0	22.9	26.4	18.5	34.0	12.6	17.4
Queue Length 50th (ft)	~348	233	10	178	100	221	30	101
Queue Length 95th (ft)	#526	358	29	273	m153	280	56	148
Internal Link Dist (ft)		468		1141		3067		464
Turn Bay Length (ft)							125	
Base Capacity (vph)	231	645	178	690	437	1255	458	1364
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.63	0.73	0.13	0.56	0.46	0.54	0.22	0.43

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group Flow (vph)	174	425	88	330	85	82	256	75	1427
v/c Ratio	0.77	0.73	0.54	0.52	0.14	0.36	0.17	0.10	0.89
Control Delay	54.0	34.9	41.3	30.1	5.8	32.2	19.4	9.7	31.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.0	34.9	41.3	30.1	5.8	32.2	19.4	9.7	31.5
Queue Length 50th (ft)	98	215	45	167	0	42	41	20	401
Queue Length 95th (ft)	#214	333	#103	253	32	m80	m78	39	#515
Internal Link Dist (ft)		468		570			3067		464
Turn Bay Length (ft)			350					125	
Base Capacity (vph)	226	580	163	633	594	226	1520	716	1611
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.73	0.54	0.52	0.14	0.36	0.17	0.10	0.89

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

	↗	→	↙	←	↖	↖	↑	↘	↓
Lane Group Flow (vph)	376	471	24	264	124	202	678	103	590
v/c Ratio	0.92	0.62	0.09	0.32	0.16	0.54	0.67	0.27	0.52
Control Delay	55.8	23.1	17.1	19.0	3.5	22.0	37.9	16.8	23.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.8	23.1	17.1	19.0	3.5	22.0	37.9	16.8	23.0
Queue Length 50th (ft)	218	201	9	105	0	105	230	36	119
Queue Length 95th (ft)	#407	310	25	164	31	m159	290	66	173
Internal Link Dist (ft)		468		570			3067		464
Turn Bay Length (ft)			350					125	
Base Capacity (vph)	410	759	262	838	781	372	1018	387	1127
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.62	0.09	0.32	0.16	0.54	0.67	0.27	0.52

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

APPENDIX K

Total Future Capacity Analyses

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Configurations	↰	↱		↰	↱		↰	↑↑↱		↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.97		1.00	0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1628		1711	1806		1711	3362		1945	3460	
Flt Permitted	0.32	1.00		0.31	1.00		0.10	1.00		0.58	1.00	
Satd. Flow (perm)	556	1628		557	1806		176	3362		1192	3460	
Volume (vph)	160	225	166	81	304	78	75	211	25	69	900	413
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	245	180	88	330	85	82	229	27	75	978	449
RTOR Reduction (vph)	0	27	0	0	9	0	0	9	0	0	54	0
Lane Group Flow (vph)	174	398	0	88	406	0	82	247	0	75	1373	0
Confl. Peds. (#/hr)							2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	37.0	37.0		37.0	37.0		48.0	40.0		48.0	40.0	
Effective Green, g (s)	38.0	38.0		38.0	38.0		50.0	41.0		50.0	41.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.41		0.50	0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	211	619		212	686		226	1378		664	1419	
v/s Ratio Prot		0.24			0.22		c0.03	0.07		0.01	c0.40	
v/s Ratio Perm	c0.31			0.16			0.15			0.05		
v/c Ratio	0.82	0.64		0.42	0.59		0.36	0.18		0.11	0.97	
Uniform Delay, d1	28.0	25.4		22.8	24.8		20.7	18.8		13.0	28.9	
Progression Factor	1.00	1.00		1.00	1.00		2.71	2.08		1.00	1.00	
Incremental Delay, d2	29.3	5.1		5.9	3.7		4.1	0.3		0.3	17.4	
Delay (s)	57.3	30.5		28.7	28.5		60.2	39.3		13.3	46.2	
Level of Service	E	C		C	C		E	D		B	D	
Approach Delay (s)		38.3			28.5			44.4			44.6	
Approach LOS		D			C			D			D	

HCM Average Control Delay	40.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.95		1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1631		1711	1773		1708	3375		1946	3395	
Flt Permitted	0.35	1.00		0.26	1.00		0.32	1.00		0.27	1.00	
Satd. Flow (perm)	608	1631		468	1773		581	3375		554	3395	
Volume (vph)	346	254	179	22	243	114	186	574	50	95	328	214
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	276	195	24	264	124	202	624	54	103	357	233
RTOR Reduction (vph)	0	25	0	0	17	0	0	6	0	0	108	0
Lane Group Flow (vph)	376	446	0	24	371	0	202	672	0	103	482	0
Confl. Peds. (#/hr)							10		8	8		10
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	37.0	37.0		37.0	37.0		48.0	36.0		48.0	36.0	
Effective Green, g (s)	38.0	38.0		38.0	38.0		50.0	37.0		50.0	37.0	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.37		0.50	0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	231	620		178	674		437	1249		458	1256	
v/s Ratio Prot		0.27			0.21		c0.06	c0.20		0.03	0.14	
v/s Ratio Perm	c0.62			0.05			0.17			0.08		
v/c Ratio	1.63	0.72		0.13	0.55		0.46	0.54		0.22	0.38	
Uniform Delay, d1	31.0	26.4		20.3	24.3		14.7	24.8		14.0	23.1	
Progression Factor	1.00	1.00		1.00	1.00		1.27	1.32		1.00	1.00	
Incremental Delay, d2	301.4	7.0		1.6	3.2		2.7	1.3		1.1	0.9	
Delay (s)	332.4	33.5		21.8	27.5		21.5	34.1		15.1	24.0	
Level of Service	F	C		C	C		C	C		B	C	
Approach Delay (s)		166.2			27.2			31.2			22.7	
Approach LOS		F			C			C			C	

HCM Average Control Delay	68.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX L

Total Future Capacity Analyses with Improvements

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.97		1.00	0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1628		1711	1806		1711	3362		1945	3460	
Flt Permitted	0.33	1.00		0.32	1.00		0.10	1.00		0.58	1.00	
Satd. Flow (perm)	572	1628		574	1806		180	3362		1189	3460	
Volume (vph)	160	225	166	81	304	78	75	211	25	69	900	413
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	245	180	88	330	85	82	229	27	75	978	449
RTOR Reduction (vph)	0	26	0	0	9	0	0	9	0	0	53	0
Lane Group Flow (vph)	174	399	0	88	406	0	82	247	0	75	1374	0
Confl. Peds. (#/hr)							2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	38.0	38.0		38.0	38.0		47.0	39.0		47.0	39.0	
Effective Green, g (s)	39.0	39.0		39.0	39.0		49.0	40.0		49.0	40.0	
Actuated g/C Ratio	0.39	0.39		0.39	0.39		0.49	0.40		0.49	0.40	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	223	635		224	704		226	1345		651	1384	
v/s Ratio Prot		0.24			0.22		c0.03	0.07		0.01	c0.40	
v/s Ratio Perm	c0.30			0.15			0.15			0.05		
v/c Ratio	0.78	0.63		0.39	0.58		0.36	0.18		0.12	0.99	
Uniform Delay, d1	26.7	24.6		22.0	24.0		21.3	19.4		13.5	29.9	
Progression Factor	1.00	1.00		1.00	1.00		2.69	2.28		1.00	1.00	
Incremental Delay, d2	23.2	4.7		5.1	3.4		4.1	0.3		0.4	22.5	
Delay (s)	50.0	29.3		27.1	27.4		61.6	44.5		13.9	52.3	
Level of Service	D	C		C	C		E	D		B	D	
Approach Delay (s)		35.3			27.4			48.7			50.4	
Approach LOS		D			C			D			D	

HCM Average Control Delay	43.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX M

Total Future Capacity Analyses with Recommended Future Lane Use and Traffic Control

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Configurations	↰	↱		↰	↑	↱	↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1628		1711	1863	1583	1711	3359		1945	3460	
Flt Permitted	0.38	1.00		0.27	1.00	1.00	0.09	1.00		0.59	1.00	
Satd. Flow (perm)	666	1628		480	1863	1583	160	3359		1202	3460	
Volume (vph)	160	225	166	81	304	78	75	211	25	69	900	413
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	245	180	88	330	85	82	229	27	75	978	449
RTOR Reduction (vph)	0	26	0	0	0	56	0	9	0	0	53	0
Lane Group Flow (vph)	174	399	0	88	330	29	82	247	0	75	1374	0
Confl. Peds. (#/hr)							2		2	2		2
Turn Type	Perm			Perm		Perm	pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	33.0	33.0		33.0	33.0	33.0	52.0	44.0		52.0	44.0	
Effective Green, g (s)	34.0	34.0		34.0	34.0	34.0	54.0	45.0		54.0	45.0	
Actuated g/C Ratio	0.34	0.34		0.34	0.34	0.34	0.54	0.45		0.54	0.45	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	226	554		163	633	538	226	1512		716	1557	
v/s Ratio Prot		0.24			0.18		c0.03	0.07		0.01	c0.40	
v/s Ratio Perm	c0.26			0.18		0.02	0.16			0.05		
v/c Ratio	0.77	0.72		0.54	0.52	0.05	0.36	0.16		0.10	0.88	
Uniform Delay, d1	29.5	28.8		26.7	26.5	22.2	18.1	16.3		11.0	25.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	2.72	1.24		1.00	1.00	
Incremental Delay, d2	22.0	7.8		12.2	3.1	0.2	4.1	0.2		0.3	7.6	
Delay (s)	51.5	36.7		38.9	29.5	22.4	53.5	20.5		11.3	32.7	
Level of Service	D	D		D	C	C	D	C		B	C	
Approach Delay (s)		41.0			30.0			28.5			31.6	
Approach LOS		D			C			C			C	

HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

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Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	12	12	11	11	11	15	13	13
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	1631		1711	1863	1583	1708	3372		1945	3395	
Flt Permitted	0.52	1.00		0.32	1.00	1.00	0.28	1.00		0.22	1.00	
Satd. Flow (perm)	911	1631		582	1863	1583	499	3372		449	3395	
Volume (vph)	346	254	179	22	243	114	186	574	50	95	328	214
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	276	195	24	264	124	202	624	54	103	357	233
RTOR Reduction (vph)	0	25	0	0	0	68	0	6	0	0	108	0
Lane Group Flow (vph)	376	446	0	24	264	56	202	672	0	103	482	0
Confl. Peds. (#/hr)							10		8	8		10
Turn Type	Perm			Perm		Perm	pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	44.0	44.0		44.0	44.0	44.0	41.0	29.0		41.0	29.0	
Effective Green, g (s)	45.0	45.0		45.0	45.0	45.0	43.0	30.0		43.0	30.0	
Actuated g/C Ratio	0.45	0.45		0.45	0.45	0.45	0.43	0.30		0.43	0.30	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	410	734		262	838	712	372	1012		388	1019	
v/s Ratio Prot		0.27			0.14		c0.07	c0.20		0.03	0.14	
v/s Ratio Perm	c0.41			0.04		0.04	0.16			0.08		
v/c Ratio	0.92	0.61		0.09	0.32	0.08	0.54	0.66		0.27	0.47	
Uniform Delay, d1	25.8	20.8		15.8	17.6	15.7	19.2	30.6		18.2	28.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.08	1.15		1.00	1.00	
Incremental Delay, d2	27.8	3.7		0.7	1.0	0.2	4.4	2.7		1.7	1.6	
Delay (s)	53.6	24.5		16.5	18.6	15.9	25.0	37.9		19.8	30.1	
Level of Service	D	C		B	B	B	C	D		B	C	
Approach Delay (s)		37.4			17.7			34.9			28.6	
Approach LOS		D			B			C			C	

HCM Average Control Delay	31.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

AIR QUALITY IMPACT STUDY

(Apex Companies, LLC)

Apex Companies, LLC
"Where Excellence Meets Value"

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AIR QUALITY IMPACT STUDY

at

The City Homes at Fort Lincoln
Washington, DC

Apex Job No. 11953.005

April 24, 2008

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EXECUTIVE SUMMARY

Apex Companies, LLC (Apex) performed a screening analysis of the potential air quality impact of the proposed Concordia Group's development of the City Homes at Fort Lincoln property located in northeast, Washington, D.C. The City Homes at Fort Lincoln property is a 2.517-acre tract of land that is bound by Bladensburg Road to the north and west, Eastern Avenue to the north and east, Fort Lincoln Drive to the east, and Pineview Court to the south and west in northeast Washington, D.C. The purpose of the study is to determine possible impacts of the development, which will consist of 56 condominiums with associated surface-grade parking lots consisting of approximately 121 spaces total. The City Homes at Fort Lincoln is proposed to be completed in 2010. The study is also to allow the Concordia Group to make sound engineering judgments in regards to further development of the parcel including compliance with District of Columbia Environmental Health Department, Air Quality Division (DCAQD) regulations regarding the property.

Appendix A provides a drawing of the parcel location and surrounding major streets based on information presented by Concordia Group. The impact was evaluated by predicting concentrations of the criteria pollutant, carbon monoxide, using a mathematical model (CAL3QHC) selected for its suitability for evaluating traffic intersections. SCREEN3 was utilized to review area source emissions from the proposed development and Mobile6.2 provided carbon monoxide (CO), oxides of nitrogen (NOx) and volatile organic compound (VOC) results for actual and potential vehicle traffic in relation to the development.

Wells & Associates, Inc. provided Apex with the existing and future Transportation Impact Study for the City Homes at Fort Lincoln property (**Appendix B**), from which input values used in this analysis were obtained. The Transportation Impact Study considered existing conditions in 2007 that were "factored by a one (1) percent annual growth rate to obtain" 2008 data. Wells & Associates, Inc. also presented forecasted traffic conditions for 2010 and time-coincident projects currently planned for development. These projects are listed beginning on page 6 of the traffic study. Modeling the carbon monoxide levels at one-hour and eight-hour peaks for the peak traffic revealed predicted impacts below the National Primary Ambient Air Quality Standards (NPAAQS) of 35 parts per million (ppm) and 9 ppm, respectively. Therefore, based on the information available to Apex at the time of this analysis, the screening results indicate that further analysis of these parameters is not warranted.

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Tables

1.0 INTRODUCTION

This report presents the findings of the potential air quality impact study for the proposed Concordia Group's development of the City Homes at Fort Lincoln property located in northeast, Washington, D.C. The City Homes at Fort Lincoln property is a 2.517-acre tract of land that is bound by Bladensburg Road to the north and west, Eastern Avenue to the north and east, Fort Lincoln Drive to the east, and Pineview Court to the south and west in northeast Washington, D.C. The purpose of the study is to determine possible impacts of the development, which will consist of 56 condominiums with associated surface-grade parking lots consisting of approximately 121 spaces total. The City Homes at Fort Lincoln is proposed to be completed in 2010. This report was completed to allow the Concordia Group to evaluate compliance with District of Columbia Environmental Health Department, Air Quality Division's (DCAQD) regulations regarding construction that, in the case of the City Homes at Fort Lincoln site, would contain "residential premises, apartment house, housing subdivisions or other housing complex designed to house 50 or more families"; and provides parking facilities having a capacity for 50 or more vehicles. The impact was evaluated by predicting concentrations of the criteria pollutant, carbon monoxide (CO), using a mathematical model, CAL3QHCR, selected for its suitability to evaluate traffic intersections and SCREEN3 to review area source emissions from the surface lot parking. MOBILE6.2 was utilized to present further emission estimates of CO and emission estimates for nitrogen oxide (NOx) and volatile organic compounds (VOCs) from sources due to the project.

Applicable models were identified through research and requests for assistance from DCAQD, the U.S. Environmental Protection Agency (EPA), North Carolina Department of Environmental Management (NCDEM), and the California Air Resources Board (CARB). Furthermore, the DCAQD **Guidance For the Analysis of Air Quality Studies Performed as a Result of the Environmental Impact Screening Form (EISF) Process** dated September 2003, the Metro Washington Council of Government's (MWCOG) **State Implementation Plan (SIP) for Washington DC – MD – VA Nonattainment, August 13, 2002**, and the U.S. Environmental Protection Agency (USEPA) "**Technical Guidance on Use of Mobile6 for Emission Source Inventory, January 2002**, were referenced. The models were selected based on its appropriateness for evaluating parking lots and nearby road intersections. Input values were determined through analysis of traffic reports, best engineering estimates, site investigation, the MWCOG SIP, and meteorological data. Input values, as well as rationales for their selection, are included in the appendices.

The CO hotspot analysis was performed to determine whether further detailed analysis of the potential pollution impact was needed. Although every attempt was made to perform a reasonable evaluation, the results are limited by the quality of the models, input values used, and certain assumptions made. Where feasible, input values were selected to give worst-case scenarios. In the future, predictions may vary with improved models, new guidance, and updated data.

The Wells & Associates, Inc. Traffic Impact Study is included as **Appendix B**. The Transportation Impact Study was conducted on February 8, 2007 and considered existing conditions in 2007 that were "factored by a one (1) percent annual growth rate to obtain" 2008 data. Wells & Associates, Inc. also presented forecasted traffic conditions for 2010 and time-coincident projects currently planned for development. These projects are listed beginning on page 6 of the traffic study. **Table 1** illustrates the existing peak traffic counts for 2008, and **Table 2** illustrates the total future traffic forecasts generated by this project (2010) for the morning peak 8:00 – 9:00 am (7:45 – 8:45 am) and afternoon peak 4:00 – 5:00 pm (4:30 – 5:30 pm) hours in vehicles per hour, for the intersection most greatly influenced by the development of the City Homes at Fort Lincoln property. Wells & Associates, Inc. conducted flow analyses for only the intersection consisting of Bladensburg Road and Eastern Avenue, NE; therefore, the intersection was used by Apex as the intersection with the heaviest impact. To determine a logical eight-hour flow pattern, Apex estimated that during the remaining six hours of the averaging period, traffic flow would reduce to 25 percent of the average rush hour volume. This flow was then distributed over the eight-hour period to simulate projected conditions (**Appendix C**).

Included within the Wells & Associates, Inc. study is a Level of Service (LOS) survey for the intersection. The LOS is the average speed during Green (i.e., non stopped) periods. They range from "A" (best) to "F" (worst). A LOS of "D" is considered the minimum acceptable level of service in urban areas such as Washington, DC. Intersections without LOS identification indicate that the intersections were too complicated (i.e., multiple road intersections) to obtain a reliable service survey.

Table 1

Current Traffic Generated in the Area of the City Homes at Fort Lincoln Site (From Wells & Associates, Inc.)

Intersection - Current	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Traffic Volume	LOS	Traffic Volume
1. Bladensburg Road / Eastern Avenue, NE	**D**		**D**	
NB		297		781
EB		517		712
SB		1328		568
WB		350		293

Table 2

Future Traffic Generated in the Area of the City Homes at Fort Lincoln Site (From Wells & Associates, Inc.)

Intersection - Future	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Traffic Volume	LOS	Traffic Volume
1. 16th Street, NW / Colorado Avenue, NW	**D**		**E**	
NB		311		810
EB		551		779
SB		1382		637
WB		463		379

2.0 CARBON MONOXIDE MODELING RESULTS

As an ambient air pollutant, carbon monoxide tends to be a localized problem. Therefore, the intersection of Bladensburg Road and Eastern Avenue, NE was selected since it appeared to contain the highest amount of localized traffic for this project. The intersection was modeled using CAL3QHCR. In accordance with DCAQD guidance, one-hour and eight-hour background levels were obtained through the EPA AirData website as referenced in the revised Guidance on the Review of Air Quality Studies Performed as a Result of the Environmental Impact Screening Form (EISF) Process Table 2. The DCAQD guidance suggests the highest 2nd-high in recent 3 years be used within the model, because the modeled intersection has been estimated to carry more than 20,000 vehicles per day. These background levels, which can be found in **Appendix D**, were then added to the carbon monoxide concentrations predicted downwind from the proposed facility.

2.1 MOBILE6.2 Model

2.1.1 MOBILE6.2 Methodology

MOBILE6.2 (August 2003) was used for this study. MOBILE6.2 is a computer program that estimates emission factors such as hydrocarbons (HC), oxides of nitrogen (NOx) and carbon monoxide (CO) for the air pollution impact of gasoline-fueled and diesel highway motor vehicles. The program files and document for the model were downloaded from the U.S. Environmental Protection Agency Transportation and Air Quality (OTAQ) website. The model was run for January and July traffic flow scenarios and for January and July idle scenarios to determine CO, NOx, and VOCs for the year. MOBILE6.2, the latest version of the MOBILE series, was released in August 2003.

Input Data

To ensure conformity with other modeling of air quality being conducted in the Washington Metropolitan Area, data input information was obtained from the MWCOG and the USEPA. The MWCOG data used is contained in Appendix B of the Washington DC-MD-VA Severe Area SIP dated August 13, 2003 (**Appendix E**). Apex utilized the most recent data available, 2005, when possible. The USEPA data was contained within the MOBILE6.2 user files down load, as well as input from the **User Guide to Mobile 6.1 and 6.2** and the **Technical Guidance on the Use of Mobile 6 for Emission Inventory Preparation**. As outlined in previous DCAQD guidance, CO, NOx, and VOC emission factors are temperature dependent. Because the highest CO monitored readings are in the winter, the following temperatures were used within the model: 20 degrees Fahrenheit (°F) (start of the 8-hour period) and 43°F (end of 8-hour period). For summer time peak NOx and VOC emissions, 68.5°F (start) and 95°F (end) temperatures were used. Input data and files were taken from the MWCOG SIP, or received from MWCOG on request (i.e. VMT, SOAK, I/M CUT POINTS, etc.). Within the DATABASE OPTIONS file (Xbase.D), Apex indicated all vehicle and emission types should be evaluated. In regards to the I/M inputs, all waiver rates were assumed to be 3% regardless of the model year, and I/M Grace Periods were not included in the runs because they were not provided by MWCOG within the SIP. Apex utilized <u>Table 16 2005 Summer VMT Mix Fractions for Network Analysis</u> for all model runs.

In those areas the MWCOG did not provide data, Apex assumed MOBILE6.2 default settings. As an example, Apex used model defaults for winter absolute humidity, weekend trip length distribution, and peak sun for summer conditions. Summer-time absolute humidity, as well as cloud cover and sun rise/sun set were determined by averaging July weather conditions and astronomical observations reported for Washington DC National Airport for the years 2001, 2002, and 2003. This data was down loaded from the U.S. Naval Observatory's web page, as well as from the National Oceanic and Atmospheric Administration (NOAA) web page. The printouts are included in **Appendix F**. To determine absolute humidity, Apex also used the M6Humid program found on the MOBILE web page. The average cloud cover was determined through the averaging of sky cover conditions for each month.

In calculating emissions, Apex used the 2008 idle emission rate for present (base) conditions and the 2010 idle emission rate for the future conditions. Therefore, Apex applied the following conservative vehicle speed assumptions (as per DCAQD guidelines Table 1, Section 2.2.5): 7 - 10 am (10 mph), 10 am - 3 pm (12 mph), 3 - 7 pm (10 mph), 7 pm - 7 am (20 mph) in order to derive the worst-case scenario for the travel rates. Apex utilized these assumptions based on the Thurgood Marshall Elementary School is located approximately 0.65 miles southwest of the property. Influence to traffic from the school would be negligible because of the distance away from modeled intersection and Bladensburg Road is already limited to 25 miles per hour at the intersection. It is also reported within the Transportation Impact Study (page 3), that

Bladensburg Road carries an average daily traffic volume within the study area of 28,500 vehicles per day. Based on all of the information, the following emission factors were used (**Appendix G**):

2008 CO MOBILE EMISSIONS FACTORS (WINTER)

Speed (MPH)	MOBILE6.2 Emission Factor
IDLE	55.995 grams per hour
10	7.933 grams per mile
12	7.186 grams per mile
20	5.666 grams per mile

2010 CO MOBILE EMISSIONS FACTORS (WINTER)

Speed (MPH)	MOBILE6.2 Emission Factor
IDLE	49.82 grams per hour
10	7.091 grams per mile
12	6.421 grams per mile
20	5.059 grams per mile

2.2 CAL3QHCR Methodology

2.2.1 CAL Background

When originally published in 1978, Volume 9 of the EPA, Guidelines for Air Quality Maintenance Planning and Analysis was considered the most appropriate methodology for calculating CO concentrations near congested intersections. The manual workbook procedures were cumbersome, time consuming and used outdated modal emissions models. In the mid 1980's, EPA developed the CAL3Q model to handle the dispersion of emissions at intersections. The latest version of the model used in this study is CAL3QHCR.

CAL3QHCR was used to determine the impacts of the proposed project on CO concentrations. The latest version of the program and documentation was downloaded from the U.S. Environmental Protection Agency World Wide Web Site. The CAL3QHC User Manual and the CAL3QHCR manual modifying the procedure was use in preparation of the modeling runs.

Figure 1, Appendix A was prepared showing the location of potential receptors near the affected intersection around the project. The figure was prepared in accordance with the instructions contained in the CAL3QHC user's manual. Traffic volumes such as contained in **Appendix B** were used to determine traffic information. In order to properly model this intersection, Apex used default input as outlined within the CAL3QHC User Guide and/or selected conservative input (i.e. single family residential surface roughness) for model variables.

2.2.2 Traffic Input

Traffic volumes for use in the model and queuing information were estimated from the Traffic Impact Study contained in **Appendix B**. The traffic volumes include all existing traffic as the existing condition with the proposed and other proposed adjacent projects added as the future case. Queuing distances for the intersections were taken from Table 3-3, Background Queue Analysis, page 10 (i.e., EB Queue = 350 feet, WB and NB Queue = 160 feet, and SB Queue = 200 feet).

CAL3QHCR, a steady-state Gaussian model, was used to evaluate carbon monoxide emissions at the intersection of Bladensburg Road and Eastern Avenue, NE. This analysis was performed using traffic counts reported by Wells & Associates, Inc. as shown in **Appendix B**. Traffic volume through the intersection was increased to reflect new traffic to the proposed facility. Wells & Associates, Inc. estimated morning and evening peak traffic flows. To determine a logical eight-hour flow pattern, Apex estimated that during the remaining six hours of the averaging period, traffic flow would reduce to 25 percent of the average rush hour volume. This flow was then distributed over the eight-hour period to simulated projected conditions. The directions of the additional departing traffic were distributed according to patterns of existing departing traffic. Existing traffic conditions were modeled first with each background to provide a baseline, and then the second model was run with each background to calculate projected project emissions. The traffic distribution is shown graphically in **Appendix C**. The input and output files are presented in **Appendix H**.

2.2.3 Background Input

The AQD guideline recommends using the second-high concentration data from a recent three-year period from the monitoring stations in the Washington DC-MD-VA CO maintenance area. The EPA monitoring data is shown in **Appendix D**. Since this modeled roadway involves roadways that carry over 20,000 vehicles per day, DCAQD guidance suggested using the highest 2^{nd}-high in the last three years, in compliance with Table 2 of the AQD guidance. Therefore, the background values for the one-hour and eight-hour peaks are 4.0 and 3.4 parts per million (ppm), respectively.

2.3 SCREEN3 Model

2.3.1 SCREEN3 Methodology

SCREEN3 was used for the area source study of the proposed parking for the development. The SCREEN3 model was developed to provide an easy-to-use method of obtaining pollutant concentration estimates based on the "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources" (EPA, 1995a) document. The program files and document for the model were downloaded from the U.S. EPA Technology Transfer Network (TTN) website. The model was chosen based on the recommendations of the DCAQD-EISF review memo of September 2003, Sections 2.2.3 and 2.2.4.2. Apex modeled the surface parking lots as the total emissions produced.

<u>Input Data</u>

To ensure conformity with other modeling of air quality being conducted in the Washington Metropolitan Area, data input information was obtained from the MWCOG and the USEPA (see section 2.1). SCREEN3 input information was provided by the Concordia Group and their construction engineers as prompted by the SCREEN3 model user's guide. The following user information was included in the input files:

1. In accordance with the DCAQD-EISF memo (Section 2.2.4.3), the source parameters were derived from the lineal dimensions of the surface grade lots and entrance/exits (area source).
2. The model was run for future conditions (year 2010).
3. As outlined above in Section 2.1.1, the CO Mobile6.2 idle emission factor of 49.82 grams/hour was used for future conditions in the computation of the emission rate.
4. The NOx and VOC Mobile6.2 idle emission factors of 3.91 and 8.02 grams/hour were used in determination of the future impact by the surface grade lots for the ozone precursors for winter conditions. The NOx and VOC Mobile6.2 idle emission factors of 3.438 and 8.723 grams/hour were used in determination of the future impact by the surface grade lots for the ozone precursors for summer conditions.
5. Default conditions were used within the model including:
   - the search through range of directions to find the maximum emission;
   - the use of full meteorology (all stabilities and wind speeds), and;

- the use of an Automated distance array.

6. Other input parameters are outlined within the SCREEN3 Model Run output in **Appendix I**.

7. Even though the parking was reviewed as independent receptor locations, in order to determine the total CO impact, Apex summed the SCREEN3 one-hour and the eight-hour results for proposed conditions and presented that information in both Tables 3 and 4, and in **Appendix I**.
8. The dimensions of the parking lots were given by, or measured from engineering specifications presented by the Concordia Group (**Appendix I**). All areas were then converted, when necessary, to meters to allow the running of the SCREEN3 model. The dimensions utilized within the model are as follows:

   Surface Lot A Area:

   - Approximate length of area = 144 ft (43.9 m) (from engineering drawings);
   - Approximate width of parking lot = 33 ft (10.1 m) (from engineering drawings);
   - Approximate length of queue on Surface Lot A = 72 ft (21.9 m) (from engineering drawings). This length is approximately half the length of the area;
   - Approximate width of queue / exit from Surface Lot A into Surface Lot B = 14 ft (4.3 m) (from engineering drawings);
   - Exhaust is passive.

   Surface Lot B Area:

   - Approximate length of area = 180 ft (54.9 m) (from engineering drawings);
   - Approximate width of area = 33 ft (10.1 m) (from engineering drawings);
   - Approximate length of queue on Surface Lot B = 90 ft (27.4 m) (from engineering drawings). This length is approximately half the length of the area;
   - Approximate width of queue / exit from Surface Lot B = 14 ft (4.3 m) (from engineering drawings);
   - Exhaust is passive.

   Surface Lot C Area:

   - Approximate length of area = 262 ft (79.9 m) (from engineering drawings);
   - Approximate width of area = 33 ft (10.1 m) (from engineering drawings);
   - Approximate length of queue on Surface Lot C = 131 ft (39.9 m) (from engineering drawings). This length is approximately half the length of the area;
   - Approximate width of queue / exit from Surface Lot C = 14 ft (4.3 m) (from engineering drawings);
   - Exhaust is passive.

9. To determine the peak vehicle traffic per hour exiting the surface lots, Apex utilized the total available parking spaces in Surface Lot A and the Wells & Associates, Inc. Transportation Impact Study, Section 4 SITE ANALYSIS and Table 4-1 Site Trip

Generation, page 11. Maximum peak trip during peak PM hour (33 out - total) for the remaining surface lots was the worst-case traffic for any one-hour during the day.

11. The one-hour impact for the parking lots were calculated, (**Appendix I**), by utilizing the total emissions factors and the 2010 MOBILE6.2 emission rates. As an example, the winter CO total emissions factor for Surface Lot A was calculated using the following equation, (I + T)/A where:

- I = Idle Emissions [grams (g)/sec(s)] = [# of vehicles exiting lot (veh/hr)][MOBILE6.2 2010 idle emission rate (g/hr)][Time of idling per vehicle (s/veh)][1/12,960,000 hr^2/s^2]

  = (27 veh/hr)(49.82 g/hr)(30 s/veh)(1/12,960,000 hr^2/sec^2)

  = 0.00311 g/s

- T= Traveling Emissions (g/s) = [# of vehicles exiting lot (veh/hr)][MOBILE6.2 2010 10 mph emission rate (g/mile)][Parking lot width + ½ length ft/veh][1/5280 mi/ft][1/3600 hr/s]

  = (27 veh/hr)(7.091 g/mi)[33 ft + ½(144.0) ft/veh][1/5280][1/3600]

  = 0.00106 g/s

- A= Area of parking lot queue (1/2 length of total lot area * width of lot exit) (m**2) = [lot queue length (m)][lot exit width (m)]

  = (21.9 m)(4.3 m)

  = (93.65 m**2)

  $\therefore$ (0.00311) + (0.00106) / (93.65) = 0.000044543 g/s

- Emission factor was then run with SCREEN3 to determine one-hour impact.
- The eight-hour impact was calculated by utilizing a conversion factor as outlined below.

12. Conversion formulas include:

- Conversion for SCREEN3 from one-hour (μg/m**3) to eight-hour (μg/m**3) = 0.70 (SCREEN3 – US EPA Web page).
- Conversion of μg/m**3 to parts per million/by weight = 834.7E-06 (US EPA, AP-42, Appendix A).
- Other conversion factors are outlined within **Appendix I**.

2.3.2 SCREEN3 Results – CO Winter

2.3.2.1 Future Parking Lot Maximum One-hour and Eight-hour Results

The total one-hour and eight-hour CO concentration for the City Homes at Fort Lincoln development project was calculated from the one- and eight-hour concentrations. For the surface lots the results were found to be:

- **Surface Lot A** - 148 μg/m**3 for one-hour and 103.53 μg/m**3 for the eight-hour concentration. These values convert to 0.1235 ppm/wt for the one-hour and 0.0864 ppm/wt for the eight-hour concentration.
- **Surface Lot B** – 175.5 μg/m**3 for one-hour and 122.85 μg/m**3 for the eight-hour concentration. These values convert to 0.1465 ppm/wt for the one-hour and 0.1025 ppm/wt for the eight-hour concentration.
- **Surface Lot C** – 163.2 μg/m**3 for one-hour and 114.24 μg/m**3 for the eight-hour concentration. These values convert to 0.1362 ppm/wt for the one-hour and 0.0954 ppm/wt for the eight-hour concentration

The maximum readings occurred at 22 meters from the center of the queue for Surface Lot A, 24 meters for Surface Lot B and 29 meters for Surface Lot C. These numbers were then added to the receptor findings and the background values in **Tables 3 and 4.**

2.4 CAL3QHCR Carbon Monoxide Results

2.4.1 One-Hour Carbon Monoxide Impact

Table 3 summarizes the baseline and future site conditions at Bladensburg Road and Eastern Avenue, NE, on the total carbon monoxide concentrations as a one-hour peak near the property using the one-hour background concentration. The total carbon monoxide concentrations, as a one-hour peak, are shown for the twelve receptors (applying the one-hour background of 4.00 ppm). As said, this number is calculated by subtracting the DCAQD recommended background from the 1 m/s model result. This number is then multiplied by the worst-case wind speed conversion factor then added to the DCAQD recommended background to achieve the final result [(ppm @ 1 m/s – 4.00) * 2.237 + 4.00].

The table also includes area parking influence, summation of total CO and the delta values from the baseline case concentration against the future development concentrations. Refer to **Appendix A** for receptor locations. All results are below the 35-ppm NAAQS carbon monoxide standard.

2.4.2 Eight-Hour Carbon Monoxide Impact

When the eight-hour background of 3.40 is added to the worst-case eight-hour peak from CAL3QHCR, the result is below the 9-ppm carbon monoxide standard. The carbon monoxide concentrations are shown in **Table 4** for the intersection of Bladensburg Road and Eastern Avenue, NE. It also illustrates the area parking influence, summation of total CO and delta value from the baseline case concentration against the street parking carbon monoxide concentration.

2.4.3 Model Assumptions

Wherever feasible during this analysis, assumptions and input parameters were used to project worst-case results. Listed below are assumptions that were used during the model.

- Wind Speed (U) - In accordance with model guidance, a wind speed of one meter per second (m/s) was input. This wind speed was then adjusted down to one mph to simulate projected calm conditions. This adjustment was performed using a conversion factor of 2.237, as outlined in the **Guidance For the Analysis of Air Quality Studies Performed as a Result of the Environmental Impact Screening Form (EISF) Process** – page 9.

- Number of Receptors – Twelve locations were designated as sites (receptors) for the model to project resultant carbon monoxide concentrations. All receptor locations are 1.8 meters above ground as specified by EPA (CO Hotspots). Receptor locations near the intersection are marked in **Appendix A**.

- Ambient Air Temperature - The CO model was run during a two-day period over winter conditions. Winter temperature was assumed to be 20°F at the 0100 hours, gradually warming to 43°F by 1200 hours then began to decrease back to 20°F by 2400 hours. Summer temperature was assumed to be 68.5°F at the 0100 hours, gradually warming to 95°F by 1200 hours then began to decrease back to 68.5°F by 2400 hours. Metrological data files input is included in **Appendix H**.

- Mixing Height (MIXH) - The mixing height was set to 1,000 meters per model guidelines for CAL3QHCR.

- Source Height (H) - The roadway is assumed to be at grade; therefore, zero meters were input. Receptor heights for SCREEN3 were also 1.8 meters, the average height of an adult male.

- Wind direction – Constant, low flow wind speed was used, as required by DCAQD. Wind direction was modeled as six hours constant direction from the south (180 degrees) with one hour alternating 22 degrees each way. Actual wind conditions will vary greatly, which would have a decreasing effect on emissions.

In conclusion, the analysis projected carbon monoxide impact to be below the eight-hour standard of 9 ppm and the one-hour standard of 35 ppm, despite using these conservative factors.

Table 3

Carbon Monoxide Emissions for One-Hour Peak
Bladensburg Road and Eastern Avenue, NE

Bladensburg Road and Eastern Avenue, NE Baseline Concentrations												
	Carbon Monoxide Emissions for One-hour Peak											
Source	Receptors											
	1	2	3	4	5	6	7	8	9	10	11	12
Intersection (ppm) (@1 m/s)	4.10	4.20	4.50	4.00	4.50	4.60	4.40	4.00	4.20	4.00	4.10	4.00
Total CO/Intersection (ppm) (@1 mph) ®	4.22	4.45	5.12	4.00	5.12	5.34	4.89	4.00	4.45	4.00	4.22	4.00
Background (ppm)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
NAAQS one-hour maximum is 35 ppm.												

Baseline plus Proposed Building												
	Carbon Monoxide Emissions for One-Hour Peak (future)											
Source	Receptors											
	1	2	3	4	5	6	7	8	9	10	11	12
Intersection (ppm) (@1 m/s)	4.10	4.20	4.50	4.00	4.50	4.40	4.40	4.00	4.10	4.00	4.10	4.00
Intersection (ppm) (@1 mph) ®	4.22	4.45	5.12	4.00	5.12	4.89	4.89	4.00	4.22	4.00	4.22	4.00
Surface Lot A	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Surface Lot B	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Surface Lot C	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Total CO	4.63	4.85	5.52	4.41	5.52	5.30	5.30	4.41	4.63	4.41	4.63	4.41
Background (ppm)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
NAAQS one-hour maximum is 35 ppm.												

Delta Concentrations from Baseline Values												
Source	**Del 1**	**Del 2**	**Del 3**	**Del 4**	**Del 5**	**Del 6**	**Del 7**	**Del 8**	**Del 9**	**Del 10**	**Del 11**	**Del 12**
I-Delta (ppm)	0.41	0.41	0.41	0.41	0.41	-0.04	0.41	0.41	0.18	0.41	0.41	0.41

®**Note:** [(ppm @ 1 m/s) – (background)] * 2.237 + background

Table 4

Carbon Monoxide Emissions for Eight-Hour Peak
Bladensburg Road and Eastern Avenue, NE

Bladensburg Road and Eastern Avenue, NE Baseline Concentrations												
	Carbon Monoxide Emissions for Eight-hour Peak											
Source	Receptors											
	1	2	3	4	5	6	7	8	9	10	11	12
Intersection (ppm) (@1 m/s)	3.41	3.50	3.64	3.40	3.67	3.65	3.68	3.40	3.49	3.40	3.45	3.40
Total CO/Intersection (ppm) (@1 mph) ®	3.42	3.62	3.94	3.40	4.00	3.96	4.03	3.40	3.60	3.40	3.51	3.40
Background (ppm)	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
NAAQS one-hour maximum is 9 ppm.												

Baseline plus Proposed Building												
	Carbon Monoxide Emissions for Eight-Hour Peak (future)											
Source	Receptors											
	1	2	3	4	5	6	7	8	9	10	11	12
Intersection (ppm) (@1 m/s)	3.41	3.49	3.59	3.40	3.64	3.61	3.70	3.40	3.46	3.40	3.46	3.40
Intersection (ppm) (@1 mph) ®	3.42	3.60	3.83	3.40	3.94	3.87	4.07	3.40	3.53	3.40	3.53	3.40
Surface Lot A	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Surface Lot B	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Surface Lot C	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total CO	3.71	3.89	4.11	3.68	4.22	4.15	4.36	3.68	3.82	3.68	3.82	3.68
Background (ppm)	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
NAAQS one-hour maximum is 9 ppm.												

Delta Concentrations from Baseline Values												
Source	**Del 1**	**Del 2**	**Del 3**	**Del 4**	**Del 5**	**Del 6**	**Del 7**	**Del 8**	**Del 9**	**Del 10**	**Del 11**	**Del 12**
I-Delta (ppm)	0.28	0.26	0.17	0.28	0.22	0.19	0.33	0.28	0.22	0.28	0.31	0.28

®**Note:** [(ppm @ 1 m/s) – (background)] * 2.237 + background

APPENDIX A

Map of Proposed Facility
and
CO Modeling Receptor Locations

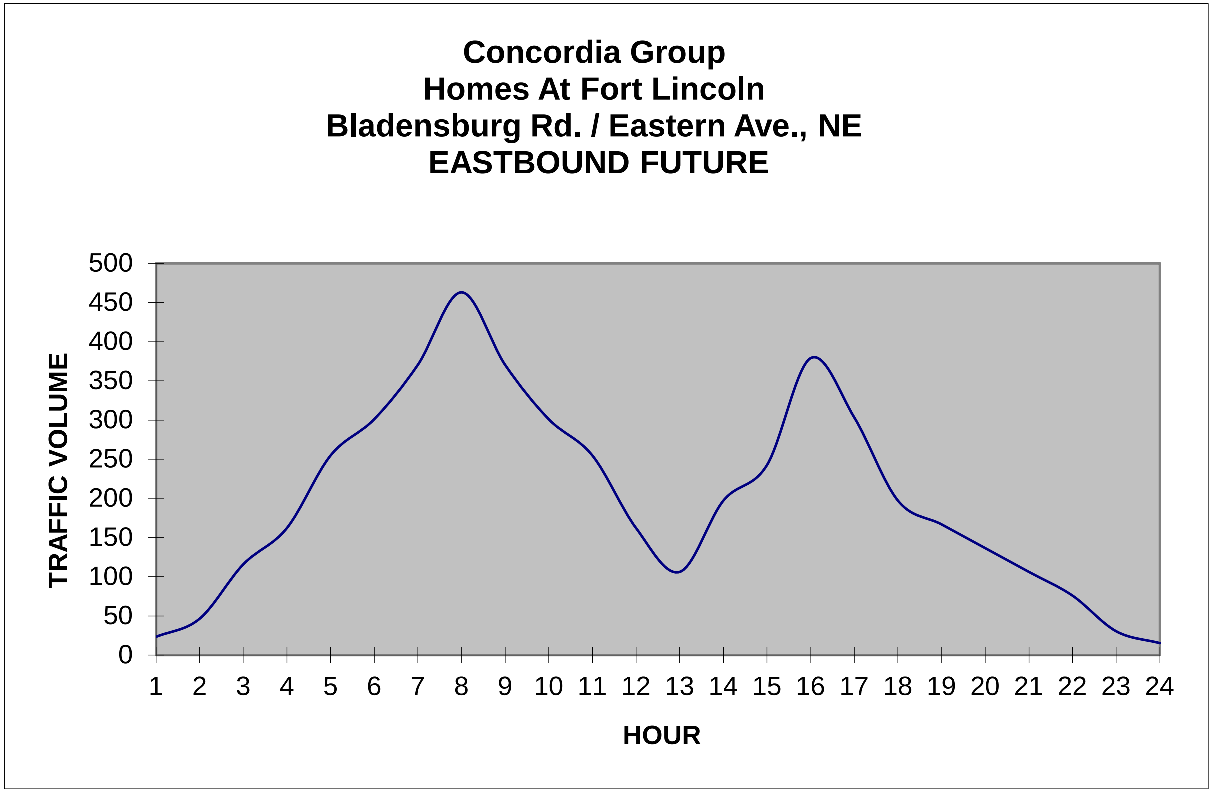
APPENDIX B

Wells & Associates, Inc.
Transportation Impact Study for City Homes at Fort Lincoln

APPENDIX C

Graphical Presentation of Traffic Flow

HOUR	TRAFFIC COUNT (veh/hr)
100	23
200	46
300	116
400	162
500	255
600	301
700	370
800	**463**
900	370
1000	301
1100	255
1200	162
1300	106
1400	197
1500	243
1600	**379**
1700	303
1800	197
1900	167
2000	136
2100	106
2200	76
2300	30
2400	15



APPENDIX D

EPA AirData – Monitor Value Report

APPENDIX E

State Implementation Plan (SIP) for Washington DC – MD – VA Nonattainment
August 13, 2002 Appendix B – Attachment A Only

APPENDIX F

Preliminary Local Climatological Data
Sun or Moon Rise/Set Table
July 2001 – 2003

APPENDIX G

MOBILE6.2 Input/Output (emissions factors)

APPENDIX H

CAL3QHCR Model Results

APPENDIX H

CAL3QHCR Model

Seven CAL3QHCR model runs were performed as follows:

Bladensburg Road and Eastern Avenue, NE

1. Baseline results – eight-hour background
2. Total Future results – eight-hour background
3. Baseline results – one-hour background
4. Total Future results – one-hour background

The following sections include a brief description of the model, traffic assumptions, input parameters, meteorological data input files, and CAL3QHCR output files.

1. Baseline results (eight-hour background)

Results for Bladensburg Road and Eastern Avenue, NE

Bladensburg Road and Eastern Avenue, NE (existing conditions)

Apex modeled the intersection of Bladensburg Road and Eastern Avenue, NE, to obtain the maximum eight-hour concentrations with regard to carbon monoxide.

2. Total future results – eight-hour background

Results for Bladensburg Road and Eastern Avenue, NE

Bladensburg Road and Eastern Avenue, NE (existing conditions)

Apex modeled the intersection of Bladensburg Road and Eastern Avenue, NE, to obtain the maximum eight-hour concentrations with regard to carbon monoxide.

3. Baseline results – one-hour background

Results for Bladensburg Road and Eastern Avenue, NE

Bladensburg Road and Eastern Avenue, NE (existing conditions)

Apex modeled the intersection of Bladensburg Road and Eastern Avenue, NE, to obtain the maximum one-hour concentrations with regard to carbon monoxide.

4. Total Future results – one-hour background

Results for Bladensburg Road and Eastern Avenue, NE

Bladensburg Road and Eastern Avenue, NE

Apex modeled the intersection of Bladensburg Road and Eastern Avenue, NE, to obtain the maximum one-hour concentrations with regard to carbon monoxide.

APPENDIX I

SCREEN 3 Input Parameters and Output Results

NOISE STUDY
(Hush Accoustics)

HUSH
ACOUSTICS LLC

2851 Marshall St., Falls Church, Va 22042
T [703] 534.2790 F [703] 286.7955

May 3, 2008

Mr. Jeff Miller
Apex Companies, LLC
8809 Sudley Road, Suite 101
Manassas, VA 20110

Re: Eastern Avenue and Fort Lincoln Drive, N.E.
Construction Noise Analysis

Mr. Miller:

Hush Acoustics LLC has completed a construction noise analysis under contract to Apex Companies, LLC for the stacked townhouse project at Eastern Avenue and Fort Lincoln Drive, N.E., in Washington, D.C.

The site is bounded by the following land uses:

- Residences to the southeast (R-5-D zone)
- Residences to the southwest (R-5-D zone at the southern half, and R-1-B at the northern half)
- Vacant lot to the northwest (GOV zone)
- Cemetery in the state of Maryland to the northeast

Construction Noise Requirement

The District of Columbia Municipal Regulation (DCMR) Chapter 27, Noise Control, Section 2802, Construction, states:

> "From 7:00 a.m. to 7:00 p.m. on any weekday, noise levels resulting from construction or demolition (excluding pile driver devices) shall not exceed a L,(1) of eighty (80) dB (A) unless granted a variance…"

Per section 2803.1, construction in residential zones is prohibited between 7 p.m. and 7 a.m., as well as on Sundays and legal holidays.

We have assumed this regulation does not apply to properties in the state of Maryland (i.e., the cemetery). This analysis was focused on the residential land uses and not the vacant government lot, since construction noise would not affect anyone on a vacant lot.

Per the DCMR, compliance measurements shall be performed 25 feet from the outermost limits of the construction site. Since 25 feet from the outermost limits of the construction site would be in the middle of the roads in three directions from the site (Bladensburg Road to the northwest, Eastern Avenue to the northeast, and Fort Lincoln Drive to the southeast), the analysis focused on properties to the southwest. The DCMR definitions section explains that the hourly average sound level shall be used to measure construction noise.

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Construction Noise Levels Prediction Methodology

Noise level data were obtained from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) User's Guide, Final Report, January 2006, FHWA-HEP-05-054. This Guide presents measured noise level data collected during the Central Artery/Tunnel (CA/T) project in Boston, Massachusetts. This Guide also presents a methodology for calculating the average sound level (L_{eq}) near construction sites based on the following information:

1. Measured maximum A-weighted sound levels (L_{max}) at 50 feet from a piece of equipment
2. The acoustical use factor (i.e., percentage of time equipment is typically operating at full power)
3. The number of pieces of each type of equipment operating at once for the given project
4. The distance from each piece of equipment to the receiver

Table 1 of the Guide presents the maximum sound level measured at 50 feet (L_{max}), and the acoustical use factors, for various pieces of common construction equipment. The number of pieces of each type of equipment operating at once, and the distances from the equipment to the limits of construction for this project, were determined in consultation with Mr. Jason Franti of Apex Companies, LLC. Various phases of construction were identified., based on the types of equipment that would be present on the site at the same time:

Predicted Construction Noise Levels

As noted above, the analysis focused on noise at properties to the southwest. Construction equipment will be operating throughout the site and will be moving most of the time. To simplify the analysis noise levels were evaluated at a prototypical receiver located 25 feet from the southwestern property line. Distances from the construction equipment to this prototypical receiver location were estimated based on the approximate ranges of distances between the areas in which each piece of equipment operates and the property line. These distances are for the worst-case hour when construction activity will occur near the receiver. For each phase, it was assumed that the loudest item would be closest to the property, and other items would be some distance farther away, since all equipment cannot operate in the same place at the same time. The resulting predicted average sound levels (L_{eq}) at the prototypical receiver location are summarized in Table 1, below.

Table 1. Predicted A-weighted Hourly Average Sound Levels, dB

	Lmax at 50'	Distance to limits (feet)	Distance from loudest item	Distance to rec (25' from limits)	Usage factor (%)	No. used at a time	Leq at rec
1. Clearing and rough grading – 74 dB							
Front end loader	79		150	175	40	1	64
Backhoe	78		150	175	40	1	63
Gradall/excavator	83	75		100	40	1	73
Truck	74		150	175	40	1	59

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Table 1 (continued)

2. Site prep and final grading – 74 dB							
Backhoe	78		150	175	40	1	63
Front end loader	79		150	175	40	1	64
Ground compactor	83	50		75	20	1	73
3 Water and sewer							
4a Water and sewer pipe excavation – 77 dB							
Big backhoe	78		150	175	40	1	63
Metal saw to cut conc. pipes	90	75		100	20	1	77
4b Water and sewer pipe backfilling – 68 dB							
Backhoe (to backfill)	78	75		100	40	1	68
5 Storm drain							
5a Excavation – 77 dB							
Conc. saw to cut conc. pipes	90	75		100	20	1	77
Backhoe	78		150	175	40	1	63
5b Backfilling – 72 dB							
Backhoe (to compact trench)	78		150	175	40	1	63
Loader	79	50		75	40	1	72
6 Gas & Electric, Telephone and Cable TV – 71 dB							
Backhoe (also to compact)	78	50		75	40	1	71
7. Roads & parking lots							
7a. Subgrade – 78 dB							
Roller	80		100	125	20	1	65
Grader	85	50		75	40	1	78
7b. Base – 78 dB							
Truck	74		150	175	40	1	59
Roller	80		100	125	20	1	65
Grader	85	50		75	40	1	78
7c. Curb and gutter – 72 dB							
Concrete mixer truck	79	50		75	40	1	72
7d. Paving – 72 dB							
Asphalt truck	76		100	125	40	1	64
Asphalt paver	77	50		75	50	1	71
Bitumen distributor	74		100	125	50	1	63
Pickup truck	75		150	175	40	1	60

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Table 1 (continued)

8. Foundation – 72 dB							
Small backhoe excavator	78		100	125	40	1	66
Concrete vibrator	80	75		100	20	1	67
Concrete mixer truck	79		100	125	40	1	67
9. Slabs –78 dB							
Concrete mixer truck	79		75	100	40	1	69
Concrete finisher/polisher	80		100	125	50	1	69
Conc. (& other types) saw	90	75		100	20	1	77
10. Framing – 77 dB							
Hammering **	80		100	125	50	2	72
Pneumatic tool	85	75		100	50	1	76
11. CMU & Brick Walls – 79 dB							
Drum mixer	80		75	100	50	1	71
Conc. (& other types) saws	90	75		100	20	1	77
Concrete mixer truck	79		100	125	40	1	67
Pressure washer	78		150	175	40	1	63
Small generator	73		75	100	50	1	64
Pickup truck	75		150	175	40	1	60
12. Roofing – 73 dB							
Lifts	79		100	125	40	1	67
Hammering **	80	100		125	50	1	72
Pickup truck	75		150	175	40	1	60
13. Interior Finish – 76 dB							
Small generator	73		75	100	50	1	64
Pneumatic tool *	85		100	125	50	1	69
Pickup truck	75		150	175	40	1	60
Truck to deliver materials	74		150	175	50	1	60
Circular saws *	90	75		100	20	2	75
14. Landscaping / Hardscaping							
14a. Landscaping – 73 dB							
Truck to deliver materials	74		100	125	50	1	63
Bobcat	77	25		50	40	1	73

Table 1 (continued)

14b. Hardscaping – 71 dB							
Truck to deliver materials	74		150	175	50	1	60
Concrete mixer truck	79		150	175	40	1	64
Concrete saw *	90	150		175	20	1	67
Pressure washer *	78		150	175	40	1	58
Backhoe	78		150	175	40	1	63

* Since the some tools will be operating in a partially enclosed spaced, a nominal value of 5 dB shielding was included for these noise sources.
** No data were available for hammering. The sound level value above is an approximation.

Conclusion

It can be seen from Table 1 that the hourly average A-weighted sound level (L_{eq}) is not expected to exceed the DCMR maximum allowable noise level of 80 dB at the property line of the nearest parcel located outside of the subject property.

If you have any questions, please contact me at 703/534.2790, or Gary@HushAcoustics.com.

Sincerely,

Gary Ehrlich, P.E.
Principal