Unit IV
Vulnerability Assessment

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Vulnerability

Any weakness that can be exploited by an aggressor or, in a non-terrorist threat environment, make an asset susceptible to hazard damage

Unit Objectives

Explain what constitutes a vulnerability.

Identify vulnerabilities using the Building Vulnerability Assessment Checklist.

Understand that an identified vulnerability may indicate that an asset:

- is vulnerable to more than one threat or hazard;
- and that mitigation measures may reduce vulnerability to one or more threats or hazards.

Provide a numerical rating for the vulnerability and justify the basis for the rating.

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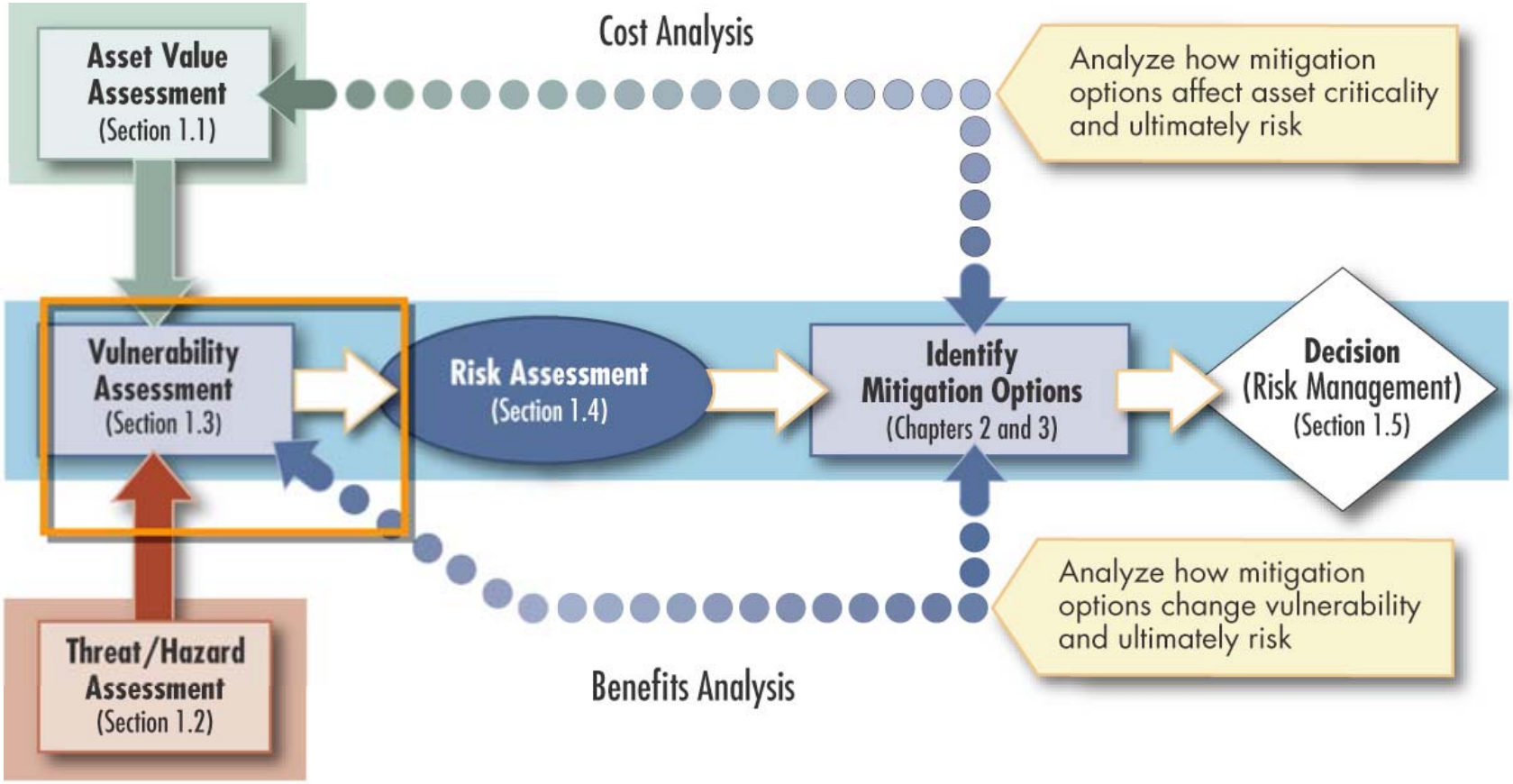
Vulnerability Assessment

Identify site and building systems design issues

Evaluate design issues against type and level of threat

Determine level of protection sought for each mitigation measure against each threat

Assessment Flow Chart



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Identifying Vulnerabilities

Multidisciplinary Team

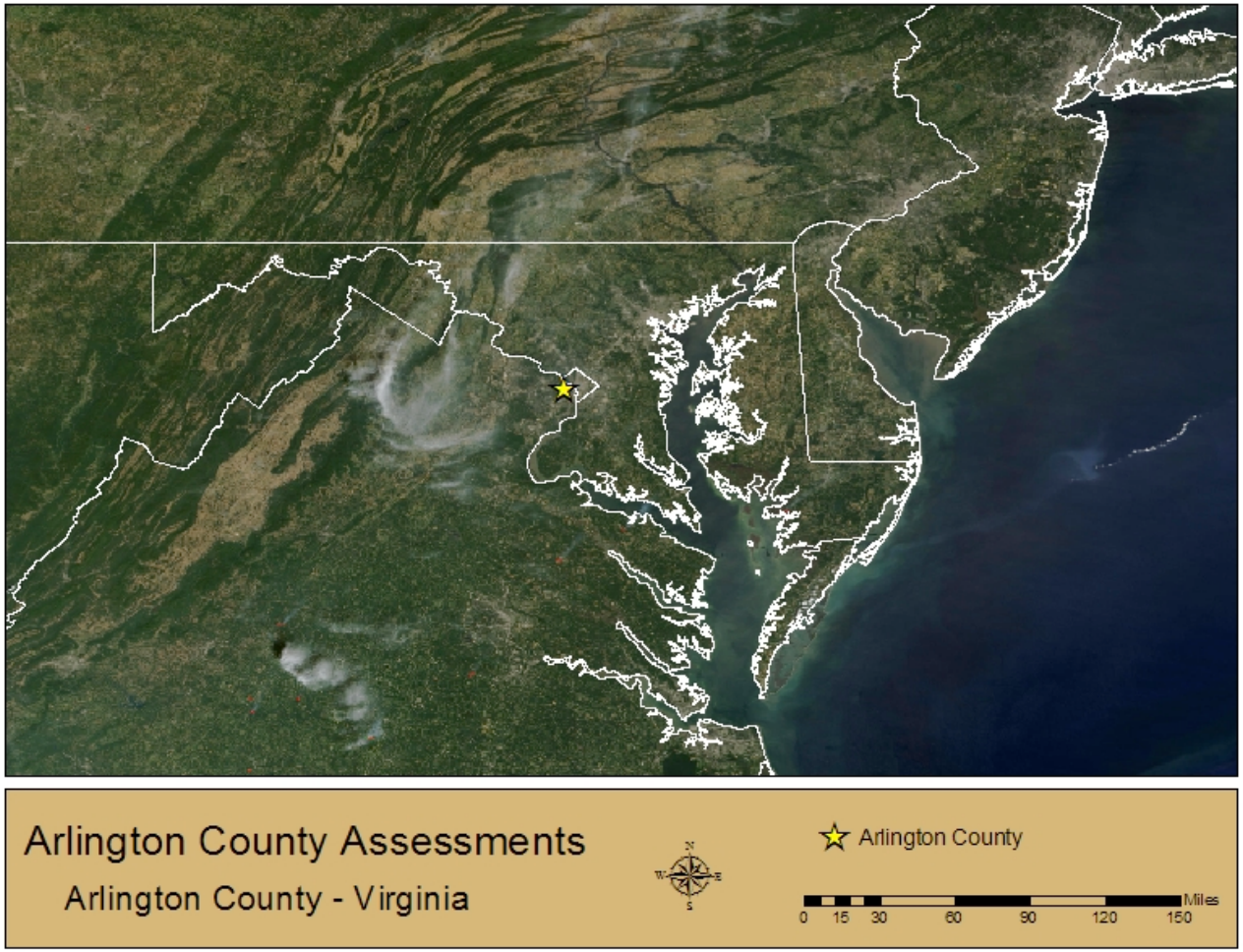
- Engineers
- Architects
- Security specialists
- Subject matter experts
- Outside experts if necessary

Vulnerability Assessment Preparation

Coordinate with the building stakeholders:

- Site and Building Plans
- Utilities
- Emergency Plans (shelter, evacuation)
- Interview schedules
- Escorts for building access

Assessment GIS Portfolio



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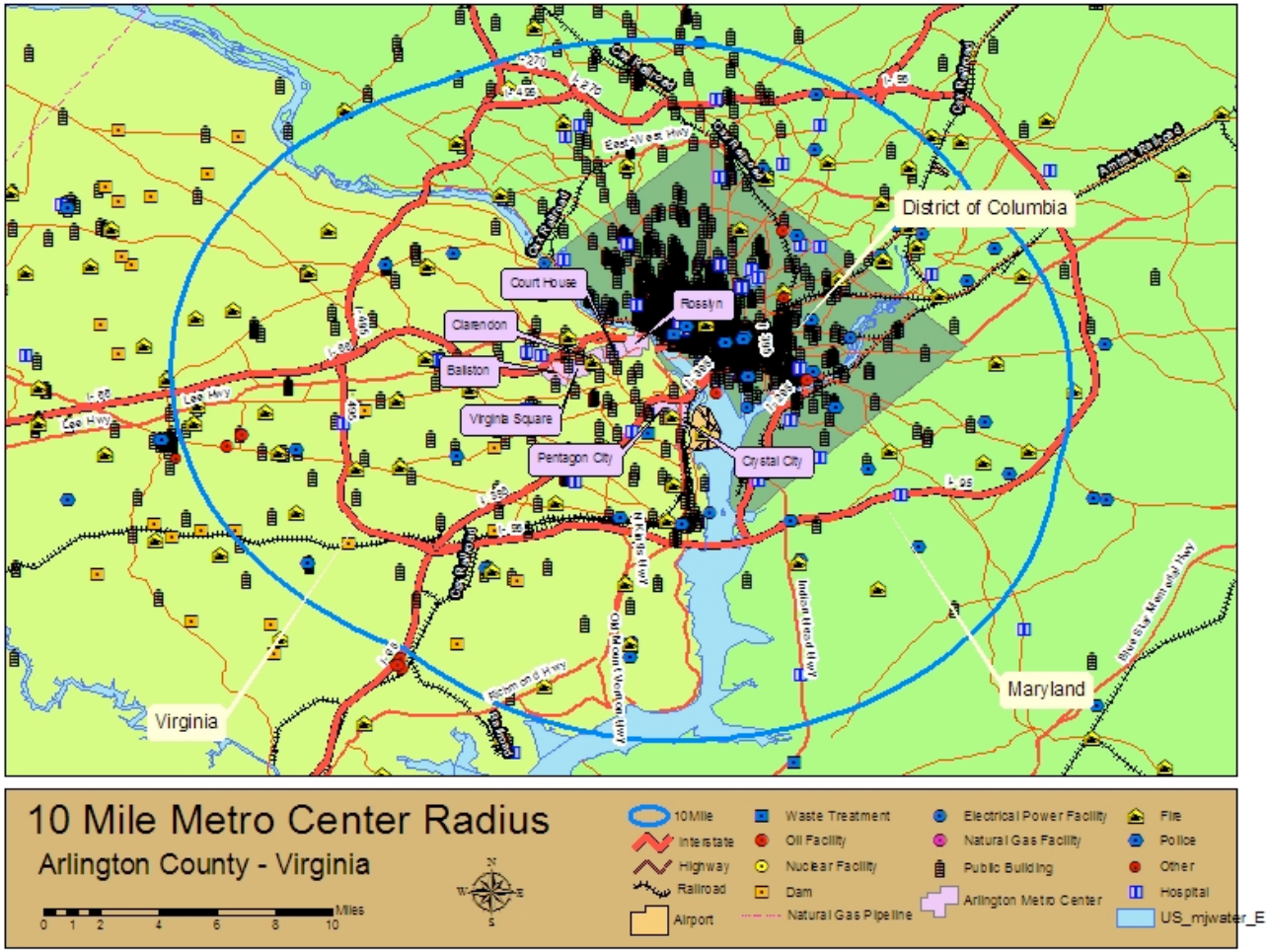
10-Mile Radius



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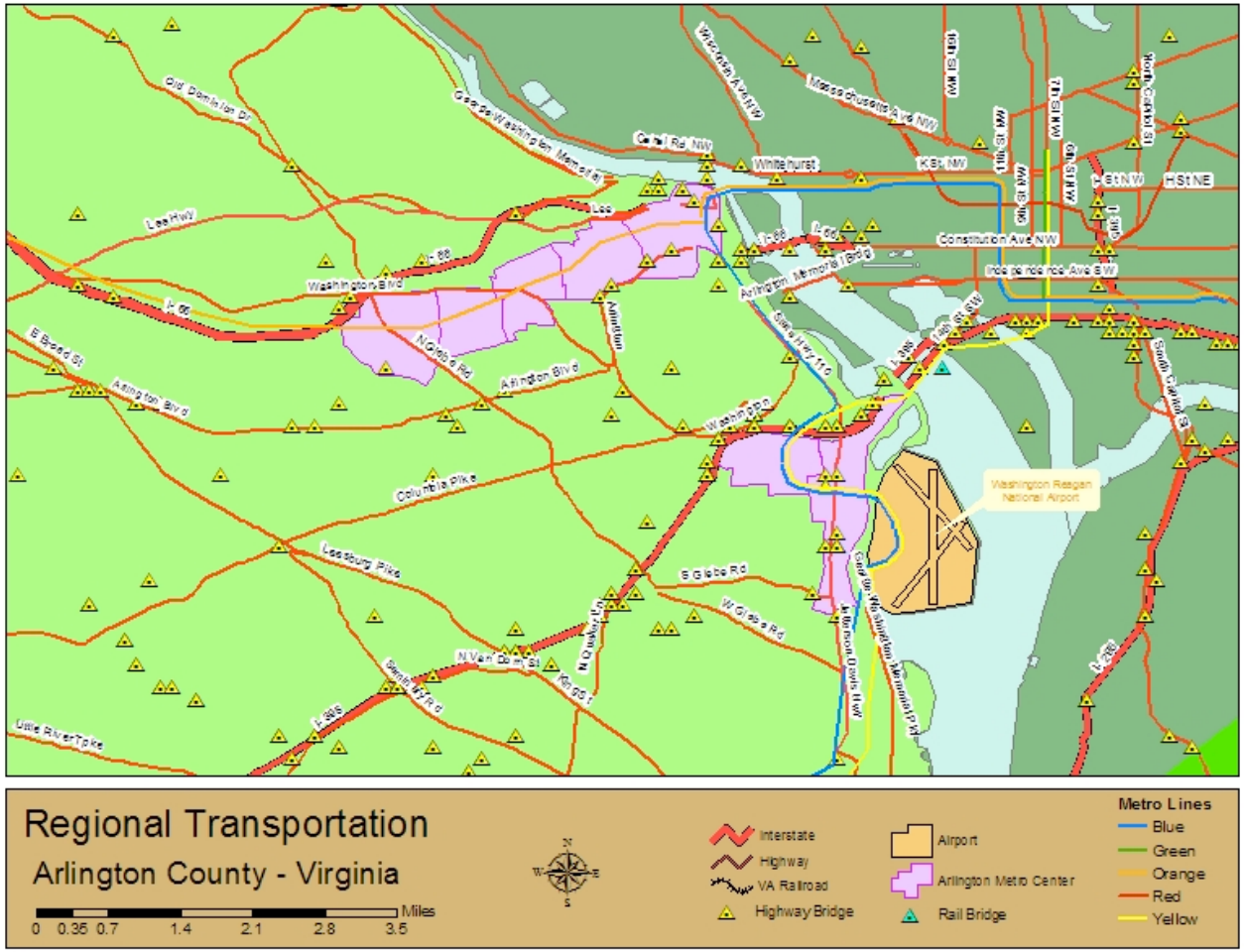
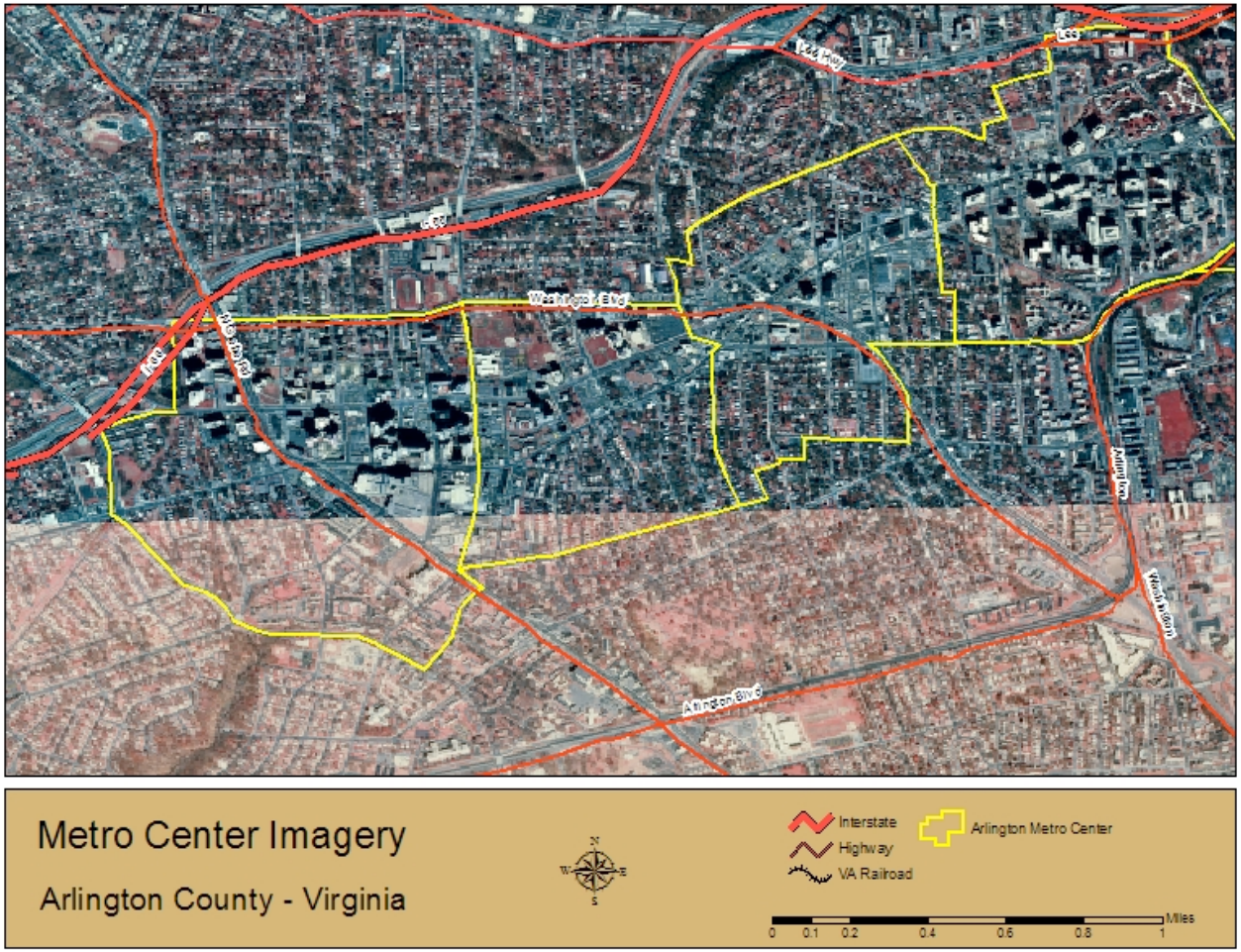
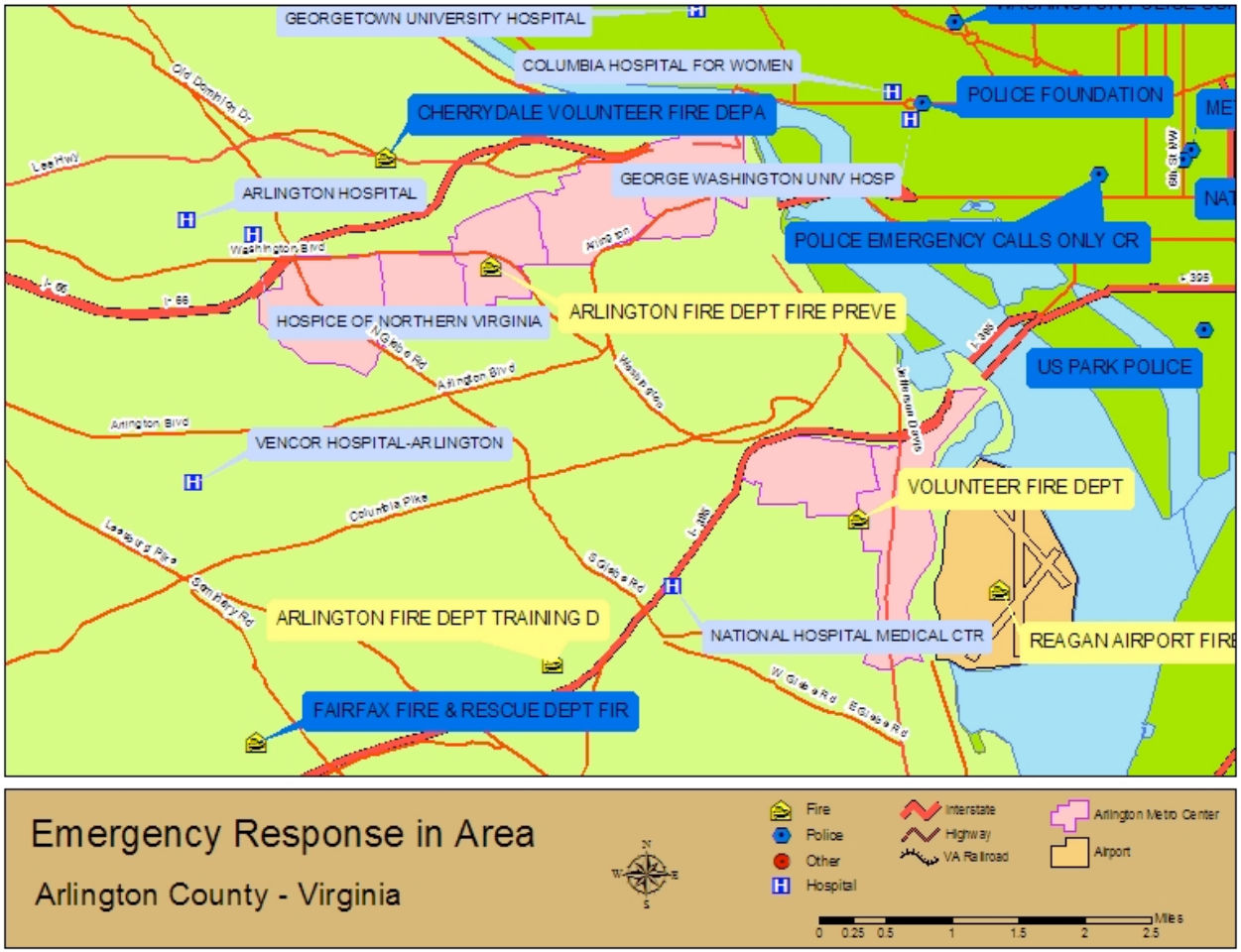
Regional Transportation



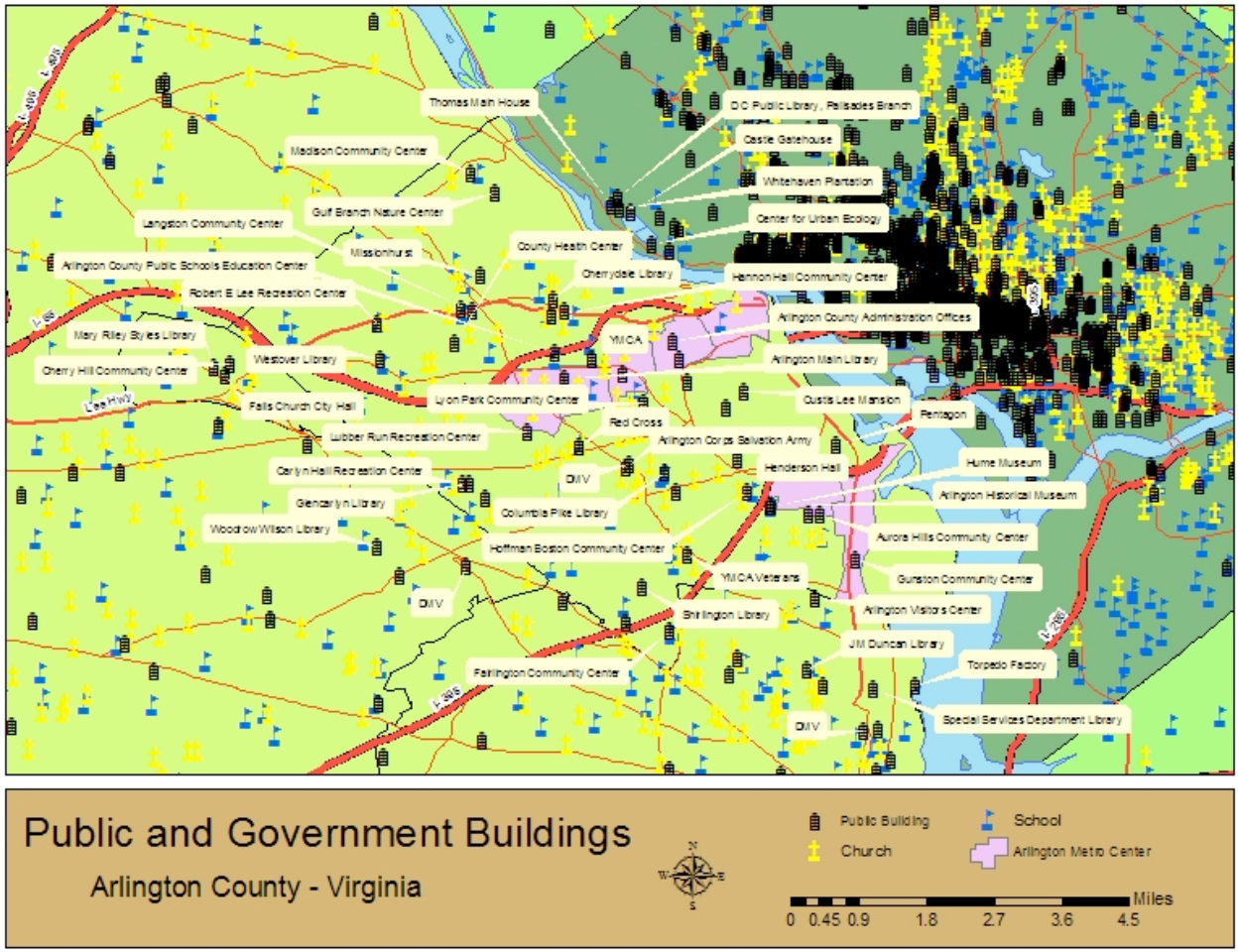
Metro Center Imagery



Site Emergency Response



Site Public and Government Buildings



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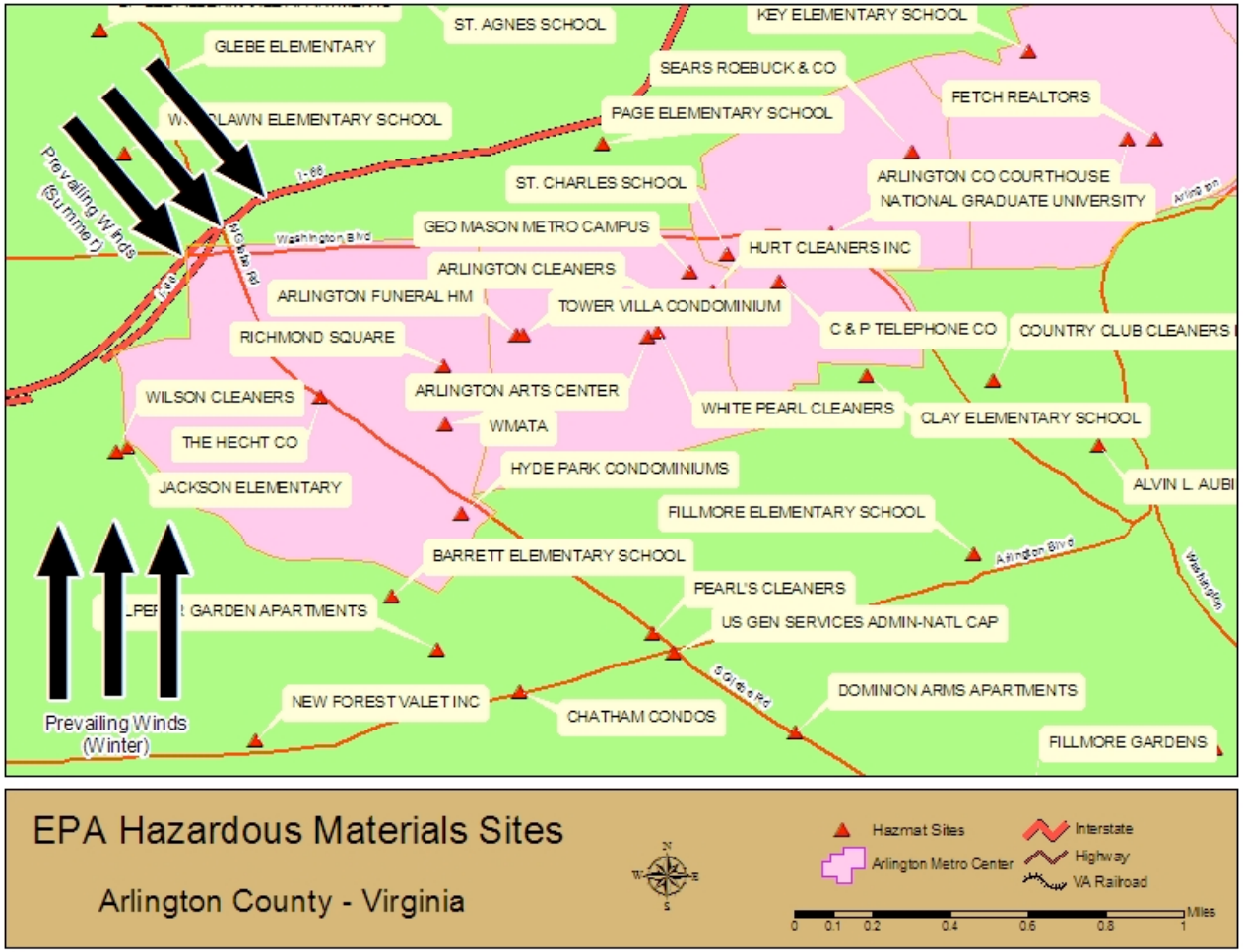
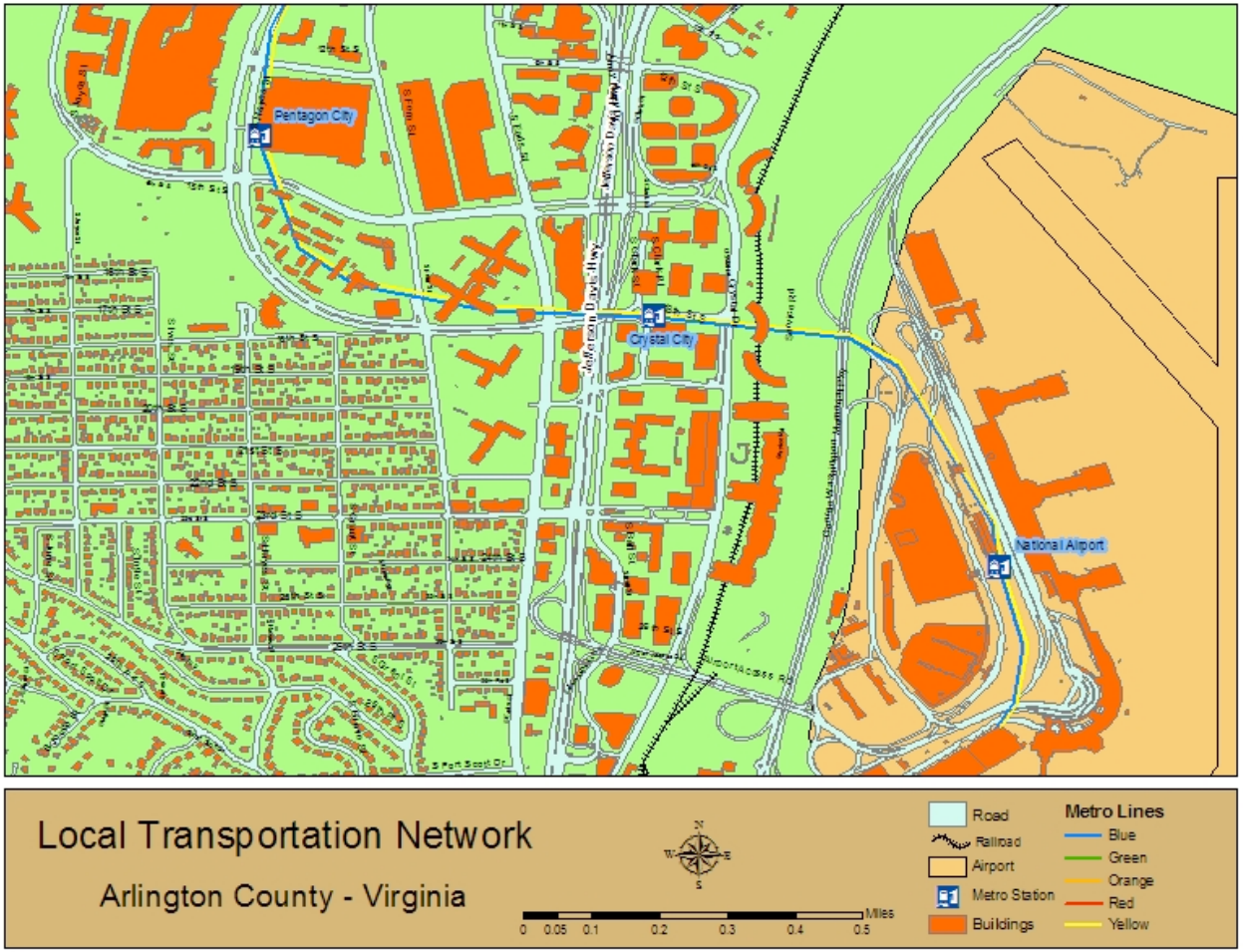
Site HazMat


ST. AGNES SCHOOL
KEY ELEMENTARY SCHOOL
GLEBE ELEMENTARY
SEARS ROEBUCK & CO
FETCH REALTORS
PAGE ELEMENTARY SCHOOL
ST. CHARLES SCHOOL
ARLINGTON CO COURTHOUSE
NATIONAL GRADUATE UNIVERSITY
GEO MASON METRO CAMPUS
HURT CLEANERS INC
ARLINGTON CLEANERS
ARLINGTON FUNERAL HM
TOWER VILLA CONDOMINIUM
C & P TELEPHONE CO
COUNTRY CLUB CLEANERS
RICHMOND SQUARE
ARLINGTON ARTS CENTER
WILSON CLEANERS
WHITE PEARL CLEANERS
CLAY ELEMENTARY SCHOOL
WMATA
THE HECHT CO
HYDE PARK CONDOMINIUMS
JACKSON ELEMENTARY
FILLMORE ELEMENTARY SCHOOL
BARRETT ELEMENTARY SCHOOL
PEARL'S CLEANERS
GARDEN APARTMENTS
US GEN SERVICES ADMIN-NATL CAP
DOMINION ARMS APARTMENTS
NEW FOREST VALET INC
CHATHAM CONDOS
FILLMORE GARDENS
Prevailing Winds (Summer)
Prevailing Winds (Winter)
Washington Blvd
Arlington Blvd
Hazmat Sites
Arlington Metro Center
Interstate
Highway
VA Railroad
Miles
0 0.1 0.2 0.4 0.6 0.8 1
EPA Hazardous Materials Sites
Arlington County - Virginia

Site Local Transportation Network



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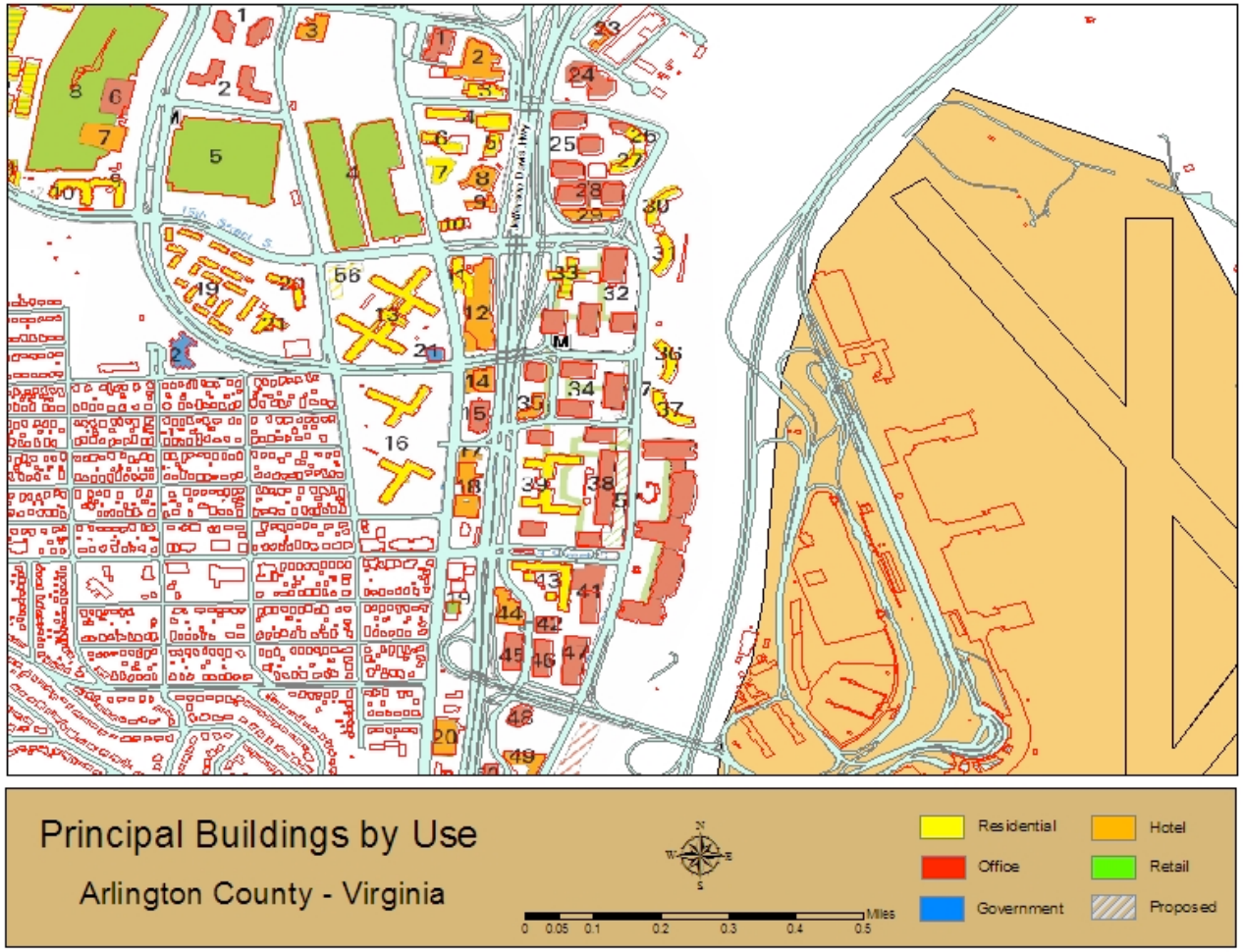
Site Principal Buildings by Use



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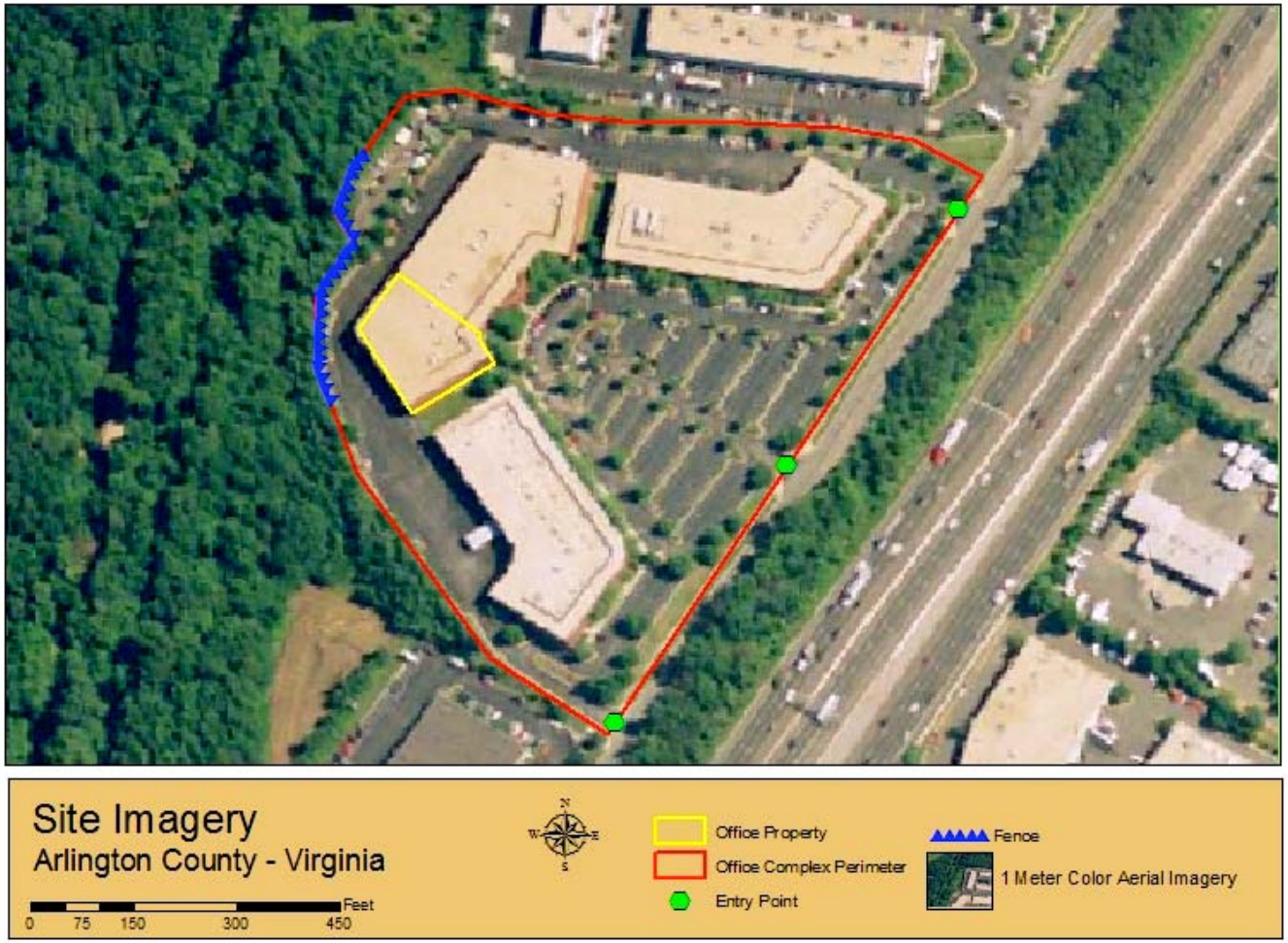
Site Perimeter Imagery



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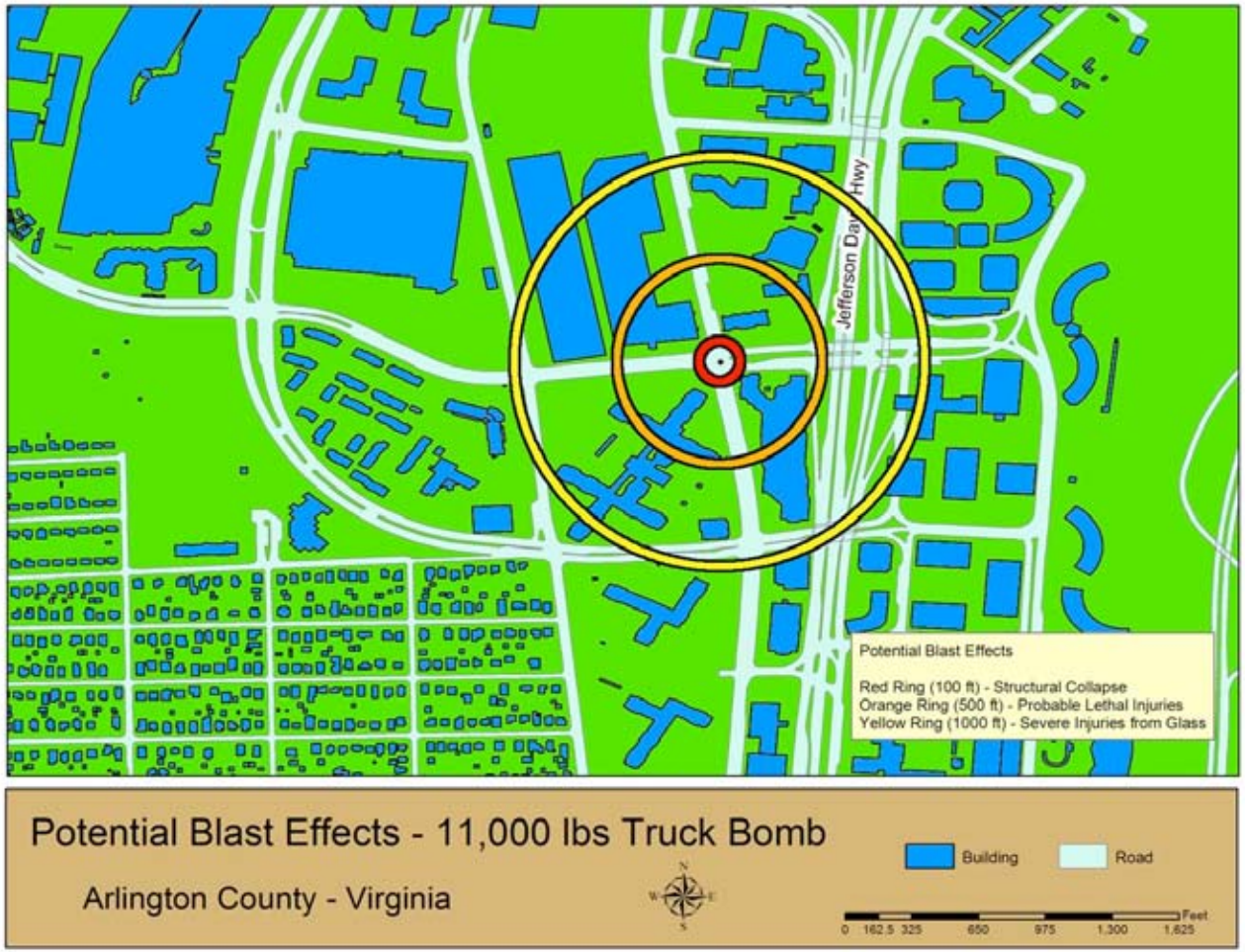
Site Truck Bomb



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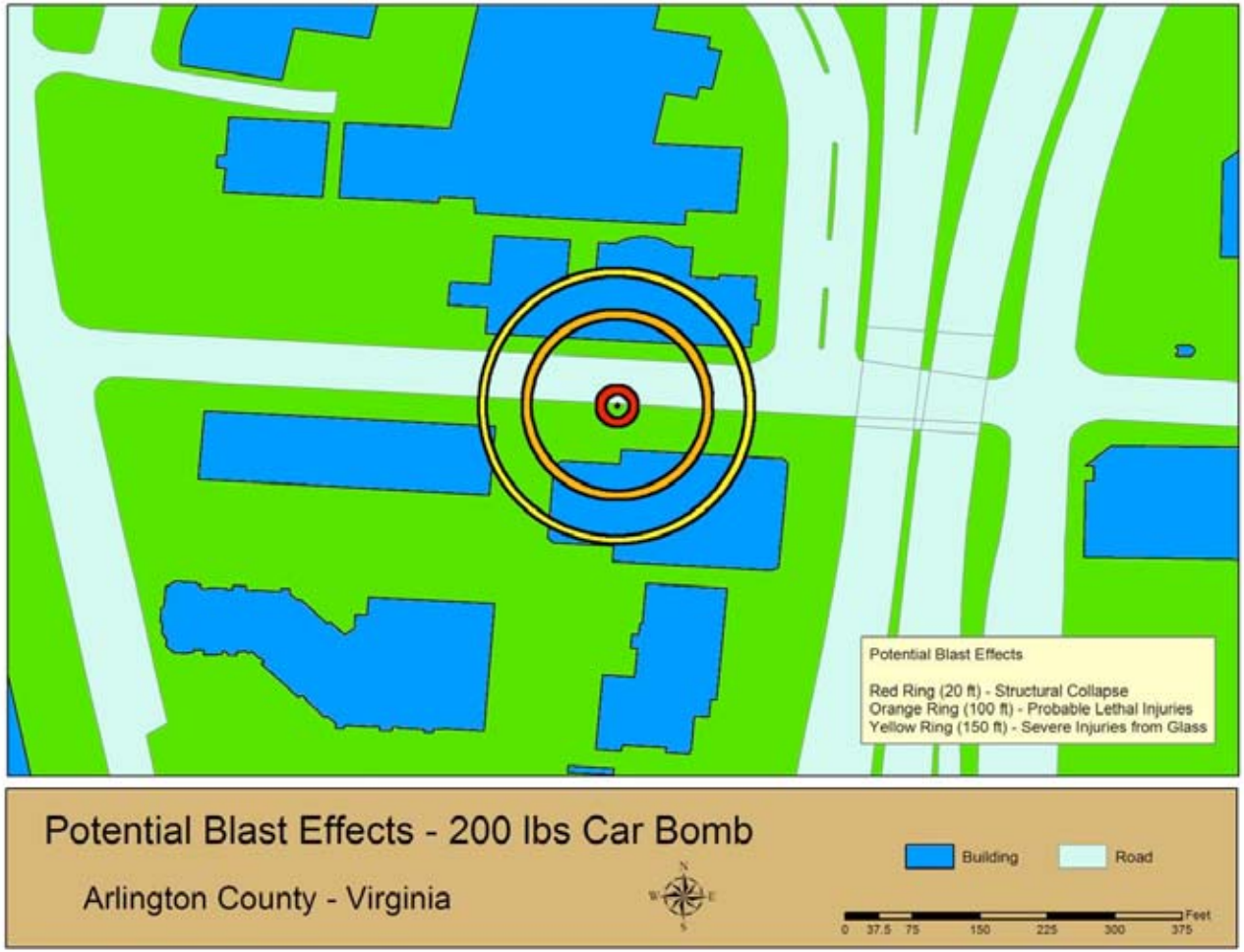
Site Car Bomb



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Options to Reduce Vulnerability

1) Define Site Functions
2) Identify Critical Systems

Interviews with Site Personnel

3) Evaluate Facility System Interactions
4) Determine Common System Vulnerabilities

Review Prints and Specs; Check with Systems Experts

5) Physically Locate Components and Lines — On-site Inspections
6) Identify Critical Components and Nodes — Apply "Vulnerability Checklist"
7) Assess Critical Nodes vs. Threats — Threat Spectrum Evaluation
8) Determine Survivability Enhancements — Survivability Options
9) Document Entire Analysis Process — Records

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Facility System Interactions

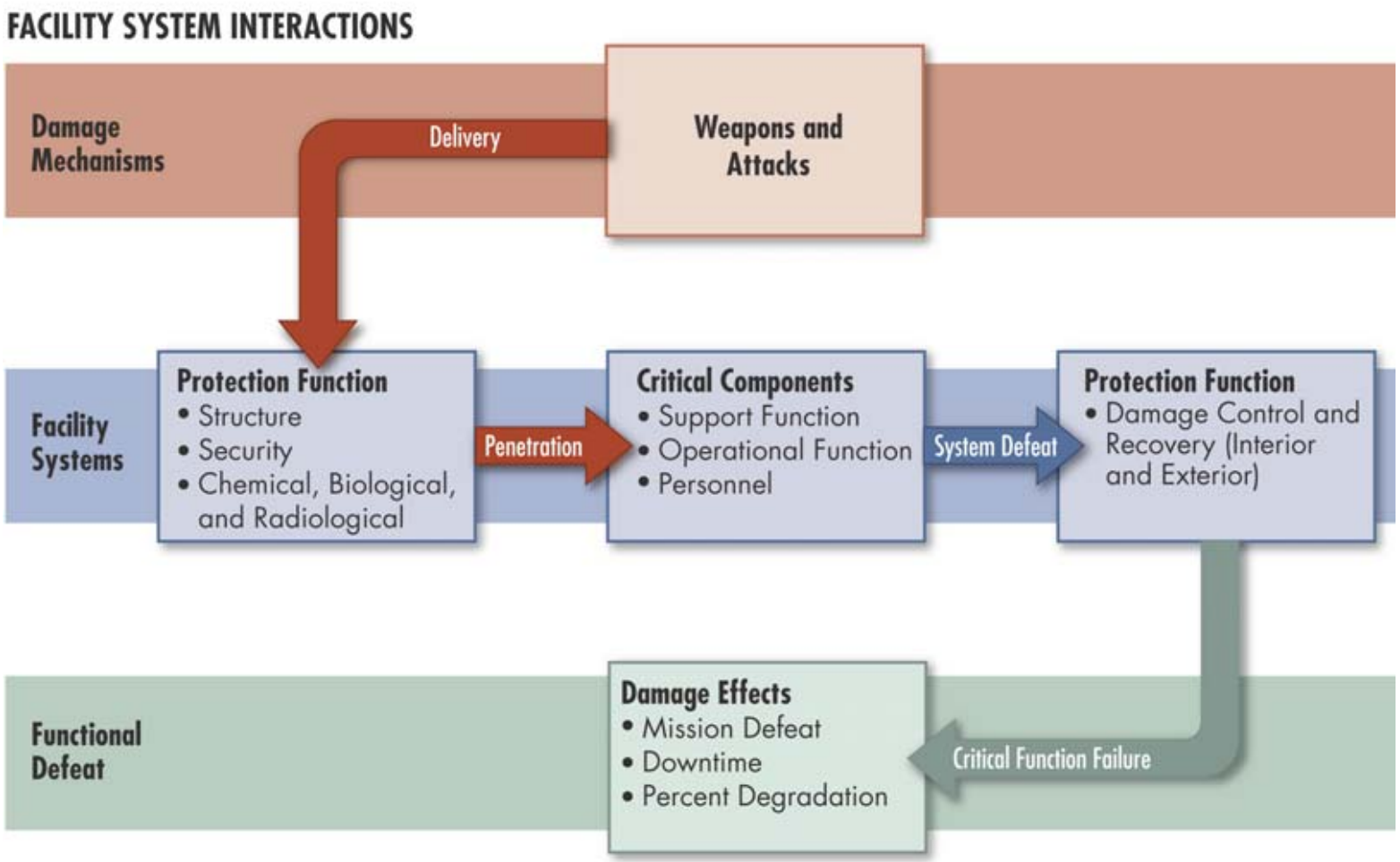
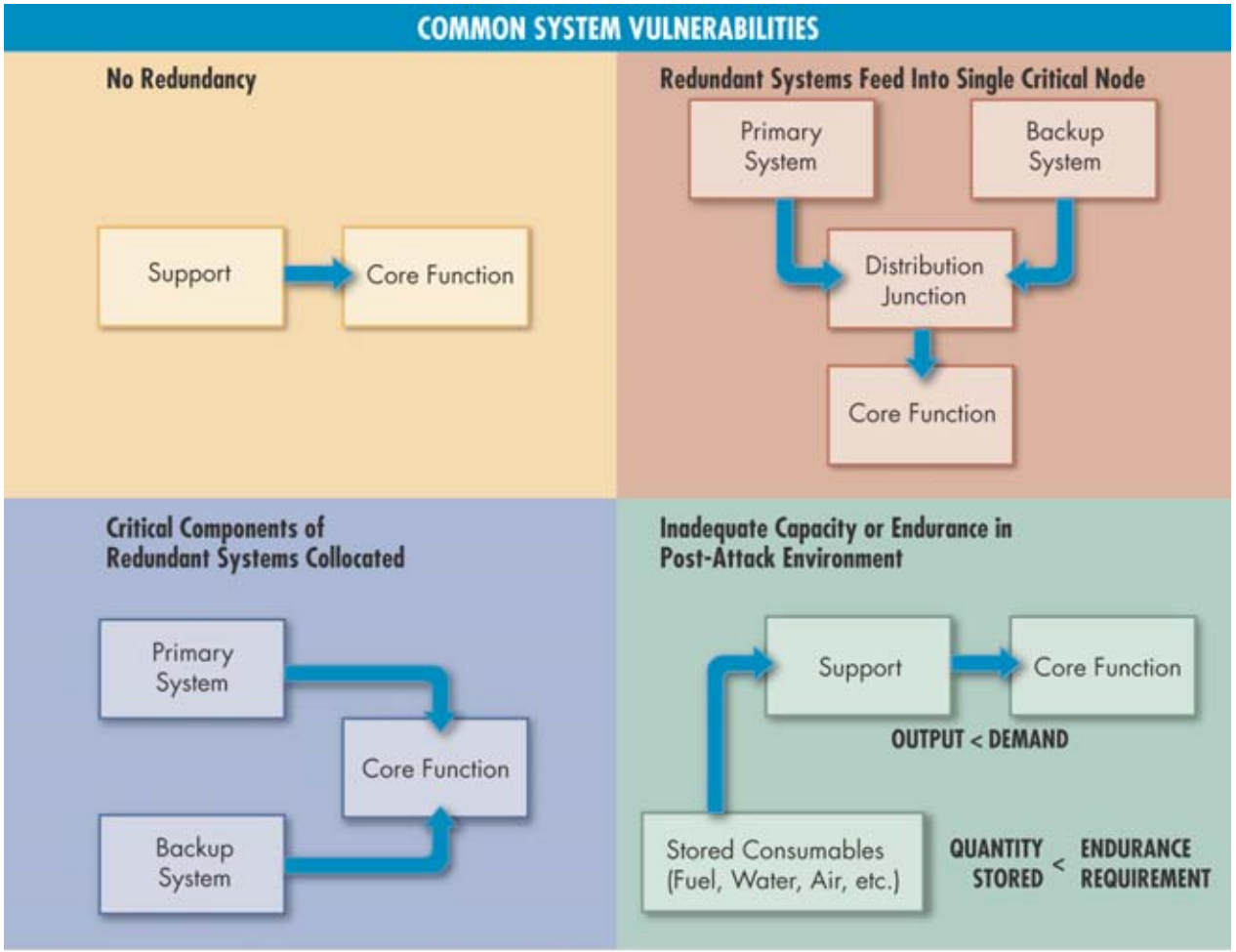


Figure 1-8: Facility System Interactions, page 1-23

Single-Point Vulnerabilities



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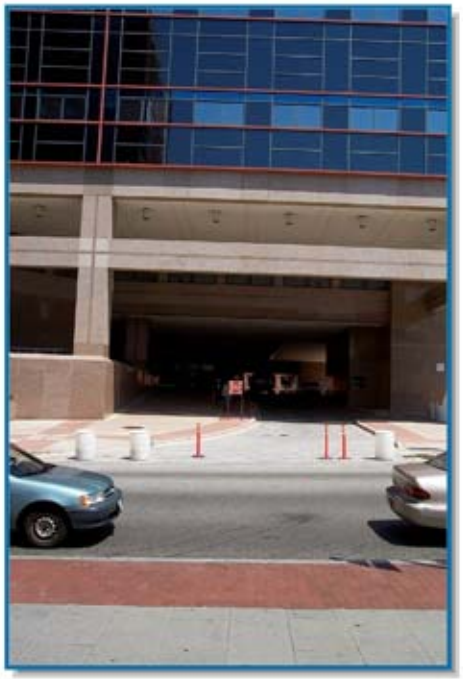
Functiona Analysis SPVs

Standard 11	The loading dock and warehouse provide single point of entry to the interior
Standard 13 and 17	The mailroom is located within the interior and not on exterior wall or separate HVAC system
Standard 1	The telecom switch and computer data center are adjacent to the warehouse
Standard 1	The trash dumpster and emergency generator are located adjacent to the loading dock

Figure 1-10: Non-Redundant Critical Functions Collocated Near Loading Dock, p. 1-41

Infrastructure SPVs

Air Intakes



Drive Through

Electrical Service

Telecom Service

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Building Vulnerability Assessment Checklist

Compiles best practices from many sources

Includes questions that determine if critical systems will continue to function during an emergency or threat event

Organized into 13 sections

- Each section should be assigned to a knowledgeable individual
- Results of all sections should be integrated into a master vulnerability assessment
- Compatible with CSI Master Format standard to facilitate cost estimates

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Building Vulnerability Assessment Checklist

- Site
- Architectural
- Structural Systems
- Building Envelope
- Utility Systems
- Mechanical Systems (HVAC and CBR)
- Plumbing and Gas Systems
- Electrical Systems
- Fire Alarm Systems
- Communications and IT Systems
- Equipment Operations and Maintenance
- Security Systems
- Security Master Plan

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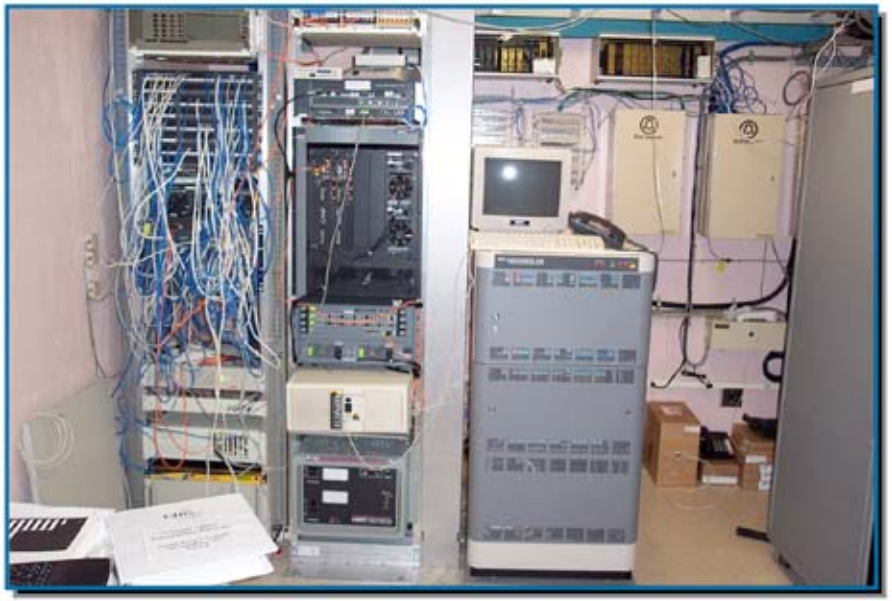
Building Vulnerability Assessment Checklist

	Vulnerability Question	Guidance	Observations
6	**Mechanical Systems (HVAC and CBR)**		
6.1	Where are the air intakes and exhaust louvers for the building? (low, high, or midpoint of the building structure) Are the intakes and exhausts accessible to the public?	*Air intakes should be located on the roof or as high as possible. Otherwise secure within CPTED-compliant fencing or enclosure. The fencing or enclosure should have a sloped roof to prevent throwing anything into the enclosure near the intakes.* *Ref: CDC/NIOSH Pub 2002-139*	
6.2	Is roof access limited to authorized personnel by means of locking mechanisms? Is access to mechanical areas similarly controlled?	*Roofs are like entrances to the building and are like mechanical rooms when HVAC is installed. Adjacent structures or landscaping should not allow access to the roof.* *Ref: GSA PBS –P100, CDC/NIOSH Pub 2002-139, and LBNL Pub 51959*	

Extracted from Table 1-22: Building Vulnerability Assessment Checklist, pages 1-46 to 1-92.

Building Vulnerability Assessment Checklist



5.19	By what means does the main telephone and data communications interface the site or building?
5.20	Are there multiple or redundant locations for the telephone and communication service?
5.21	Does the fire alarm system require communication with external sources? By what method is the alarm signal sent to the responding agency: telephone, radio, etc.? Is there an intermediary alarm monitoring center?

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Extracted from Table 1-22: Building Vulnerability Assessment Checklist, pages 1-46 to 1-92.

Building Vulnerability Assessment Checklist

1.15	Is there minimum setback distance between the building and parked cars?
4.1	What is the designed or estimated protection level of the exterior walls against the postulated explosive threat?
4.2	Is the window system design on the exterior façade balanced to mitigate the hazardous effects of flying glazing following an explosive event? (glazing, frames, anchorage to supporting walls, etc.)?

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Extracted from Table 1-22: Building Vulnerability Assessment Checklist, pages 1-46 to 1-92.

Building Vulnerability Assessment Checklist

6.1 ☐	Where are the air intakes and exhaust louvers for the building? (low, high, or midpoint of the building structure) Are the intakes and exhausts accessible to the public?
1.9 ☐	Is there any potential access to the site or building through utility paths or water runoff? (***Eliminate potential site access through utility tunnels, corridors, manholes, storm water runoff culverts, etc. Ensure covers to these access points are secured.)***
3.1 ☐	What type of construction? What type of concrete and reinforcing steel? What type of steel? What type of foundation?

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Extracted from Table 1-22: Building Vulnerability Assessment Checklist, pages 1-46 to 1-92.

Building Vulnerability Assessment Checklist

2.19	Are loading docks and receiving and shipping areas separated in any direction from utility rooms, utility mains, and service entrances, including electrical, telephone/data, fire detection/alarm systems, fire suppression water mains, cooling and heating mains, etc.?
1.16	Does adjacent surface parking on site maintain a minimum standoff distance? ***For initial screening consider using 25 meters (82 feet) as a minimum with more distance needed for unreinforced masonry or wooden walls. Reference: GSA PBS-P100***

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Extracted from Table 1-22: Building Vulnerability Assessment Checklist, pages 1-46 to 1-92.

Vulnerability Rating

Very High – One or more major weaknesses have been identified that make the asset extremely susceptible to an aggressor or hazard.

High - One or more significant weaknesses have been identified that make the asset highly susceptible to an aggressor or hazard.

Medium High – An important weakness has been identified that makes the asset very susceptible to an aggressor or hazard.

Medium – A weakness has been identified that makes the asset fairly susceptible to an aggressor or hazard.

Medium Low – A weakness has been identified that makes the asset somewhat susceptible to an aggressor or hazard.

Low – A minor weakness has been identified that slightly increases the susceptibility of the asset to an aggressor or hazard.

Very Low – No weaknesses exist.

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Critical Functions

Function	Cyber attack	Armed attack (single gunman)	Vehicle bomb	CBR attack
Administration				
Asset Value	5	5	5	5
Threat Rating	8	4	3	2
Vulnerability Rating	**7**	**7**	**9**	**9**
Engineering				
Asset Value	8	8	8	8
Threat Rating	8	5	6	2
Vulnerability Rating	**2**	**4**	**8**	**9**

Extracted from Table 1-20, page 1-38

Critical Infrastructure

Function	Cyber attack	Armed attack (single gunman)	Vehicle bomb	CBR attack
Site				
Asset Value	4	4	4	4
Threat Rating	4	4	3	2
Vulnerability Rating	**3**	**5**	**9**	**9**
Structural Systems				
Asset Value	8	8	8	8
Threat Rating	3	4	3	2
Vulnerability Rating	**2**	**4**	**8**	**9**

Extracted from Table 1-21, page 1-39

Summary

Step-by-Step Analysis Process:

- Expertly performed by experienced personnel
- Determines critical systems
- Identifies vulnerabilities
- Focuses survivability mitigation measures on critical areas
- Essential component of Critical Infrastructure and Critical Function Matrices

Unit IV Case Study Activity

Vulnerability Rating

Background

Vulnerability: any weakness that can be exploited by an aggressor or, in a non-terrorist threat environment, make an asset susceptible to hazard damage

Requirements: Vulnerability Rating Approach

Use rating scale of 1 (very low or no weakness) to
10 (one or major weaknesses)

Refer to HIC case study and rate the vulnerability of asset-threat/hazard pairs:

- HIC Critical Functions
- HIC Infrastructure

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