Commonwealth of Virginia Emergency Operations Plan
Standard Hazard Mitigation Support Annex 3
(Volume II)

CHAPTER 3

Hazard Identification and Risk Assessment (HIRA)

Section 3.4:
State and Critical Facility Analysis

2010

SECTION 3.4

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Section 3.4: State and Critical Facility Analysis

In addition to examining vulnerability to jurisdictions, the HIRA also considered state facility and critical facility vulnerability. The HIRA does not include local assessment information; local plan data was evaluated, but was not included due to inconsistencies between the plans. See Section 3.6 for detailed information about the local plans and future mitigation action items to increase the usability of local plan data.

Facility Databases and Locations

The HIRA examined two major sources of facility data: the Virginia Agency Property System (VAPS) for state owned, leased, or managed facilities; and, a critical facilities data collection built from datasets provided by various state and local entities. Many of the buildings in the VAPS database are critical to disaster preparedness and response, although not all critical facilities are in the VAPS database. For example, many privately owned buildings and structures (hospitals, power plants, certain industrial facilities, etc.) may be considered critical during certain natural disasters. As such, the critical facilities data collection has been used to represent a broader array of critical facilities than would be available through VAPS. However, as will be discussed, the critical facilities data collection is currently a work-in-progress.

VAPS Database

The most comprehensive source of state facility information was the VAPS database, maintained by the Division of Risk Management in the Virginia Department of the Treasury. VAPS contains information for over 13,000 locations for 246 state agencies, which includes public universities and colleges in Virginia. For the purposes of the risk assessment, the term State-owned facilities is used to refer to both State-owned and State-operated facilities. The VAPS database is non-spatial; that is, geographic coordinates (or more advanced geographic data types) are not included for all of the records in the database. The VAPS database does contain extensive attributes about each building or structure, such as basic structural information, construction type, building value, square footage, number of floors, year built, and sprinkler systems.

The 2003 version of the HMP used the VAPS database. This version of the HMP updated the data used in 2003 with a new export of VAPS records from the Department of Treasury, and expanded the geocoding effort to relate more of the VAPS records to geographic locations in the form of building footprints, campus footprints, or geocoded points.

While many state agencies have a large number of records in the VAPS database, public colleges and universities account for a significant portion, and may already have geocoded locations or building footprints as a result of previous GIS efforts. In attempt to avoid duplicating efforts, Colleges and Universities were contacted (in September 2008) to see if they would be able to provide the GIS files for building footprints on their campus. All of the agencies that were able to provide data were a result of the efforts for the Disaster Resistant University (DRU) plans.

The following universities were able to provide data:

- Virginia Tech
- Radford State University
- Virginia State University
- George Mason University
- University of Virginia
- Old Dominion University
- University of Mary Washington

The DRU project is a grant matching program started by the FEMA as an outreach of that agency's Project Impact to help universities improve life safety and continuity of operations in the event of a natural disaster. In the last decade, disasters have affected university and college campuses with disturbing frequency, sometimes causing death and injury, but always imposing monetary losses and disruption of the institution's teaching, research, and public service. Eight colleges and universities are currently working on (or have completed) separate hazard mitigation plans (DRUs) in the Commonwealth. These include:

- Radford State University (Approved & Adopted DRU)
- Virginia Tech (Approved & Adopted DRU)
- Mary Washington (Approved & Adopted DRU)
- Old Dominion (Approved & Adopted DRU)
- Virginia State University (Approved & Adopted DRU)
- University of Virginia (Approved & Adopted DRU)
- George Mason (Approved & Adopted DRU)
- Virginia Commonwealth University (Underway)

As in the 2003 plan, several methods were used to spatially locate the VAPS facility records. One change from the previous plan is that this version has not used county-level location of state facilities, due to the lack of precision in such a method. In this version of the plan, approximately 97% of the total building value reflected in VAPS can be tied to a spatial location. Three geo-locating methods were used, from least to most complex:

1. Buffered Address Point
2. Individual Building Polygon
3. Building Group Polygon

The lack of locational information (or the presence of inaccurate information) in the database resulted in some facilities not being tied to a geographic location. Some of the VAPS address fields were incomplete, or not in a format that could be used by a geocoding service (i.e. E911 format). Approximately 33% of the VAPS facilities were not geo-located, these facilities account for about 3% of the total building value in the entire database. As shown in Table 3.4-1, over 80% of the High Potential Loss (CP), Hazardous Materials (CH), Vulnerable (CV), and Archival (CA) facility types have been mapped by one of the three methods mentioned above. Approximately 63% of the Transportation Systems (CT) and Lifeline Utility Systems (CL) have been mapped. Table 3.4-2 shows the breakdown of the location method used and building value of the state facilities in each group.

Table 3.4- 1: VAPS database summary of location method, percentage mapped, and building value.

Location Method	Number of Locations	Percent of Facilities	Total Value	Percent of Total Value
Buffered Address Point	4,620	34.7%	$1,847,518,126	8.1%
Individual Building	1,579	11.9%	$13,995,677,110	61.6%
Building Group Polygons	2,752	20.7%	$6,217,749,861	27.4%
Not Found	4,360	32.7%	$668,094,796	2.9%
Buffered Address Point Outside of Virginia	7	0.05%	N/A	0.0%
Total	**13,318**	**100%**	**$22,729,039,893**	**100%**

Buffered Address Point

Geocoding or “address matching” uses non-spatial information describing a location (i.e. VAPS database addresses) and converts this information into a spatial address in terms of latitude and longitude (i.e. the geocoded point). In geocoding, addresses from the VAPS database were compared against the addresses in ESRI’s StreetMap USA dataset. When an address match was found between the two databases, a

geographic point location was assigned to the particular record in the VAPS database. After geocoding, each point was buffered to create a polygon approximating the size of the building. The approximate size of each building was determined by dividing the total square footage of the building by the number of floors, as reported in VAPS. Overall, this geocoding and buffering method yields an approximate location and area for geocoded VAPS facilities. This method is the least accurate of the methods used, as the geocoding process does not usually yield points that fall precisely on the buildings. Approximately 35% of the VAPS facilities buildings, or 8% of the total building value, were located using this technique. Of the buffered addresses, 7 facilities that were located were outside of Virginia. These facilities were not a part of the hazard analysis. Figure 3.4-1 shows an example of a buffered address point.

Individual Building Polygon

The most desirable geospatial representation of a building is a polygon representing its footprint. This representation was used for the higher building value locations. First, the VAPS database was sorted by building contents and fine arts values. Locations that could be considered “institutions”, such as hospitals, correctional facilities, community colleges and state colleges and universities, were spatially located to an appropriate location using various methods (such as ESRI data, web searches, and online campus maps). Editing tools were then used to draw a “polygon” around the perimeter of the buildings. In addition to creating the building footprints manually, some universities provided GIS data that already included building footprint polygons. This provided data was incorporated into the geodatabase. The majority of the Hazardous Materials (CH) facility types were located with this method. Figure 3.4-2 shows an example of an individual building polygon.

Building Group Polygon

The same technique used for individual building polygons was used to create building group polygons (or “campus” polygons). A building group polygon was used when only general information about the facility location was found, without enough specifics to support the creation of individual building polygons. In some cases building groups would enclose individual buildings; in these cases the area of the individual building would be clipped out (forming a donut hole) so the area would not be double-counted. The resulting building group polygons were then used in analyses to represent all of the related buildings listed in the VAPS database. The majority of the Vulnerable (CV) and Archival (CA) facility types were located witht his method. Figure 3.4-3 shows an example of a building group and Figure 3.4-4 shows and example of a building group with individual buildings enclosed inside.

Figure 3.4- 1: Buffered address point.

Figure 3.4- 2: Individual building polygon.

Figure 3.4- 3: Building group polygon.

Figure 3.4- 4: Building group polygon with individual building polygons.

Critical Facilities

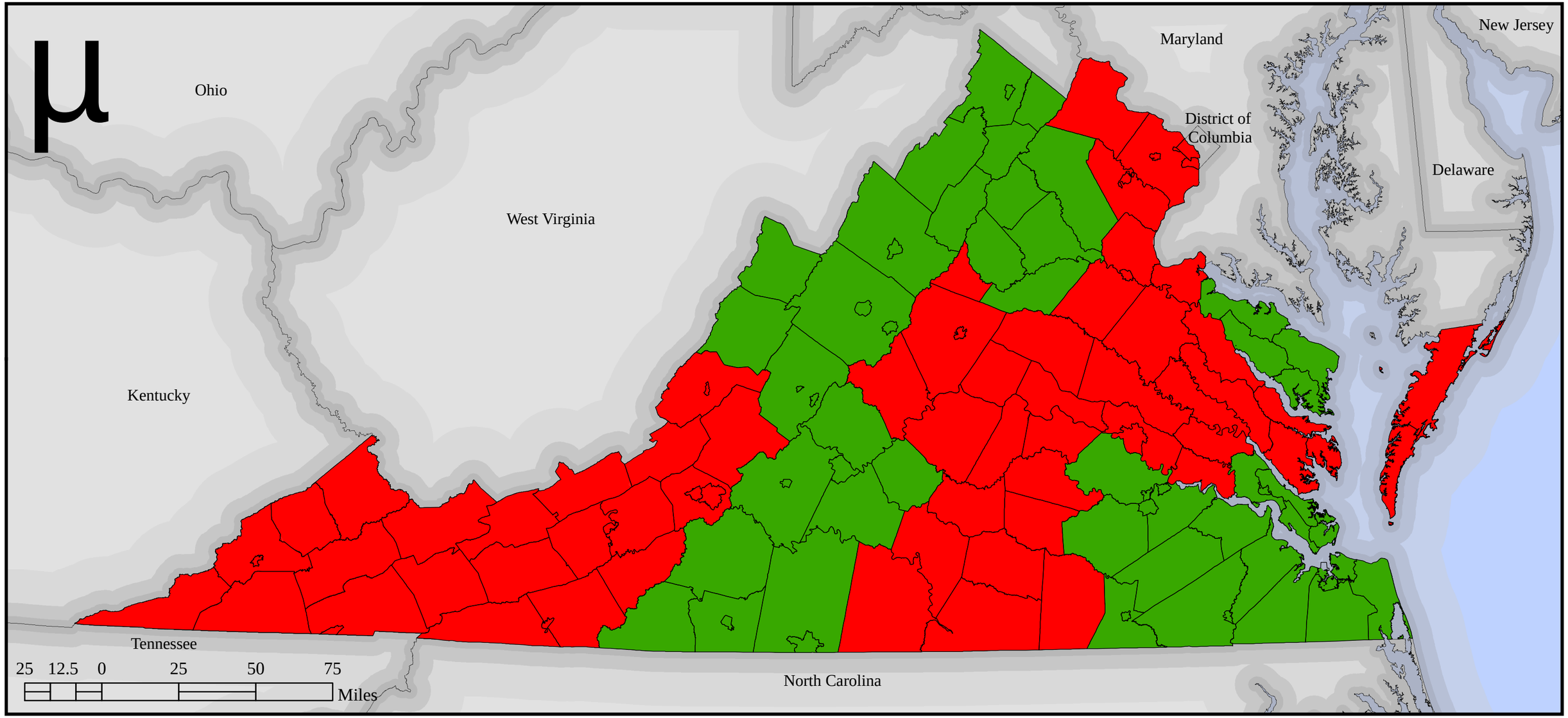
There is currently no standard critical facility dataset for the Commonwealth; various plans have used different datasets, based upon the geographic and subject-matter scope of each plan. Requests for the critical facility data used in the local hazard mitigation plans were sent out to the designated representatives in November 2007, asking for any spatial data that was used in the creation of the local plan. Response from the 27 approved plans was very limited, 13 local plan representatives were able to provide data (Figure 3.4-5). This data was examined for usability by CGIT and VDEM, but there was a lack of consistency between the various local datasets, in terms of spatial and attribute detail, and in terms of the definition of what constitutes a "critical" facility.

Due to the lack of local data, and the inconsistency in the data received, this plan uses separate sources of data to describe each critical facility. This version of the plan identifies the following broad types of critical facilities:

- Law Enforcement Facilities
- Schools
- Emergency Operation Centers
- Fire Stations
- Hospitals
- Nursing Homes

Although not a complete representation of all the possible types of critical facilities, this data is a good representation of facility locations in the state. The data from these various sources (Table 3.4-3) was combined together in a unified database for analysis and ease of distribution to localities. The available critical facility data is not as comprehensive as the VAPS database; it only contains the general location of each of the facilities, with no attribute information such as building value, size, etc. In addition, facilities are represented only as geographic points, and so the full spatial extent of larger facilities is not considered.

Figure 3.4-5: Local Critical Facility Data Provided



DATA SOURCES:

CGIT Data Provided
VGIN Jurisdicational Boundaries
ESRI State Boundaries

LEGEND:

Critical Facility Data Provided

- No data provided at this time
- Critical facility data used in plan provided

DATA DESCRIPTION:

There is currently no standard critical facility dataset for the Commonwealth. Requests for critical facility data used in the local hazard mitigation plans were sent out to the designated representatives of the 27 approved plans, 13 local plan representatives were able to provide data. This data was examined for usability by CGIT and VDEM, but there was a lack of consistency between the various local datasets, in terms of spatial and attribute detail, and in terms of the definition of what constitutes a "critical" facility.

PROJECTION: *VA Lambert Conformal Conic*
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DISCLAIMER: Majority of available hazard data is intended to be used at national or regional scales. The purpose of the data sets are to give general indication of areas that may be susceptible to hazards. In order to identify potential risk in the Commonwealth available data has been used beyond the original intent.

Facility Analysis

Each individual hazard includes the analysis results in the risk assessment section for the state owned and critical facilities. Facilities were intersected with the hazard's Geographic Extent (GE) layer to determine the buildings risk zone. The analysis methodology is described in full detail in these sections; tables are used to represent the number of facilities in each risk category.

Potential dollar loss to state facilities was completed for some of the hazards. Total exposed building value has been denoted for all of the addressed hazards. Annualized loss and the total building value at risk has been calculated for state facilities within special flood hazard areas (section 3.7). Agencies with a large quantity of structures or building value in the high risk hazard areas are noted in each of the sections. These agencies and buildings are an excellent starting point for assessing the need for specific mitigation action items.

In depth analysis could not be completed for the critical facilities because of the lack of building specific details, as previously discussed.

Future Mitigation Actions

Proposed mitigation actions address the need for a more complete critical facility database, and an enhanced state facility database.

VDEM will need to consider standardizing the definition of a critical facility for local plan revisions, and provide advice on the essential attributes to be collected. This would act as a template for local plans to follow in the future. Some options could include the VAPS database definitions (table 3.4-1) or the FEMA HAZUS software which is currently evolving into the Comprehensive Data Management System (CDMS) that could be used as a template for this data collection process.