

Northeast Utilities Overhead Transmission Line Standards

1. Scope

This standard describes the vegetation clearing along rights-of-way (ROW) of the NU operating companies in Connecticut and Massachusetts where overhead transmission lines are to be constructed. The practices described here apply to the construction requirements for all 115kV and 345kV ¹ electric transmission lines, and are consistent with the North American Electric Reliability Council (NERC) Vegetation Management Standard FAC-003-1 dated 2/16/2006, The New England Independent System Operator's (ISO-NE) vegetation clearing standard OP-3 dated 2/1/2005, and the National Electrical Safety Code (NESC) Rule 218 as adopted by the Connecticut Department of Public Utility Control (Regulation Sec. 16-11-134).

This standard applies to new construction clearing requirements and practices and not to on-going future vegetation maintenance of the ROW's. The initial clearance requirements outlined in this standard are intended to provide adequate clearances for a period of four (4) years at which time scheduled maintenance will be performed to reestablish or preserve the initial clearances. The maintenance of the vegetation following construction is addressed under the Northeast Utilities Specification for Rights-of-Way Vegetation Management. Low-maturing trees, which are allowed to remain after completion of vegetation clearing, are still subject to future trimming and removals, depending upon their growth and health, as well as the future needs of NU to operate, maintain, and add or replace electric facilities on the ROW.

NU operating companies typically obtain permanent easement rights for the placement of overhead transmission lines, including the right to clear vegetation within the fully defined limits of a ROW. In most locations the right to remove any tree or portion of tree outside the easement limits of the ROW ("danger tree") that by falling could endanger the transmission line facilities is also obtained. These rights are necessary to provide for the safe and reliable operation and maintenance of any overhead transmission line that is built on a ROW.

Notwithstanding these rights, the standard practice of the NU operation companies is to minimize tree and other vegetation removal that is required for new transmission line construction by:

- A. Designing new lines to keep the positions of new conductors as much as possible within any existing cleared ROW corridor, thus minimizing additional clearing
- B. Remove non-compatible vegetation (trees and tall growing shrub species) within the conductor clearance zone (area directly under the conductors extending 15 feet horizontally outward from the outermost line conductors)

¹ Except for possible modifications to existing 69kV lines, it is unlikely that NU will construct any new 69kV lines. Therefore, this standard covers 115 and 345kV lines only, and 115kV line clearances would apply to any new 69kV lines.

Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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- C. Allowing low-maturing tree species such as dogwoods to remain within the side zones (area outside of the conductor clearance zone extending to the edge of the ROW clearing limits) where these low-maturing species exist
- D. Re-establishing pre-existing access roads for construction vehicles to minimize the clearing of low growth within the existing corridor for access
- E. Locating new line structures close to old structures and overlapping the work areas of old structures to reduce to the amount of clearing for the new structure work areas
- F. Where feasible, using existing conductors to pull in new conductors, thus reducing damage to low growth vegetation along the cleared corridor
- G. Engaging an arborist to determine individual “danger trees” for removal considering
 - 1) Species
 - 2) Soil conditions
 - a) including wetland vs. upland
 - b) susceptibility to flooding
 - c) depth to rock (and adaptability of the species to those conditions)
 - 3) Health of the tree
 - 4) Inclination of trunk
 - 5) shape of crown

Refer to figures V-1 through V-6 for diagrams of the conductor clearance zone and side zones associated with various line structure types.

2. Clearance between Conductors and Woody Vegetation

Transmission lines within the Northeast Utilities System present a variety of woody vegetation control situations. Regulatory authorities may require “buffers” or “screening” at visually sensitive highway and local road crossings or other locations, and such locations require special attention to achieve and maintain the necessary clearances. At all other locations, standard ROW vegetation clearing practices for new line construction are as follows:

- A. Within the ROW limits, as depicted on Figures A, B, and C, cut all tall-maturing tree species of any height while retaining existing compatible woody shrub species (see Appendix 1).
- B. Clear-cut construction areas at structure locations and access roads as depicted on Figure C.
- C. At road crossings, within side zones and other sensitive areas, as specified by ROW development and management plans, retain existing low-maturing tree species such as Flowering Dogwood (see Appendix 2) to the extent that these trees will not conflict with operation of the transmission line prior to the next scheduled vegetation maintenance.
- D. At ravines, river crossings, and similar locations: retain tree species on the ROW where the conductors will be significantly higher than normal and where the

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vegetation at full mature height would not violate Figure A clearances and will not cause construction or access problems.

The minimum clearances established in Figures A, B, and C between conductors and woody vegetation includes allowances for re-growth over the periodic maintenance cycle of four (4) years for vegetation within the cleared limits of the ROW, and ten (10) years for vegetation beyond the cleared limits of the ROW. The defined clearances cover all vegetation including natural growth, screens or buffers, orchards, ornamental plantings, nursery stock, and danger trees.

The minimum clearances applicable to woody vegetation are shown in the included figures.

- 1) Figure A; Minimum Conductor Clearances
- 2) Figure B; Danger Tree Clearance
- 3) Figure C; Conductor Clearance Zone, Side Zones and Structure Clearing Areas for New Construction

Where Orchards, ornamental plantings, or nursery stock is permitted by easement or license to exist, the maximum tree heights allowed within the conductor and side zones are shown in Figure A. Agreements with individual property owners may define site-specific maximum allowable tree heights and should be checked prior to scheduled maintenance activities.

Where rights exist beyond the edge of the ROW, any tree designated as a “danger tree,” i.e. a tree that can fall within the dimensions noted in Figure B that is determined to be an imminent hazard will be removed at the discretion of the arborist. In sensitive areas adjacent to or within the ROW or where rights or other permission to remove danger trees cannot be obtained, arborists will direct the removal of those portions of the tree canopy projecting into the ROW, and those portions of a tree which, if they become detached, may fall within the minimum clearance distances as shown on Figure B. On side-hill ROW’s, danger trees can be found significantly further from the conductors on the uphill side of the ROW.

3. Clearing for New Construction

This clearing consists of clear cutting four distinct areas of the ROW as defined by Figure C. These clearing areas are:

- A. Basic clearing of the ROW width, which consists of a conductor clearance zone and side zones. Low-maturing woody shrub species are typically not removed from the side zones, and low maturing tree species such as Flowering Dogwood will be preserved where they do not conflict with construction needs.
- B. Clearing at each structure location as required for construction equipment
- C. Clearing the full length of all access road and spurs to structure sites for a cleared width of fifteen (15) feet
- D. Removal of danger trees that pose an imminent risk to the new line along the new or existing clearing edge

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For new line construction, in addition to the cleared area around each structure, a lay-down and assembly area may be required that is considerably larger. The size of this area depends upon topography, the type of structure to be assembled, and the type of foundation required at the site. Also at selected locations spaced several miles apart, setup sites for conductor-pulling equipment are required within the conductor zone and may require some removal of shrub growth.

The process to accomplish the clearing for new construction involves:

- A. Field survey and stake the edge of the clearing limits and conductor zone
- B. The NU "Owner's Representative" further reviews the survey staking before clearing begins
- C. Where specified in an existing agreement with individual landowners, the Owner's Representative or his designee marks acceptable low growing trees they will attempt to retain within a side zone
- D. The Owner's Representative contacts landowners before the clearing begins if they wish to discuss the clearing as marked out, and to ask if the property owner wishes to take ownership of the cut wood
- E. Where the landowner will take the cut wood, an agreement will specify the contractor's placement of cut wood outside the ROW, or the landowner's schedule for removal if at a location within the ROW
- F. Carry out the clearing operation
- G. Cut using chain saws within wetland areas, and minimize the use of mechanized equipment for removal (note: mechanized equipment may be used to remove the logs and tree tops from a wetland by positioning equipment outside wetlands to drag out logs and tops using cables)
- H. During or shortly after the initial clearing operation, an arborist will evaluate trees beyond the edge of the clearing limits to identify and mark danger trees that pose an imminent risk to the new line
- I. The landowner will then be given an opportunity to discuss the danger trees marked for removal with the Owner's Representative who will then give instructions to the contractor

Contracts for clearing will be structured to effectively implement the above process and this standard. Despite efforts to minimize tree and other vegetation removal, there may still be locations where the transmission facility requirements and/or the existing vegetation conditions are such that no substantial vegetation may remain within the ROW limits.

4. Clearing for Structure Maintenance or the Replacement of an Existing Line

Clearing for structure maintenance or replacement of an existing line is similar to that for new line construction with the following exceptions:

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- A. Clearing needs depend on the relative location of the rebuilt line with respect to the existing maintained area of the ROW and the proposed construction method for installation of conductors and shield wires. These factors may reduce the needed clearing.
- B. Structure site and access road clearing will still be required but may also be significantly reduced.
- C. When structures from the old line are removed, the cleared area at these sites and the access spurs to them will be allowed to naturally re-vegetate with native plant species, which may include native grasses, forbs or shrubs.

5. Decision Responsibility for Retention of Non-standard Woody Vegetation

The transmission line Construction Manager and Contractor Arborist will be responsible for obtaining approval from the Transmission Supervisor, Vegetation Management before allowing vegetation to remain which conflicts with the clearances shown in Figures A, B, and C.

6. Approving Managers and SME

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Manager Transmission Line and Civil Engineering
Northeast Utilities

Peter Avery
Manager Transmission Line Construction and MTCE
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SME

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7. Deviations

This standard sets forth the current NU 'best practices' for most applications of this subject matter. Therefore, deviation from this standard is generally not permitted. However, in unique instances a user may submit a written deviation request including justification to the listed Subject Matter Expert (SME). The SME must approve or deny the request in writing prior to the user commencing any non-standard activities. The SME may consult with his/her supervisor, co-SME if any and co-SME supervisor, and subsequently must copy any approval to them.

Revision History
Rev.0 – original issue
Rev. 1 – Clarified conductor zone and side zone definitions, and clearing practices to address NERC reliability requirements through strict conformance to the ISO-NE OP-3.

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APPENDIX 1

SHRUB SPECIES ALLOWED TO REMAIN: (PARTIAL LIST)

<u>COMMON NAME</u>	<u>GENUS/SPECIES</u>
Arrowwood Viburnum	<i>Viburnum dentatum</i>
Bayberry	<i>Myrica pennsylvanica</i>
Blueberry - Highbush	<i>Vaccinium corymbosum</i>
Blueberry - Lowbush	<i>Vaccinium angustifolium</i> & <i>V. vacillans</i>
Brambles	<i>Rubus</i> spp.
Buttonbush	<i>Cephalanthus occidentalis</i>
Dogwood - Gray	<i>Cornus racemosa</i>
Dogwood - Redosier	<i>Cornus stolonifera</i>
Dogwood - Silky	<i>Cornus amomum</i>
Elderberry	<i>Sambucus</i> spp.
Hazelnut	<i>Corylus americana</i> & <i>C. cornuta</i>
Honeysuckle - Bush	<i>Diervilla lonicera</i>
Honeysuckle - Fly	<i>Lonicera canadensis</i>
Honeysuckle - Tartarian	<i>Lonicera tatarica</i>
Huckleberry	<i>Gaylussacia</i> spp.
Maple-leaf Viburnum	<i>Viburnum acerifolium</i>
Meadowsweet - Broad-leaved	<i>Spirea latifolia</i>
Meadowsweet - Narrow-leaved	<i>Spirea alba</i>
Mountain Laurel	<i>Kalmia</i> spp.
Oblong Fruited Juneberry	<i>Amelanchier bartramiana</i>
Oldfield Common Juniper	<i>Juniperus depressa</i>
Pasture Juniper	<i>Juniperis communis</i>
Running Shadbush	<i>Amelanchier stolonifera</i>
Sheeplaurel	<i>Kalamia augustifolia</i>
Spicebush	<i>Lindera benzoin</i>
Steeplebush	<i>Spirea tomentosa</i>
Sumac - Smooth	<i>Rhus glabra</i>
Sweetfern	<i>Comptonia peregrina</i>
Sweetpepperbush	<i>Clethra alnifolia</i>
Winterberry	<i>Ilex verticillata</i>
Witch Hobble	<i>Vburnum alnifolium</i>
Witherod	<i>Viburnum cassinoides</i>

Appendix 1			
Right-of-Way Vegetation Initial Clearance Standard			
for 115- and 345-kV Transmission Lines			
Northeast Utilities Approved by: DEH, PJA	Design and Application	OTRM 030.006	Rev. 1 05/16/2008

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APPENDIX 2

LOW-MATURING TREE AND SHRUB SPECIES ALLOWED TO REMAIN ALONG THE SIDE ZONES: (PARTIAL LIST)

All species listed above including:

Alder

Dogwood - Alternate-leaved

Dogwood - Flowering

Sumac - Shining

Sumac - Staghorn

Willows (except tree species)

Witch-Hazel

Alnus spp.

Cornus alternifolia

Cornus florida

Rhus copillina

Rhus typhina

Salix spp.

Hamamelis virginiana

Appendix 2 Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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Figure A

Minimum Conductor Clearances

* All Other Woody Species		
Line Voltage	A (ft.)	B (ft.)
69 & 115 kV	12	11
230 & 345 kV	16	15

* Orchards		
Line Voltage	A (ft.)	B (ft.)
69 & 115 kV	14	11
230 & 345 kV	18	15

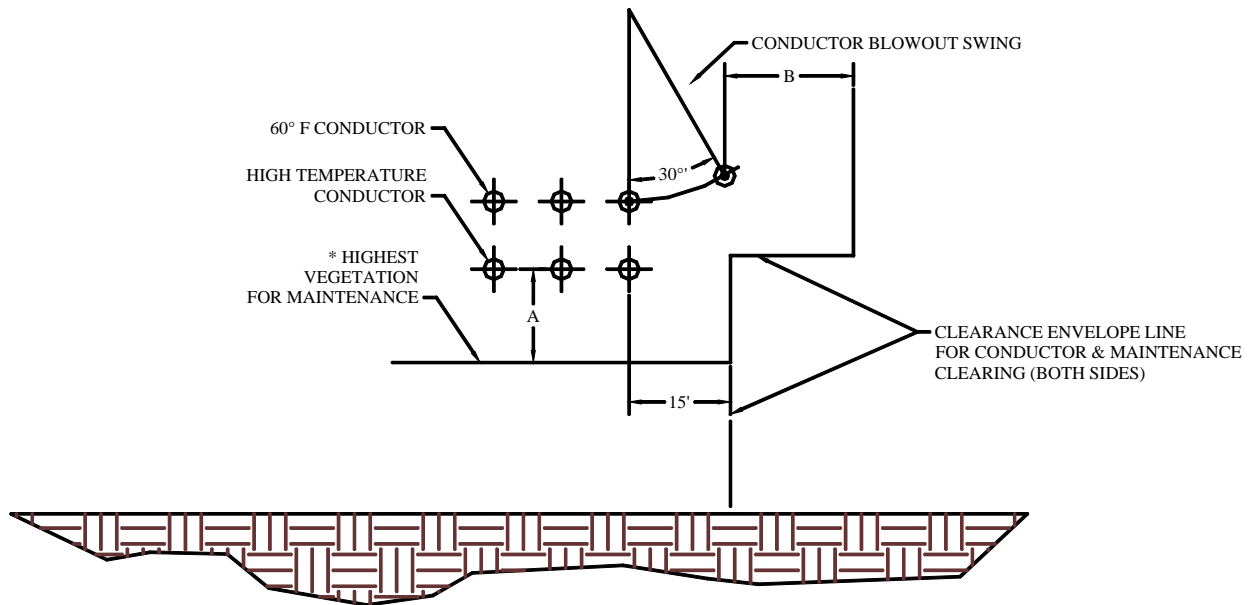


Figure A Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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Figure B

Danger Tree Clearances

Line Voltage	A (ft.)
69 & 115 kV	6
230 & 345 kV	10

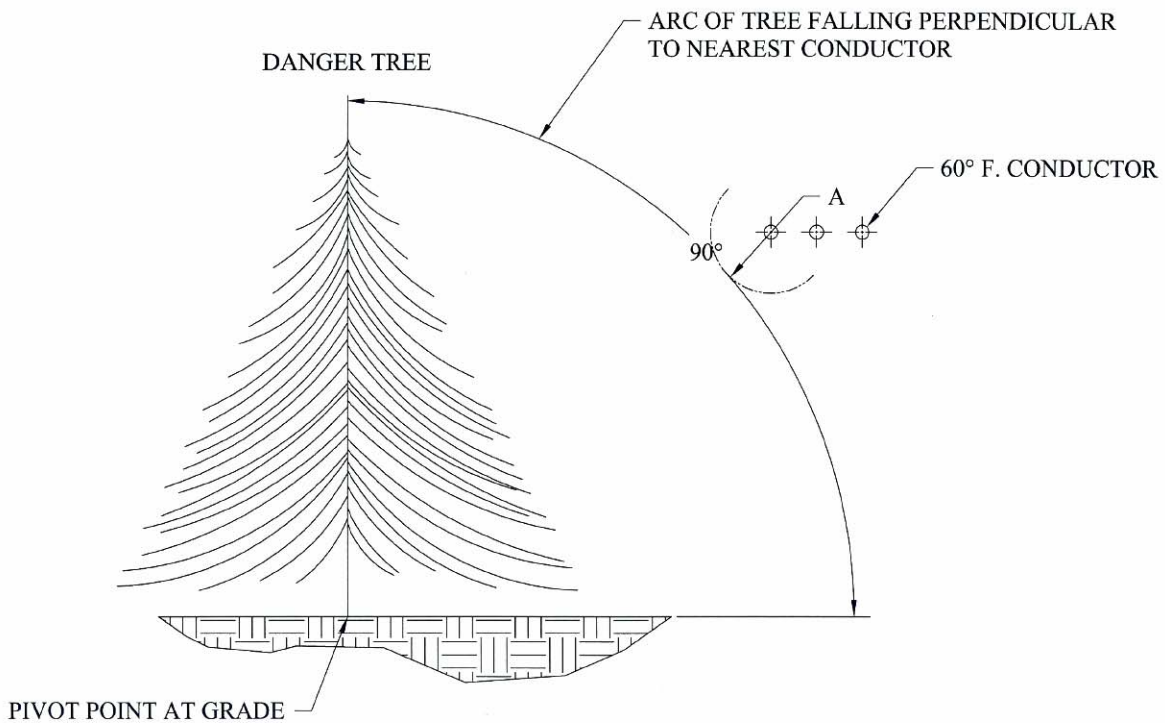
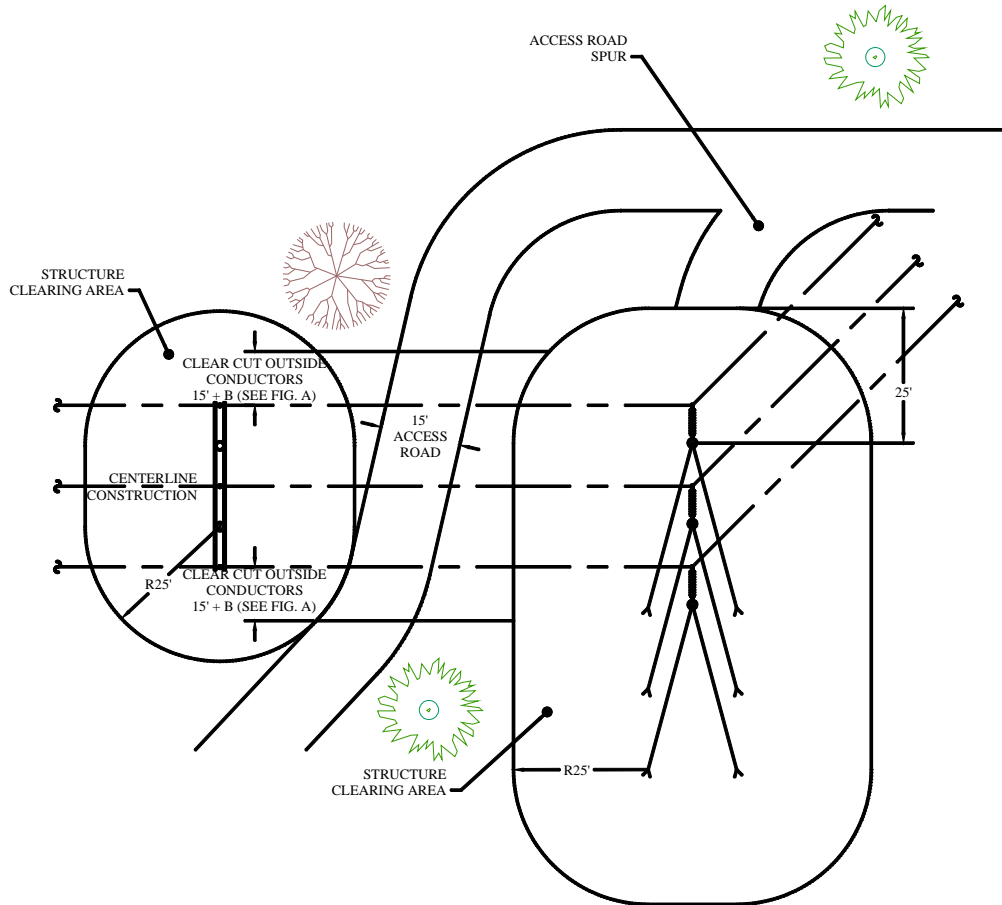


Figure B			
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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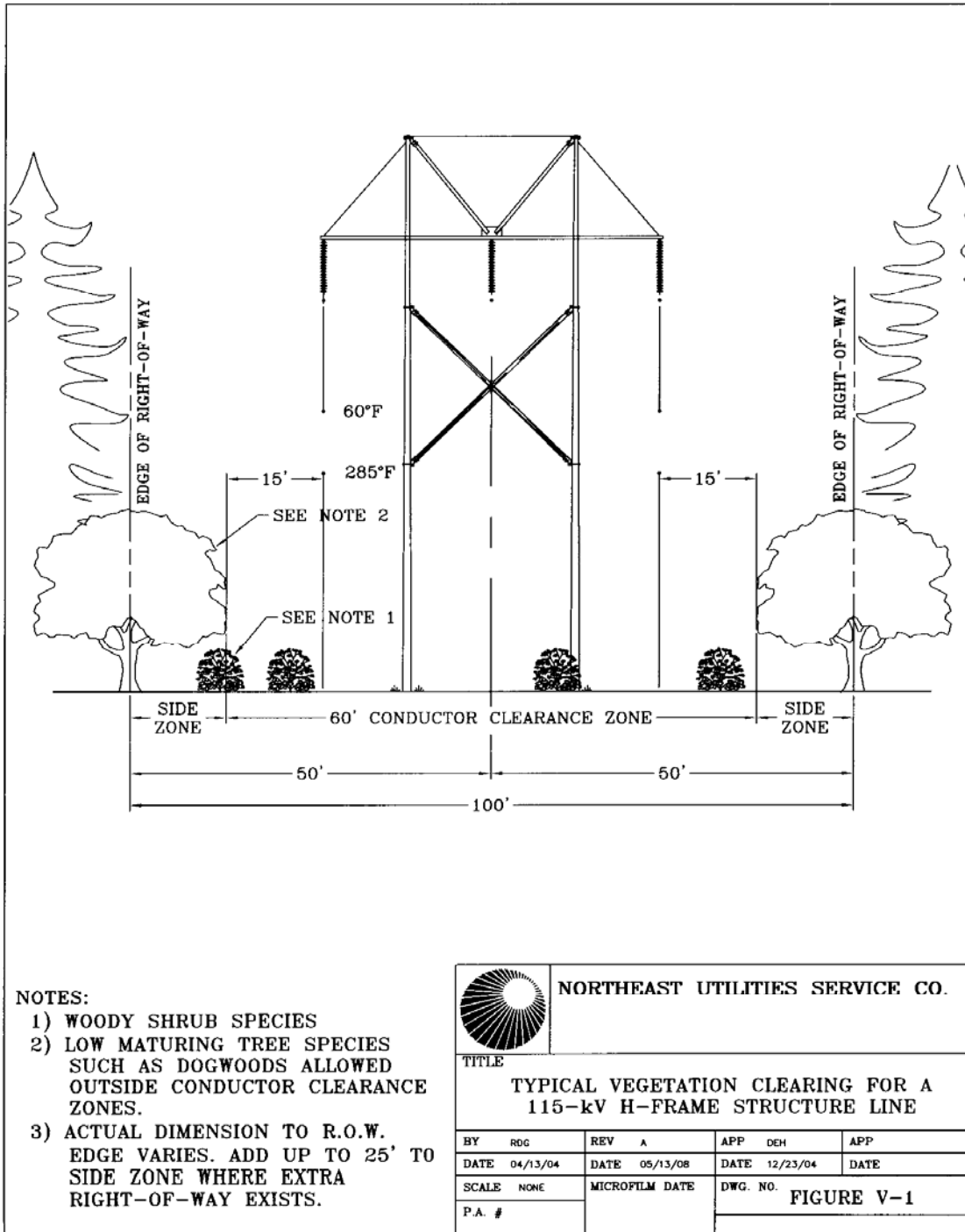
Figure C

Conductor Clearance Zone, Side Zones
and Structure Clearing Areas for New Construction



<p>Figure C Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines</p>			
<p>Northeast Utilities Approved by: DEH, PJA</p>	<p>Design and Application</p>	<p>OTRM 030.0010</p>	<p>Rev. 1 05/16/2008</p>

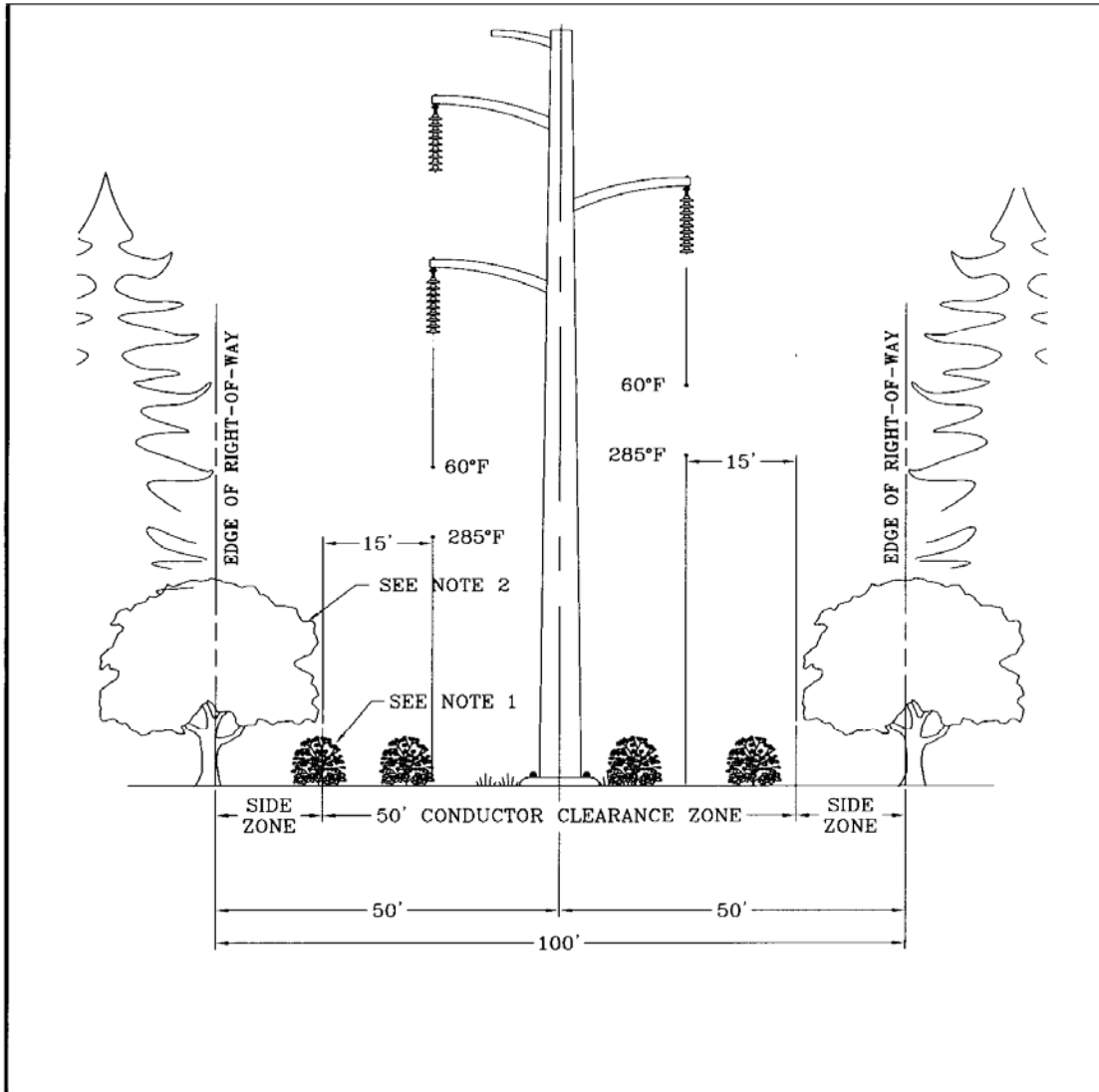
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Figure V-1			
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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NOTES:

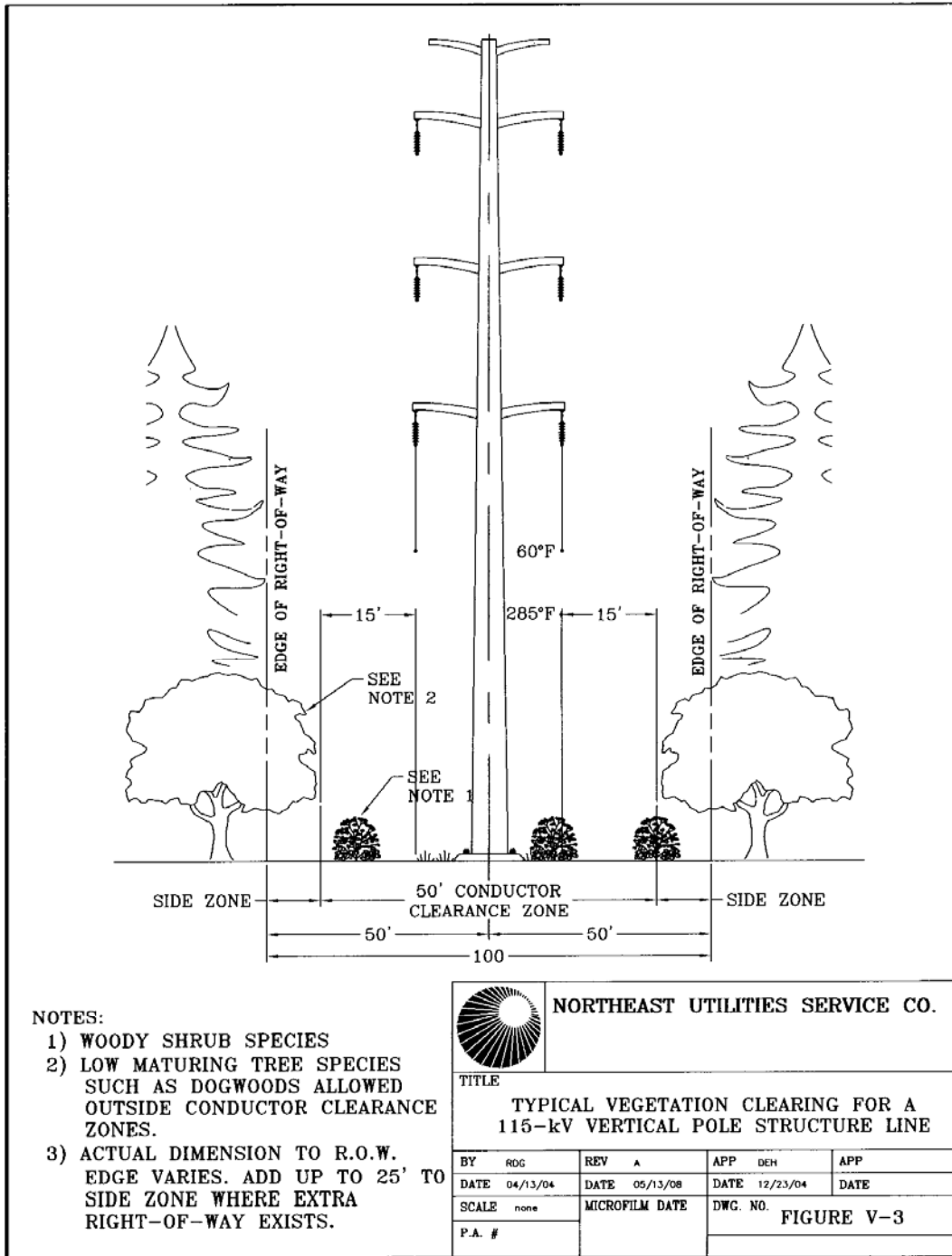
- 1) WOODY SHRUB SPECIES
- 2) LOW MATURING TREE SPECIES SUCH AS DOGWOODS ALLOWED OUTSIDE CONDUCTOR CLEARANCE ZONES.
- 3) ACTUAL DIMENSION TO R.O.W. EDGE VARIES. ADD UP TO 25' TO SIDE ZONE WHERE EXTRA RIGHT-OF-WAY EXISTS.

	NORTHEAST UTILITIES SERVICE CO.		
TITLE TYPICAL VEGETATION CLEARANCE FOR A 115-kV DELTA POLE STRUCTURE LINE			
BY	RDG	REV	RDG
DATE	04/13/04	DATE	05/13/08
SCALE	none	MICROFILM DATE	DWG. NO. FIGURE V-2
P.A. #			

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Figure V-2			
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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Figure V-3			
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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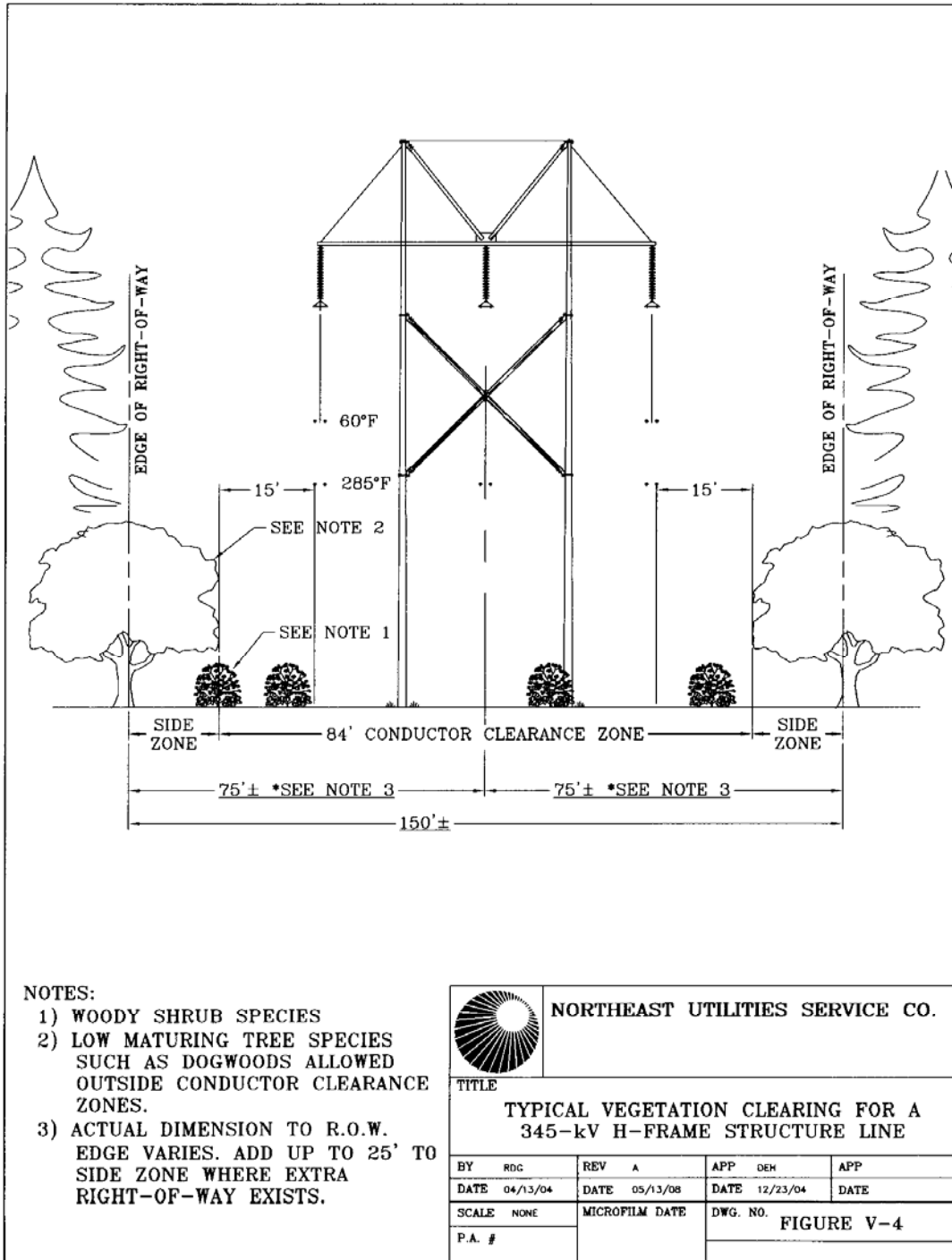
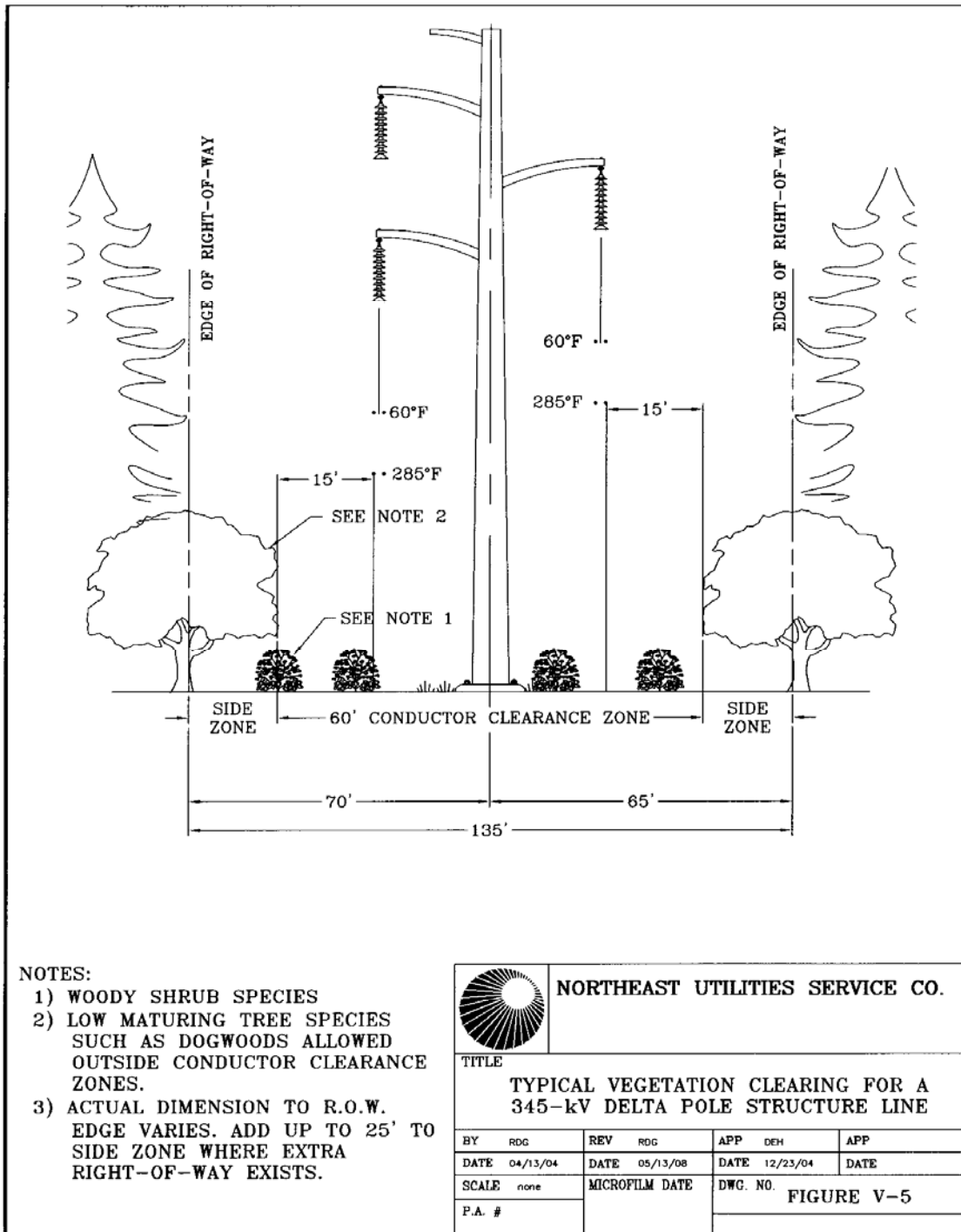


Figure V-4			
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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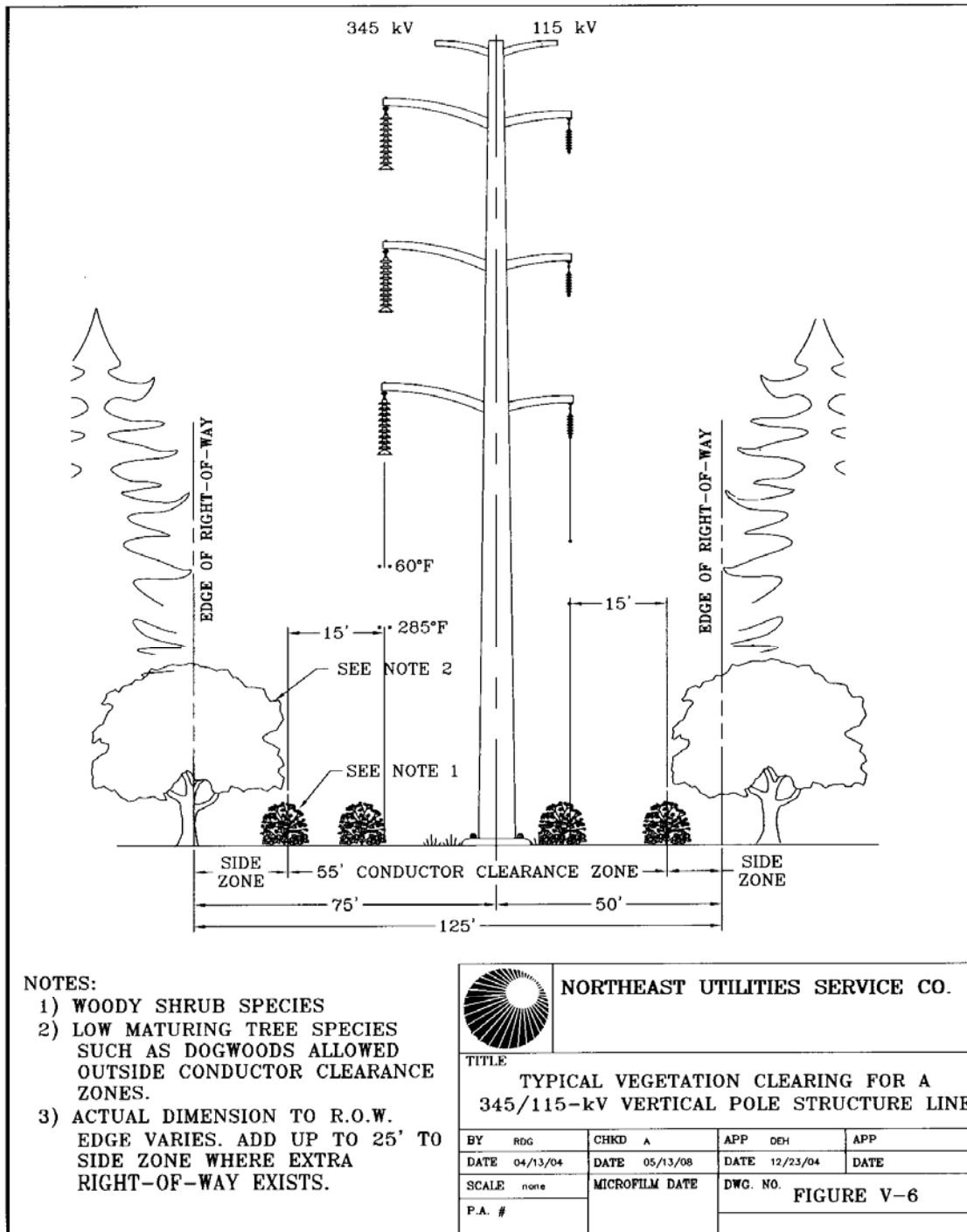


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**Figure V-5
Right-of-Way Vegetation Initial Clearance Standard
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Figure V-6			
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
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