

**AREA 8, PHASE III
NATURAL RESOURCE
RESTORATION DESIGN PLAN**

**FERNALD CLOSURE PROJECT
FERNALD, OHIO**



AUGUST 2003

**U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE**

**21110-PL-0001
REVISION B
DRAFT**

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LIST OF ACRONYMS AND ABBREVIATIONS

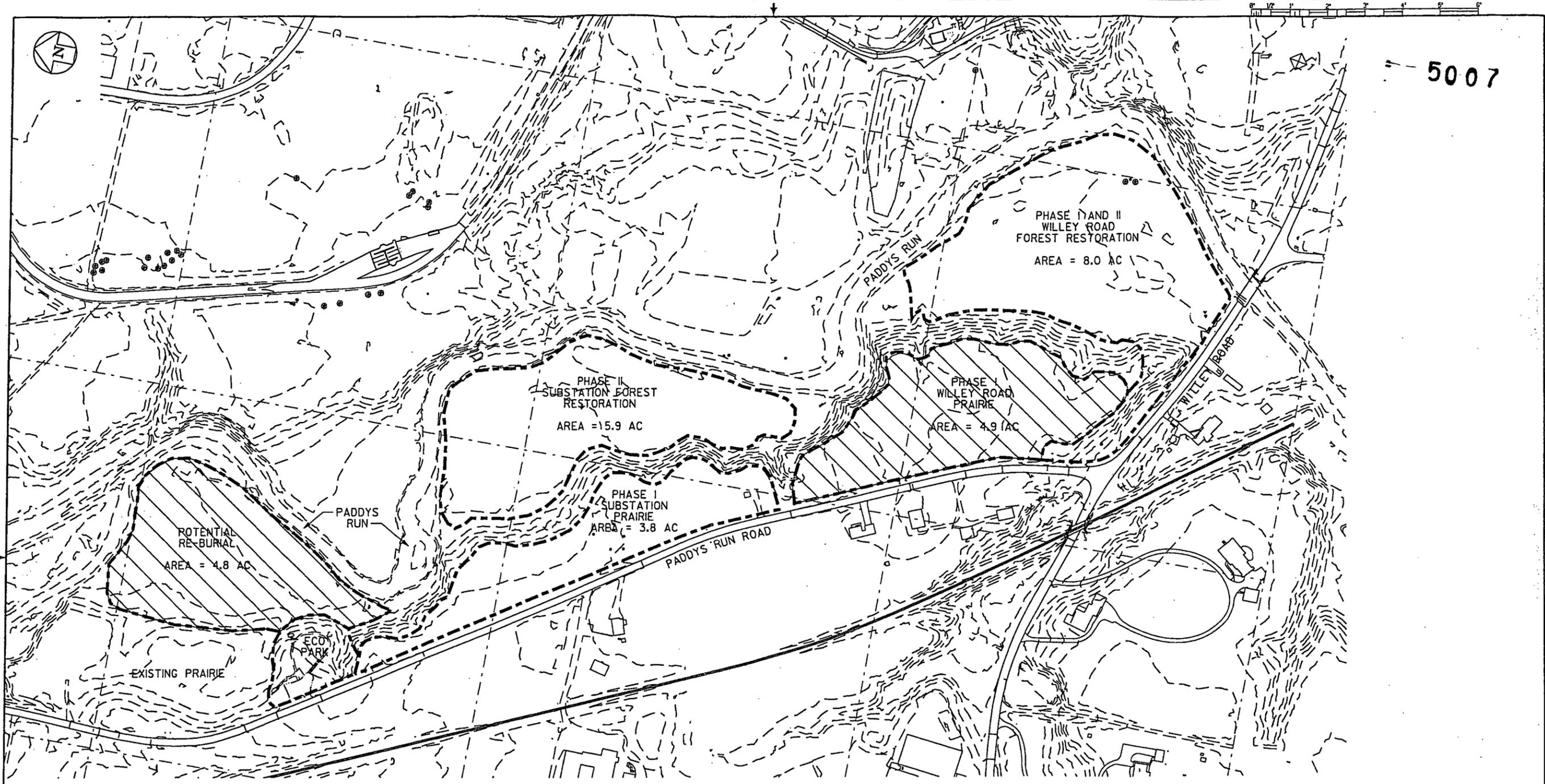
A8PIII	Area 8, Phase III
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
FCP	Fernald Closure Project
NRRDP	Natural Resource Restoration Design Plan
NRRP	Natural Resource Restoration Plan

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1.0 PROJECT OVERVIEW

Area 8, Phase III (A8PIII) is the fifth in a series of ecological restoration projects at the Fernald Closure Project (FCP). It encompasses approximately 43 acres along the western edge of the FCP property, within the Paddys Run West restoration scope of work. The conceptual restoration plan for the FCP is described in the Natural Resource Restoration Plan (NRRP, DOE 2002). Compensatory restoration of the FCP is part of the proposed settlement for natural resource damages under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Restoration primarily consists of prairie establishment and forest restoration to expand the riparian corridor along Paddys Run. A8PIII is divided into two areas; A8PIII North and A8PIII South. The scope of restoration is broken in to six separate areas; three forest and three prairie. Two forest areas are located in A8PIII South. These include the Willey Road Forest Area and the Substation Forest Area. The third forest area is located within A8PIII North. Similarly, two prairie areas are located in A8PIII South and one in A8PIII North. Figure 1-1 shows the conceptual restoration plan for all of A8PIII South, and Figure 1-2 shows the conceptual restoration plan for A8PIII North.



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POTENTIAL RE-BURIAL SITE

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NO.	REVISIONS	DATE	DWN. BY	APPD. NO.	REVISIONS	DATE	DWN. BY	APPD. NO.	REF. DWG. NO.

NOTE:
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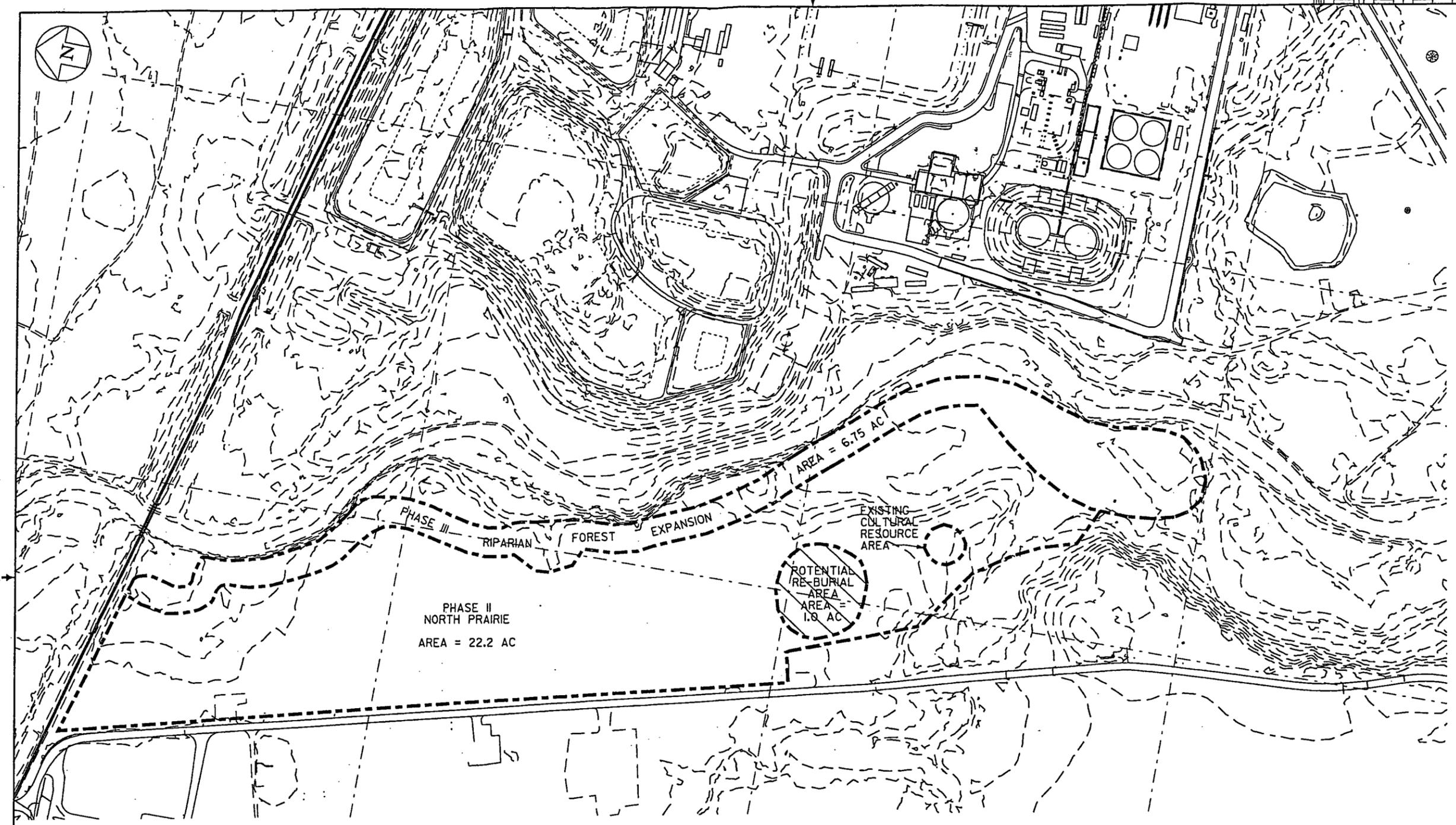
APPROVALS	
CIVIL & STR.	SAFETY ENG.
ELECTRICAL	MAINTENANCE
ENGINEER	FIRE PROTECT.
ENVIRONMENTAL	WASTE MNGT.
MECHANICAL	SECURITY
	PROJECTS
CHECKED	
APPROVED	

Fernald Closure Project
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PADDY'S RUN WEST RESTORATION
AREA 8 PHASE III SOUTH
CONCEPTUAL RESTORATION PLAN

DATE 06/29/03
DRAWN K.L. RABBITT

FIGURE I-1



 POTENTIAL RE-BURIAL SITE

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ENGINEER	FIRE PROTECT.
INS. TRUMENT	WASTE MANAGE.
MECHANICAL	SECURITY
CHECKED	PROJECTS
APPROVED	

Fernald Environmental
Management Project
FLUOR FERNALD, INC.
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PADDYS RUN WEST RESTORATION
AREA 8 PHASE III NORTH
CONCEPTUAL RESTORATION PLAN

DATE 06/21/03
DRAWN K.L. RABBITT
FIGURE I-2

2.0 SEQUENCE OF ACTIVITIES

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Restoration of A8P3III will be conducted in three phases, starting in Fall 2003. Table 2-1 below demonstrates the sequence and timing of the individual areas.

TABLE 2-1
SEQUENCE OF A8P3III RESTORATION ACTIVITIES

Phase	Timeframe	Restoration Activities
Site Prep	Summer 2003	<ul style="list-style-type: none">• Improve access points and gates• Improve and/or install gravel pads, access paths, and staging areas• Kill existing vegetation in the Willey Road Forest Area and the two prairie areas within A8P3III South• Locate and plug existing drain tiles within the A8P3III North prairie area
I	Fall 2003	<ul style="list-style-type: none">• Install trees and shrubs within approximately 3.5 acres of the Willey Road Forest Area• Seed the two A8P3III South Prairie Areas
II	Fall 2004	<ul style="list-style-type: none">• Install trees and shrubs within the remainder of the Willey Road Forest Area• Install trees and shrubs within the Substation Forest Area• Seed the A8P3III North Prairie Area (following eradication of existing vegetation)
III	Fall 2005	<ul style="list-style-type: none">• Install trees and shrubs within the A8P3III North Forest Area

Activities will be accelerated where possible. In addition to the above, soil sampling will be conducted as needed to determine the composition of soils within restoration areas. Most (if not all) of the restoration areas have intact topsoil, so the need for soil amendments is not anticipated. Some areas will require lime application in order to adjust pH.

3.0 AREA-SPECIFIC DESCRIPTIONS

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Each of the six restoration areas within A8P3III is discussed in more detail below. All forest areas are designed as a mesophytic forest template. Species that comprise the mesophytic template are listed in the Master Plant List (Table 3-1). All planting activities will be conducted according to the planting specifications (Appendix A). Prairie areas will be seeded in either upland mesic or wetland seed mixes. Forest areas will be seeded with an interim seed mix following plant installation. These species lists are provided in Table 3-2 through 3-4. Seed lists are consistent with the latest sitewide seeding specification (Appendix B).

3.1 WILLEY ROAD FOREST AREA

The planting plan for the Willey Road Forest Area is shown in Figure 3-1. This area consists primarily of former Paddys Run floodplain. The area presently consists of former grazed pasture, with a narrow strip of woody vegetation bordering Paddys Run to the west and a wooded slope to the east. The entire project area is visible from Willey Road to the south.

Forest restoration will focus on the expansion of the riparian corridor along Paddys Run. Since the area is not a floodplain, the mesophytic forest template is appropriate. Five patches will be established in the project area; three forest patches, a transition patch that will consist primarily of seeded herbaceous vegetation, and a woody understory/prairie edge patch that will be placed within the high-visibility wooded and open slope along Willey Road. The species lists and quantities for these patches are presented in Table 3-5.

Since the Willey Road Forest area is the first location to be restored, it will serve as a staging area for the remaining portions of A8P3III South. A gravel access and parking area will be constructed, along with a new gate. A mowed path from the gravel pad will serve as the main access point to the Willey Road Prairie Area.

3.2 WILLEY ROAD PRAIRIE AREA

The Willey Road Prairie Area is also shown on Figure 3-1. The area sits on a terrace above the Paddys Run Stream Corridor. As with the other areas within A8P3III, this area is located around the perimeter of the FCP and was not used except for grazing cattle. Presently, the area is dominated with pasture grasses and forbs that ideally would be eliminated prior to prairie establishment. Following the removal of existing vegetation, the area will be seeded with an upland mesic prairie grass and forb list.

1 As Figure 1-1 shows, the Willey Road Prairie Area may be utilized as a reburial location for prehistoric
2 Native American remains. If this location is chosen as the reburial site, then additional arrangements will
3 be made regarding land use, identification markers, etc. Preliminary discussions with several Native
4 American Tribes have revealed that any on-property reburial would be compatible with restoration
5 activities such as prairie establishment and maintenance.

6 7 3.3 SUBSTATION FOREST AREA

8 The planting plan for the Substation Forest Area is shown in Figure 3-2. This area is similar to the Willey
9 Road Forest area discussed above, except that there is a higher density of existing woody vegetation
10 across the project area. Forest Patch No. 1 is more of a woodland community, so the planting patch list
11 has been adjusted to increase the number of shade tolerant understory species for this area. Table 3-6
12 presents the patch-specific planting lists for the Substation Forest Area.

13
14 In addition to the four mesophytic forest patches, two small herbaceous patches will be established to
15 enhance microhabitats created by the site hydrology. Herbaceous Patch No. 1 is in response to two
16 groundwater seeps located on the side of the slope that separates the forest area from the prairie area.
17 Herbaceous Patch No. 2 is located at the base of a small gully, where channelized surface water flow
18 dissipates into sheet flow. These two areas present an opportunity to create several small wetland
19 communities. Presently, some sedges (*Carex* spp.) and spikerush (*Eleocharis* spp.) are present, but the
20 dominant vegetation is pasture grass. Planting activities in these two patches will focus on enhancing the
21 existing wetland vegetation. The plant list for these areas is provided in Table 3-7.

22 23 3.4 SUBSTATION PRAIRIE AREA

24 The Substation Prairie Area is also shown in Figure 3-2. This area is similar to the Willey Road Prairie
25 Area. A stand of trees from an old home site bisects the prairie into a northern and southern portion.

26 27 3.5 A8PIII NORTH FOREST AREA

28 The planting plan for the A8PIII North Forest Area is shown in Figure 3-3. This area extends from a
29 former floodplain area that is similar to the two forest areas in A8PIII South to a high cut bank that has
30 always been outside of the Paddys Run flood zone. A wooded riparian corridor in A8PIII North is very
31 narrow and even non-existent in some stretches. Therefore, as Figure 3-3 shows, the planting plan for
32 A8PIII North is designed to expand the forested riparian corridor along Paddys Run. Table 3-8 provides
33 the patch-specific planting lists for A8PIII North. Patch No. 2 and a portion of Patch No. 4 will be more

1 densely planted than the other three patches, in response to the lack of any existing woody vegetation in
2 these areas.

3 4 3.6 A8P3III NORTH PRAIRIE AREA

5 The A8P3III North Prairie Area is shown in Figure 3-3. This area is similar in description to the other
6 A8P3III prairie areas, except that portions of the former grazed pasture exhibit hydric characteristics. It is
7 suspected that the project area has been extensively drain tiled. Therefore, unlike the prairie areas in
8 A8P3III South, this prairie will be a combination of upland mesic and wetland seeded areas. Wet areas
9 will be determined following an attempt to plug drain tiles across the project area.

10
11 The portion of the A8P3III North Prairie Area may also be used as a reburial location, similar to the Willey
12 Road Prairie Area. In addition, an existing prehistoric cultural resource site is located just south of the
13 prairie area. The general location of the site is shown on Figures 1-2 and 3-3. The site boundaries are
14 delineated, and restoration activities have been designed to avoid this area. Any field changes must avoid
15 disturbance to this area as well.

TABLE 3-1
AREA 8, PHASE III RESTORATION MASTER PLANT LIST

SAPLINGS

ID	Species	Common Name	Form	Function	Coefficient of Wetness	Phase 1 Fall 2003	Phase 2 Fall 2004	Phase 3 Spring 2005	Total
A	<i>Acer rubrum</i>	Red Maple	canopy	cover	0	16	34	34	84
B	<i>Acer saccharinum</i>	Silver Maple	canopy	cover	-3	3	6	6	15
C	<i>Acer saccharum</i>	Sugar Maple	canopy	cover, mast	4	160	318	320	798
D	<i>Carya cordiformis</i>	Bitternut Hickory	canopy	cover	2	25	50	51	126
E	<i>Carya laciniosa</i>	Shellbark Hickory	canopy	cover, mast	0	28	57	56	141
F	<i>Carya ovata</i>	Shagbark Hickory	canopy	cover, mast	4	4	10	10	24
G	<i>Fagus grandifolia</i>	Beech	canopy	cover, mast	3	65	132	130	327
H	<i>Fraxinus americana</i>	White Ash	canopy	cover	3	20	39	40	99
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	cover	-3	7	12	14	33
J	<i>Fraxinus quadrangulata</i>	Blue Ash	canopy	cover, diversity	ni	1	3	2	6
K	<i>Gymnocladus dioica</i>	Kentucky Coffetree	canopy	diversity	ni	1	2	1	4
L	<i>Juglans cinerea</i>	Butternut	canopy	diversity	2	2	4	6	12
M	<i>Juglans nigra</i>	Black Walnut	canopy	diversity, mast	3	16	32	30	78
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	cover, aesthetics	3	3	6	6	15
O	<i>Prunus serotina</i>	Black Cherry	canopy	fruit	3	11	21	22	54
P	<i>Quercus alba</i>	White Oak	canopy	cover, mast	4	41	80	80	201
Q	<i>Quercus bicolor</i>	Swamp White Oak	canopy	cover, mast	-4	11	22	21	54
R	<i>Quercus coccinea</i>	Scarlet Oak	canopy	cover, mast	ni	3	6	6	15
S	<i>Quercus inbricaria</i>	Shingle Oak	canopy	diversity, mast	0	3	5	4	12
T	<i>Quercus macrocarpa</i>	Bur Oak	canopy	diversity, mast	1	65	130	129	324
U	<i>Quercus muhlenbergii</i>	Chinquapin Oak	canopy	diversity, mast	0		2	1	3
V	<i>Quercus palustris</i>	Pin Oak	canopy	cover	-3	3	6	6	15
W	<i>Quercus prinus</i>	Chestnut Oak	canopy	diversity	5	1	1	1	3
X	<i>Quercus rubra</i>	Northern Red Oak	canopy	cover, mast	4	33	66	66	165
Y	<i>Quercus shumardii</i>	Shumard Oak	canopy	diversity, mast	-1	3	7	8	18
Z	<i>Quercus velutina</i>	Black Oak	canopy	cover, mast	ni	4	9	8	21
AA	<i>Tilia americana</i>	Basswood	canopy	cover, aesthetics	3	8	16	15	39
AB	<i>Ulmus rubra</i>	Slippery Elm	canopy	cover	0	1	2	3	6
AC	<i>Aesculus glabra</i>	Ohio Buckeye	understory	diversity	2	2	3	4	9
AD	<i>Asimina triloba</i>	Pawpaw	understory	fruit, diversity	2	4	9	9	22
AE	<i>Carpinus caroliniana</i>	American Hornbeam	understory	diversity, mast	0	18	37	38	93
AF	<i>Cercis canadensis</i>	Redbud	understory	cover, aesthetics, edge	4	5	10	10	25
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	understory	cover, diversity	ni	2	3	4	9
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	understory	cover, edge	0	2	4	5	11
AI	<i>Cornus florida</i>	Flowering Dogwood	understory	aesthetics	4	5	10	12	27
AJ	<i>Cornus racemosa</i>	Gray Dogwood	understory	cover	ni	14	28	26	68
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	understory	cover, diversity	ni	3	6	6	15
AL	<i>Crateagus mollis</i>	Downy Hawthorne	understory	cover	3	2	4	4	10
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	understory	diversity	4	19	37	38	94
AN	<i>Prunus americana</i>	American Plum	understory	diversity	4	11	21	22	54
AO	<i>Sassafras albidum</i>	Sassafras	understory	diversity	4	1	2	2	5
AP	<i>Alnus serrulata</i>	Smooth Alder	shrub	erosion	-5	1			1
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	shrub	fruit, aesthetics	1	3	8	8	19
AR	<i>Amorpha fruticosa</i>	False Indigo Bush	shrub	cover, aesthetics	-3	3	6	5	14
AS	<i>Ceanothus americanus</i>	New Jersey Tea	shrub	diversity	ni	1	2	2	5
AT	<i>Celastrus scandens</i>	Bittersweet	shrub	diversity	-4	6	12	11	29
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	shrub	cover, erosion	-5	5	6	6	17
AV	<i>Cornus amomum</i>	Silky Dogwood	shrub	cover, erosion	-3	3	6	6	15
AW	<i>Corylus americana</i>	Hazelnut	shrub	diversity	4	4	7	8	19
AX	<i>Hamamelis virginiana</i>	Witch Hazel	shrub	cover	1	23	46	44	113
AY	<i>Hypericum spathulatum</i>	Shrubby St. John's Wort	shrub	diversity	3	5	10	10	25
AZ	<i>Ilex verticillata</i>	Winterberry	shrub	aesthetics	-4	2	5	6	13
BA	<i>Lindera benzoin</i>	Spicebush	shrub	cover	-2	12	24	24	60
BB	<i>Physocarpus opulifolius</i>	Ninebark	shrub	diversity, edge	-2	4	7	8	19
BC	<i>Rhus aromatica</i>	Fragrant Sumac	shrub	cover, aesthetics	ni	5	12	10	27
BD	<i>Rhus glabra</i>	Smooth Sumac	shrub	aesthetics, edge	ni	5	11	11	27
BE	<i>Rhus typhina</i>	Staghorn Sumac	shrub	aesthetics	ni	17	36	34	87
BF	<i>Rosa caroliniana</i>	Carolina Rose	shrub	aesthetics	5	9	18	16	43
BG	<i>Rosa palustris</i>	Swamp Rose	shrub	aesthetics	-5	1	2	2	5
BH	<i>Rosa setigera</i>	Prairie Rose	shrub	diversity	3	17	34	36	87

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TABLE 3-1
 AREA 8, PHASE III RESTORATION MASTER PLANT LIST

ID	Species	Common Name	Form	Function	Coefficient of Wetness	Phase 1 Fall 2003	Phase 2 Fall 2004	Phase 3 Spring 2005	Total
BI	<i>Rubus occidentalis</i>	Black Raspberry	shrub	fruit, edge	ni	9	18	16	43
BJ	<i>Salix discolor</i>	Pussy Willow	shrub	cover, edge	-3	1	2	2	5
BK	<i>Sambucus canadensis</i>	Elderberry	shrub	erosion, fruit	-2	24	46	47	117
BL	<i>Spiraea alba</i>	Meadowsweet	shrub	diversity	-4	2	2	4	8
BM	<i>Staphylea trifolia</i>	Bladdernut	shrub	diversity	0	6	13	13	32
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	diversity	5	18	38	37	93
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	diversity, edge	5	10	20	19	49
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	shrub	cover	3	17	34	34	85
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	diversity, edge	ni	2	4	4	10
BR	<i>Campsis radicans</i>	Trumpet Creeper	vine	aesthetics, edge	0	5	9	10	24
					Total	846	1,690	1,689	4,225
SEEDLINGS									
B	<i>Acer saccharinum</i>	Silver Maple	canopy	cover	-3	40	80	80	200
C	<i>Acer saccharum</i>	Sugar Maple	canopy	cover, mast	4	384	768	768	1920
D	<i>Carya cordiformis</i>	Bitternut Hickory	canopy	cover	2	40	80	80	200
E	<i>Carya laciniata</i>	Shellbark Hickory	canopy	cover, mast	0	40	80	80	200
F	<i>Carya ovata</i>	Shagbark Hickory	canopy	cover, mast	4	40	80	80	200
G	<i>Fagus grandifolia</i>	Beech	canopy	cover, mast	3	168	336	336	840
H	<i>Fraxinus americana</i>	White Ash	canopy	cover	3	72	144	144	360
M	<i>Juglans nigra</i>	Black Walnut	canopy	diversity, mast	3	96	192	192	480
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	cover, aesthetics	3	40	80	80	200
O	<i>Prunus serotina</i>	Black Cherry	canopy	fruit	3	40	80	80	200
P	<i>Quercus alba</i>	White Oak	canopy	cover, mast	4	120	240	240	600
X	<i>Quercus rubra</i>	Northern Red Oak	canopy	cover, mast	4	120	240	240	600
					Total	1,200	2,400	2,400	6,000

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**TABLE 3-2
 UPLAND MESIC PRAIRIE SEED MIX**

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Species	Pounds Per Acre (lb/ac)
Big Bluestem (<i>Andropogon gerardi</i>)	3
Little Bluestem (<i>Andropogon scopariu</i>)	2
Side-Oats Grama (<i>Bouteloua curtipendula</i>)	0.5
Indian Grass (<i>Sorghastrum nutans</i>)	2
Canada Wild-Rye (<i>Elymus canadensis</i>)	25
Switch grass (<i>Panicum virgatum</i>)	0.5
ReGreen (<i>n/a</i>)	5
Wildflowers, uniform mix of the following:	1.5
Butterflyweed (<i>Asclepias tuberosa</i>)	
Smooth Aster (<i>Aster laevis</i>)	
Ox-eye Sunflower (<i>Heliopsis helianthoides</i>)	
Bergamot (<i>Monadara fistulosa</i>)	
Purple Coneflower (<i>Echinacea purpurea</i>)	
Yellow Coneflower (<i>Ratibida pinnata</i>)	
Black-Eyed Susan (<i>Rudbeckia hirta</i>)	
Spiderwort (<i>Tradescantia ohioensis</i>)	
Hoary Vervain (<i>Verbena stricta</i>)	
Beardtongue (<i>Penstemon grandiflorus</i>)	
Sweet Joe Pye-Weed (<i>Eupatorium purpureum</i>)	
Blue False Indigo (<i>Baptisia australis</i>)	
Partridge Pea (<i>Cassia fasciculata</i>)	
Round-headed Bush Clover (<i>Lespedeza Capitata</i>)	
Rattlesnake Master (<i>Eryngium yuccifolium</i>)	
Stiff Goldenrod (<i>Solidago rigida</i>)	

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TABLE 3-3
 WETLAND SEED MIX

Species	Pounds Per Acre (lb/ac)
Big Bluestem (<i>Andropogon gerardi</i>)	3.0
Canada Wild-Rye (<i>Elymus canadensis</i>)	25
Virginia Wild-Rye (<i>Elymus virginicus</i>)	5.0
Switch Grass (<i>Panicum virgatum</i>)	0.5
Blue Joint Grass (<i>Calamagrostis canadensis</i>)	0.5
Porcupine Sedge (<i>Carex hystericina</i>)	1 ounce per acre (oz/ac)
Fox Sedge (<i>Carex vulpinoidea</i>)	1 ounce per acre (oz/ac)
Dark Green Bulrush (<i>Scirpus atrovirens</i>)	1 ounce per acre (oz/ac)
ReGreen (<i>n/a</i>)	5.0
Prairie Cordgrass (<i>Spartina pectinata</i>)	1.0
Wildflowers, uniform mix of the following:	1.5
Red Milkweed (<i>Asclepias incarnata</i>)	
New England Aster (<i>Aster novae-angliae</i>)	
Wild Senna (<i>Cassia hebecarpa</i>)	
Great Blue Lobelia (<i>Lobelia siphilitica</i>)	
Yellow Coneflower (<i>Ratibida pinnata</i>)	
Blue Vervain (<i>Verbena hastata</i>)	
Spotted Joe-Rye Weed (<i>Eupatorium maculatum</i>)	
Cardinal Flower (<i>Lobelia cardinalis</i>)	
Sawtooth sunflower (<i>Helianthus grosseserratus</i>)	

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**TABLE 3-4
INTERIM SEED MIX**

Species	Pounds Per Acre (lb/ac)
ReGreen (<i>n/a</i>)	40
Annual Rye Grass (<i>Lolium multiflorum</i>)	20
Canada Wild Rye (<i>Elymus canadensis</i>)	20
Timothy (<i>Phleum Pretense</i>)	5.0
Partridge Pea (<i>Cassia fasciculata</i>)	2 oz./Acre
Black-Eyed Susan (<i>Rudbeckia hirta</i>)	oz./Acre

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TABLE 3-5
 WILLEY ROAD FOREST RESTORATION AREA

ID	Species	Common Name	Phase 1 Quantity	Phase 2 Quantity	Patch 1 2.0 acres	Patch 2 1.25 acres	Patch 3 1.0 acre	Prairie Transition Area 1.25 acres	Woodland Understory/ Prairie Edge 0.5 acre
A	<i>Acer rubrum</i>	Red Maple	16	4	10	6	4		
B	<i>Acer saccharinum</i>	Silver Maple	3	0	3				
C	<i>Acer saccharum</i>	Sugar Maple	160	38	100	60	38		
D	<i>Carya cordiformis</i>	Bitternut Hickory	25	5	15	10	5		
E	<i>Carya laciniosa</i>	Shellbark Hickory	28	7	15	13	7		
F	<i>Carya ovata</i>	Shagbark Hickory	4	0		4			
G	<i>Fagus grandifolia</i>	Beech	65	22	40	25	22		
H	<i>Fraxinus americana</i>	White Ash	20	4	12	8	4		
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	7	2	7		2		
J	<i>Fraxinus quadrangulata</i>	Blue Ash	1	0	1				
K	<i>Gymnocladus dioica</i>	Kentucky Coffeetree	1	0		1			
L	<i>Juglans cinerea</i>	Butternut	2	0		2			
M	<i>Juglans nigra</i>	Black Walnut	16	6	10	6	6		
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	3	1		3	1		
O	<i>Prunus serotina</i>	Black Cherry	11	1	6	5	1		
P	<i>Quercus alba</i>	White Oak	41	20	26	15	20		
Q	<i>Quercus bicolor</i>	Swamp White Oak	11	0	11				
R	<i>Quercus coccinea</i>	Scarlet Oak	3	1	2	1	1		
S	<i>Quercus inbricaria</i>	Shingle Oak	3	0	2	1			
T	<i>Quercus macrocarpa</i>	Bur Oak	65	20	30	25	20	10	
V	<i>Quercus palustris</i>	Pin Oak	3	0	3				
W	<i>Quercus prinus</i>	Chestnut Oak	1	0		1			
X	<i>Quercus rubra</i>	Northern Red Oak	33	6	13	20	6		
Y	<i>Quercus shumardii</i>	Shumard Oak	3	0	2	1			
Z	<i>Quercus velutina</i>	Black Oak	4	2	2	2	2		
AA	<i>Tilia americana</i>	Basswood	8	1	4	4	1		
AB	<i>Ulmus rubra</i>	Slippery Elm	1	0	1				
AC	<i>Aesculus glabra</i>	Ohio Buckeye	2	0	2				
AD	<i>Asimina triloba</i>	Pawpaw	4	0	4				
AE	<i>Carpinus caroliniana</i>	American Hornbeam	18	2	8	10	2		
AF	<i>Cercis canadensis</i>	Redbud	5	3	1	1	3		3
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	2	0		2			
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	2	0		2			
AI	<i>Cornus florida</i>	Flowering Dogwood	5	0					5
AJ	<i>Cornus racemosa</i>	Gray Dogwood	14	5	10	4	5		
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	3	0	2	1			
AL	<i>Crateagus mollis</i>	Downy Hawthorne	2	0	1	1			
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	19	7	9	7	7		3
AN	<i>Prunus americana</i>	American Plum	11	3	5	6	3		
AO	<i>Sassafras albidum</i>	Sassafras	1	0					1
AP	<i>Alnus serrulata</i>	Smooth Alder	1	0	1				
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	3	3	1	1	3		1
AR	<i>Amorpha fruticosa</i>	False Indigo Bush	3	6			3	3	3
AS	<i>Ceanothus americanus</i>	New Jersey Tea	1	0	1				
AT	<i>Celastrus scandens</i>	Bittersweet	6	2	3	3	2		
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	5	0	5				
AV	<i>Cornus amomum</i>	Silky Dogwood	3	0	3				
AW	<i>Corylus americana</i>	Hazelnut	4	2		4	2		
AX	<i>Hamamelis virginiana</i>	Witch Hazel	23	6	15	8	6		

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TABLE 3-5
 WILLEY ROAD FOREST RESTORATION AREA

ID	Species	Common Name	Phase 1 Quantity	Phase 2 Quantity	Patch 1 2.0 acres	Patch 2 1.25 acres	Patch 3 1.0 acre	Prairie Transition Area 1.25 acres	Woodland Understory/ Prairie Edge 0.5 acre
AY	<i>Hypericum spathulatum</i>	Shrubby St. John's Wort	5	10	2	3	10		
AZ	<i>Ilex verticallata</i>	Winterberry	2	0	2				
BA	<i>Lindera benzoin</i>	Spicebush	12	3	4	3	3		5
BB	<i>Physocarpus opulifolius</i>	Ninebark	4	2	2	2	2		
BC	<i>Rhus aromatica</i>	Fragrant Sumac	5	2	3	2	2		
BD	<i>Rhus glabra</i>	Smooth Sumac	5	3	2	3	3		
BE	<i>Rhus typhina</i>	Staghorn Sumac	17	6	9	5	3	3	3
BF	<i>Rosa caroliniana</i>	Carolina Rose	9	3	3	3	3		3
BG	<i>Rosa palustris</i>	Swamp Rose	1	0	1				
BH	<i>Rosa setigera</i>	Prairie Rose	17	14	10	7	9	5	
BI	<i>Rubus occidentalis</i>	Black Raspberry	9	3	6	3		3	
BJ	<i>Salix discolor</i>	Pussy Willow	1	0	1				
BK	<i>Sambucus canadensis</i>	Elderberry	24	10	16	8	10		
BL	<i>Spirea alba</i>	Meadowsweet	2	0	2				
BM	<i>Staphylea trifolia</i>	Bladdernut	6	3		6	3		
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	18	3	13	5	3		
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	10	5	5	1	4		5
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	17	4	9	5	4		3
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	2	0	1	1			
BR	<i>Campsis radicans</i>	Trumpet Creeper	5	0	3	2			
Total trees			626	160	357	247	160	10	12
Total shrubs			220	90	123	75	75	14	23
Total			846	250	480	322	235	24	35

SEEDLINGS

B	<i>Acer saccharinum</i>	Silver Maple	40		40	0		
C	<i>Acer saccharum</i>	Sugar Maple	384	158	234	150	158	
D	<i>Carya cordiformis</i>	Bitternut Hickory	40	10	25	15	10	
E	<i>Carya laciniata</i>	Shellbark Hickory	40	10	25	15	10	
F	<i>Carya ovata</i>	Shagbark Hickory	40		25	15		
G	<i>Fagus grandifolia</i>	Beech	168	56	108	60	56	
H	<i>Fraxinus americana</i>	White Ash	72	24	47	25	24	
M	<i>Juglans nigra</i>	Black Walnut	96	42	61	35	42	
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	40	10	25	15	10	
O	<i>Prunus serotina</i>	Black Cherry	40	10	25	15	10	
P	<i>Quercus alba</i>	White Oak	120	40	80	40	40	
X	<i>Quercus rubra</i>	Northern Red Oak	120	40	80	40	40	
Total			1,200	400	775	425	400	

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TABLE 3-6
 SUBSTATION FOREST RESTORATION AREA

ID	Species	Common Name	Quantity	Patch 1 0.75 acre	Patch 2 2.0 acre	Patch 3 1.5 acre	Patch 4 1.25 acre
A	<i>Acer rubrum</i>	Red Maple	30		15	10	5
B	<i>Acer saccharinum</i>	Silver Maple	6	3	3		
C	<i>Acer saccharum</i>	Sugar Maple	280	80	80	60	60
D	<i>Carya cordiformis</i>	Bitternut Hickory	45		15	15	15
E	<i>Carya laciniosa</i>	Shellbark Hickory	50	20	15	10	5
F	<i>Carya ovata</i>	Shagbark Hickory	10		7	3	
G	<i>Fagus grandifolia</i>	Beech	110	35	50	15	10
H	<i>Fraxinus americana</i>	White Ash	35	5	15	10	5
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	10	7	3		
J	<i>Fraxinus quadrangulata</i>	Blue Ash	3			3	
K	<i>Gymnocladus dioica</i>	Kentucky Coffetree	2		2		
L	<i>Juglans cinerea</i>	Butternut	4	2	2		
M	<i>Juglans nigra</i>	Black Walnut	26	6	10	5	5
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	5		2	3	
O	<i>Prunus serotina</i>	Black Cherry	20	5	5	5	5
P	<i>Quercus alba</i>	White Oak	60	10	20	20	10
Q	<i>Quercus bicolor</i>	Swamp White Oak	22	12		10	
R	<i>Quercus coccinea</i>	Scarlet Oak	5		3	2	
S	<i>Quercus inbricaria</i>	Shingle Oak	5			2	3
T	<i>Quercus macrocarpa</i>	Bur Oak	110	10	43	33	24
U	<i>Quercus muhlenbergii</i>	Chinquapin Oak	2		2		
V	<i>Quercus palustris</i>	Pin Oak	6	2		4	
W	<i>Quercus prinus</i>	Chestnut Oak	1		1		
X	<i>Quercus rubra</i>	Northern Red Oak	60	10	20	20	10
Y	<i>Quercus shumardii</i>	Shumard Oak	7		3	4	
Z	<i>Quercus velutina</i>	Black Oak	7		4		3
AA	<i>Tilia americana</i>	Basswood	15		5	5	5
AB	<i>Ulmus rubra</i>	Slippery Elm	2	2			
AC	<i>Aesculus glabra</i>	Ohio Buckeye	3	3			
AD	<i>Asimina triloba</i>	Pawpaw	9	9			
AE	<i>Carpinus caroliniana</i>	American Hornbeam	35		20	10	5
AF	<i>Cercis canadensis</i>	Redbud	7	3	4		
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	3	3			
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	4			4	
AI	<i>Cornus florida</i>	Flowering Dogwood	10	5	3	2	
AJ	<i>Cornus racemosa</i>	Gray Dogwood	23	3	7	7	6
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	6		3		3
AL	<i>Crateagus mollis</i>	Downy Hawthorne	4		2	2	
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	30	5	5	10	10
AN	<i>Prunus americana</i>	American Plum	18		6	6	6
AO	<i>Sassafras albidium</i>	Sassafras	2	2			
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	5		3	2	
AS	<i>Ceanothus americanus</i>	New Jersey Tea	2		2		
AT	<i>Celastrus scandens</i>	Bittersweet	10			5	5
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	6	6			
AV	<i>Cornus amomum</i>	Silky Dogwood	6	3		3	

TABLE 3-6
 SUBSTATION FOREST RESTORATION AREA

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ID	Species	Common Name	Quantity	Patch 1 0.75 acre	Patch 2 2.0 acre	Patch 3 1.5 acre	Patch 4 1.25 acre
AW	<i>Corylus americana</i>	Hazelnut	5		5		
AX	<i>Hamamelis virginiana</i>	Witch Hazel	40	10	10	10	10
AZ	<i>Ilex verticallata</i>	Winterberry	5			5	
BA	<i>Lindera benzoin</i>	Spicebush	21	12	3	3	3
BB	<i>Physocarpus opulifolius</i>	Ninebark	5		5		
BC	<i>Rhus aromatica</i>	Fragrant Sumac	10		5	5	
BD	<i>Rhus glabra</i>	Smooth Sumac	8		5	3	
BE	<i>Rhus typhina</i>	Staghorn Sumac	30		15	10	5
BF	<i>Rosa caroliniana</i>	Carolina Rose	15		5	5	5
BG	<i>Rosa palustris</i>	Swamp Rose	2	2			
BH	<i>Rosa setigera</i>	Prairie Rose	20		7	7	6
BI	<i>Rubus occidentalis</i>	Black Raspberry	15		5	5	5
BJ	<i>Salix discolor</i>	Pussy Willow	2		2		
BK	<i>Sambucus canadensis</i>	Elderberry	36	18	12	6	
BL	<i>Spirea alba</i>	Meadowsweet	2	2			
BM	<i>Staphylea trifolia</i>	Bladdernut	10		5	5	
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	35		14	11	10
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	15		5	5	5
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	30	10	7	7	6
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	4		4		
BR	<i>Campsis radicans</i>	Trumpet Creeper	9		3	3	3
total trees			1092	242	375	280	195
total shrubs			348	63	122	100	63
total			1440	305	497	380	258

SEEDLINGS

B	<i>Acer saccharinum</i>	Silver Maple	80		50	20	10
C	<i>Acer saccharum</i>	Sugar Maple	610	100	200	160	150
D	<i>Carya cordiformis</i>	Bitternut Hickory	70		40	30	
E	<i>Carya laciniosa</i>	Shellbark Hickory	70	20		30	20
F	<i>Carya ovata</i>	Shagbark Hickory	80		80		
G	<i>Fagus grandifolia</i>	Beech	280	100	100	40	40
H	<i>Fraxinus americana</i>	White Ash	120	30	30	30	30
M	<i>Juglans nigra</i>	Black Walnut	150	30	45	45	30
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	70		40	30	
O	<i>Prunus serotina</i>	Black Cherry	70		20	30	20
P	<i>Quercus alba</i>	White Oak	200	25	75	75	25
X	<i>Quercus rubra</i>	Northern Red Oak	200	25	75	75	25
total				330	755	565	350

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TABLE 3-7
SUBSTATION FOREST RESTORATION AREA HERBACEOUS PLANTS
(2 in. x 2 in. plugs)

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Species	Common Name	Quantity	Herbaceous Patch 1	Herbaceous Patch 2
<i>Carex vulpinoidea</i>	fox sedge	48	24	24
<i>Eupatorium maculatum</i>	spotted Joe pye weed	48	24	24
<i>Eupatorium perfoliatum</i>	boneset	48	24	24
<i>Filipendula rubra</i>	queen of the prairie	48	24	24
<i>Helianthes grossesserratus</i>	sawtooth sunflower	48	24	24
<i>Liatris spicata</i>	marsh blazingstar	48	24	24
<i>Lobelia siphilitica</i>	great blue lobelia	48	24	24

TABLE 3-8
 AREA 8, PHASE III NORTH RESTORATION AREA

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ID	Species	Common Name	Quantity	Patch 1 0.5 acre	Patch 2 0.75 acre	Patch 3 1.0 acre	Patch 4 1.25 acre	Patch 5 3.25 acre
A	<i>Acer rubrum</i>	Red Maple	34				10	24
B	<i>Acer saccharinum</i>	Silver Maple	6			6		
C	<i>Acer saccharum</i>	Sugar Maple	320	20	50	50	50	150
D	<i>Carya cordiformis</i>	Bitternut Hickory	51			15	15	21
E	<i>Carya laciniosa</i>	Shellbark Hickory	56	10		10	10	26
F	<i>Carya ovata</i>	Shagbark Hickory	10		10			
G	<i>Fagus grandifolia</i>	Beech	130	15	15	25	25	50
H	<i>Fraxinus americana</i>	White Ash	40		20	5	5	10
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	14			4		10
J	<i>Fraxinus quadrangulata</i>	Blue Ash	2		2			
K	<i>Gymnocladus dioica</i>	Kentucky Coffetree	1	1				
L	<i>Juglans cinerea</i>	Butternut	6	3				3
M	<i>Juglans nigra</i>	Black Walnut	30		15			15
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	6	2			2	2
O	<i>Prunus serotina</i>	Black Cherry	22			10	12	
P	<i>Quercus alba</i>	White Oak	80	20		20	20	20
Q	<i>Quercus bicolor</i>	Swamp White Oak	21			14		7
R	<i>Quercus coccinea</i>	Scarlet Oak	6	3	3			
S	<i>Quercus inbricaria</i>	Shingle Oak	4	2	2			
T	<i>Quercus macrocarpa</i>	Bur Oak	129	20	29	20	20	40
U	<i>Quercus muhlenbergii</i>	Chingapin Oak	1		1			
V	<i>Quercus palustris</i>	Pin Oak	6					6
W	<i>Quercus prinus</i>	Chestnut Oak	1		1			
X	<i>Quercus rubra</i>	Northern Red Oak	66	10	10	10	10	26
Y	<i>Quercus shumardii</i>	Shumard Oak	8	3				5
Z	<i>Quercus velutina</i>	Black Oak	8			3		5
AA	<i>Tilia americana</i>	Basswood	15			5	5	10
AB	<i>Ulmus rubra</i>	Slippery Elm	3	3				
AC	<i>Aesculus glabra</i>	Ohio Buckeye	4	2				2
AD	<i>Asimina triloba</i>	Pawpaw	9	3			3	3
AE	<i>Carpinus caroliniana</i>	American Hornbeam	38	10			10	18
AF	<i>Cercis canadensis</i>	Redbud	10	3		2	3	
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	4					4
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	5					5
AI	<i>Cornus florida</i>	Flowering Dogwood	12	3		3	3	3
AJ	<i>Cornus racemosa</i>	Gray Dogwood	26		10			16
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	6	3	3			
AL	<i>Crateagus mollis</i>	Downy Hawthorne	4					4
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	38			10	10	18
AN	<i>Prunus americana</i>	American Plum	22	2	10			10
AO	<i>Sassafras albidium</i>	Sassafras	2				2	
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	8	3				4
AR	<i>Amorpha fruticosa</i>	False Indigo Bush	5		5			
AS	<i>Ceanothus americanus</i>	New Jersey Tea	2		2			
AT	<i>Celastrus scandens</i>	Bittersweet	11	3				8
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	6			6		
AV	<i>Cornus amomum</i>	Silky Dogwood	6			6		
AW	<i>Corylus americana</i>	Hazelnut	8					8
AX	<i>Hamamelis virginiana</i>	Witch Hazel	44		7	10	10	17
AY	<i>Hypericum spathulatum</i>	Shrubby St. John's Wort	10					10
AZ	<i>Ilex verticallata</i>	Winterberry	6	6				
BA	<i>Lindera benzoin</i>	Spicebush	24	3			7	14
BB	<i>Physocarpus opulifolius</i>	Ninebark	8		4	4		
BC	<i>Rhus aromatica</i>	Fragrant Sumac	10		5		5	

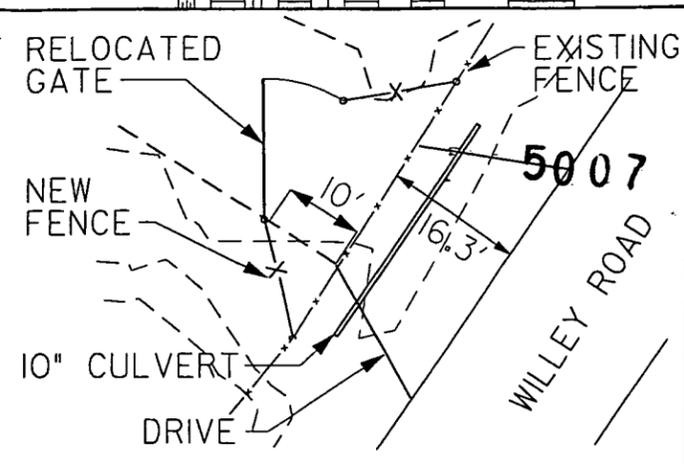
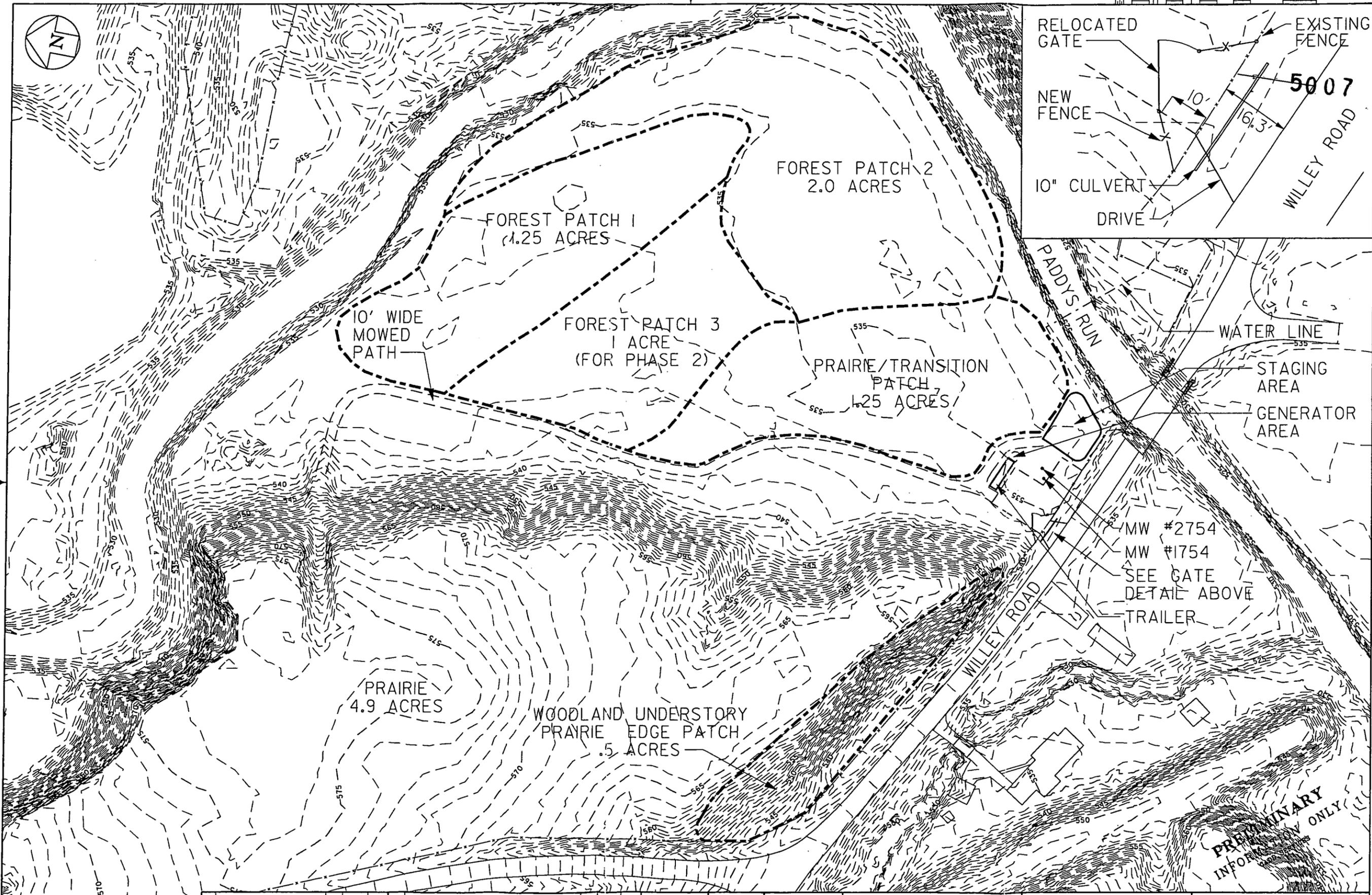
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TABLE 3-8
 AREA 8, PHASE III NORTH RESTORATION AREA

ID	Species	Common Name	Quantity	Patch 1 0.5 acre	Patch 2 0.75 acre	Patch 3 1.0 acre	Patch 4 1.25 acre	Patch 5 3.25 acre
BD	<i>Rhus glabra</i>	Smooth Sumac	11		5			6
BE	<i>Rhus typhina</i>	Staghorn Sumac	34			7	7	20
BF	<i>Rosa caroliniana</i>	Carolina Rose	16			6		10
BG	<i>Rosa palustris</i>	Swamp Rose	2			2		
BH	<i>Rosa setigera</i>	Prairie Rose	36				10	26
BI	<i>Rubus occidentalis</i>	Black Raspberry	16		6	10		
BJ	<i>Salix discolor</i>	Pussy Willow	2		2			
BK	<i>Sambucus canadensis</i>	Elderberry	47	10		10	7	20
BL	<i>Spirea alba</i>	Meadowsweet	4			4		
BM	<i>Staphylea trifolia</i>	Bladdernut	13	6				7
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	37		20		17	
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	19	5		5	9	
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	34	4			15	15
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	4					4
BR	<i>Campsis radicans</i>	Trumpet Creeper	10					10
Total trees			1256	138	181	212	215	513
Total shrubs			433	40	56	70	87	179
Total			1,689	178	237	282	302	692

SEEDLINGS

B	<i>Acer saccharinum</i>	Silver Maple	80			40		40
C	<i>Acer saccharum</i>	Sugar Maple	768	50	75	175	200	268
D	<i>Carya cordiformis</i>	Bitternut Hickory	80			20	20	40
E	<i>Carya laciniosa</i>	Shellbark Hickory	80	40		20	20	
F	<i>Carya ovata</i>	Shagbark Hickory	80		40	20	20	
G	<i>Fagus grandifolia</i>	Beech	336	36		50	100	150
H	<i>Fraxinus americana</i>	White Ash	144	20	20	20	44	40
M	<i>Juglans nigra</i>	Black Walnut	192	42	50			100
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	80	20	20	20	20	
O	<i>Prunus serotina</i>	Black Cherry	80		20	20	20	20
P	<i>Quercus alba</i>	White Oak	240		60	60	60	60
X	<i>Quercus rubra</i>	Northern Red Oak	240		60	60	60	60
total			2,400	208	345	505	564	778



PRELIMINARY
INFORMATION ONLY

NO.	REVISIONS	DATE	OWN.	BY	APPD.	NO.	REVISIONS	DATE	OWN.	BY	APPD.	NO.	REF. DWG. NO.

NOTE:
FLUOR FERNALD
CADD DRAWING.
DO NOT REVISE
MANUALLY.

CONFIGURATION
DRAWING
DATE: 06/26/03
DRAWN: K.L. RABBITT

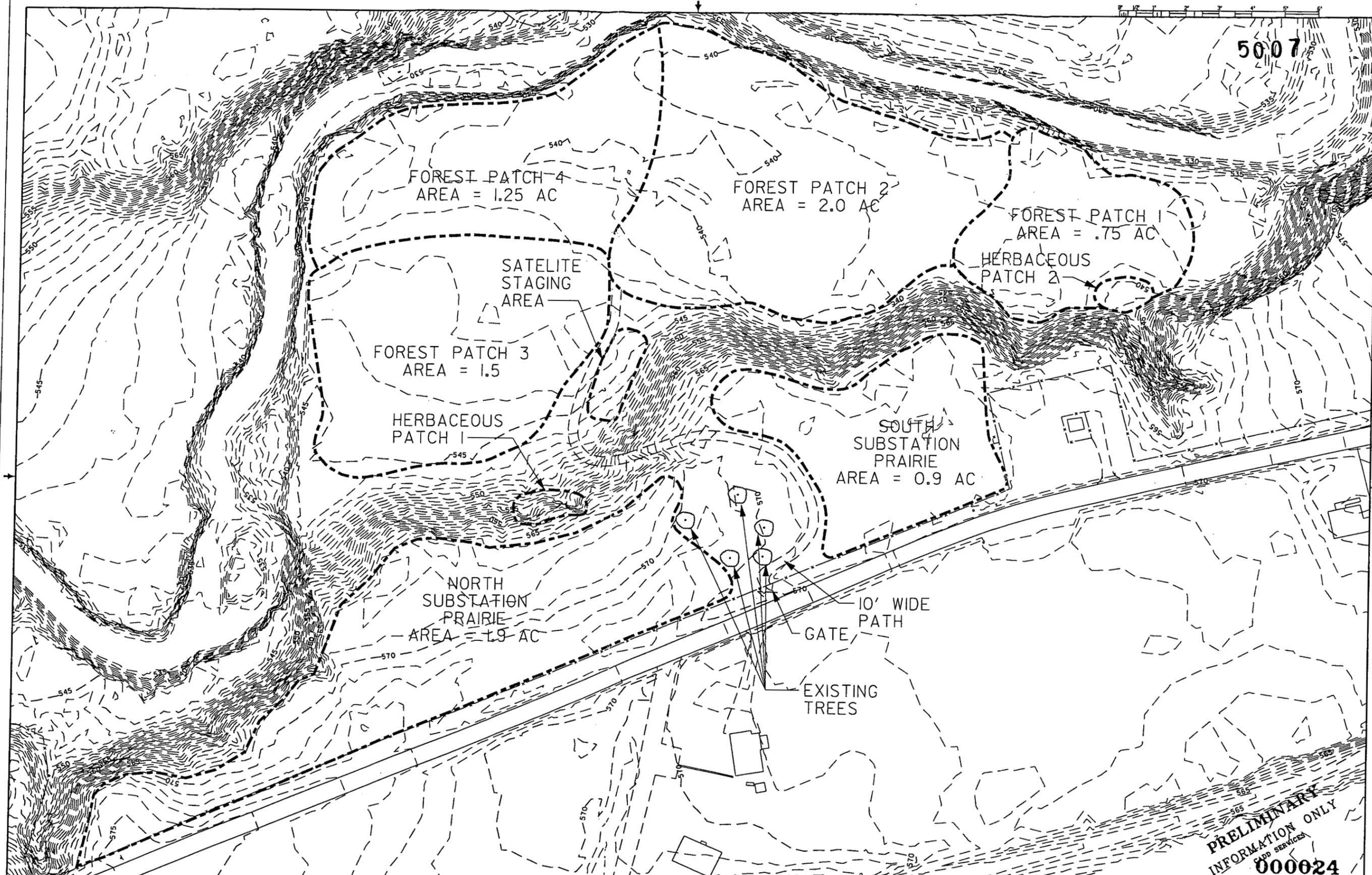
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CIVIL & STR.	SAFETY ENG.
ELECTRICAL	MAINTENANCE
ENGINEER	FIRE PROTECT.
INSTRUMENT	WASTE MANAGE.
MECHANICAL	SECURITY
CHECKED	PROJECTS
APPROVED	

Fernald Closure Project
FLUOR FERNALD, INC.
U.S. DEPARTMENT OF ENERGY

AREA 8, PHASE III SOUTH
WILLEY ROAD FOREST
RESTORATION PROJECT
DATE: 06/26/03
DRAWN: K.L. RABBITT
FIGURE 3-1

000023

FILE NAME: South Planting Plan.dgn



PRELIMINARY
INFORMATION ONLY
 CADD SERVICES
000024

NO.	REVISIONS	DATE	DN.	BY	APPD.	NO.	REVISIONS	DATE	DN.	BY	APPD.	REF. DWG. NO.

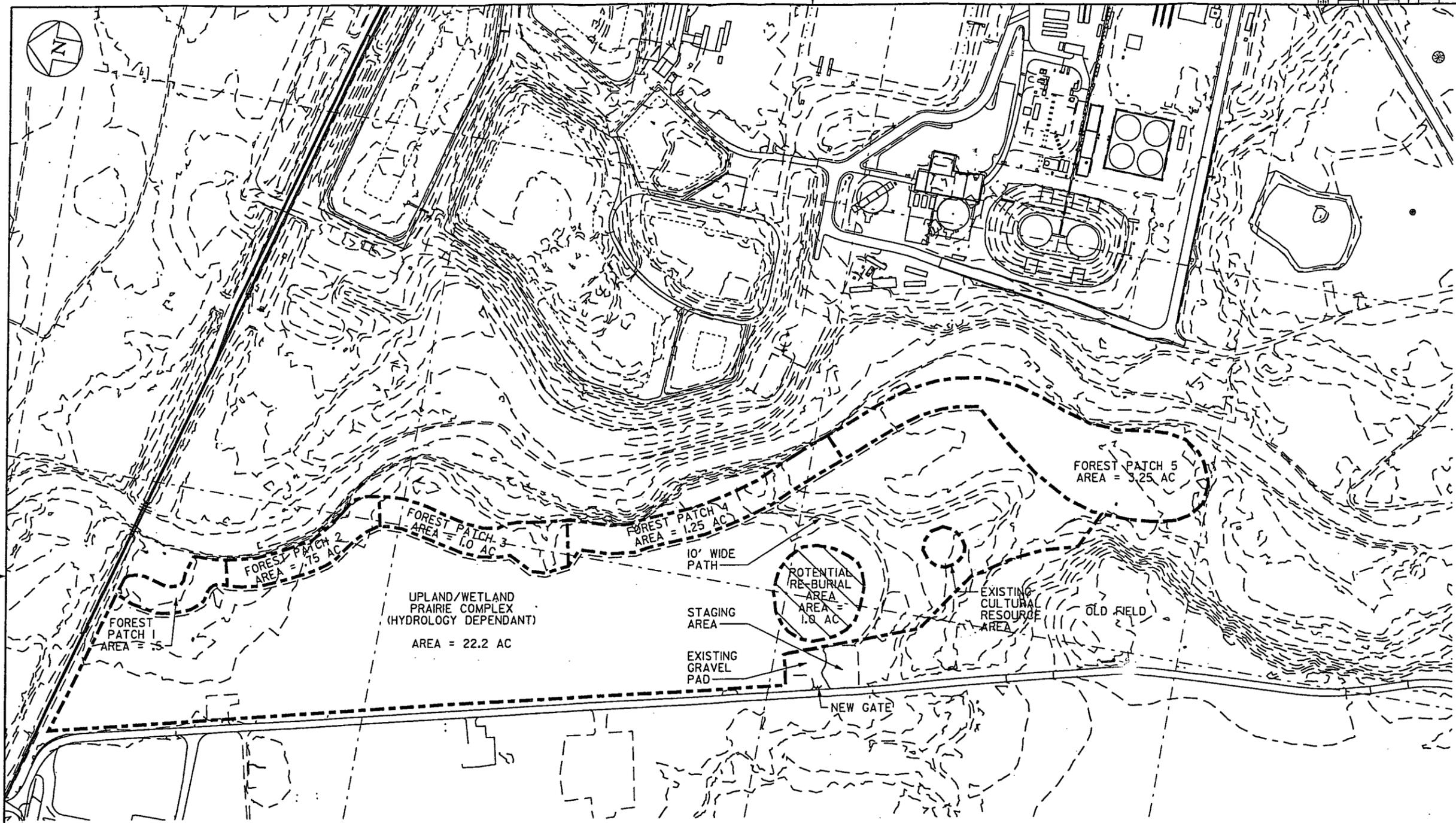
NOTE:
 FLUOR FERNALD
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 MANUALLY.

CONFIGURATION
 MANAGEMENT
 DRAWING
 DATE: 06/25/03
 DRAWN BY: K.L. RABBITT

APPROVALS	
CIVIL & STR.	SAFETY ENG.
ELECTRICAL	MAINTENANCE
ENGINEER	FIRE PROTECT.
INSTRUMENT	WASTE MANAG.
MECHANICAL	SECURITY
CHECKED	PROJECTS
APPROVED	

Fernald Closure Project
FLUOR FERNALD, INC.
 U.S. DEPARTMENT OF ENERGY

AREA 8, PHASE III SOUTH
 SUBSTATION FOREST
 RESTORATION PROJECT
 PLANTING PLAN
 DATE: 06/25/03
 DRAWN: K.L. RABBITT
FIGURE 3-2



 POTENTIAL RE-BURIAL SITE

000025

NO.	REVISIONS	DATE	OWN. BY	APPD. NO.	REVISIONS	DATE	OWN. BY	APPD.	REF. DWG. NO.

NOTE:
FLUOR FERNALD
CADD DRAWING.
DO NOT REVISE
MANUALLY.

CONSTRUCTION
DRAWING
DATE: 06/28/03
DRAWN BY: AL. RABBITT
CHECKED BY: []
DATE: []

APPROVALS		SAFETY	
CIVIL & STR.	ENGINEER	SAFETY ENG.	MAINTENANCE
ELECTRICAL	ENGINEER	FIRE PROTECT.	WASTE MANAGE.
INSTRUMENT	MECHANICAL	SECURITY	PROJECTS
CHECKED	APPROVED		

Fernald Environmental
Management Project
FLUOR FERNALD, INC.
U.S. DEPARTMENT OF ENERGY

PADDYS RUN WEST RESTORATION
AREA B PHASE III
PLANTING PLAN
DATE: 06/28/03
DRAWN BY: AL. RABBITT
FIGURE 3-3

4.0 FIELD IMPLEMENTATION

Field implementation of the A8P3III restoration areas is described below and in the attached planting and seeding specifications. Extensive grading and bioengineering for erosion control is not anticipated.

4.1 SITE PREPARATION ACTIVITIES

As shown in Table 2-1, Site Preparation involves the establishment of access points and staging areas for the delivery of tools, equipment, materials, and planting stock. One gravel pad will be installed at the access point for the Willey Road Forest Area (Figure 3-1). This area will also serve as the main staging location for the Substation Forest Area and the two A8P3III South prairie areas. In A8P3III North, the gravel pad that was used in support of riprap installation west of the Silos will be improved and used during Phases II and III of restoration (Figure 3-3). Fluor Fernald construction personnel will install gates, access points, and gravel pads pursuant to Figure 3-3 and as directed by the construction manager.

Existing herbaceous vegetation within all prairie and planting areas will be killed using a glyphosphate herbicide. Licensed subcontract personnel will apply herbicide via a truck-mounted boom sprayer and/or a backpack sprayer. Seeding areas will be sprayed at least twice prior to seeding. Planting areas will be sprayed only once.

An attempt will be made to locate drain tiles across the A8P3III North Prairie Area. Tiles will either be located by hand or through the use of ground-penetrating radar.

4.2 PLANTING ACTIVITIES

Planting activities involve the establishment of trees, shrubs, and herbaceous plants across the project area. All revegetation activities will be conducted pursuant to the densities documented in the NRRP. Densities for areas amenable to planting include 160 trees/acre, 90 shrubs/acre, and 400 seedlings/acre.

Woody plants will be installed in the same manner as other ecological restoration projects at the FCP. Habitat templates will be divided into smaller planting patches. Each planting patch will be laid out in the field and color-coded. The plants themselves will be staged at the project site and tagged with a corresponding colored patch code. Laborers would then simply match the plant/patch codes and install the plant pursuant to the planting specifications in Appendix A. This "random patch" method allows the restoration ecologist to strategically place specific species based on its habitat requirements, distribution patterns, exposure, topography, deer pressure, hydrology, soils, etc.

1 Bare-root seedlings will not be individually "flagged and tagged." Instead, the restoration ecologist will
2 group the seedlings by patch and instruct the laborers to randomly distribute the seedlings within the
3 patch area. Seedlings will also be installed pursuant to the specifications in Appendix A.

4
5 The use of herbaceous plants will be limited to several seeps on the slope between the Substation Prairie
6 Area and Forest Area (Figure 3-2). Herbaceous plants will be delivered to the site in 2-inch square
7 open-bottom pots. These plants must be staged by placing in water immediately upon arrival at the site.
8 Herbaceous plant installation will be conducted using a dibble bar or shovel. Plants will be carefully
9 removed from their pot and placed into the planting hole, keeping the root mass and soil ball intact. The
10 plant is then gently pressed into place by hand. Laborers should make sure that no roots are exposed.

11
12 All plant material will be procured from local sources, if possible. All trees shall be at least one-gallon
13 container size, grown in "spin out" containers to prevent root binding. Shrubs must also be grown in spin
14 out containers, and must be at least 1 foot tall. Seedlings may be container-grown or bare root. Certain
15 species may not be available locally, if at all. The restoration ecologist will determine the appropriate
16 substitution for a plant. The function of the tree as listed in Table 3-1 will be used as a guide to
17 determining substitutions. The Natural Resource Trustees will be notified of any substitutions as part of
18 the consolidated monitoring program discussed in the NRRP.

19
20 All plant material will be delivered to the Southern Waste Units project area directly. A laydown area
21 will be established adjacent to the mulch stockpile area, where plant material may be staged. Any plants
22 that are stored for more than 24 hours at the staging area shall be healed in with woodchip mulch. Bare
23 root seedlings shall be immediately removed from their packing materials and healed in or placed directly
24 in water, in accordance with the vendor's directions. Live stakes will be installed as soon as possible
25 upon receipt. Seed will be stored in a cool place until it can be applied to the project area.

26 27 4.3 SEEDING ACTIVITIES

28 All prairie areas will be seeded pursuant to the seeding specification. As stated in Section 4.1 above,
29 areas will be seeded following at least two applications of glyphosphate herbicide. All areas will be
30 seeded in an upland mesic grass and forb mix, with the exception of several wet areas within the A8PIII
31 North Prairie Area. A wet prairie grass and forb mix will be seeded within these areas. Wet areas will be
32 determined following the plugging of agricultural drain tiles across the prairie area.

33 Forest areas will be seeded with the interim cover mix pursuant to the attached specification
34 (Appendix B). These areas will be broadcast seeded following plant installation.

1 4.4 MAINTENANCE ACTIVITIES

2 Maintenance is critical to restoration success. Activities that will be required for A8P3III restoration areas
3 include watering, deer control, and invasive species control. These activities are discussed in more detail
4 below.

5
6 4.4.1 Watering

7 Each plant will be watered at the time of installation. Watering will not be carried out beyond the initial
8 watering, unless drought conditions persist during the first growing season. Water is accessible to both
9 planting areas within A8P3III South. In A8P3III North, polyethylene tanks may be used to provide water
10 for planting areas. Watering will be carried out either directly via hose, tree gator and/or bucket, or
11 remotely via water cannon. Water may be carried out during the second growing season if significant
12 drought conditions occur similar to the summer of 1999. Under normal rainfall conditions, watering after
13 planting will not be necessary.

14
15 For seeded areas, the planting window restrictions in the attached seeding specification help to ensure that
16 sufficient soil moisture exists for germination and survival of seeds. Weather patterns will be a
17 contributing factor in timing seed application.

18
19 4.4.2 Deer Control

20 Installed trees and shrubs must be protected from deer browsing and rubbing in order for forest restoration
21 efforts to be successful. At a minimum, field personnel will install deer tubes around all planted trees. In
22 addition, a latex-based taste repellent will be applied to all plant material. These measures have proven to
23 be moderately effective in past restoration efforts.

24
25 4.4.3 Invasive Species

26 The forest restoration concept developed in the NRRP depends on ecological succession as primary
27 component. Without adequate control, invasive species may impede succession and alter the intended
28 course of maturation for restored areas. Therefore, field personnel will mechanically remove or apply
29 glyphosphate herbicide to bush honeysuckle, multiflora rose, and grape vines present in A8P3III planting
30 areas.

5.0 MONITORING

1
2
3 Both Implementation and Functional monitoring will be conducted for A8P3 restoration. For
4 Implementation Phase Monitoring, plant survival and herbaceous cover are the only requirements. To
5 facilitate plant survival evaluations, all sapling trees and shrubs will be tagged with a unique number,
6 which will be recorded on patch-specific data sheets. Mortality counts will be conducted at the end of the
7 first growing season following completion of each phase of restoration. (Phase III will not be included in
8 Implementation Phase Monitoring, since the growing season following installation is beyond site
9 closure.) For Implementation Monitoring of seeded areas, herbaceous cover will be evaluated pursuant to
10 the process and criteria set forth in the 2002 Consolidated Monitoring Report (DOE 2003).

11
12 Functional Monitoring will also commence following restoration of each phase. In accordance with the
13 current Functional Monitoring schedule, completed prairie areas will be evaluated in 2004 and completed
14 forest areas will be evaluated in 2005. As with Implementation Monitoring, methods, results, analyses,
15 and reporting are conducted under the Consolidated Monitoring Report.

REFERENCES

- 1
- 2
- 3 U.S. Department of Energy, 2002, "Natural Resource Restoration Plan," Final, Fernald Environmental
4 Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.
- 5
- 6 U.S. Department of Energy, 2003, "2002 Consolidated Monitoring Report for Restored Areas at the
7 Fernald Closure Project," Draft, Fernald Closure Project, DOE, Fernald Area Office, Cincinnati, Ohio.

APPENDIX A
PLANTING SPECIFICATIONS

**SECTION 02940
PLANTING****PART 1 GENERAL****1.1 SCOPE**

- A. This Section includes the requirements for planting trees, shrubs, and herbaceous potted plants as shown on the Construction Drawings.

1.2 RELATED SECTIONS AND DOCUMENTS

- A. Section 02930 - Vegetation.

PART 2 PRODUCTS**2.1 MATERIALS**

- A. Container grown trees shall be a minimum of 6 feet in height, grown in "spin-out" containers and acquired from a local seed source if possible. Potting material shall be pre-inoculated with mycorrhizae.
- B. Container-grown shrubs shall be a minimum of 1 foot in height, grown in "spin-out" containers and acquired from a local seed source if possible. Potting material shall be pre-inoculated with mycorrhizae.
- C. Bareroot seedlings shall be pre-inoculated with ecto-mycorrhizae and shall not be exposed to the air any longer than possible prior to planting.
- D. Herbaceous potted plants shall be grown in open bottom, minimum 2-inch square and 3-inch deep containers. Potting material shall be inoculated with ecto-mycorrhizae.
- E. Fertilizer shall be slow-release tablet form, and not exceed a N-P-K mix of 22-5-10. Fertilizer shall contain not less than 1 percent added sulfur and not more than 8 percent added iron, or an approved equal.
- F. Mulch shall be an aged hardwood mulch, free of clay, stone, foreign substances, and free of weeds.
- G. Wooden stakes for staking trees as needed shall be nominal 2 inch square, approximately 18-inches in length.

2.2 EQUIPMENT

- A. Equipment for performing work in this section shall be low ground pressure equipment that will not compact amended soils.

PART 3 EXECUTION**3.1 GENERAL**

- A. Planting locations will be flagged in the field by the Restoration Ecologist. The Restoration Ecologist is the Fluor Fernald contact responsible for identifying locations of all plant material installation, verifying acceptance of delivered plant material, and ensuring proper installation.
- B. Unless otherwise approved by the Restoration Ecologist, all plant installation shall take place between October 1 and December 15 or February 15 and May 15.
- C. The Restoration Ecologist may restrict planting activities based on field conditions (e.g., droughts, unseasonable freezes).
- D. No plant installation may take place while the soil surface is frozen.
- E. Plant material delivered to the project site that will not be planted within 24 hours shall have their containers completely covered with woodchip mulch and kept moist with periodic watering.
- F. The Construction Manager will provide a source of water sufficient to support all field activities specified in this Section.

3.2 INSTALLATION OF CONTAINER-GROWN TREES AND SHRUBS (DETAIL A-1)

- A. Excavate planting pit to a depth such that the top of the ball, when planted, extends 1 to 2 inches above ground surface.
- B. Excavate the planting pit so that it is wider than the root ball by 9 inches on all sides.
- C. Scarify the sides of the planting pit using a shovel.
- D. Remove the plant from the container by carefully inverting the plant and loosening the root ball from the container, cutting the container if necessary. Keep the root ball as intact as possible. Handle the plant by the root ball only. Do not pull the plant from the container by the trunk of the tree or shrub.
- E. Add a slow-release fertilizer tablet or packet (e.g., Osmocote, Agriform or similar) around the ball per manufacturers recommendations.
- F. Set trees and shrubs such that the top of the ball extends 1 to 2 inches above the ground surface and that the trunk is vertical. Trunks shall have no appreciable lean, at the discretion of the Restoration Ecologist.
- G. Backfill around the root ball with a mixture of the topsoil and subsoil removed from the pit. Gently tamp the backfill as it is placed into the pit.
- H. Water the tree/shrub immediately after planting to saturate the upper 12 inches of soil.

- I. Remove any tags, labels, strings or wires from the plant, unless otherwise directed by the Restoration Ecologist.

3.3 INSTALLATION OF BAREROOT PLANTS (DETAIL A-2)

- A. Carry bareroot plants in a bucket of water (or moist sand or other moist medium) in the field to keep the roots from drying out. Bareroot plants shall not be stored in water for more than 6 hours at a time. Bareroot plants that require overnight storage shall have their root balls covered completely with moist hardwood mulch and kept moist with periodic watering.
- B. Excavate the planting pit by hand using a dibble bar or spade. The pit shall be only broad enough to accommodate the roots when fully extended and only deep enough such that the uppermost roots will be just below ground surface.
- C. Set the plant and spread the roots in a natural pattern such that the roots are fully extended without touching the sides of the planting pit and that the uppermost roots are just below ground surface.
- D. Carefully work backfill (mix of topsoil and subsoil removed from the planting pit) through the fully spread root systems and water while backfilling.
- E. Firmly tamp backfill with the heel of the shoe when complete.
- F. Remove any tags, labels, and strings from the plant, unless otherwise directed by the Restoration Ecologist.

3.4 INSTALLATION OF HERBACEOUS POTTED PLANTS

- A. Place potted plant flats in standing water immediately upon delivery to the project site. Keep flats in water until installation.
- B. Excavate the planting pit by hand using a dibble bar or spade. The pit shall be only broad enough to accommodate the roots when fully extended and only deep enough such that the uppermost roots will be just below ground surface.
- C. Set the plant and spread the roots in a natural pattern such that the roots are fully extended without touching the sides of the planting pit and that the uppermost roots are just below ground surface.
- D. Carefully work backfill (mix of topsoil and subsoil removed from the planting pit) through the fully spread root systems and water while backfilling.
- E. Firmly tamp backfill with the heel of the shoe when complete.
- F. Remove any tags, labels, and strings from the plant, unless otherwise directed by the Restoration Ecologist.

3.5 PRUNING

- A. Once trees and shrubs are planted, prune off any dead or damaged limbs.
- B. All pruning shall involve removal of limbs back to a lateral branch or bud.
- C. Perform additional pruning at the request of the Restoration Ecologist.

3.6 MULCHING

- A. Apply a 4-inch layer of hardwood mulch over a circular area 4 feet in diameter surrounding balled and burlapped and container grown trees and shrubs. At the discretion of the Restoration Ecologist, straw may be used as a substitute for hardwood mulch.
- B. Apply a 4-inch layer of hardwood mulch over a circular area 2 feet in diameter surrounding each bare root or potted plant. At the discretion of the Restoration Ecologist, straw may be used as a substitute for hardwood mulch.
- C. Mulch shall be placed so as to not physically contact the plants.

3.7 WATERING

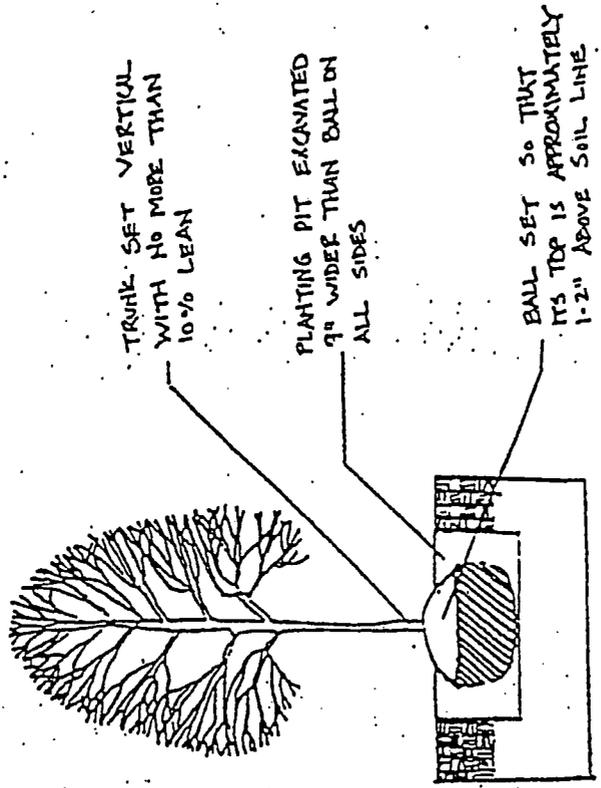
- A. Water all planted material weekly for 6 weeks following installation, unless otherwise directed by the Restoration Ecologist. Watering shall be sufficient to saturate the entire root ball. This typically requires the slow release of approximately 10 gallons of water for each plant.

3.8 STAKING AND GUYING

- A. Stake and guy trees only at the request of the Restoration Ecologist.

END OF SECTION

Detail A-1: Installation of Balled and Burlapped and Container-Grown Trees and Shrubs



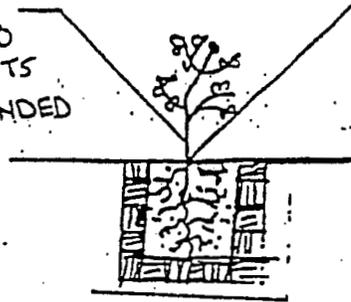
SHRUB SET VERTICAL WITH NO MORE THAN 10% LEAN

BALL SET SO THAT ITS TOP IS APPROX. 1-2" ABOVE SOIL LINE

PLANTING PIT EXCAVATED 1/4" WIDER THAN BALL ON ALL SIDES

Detail A-2: Installation of Bareroot Plants

PLANTING POT
LARGE ENOUGH TO
ACCOMMODATE ROOTS
IN A FULLY EXTENDED
POSITION



SET PLANT SUCH
THAT UPPER MOST
ROOTS ARE JUST
BELOW THE SOIL
SURFACE

5007

APPENDIX B

**SEEDING AND BIOENGINEERING EROSION
CONTROL SPECIFICATIONS**

000038

**SECTION 02930
SEEDING AND BIOENGINEERING EROSION CONTROL****PART 1 GENERAL****1.1 SCOPE**

- A. This Section includes soil stabilization, which includes application of crusting agent, establishing vegetation by seeding and dormant live cuttings, and installing biodegradable erosion control materials. The work in this Section includes, but is not limited to; soil preparation, interim vegetation, permanent vegetation, application of fertilizer, application of mulches, application of crusting agent, and installation of erosion control materials.

1.2 RELATED SECTIONS AND PLANS

- A. Section 02940 – Planting

1.3 REFERENCES

- A. Latest version of Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Standards (ODNR Rainwater and Land Development Standards).
- B. *"Identification and Listing of Hazardous Waste,"* Title 40, Code of Federal Regulations (CFR), Part 261, Subpart E.C.
- C. *"Federal Hazardous Material Transportation Law,"* U.S. Department of Transportation (U.S. DOT, 1994).

PART 2 PRODUCTS**2.1 MATERIALS**

- A. Furnish seed labeled in accordance with U.S. Department of Agriculture (USDA) Rules and Regulations under the Federal Seed Act and applicable State seed laws. Furnish seed in sealed bags or containers bearing the date of expiration. Do not use seed after its date of expiration. Each variety of seed shall have a purity of not less than 90 percent by weight, a percentage of germination not less than 80 percent by weight, and a weed to seed content of not more than 0.75 percent by weight and contain no noxious weeds. Furnish seed mixtures having seed proportioned by weight in accordance with Tables 1 and 2 of the Northern Pine Plantation Natural Resource Restoration Design Plan (NPP NRRDP), and Table 02930-2 of this Section. Areas requiring permanent seeding during the summer months (July 1 – September 20) shall be seeded with 30 lbs/acre of ReGreen or stabilize with a crusting agent as specified in this Section, unless otherwise directed by the Construction Manager or the Restoration Ecologist. Stabilization performed during the summer shall be followed by fall application of the appropriate permanent seed mix.

- B. Permanent seed mixes shall be treated with fungal (mycorrhizae) inoculant and bacterial (rhizobium) inoculants. The specified legumes must be inoculated with the appropriate rhizobial strains.
- C. Furnish mulch meeting the following requirements:
 - 1. Mulch shall be straw or wood cellulose fibers; free of clay, stone, foreign substances, and free of weeds.
 - 2. Straw should not contain sticks larger than ¼-inch diameter or other materials that may prevent matting down during application. Use straw that is free from mold and other objectionable material for placing with mulch blower equipment or other equipment as approved by the Construction Manager. Straw shall be generally 6 inches or more in length.
 - 3. Straw shall be:
 - a. weed free straw from the Minnesota Crop Improvement Association certified weed free straw vendors;
 - b. straw that has been inspected and determined to be weed free by Central Ohio Seed Testing;
 - c. native prairie grass mulch; or
 - d. equivalent substitute as approved by the Construction Manager.
 - 4. Mulch applied by hydrospraying shall be a bonded fiber matrix containing wood fibers held together with a hydrocolloid-based binder, which upon drying becomes insoluble and non-dispersible. The fibers shall be composed of 100 percent wood or wood by-products and shall be 100 percent biodegradable. Use a bonded fiber matrix containing a green dye that will provide for easy visual inspection for uniformity of slurry spread. The bonded fiber matrix, including dye, shall contain no growth or germination inhibiting properties. The wood cellulose fiber shall be manufactured in such a manner that, after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous material. When sprayed on the ground, the material shall allow absorption and percolation of moisture. The wood cellulose fiber shall meet the following requirements:

<u>Item</u>	<u>Specification Limit</u>
Particle Length	0.4 inch (maximum)
Particle Thickness	0.047 inch (maximum)
PH	4.0 to 8.5
Ash Content	1.6 % (maximum)
Water Holding Capacity (based on fiber dry weight)	500 % (minimum)
Moisture Content	12 % ± 3 % (by weight)

- D. Mulch binder agent shall be as approved by the Construction Manager and shall meet the following requirements:
1. The mulch binder shall be hydrocolloid base (guar gum) and shall not dissolve or disperse upon rewetting.
 2. The mulch binder shall not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states.
 3. The mulch binder shall have a flash point greater than 200°F. The mulch binder shall be neither a flammable nor combustible liquid per U.S. Department of Transportation definition (DOT 1994). The mulch binder must not be susceptible to significant deterioration from exposure to the elements, including sunlight.
 4. The mulch binder shall be provided in concentrated solution and prepared so that it will not change in transportation or storage.
- E. The crusting agent shall be as approved by the Construction Manager and shall meet the following criteria:
1. pine sap emulsion comprised of a 100 percent organic emulsion produced from naturally occurring resins (pine sap); or a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik tacking agent (mulch binder); or an approved equal;
 2. not comprised of chloride, lignosulfonate, petroleum, or asphaltic-type emulsions;
 3. provide dust suppression and surface stability for exposed soils, both disturbed and undisturbed soils, and exposed coal fired ash (flyash);
 4. compatible with application via a hydro seeder, and must not require intense cleaning of equipment after application;
 5. non-tracking (i.e., will not stick to boots or tires) once cured;
 6. not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states;
 7. have a flash point greater than 200°F;
 8. be neither a flammable nor combustible liquid per DOT definition; and
 9. not be susceptible to significant deterioration from exposure to the elements, including sunlight.

- F. Woven coir erosion mat shall meet the following criteria:
1. coconut fiber content: 100%
 2. weight: 22 ounces per square yard
 3. thickness: 0.3 inches
 4. open area: 38%
 5. tensile strength: 1,350 lb/ft by 626 lb/ft (length by width)
 6. elongation: 34% by 38% (length by width)
- G. Coconut logs shall be constructed of 100% coconut fiber, 10-inch minimum diameter and 8-foot maximum length.
- H. Wood stakes for fastening coir mats and logs shall be as follows:
1. stakes for coir erosion mats shall be nominal 2-inch square, minimum 8 inches in length.
 2. stakes for coconut logs shall be nominal 2-inch square, minimum 35 inches in length.
- I. Metal staples for fastening coir mats shall be 11-gauge wires formed into a staple shape with minimum dimensions of 6 inches by 1 inch by 6 inches.
- J. Dormant live cuttings for bioengineering erosion control shall be as follows:
1. length: 2.5-foot minimum, 4 foot maximum
 2. diameter: 0.5-inch minimum, 2 inch maximum
 3. acceptable species include: silky dogwood (*Cornus amonum*), gray dogwood (*Cornus racemosa*), red osier dogwood (*Cornus stolonifera*), cottonwood (*Populus deltoides*), peachleaf willow (*Salix amygdaloides*), pussy willow (*Salix discolor*), sandbar willow (*Salix exigua*), black willow (*Salix nigra*), silky willow (*Salix sericea*), elderberry (*Sambucus canadensis*), and arrow wood (*Viburnum dentatum*). Additional species may be used upon approval by the Restoration Ecologist.
- K. Fertilizer:
1. Furnish commercial grade fertilizer, uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists.
 2. Fertilizer shall be slow release complete fertilizer.

3. Fertilizer for application within the NPP area shall be 34-0-10; other fertilizers may be approved by the Construction Manager or Restoration Ecologist. Fertilizers shall contain not less than 1 percent added sulfur and not more than 8 percent added iron, or an approved equal.
 4. Fertilizer must have MSDS submitted in accordance with this Section.
 5. Fertilizer shall be used for interim seeding only.
- L. Construction water shall be obtained from the on-site water source as directed by the Construction Manager.

2.2 EQUIPMENT

- A. Provide equipment of size and type to perform work specified in this Section.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

- A. Deliver containerized materials in uniform packages bearing the name of the manufacturer, the net weight and a statement of content. Deliver containerized materials to the site in original, properly labeled, unopened, clean containers each showing the manufacturer's guaranteed analysis conforming to applicable regulations and standards.
- B. Store materials in a dry area in a manner to prevent physical damage.

3.2 GENERAL

- A. Stabilization of disturbed areas by vegetation or by use of a crusting agent shall be performed at completion of excavation and stockpiles or within 7 calendar days of knowing a disturbed area will be idle for more than 45 calendar days, whichever is sooner.
- B. Crusting agents may be used as temporary measures prior to placement of interim vegetation after approval for the area by the Construction Manager.
- C. Disturbed areas which are scheduled to be significantly disturbed after initial stabilization and/or need effective erosion control immediately, are to be stabilized with the interim seed mix rate specified in this Section. Disturbed areas, which are not scheduled to be significantly disturbed again, are to be stabilized with the permanent seed mix rate specified in this Section. Soil piles, which require effective erosion control immediately, are to be stabilized with the interim seed mix rate or a crusting agent as specified in this Section.
- D. Stabilization of permanent slopes steeper than 3H:1V (horizontal to vertical) shall utilize coir matting as specified in Section 3.5 of this specification after application of seed mixture, unless otherwise specified by the Construction Manager or Restoration Ecologist.

- E. Area(s) to be seeded shall be generally free of debris, rock, root material, and other objects that may impede soil preparation and seeding activities. Perform soil preparation by tilling/cultivating, to a depth of approximately 2 inches, to eliminate uneven areas and low spots. Maintain lines, levels and contours.
- F. Repeat cultivation in areas where equipment used for hauling and spreading has compacted the area(s) to be seeded.

3.3 APPLICATION OF SEED AND CRUSTING AGENT

- A. The seeding season, for interim vegetation specified in this Section, is year round. However, if seeding is contemplated during the winter months of December through March, then field conditions should be assessed for ability to provide soil to seed contact. If field conditions do not support the ability to provide soil to seed contact then the area shall be stabilized with a crusting agent followed by seeding during conditions conducive to adequate soil to seed contact.
- B. The seeding seasons for permanent seeding in wet and dry areas are Spring Season between April 1 and July 1 and Fall Season between October 1 and November 15.
- C. Apply fertilizer, seed, and mulch to disturbed areas and areas excavated and graded under this Contract requiring seeding unless otherwise directed by the Construction Manager. Apply mulch within 24 hours of seeding; do not seed areas in excess of that which can be mulched within 24 hours. Winter application of seed and related materials are subject to adjustment as directed by the Construction Manager.
- D. Apply seed using either the drilling, broadcasting, or hydroseeding method, as described below:
 - 1. Seed drilling method:
 - a. This method shall be used for applying the permanent seed mix in accessible areas unless otherwise approved by the Construction Manager. The method may also be used for interim vegetation.
 - b. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches.
 - c. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
 - d. Install seed with a seed drill to obtain a final planting depth of $\frac{1}{4}$ to $\frac{1}{2}$ inch using the seed rates indicated in Tables 1 and 2 of the NPP NRRDP, and 02930-2 of this Section. All seed drilling should be done perpendicular to the direction of surface-water flow.

2. Broadcast Seeding Method:

- a. This method may be used for interim vegetation, and can be performed with the use of mechanical "cyclone" seeders, by hand seeding or by any other method which scatters seed over the soil surface.
- b. This method may also be used for permanent seeding in areas that are not accessible with the seed drill (i.e., sloped areas) as approved by the Construction Manager.
- c. If Broadcast Method is used to apply permanent seed mix in sloped areas (3H:1V slope or steeper), seeding application rates in Tables 1 and 2 of the NPP NRRDP and 02930-2 of this Section shall be doubled.
- d. Prepare the area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.
- e. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
- f. Install seed by broadcasting evenly over the entire site using the seed rates indicated in Tables 1 and 2 of the NPP NRRDP and 02930-2 of this Section.
- g. Rake the area after seeding.
- h. Mulch and disc-anchor using weed free mulch at a rate of 2.0 tons per acre. Spread straw mulch, either by hand or by blowing method, at the rate of 2 air-dried tons per acre. During June through September, increase straw mulch application rate to 3 air-dried tons per acre.

3. Hydroseeding Method:

- a. This method may be used for interim vegetation only. Hydroseeding shall be a two-step process. The seed shall be applied first, followed by a separate application of the mulch. This is to ensure soil to seed contact.
- b. The mixture tank shall be cleaned prior to use to ensure remnant seed is not introduced to the proposed seed mixture.
- c. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.
- d. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre. The fertilizer is to be mixed and applied with the mulch.

- e. Install seed by hydroseeding evenly over the entire area using the seed rates indicated in Table 02930-2. Use a fan-type nozzle with approximately 500 gallons of water per acre to ensure even distribution.
 - f. Rake the area where accessible following seeding.
 - g. Apply sprayed mulch at a net dry weight of 2,000 pounds per acre minimum and 100 percent continuous coverage. Mix the mulch with water at a ratio of 50 pounds of mulch per 100 gallons of water.
- E. Application of Crusting Agent:
1. Apply crusting agent in accordance with manufacturer's directions.
 2. Unless otherwise specified by the manufacturer, dilute concentrated pinesap emulsion to ratio of 4 parts water to 1 part concentrate. Apply diluted pinesap emulsion at a rate of 2,500 gallons per acre.
 3. Apply a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik mulch binder, using the hydroseeder, at the rate of 1,000 lbs/acre on flat surfaces; and 1,125 lbs/acre on slopes greater than 3H:1V. The mixture rate for each product shall be 20 lbs/acre on flat surfaces and 30 lbs/acre on greater than 3H:1V slopes for the hydraulic mulch; and 20 lbs/acre on flat surfaces and 30 lbs/acre on slopes greater than 3H:1V for the Hydro-Stik mulch binder.

3.4 BIOENGINEERING EROSION CONTROL

- A. Following seeding, install coir matting and/or coir logs in areas indicated on the Construction Drawings, on slopes steeper than 3H:1V, or in any other areas prone to erosion, as identified by the Construction Manager or the Restoration Ecologist. Installation is as follows:
1. coir matting: Stake coir matting on minimum 5-foot centers with wood stakes, angled upstream/upgradient. Use metal staples for added support, installing staples on minimum 5-foot centers between wood stakes and in additional areas so that the coir matting is in direct contact with the soil. The Restoration Ecologist shall direct the installation of additional stakes and/or staples as necessary. Overlap adjoining sections of coir matting 6 to 12 inches, with the upstream/upgradient matting laid on top. Sew adjoining sections of matting together with coir rope. Bury the upper edge of coir matting in a 6-inch trench.
 2. coir logs: Stake coir logs on 10-foot centers. Install 2 stakes opposite each other and tie the stakes together with coir rope. Sew adjoining coir logs together with coir rope.
- B. Secure all coir materials at the end of the day in preparation for unexpected rain events.

- C. Dormant live cuttings shall be installed as follows: Cut a point onto the bottom of the live cutting and drive into the soil on 4 foot centers using a dead blow hammer. Drive cuttings (minimum two-thirds, maximum four-fifths of their length) into soil angled slightly downstream/downgradient. Minimize damage to the cuttings when driving into the soil. If necessary, prepare a pilot hole by driving rebar into the soil and removing prior to inserting cuttings. Saw any damaged tops once the cuttings are installed. Dormant live cuttings may be installed into coir matting or other areas prone to erosion as directed by the Restoration Ecologist.

3.5 MAINTENANCE

- A. Maintain the vegetated areas in satisfactory condition until acceptance of the vegetation by the Construction Manager. Maintenance of the vegetated areas includes repairing eroded areas, revegetating when necessary, watering, and mowing (if applicable). A satisfactory condition of vegetated area is defined as follows:
1. an area shall have a predominant stand of the seeded vegetation;
 2. within 3 weeks, germination must occur over 90 percent of the area with no single bare area greater than 3 square feet; and
 3. within 3 months, 90 percent of the area must be covered with mature vegetation.
- B. The above timeframes for germination and coverage requirements are to be delayed during the dormant season between November 1 and March 15 application of the seed. The performance criteria shall be measured at the beginning of the growing season (April 1) for seed applied during the previous dormant season.
- C. Areas that fail to meet these requirements shall be repaired or reseeded as necessary to produce an acceptable stand of vegetation, as specified in this Section.
- D. The acceptance inspection will be performed by the Construction Manager who will determine whether repair of vegetated areas or revegetation is required.
- E. Maintain areas with a crusting agent to ensure proper erosion control. The crusting agent shall be reapplied to eroded and bare areas as necessary.

**TABLE 02930-2
SEED MIX FOR INTERIM VEGETATION**

Species	Pounds Per Acre (lb/ac)
ReGreen	50
Annual Rye Grass	20
Canada Wild Rye	20

[END]