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**FORMER PRODUCTION AREA
NATURAL RESOURCE RESTORATION DESIGN PLAN**

**FERNALD CLOSURE PROJECT
FERNALD, OHIO**



JANUARY 2005

U.S. DEPARTMENT OF ENERGY

**20810 & 20800-PL-0005
REVISION 0
FINAL**

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ACRONYM LIST

CA	Certified Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDL	Certification Design Letter
CFC	Certified for Construction
DOE	U.S. Department of Energy
FCP	Fernald Closure Project
FPA	Former Production Area
MDC	Main Drainage Corridor
NRRP	Natural Resource Restoration Plan
NRRDP	Natural Resource Restoration Design Plan
NRT	Natural Resource Trustees
OSDF	On-site Disposal Facility
SSOD	Storm Sewer Outfall Ditch
SWRB	Storm Water Retention Basin

1.0 INTRODUCTION

The Former Production Area (FPA) is one of 11 ecological restoration projects implemented or planned at the U.S. Department of Energy (DOE) Fernald Closure Project (FCP). Ecological restoration activities at the FCP are required as part of a tentative agreement for resolution of natural resource damage liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This Natural Resource Restoration Design Plan (NRRDP) provides the detailed design and specifications for conducting restoration activities within a portion of the FPA.

The FPA NRRDP is consistent with the sitewide ecological restoration goals set forth in the Natural Resource Restoration Plan (NRRP, DOE 2002). Restoration goals include the establishment of pre-settlement native communities and wildlife habitat, and the resolution of substantive, regulatory-driven mitigation requirements. To achieve these goals, a conceptual restoration plan was first developed as part of the NRRP and then refined and submitted as the Former Production Area Conceptual Restoration Design Plan (DOE 2004). The FPA Conceptual Restoration Design Plan called for a series of open water and emergent wetland communities surrounded by wetland and upland mesic prairie. Herbaceous wetland plants will be planted to augment emergent wetland creation, and patches of shrubs will be established to increase native plant diversity and wildlife habitat.

The FPA restoration project boundary is shown on Figure 1-1. The project encompasses what was once the production and administrative areas at the FCP. These areas include Certification Areas 3A, 3B, 4A, 4B, 5, a portion of Areas 6 and 7, the Main Drainage Corridor (MDC) and the Stormwater Retention Basin (SWRB). Four separate Certified for Construction (CFC) design packages (i.e., drawings and specifications) will be submitted for various components of the FPA. The CFC package for Area 3B is included in this NRRDP. Subsequent CFC submittals are listed in Table 1-1 below. Note that this schedule is slightly different than the schedule set forth in the FPA conceptual restoration plan. Revisions to the path forward are necessary to accommodate engineering and construction planning. Where possible, restoration activities will be accelerated.

**TABLE 1-1
 FPA REVISED RESTORATION SCHEDULE**

Certification Area(s)	CFC Package Submittal	Field Implementation
3B	9/30/04	Fall/Winter 2004
3A/4A	01/25/05	Winter 2004/Spring 2005
4B, 6, MDC	05/19/05	Summer 2005
6, 7, SWRB	06/16/05	Summer/Fall 2005

2.0 SITE DESCRIPTION

The entire project area is in the process of extensive remediation. Figure 2-1 provides an overview of the project area based on a July 2004 flyover. As the figure shows, remedial activities have been completed in 3A and 3B, and these areas are in the process of being certified. Active remediation is underway in 4A and 4B. The remaining areas are either in use or in various stages of decommission and demolition. Within remediated areas, several deep excavations remain. In addition, utility corridors have been excavated, leaving a network of ditches across the project area. Additional ditches have been or will be excavated around each certification area in order to prevent uncontrolled runoff from compromising each area's certification status. Once upgradient areas are certified, run-on control channels will be incorporated into future restoration design packages.

The existing topography of Area 3B is shown on Figure 2-2. This area encompasses approximately 11 acres of the northwest quadrant of the FPA. It does not have any large, deep basins. Instead, several excavated utility ditches cross the project area. These generally drain to the south. Excess soil from the surface water runoff control ditch has been bermed up along the western edge of the project area. An access point has been constructed in the northwest corner of Area 3B, between these berms.

Remedial activities have left much of the project area devoid of topsoil. Field observations and nutrient composition sampling across Areas 3A and 3B confirm that very little organic matter is present in the remaining subsoil. It is suspected that other remedial areas will show similar results. To remedy these conditions, soil amendments will be incorporated into accessible excavated areas.

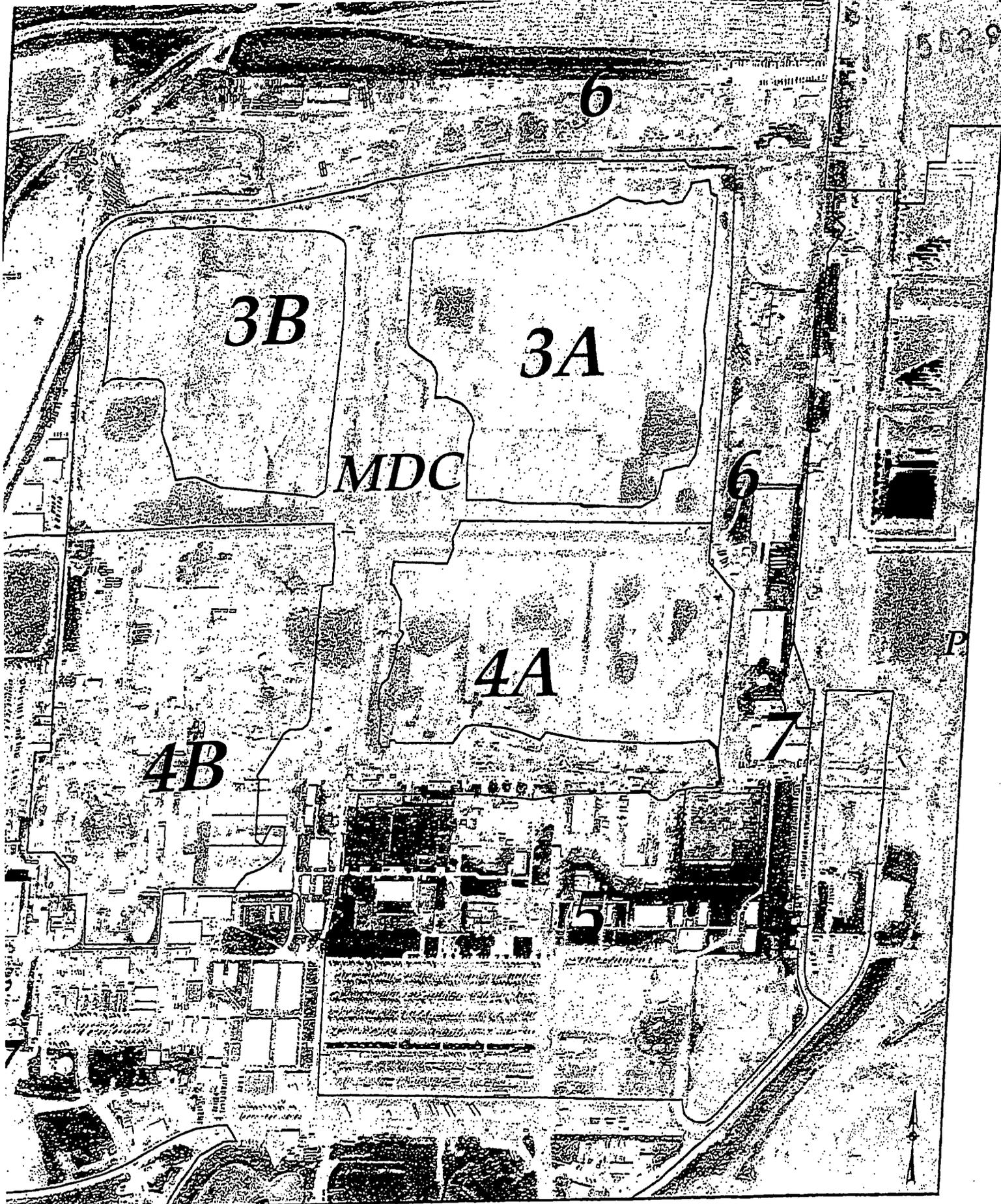
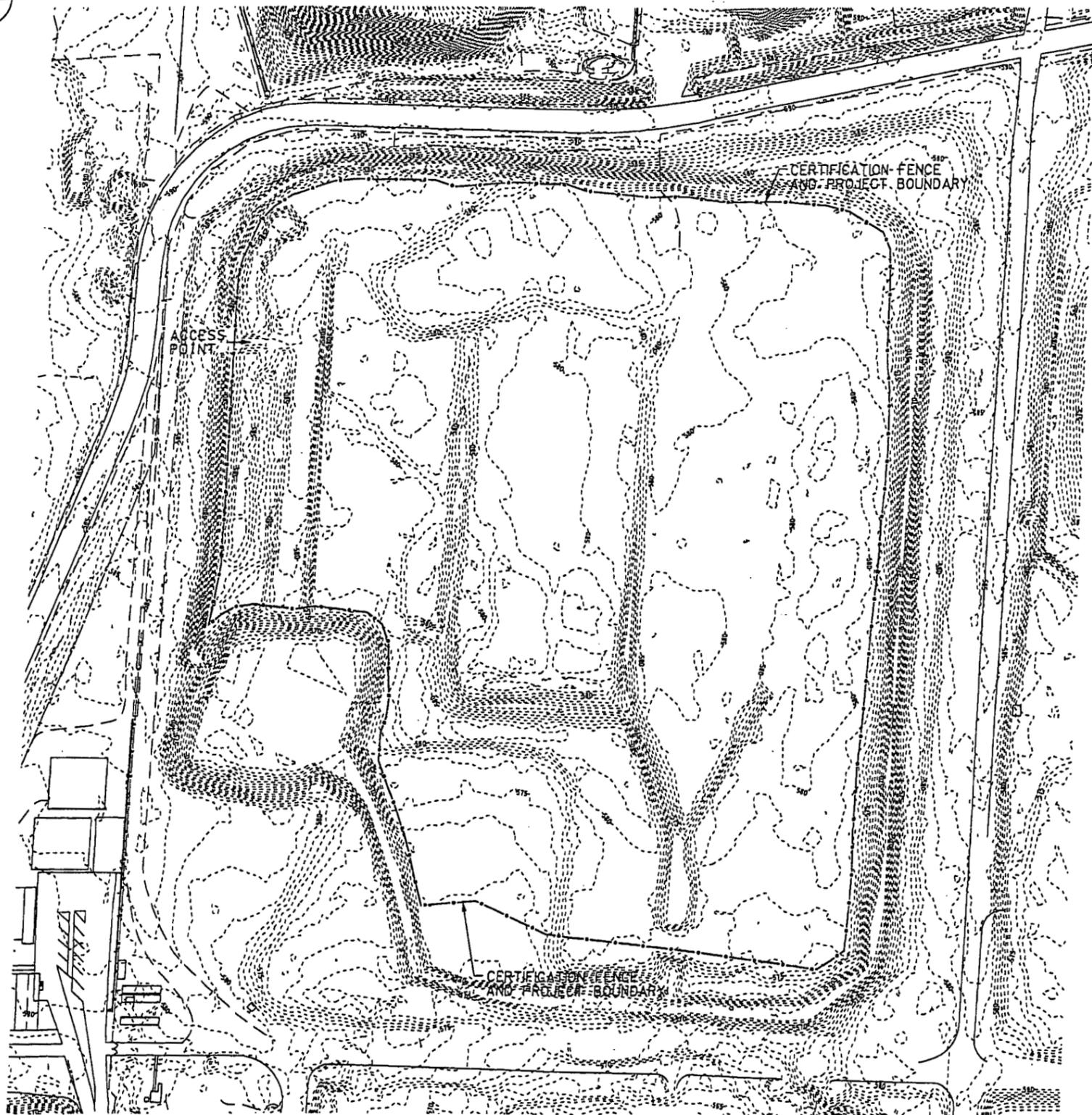


Figure 2-1
Former Production Area
July 2004 Fly Over

Figure 2-2 OSD/F3 lind8392 09/28/2004 11:05:11 AM



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

NOTE:
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CONFIGURATION
MANAGEMENT
DRAWING

COORDINATOR ENGINEER DATE

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

Fernald Closure Project
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AREA 3B
RESTORATION PROJECT AREA
PROJECT NO. 2080
DATE 8/26/04
DRAWN RAL LINDGREN
FIGURE 2-2 A

3.0 COMPONENTS OF RESTORATION

The conceptual restoration plan for the FPA is shown on Figure 3-1. Restoration consists of a series of wetland and open water areas, surrounded by a mosaic of native shrub plantings and seeded areas (DOE 2004). To the degree practicable, shallow sloping littoral zones will be constructed adjacent to ponds and wetlands throughout the FPA to promote additional ecological diversity. Five main components are required to achieve this; grading, application of soil amendments, planting, seeding, and erosion control. Each of these components is discussed in more detail below.

3.1 GRADING

The restoration grading approach for the FPA meets the natural resource restoration goals discussed in Section 1.0 above while minimizing the amount of grading required following remediation. A restoration grade will be developed that incorporates post-remediation basins and ditches where possible. Several deep-water basins will remain following remediation, along with a variety of more shallow basins and interconnected swales. Once all areas are certified and restoration grading complete, the FPA will function as an integrated portion of the Paddys Run watershed that drains to the south through the Stormwater Retention Basin and into the Storm Sewer Outfall Ditch. This will be accomplished by using the MDC as a central drainage corridor for all of the FPA. Since remediation is taking place in phases, individual certification areas cannot be linked until certification is complete.

Certification will take place once all debris removal and excavation is completed. Following certification in each area, a restoration grade will be implemented that adjusts the final excavation grade in order to maximize wetland creation and link the hydrology to adjacent areas. The restoration grade will usually balance the amount of cut and fill required within each area.

The restoration grade for Area 3B is shown on Figure 3-2. The 3B restoration grade takes advantage of several shallow basins and ditches to create approximately 0.7 acre of emergent wetland/open water and 1.0 acre of wet prairie. In general, the 3B area will drain to the south, providing Area 4B with additional watershed once it is restored. The restoration grading in Area 3B will result in balanced soil cut and fill volumes

3.2 SOIL AMENDMENTS

Once restoration grade is achieved, soil amendments will be added to existing subsoil. The primary amendment that will be used across the FPA is yard waste compost. Compost provides organic matter and nutrients to the clay subsoil found across excavated areas at the FCP. It also loosens the soil and adds

pore spaces, thereby improving conditions for vegetation establishment (Hammer 1996). Mature, screened compost will be imported from local suppliers and stockpiled on site. The compost will be sampled prior to delivery to ensure that no Final Remediation Levels or Benchmark Toxicity Levels are exceeded. Following grading, soil will be ripped to a depth of 12 to 18 inches and loose rock that may impede further tilling and seeding will be removed. Mature compost will be spread at a minimum of four inches thick across all accessible areas. Fertilizer and mycorrhizae inoculant will also be added to upland areas as needed. A mechanical tiller, disc or similar method will then incorporate the compost into the top 8 inches of existing soil. This process is consistent with current EPA guidance (U.S. Composting Council 2004). For wetland areas, the compost will not be tilled, but rather spread across the ground surface. This approach will maintain the integrity of compacted basins. Figure 3-3 shows the location of wet areas in Area 3B where compost will not be incorporated into soil.

Additional amendments will be added to emergent wetland and open water areas in the form of pond "muck." Hydric soils, plants and leaf litter from onsite and/or offsite wetlands will be hand dug and placed in five-gallon buckets, then dumped into FPA wetlands. Wetland "muck" contains high concentrations of nutrients, macroinvertebrates, and wetland seeds and rhizomatous plants. The muck acts as an inoculant, facilitating the spread of vegetation and wildlife into newly created wetlands. This approach has proven very successful in other restoration projects at the FCP.

3.3 PLANTING

Native upland and wetland shrub species will be used to establish woody vegetation across the FPA. Table 3-1 lists the plants intended for each certification area. The exclusive use of shrubs is a departure from the strategy used in previous NRRDPs. This is because the restoration goals for the FPA do not include the development of forest communities. As Section 1.0 states, the goals for restoration of the FPA are to establish wetland and mesic prairies around emergent wetland and open water basins. Shrub patches will provide increased diversity and wildlife habitat.

The planting plan for Area 3B is shown on Figure 3-4. The approach calls for the establishment of several wetland and upland shrub patches. Patches WS-1 and WS-2 are wetland shrub patches, while Patches US-1 through US-6 are upland. The two wetland patches comprise approximately 0.4 acre and the upland patches total approximately 1.4 acre. A total of 450 shrubs will be planted in Area 3B. These planting densities are consistent with the approach established in previous restoration designs (DOE 2000).

In addition to the establishment of native shrubs, herbaceous plant plugs will be used to vegetate wetlands. Table 3-2 lists the herbaceous plugs that will be planted across the FPA. For Area 3B, approximately 1,300 plugs will be placed within the wetland communities that will be created.

3.4 SEEDING AND EROSION CONTROL

Seeding is the primary means of establishing vegetation across the FPA. Three mixes will be used; mesic, wet and interim. Table 3-3 lists the species composition for each mix. The mesic mix will be used for all restored upland areas. The wet mix will be seeded in all areas graded to retain water and along the edge of existing and graded open water basins. Figure 3-4 shows the location of seeding templates within Area 3B.

Seeding is also used to stabilize slopes and control erosion across restored areas. In areas of concentrated flow (e.g., drainage channels, spillways), C350 erosion matting or equivalent will be used. Prior use of C350 has proven to be effective in preventing erosion in swales and other areas of concentrated flow. Use of jute or coir matting in swales and spillways in other parts of the site (e.g., A1PI, SWU) has resulted in erosion under the matting, requiring repair. On other slopes (greater than 3:1), erosion control matting (jute, coir, or equivalent) will be used to retain soil until vegetation is established. In Area 3B, matting installation is limited to a drainage swale on the western portion of the project (Figure 3-2). The interim mix will be used in 3B to stabilize soils that will be disturbed later following certification of adjacent areas. The interim mix will be used to stabilize several areas on the eastern and southern edge of the project. Once area 4B and the MDC are remediated, certified, and restored, these areas will be seeded with upland mesic mix.

3.5 WILDLIFE AMENITIES

As with other restoration projects at the FCP, several wildlife amenities will be installed across the FPA. Wildlife amenities promote wildlife use of restored areas, which is one of the restoration goals at the FCP (DOE 2002). They provide nesting and cover that would otherwise not be present until the restored community matures. Monitoring of other restoration projects has demonstrated that amenities increase wildlife use (DOE 2003). Figure 3-4 shows the location of wildlife amenities for Area 3B.

TABLE 3-1
FORMER PRODUCTION AREA PLANT LIST

ID	Species	Common Name	Function	Coefficient of Wetness	Quantities			
					(total)	3B	3A/4A	4B/5
A	<i>Alnus serrulata</i>	common alder	erosion	-5	36	5	18	13
B	<i>Amelanchier arborea</i>	downy serviceberry	fruit, aesthetics	1	39	9	19	11
C	<i>Amorpha fruticosa</i>	false indigo bush	cover, aesthetics	-3	41	21	20	0
D	<i>Asimina triloba</i>	paw paw	fruit, diversity	-1	13	3	10	0
E	<i>Campsis radicans</i>	trumpet creeper	aesthetics, edge	0	23	5	11	7
F	<i>Carpinus caroliniana</i>	ironwood	diversity, mast	0	51	5	30	16
G	<i>Ceanothus americanus</i>	New Jersey tea	diversity	5	5	2	3	0
H	<i>Celastrus scandens</i>	bittersweet	diversity	4	18	5	11	2
I	<i>Cephalanthus occidentalis</i>	buttonbush	cover, erosion	-5	92	15	45	32
J	<i>Cercis canadensis</i>	redbud	cover, aesthetics, edge	4	25	7	12	6
K	<i>Cornus amomum</i>	silky dogwood	cover, erosion	-3	14	3	9	2
L	<i>Cornus drummondii</i>	roughleaf dogwood	cover, edge	0	14	5	9	0
M	<i>Cornus florida</i>	flowering dogwood	aesthetics	4	18	9	9	0
N	<i>Cornus racemosa</i>	grey dogwood	cover	1	37	9	18	10
O	<i>Corylus americana</i>	hazelnut	diversity	4	21	5	11	5
P	<i>Crateagus crus-galli</i>	cockspur hawthorne	cover, diversity	3	20	5	10	5
Q	<i>Crateagus mollis</i>	downy hawthorne	cover	3	8	3	5	0
R	<i>Hamamelis virginiana</i>	witch hazel	cover	1	80	30	40	10
S	<i>Hypericum prolificum</i>	shrubby St. John's wort	diversity	3	64	23	31	10
T	<i>Ilex verticallata</i>	winterberry	aesthetics, fruit	-4	77	9	43	25
U	<i>Lindera benzoin</i>	spicebush	cover, diversity	-2	49	15	24	10
V	<i>Ostrya virginiana</i>	hop-hornbeam	diversity	4	51	16	25	10
W	<i>Physocarpus opulifolius</i>	ninebark	diversity, edge	-2	18	9	9	0
X	<i>Prunus americana</i>	American plum	cover, fruit	4	42	11	21	10
Y	<i>Rhus aromatica</i>	fragrant sumac	cover, aesthetics	5	30	10	15	5
Z	<i>Rhus glabra</i>	smooth sumac	aesthetics, edge	5	15	0	8	7
AA	<i>Rhus typhina</i>	staghorn sumac	aesthetics, edge	5	79	25	39	15
AB	<i>Rosa caroliniana</i>	Carolina rose	aesthetics	5	23	12	11	0
AC	<i>Rosa palustris</i>	swamp rose	aesthetics	-5	66	15	40	11
AD	<i>Rosa setigera</i>	prairie rose	diversity	3	82	27	45	10
AE	<i>Rubus occidentalis</i>	black raspberry	fruit, edge	5	42	16	21	5
AF	<i>Salix discolor</i>	pussy willow	cover, edge	-3	46	18	23	5
AG	<i>Sambucus canadensis</i>	elderberry	erosion, fruit	-2	110	25	74	11
AH	<i>Sassafras albidum</i>	sassafras	diversity	4	5	2	3	0
AI	<i>Spirea alba</i>	steeplebush	diversity	-4	51	10	35	6
AJ	<i>Staphylea trifolia</i>	bladdernut	diversity	0	33	7	26	0
AK	<i>Symphoricarpos orbiculatus</i>	coralberry	diversity	5	80	20	50	10
AL	<i>Viburnum acerifolium</i>	mapleleaf viburnum	diversity, edge	5	36	9	27	0
AM	<i>Viburnum prunifolium</i>	blackhaw viburnum	cover	3	72	25	35	12
AN	<i>Zanthoxylum americanum</i>	prickly ash	diversity, edge	3	5	0	5	0
Totals:					1,631	450	900	281

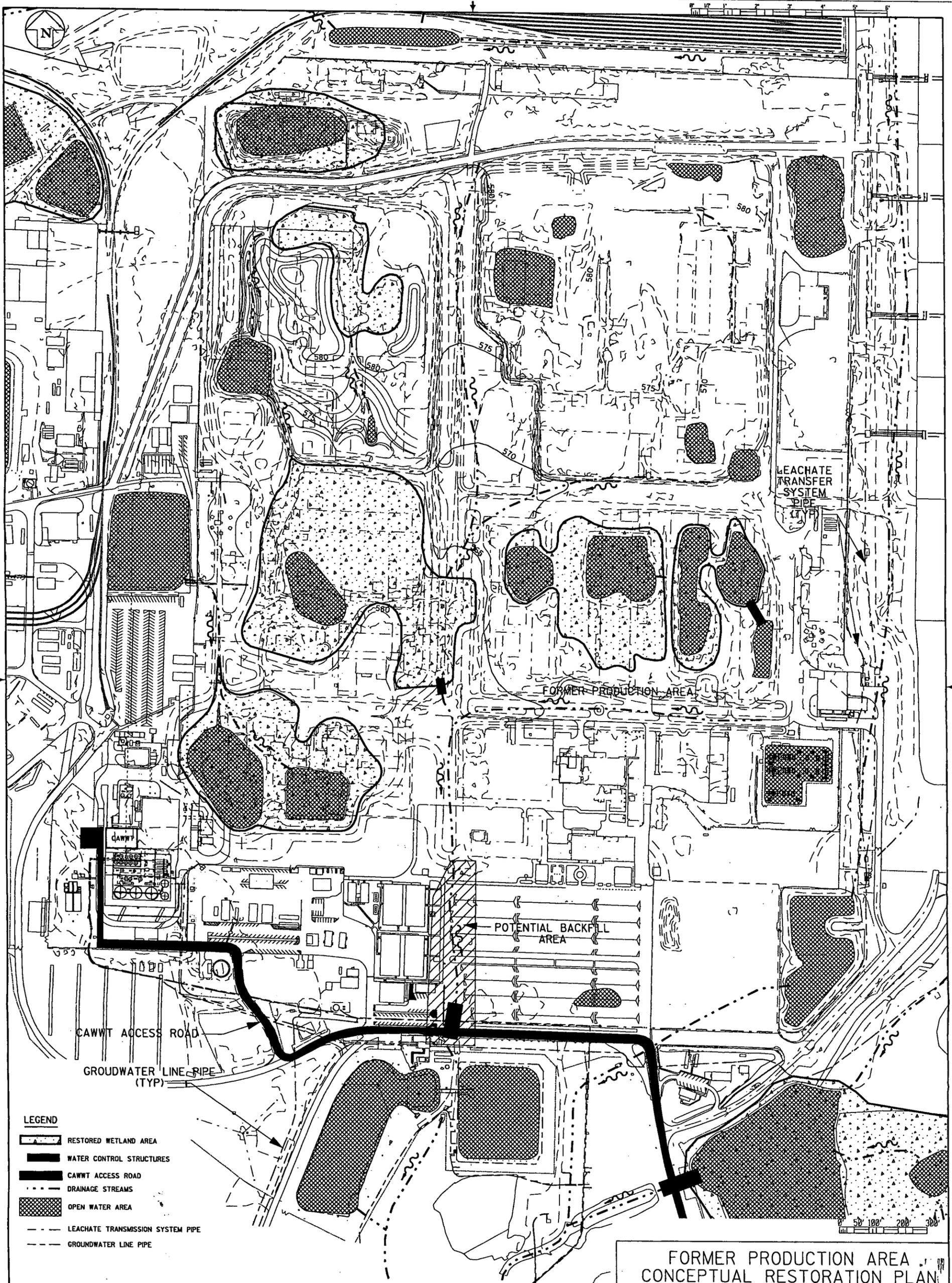
**TABLE 3-2
FPA HERBACEOUS PLANT PLUGS**

Species	Common Name	Form	(total)	Quantities		
				3B	3A/4A	4B/5
<i>Carex comosa</i>	bristly sedge	graminoid	294	49	147	98
<i>Carex lacustris</i>	lake sedge	graminoid	343	98	196	49
<i>Carex lurida</i>	lurid sedge	graminoid	294	98	147	49
<i>Carex vulpinoidea</i>	fox sedge	graminoid	294	98	98	98
<i>Schoenoplectus acutus</i>	hardstem bulrush	graminoid	343	98	147	98
<i>Schoenoplectus tabernaemontanii</i>	softstem bulrush	graminoid	343	98	196	49
<i>Scirpus atrovirens</i>	dark green bulrush	graminoid	294	98	98	98
<i>Scirpus cyperinus</i>	woolgrass	graminoid	294	49	147	98
<i>Spartina pectinata</i>	prairie cordgrass	graminoid	392	98	196	98
<i>Iris versicolor</i>	northern blue flag	forb	343	98	147	98
<i>Asclepias incarnata</i>	swamp milkweed	forb	343	98	147	98
<i>Helianthus grosseserratus</i>	sawtooth sunflower	forb	343	98	147	98
<i>Lobelia cardinalis</i>	cardinal flower	forb	294	49	147	98
<i>Lobelia siphilitica</i>	great blue lobelia	forb	294	98	147	49
<i>Sparganium americanum</i>	American burreed	forb	294	49	147	98
Totals:			4,802	1,274	2,254	1,274

TABLE 3-3
FORMER PRODUCTION AREA MASTER SEED LIST

Species	Common Name	Coefficient of Wetness	Mesic	Wet	Interim
Graminoids (lb/ac unless otherwise noted)					
<i>Andropogon gerardi</i>	big bluestem	1	3	3	
<i>Andropogon scoparius</i>	little bluestem	4	2		
<i>Bouteloua curtipendula</i>	side-oats grama	5	0.5		
<i>Calamagrostis canadensis</i>	blue joint grass	-5		0.5	
<i>Carex hystericina</i>	porcupine sedge	-5		1 oz/ac	
<i>Carex vulpinoidea</i>	fox sedge	-5		1 oz/ac	
<i>Elymus canadensis</i>	Canada wild rye	2	25	25	20
<i>Elymus virginicus</i>	Virginia wild rye	-2		5	
<i>Lolium multiflorum</i>	annual rye	ni			20
<i>Panicum virgatum</i>	switchgrass	-1	0.5	0.5	
<i>Scirpus atrovirens</i>	dark green bulrush	-5		1 oz/ac	
<i>Sorghastrum nutans</i>	indian grass	2	2		
<i>Spartina pectinata</i>	prairie cordgrass	-4		1	
na	Regreen	ni	5	5	50
Forbs (1.5 lb/ac uniform mix unless otherwise noted)					
<i>Asclepias incarnata</i>	swamp milkweed	-5		x	
<i>Asclepias tuberosa</i>	butterflyweed	5	x		
<i>Aster laevis</i>	smooth aster	5	x		
<i>Aster novae-angliae</i>	New England aster	-3		x	
<i>Baptisia australis</i>	blue false indigo	5	x		
<i>Cassia fasciculata</i>	partridge pea	4	x		2 oz/ac
<i>Cassia hebecarpa</i>	wild senna	-3		x	
<i>Echinacea purpurea</i>	purple coneflower	5	x		
<i>Eryngium yuccifolium</i>	rattlesnake master	-1	x		
<i>Eupatorium maculatum</i>	spotted Joe pye weed	-5		x	
<i>Eupatorium purpureum</i>	sweet Joe pye-weed	0	x		
<i>Heliopsis helianthoides</i>	Ox-eye sunflower	5	x		
<i>Lespedeza capitata</i>	round-headed bush clover	3	x		
<i>Lobelia cardinalis</i>	cardinal flower	-5		x	
<i>Lobelia siphilitica</i>	great blue lobelia	-4		x	
<i>Monarda fistulosa</i>	bergamot	3	x		
<i>Penstemon grandiflorus</i>	beardtongue	5	x		
<i>Ratibida pinnata</i>	yellow coneflower	5	x	x	
<i>Rudbeckia hirta</i>	black-eyed Susan	3	x		2 oz/ac
<i>Solidago rigida</i>	stiff goldenrod	4	x		
<i>Tradescantia ohioensis</i>	spiderwort	2	x		
<i>Verbena hastata</i>	blue vervain	-4		x	
<i>Verbena stricta</i>	hoary vervain	5	x		

Coefficient of Wetness values were obtained from the U.S. Department of Agriculture Plants Database
ni = no indicator



- LEGEND**
- RESTORED WETLAND AREA
 - WATER CONTROL STRUCTURES
 - CAWWT ACCESS ROAD
 - DRAINAGE STREAMS
 - OPEN WATER AREA
 - LEACHATE TRANSMISSION SYSTEM PIPE
 - GROUNDWATER LINE PIPE

FORMER PRODUCTION AREA
CONCEPTUAL RESTORATION PLAN

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

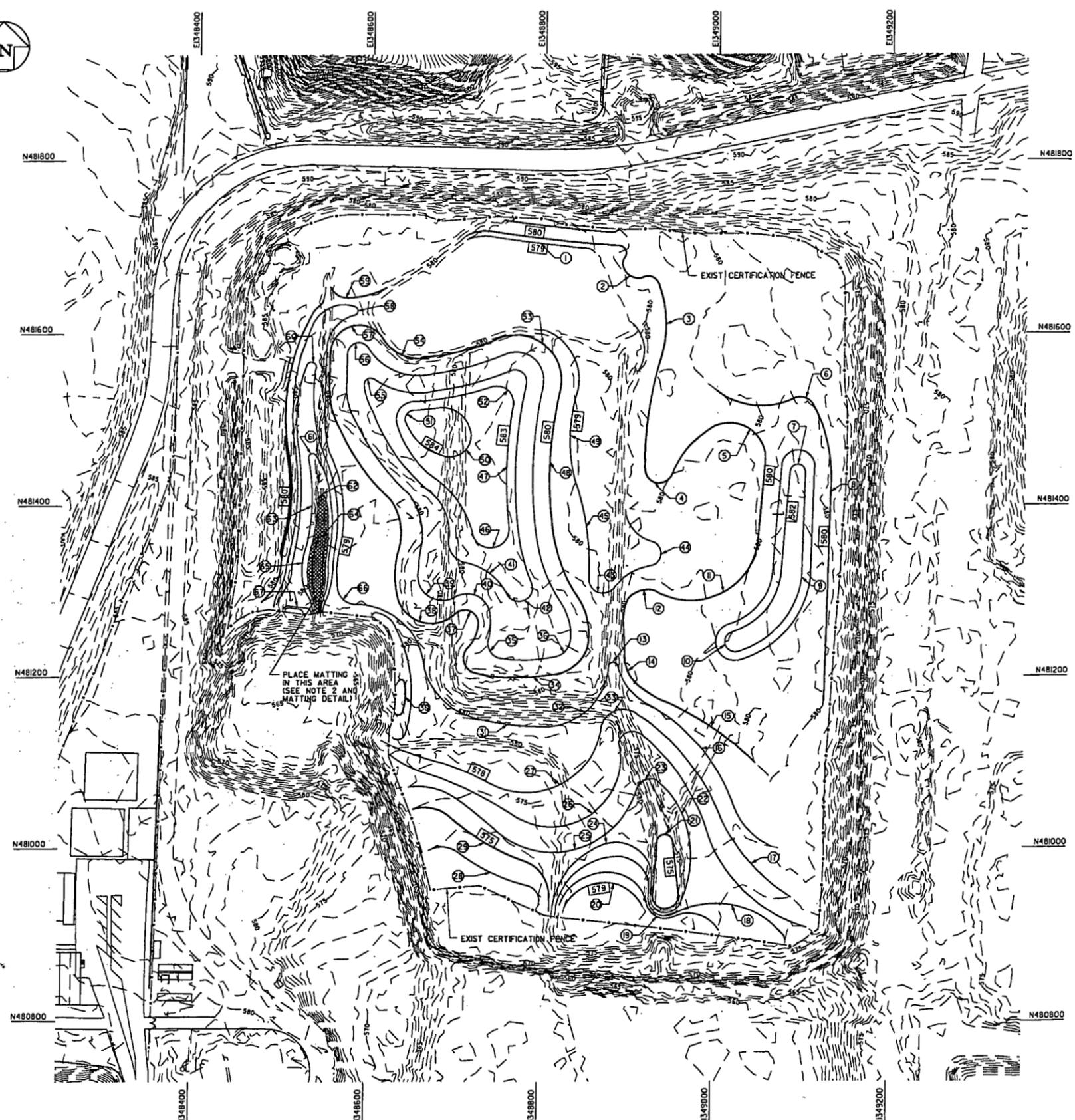
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Fernald Closure Project
FLUOR FERNALD, INC.
U.S. DEPARTMENT OF ENBRGY

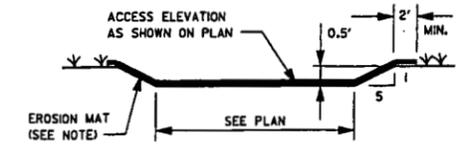
FIGURE 3-1
5829

99XG0813 OSD F3 lnd8392 01/26/2005 10:57:34 AM

- RESTORATION GRADE MAY BE REVISED IN THE FIELD AS NECESSARY, AS APPROVED BY RESTORATION MANAGER.
- INSTALL EROSION CONTROL MATTING PER SPECIFICATION 2930 AND DETAIL BELOW.
- EXISTING CONTOUR ELEVATIONS ARE FROM LIDAR SURVEY DATED: 10/2005.
- SEE DRAWING 99X-5500-G-00841 FOR SOIL AMENDMENT PLAN.
- SEE DRAWING 99X-5500-G-00842 FOR PLANTING AND SEEDING PLAN.



GRADING CONTROL POINTS							
POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
1	481703.6	1348795.4	579.0	56	481227.7	1348826.9	581.0
2	481666.4	1348898.0	580.0	57	481276.6	1348718.2	580.0
3	481610.6	1348940.1	580.0	58	481264.2	1348660.0	580.0
4	481426.2	1348928.4	580.0	59	481296.2	1348657.0	581.0
5	481488.1	1349038.2	580.0	60	481295.8	1348722.8	581.0
6	481524.1	1349102.6	580.0	61	481320.7	1348740.2	582.0
7	481447.2	1349094.1	582.0	62	481288.9	1348780.4	582.0
8	481414.5	1349132.1	580.0	63	481298.2	1348865.2	579.0
9	48135.5	1349099.5	582.0	64	481342.6	1348937.4	579.0
10	481236.3	1349012.3	582.0	65	481374.6	1348850.8	579.0
11	481298.2	1349009.9	580.0	66	481350.5	1348743.6	583.0
12	481301.1	1348917.0	580.0	67	481445.3	1348758.8	583.0
13	481216.0	1348882.8	579.0	68	481450.4	1348808.7	580.0
14	481205.5	1348900.3	580.0	69	481481.3	1348831.6	579.0
15	48140.5	1348997.1	580.0	70	481465.2	1348711.1	584.0
16	48115.7	1348986.0	579.0	71	481506.6	1348641.8	584.0
17	480981.4	1349044.1	578.0	72	481533.9	1348759.0	583.0
18	480933.6	1349022.7	577.0	73	481587.7	1348799.0	580.0
19	480919.5	1348936.0	578.0	74	481574.8	1348635.9	580.0
20	480958.8	1348886.3	579.0	75	481547.6	1348596.0	582.0
21	481015.0	1348944.8	575.0	76	481589.4	1348581.7	581.0
22	481039.1	1348964.8	576.0	77	481608.7	1348576.1	580.0
23	481078.2	1348920.6	576.0	78	481626.6	1348583.6	579.0
24	481005.0	1348877.8	576.0	79	481641.6	1348569.7	580.0
25	480998.5	1348842.0	576.0	80	481666.7	1348533.4	578.0
26	481039.9	1348861.0	577.0	81	481460.5	1348531.6	577.0
27	481073.6	1348823.6	578.0	82	481413.2	1348544.7	---
28	480971.9	1348745.5	574.0	83	481400.0	1348534.0	577.0
29	481006.5	1348738.2	575.0	84	481364.1	1348546.4	576.0
30	48175.9	1348643.9	580.0	85	481333.4	1348524.0	577.0
31	48144.0	1348762.7	579.0	86	481290.3	1348570.9	579.0
32	48158.2	1348851.7	579.0	87	481281.8	1348518.6	578.0
33	48159.0	1348885.3	578.0				
34	48199.2	1348791.2	580.0				
35	481229.1	1348741.9	581.0				



MATTING DETAIL
NTS

INSTALL GEOSYNTHETIC EROSION MAT PER MANUFACTURER'S RECOMMENDATIONS. EROSION MAT SHALL BE TURF REINFORCEMENT MATTING TRM C350 MANUFACTURED BY NORTH AMERICAN GREEN OR APPROVED EQUAL.



NO.	REVISIONS	DATE	DWN. BY	APPD. NO.	A	ISSUED FOR REVIEW	DATE	DWN. BY	APPD. NO.	REF. Dwg. NO.

NOTE:		APPROVALS	
FLUOR FERNALD CAD DRAWING. DO NOT REVISE MANUALLY.		CIVIL & STR.	SAFETY ENG.
		ELECTRICAL ENGINEER	MAINTENANCE
		INSTRUMENT MECHANICAL	FIRE PROTECT.
			WASTE MANAG.
			SECURITY PROJECTS
CONTRACT ENGINEER	DATE	CHECKED	APPROVED

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

AREA 3B
RESTORATION GRADING PLAN
FIGURE 3-2

PROJECT NO. 2090
DATE 8/29/04
DRAWN A.L. LANGRISH

99X-5500-G-00813 A

99xg0842 OSD/F3 lind8392 01/26/2005 11:07:44 AM



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PLANTING AND SEEDING AREAS		
AREA	DESCRIPTION	ACREAGE
BASIC TOTAL	CERTIFIED FENCE	11.1
WS-1	PLANTING	0.1
WS-2	PLANTING	0.3
US-1	PLANTING	0.4
US-2	PLANTING	0.2
US-3	PLANTING	0.2
US-4	PLANTING	0.1
US-5	PLANTING	0.2
US-6	PLANTING	0.3
INTERM-1	SEEDING	0.6
INTERM-2	SEEDING	0.6
WET-1	SEEDING	1.0
WET-2	SEEDING	0.7
WET-3	SEEDING	0.3
WET-4	SEEDING	0.1

- WOOD DUCK BOX
- FOX DEN
- TREE SWALLOW / BLUEBIRD BOX
- OPEN WATER - NO SEEDING



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

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

CONFIGURATION
MANAGEMENT
DRAWING

APPROVALS

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

Fernald Closure Project

FLUOR FERNALD, INC.

U.S. DEPARTMENT OF ENERGY

AREA 3B
PLANTING AND SEEDING PLAN
FIGURE 3-4'

PROJECT NO. 20810
DATE 07/20/04
DRAWN BY: LINDSEEN

99X-5500-G-00842 A

FILE NAME: /osdf/Project20810/Restoration/99xg0842.dgn

4.0 FIELD IMPLEMENTATION

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This section describes the activities that will be undertaken to implement the ecological restoration components discussed in Section 3.0. There are four main phases of implementation; site prep, grading activities, vegetation installation, and maintenance activities. Each of these phases is discussed in more detail below.

Field work will be conducted by Fluor Fernald Building Trade personnel. All activities will be undertaken in accordance with Module 1 and 2 of the Soils Excavation and Onsite Disposal Facility Construction Work Activities Traveler. This document describes the health and safety requirements for all restoration activities at the FCP. Field personnel will be briefed on the Traveler modules as well as this NRRDP prior to commencement of field activities. The project Restoration Ecologist and Restoration Construction Manager will provide technical direction and oversight of field personnel.

4.1 SITE PREP

Site prep involves activities necessary to prepare for grading, seeding, erosion control and plant installation. Typically, this would include the establishment of access points and construction area boundaries, clearing existing vegetation, and setting up staging areas. For the FPA, most project areas have undergone extensive remediation. Construction boundaries will correspond with certification area boundaries. Therefore, construction boundaries and access points are usually already established through the certification process. For Area 3B, the project boundary and main access point is identified on Figure 2-2. The project boundaries of other portions of the FPA will be outlined in CFC packages submitted pursuant to Table 1-1. Entry into the project area will be controlled through the constructed access point. All personnel and equipment entering Area 3B must comply with site procedure EP-0008, Access To and Management of a Certified Area (CA). This procedure requires that any equipment entering a certified area is cleaned of potentially uncertified dirt and mud prior to entry. Project areas within the FPA will have additional requirements for entry when the access point is accessible only through a radiologically controlled area. Field personnel will work closely with Radiological Control to ensure that all controlled access requirements are met. These measures, coupled with the surface water runoff control ditches installed prior to certification, will keep restored areas certified.

Material and plant stock staging areas will be established in each project area. Staging areas will usually be located in the field, on level, accessible ground. In Area 3B, the staging area will facilitate planting stock and woodchip mulch. Compost soil amendments will be stockpiled outside of Area 3B and imported once the restoration grade is complete.

4.2 GRADING ACTIVITIES

Grading activities will usually involve two phases. For the first phase, the restoration grade will be implemented. For the second phase, soil amendments will be spread and incorporated into the soil. Field implementation of grading and soil amendment application is the responsibility of the restoration construction manager. Any field changes to grading plans based on site conditions or unforeseen circumstances will be approved by the restoration ecologist in consultation with the construction manager.

Grading will be accomplished with conventional construction equipment. In Area 3B, it is anticipated that the restoration grade can be reached with a bulldozer and elevated pan scraper. A similar approach will be utilized in later portions of the FPA (e.g., 3A, 4A & 4B). If practicable, wet areas will be compacted to maximize water retention.

Once grading and soil ripping to a depth of 12 to 18 inches is complete, soil amendments will be incorporated. For Area 3B, approximately 6,000 cubic yards of compost will be imported into the project area. Articulating dump trucks will place compost across the project area, which will then be spread a minimum of four inches deep with a bulldozer. Slow-release fertilizer (34-0-10) and mycorrhizae inoculant (6 lb/acre) will be hand-broadcast across upland areas, as needed. Following this, the amendments will be incorporated into the top 8 inches of existing soil with a mechanical tiller or similar method. As stated in Section 3.2, compost will not be tilled into wet areas, but rather spread across the surface. This approach will also be utilized in later portions of the FPA.

4.3 VEGETATION INSTALLATION

The establishment of native vegetation is a primary goal of this NRRDP. This will be accomplished in several ways. Container grown shrubs will be planted. Native grasses and wildflowers will be seeded across prepared seedbeds. Lastly, herbaceous wetland plants will be installed within wetland features. Implementation of these three methods is discussed in more detail below.

4.3.1 Woody Vegetation

Planting activities involve the establishment of shrubs across the FPA. Shrubs will be planted at a density of approximately 250 plants per acre. Shrubs will be installed in the same manner as other ecological restoration projects at the FCP. Each restoration area will be divided into smaller planting patches (Area 3B shown on Figure 3-4, and patch pages are included in Appendix A). Each planting patch will be laid out in the field and color-coded. The plants themselves will be staged at a central location and tagged with a corresponding colored patch code. Field personnel will then simply match the plant/patch codes and install the plant pursuant to the planting specifications in Appendix B. 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. Plantings will be located away from areas that may be disturbed by future remedial or restoration activities.

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All plant material will be procured from local sources, if possible. All shrubs shall be at least one-gallon container size, grown in "spin out" containers to prevent root binding. Certain species may not be available locally, if at all. The restoration ecologist will determine the appropriate substitution for a plant. The function of the tree as listed in Table 3-1 will be used as a guide to determining substitutions.

4.3.2 Seeding and Erosion Control

With the exception of open water areas, restored areas will be seeded pursuant to the seeding specification (Appendix C). A seed drill will be used where possible. Areas inaccessible to the seed drill will be hand broadcast.

If erosion control matting and/or coir logs are required, installation will take place pursuant to the specifications in Appendix C. For Area 3B, it is anticipated that matting will be installed in one drainage swale (Figure 3-2). The need for matting on additional slopes and swales will be determined in the field by the restoration ecologist.

4.3.3 Herbaceous Vegetation

The use of herbaceous plants will be used to vegetate wet areas and the fringes of open water basins (where accessible). Table 3-2 lists the herbaceous plants that are to be installed across the FPA. Plants will be delivered to the site in approximately 2.375-inch square by 3.75-inch deep open-bottom pots. These plants must be staged by placing in water immediately upon arrival at the site. Herbaceous plant installation will be conducted using a dibble bar or shovel. Plants will be carefully removed from their pot and placed into the planting hole, keeping the root mass and soil ball intact. The plant is then gently pressed into place by hand. Field personnel should make sure that no roots are exposed. In addition, donor vegetation will be imported into the FPA from other restoration projects. Field personnel will use a round point shovel to transplant root wads from established stands of bur reed (*Sparganium americanum*), arrowhead (*Sagittaria spp.*), and other desirable wetland species. These plants rapidly spread via root sprouting, thus accelerating the establishment of native wetland vegetation. In addition, the soil and organic matter that accompanies the transplants serves to inoculate created wetlands with desirable mycorrhizae and macroinvertebrates.

4.3.4 Wildlife Amenities

Wildlife amenities will be installed across the FPA. For Area 3B, planned amenities are displayed on Figure 3-4. Wildlife amenities will be constructed and installed pursuant to the specifications in Appendix D. Amenities will generally be installed following planting activities. Field personnel will take care not to compromise wetland basins when installing posts for wood duck boxes.

4.4 MAINTENANCE ACTIVITIES

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

4.4.1 Watering

Each plant will be watered at the time of installation. Pursuant to the attached specification (Appendix B), field personnel will ensure that each plant receives an adequate amount of water each week, for the first six weeks after planting. Watering will be carried out either directly via hose, tree gator and/or bucket, or remotely via water cannon. Water may be carried out during the second growing season if significant drought conditions occur similar to the summer of 1999. Under normal rainfall conditions, watering after the initial planting period will not be necessary.

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

4.4.2 Deer Control

Installed shrubs must be protected from deer browsing and rubbing in order for restoration efforts to be successful. Experience from past restoration projects at the FCP show that enclosure fencing is the most effective means of protection. The restoration ecologist will clump shrub plantings in order to maximize the effectiveness of fencing. Field personnel will then install welded wire or deer enclosure fencing around a significant portion, if not all woody plant material.

4.4.3 Invasive Species

Invasive species within the FPA will be primarily limited to seeded areas. Where possible, prescribed burning is the preferred method of invasives control. The benefits to prescribed burning are numerous (Packard 1997). Given proper planning and execution, prescribed burns are a safe and effective means of managing restored prairies. Currently, DOE has imposed a complex-wide moratorium on all prescribed burning activities. In order to conduct a prescribed burn at the FCP, a waiver to the moratorium must be granted by the DOE Ohio Field Office.

If a waiver is not granted, or if burning is not technically or logistically feasible, then mowing will be used to control invasives. Weeds and cool season grasses will be mowed before they go to seed. Typically, this will require cutting vegetation when it reaches 18 inches in height. Mowing may occur as many as three or four times through the first growing season. The mower deck will be set to cut at six inches. In this way, native grass and forb seedlings will not be cut, and will not be shaded out by faster-growing invasives.

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5.0 MONITORING

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Implementation monitoring parameters for FPA restoration will consist of plant survival and herbaceous cover in Areas 3B and 3A/4A. Mortality counts will be conducted for all areas at the end of the first growing season in late summer 2005. For Implementation Monitoring of seeded areas within 3B and 3A/4A, herbaceous cover will be evaluated pursuant to the process and criteria set forth in the 2002 Consolidated Monitoring Report (DOE 2003). Implementation monitoring of Areas 4B, 5, 6, 7, the MDC, and the SWRB will be carried out in 2006 through the DOE Office of Legacy Management. Functional monitoring of restored wetlands and prairies in the FPA will be carried out pursuant to the schedule being developed by DOE and Ohio EPA as part of the Natural Resource Damage Settlement at Fernald.

REFERENCES

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APPENDIX A
AREA 3B PATCH PAGES

WS-1

Size:	0.1 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	24	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
I	<i>Cephalanthus occidentalis</i>	buttonbush	5		
T	<i>Ilex verticillata</i>	winterberry	3		
AC	<i>Rosa palustris</i>	swamp rose	3		
AF	<i>Salix discolor</i>	pussy willow	7		
AG	<i>Sambucus canadensis</i>	elderberry	3		
AI	<i>Spirea alba</i>	steeplebush	3		

Notes:

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WS-2

Size:	0.3 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	58	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
A	<i>Alnus serrulata</i>	common alder	5		
I	<i>Cephalanthus occidentalis</i>	buttonbush	10		
T	<i>Ilex verticillata</i>	winterberry	6		
AC	<i>Rosa palustris</i>	swamp rose	12		
AF	<i>Salix discolor</i>	pussy willow	11		
AG	<i>Sambucus canadensis</i>	elderberry	7		
AI	<i>Spiraea alba</i>	steeplebush	7		

Notes:

US-1

582 9

Size:	0.4 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	98	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
B	<i>Amelanchier arborea</i>	downy serviceberry	3		
C	<i>Amorpha fruticosa</i>	false indigo bush	4		
F	<i>Carpinus caroliniana</i>	ironwood	3		
G	<i>Ceanothus americanus</i>	New Jersey tea	2		
H	<i>Celastrus scandens</i>	bittersweet	5		
J	<i>Cercis canadensis</i>	redbud	3		
O	<i>Corylus americana</i>	hazelnut	5		
Q	<i>Crateagus mollis</i>	downy hawthorne	3		
R	<i>Hamamelis virginiana</i>	witch hazel	5		
S	<i>Hypericum prolificum</i>	shrubby St. John's wort	5		
V	<i>Ostrya virginiana</i>	hop-hornbeam	5		
X	<i>Prunus americana</i>	American plum	7		
AA	<i>Rhus typhina</i>	staghorn sumac	5		
AB	<i>Rosa caroliniana</i>	Carolina rose	6		
AD	<i>Rosa setigera</i>	prairie rose	9		
AE	<i>Rubus occidentalis</i>	black raspberry	8		
AJ	<i>Staphylea trifolia</i>	bladdernut	7		
AK	<i>Symphoricarpos orbiculatus</i>	coralberry	5		
AL	<i>Viburnum acerifolium</i>	mapleleaf viburnum	3		
AM	<i>Viburnum prunifolium</i>	blackhaw viburnum	5		

Notes:

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US-2

Size:	0.2 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	52	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
B	<i>Amelanchier arborea</i>	downy serviceberry	6		
D	<i>Asimina triloba</i>	paw paw	3		
F	<i>Carpinus caroliniana</i>	ironwood	2		
M	<i>Cornus florida</i>	flowering dogwood	4		
P	<i>Crateagus crus-galli</i>	cockspur hawthorne	3		
R	<i>Hamamelis virginiana</i>	witch hazel	5		
S	<i>Hypericum prolificum</i>	shrubby St. John's wort	5		
U	<i>Lindera benzoin</i>	spicebush	10		
AD	<i>Rosa setigera</i>	prairie rose	4		
AG	<i>Sambucus canadensis</i>	elderberry	5		
AH	<i>Sassafras albidium</i>	sassafras	2		
AL	<i>Viburnum acerifolium</i>	mapleleaf viburnum	3		

Notes:

US-3

Size:	0.2 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	49	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
C	<i>Amorpha fruticosa</i>	false indigo bush	7		
E	<i>Campsis radicans</i>	trumpet creeper	3		
J	<i>Cercis canadensis</i>	redbud	2		
N	<i>Cornus racemosa</i>	grey dogwood	4		
P	<i>Crateagus crus-galli</i>	cockspur hawthorne	2		
R	<i>Hamamelis virginiana</i>	witch hazel	7		
S	<i>Hypericum prolificum</i>	shrubby St. John's wort	3		
V	<i>Ostrya virginiana</i>	hop-hornbeam	3		
X	<i>Prunus americana</i>	American plum	2		
Y	<i>Rhus aromatica</i>	fragrant sumac	5		
AA	<i>Rhus typhina</i>	staghorn sumac	8		
AL	<i>Viburnum acerifolium</i>	mapleleaf viburnum	3		

Notes:

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US-4

Size:	0.1 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	28	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
C	<i>Amorpha fruticosa</i>	false indigo bush	3		
E	<i>Campsis radicans</i>	trumpet creeper	2		
M	<i>Cornus florida</i>	flowering dogwood	2		
N	<i>Cornus racemosa</i>	grey dogwood	5		
R	<i>Hamamelis virginiana</i>	witch hazel	3		
V	<i>Ostrya virginiana</i>	hop-hornbeam	3		
X	<i>Prunus americana</i>	American plum	2		
AB	<i>Rosa caroliniana</i>	Carolina rose	3		
AM	<i>Viburnum prunifolium</i>	blackhaw viburnum	5		

Notes:

US-5

Size:	0.2 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	52	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
C	<i>Amorpha fruticosa</i>	false indigo bush	7		
J	<i>Cercis canadensis</i>	redbud	2		
M	<i>Cornus florida</i>	flowering dogwood	3		
R	<i>Hamamelis virginiana</i>	witch hazel	5		
S	<i>Hypericum prolificum</i>	shrubby St. John's wort	10		
V	<i>Ostrya virginiana</i>	hop-hornbeam	5		
AA	<i>Rhus typhina</i>	staghorn sumac	5		
AD	<i>Rosa setigera</i>	prairie rose	5		
AG	<i>Sambucus canadensis</i>	elderberry	5		
AK	<i>Symphoricarpos orbiculatus</i>	coralberry	5		

Notes:

029

US-6

Size:	0.3 acre
Flag/tag color:	

	Planned	Installed
Shrubs:	78	

ID	Scientific Name	Common Name	Quantity	Installed	Mulched
L	<i>Cornus drummondii</i>	roughleaf dogwood	5		
R	<i>Hamamelis virginiana</i>	witch hazel	5		
W	<i>Physocarpus opulifolius</i>	ninebark	6		
Y	<i>Rhus aromatica</i>	fragrant sumac	5		
AA	<i>Rhus typhina</i>	staghorn sumac	7		
AB	<i>Rosa caroliniana</i>	Carolina rose	3		
AD	<i>Rosa setigera</i>	prairie rose	9		
AE	<i>Rubus occidentalis</i>	black raspberry	8		
AG	<i>Sambucus canadensis</i>	elderberry	5		
AK	<i>Symphoricarpos orbiculatus</i>	coralberry	10		
AM	<i>Viburnum prunifolium</i>	blackhaw viburnum	15		

Notes:

APPENDIX B
PLANTING SPECIFICATIONS

**SECTION 02940
PLANTING**

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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 ectomycorrhizae 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, 3-inch deep containers. Potting material shall be inoculated with ectomycorrhizae.
- 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 hardwood mulch.
- 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

APPENDIX C
SEEDING SPECIFICATIONS

**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 fiber, 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 [U.S. 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 (fly ash);
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, 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 wire 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 pine sap emulsion to ratio of 4 parts water to 1 part concentrate. Apply diluted pine sap 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**

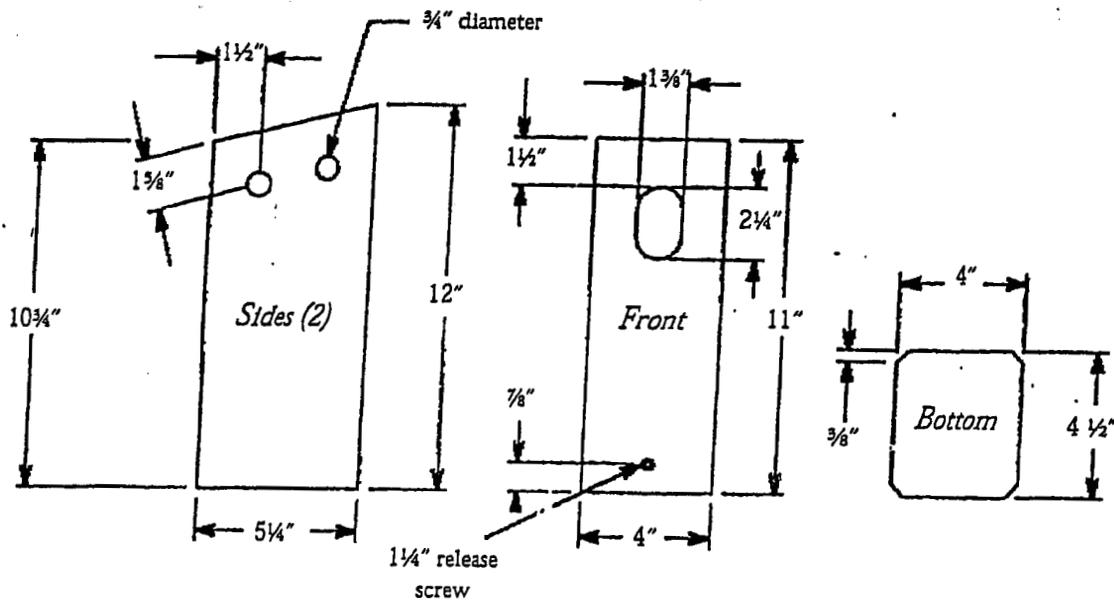
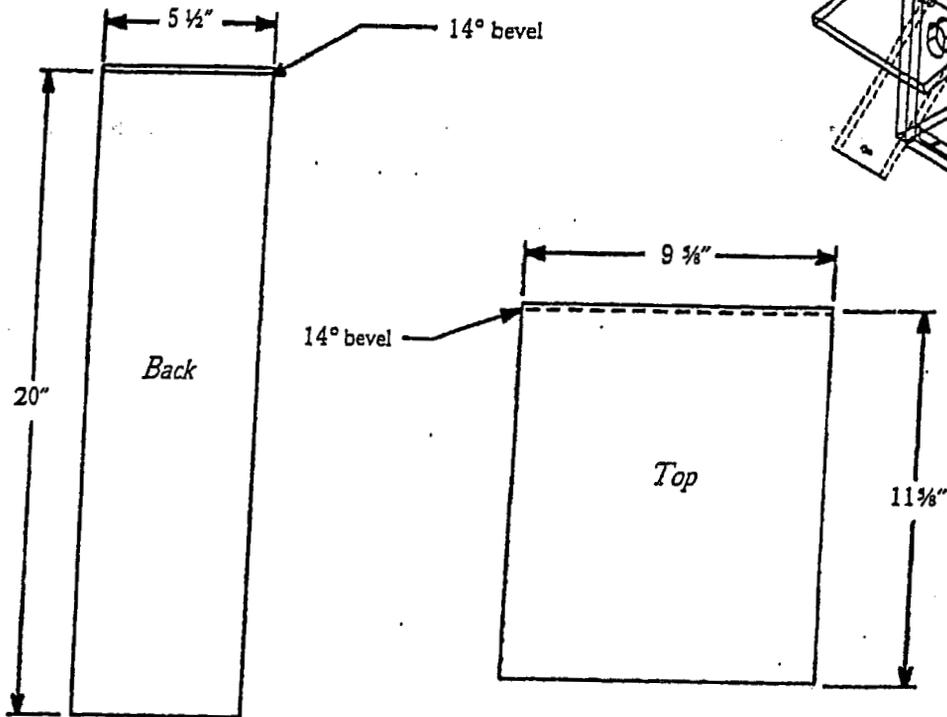
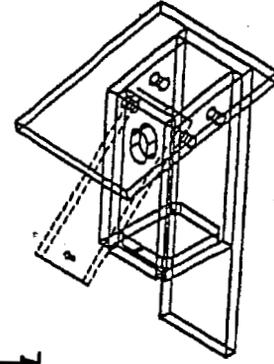
Species	Pounds Per Acre (lb/ac)
ReGreen	50
Annual Rye Grass	20
Canada Wild Rye	20

[END OF SECTION]

APPENDIX D
WILDLIFE AMENITY SPECIFICATIONS

A Nest-Box Plan for Cavity-Nesting Songbirds

(flycatchers, swallows, titmice, chickadees, nuthatches, wrens, and bluebirds)



All wood in the design is 3/4" actual thickness. The pictured entrance hole is recommended for bluebirds. To adapt the nest box for individual species, change the dimensions of the entrance hole. Visit <<http://birds.cornell.edu/birdhouse>> for guidelines on entrance hole sizes.

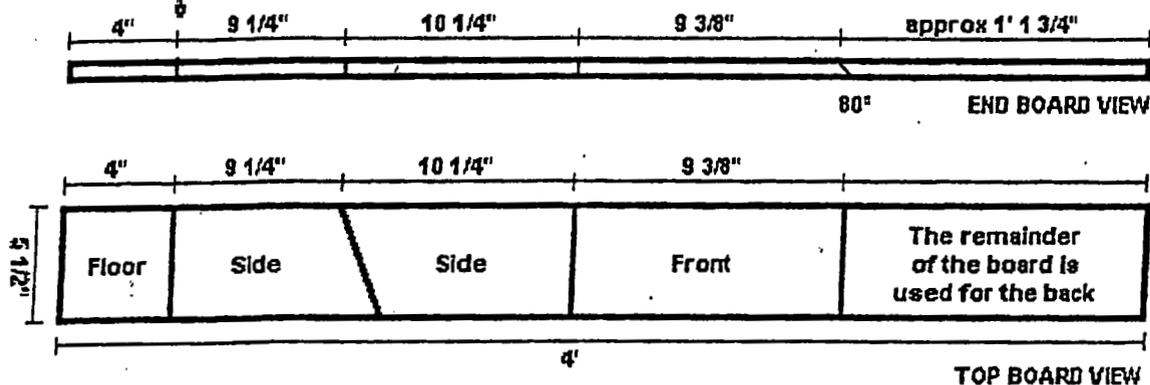
Eastern/Western Bluebird Nest Box Plans -- Part 1

MATERIALS LIST

- Standard Board 1" x 6" x 4' long
- Standard Board 1" x 10" x 10 1/2" long (for roof)
- 1 3/4" galvanized nails or screws -- approx. 20
- 1 3/4" galvanized screw or nail for pivot point -- 2
- Double-headed Nail for holding door closed -- 1

BOARD DIAGRAM

Start cutting at the "floor" and work towards the "back" since the "back" dimension is the least critical

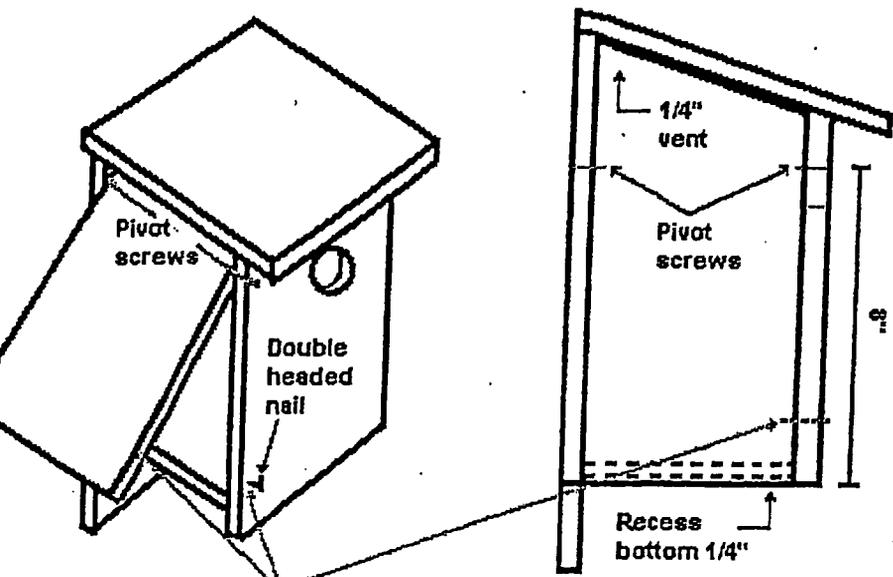
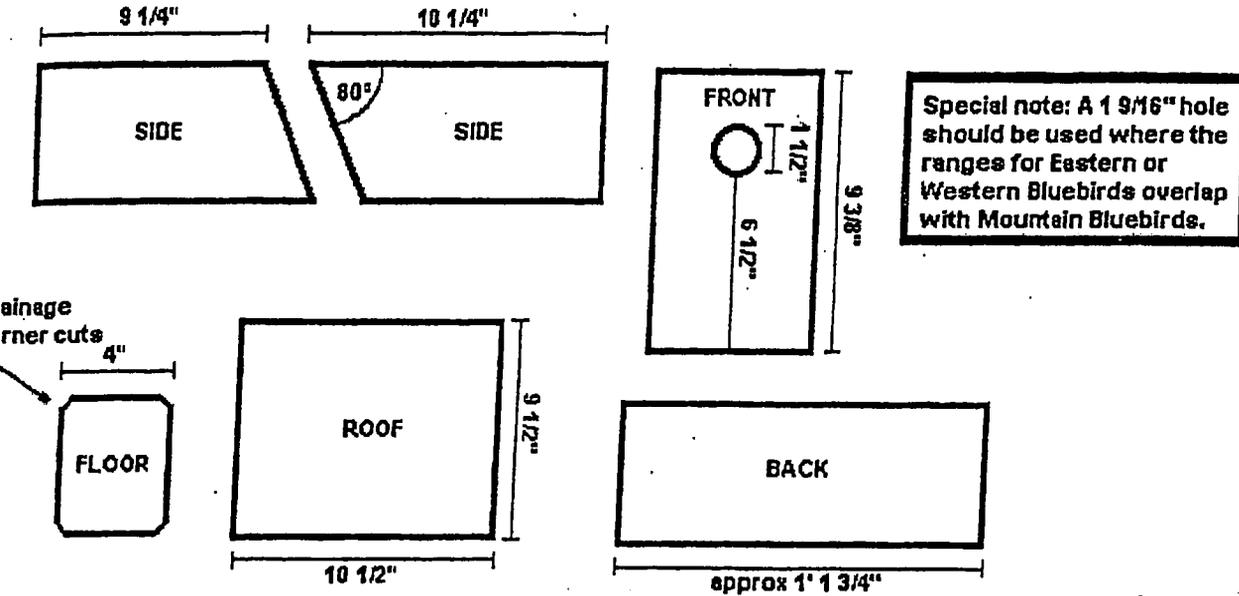


[Back | Go to Construction Plans](#)

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Eastern/Western Bluebird Nest Box Plans -- part 2

CONSTRUCTION PLAN



Drill hole through "front" and side of door to hold door closed with nail

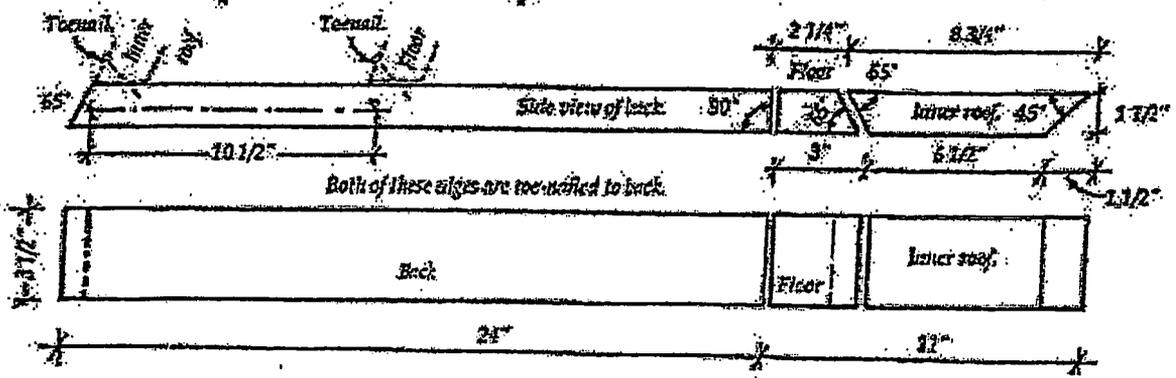
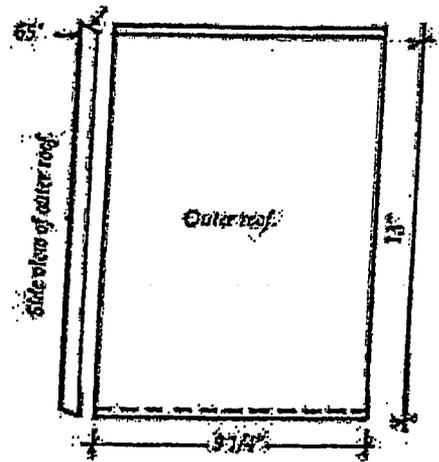
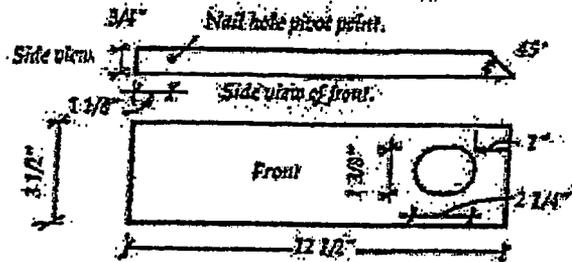
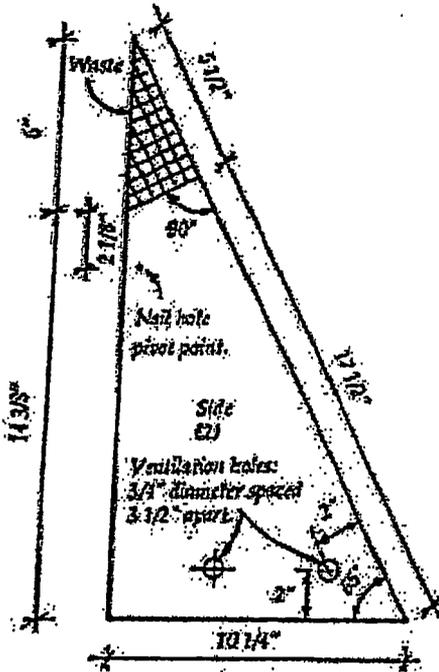
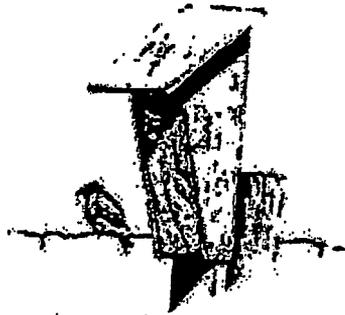
Go to Plans for Optional Oval Hole

PETERSON BLUEBIRD HOUSE

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Woodworking for Wildlife

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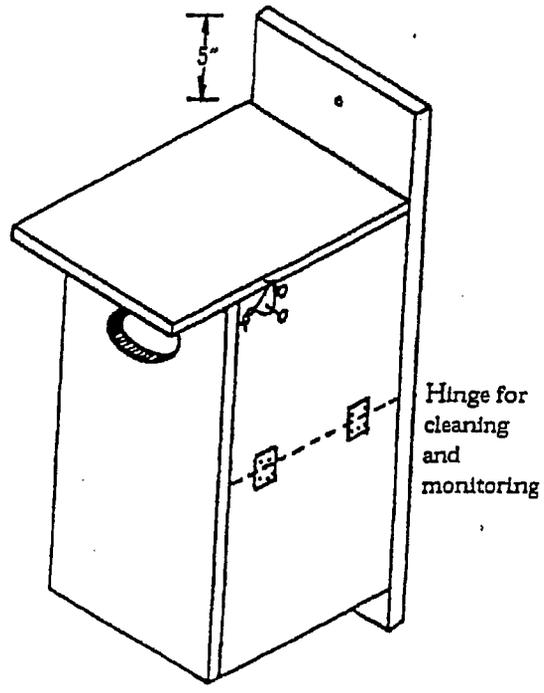
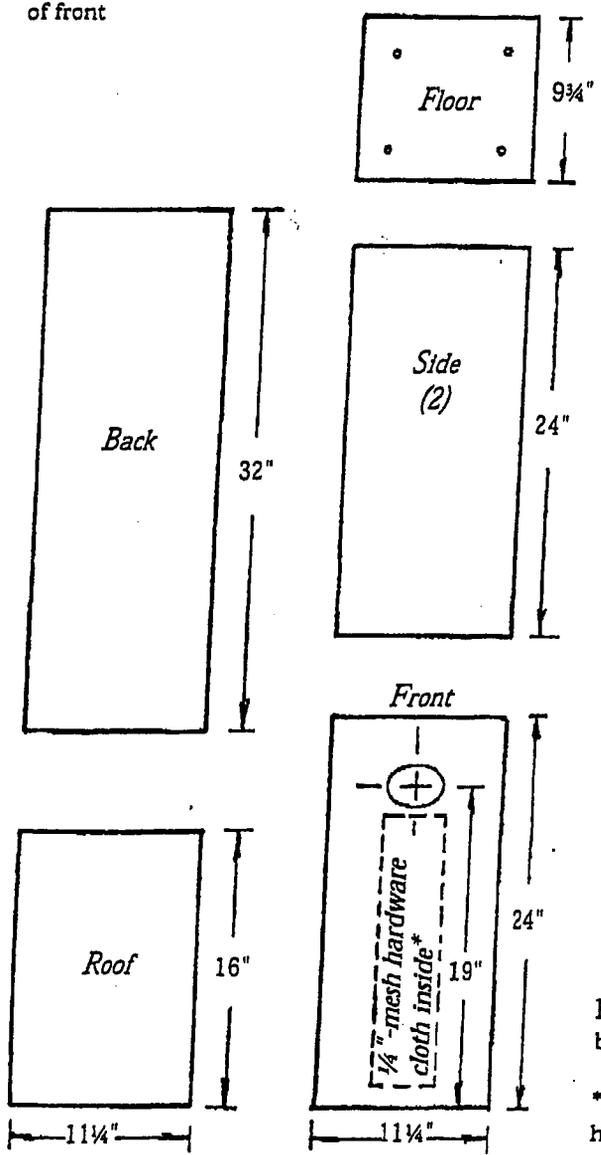


BACK

A Nest-Box Plan for Common and Hooded Mergansers, Wood Ducks, and American Kestrels

Entrance Holes

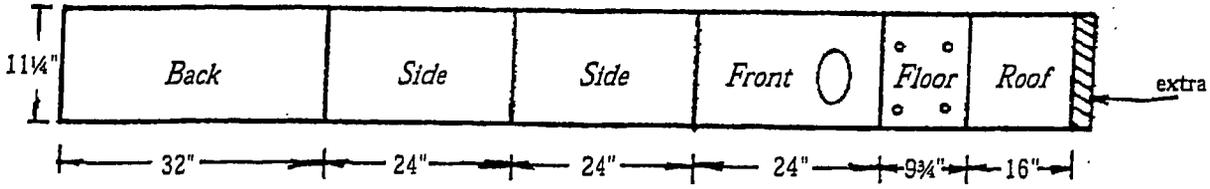
Common Merganser—minimum 5" diameter round
 Wood Duck and Hooded Merganser—3"-high by 4"-wide oval
 American Kestrel—3" diameter round, 4 1/2" down from top edge of front



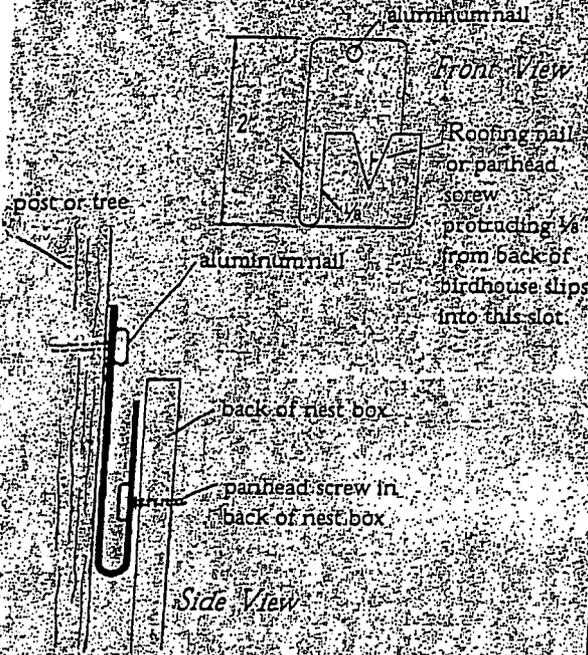
Place 3 to 4 inches of wood shavings in bottom of box.

*Ducklings need a "ladder" to provide toe-holds so they can climb out of nest box.

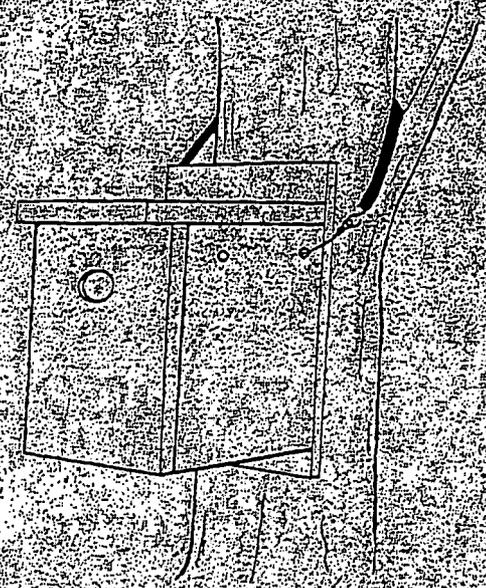
Lumber: One 1" x 12' x 12' 0"



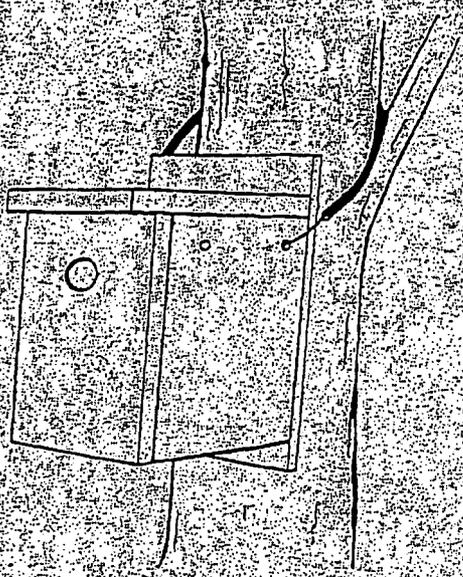
Four Ways to Hang Next Boxes



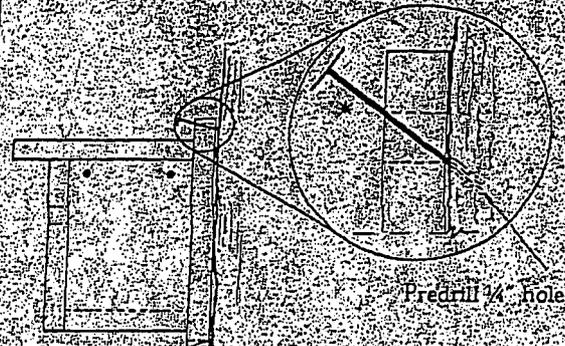
Metal clip—This clip, made from rust-proofed heavy-gauge metal, allows easy removal of boxes from posts or trees. This makes for easier cleaning and winter storage.



Bungee cord—After pulling galvanized wire through vent holes, attach bungee cords. Stretch cord around tree, over limb, as illustrated.



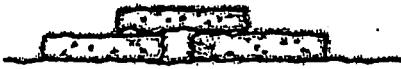
Wire through hose—Galvanized wire through vent holes, attach rubber-coated wire (or hose with wire run through it) and loosely drape over limb as illustrated.



Aluminum nails—Drill 1/4" holes into top and bottom of the back-board of the box. Aluminum nails are driven in at an angle, as illustrated. As the tree grows the box is forced to slide along the flexing nail.

FOX DEN STRUCTURE

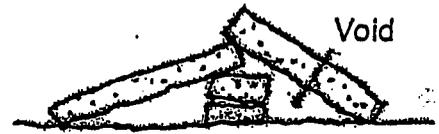
CROSS SECTIONS



Tunnel structure

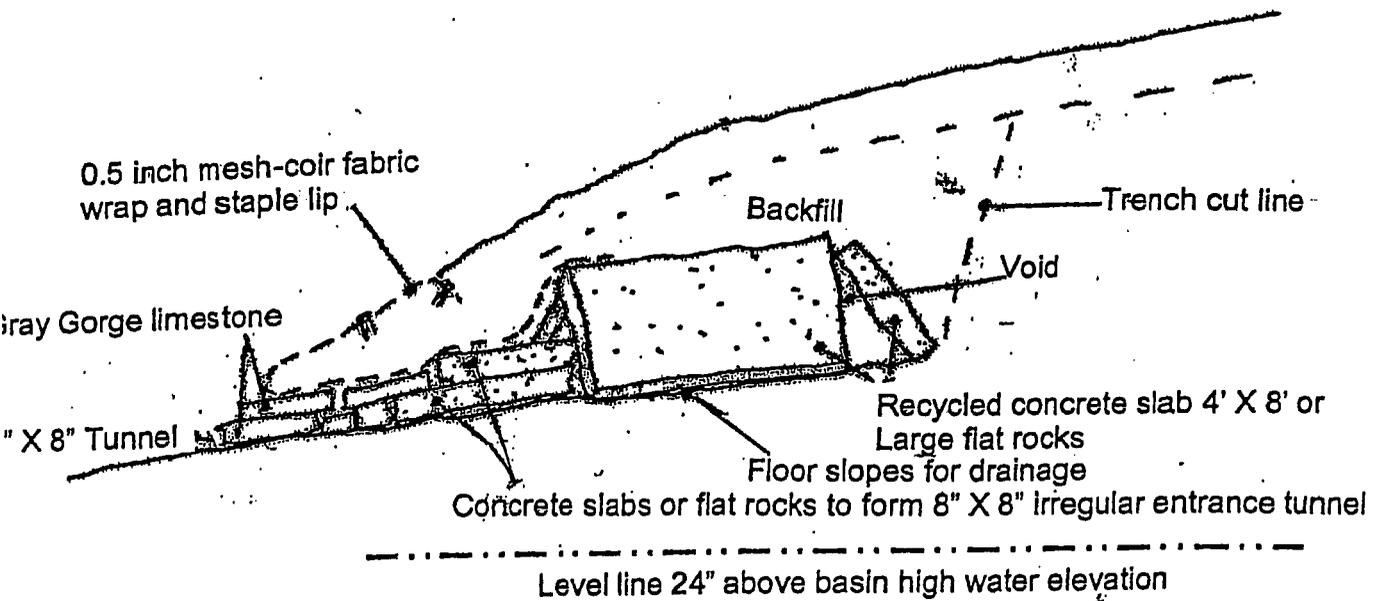


Visible entrance



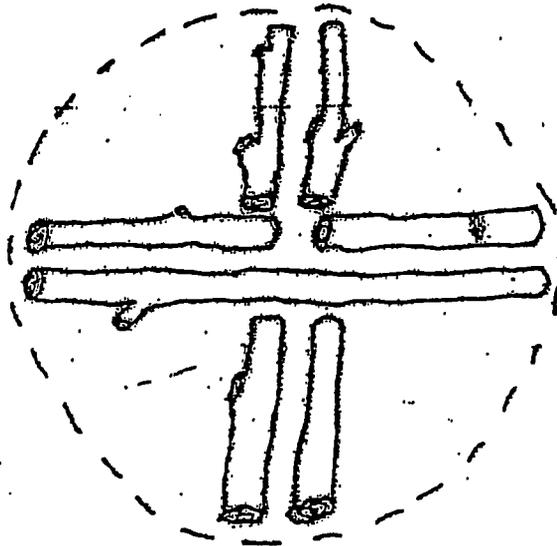
Den support structure

SIDE VIEW



BRUSH PILE

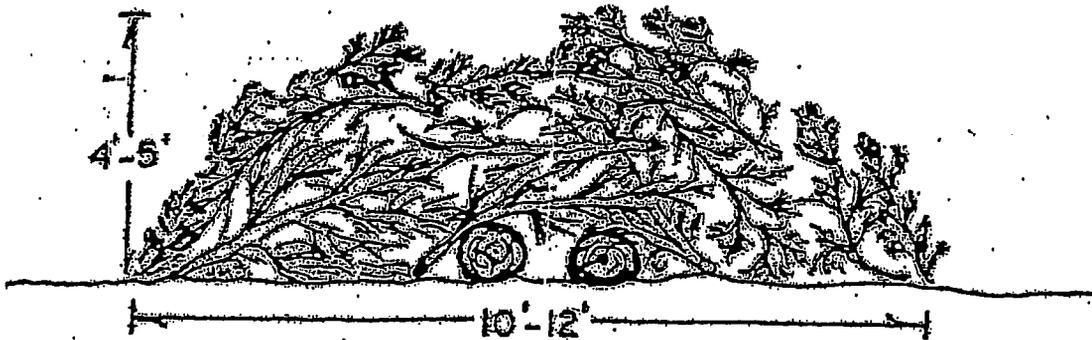
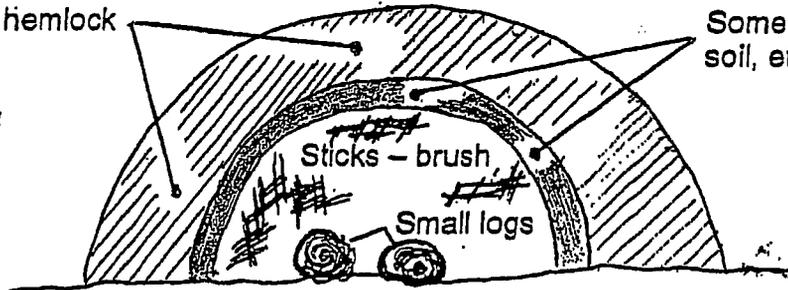
PLAN VIEW.



Log pattern

Evergreen branches
Pine, juniper, hemlock

Some straw, burlap,
soil, etc.



POST INSTALLATION DETAIL

