

7124

**WASTE PITS AREA AND PADDYS RUN
NATURAL RESOURCE RESTORATION DESIGN PLAN**

**FERNALD CLOSURE PROJECT
FERNALD, OHIO**



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U.S. DEPARTMENT OF ENERGY

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ACRONYM LIST

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	Department of Energy
FCP	Fernald Closure Project
NRRP	Natural Resource Restoration Plan
NRRDP	Natural Resource Restoration Design Plan

1.0 INTRODUCTION

Ecological restoration activities at the Fernald Closure Project (FCP) are required per the requirements of the Natural Resource Restoration Plan (NRRP) (DOE 2002) and 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 both the Waste Pits Area and Paddys Run.

The Waste Pits Area and Paddys Run NRRDP is consistent with the sitewide ecological restoration goals set forth in the NRRP (DOE 2002). Restoration goals include the establishment of additional wetlands and ponds, expansion of the Paddys Run floodplain and the establishment of pre-settlement native communities and wildlife habitat.

The Waste Pits Area project boundaries are shown on Sheet G-1 of the attached construction drawings. The Waste Pits Area project encompasses approximately 39 acres of the Waste Pits Area and additional acreage in Paddys Run. Restoration of the Waste Pits Area will focus on the enhancement and creation of wetlands and open water habitats. Approximately 5 acres along Paddys Run will be planted with trees and shrubs. Surrounding areas will be seeded as prairie, which will be contiguous with the prairies established in the Former Production Area.

The Paddys Run restoration project boundary is shown on Sheets G-1 through G-4. The project will focus on the expansion of the floodplain in two areas of Paddys Run. One is immediately west of the Waste Pits Area, east of the current Paddys Run channel. The second area is on the west side of Paddys Run just south of the silos. The expanded floodplain adjacent to the Waste Pits Area will also serve as a collection point for outfall from the Waste Pits Area wetland and open water system, which will also assist in maintaining the wetlands created with the expanded floodplain. In both cases, the floodplain expansion involves the removal of man-made berms and opening the historic Paddys Run channel to floodwater from the current stream channel.

Gradient control structures will also be installed in the Paddys Run channel to reduce the rate of down-cutting in the stream bed. These structures will be installed at three strategic locations. Two cross-vane structures will be installed, immediately down stream of floodplain expansion areas (including the Southern Waste Units completed in 2002) (Sheets G-2, G-3 and G-4). Also, A Newbury Riffle Structure will be constructed west of the Silos Restoration Area. The gradient control structures, in concert with expanded floodplains, should increase the stability and stream quality of Paddys Run at the FCP.

2.0 SITE DESCRIPTION

2.1 WASTE PITS AREA SITE DESCRIPTION

The Waste Pits Area project encompasses approximately 39 acres immediately northwest of the former production area. Remediation of the Waste Pits Area included excavating, drying, loading and transporting the contents of the waste pits to an off-site disposal facility. All waste has been removed from the pits, but soil remediation is still on going. As remedial activities are being completed, certification (i.e., precertification scanning) of the area is beginning concurrently.

Sheet G-2 shows the overall restoration grading plan for this area. The restoration grading will make use of the deep and shallow depressions that remain after remedial excavation is completed. Eleven basins will remain in all.

2.2 PADDYS RUN SITE DESCRIPTION

Paddys Run is located in the western portion of the site. It is a north to south flowing, intermittent stream, losing flow to the underlying sand and gravel aquifer just south of the Waste Pits Area. Paddys Run empties into the Great Miami River approximately 1.5 miles south of the site.

There is a wooded riparian corridor that exists along most of Paddys Run. The corridor has recently been enhanced through various other restoration projects at the FCP. Historically, former pasture areas have extended to the stream bank of Paddys Run in select areas. Restoration work west of Paddys Run has resulted in the installation of new trees and shrubs to expand the wooded corridor along the stream.

Portions of the Paddys Run channel were excavated (channelized) and man-made berms were constructed to prevent erosion along the Waste Pits Area and Paddys Run Road. The creation of these berms, altering the flow of Paddys Run, contributed to increased down-cutting of the stream channel. A goal of this restoration project is to slow down the down-cutting and create a more stable stream bed, while expanding the floodplain both east and west of the current stream channel.

3.0 COMPONENTS OF RESTORATION

Restoration components for both the Waste Pits Area and Paddys Run are illustrated on Sheets G-1 through Sheet G-7. A brief description of the components of restoration for each area is provided below.

3.1 WASTE PITS AREA COMPONENTS

3.1.1 Creation Of Wetland/Open Water Habitats

A key component of the Waste Pits Area Restoration Project will be the use of various depressions left after excavation to create new wetland and open water habitat. A similar approach is currently being implemented in the Former Production Area at the FCP. Multiple basins remain from remedial actions in the Waste Pits Area (Sheet G-2). These will be converted into an interconnected series of open water and wetland areas. Several spillways will direct surface water from east to west toward Paddys Run.

3.1.2 Expansion Of Riparian Corridor Along Paddys Run

Six planting areas will be established around the Waste Pits Area to expand the wooded corridor along Paddys Run (Sheet G-5). Installation of trees and shrubs will help to stabilize areas along Paddys Run disturbed during remediation. Planting will also add new habitat and diversity to help expand and enhance created wetlands and the existing riparian corridor.

3.1.3 Establishing Prairies

Additional prairie areas will be established by seeding with native prairie grasses and forbs around wetlands and open water areas in the Waste Pits Area. These prairie areas will be contiguous with the prairies being established in the Former Production Area.

3.1.4 The Installation Of Wildlife Amenities

Wildlife amenities will be installed throughout the Waste Pits Area Project to promote wildlife use of the area. The installation of wildlife amenities in other restoration projects at the FCP has proven very successful in encouraging wildlife to become established in the restored areas.

3.2 PADDYS RUN COMPONENTS

3.2.1 Floodplain Expansion

The berm that separates the former Paddys Run channel, east of the current channel and west of the Waste Pits Area, will be graded in two places to allow flooding to occur outside the current Paddys Run channel adjacent to the Waste Pits Area (Sheet G-2). Additional floodplain will create unique habitat along Paddys Run and serve to slow stream velocities reducing erosion and down-cutting in the stream bed. The same thing will be done on the west side of Paddys Run just south of the silos, creating additional floodplain there, too.

3.2.2 Installation Of Gradient Control Structures

Gradient control structures will be installed at three locations within the Paddys Run channel to further aid in reducing the rate of down-cutting in the stream bed (Sheet G-2). The gradient control structures will be installed downstream of the three floodplain expansion areas (including the Southern Waste Units completed in 2002) in an effort to maintain the effectiveness of the floodplain expansion projects.

4.0 FIELD IMPLEMENTATION FOR WASTE PITS AREA

This section describes the activities that will be undertaken to implement the ecological restoration components discussed in Section 3.0. Restoration activities in the Waste Pits Area will focus on the establishment of open water and wetland areas and expansion of the riparian corridor. 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 Fernald Building Trades 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 (Traveler). The Traveler 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. In addition, Project Management will ensure that the requirements of the Soil and Disposal Facility Project (SDFP) Integrated Health and Safety Plan (20100-HS-0002, Rev. 1) are met. 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. Most of the project area has 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. Entry into the project area will be controlled through the constructed access point. All personnel and equipment entering the Waste Pits Area 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. The project area will have additional requirements for entry if 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.

Material and plant stock staging areas will be established in the project area. Staging areas will usually be located in the field, on level, accessible ground. The staging area will be fenced in order to protect plants from deer browsing. All plants will be healed in with mulch to prevent the roots from drying out and to protect them from the cold.

4.2 GRADING ACTIVITIES

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 activities will involve two phases. For the first phase, restoration grading will be completed according to the specifications on Sheet G-2. The grading plan uses the topography that resulted from the remediation excavation as a guide to creating open water areas and wetlands. The slopes of the basins will be graded to approximately 5:1 or 6:1 slopes, where possible. Due to the limited "footprint" of the Waste Pits Area, some slopes may need to be graded to a 3:1 slope. No slope will be greater than 3:1.

For the second phase, soil amendments will be added to soil as needed. Soil amendment prior to planting will be completed as necessary in the Waste Pits Area (Sheet G-6). After ripping the soil approximately 18 inches deep compost will be spread on the berms between the basins and on the slopes of the basins and tilled into the existing soil. Mature compost will be spread approximately 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 be used to incorporate the compost into the top eight inches of existing soil. This process is consistent with current U.S. EPA guidance (U.S. Composting Council 2004). The areas planned as wetlands will have compost spread over the bottom of the basin, however the compost will not be tilled into the existing soil. This approach will maintain the integrity of the compacted basins. Figures G-1 and G-5 show the locations of the wet areas. Instead, the compost will be spread and tracked/compacted using heavy equipment (e.g., bulldozer), similar to methods used in the Former Production Area. Open water or pond areas will not have compost applied.

4.3 VEGETATION INSTALLATION

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

4.3.1 Woody Vegetation

Planting activities involve the installation of 825 trees and 450 shrubs across the area (Table 4-1). Trees will be planted at a density of approximately 160 per acre. Shrubs will be planted at a density of approximately 90 plants per acre. The trees and shrubs will be installed in the same manner as other ecological restoration projects at the FCP. Six planting areas (patches) will be established in the Waste Pits Area (Sheet G-6 and Appendix A). Each planting patch will be laid out in the field and

TABLE 4-1
PLANT LIST

Planting Area

Species	Common Name	Form	Coefficient of Wetness	Shade Tolerance	Quantity	1	2	3	4	5	6
<i>Acer nigrum</i>	Black Maple	canopy	0	low	23	13	7	3			
<i>Acer rubrum</i>	Red Maple	canopy	0	high	63	23	15	15			10
<i>Acer saccharinum</i>	Silver Maple	canopy	-3	intermediate	7		3	4			
<i>Acer saccharum</i>	Sugar Maple	canopy	4	high	70	25	20	15			10
<i>Carya cordiformis</i>	Bitternut Hickory	canopy	2	low	9	5	4				
<i>Carya laevis</i>	Shellbark Hickory	canopy	0	high	31	12	7	5			7
<i>Carya ovata</i>	Shagbark Hickory	canopy	4	intermediate	23	15	8				
<i>Celtis occidentalis</i>	Hackberry	canopy	3		2		2				
<i>Fagus grandifolia</i>	Beech	canopy	3	high	110	45	40	15			10
<i>Fraxinus americana</i>	White Ash	canopy	3	low	21	11	7	3			
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	-3	high	90	35	25	15	5	5	5
<i>Juglans nigra</i>	Black Walnut	canopy	3	low	16	8	4	4			
<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	3	low	14	7	5	2			
<i>Platanus occidentalis</i>	Sycamore	canopy	-2	intermediate	38	8	20	10			
<i>Populus deltoides</i>	Cottonwood	canopy	0	low	46	16	25	5			
<i>Prunus serotina</i>	Black Cherry	canopy	3	low	10	5	5				
<i>Quercus alba</i>	White Oak	canopy	4	intermediate	18	9	9				
<i>Quercus bicolor</i>	Swamp White Oak	canopy	-4	intermediate	11		8	3			
<i>Quercus coccolinea</i>	Scarlet Oak	canopy	5	low	3		3				
<i>Quercus inbricaria</i>	Shingle Oak	canopy	0	na	2	2					
<i>Quercus palustris</i>	Pin Oak	canopy	-3	low	30	10	10	10			
<i>Quercus prinus</i>	Chestnut Oak	canopy	5	intermediate	3	3					
<i>Quercus rubra</i>	Northern Red Oak	canopy	4	intermediate	17	14					3
<i>Quercus shumardii</i>	Shumard Oak	canopy	-1	low	7	3	4				
<i>Quercus velutina</i>	Black Oak	canopy	5	intermediate	3	2	1				
<i>Tilia americana</i>	Basswood	canopy	3	high	7	4	3				
<i>Ulmus rubra</i>	Slippery Elm	canopy	0	high	5	2	3				
<i>Aesculus glabra</i>	Ohio Buckeye	understory	2	high	42	20	11	11			
<i>Asimina triloba</i>	Pawpaw	understory	2	high	13	13					
<i>Cercis canadensis</i>	Redbud	understory	4	high	14	9	3	2			
<i>Cornus drummondii</i>	Roughleaf Dogwood	understory	0	intermediate	11	6	2	3			
<i>Cornus florida</i>	Flowering Dogwood	understory	4	high	11	9		2			
<i>Cornus racemosa</i>	Gray Dogwood	understory	1	high	49	15	15	9	5	5	
<i>Euonymus atropurpureus</i>	Eastern Wahoo	understory	3	na	6	3	3				
<i>Celastrus scandens</i>	Bittersweet	shrub	4	high	18	9	6	3			
<i>Cornus alternifolia</i>	Alternate-leaf dogwood	shrub	5	high	2	2					
<i>Corylus americana</i>	Hazelnut	shrub	4	intermediate	9	5	4				
<i>Crataegus mollis</i>	Downy Hawthorne	shrub	3	na	2	2					
<i>Hamamelis virginiana</i>	Witch Hazel	shrub	1	intermediate	12	7	3	2			
<i>Ilex verticillata</i>	Winterberry	shrub	-4	intermediate	7		7				
<i>Lindera benzoin</i>	Spicebush	shrub	-2	intermediate	27	17	5	5			
<i>Ostrya virginiana</i>	Hop-Hornbeam	shrub	4	high	2	2					
<i>Physocarpus opulifolius</i>	Ninebark	shrub	-2	low	74	30	16	5	11	12	
<i>Rhus aromatica</i>	Fragrant Sumac	shrub	5	na	16				5		11
<i>Rhus glabra</i>	Smooth Sumac	shrub	5	low	17				5	5	7
<i>Rosa carolina</i>	Carolina Rose	shrub	5	na	21	7	4	3	3	4	
<i>Salix humile</i>	Prairie Willow	shrub	3		21	14	7				
<i>Sambucus canadensis</i>	Elderberry	shrub	-2	low	17		5		7	5	
<i>Staphylea trifolia</i>	Bladdernut	shrub	0	na	79	30	15	9	5	5	15
<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	5	intermediate	20	5	5			5	5
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	5	high	19	5	5		5	4	
<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	3	na	87	13	25	10	20	19	

Total Saplings = 825 352 272 ## 10 10 45
Total Shrubs = 450 148 107 37 61 59 38
Grand Total = 1,275 500 379 ## 71 69 83

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. A total of 2,000 seedlings will also be installed within the Waste Pits Area (Table 4-2).

All plant material will be procured from local sources, if possible. All trees and 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 form and shade tolerance of the tree as listed in Table 4-1 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). The seed mixes are shown on Table 4-3. The mesic seed mix will be used on all upland areas. The wet seed mix will be used around all open water areas and within wetlands and spillways. A seed drill will be used where possible. Areas inaccessible to the seed drill will be seeded by hand using the broadcast method or seeded with seed paper (biodegradable paper-like product with seed embedded).

If erosion control matting and/or coir logs are required, installation will take place immediately following seeding pursuant to the specifications in Appendix C. The need for matting on additional slopes and swales will be determined in the field by the restoration ecologist.

4.3.3 Herbaceous Vegetation

Donor vegetation will be imported into the wetland areas from other FCP wetland 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 macro invertebrates.

**TABLE 4-2
 SEEDLING LIST**

Species	Common Name	Quantity	Planting Area					
			1	2	3	4	5	6
<i>Acer rubrum</i>	Red Maple	160	25	35	25	25	25	25
<i>Acer saccharinum</i>	Silver Maple	48	24	12	12			
<i>Acer saccharum</i>	Sugar Maple	280	100	100	40			40
<i>Aesculus glabra</i>	Ohio Buckeye	160	40	40	20	20	20	20
<i>Carya cordiformis</i>	Bitternut Hickory	24	24					
<i>Carya laciniosa</i>	Shellbark Hickory	24		24				
<i>Carya ovata</i>	Shagbark Hickory	24	24					
<i>Cercis canadensis</i>	Redbud	96	48	24	24			
<i>Fagus grandifolia</i>	Beech	312	100	100	56			56
<i>Fraxinus americana</i>	White Ash	216	200	16				
<i>Fraxinus pennsylvanicum</i>	Green Ash	80		20	20	20	20	
<i>Juglans nigra</i>	Black Walnut	72	32	40				
<i>Liriodendron tulipifera</i>	Tulip Poplar	40	20	20				
<i>Prunus serotina</i>	Black Cherry	96	48	24	24			
<i>Quercus alba</i>	White Oak	72	42	30				
<i>Quercus palustris</i>	Pin Oak	80	20	20	20			20
<i>Quercus rubra</i>	Northern Red Oak	72	42	30				
<i>Tilia americana</i>	Basswood	144	72	50	22			
Total Seedlings =		2,000	861	585	263	65	65	161

TABLE 4-3
MASTER SEED LIST

Species	Common Name	Coefficient of Wetness	Mesic	Wet
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 jamesii</i>	grass sedge	5		
<i>Carex normalis</i>	large straw sedge	3		
<i>Carex vulpinoidea</i>	fox sedge	-5		1 oz/ac
<i>Diarrhena americana</i>	beak grass	-1		
<i>Elymus canadensis</i>	Canada wild rye	2	25	25
<i>Elymus hystrix</i>	bottlebrush grass	5		
<i>Elymus riparius</i>	riverbank wild rye	-3		
<i>Elymus virginicus</i>	Virginia wild rye	-2		5
<i>Lolium multiflorum</i>	annual rye	ni		
<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
Forbs (1.5 lb/ac uniform mix unless otherwise noted)				
<i>Anemone virginiana</i>	thimbleweed	ni		
<i>Aquilegia canadensis</i>	eastern columbine	0		
<i>Asclepias incarnata</i>	swamp milkweed	-5		x
<i>Asclepias tuberosa</i>	butterflyweed	5	x	
<i>Aster cordifolius</i>	blue wood aster	ni		
<i>Aster divaricatus</i>	white wood aster	ni		
<i>Aster laevis</i>	smooth aster	5	x	
<i>Aster macrophyllus</i>	bigleaf aster	ni		
<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	
<i>Cassia hebecarpa</i>	wild senna	-3		x
<i>Caulophyllum thalictoides</i>	blue cohosh	ni		
<i>Cimicifuga racemosa</i>	black cohosh	ni		
<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>Eupatorium rugosum</i>	white snakeroot	4		
<i>Geum laciniatum</i>	rough avens	-1		
<i>Helianthus grosseserratus</i>	sawtooth sunflower	ni		
<i>Heliopsis helianthoides</i>	Ox-eye sunflower	5	x	

TABLE 4-3
 (Continued)

Species	Common Name	Coefficient of Wetness	Mesic	Wet
Forbs (1.5 lb/ac uniform mix unless otherwise noted)				
<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	
<i>Smilacina racemosa</i>	false Solomon's seal	4		
<i>Solidago caesia</i>	blue-stemmed goldenrod	3		
<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 (USDA 2004)

ni = no indicator

4.3.4 Wildlife Amenities

Wildlife amenities will be constructed and installed across the area pursuant to the specifications in Appendix D. Amenities will generally be installed following the completion of planting activities. Field personnel will take care not to compromise wetland basins when installing posts for wood duck boxes. The wildlife amenities included for the Waste Pits Area include the following:

- Six (6) duck boxes
- One (1) fox den
- Five (5) bat structures (for Indiana Bat)
- One (1) raptor platform
- Three (3) woodpecker boxes

4.4 MAINTENANCE ACTIVITIES

Maintenance is critical to restoration success. Activities that will be required 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 (or longer if excessive dry or drought conditions exist). 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 timing 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. If seeding activities are required outside of the seeding window, steps will be taken to water seeded areas on a regular basis (i.e., approximately 1 inch of water per week).

4.4.2 Deer Control

Installed trees and 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 shows 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

exclosure fencing around a significant portion, if not all woody plant material. In some cases, the deer exclosure fencing may be installed around an area prior to planting activities. Where required, individual trees and shrubs will be fenced.

4.4.3 Invasive Species

Due to the heavy disturbance of the area, invasive species within the area will be primarily limited to seeded areas. Where possible, prescribed burning is the preferred method of invasive species 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 and/or selective herbicides will be used to control invasive species. 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 invasive species. The application of selective herbicides is another form of invasive species control that may be implemented if mowing is not providing enough control or to supplement mowing.

5.0 FIELD IMPLEMENTATION FOR PADDYS RUN

This section describes the activities that will be undertaken to implement the ecological restoration components discussed in Section 3.0 related to Paddys Run. Restoration activities in Paddys Run will focus on expansion of the floodplain and reducing the rate of incisement in the stream. There are four main phases of implementation; site prep, grading activities, seeding and erosion control, and maintenance activities. Each of these phases is discussed in more detail below.

Field work will be conducted by Fernald Building Trades personnel. All activities will be undertaken in accordance with Module 1 and 2 of the Soils Excavation and On-site Disposal Facility Construction Work Activities Traveler (Traveler). The Traveler 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. In addition, Project Management will ensure that the requirements of the Soil and Disposal Facility Project (SDFP) Integrated Health and Safety Plan (20100-HS-0002, Rev. 1) are met. The project restoration ecologist and Restoration Construction Manager will provide technical direction and oversight of field personnel.

5.1 SITE PREP

Site prep involves activities necessary for grading for expansion of the floodplain and installation of gradient control structures. Three structures are being installed at various locations; therefore, there will be several individual construction areas set up along Paddys Run. Access points need to be established for each area. This may involve the clearing of minor brush and vegetation and setting up staging areas for materials and supplies. Entry to Paddys Run will be through existing access points in certified areas when possible. Any disturbance of the stream bank will be stabilized and re-vegetated using bioengineering practices consistent with those employed in the past at the FCP. All personnel entering the Paddys Run project areas must comply with EP-0008, Access to and Management of a Certified Area (CA). This procedure requires that any equipment entering a certified area be cleaned of potentially uncertified dirt prior to entry.

The project areas will have additional requirements for entry if the access points are only accessible through a radiologically controlled area. Field personnel will work closely with Radiological Control to ensure that all controlled access requirements are met.

5.2 GRADING ACTIVITIES

Grading activities will 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. This will occur only in the portion of Paddys Run adjacent to the Waste Pits Area. 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.

5.2.1 Expansion of Floodplain

Grading activities will be conducted at two locations adjacent to the Waste Pits Area (on the west side of Paddys Run) to remove portions of an existing berm that separates the Paddys Run channel from the Waste Pits Area (Sheet G-2). The berm was installed to channelize the flow of Paddys Run to prevent erosion of the Waste Pits Area. Currently, the berm is high enough to prevent water flow into the former stream channel during periods of high water or flash flooding. Sections of the berm will be removed to allow water flow into the former stream channel between Paddys Run and the Waste Pits Area at a one to two-year flood interval or higher to create expanded floodplain. The inlet elevations used are based on previous models conducted for the Operable Unit 2 Remedial Investigation (Parsons 1993). The elevations have proven successful in the Southern Waste Units, which has flooded about once a year since the berm was opened there in 2003.

In addition to the grading of the sections of berm to allow water flow into the floodplain area, there will be spillways constructed from the Waste Pits Area Project (from one pond and one wetland) that will also provide water to this expanded floodplain. The area targeted for floodplain expansion west of the Waste Pits Area was a delineated wetland (DOE 2002). Restoration work in the expanded floodplain area (i.e., grading, seeding) will restore wetland function to this area.

Another berm on the west side of the Paddys Run channel and south of the silos will also be graded to allow water to flow into a low area (former channel), creating an additional floodplain on the west side of Paddys Run (Sheet G-3). This berm was also installed to channelize Paddys Run and prevent erosion of Paddys Run Road. The removal of the section of berm will allow water to enter the historic stream channel of Paddys Run at the one to two-year flood interval.

5.2.2 Gradient Control Structures

Three gradient control structures will be installed within Paddys Run, from the Waste Pits (to the north) to Willey Rd (to the south), to aid in the reduction of the rate of incisement of the stream bed. Two designs will be used: Cross-vane and Newbury Riffle. Sheets G-1 through G-4 show their locations:

- Structure #1 – Waste Pits Area (cross-vane)
- Structure #2 – Silos (Newbury Riffle)
- Structure #3 – Southern Waste Units (cross-vane)

Grading activities to support their construction and installation will be required. The function and design of the cross-vane structures are described by Rosgen (2003) and detailed on Sheet G-7. The Newbury Riffle Design is also provided on Sheet G-7. The three structures will be installed down stream or upstream of expanded floodplain areas to ensure a stable streambed.

5.2.3 Soil Amendment

Soil amendment in the expanded floodplain and wetland adjacent to the Waste Pits Area will be completed as necessary. If topsoil is not available in the project area, compost will be applied to the surface of the floodplain/wetland area at an appropriate depth of four inches across the area. The compost will not be tilled into the soil, but instead will be tracked using heavy equipment (bulldozer).

5.3 SEEDING AND EROSION CONTROL

The expanded floodplain adjacent to the Waste Pits Area will be seeded pursuant to the seeding specification (Appendix C). A wet seed mix will be used and is included in Table 4-3. A seed drill will be used where possible. Areas inaccessible to the seed drill will be seeded by hand using the broadcast method.

If erosion matting and/or coir logs are required, installation will take place immediately following seeding pursuant to the specifications in Appendix C. The need for matting on additional slopes and swales will be determined in the field by the restoration ecologist.

Any disturbance along the banks of Paddys Run due to construction and/or access will be repaired as soon as practicable after the disturbance using bioengineering techniques employed throughout the site.

5.4 MAINTENANCE ACTIVITIES

5.4.1 Watering

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.

Pursuant to the attached specification (Appendix B), field personnel will ensure that seeded areas receive an adequate amount of water each week, for the first six weeks after planting (or longer if excessive dry or drought conditions exist). Watering will be carried out either directly via hose 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.

5.4.2 Construction Maintenance

The gradient control structures will be inspected following their installation to ensure they are holding their construction. In the event that they are not maintaining their construction, maintenance or repair work may be required.

6.0 MONITORING

Implementation monitoring parameters for restoration will consist of plant survival and herbaceous cover. Mortality counts will be conducted for all areas at the end of the first growing season in late summer 2006 to ensure 80% survival is maintained. For Implementation Monitoring of seeded areas herbaceous cover will be evaluated pursuant to the process and criteria set forth in the 2002 Consolidated Monitoring Report (DOE 2003) to ensure 90% vegetative cover is being maintained in seeded areas. Implementation monitoring will be carried out in 2006 (end of the first growing season) by the DOE Office of Legacy Management.

Functional monitoring of restored wetlands and prairies will be carried out pursuant to the schedule being developed by DOE and the Ohio Environmental Protection Agency as part of the Natural Resource Damages Settlement at Fernald. Visual inspections of the gradient control structures will occur on a quarterly basis after installation until physical completion to ensure the structures are functioning as designed. After closure, the structures will be inspected annually and maintained as needed by the DOE Office of Legacy Management.

REFERENCES

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- U.S. Composting Council, 2004, "Compost Use on State Highway Applications," available online at <http://www.epa.gov/compost/highway/index.htm>.
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APPENDIX A
WASTE PITS AREA PATCH PAGES

WP-1

Size:	2.4 acres
Flag/tag color	

	Planned	Installed
Saplings	404	
Shrubs	262	

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Acer nigrum</i>	Black Maple	canopy	4-ft. min.	13			
<i>Acer rubrum</i>	Red Maple	canopy	4-ft. min.	33			
<i>Acer saccharum</i>	Sugar Maple	canopy	4-ft. min.	35			
<i>Carya cordiformis</i>	Bitternut Hickory	canopy	4-ft. min.	5			
<i>Carya laciniosa</i>	Shellbark Hickory	canopy	4-ft. min.	16			
<i>Carya ovata</i>	Shagbark Hickory	canopy	4-ft. min.	15			
<i>Fagus grandifolia</i>	Beech	canopy	4-ft. min.	55			
<i>Fraxinus americana</i>	White Ash	canopy	4-ft. min.	11			
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	4-ft. min.	45			
<i>Juglans nigra</i>	Black Walnut	canopy	4-ft. min.	8			
<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	4-ft. min.	7			
<i>Platanus occidentalis</i>	Sycamore	canopy	4-ft. min.	8			
<i>Populus deltoides</i>	Cottonwood	canopy	4-ft. min.	16			
<i>Prunus serotina</i>	Black Cherry	canopy	4-ft. min.	5			
<i>Quercus alba</i>	White Oak	canopy	4-ft. min.	9			
<i>Quercus inbricaria</i>	Shingle Oak	canopy	4-ft. min.	2			
<i>Quercus palustris</i>	Pin Oak	canopy	4-ft. min.	10			
<i>Quercus prinus</i>	Chestnut Oak	canopy	4-ft. min.	3			
<i>Quercus rubra</i>	Northern Red Oak	canopy	4-ft. min.	17			
<i>Quercus shumardii</i>	Shumard Oak	canopy	4-ft. min.	3			
<i>Quercus velutina</i>	Black Oak	canopy	4-ft. min.	2			
<i>Tilia americana</i>	Basswood	canopy	4-ft. min.	4			
<i>Ulmus rubra</i>	Slippery Elm	canopy	4-ft. min.	2			
<i>Aesculus glabra</i>	Ohio Buckeye	understory	4-ft. min.	20			
<i>Asimina triloba</i>	Pawpaw	understory	4-ft. min.	13			
<i>Cercis canadensis</i>	Redbud	understory	4-ft. min.	9			
<i>Cornus drummondii</i>	Roughleaf Dogwood	understory	4-ft. min.	6			
<i>Cornus florida</i>	Flowering Dogwood	understory	4-ft. min.	9			

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Cornus racemosa</i>	Gray Dogwood	understory	4-ft. min.	20			
<i>Euonymus atropurpureus</i>	Eastern Wahoo	understory	4-ft. min.	3			
<i>Celastrus scandens</i>	Bittersweet	shrub	1-ft. min.	9			
<i>Cornus alternifolia</i>	Alternate-leaf dogwood	shrub	1-ft. min.	2			
<i>Corylus americana</i>	Hazelnut	shrub	1-ft. min.	5			
<i>Crataegus mollis</i>	Downy Hawthorne	shrub	1-ft. min.	2			
<i>Hamamelis virginiana</i>	Witch Hazel	shrub	1-ft. min.	7			
<i>Ilex verticillata</i>	Winterberry	shrub	1-ft. min.	0			
<i>Lindera benzoin</i>	Spicebush	shrub	1-ft. min.	17			
<i>Ostrya virginiana</i>	Hop-Hornbeam	shrub	1-ft. min.	2			
<i>Physocarpus opulifolius</i>	Ninebark	shrub	1-ft. min.	44			
<i>Rhus aromatica</i>	Fragrant Sumac	shrub	1-ft. min.	11			
<i>Rhus glabra</i>	Smooth Sumac	shrub	1-ft. min.	11			
<i>Rosa carolina</i>	Carolina Rose	shrub	1-ft. min.	14			
<i>Salix humila</i>	Prairie Willow	shrub	1-ft. min.	14			
<i>Sambucus canadensis</i>	Elderberry	shrub	1-ft. min.	7			
<i>Staphylea trifolia</i>	Bladdernut	shrub	1-ft. min.	50			
<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	1-ft. min.	10			
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	1-ft. min.	10			
<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	1-ft. min.	47			

Notes:

WP-2

Size:	1.3 acres
Flag/tag color	

	Planned	Installed
Saplings	285	
Shrubs	146	

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Acer nigrum</i>	Black Maple	canopy	4-ft. min.	7			
<i>Acer rubrum</i>	Red Maple	canopy	4-ft. min.	15			
<i>Acer saccharinum</i>	Silver Maple	canopy	4-ft. min.	3			
<i>Acer saccharum</i>	Sugar Maple	canopy	4-ft. min.	20			
<i>Carya cordiformis</i>	Bitternut Hickory	canopy	4-ft. min.	4			
<i>Carya laciniosa</i>	Shellbark Hickory	canopy	4-ft. min.	10			
<i>Carya ovata</i>	Shagbark Hickory	canopy	4-ft. min.	8			
<i>Celtis occidentalis</i>	Hackberry	canopy	4-ft. min.	2			
<i>Fagus grandifolia</i>	Beech	canopy	4-ft. min.	40			
<i>Fraxinus americana</i>	White Ash	canopy	4-ft. min.	7			
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	4-ft. min.	30			
<i>Juglans nigra</i>	Black Walnut	canopy	4-ft. min.	4			
<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	4-ft. min.	5			
<i>Platanus occidentalis</i>	Sycamore	canopy	4-ft. min.	20			
<i>Populus deltoides</i>	Cottonwood	canopy	4-ft. min.	25			
<i>Prunus serotina</i>	Black Cherry	canopy	4-ft. min.	5			
<i>Quercus alba</i>	White Oak	canopy	4-ft. min.	9			
<i>Quercus bicolor</i>	Swamp White Oak	canopy	4-ft. min.	8			
<i>Quercus coccinea</i>	Scarlet Oak	canopy	4-ft. min.	3			
<i>Quercus palustris</i>	Pin Oak	canopy	4-ft. min.	10			
<i>Quercus shumardii</i>	Shumard Oak	canopy	4-ft. min.	4			
<i>Quercus velutina</i>	Black Oak	canopy	4-ft. min.	1			
<i>Tilia americana</i>	Basswood	canopy	4-ft. min.	3			
<i>Ulmus rubra</i>	Slippery Elm	canopy	4-ft. min.	3			
<i>Aesculus glabra</i>	Ohio Buckeye	understory	4-ft. min.	11			
<i>Cercis canadensis</i>	Redbud	understory	4-ft. min.	3			
<i>Cornus drummondii</i>	Roughleaf Dogwood	understory	4-ft. min.	2			

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Cornus racemosa</i>	Gray Dogwood	understory	4-ft. min.	20			
<i>Euonymus atropurpureus</i>	Eastern Wahoo	understory	4-ft. min.	3			
<i>Celastrus scandens</i>	Bittersweet	shrub	1-ft. min.	6			
<i>Corylus americana</i>	Hazelnut	shrub	1-ft. min.	4			
<i>Hamamelis virginiana</i>	Witch Hazel	shrub	1-ft. min.	3			
<i>Ilex verticillata</i>	Winterberry	shrub	1-ft. min.	7			
<i>Lindera benzoin</i>	Spicebush	shrub	1-ft. min.	5			
<i>Physocarpus opulifolius</i>	Ninebark	shrub	1-ft. min.	25			
<i>Rhus aromatica</i>	Fragrant Sumac	shrub	1-ft. min.	5			
<i>Rhus glabra</i>	Smooth Sumac	shrub	1-ft. min.	6			
<i>Rosa carolina</i>	Carolina Rose	shrub	1-ft. min.	4			
<i>Salix humila</i>	Prairie Willow	shrub	1-ft. min.	7			
<i>Sambucus canadensis</i>	Elderberry	shrub	1-ft. min.	5			
<i>Staphylea trifolia</i>	Bladdernut	shrub	1-ft. min.	20			
<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	1-ft. min.	10			
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	1-ft. min.	9			
<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	1-ft. min.	30			

Notes:

WP-3

Size:	0.4 acres
Flag/tag color	

	Planned	Installed
Saplings	136	
Shrubs	42	

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Acer nigrum</i>	Black Maple	canopy	4-ft. min.	3			
<i>Acer rubrum</i>	Red Maple	canopy	4-ft. min.	15			
<i>Acer saccharinum</i>	Silver Maple	canopy	4-ft. min.	4			
<i>Acer saccharum</i>	Sugar Maple	canopy	4-ft. min.	15			
<i>Carya laciniosa</i>	Shellbark Hickory	canopy	4-ft. min.	5			
<i>Fagus grandifolia</i>	Beech	canopy	4-ft. min.	15			
<i>Fraxinus americana</i>	White Ash	canopy	4-ft. min.	3			
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	4-ft. min.	15			
<i>Juglans nigra</i>	Black Walnut	canopy	4-ft. min.	4			
<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	4-ft. min.	2			
<i>Platanus occidentalis</i>	Sycamore	canopy	4-ft. min.	10			
<i>Populus deltoides</i>	Cottonwood	canopy	4-ft. min.	5			
<i>Quercus bicolor</i>	Swamp White Oak	canopy	4-ft. min.	3			
<i>Quercus palustris</i>	Pin Oak	canopy	4-ft. min.	10			
<i>Aesculus glabra</i>	Ohio Buckeye	understory	4-ft. min.	11			
<i>Cercis canadensis</i>	Redbud	understory	4-ft. min.	2			
<i>Cornus drummondii</i>	Roughleaf Dogwood	understory	4-ft. min.	3			
<i>Cornus florida</i>	Flowering Dogwood	understory	4-ft. min.	2			
<i>Cornus racemosa</i>	Gray Dogwood	understory	4-ft. min.	9			
<i>Celastrus scandens</i>	Bittersweet	shrub	1-ft. min.	3			
<i>Hamamelis virginiana</i>	Witch Hazel	shrub	1-ft. min.	2			
<i>Lindera benzoin</i>	Spicebush	shrub	1-ft. min.	5			
<i>Physocarpus opulifolius</i>	Ninebark	shrub	1-ft. min.	5			
<i>Rosa carolina</i>	Carolina Rose	shrub	1-ft. min.	3			
<i>Sambucus canadensis</i>	Elderberry	shrub	1-ft. min.	5			
<i>Staphylea trifolia</i>	Bladdernut	shrub	1-ft. min.	9			
<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	1-ft. min.	10			

Notes:

WP-4

Size:	0.2 acres
Flag/tag color	

	Planned	Installed
Saplings	10	
Shrubs	61	

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	4-ft. min.	5			
<i>Cornus racemosa</i>	Gray Dogwood	understory	4-ft. min.	5			
<i>Physocarpus opulifolius</i>	Ninebark	shrub	1-ft. min.	11			
<i>Rhus aromatica</i>	Fragrant Sumac	shrub	1-ft. min.	5			
<i>Rhus glabra</i>	Smooth Sumac	shrub	1-ft. min.	5			
<i>Rosa carolina</i>	Carolina Rose	shrub	1-ft. min.	3			
<i>Sambucus canadensis</i>	Elderberry	shrub	1-ft. min.	7			
<i>Staphylea trifolia</i>	Bladdernut	shrub	1-ft. min.	5			
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	1-ft. min.	5			
<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	1-ft. min.	20			

Notes:

WP-5

Size:	0.2 acres
Flag/tag color	

	Planned	Installed
Saplings	10	
Shrubs	59	

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	4-ft. min.	5			
<i>Cornus racemosa</i>	Gray Dogwood	understory	4-ft. min.	5			
<i>Physocarpus opulifolius</i>	Ninebark	shrub	1-ft. min.	12			
<i>Rhus glabra</i>	Smooth Sumac	shrub	1-ft. min.	5			
<i>Rosa carolina</i>	Carolina Rose	shrub	1-ft. min.	4			
<i>Sambucus canadensis</i>	Elderberry	shrub	1-ft. min.	5			
<i>Staphylea trifolia</i>	Bladdernut	shrub	1-ft. min.	5			
<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	1-ft. min.	5			
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	1-ft. min.	4			
<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	1-ft. min.	19			

Notes:

WP-6

Size:	0.2 acres
Flag/tag color	

	Planned	Installed
Saplings	45	
Shrubs	38	

Scientific Name	Common Name	Form	Size	Qty.	Installed	Protected	Mulched
<i>Acer rubrum</i>	Red Maple	canopy	4-ft. min.	10			
<i>Acer saccharum</i>	Sugar Maple	canopy	4-ft. min.	10			
<i>Carya laciniosa</i>	Shellbark Hickory	canopy	4-ft. min.	7			
<i>Fagus grandifolia</i>	Beech	canopy	4-ft. min.	10			
<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	4-ft. min.	5			
<i>Quercus rubra</i>	Northern Red Oak	canopy	4-ft. min.	3			
<i>Rhus aromatica</i>	Fragrant Sumac	shrub	1-ft. min.	11			
<i>Rhus glabra</i>	Smooth Sumac	shrub	1-ft. min.	7			
<i>Staphylea trifolia</i>	Bladdernut	shrub	1-ft. min.	15			
<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	1-ft. min.	5			

Notes:

APPENDIX B
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.

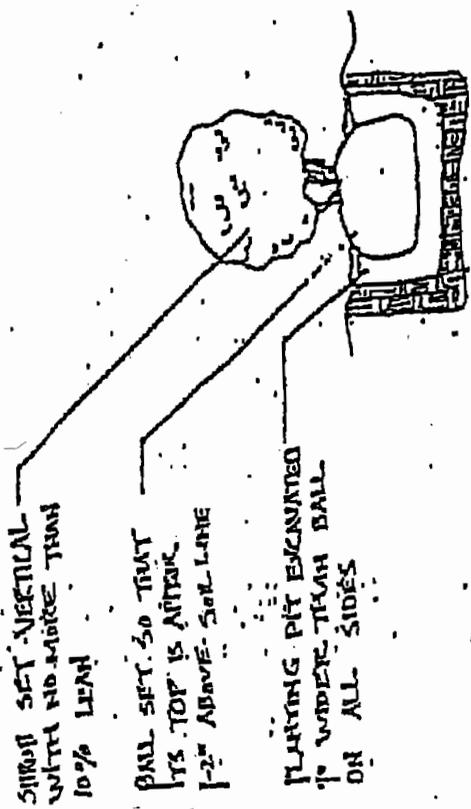
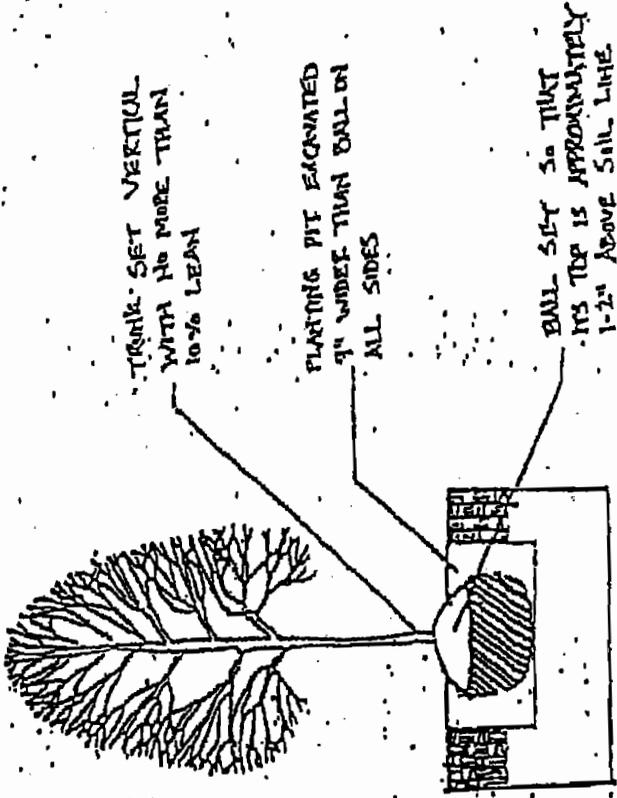
3.7 WATERING

- 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.

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



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

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

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.

"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 Table 02930-1A, Table 02930-1B, 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.

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.

Woven coir erosion mat shall meet the following criteria:

coconut fiber content: 100%

weight: 22 ounces per square yard

thickness: 0.3 inches

open area: 38%

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 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.

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.

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 Table 02930-1A, Table 02930-1B, and Table 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 Table 02930-1A, Table 02930-1B, and Table 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 Table 02930-1A, Table 02930-1B, and Table 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.

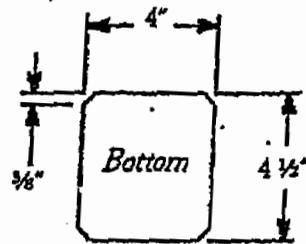
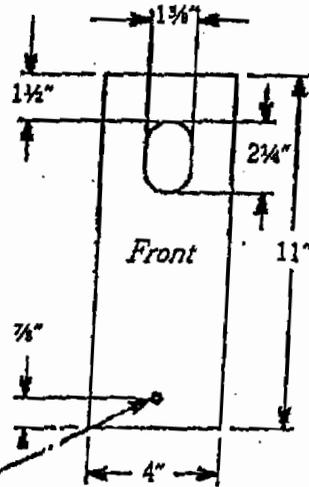
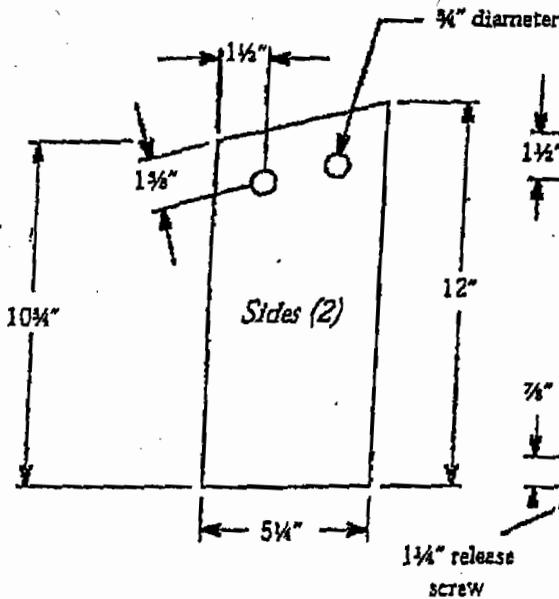
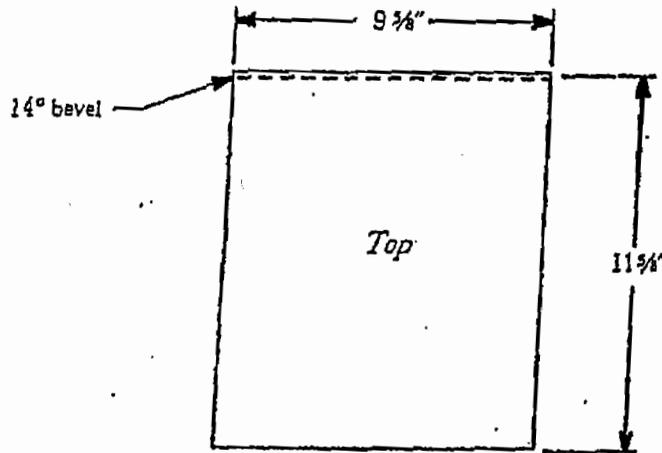
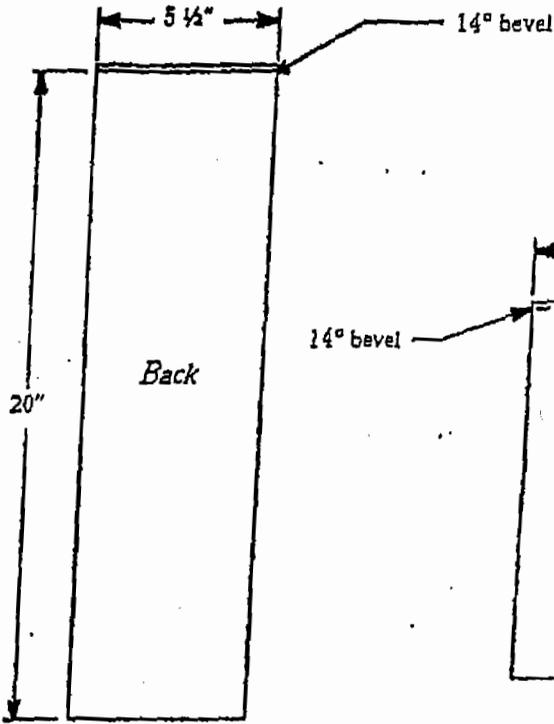
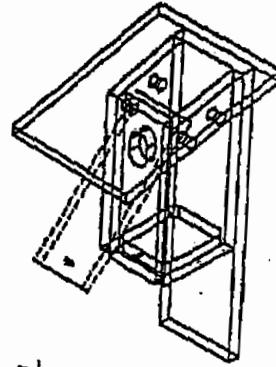
3.5 MAINTENANCE

- 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.

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.

Reprinted with permission from the New York State Bluebird Society (Herm Bressler modified nest box)

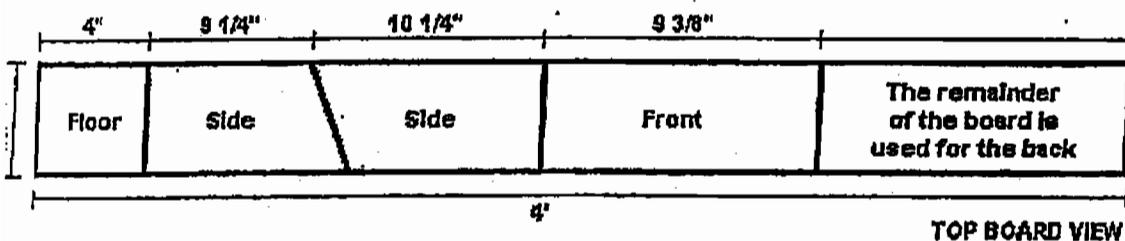
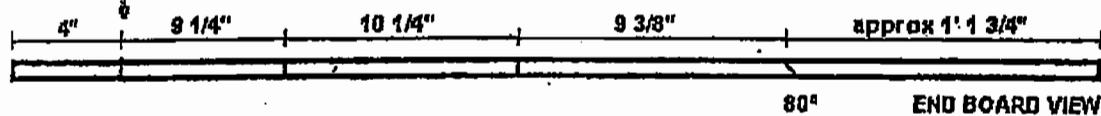
Eastern/Western Bluebird Nest Box Plans -- Part 1

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

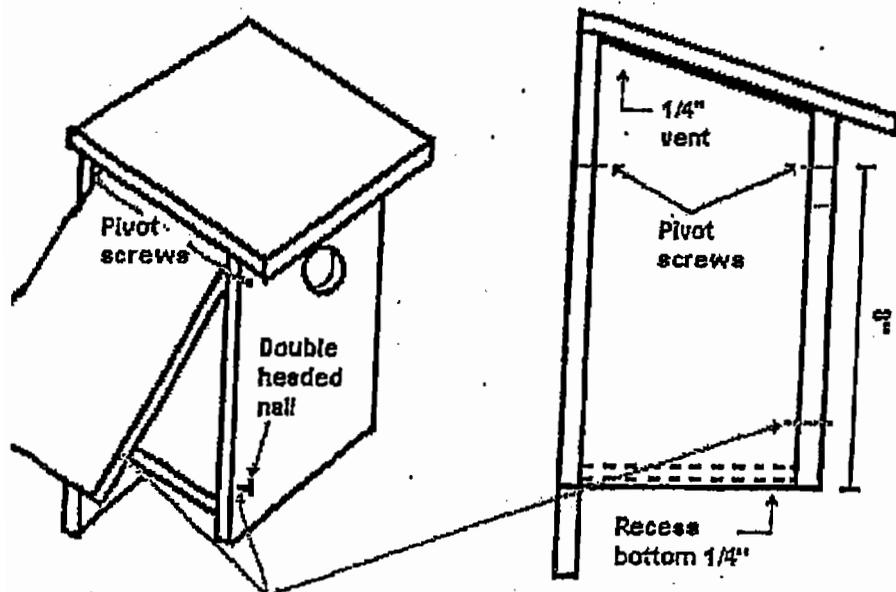
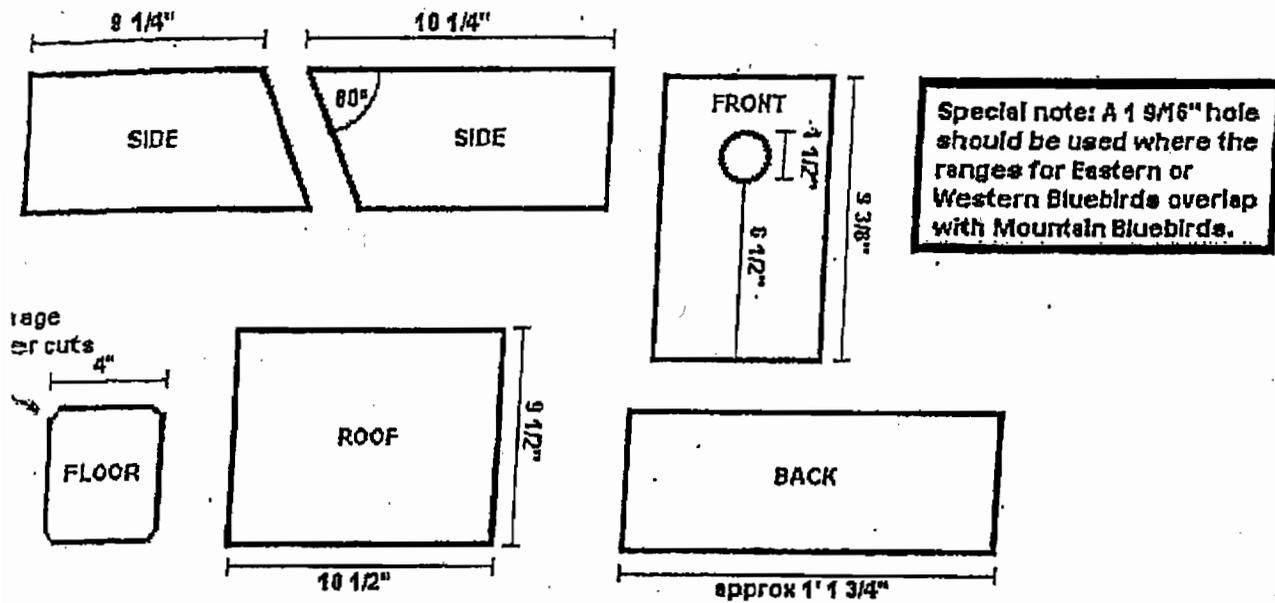


[Back | Go to Construction Plans](#)

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Eastern/Western Bluebird Nest Box Plans -- part 2

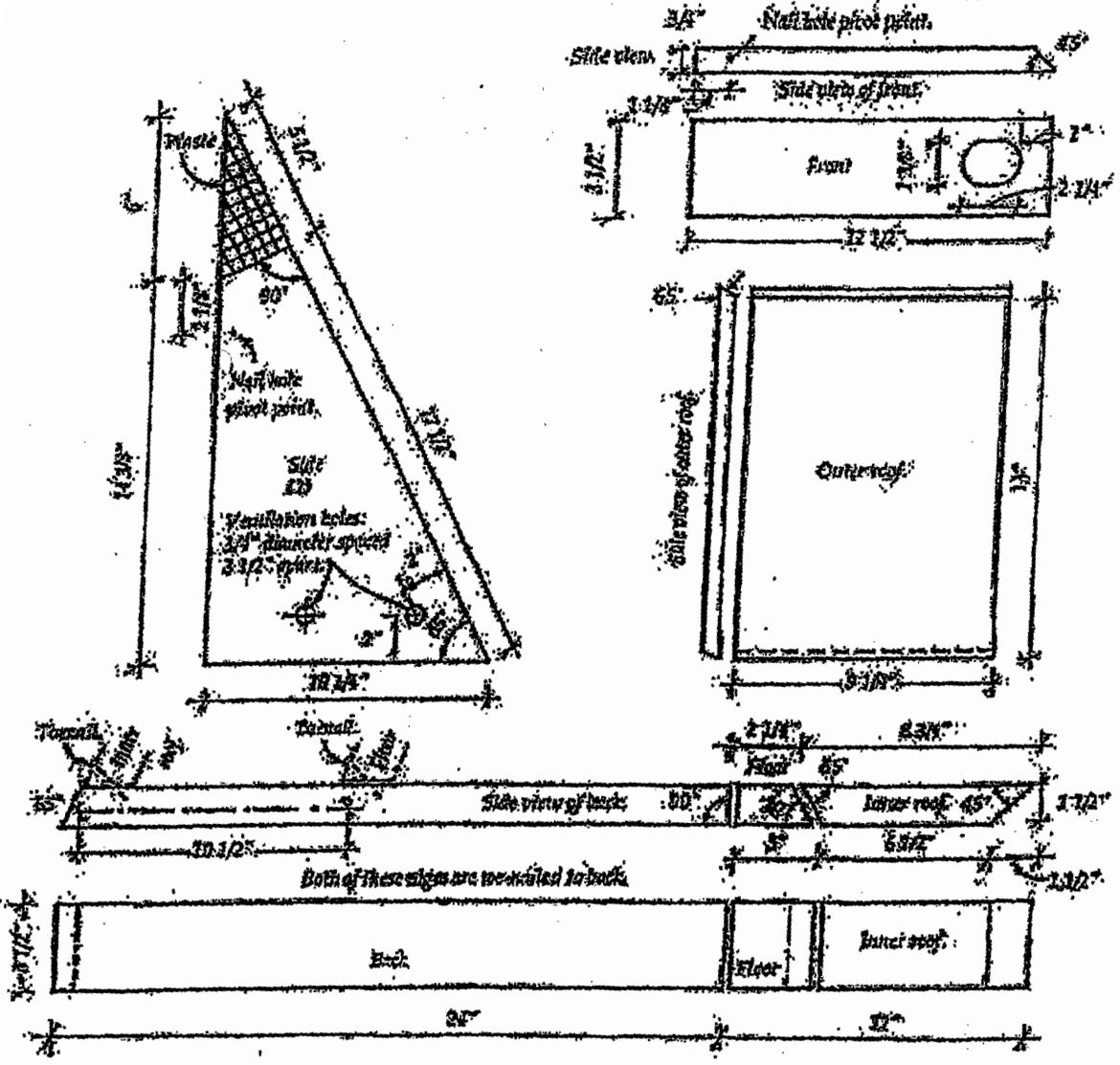
CONSTRUCTION PLAN



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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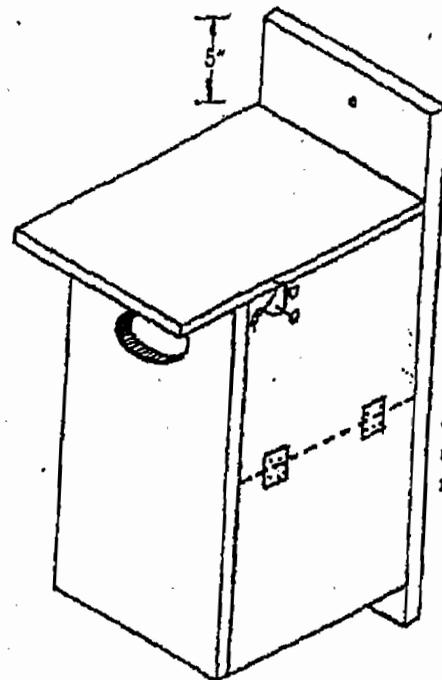
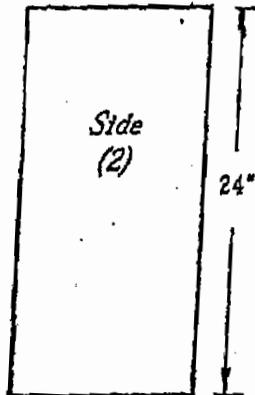
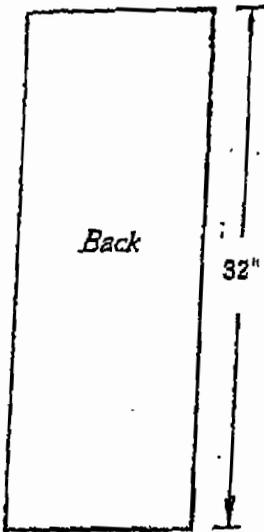
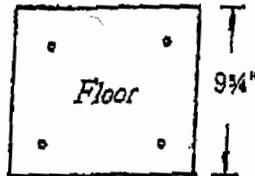


BACK

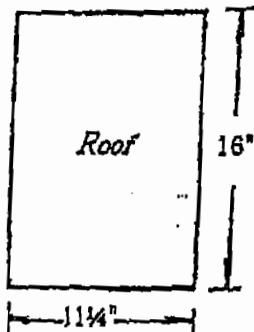
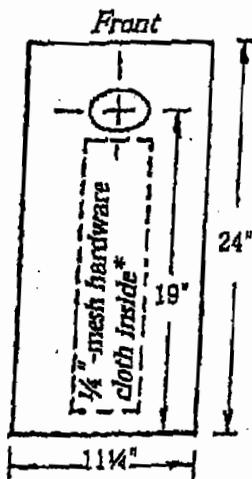
A Nest-Box Plan for Common and Hooded Mergansers, Wood Ducks, and American Kestrels

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



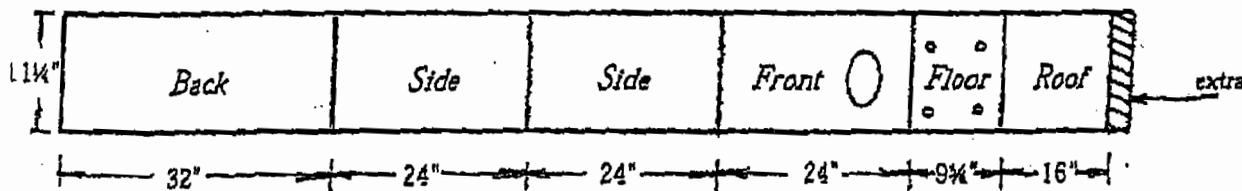
Hinge for cleaning and monitoring



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"



Nest Box 10

- WOOD DUCK
- HOODED MERGANSER
- RACCOON
- FOX and GRAY SQUIRREL
- PILEATED WOODPECKER (?)



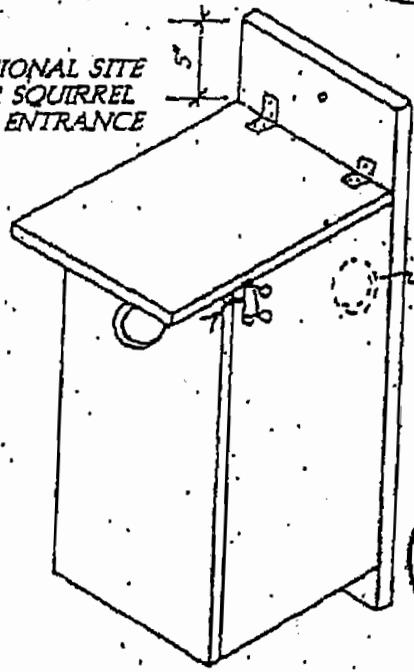
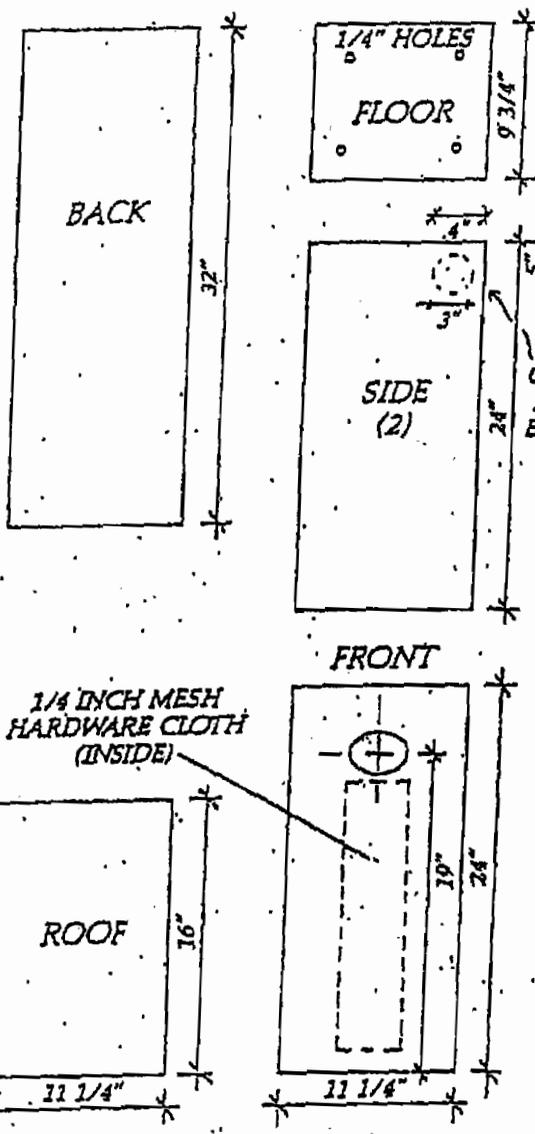
**HOLE SIZE:
(UP)**

WOOD DUCK and HOODED MERGANSER:
3" HIGH AND 4" WIDE OVAL

RACCOON:
5" HIGH AND 9" WIDE OVAL

FOX and GRAY SQUIRREL:
3" DIAMETER ROUND

PILEATED WOODPECKER:
4" DIAMETER ROUND



HINGE OR CLEAT ROOF FOR CLEANING

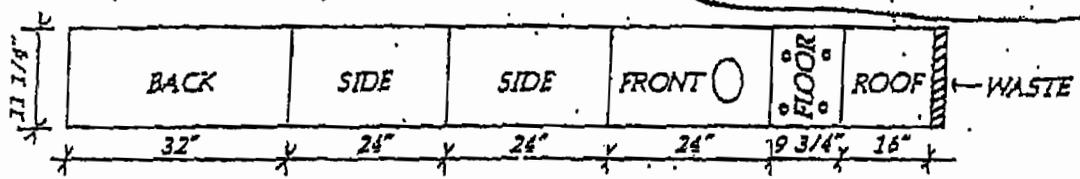
OPTIONAL:
LOCATE 3" DIAMETER ENTRANCE HOLE HERE FOR SQUIRREL BOX

FOR WOOD DUCK HOUSE -
PLACE 3/4" OF SAWDUST IN BOTTOM OF BOX

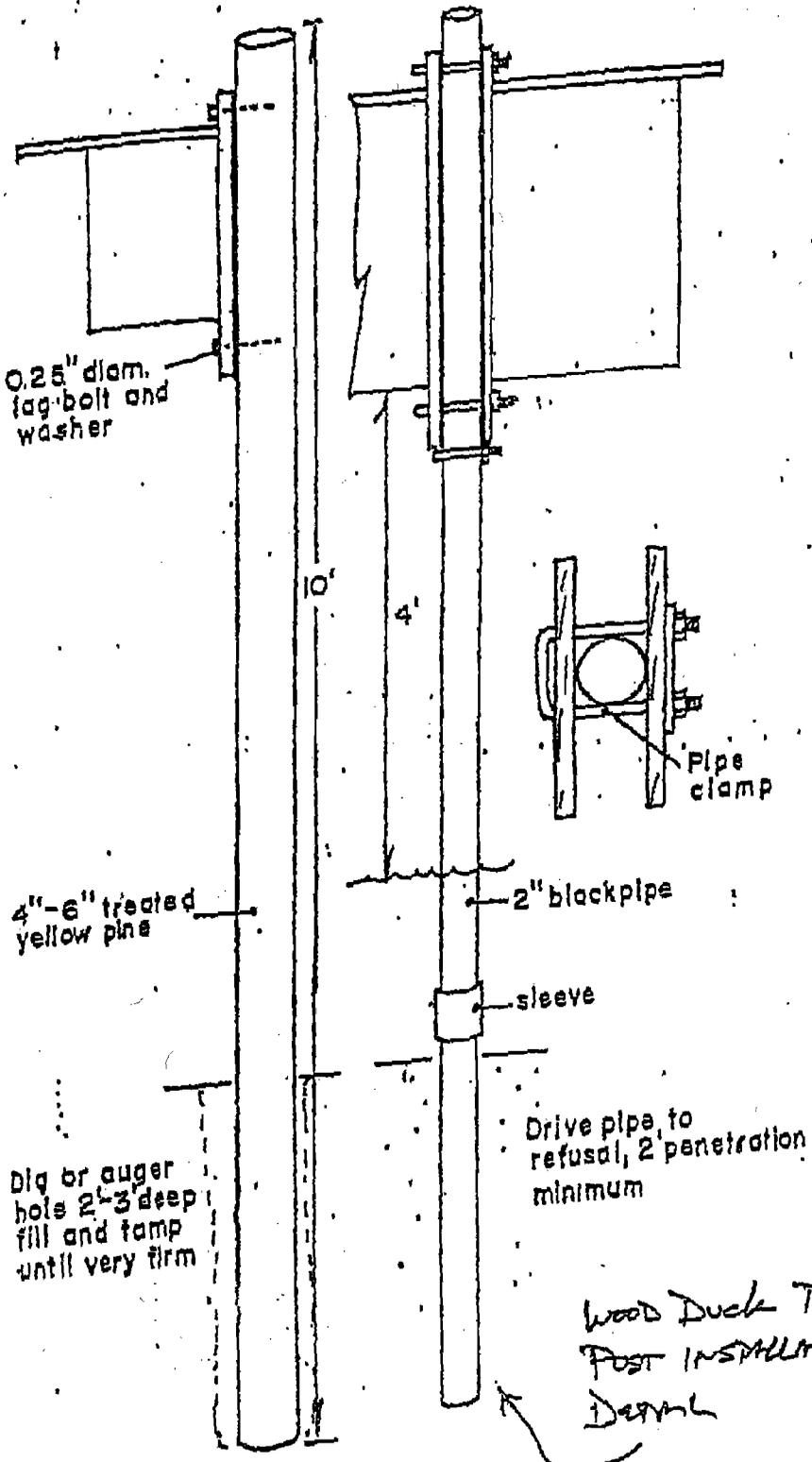
FOR PILEATED WOODPECKER HOUSE -
FILL BOX TO TOP WITH SAWDUST

LUMBER: ONE 1" x 12" x 12'0"

NOTE: PILEATED WOODPECKER BOX SHOULD BE CONSTRUCTED FROM ONE 2" x 12" x 12'0" CEDAR, AND FLOOR MUST BE 8 1/4" LONG INSTEAD OF 9 3/4" FOR USE OF 1 1/2" THICK LUMBER



POST INSTALLATION DETAIL



LOADEN STRUCTURE

CROSS SECTIONS



Tunnel structure

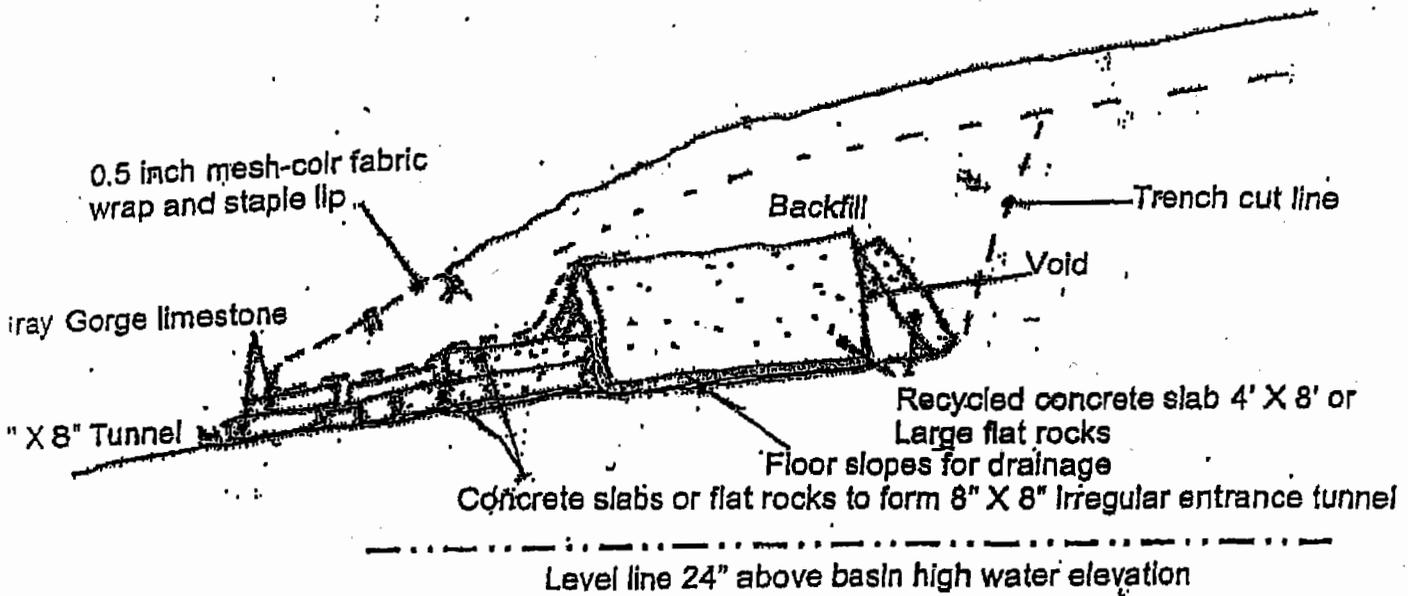


Visible entrance

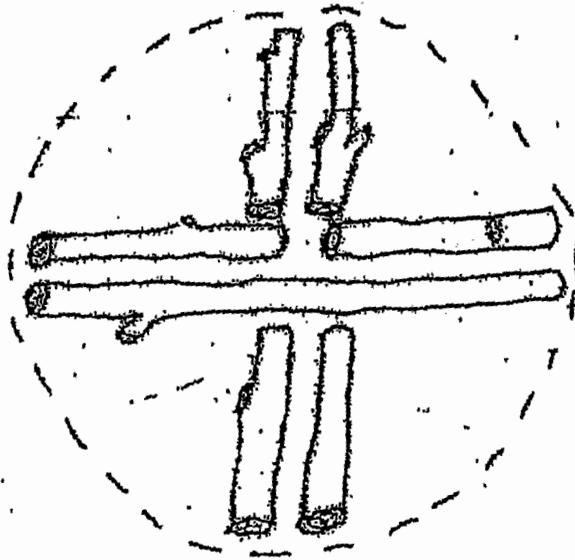


Den support structure

SIDE VIEW



PLAN VIEW.



Log pattern

Evergreen branches
Pine, juniper, hemlock

Some straw, burlap,
soil, etc.

