SPECIAL AREA MANAGEMENT PLAN

PROPOSED 1000 WEST INDUSTRIAL CORRIDOR

LOGAN, UTAH

1994050235 - GP47

Prepared for

CITY OF LOGAN
Logan, Utah

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INTRODUCTION

The City of Logan, Utah plans to encourage the development of an industrial corridor along 1000 West between 300 South and 1800 North. The development will take place within a one-half mile wide corridor centered on 1000 West (Figure 1). The City has zoned this area for industrial development and has taken steps to provide the necessary utilities to support manufacturing, assembly, and other commercial establishments.

Substantial areas of jurisdictional wetlands occur within the proposed industrial corridor along 1000 West, some of which will be impacted by future development. A number of alternative locations for the industrial corridor have been considered, but have been rejected for the following reasons. 1) All sites east of Main Street within the City of Logan limits are too small to accommodate the projected size of the industrial corridor. 2) Available large parcels of land along 600 West within the City of Logan limits are limited in extent to the east or west by the railroad tracks. 3) Available large parcels of land along 600 West within the City of Logan limits are located north of 1000 North where conditions get progressively wetter and the proportion of the land consisting of jurisdictional wetlands increases. 4) Areas along 1000 West north of 1800 North also get progressively wetter, with an increasing proportion of area qualifying as jurisdictional wetland. 5) Available parcels along 1000 West south of 300 South are zoned for residential development and are adjacent to existing residential areas. 6) Available parcels near the intersection of Highway 89/91 and 1000 West are already designated for development as the Logan River Business Park and there is inadequate nonwetland area to accommodate the projected size of the industrial corridor. 7) Areas within the City of Logan limits to the west of 1000 West also get progressively wetter, with an increasing proportion of area qualifying as jurisdictional wetland. Because it represents the only area of adequate size within the City of Logan limits that is not substantially restricted by on-site conditions, the four block wide corridor along 1000 West between 300 South and 1800 North has been zoned for industrial development and utilities have been installed by the City to support such development. The City Master Plan includes the industrial corridor at the 1000 West location and substantial resources have been committed by the City toward the implementation of the plan. No other sites within the City of Logan boundaries or the near vicinity have been zoned for such development, with such a commitment of resources to accommodate that development.

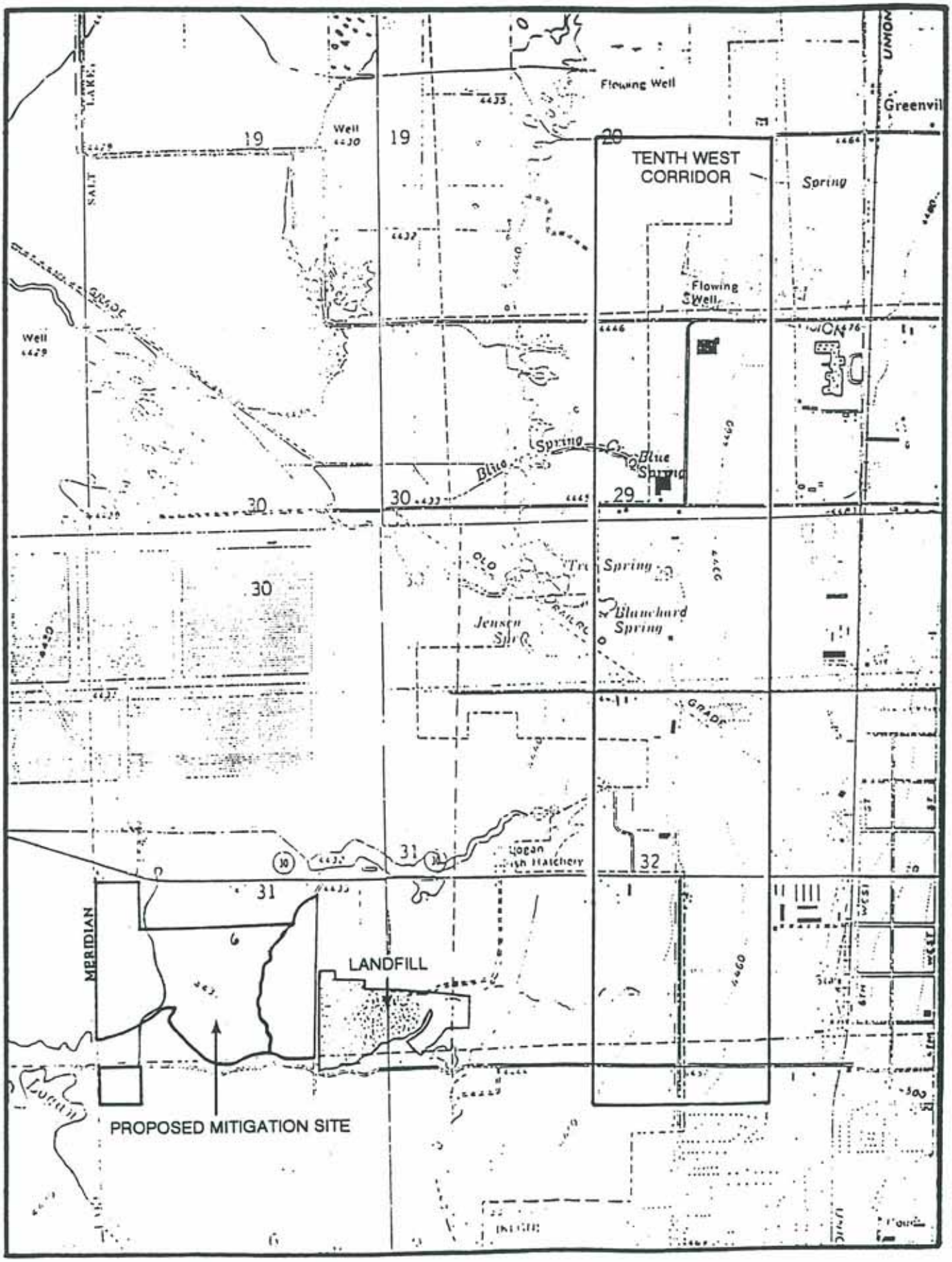


FIGURE 1. Location map of 100 West industrial corridor and wetland mitigation site.

Permits for the discharge of fill material will be required by Section 404 of the Clean Water Act prior to construction of facilities within the areas qualifying as jurisdictional wetlands. The special area management plan for the proposed 1000 West industrial corridor is intended to facilitate the 404 permitting process for industrial development within the corridor.

OBJECTIVES

Facilitation of the 404 permit process will require the accomplishment of the following objectives:

1) To delineate the jurisdictional wetlands within the proposed industrial corridor and to identify those wetlands that are unsuitable for the discharge of fill material;

2) To propose measures to protect those wetlands classified as unsuitable for the discharge of fill material;

3) To obtain a general permit for the unavoidable impacts of industrial development on those wetlands that have not been identified as unsuitable for the discharge of fill material;

4) To propose measures, including the development of a mitigation bank, to provide compensation for the functions and values of the wetlands that have not been identified as unsuitable for the discharge of fill material and that would be lost due to the impacts of industrial development; and

5) To propose a means of accounting for debits and credits to the mitigation bank resulting from impacts to wetlands and implementation of mitigation activities, respectively.

The purpose of this report is to identify the jurisdictional wetlands within the proposed industrial corridor and wetland mitigation site, to discuss the functions and values of those wetlands and the process by which some of the wetlands have been identified as unsuitable for the discharge of fill material, to describe the potential impacts of industrial development within the corridor to the wetlands that have not been identified as unsuitable for the discharge of fill material, to establish priorities for the development of compensatory mitigation for unavoidable impacts to wetlands not designated as unsuitable for the discharge of fill material, to provide a conceptual design for the creation of wetlands on the off-site mitigation site, and to propose an accounting system for wetland debits and credits.

DELINEATION OF JURISDICTIONAL WETLANDS

Jurisdictional wetlands within the 1000 West corridor have been delineated and the delineation has been verified by the U.S. Army Corps of Engineers. Figure 2 illustrates the extent and distribution of wetlands on the site. Table 1 summarizes the proportions of the different vegetation types within the corridor.

A full wetland delineation report has been presented in two documents prepared by Ecosystems Research Institute and White Horse Associates, dated November 15, 1990 and May 1, 1991 (ERI/WHA 1990, 1991a). A reconciliation document addressing issues identified by the U.S. Army Corps of Engineers was issued on April 27, 1991 (ERI/WHA 1991b).

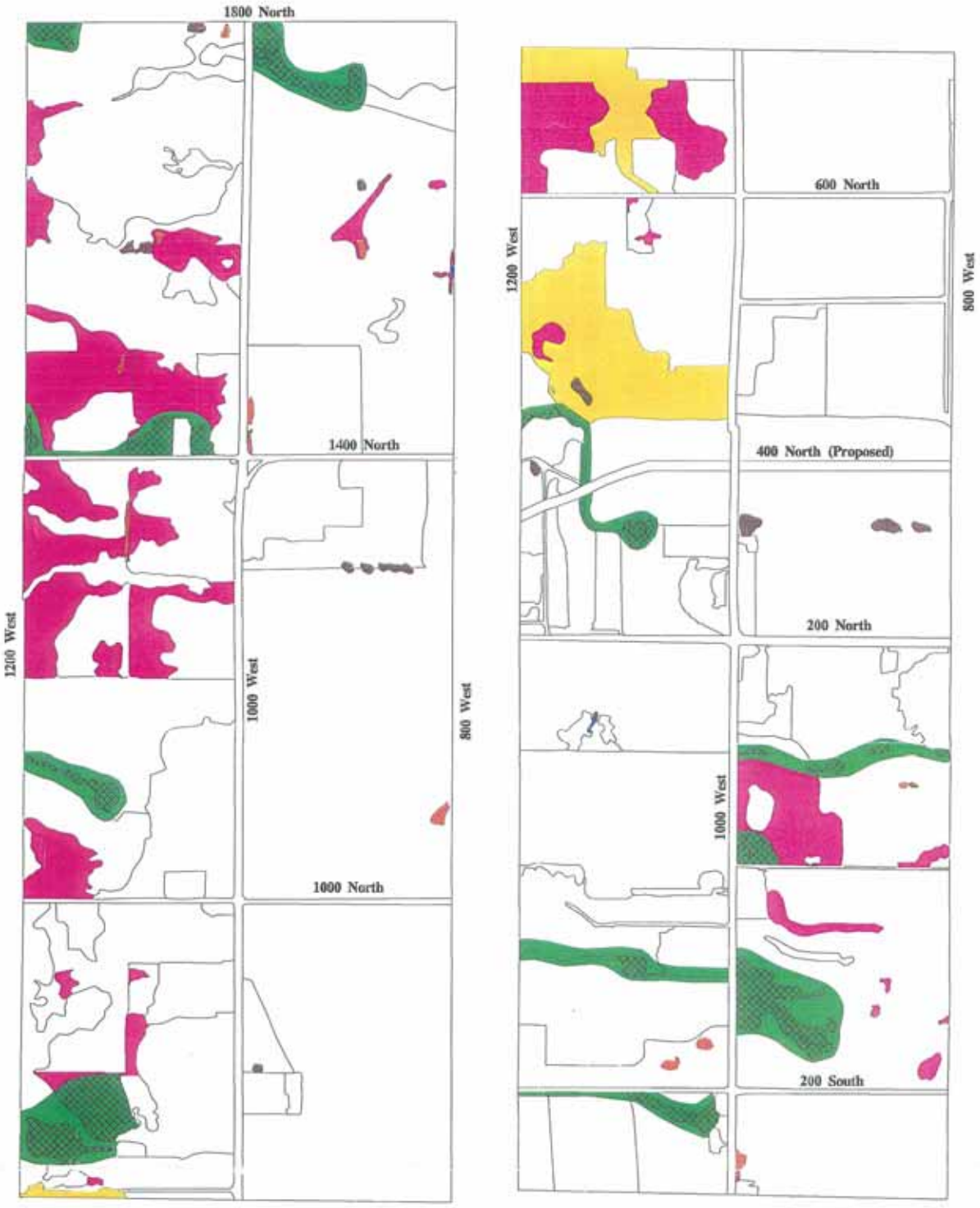
WETLAND FUNCTIONAL ASSESSMENT

The relative value of different types of wetlands can be assessed by the extent to which each type provides a variety of functions and values, including groundwater discharge, groundwater recharge, floodflow desynchronization, sediment stabilization, sediment/toxicant retention, nutrient removal/transformation, production export, wildlife diversity/abundance, aquatic diversity/abundance, recreation, and uniqueness/heritage (Adamus 1987). The wetland types within the proposed industrial corridor along the 1000 West corridor are characterized by these functions and values to an extent determined by the quantity and temporal distribution of water, the extent of soil and vegetation development associated with each wetland type, and the extent of human disturbance within or in the immediate vicinity of the wetlands.

All Wetlands

Most of the wetlands within the proposed industrial corridor are contiguous with each other and with off-site wetlands through surface water and groundwater connections. The water quality protection and enhancement functions of the wetlands, including sediment stabilization, sediment/toxicant retention, and nutrient removal/transformation, are particularly important characteristics of the wetlands with surface water connections to other wetlands. Floodflow desynchronization, aquatic diversity/abundance, and production export are also wetland functions that are more important for the wetlands with surface water hydrology than for the wetlands supported by strictly groundwater hydrology.

Proposed Management Status of Tenth West Corridor Wetlands



A) Northern Area

B) Southern Area

Figure 3.

N

0 1000

Feet

Areas Designated as Unsuitable for Fill

- Wetlands
- Proposed Buffer Areas

Areas Not Designated as Unsuitable for Fill

- Pond
- Marsh
- Wet Meadow
- Nonirrigated Mesic Meadow
- Trees

TABLE 1. Acreage and relative extent of cover types within the proposed 1000 West corridor.

VEGETATION TYPE	STATUS	ACRES	PERCENT
Pond	Wetland	2.03	0.2
Marsh	Wetland	7.16	0.8
Wet Meadow	Wetland	69.75	8.1
Nonirrigated Mesic Meadow	Wetland	23.60	2.7
Filled Wetland	Wetland	4.66	0.5
TOTAL		**107.20**	**12.3**
Irrigated Mesic Meadow	Upland	207.50	24.1
Dry Meadow	Upland	111.40	12.9
Trees	Upland	3.20	0.4
Cropland	Upland	261.39	30.3
Filled	Upland	140.97	16.3
Road	Upland	30.72	3.6
TOTAL		**755.18**	**87.6**

In addition to these water quality functions and values, the wetlands within the proposed industrial corridor provide habitat for a variety of terrestrial vertebrates. Although systematic surveys for wildlife within the project area have not been conducted, incidental observations of wildlife use within the proposed industrial corridor and existing information regarding habitat preferences and range distributions of Utah wildlife have been combined to provide an evaluation of project area habitat values.

Birds - Up to 130 species of birds may use the proposed industrial corridor (Table 2). Many of these use the area for feeding during some portion of the year, while a few species nest within the corridor boundaries. Up to 58 of the species are likely infrequent users of the project area, with use of the area very limited in scope.

Bird life in the project area is a mix of waterbirds, raptors, and passerines. The mix of species reflects the diversity of habitats within the project area. Waterbirds include waterfowl, waders and shorebirds. Most of the waterfowl are transient users of the ponds for feeding and loafing, with nesting by mallards and cinnamon teal possible. Only killdeer and common snipe are probable breeders among the shorebirds, with the occurrence of the other species dependent upon the occurrence of ephemeral shallow water. Waders use the area for feeding, with no breeding in the project area likely. Raptors use the project area year-round and their occurrence is dependent upon rodent populations. Some differences in species composition occur between winter and summer. Much of the rest of the birdlife consists of passerine species. Many of these species use the area for feeding during various periods of the year, with some species nesting where appropriate habitat occurs.

Mammals - A total of 34 species of mammals may use the 1000 West corridor area (Table 3). The most common species using the area include muskrat, deer mouse, montane vole, striped skunk, red fox and vagrant shrew. Most of the nine bat species are probably very infrequent users of the area, feeding occasionally over ponds or around farm lights which attract insects.

Reptiles and amphibians - Four species each of reptiles and amphibians (Table 4) may use the proposed industrial corridor area. Amphibians species would be restricted to the pond and ditch areas within the corridor. Snakes are likely the only reptile group that uses the proposed industrial corridor area, with garter and gopher snakes the most common.

TABLE 2. Projected list of birds inhabiting the proposed 1000 West industrial corridor. Species marked with an 'i' are infrequent users of the area.

Order PODICEPEDIFORMES--Grebes		
i	Pied-billed Grebe	Podilymbus podiceps
Order CICONIFORMES-- Herons and Allies		
i	American Bittern	Botaurus lentiginosus
	Great Blue Heron	Ardea herodias
	Snowy Egret	Egretta thula
	Cattle Egret	Bubulcus ibis
i	Black-crowned Night Heron	Nycticorax nycticorax
	White-faced Ibis	Plegadis chihi
Order ANSERIFORMES--Waterfowl		
i	Snow Goose	Chen caerulescens
	Canada Goose	Branta canadensis
i	Wood Duck	Aix sponsa
	Green-winged Teal	Anas crecca
	Mallard	Anas platyrhynchos
i	Northern Pintail	Anas acuta
i	Blue-winged Teal	Anas discors
	Cinnamon Teal	Anas cyanoptera
	Northern Shoveler	Anas clypeata
	Gadwall	Anas strepera
i	American Widgeon	Anas americana
i	Canvasback	Aythya valisineria
	Redhead	Aythya americana
i	Ring-necked Duck	Aythya collaris
	Lesser Scaup	Aythya affinis
i	Common Goldeneye	Bucephala clangula
i	Bufflehead	Bucephala albeola
	Ruddy Duck	Oxyura jamaicensis
Order FALCONIFORMES--Vultures and Hawks		
i	Turkey Vulture	Cathartes aura
i	Bald Eagle	Haliaeetus leucocephalus
	Northern Harrier	Circus cyaneus
i	Sharp-shinned Hawk	Accipitor striatus
i	Cooper's Hawk	Accipitor cooperii
	Swainson's Hawk	Buteo swainsoni
	Red-tailed Hawk	Buteo jamaicensis
i	Ferruginous Hawk	Buteo regalis
	Rough-legged Hawk	Buteo lagopus
i	Golden Eagle	Aquila chrysaetos
	American Kestrel	Falco sparverius
i	Merlin	Falco columbarius
i	Peregrine Falcon	Falco peregrinus
	Prairie Falcon	Falco mexicanus
Order GALLIFORMES--Pheasants and Allies		
	Ring-necked Pheasant	Phasianus colchicus

TABLE 2 (continued). Projected list of birds inhabiting the proposed 1000 West Industrial corridor. Species marked with an 'i' are infrequent users of the area.

Order GRUIFORMES--Cranes and Rails		
	Virginia Rail	Rallus limicola
	Sora	Porzana carolina
	American Coot	Fulica americana
i	Sandhill Crane	Grus canadensis
Order CHARADRIIFORMES--Shorebirds, Gulls and Terns		
	Killdeer	Charadrius vociferus
i	Black-necked Stilt	Himantopus mexicanus
i	American Avocet	Recurvirostra americana
i	Greater Yellowlegs	Tringa melanoleuca
i	Lesser Yellowlegs	Tringa flavipes
i	Solitary Sandpiper	Tringa solitaria
i	Willet	Catoptrophorus semipalmatus
i	Spotted Sandpiper	Actitis macularia
i	Long-billed Curlew	Numenius americanus
i	Marbled Godwit	Limosa fedoa
i	Semipalmated Sandpiper	Calidris pusilla
i	Western Sandpiper	Calidris mauri
i	Least Sandpiper	Calidris minutilla
i	Baird's Sandpiper	Calidris bairdii
i	Pectoral Sandpiper	Calidris melanotos
i	Long-billed Dowitcher	Limnodromus griseus
	Common Snipe	Gallinago gallinago
i	Wilson's Phalarope	Phalaropus tricolor
	Franklin's Gull	Larus pipixcan
	Ring-billed Gull	Larus delawarensis
	California Gull	Larus californicus
Order COLUMBIFORMES--Doves and Pigeons		
	Rock Dove	Columba livia
	Mourning Dove	Zenaida macroura
Order STRIGIFORMES--Owls		
i	Common Barn Owl	Tyto alba
i	Western Screech Owl	Otus kennicottii
	Great Horned Owl	Bubo virginianus
i	Short-eared Owl	Asio flammeus
Order CAPRIMULGIFORMES--Goatsuckers		
	Common Nighthawk	Chordeiles acutipennis
Order APODIFORMES--Swifts and Hummingbirds		
i	Black-chinned Hummingbird	Archilochus alexandri
i	Broad-tailed Hummingbird	Selasphorus platycercus
i	Rufous Hummingbird	Selasphorus rufus
Order CORACIIFORMES--Kingfishers		
i	Belted Kingfisher	Ceryle alcyon

TABLE 2 (continued). Projected list of birds inhabiting the proposed 1000 West industrial corridor. Species marked with an 'I' are infrequent users of the area.

Order PICIFORMES--Woodpeckers		
	Downy Woodpecker	Picoides pubescens
	Northern Flicker	Colaptes auratus
Order PASSERIFORMES--Perching Birds		
i	Willow Flycatcher	Empidonax traillii
	Western Kingbird	Tyrannus verticalis
	Horned Lark	Eremophila alpestris
	Tree Swallow	Tachycineta bicolor
i	Violet-green Swallow	Tachycineta thalassina
	North. Rough-wng. Swallow	Stelgidopteryx serripennis
	Bank Swallow	Riparia riparia
	Cliff Swallow	Hirundo pyrrhonota
	Barn Swallow	Hirundo rustica
	Black-billed Magpie	Pica pica
	American Crow	Corvus brachyrhynchos
i	Common Raven	Corvus corax
	Black-capped Chickadee	Parus atricapillus
	House Wren	Troglodytes aedon
	Marsh Wren	Cistothorus palustris
i	Golden-crowned Kinglet	Regulus satrapa
	Ruby-crowned Kinglet	Regulus calendula
	American Robin	Turdus migratorius
	Water Pipit	Anthus spinoletta
	Cedar Waxwing	Bombycilla cedrorum
	Northern Shrike	Lanius excubitor
i	Loggerhead Shrike	Lanius ludovicianus
	European Starling	Sturnus vulgaris
	Warbling Vireo	Vireo gilvus
	Yellow Warbler	Dendroica petechia
	Yellow-rumped Warbler	Dendroica coronata
i	MacGillivray's Warbler	Oporornis tolmiei
i	Common Yellowthroat	Geothlypis trichas
i	Western Tanager	Piranga ludoviciana
	Lazuli Bunting	Passerina amoena
i	Rufous-sided Towhee	Pipilo erythrophthalmus
	American Tree Sparrow	Spizella arborea
	Chipping Sparrow	Spizella passerina
i	Brewer's Sparrow	Spizella breweri
i	Sage Sparrow	Amphispiza belli
	Vesper Sparrow	Pooecetes gramineus
	Savannah Sparrow	Passerculus sandwichensis
	Song Sparrow	Melospiza melodia
i	Lincoln's Sparrow	Melospiza lincolnii
	White-crowned Sparrow	Zonotrichia leucophrys
	Dark-eyed Junco	Junco hyemalis
i	Bobolink	Dolichonyx oryzivorus
	Red-winged Blackbird	Agelaius phoeniceus
	Western Meadowlark	Sturnella neglecta
	Yellow-headed Blackbird	Xanthocephalus xanthocephalus
	Brewer's Blackbird	Euphagus cyanocephalus

TABLE 2 (continued). Projected list of birds inhabiting the proposed 1000 West industrial corridor. Species marked with an 'i' are infrequent users of the area.

Order PASSERIFORMES--Perching Birds (continued)		
	Brown-headed Cowbird	Molothrus ater
	Northern Oriole	Icterus glabula
	House Finch	Carpodacus mexicanus
	American Goldfinch	Carduelis tristis
i	Evening Grosbeak	Coccothraustes vespertinus
	House Sparrow	Passer domesticus

TABLE 3. Projected list of mammals occurring within the proposed 1000 West industrial corridor.

Order Insectivora--Insectivores	
Merriam Shrew	Sorex merriami
Dusky Shrew	Sorex monticolus
Vagrant Shrew	Sorex vagrans
Northern Water Shrew	Sorex palustris
Masked Shrew	Sorex cinereus
Order Chioptera--Bats	
Little Brown Bat	Myotis lucifugus
Long-eared Myotis	Myotis evotis
Fringed Myotis	Myotis thysanodes
California Myotis	Myotis californicus
Yuma Myotis	Myotis yumanensis
Long-legged Myotis	Myotis volans
Western Pipistrel	Pipistrellus hesperus
Big Brown Bat	Eptesicus fuscus
Hoary Bat	Lasiurus cinereus
Order Rodentia--Rodents	
Northern Pocket Gopher	Thomomys talpoides
Beaver	Castor canadensis
Western Harvest Mouse	Reithrodontomys megalotis
Deer Mouse	Peromyscus maniculatus
Meadow Vole	Microtus pennsylvanicus
Montane Vole	Microtus montanus
Long-tailed Vole	Microtus longicaudus
Muskrat	Ondatra zibethicus
Norway Rat	Rattus norvegicus
Black Rat	Rattus rattus
House Mouse	Mus musculus
Western Jumping Mouse	Zapus princeps
Porcupine	Erethizon dorsatum
Order Carnivora--Carnivores	
Long-tailed Weasel	Mustela frenata
Mink	Mustela vison
Badger	Taxidea taxus
Striped Skunk	Mephitis mephitis
Coyote	Canis latrans
Red Fox	Vulpes vulpes
Order Artiodactyla--Even-toed Ungulates	
Mule Deer	Odocoileus hemionus

TABLE 4. Projected list of the reptiles and amphibians found within the proposed 1000 West Industrial corridor.

AMPHIBIANS	
Order Caudata--Salamanders	
Tiger Salamander	Ambystoma tigrinum
Order Salientia--Toads and Frogs	
Woodhouse's Toad	Bufo woodhousei
Chorus Frog	Pseudacris triseriata
Leopard Frog	Rana pipiens
REPTILES	
Order Squamata--Lizards and Snakes	
Western Yellow-bellied Racer	Coluber constrictor
Great Basin Gopher Snake	Pituophis melanoleucus
Valley Garter Snake	Thamnophis siratalis
Wandering Garter Snake	Thamnophis elegans

Threatened and endangered species - The proposed industrial corridor does not contain any areas listed as critical or essential habitat for threatened or endangered species. Two species, the bald eagle and peregrine falcon, may be very infrequent users of this area for feeding. Quality habitat does not exist for either species within the corridor. Bald eagles have been observed flying over the corridor, moving between roosting areas in local canyons and feeding areas at Cutler Reservoir and the Logan sewage lagoons. Peregrine falcons have not been recorded from the area but have been seen during one winter in similar habitat approximately two miles to the north. Any use by peregrines would be restricted to feeding on birds within the corridor.

Species of special concern - Four bird species listed as sensitive by the Utah Division of Wildlife Resources have been observed within the proposed industrial corridor area: ferruginous hawk, Swainson's hawk, long-billed curlew and white-faced ibis. These species, while occurring in numbers adequate for survival, have been greatly depleted or occur in limited areas or numbers due to restricted or specialized habitat. The Division suggests a management program be developed for these species within the state.

Swainson's hawks are regular and common breeders within Cache Valley and have nested within the 1000 West corridor. Large trees in the area provide nesting sites for this summer resident. Much of the upland area in the corridor provides feeding areas for this species.

At least one record of ferruginous hawk exists for the proposed industrial corridor area, with one individual observed during December of 1993. This species is an infrequent migrant and winter resident on the floor of Cache Valley. Significant numbers of rodents during the fall and winter months could infrequently attract this species to the project area.

White-faced ibis are regular visitors to the proposed industrial corridor area during the summer. They can be observed feeding on invertebrates in flood-irrigated pastureland shortly after irrigation. The presence of this species within the proposed industrial corridor area is probably enhanced by the heavy grazing of these pastures which keep vegetation short. Ibis seem to prefer feeding in pastures and alfalfa fields where vegetation is quite short in stature.

Long-billed curlews are infrequent spring visitors to the 1000 West corridor. They have been seen during spring migration feeding in flooded pastures. Prior to intensive grazing, this species likely bred

within the mesic grasslands of the proposed industrial corridor. However, the lack of significant tall grassland vegetation has removed the possibility of this species nesting within the corridor.

Game species - Up to four species of harvested wildlife may use the proposed industrial corridor: ring-necked pheasant, sandhill crane, mule deer, and mink. None of these species is particularly numerous and the area does not hold great potential to provide harvestable numbers of these species. The location of the corridor within the city limits of Logan also precludes any hunting opportunity.

Ring-necked pheasants are found scattered throughout the area, but their nesting and brood-rearing success is limited by the lack of significant tall upland vegetation and shrub cover. Also, minimal winter cover exists within the area.

Sandhill cranes are infrequent visitors to the proposed industrial corridor area. Occasionally, cranes have been observed feeding in the area. Heavy grazing and trampling of marsh areas has essentially eliminated the potential for nesting of this species within the corridor. Prior to intensive grazing practices, sandhill cranes probably nested within the 1000 West corridor area within the small pockets of marsh.

Mule deer are likely sporadic visitors to the proposed industrial corridor. Minimal habitat exists for this species and most use would be transient in nature. Similarly, mink may pass through the corridor, but little suitable habitat exists for this species.

Ponds

The ponds within the 1000 West corridor are small and occur in association with springs and irrigation canals. The ponds are generally less than 4 feet deep, with small areas of marsh and wet meadow in zones of shallower water. Most of the ponds occur as a result of groundwater discharge and do not receive significant surface flows. Floodflow desynchronization is not an important function of the ponds within the 1000 West corridor due to the lack of significant surface flows. Those ponds that do receive inputs of surface runoff or irrigation overflow perform the functions of sediment retention and removal of nutrients by precipitation of particulates and transformation of dissolved forms. In addition, vegetation within the shallower portions of the ponds provide uptake and transformation of nutrients, as well as stabilization and retention of sediments.

The more productive ponds with outlets may function as sources of organic material to

downstream aquatic systems. All of the ponds provide habitat for aquatic and water-dependent organisms, which is relatively rare within the 1000 West corridor. They also provide drinking water for use by terrestrial wildlife, which is critical when irrigation flows are not available on the site. When in good condition, these ponds provide feeding, brooding and loafing habitat for puddle ducks, and feeding areas for egrets and herons. The surrounding vegetation provides habitat for rails and other wildlife species using emergent vegetation. The value of ponds for wildlife in the corridor area has been decreased due to extensive grazing of adjacent uplands and in some, significant disturbance of emergent vegetation by livestock. Breeding by waterfowl is likely limited by the lack of sufficient cover for nests adjacent to these ponds.

It is not likely that the ponds within the 1000 West corridor provide recreational opportunities other than viewing of aquatic and water-dependent organisms, such as ducks and other water birds. Hunting opportunities are not provided by any of the 1000 West corridor wetlands due to their location within the city limits of Logan.

Most of the ponds overflow into small channels or ditches that convey streamflows toward the west. These flows augment the hydrology of wetlands to the west of the proposed industrial corridor. As a result, the ponds within the 1000 West corridor are contiguous with off-site wetlands via surface hydrology.

Although they were not identified as a separate wetland vegetation type by the wetland delineation due to the extremely small area involved, the channels conveying flows from the ponds within the 1000 West corridor represent riparian wetlands or at least areas with the potential to support riparian wetlands. Most of the channels have been straightened and are located adjacent to roads or fencelines. Woody vegetation has generally been eliminated by burning or herbicide use, but some of the large trees within the corridor are associated with these stream channels or ditches. Despite the altered condition of the streams and the associated riparian vegetation, they provide a variety of wetland functions and values, albeit to a limited extent. During periods of increased streamflows, the alluvial groundwater along the channels is recharged, with groundwater discharge occurring during periods of low flow. The vegetation along the channels stabilizes the streambanks and filters suspended sediments from the streamflow. The vegetation also provides nutrient uptake/transformation, toxicant retention, and production of organic

material for export to the aquatic ecosystems within the channel and downstream. The streams provide habitat for aquatic organisms; while the riparian vegetation provides habitat associated with flowing water for terrestrial wildlife species. Floodflow desynchronization is a potential function of the riparian zone associated with the streams but is not very important within the 1000 West corridor due to the nature of the water source (groundwater discharge or irrigation), channelization of the streams, and subsequent elimination of floodplains. As indicated by the limited area occupied by the streams and their associated riparian plant communities, they represent a rare vegetation type within the 1000 West corridor. However, they are essential for the maintenance of contiguity between the wetlands within the 1000 West corridor and wetlands off-site to the west.

Marshes

Small areas of marsh occur in association with springs and in depressions at the lower edges of fields where irrigation water is ponded for livestock. Marsh areas are semipermanently flooded to a maximum depth of about six inches. About seven percent of the marshes in the 1000 West corridor are irrigated; the remaining 93 percent of marshes are supplied by natural wetland hydrology. Most of these natural marsh areas are supplied by water from springs or elevated water table conditions which perform a groundwater discharge function. Cattails (*Typha latifolia*), bulrushes (*Scirpus americanus, S. acutus*), and Nebraska sedge (*Carex nebrascensis*) are the dominant plants in this vegetation type.

Storage of water in the marshes during periods of groundwater discharge desynchronizes the release of floodflows and reduces peak flows in downstream receiving waters. Vegetation in the marshes performs sediment stabilization and retention functions, particularly where water is flowing through the wetlands. These wetlands also retain toxicants and remove nutrients from the water. The marshes that discharge into streams or irrigation ditches may function as sources of allochthonous organic material to downstream aquatic systems. The marshes provide unique habitat values for wildlife, particularly rails, blackbirds and other marsh species. Marshes with areas of open water may provide habitat for some aquatic organisms, such as invertebrates and amphibians. Like the ponds, marsh wetlands are relatively rare within the 1000 West corridor and provide some opportunities for recreational wildlife observation. As with ponds, the value of much of these areas to wildlife has been decreased due to trampling by livestock and extensive grazing in adjacent lands.

Like the ponds, most of the marshes discharge streamflows toward the west through small channels or ditches. The channels and riparian vegetation associated with the streamflows provide the same wetland functions and values described previously for the channels conveying streamflows from ponds. The marshes and streams are contiguous with off-site wetlands via surface hydrology.

Wet Meadows

The wet meadow vegetation type within the 1000 West corridor occurs around springs, in concave areas that retain water, and in lower portions of irrigated pastures. Wet meadows around springs are supplied with water from natural sources, while wet meadows in pastures are sustained by irrigation. These pasture wet meadows comprise 90 percent of the wet meadows on the site. Dominant plant species include Nebraska sedge, carpet bentgrass (*Agrostis stolonifera*), creeping spikerush (*Eleocharis palustris*), reed canarygrass (*Phalaris arundinacea*), beaked sedge (*Carex rostrata*), wiregrass (*Juncus arcticus*), water groundsel (*Senecio hydra*), foxtail barley (*Hordeum jubatum*), teasel (*Dipsacus sylvestris*), and Canada thistle (*Cirsium arvense*).

Located at the foot of the Wasatch Mountains over relatively impermeable soil layers, the wet meadows with natural hydrology are supported by a shallow water table that represents the discharge of groundwater originating as snowmelt in the mountains or as irrigation applied upgradient. To the extent that the water supporting the wet meadows would otherwise be discharged into stream channels, the wet meadows perform a floodflow desynchronization function by dissipating the snowmelt over a large area. Because of the flat gradient of the wet meadow wetlands, flows do not develop through the wet meadows even during periods in which elevated water table conditions result in seasonal inundation. Due to the absence of surface flows or perennial surface water, the wet meadows generally do not perform water quality protection functions (sediment stabilization, sediment/toxicant retention) or provide production export or aquatic habitat values. During periods of seasonal high water when surface water may be present, the wetland vegetation may remove and transform nutrients from the water.

The wet meadow areas have been heavily impacted by livestock grazing, and in general have characteristics of pastureland. Seasonal flooding combined with short vegetation stature provides sporadic feeding habitat for white-faced ibis and shorebirds, particularly in the spring. Some nesting by common snipe is possible. Removal of livestock from these areas would change the vegetation

characteristics and may make these areas less suitable to white-faced ibis for feeding due to the higher vegetation cover. This would be the case particularly from mid-summer through fall.

The vegetation in the wet meadows may be somewhat more productive than that present in the upland vegetation types due to more consistent water supply, but irrigation of upland pastures probably minimizes this difference. Wet meadows are more widespread within the 1000 West corridor than are ponds or marshes and the functions and values associated with wet meadows are not as unique relative to upland vegetation types as those associated with ponds or marshes. However, wet meadow areas associated with marshes and/or ponds supplement the habitat values of those wetlands as part of a wetland mosaic.

The wet meadows within the 1000 West corridor are contiguous with off-site wetlands only via the shallow groundwater that underlies much of the valley.

Nonirrigated Mesic Meadows

Mesic meadows occur on level topographic positions and are used as pastures. Boundaries with wet meadows in irrigated pastures are diffuse and small areas of wet meadow are included in this vegetation type. Under natural conditions, surface water used to collect in shallow swales and drain through these mesic meadows. Concave areas were wetlands while convex positions were upland. Tillage and levelling for flood irrigation has eliminated most of this microtopography. Ditches, roads, and fill have also disrupted the natural drainage to these meadows, which has been replaced in most areas by flood irrigation. Dominant plants in mesic meadows include Kentucky bluegrass (*Poa pratensis*), Canada thistle, carpet bentgrass, wiregrass, dandelion (*Taraxacum officinale*), clustered field sedge (*Carex praegracilis*), Nuttall's alkaligrass (*Puccinellia nuttalliana*), saltgrass (*Distichlis spicata*), meadow fescue (*Festuca pratensis*), foxtail barley, reed canarygrass, prickly lettuce (*Lactuca serriola*), and timothy (*Phleum pratense*).

Under current conditions, only those mesic meadows whose vegetation is supported by unintentional or uncontrolled irrigation are jurisdictional wetlands. The functions and values of these nonirrigated mesic meadow wetlands are not significantly different from those of the nonwetland pastures supported by controlled flood irrigation. The vegetation structure and species composition are the same, which would result in similar wildlife habitat values. Extensive livestock grazing has also altered the value

to wildlife of these lands. Seasonal flooding and irrigation of some areas provides habitat suitable to feeding of white-faced ibis, gulls and some shorebirds. Removal of livestock grazing would alter the vegetation structure of these areas by providing much taller vegetation. The resulting grasslands would provide nesting and cover habitat for a variety of grassland species including long-billed curlew. In areas adjacent to ponds, these meadows may provide nesting cover for puddle ducks such as mallards, but such possibilities would be greatly enhanced by the removal of grazing. Northern harriers feed over these areas year-round, while other raptors may use these areas seasonally for feeding, depending upon rodent populations.

Water regimes of the irrigated and nonirrigated mesic meadows would also be similar. During periods when surface water flows over or is ponded in mesic meadows, the vegetation retains sediments by impeding flows and removes nutrients by uptake and transformation. Shallow groundwater recharge may also take place during flooded periods.

Like the wet meadows, the nonirrigated mesic meadows are hydrologically connected with off-site wetlands only via the regional shallow groundwater.

Trees

Areas supporting large willow trees, generally relegated to fence rows, ditch banks or isolated trees in meadows, provide cover for several species of birds. Raptors use these trees for roosting and in some cases nesting, while several passerine birds may nest in the larger trees or tree covered areas. The value of these trees is enhanced by the proximity to foraging areas for both raptors and passerine species. Because of their isolation from other wetlands and the relatively small amount of area represented by the trees, the significance of the other wetland functions and values provided by these areas is negligible.

Relative Wetland Values

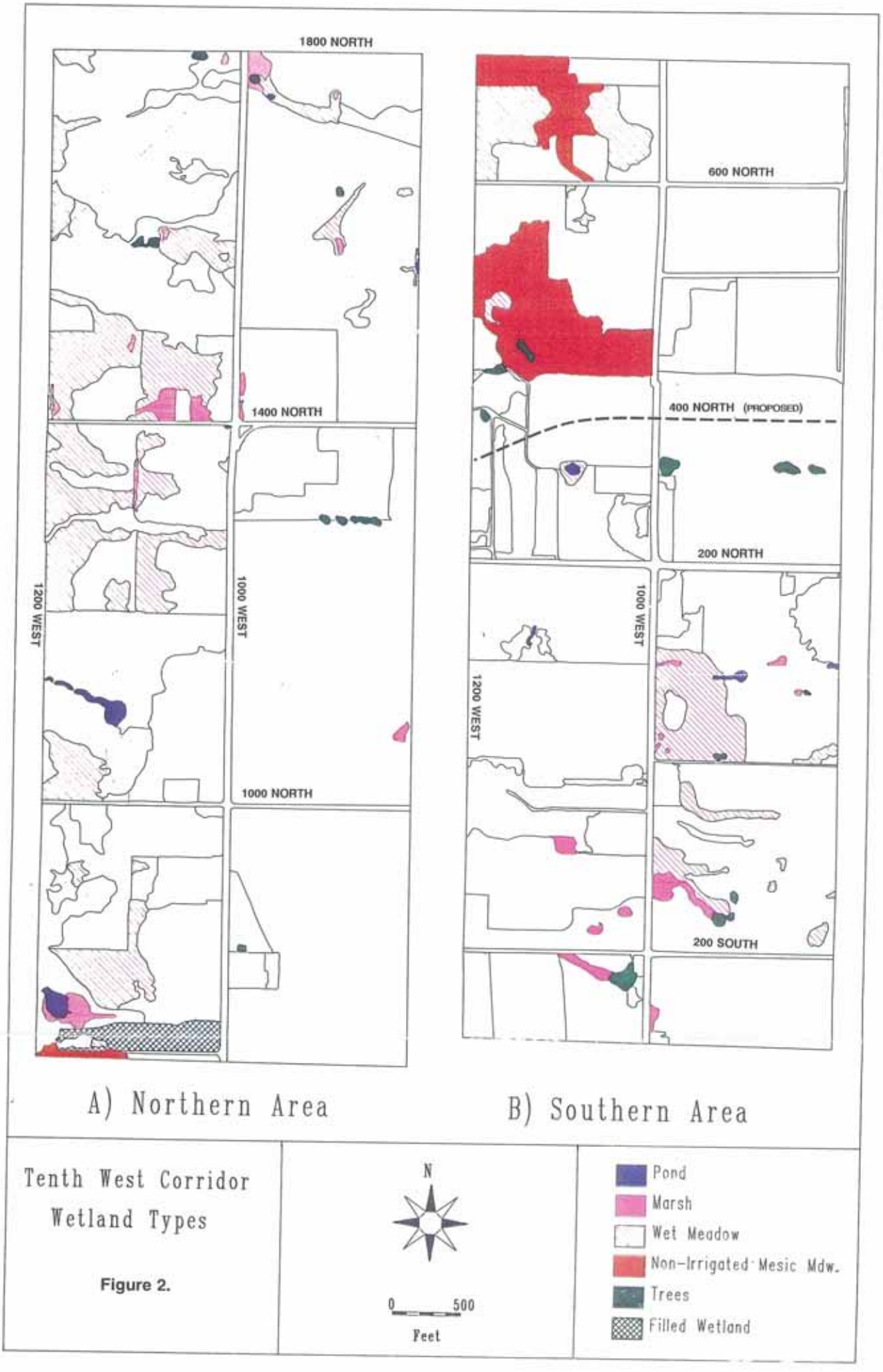
Because of the presence of permanent or semipermanent surface water, the ponds and marshes within the 1000 West corridor provide the widest variety of wetland functions and values on the most consistent basis. The ponds and marshes are also the most rare of the wetland types represented on the site and in the vicinity. They provide the only aquatic habitat values present on the site and are of significant value to terrestrial wildlife species, particularly within the mosaic of habitat that occupies the project area. The ponds and marshes protect and improve water quality by performing such functions

as sediment stabilization, sediment/toxicant retention, and nutrient removal/transformation. The other wetland and upland vegetation types within the corridor do not perform these functions to any significant degree because they are not subject to surface flows of water or long-term inundation.

The water quality protection and improvement functions of the wetlands are critical functions to maintain within a corridor for which industrial development has been proposed. Although these wetland functions may be replaced on a regional basis through the development of mitigation wetlands, the establishment of such functions at an off-site location results in the transfer of the value of the wetlands to a different watershed from that in which the wetland impacts will occur. Considering the potential for water quality to be adversely affected by the proposed development within the 1000 West corridor, it is important that the existing water quality protection and improvement functions of the existing wetlands be preserved on-site, as opposed to being replaced off-site. Since the ponds, marshes, and more frequently inundated wet meadows are the wetland areas that are characterized by the type of hydrology for which the water quality protection and improvement functions of wetlands are most relevant, they are the types of wetlands for which on-site preservation of their functions and values is most important. In addition, these wetlands are sustained to some degree by surface hydrology and are contiguous with off-site wetlands via surface hydrology. Since development within the proposed corridor is more likely to disrupt surface hydrology than the shallow groundwater hydrology that sustains the drier meadow wetland types, the protection of the ponds, marshes, and more frequently inundated wet meadows is important in order to avoid indirect impacts to adjacent on-site and off-site wetlands with which they are hydrologically contiguous.

WETLANDS UNSUITABLE FOR DISCHARGE OF FILL

As a result of the diversity and site-specific nature of the functions and values associated with most of the ponds, marshes, and more frequently inundated wet meadow wetlands within the proposed 1000 West industrial corridor, these wetland types have been identified as presumptively unsuitable for the discharge of fill material (Figure 3). The hydrologic contiguity of these wetlands with other wetlands within the proposed industrial corridor and outside of the proposed industrial corridor has also considered in the determination of wetland areas unsuitable for the discharge of fill material. Exceptions to the


1800 NORTH
1400 NORTH
1200 WEST
1000 WEST
1000 NORTH
A) Northern Area
600 NORTH
400 NORTH (PROPOSED)
200 NORTH
1000 WEST
1200 WEST
200 SOUTH
B) Southern Area
Tenth West Corridor
Wetland Types
Figure 2.
N
0
500
Feet
Pond
Marsh
Wet Meadow
Non-Irrigated Mesic Mdw.
Trees
Filled Wetland

designation of ponds and marshes as unsuitable for the discharge of fill material include small pond and marsh wetlands that are isolated from other wetlands, are located within established or designated road rights-of-way, or are associated strictly with irrigation ditches. In addition, several areas of wet meadow adjacent to ponds or marshes are also considered to be unsuitable for the discharge of fill material due to their contiguity with the adjacent ponds and marshes, and the apparently persistent nature of groundwater availability in these areas relative to other wet meadow areas.

It is also recommended that buffer areas at least 50 feet wide be established around wetlands identified as unsuitable for the discharge of fill material, with the exception of areas where these proposed buffer areas intersect established or designated road rights-of-way. Similar buffer zones should be established along the channels that drain these wetlands so that natural riparian zones along streams following natural channel patterns may be developed (Figure 3). The establishment of additional wetlands, complementary upland vegetation, and screening vegetation within these buffer areas will reduce the indirect impacts of future development on the unregulated upland areas surrounding the wetlands designated as unsuitable for fill. Habitat enhancement within the buffer areas will also maintain a mosaic of vegetation and habitat types within the protected areas, albeit on a smaller scale than currently exists within the project area.

The wetland areas designated as unsuitable for the discharge of fill material are distributed throughout the proposed 1000 West industrial corridor. No large, contiguous areas of high quality wetlands have been identified within the project area. As a result, individual areas that do include high quality wetlands have been designated as unsuitable for the discharge of fill material, despite the consequent further fragmentation of wetlands that are already relatively discontinuous. Although they are generally isolated from one another, each individual area will encompass all of the contiguous wetlands in the vicinity, with the exception of extensive adjacent wet meadow areas that do not provide comparable wetland functions and values. By including the buffer areas, contiguity with nearby or off-site wetlands will be provided except in cases where existing roads, canals, and other physical barriers preclude connection of surface hydrology. The buffer areas will also prevent the total isolation of the wetlands from adjacent upland habitat and adjacent wetland habitat, in the cases of those wetlands that are not already isolated from other wetlands.

WETLANDS NOT DESIGNATED AS UNSUITABLE FOR DISCHARGE OF FILL

The wetland types within the proposed 1000 West industrial corridor that have not been designated as unsuitable for the discharge of fill material include one small isolated pond, several isolated marsh areas, wet meadows in pastures, and nonirrigated mesic meadows. The isolated pond is almost entirely surrounded by fill material and represents a wetland of limited existing or potential value. The marsh areas that have not been designated as unsuitable for discharge of fill material are small and are either surrounded by cropland or pasture, located within established or designated road rights-of-way, supplemented by irrigation water, or are not hydrologically contiguous with other wetlands. As a result, these marsh areas are considered to be lacking in potential to provide substantial wetland functions and values in the event that the surrounding upland areas are developed and/or the source of irrigation water is eliminated.

The wet meadow areas that have not been designated as unsuitable for fill and the nonirrigated mesic meadow wetlands do not provide the water quality protection or aquatic habitat/food chain support functions typical of wetlands associated with surface water except during seasonal periods of inundation. Although they are supported by a shallow water table that is contiguous with adjacent wetlands, the discharge of fill material into the wet meadows or nonirrigated mesic meadows would not interfere with the hydrology of those adjacent wetlands. The species composition and structure of the vegetation in these wetland types closely resembles those of surrounding irrigated pastures, resulting in a close similarity of terrestrial habitat, recreation, and heritage values. Considering this similarity in functions and values of these wetlands to characteristics of irrigated upland pastures within the corridor and the extent of existing disturbance to the natural topography and surface hydrology of these wetlands, most of the wet meadows in pastures and the nonirrigated mesic meadows have not been identified as unsuitable for the discharge of fill material.

TOTAL POTENTIAL WETLAND IMPACTS WITHIN 1000 WEST CORRIDOR

The total wetland area that has been identified as unsuitable for the discharge of fill material includes 2.88 acres of ponds, 5.74 acres of marsh, and 9.47 acres of wet meadow or wet meadow with trees. Of the remaining wetland area, 20.43 acres have been proposed as buffer areas. The remaining

89.11 acres of wetlands within the proposed 1000 West industrial corridor could potentially be filled under the general permit issued for the Special Area Management Plan (Figure 3). However, it is likely that avoidance and minimization of wetland impacts during the planning phases of individual projects will reduce the actual acreage of wetlands that will be filled under the permit. The quantity and type of fill material to be discharged into this area will be determined on a site-specific basis by the types of development to be implemented within the corridor.

In addition to the potential direct impacts to wetlands due to the discharge of fill material, all of the wetland areas with the proposed industrial corridor will be subject to the indirect impacts of development on adjacent upland areas. Those impacts are likely to include increased human activity, increased traffic, increased runoff from impermeable surfaces, decreased water quality of surface runoff, and a variety of other potential reductions in environmental quality. In order to protect the wetlands providing the greatest diversity of wetland functions and values, as well as the most site-specific wetland functions and values, the areas designated as unsuitable for the discharge of fill material are widely distributed and somewhat isolated from one another. As a result, they are vulnerable to the indirect impacts of development on surrounding upland areas. However, the protection and enhancement of habitat within the buffer areas around the wetlands designated as unsuitable for fill, as well as City regulations regarding stormwater runoff and land use within the wetlands and the buffers, will minimize the indirect impacts to the designated wetlands.

CONSEQUENCES OF WETLAND DESIGNATION

The wetland and buffer areas designated as unsuitable for the discharge of fill material will not be included in the general 404 permit for the proposed 1000 West industrial corridor. Land owners may apply to the U.S. Army Corps of Engineers for individual 404 permits to fill these wetlands without assistance from the City of Logan; however, there will be no advantage to applying for individual permits. Although the buffer areas that are not located in jurisdictional wetlands do not require a 404 permit for the discharge of fill material, the City of Logan will establish a policy to deny requests for building permits for the areas so designated. Deed restrictions will be required for the wetland and buffer areas designated as unsuitable for fill which will limit future changes to those areas to approved measures to

improve the quality of the wetlands and associated upland habitat. The U.S. Army Corps of Engineers and the Environmental Protection Agency will also establish a policy to vigorously pursue violations of Section 404 of the Clean Water Act within the 1000 West industrial corridor, with orders to remove illegally discharged fill material and fines administered as appropriate.

All of the wetland area within the proposed 1000 West industrial corridor that has not been identified as unsuitable for the discharge of fill material will be covered under the general 404 permit issued for the Special Area Management Plan. The U.S. Army Corps of Engineers will issue a set of specific conditions with the general 404 permit that will clearly delineate the procedures to be completed in order to qualify for a permit to discharge fill on a specific parcel within the 1000 West industrial corridor. A preliminary set of procedures for notification of the Corps of the intent to fill has been discussed in pre-submittal meetings and includes the following:

1) Identification of wetlands designated as unsuitable for the discharge of fill material and proposed buffer areas within the property proposed for development.

2) Total avoidance of project impacts to wetlands designated as unsuitable for the discharge of fill material and to buffer areas. Adjustment of project plans to avoid all other wetlands on the property to the extent practicable while maintaining the project purpose.

3) Minimization of project impacts to wetlands not designated as unsuitable for the discharge of fill material on the property to the extent practicable while maintaining the project purpose.

4) Development of plans to provide mitigation for unavoidable wetland impacts. The current condition of the wetlands designated as unsuitable for discharge of fill material and the proposed buffer zones is generally degraded by the impacts of grazing and other agricultural and industrial activities in the vicinity. The opportunity exists for substantial enhancement and restoration of the potential of these wetlands to provide the functions and values inherent to them and to improve the condition of downstream wetlands with which they are hydrologically connected. Land owners seeking to develop property on which the wetlands identified as unsuitable for the discharge of fill material and the proposed buffer zones are located will be required to consider the enhancement of the functions and values of the wetlands and restoration of natural channel patterns and riparian wetlands within the buffer zones as their first priority in developing a plan to provide compensatory mitigation. As part of such enhancement,

contiguous wetlands will be created and screening vegetation will be planted within the proposed buffer areas associated with those wetlands. The enhancement of the water quality protection and improvement functions of the on-site wetlands will be emphasized.

Second priority will be assigned to restoration and enhancement of other on-site wetlands within the property boundaries that will not be affected by the proposed development on the property. Third priority will be assigned to the restoration and enhancement of off-site wetlands and final priority will be assigned to the creation of off-site wetlands as mitigation. Off-site wetland creation may include the use of mitigation credits provided by the mitigation wetland to be developed by the City of Logan at a site adjacent to the landfill. Use of the mitigation wetland acreage developed by the City at the site adjacent to the landfill will be minimized by requiring prospective developers to consider avoidance and minimization of wetland impacts within the industrial corridor, as well as on-site mitigation and hydrologic restoration of off-site wetlands, prior to consideration of the City-sponsored mitigation. Plans for the development of the mitigation wetland and its use as a mitigation bank are included in this Special Area Management Plan.

The creation of additional wetland area and the restoration of wetland hydrology to previously impacted wetlands will receive more mitigation credit than will wetland enhancement activities, such as revegetation, exclusion of grazing, control of noxious weeds, and other activities that increase the value of the wetlands without increasing the acreage. However, the mitigation proposed for any specific project will be evaluated as a package with regard to proposed improvements in wetland functions and values. Final determination of the adequacy of proposed mitigation to compensate for the impacts to wetlands of any proposed development will be at the discretion of the U.S. Army Corps of Engineers.

5) Submittal to the U.S. Army Corps of Engineers of a notification document including a description and map of the wetland areas to be filled, a description of the amount and type of fill material to be used, and a description of the mitigation activities to be implemented to compensate for unavoidable impacts to wetlands on the project site. If the amount of wetland area to be impacted by the project is less than one acre, the Corps will process the application within 30 calendar days without soliciting comment from the other resource agencies. If the area of wetland impact is greater than one acre, comment from the other resource agencies will be solicited and the application processing may take more

than 30 calendar days.

SPECIAL AREA MANAGEMENT PLAN SUMMARY

The City of Logan, Utah proposes to develop an industrial corridor centered on 1000 West between 300 South and 1800 North in Logan, Utah. According to a delineation of jurisdictional wetlands within the proposed corridor, 12.3 percent of the area within the corridor supports jurisdictional wetlands. Using an assessment of the functions and values associated with the wetlands within the corridor, a total of 18.09 acres of wetlands have been identified as unsuitable for future development involving any activities that would interfere with those functions and values. Buffer areas have also been proposed, within which project proponents will be restricted from development activities and encouraged to provide mitigation for wetlands impacted elsewhere on the property by enhancement and restoration activities. The remaining wetland areas within the 1000 West corridor will be included in a general 404 permit from the U.S. Army Corps of Engineers. The general 404 permit will allow the discharge of fill material into those wetlands in exchange for mitigation for projects that comply with a strict set of conditions to be specified by the U.S. Army Corps of Engineers.

WETLAND MITIGATION PLAN

In order to compensate for some of the impacts to wetlands caused by industrial development within the 1000 West corridor and elsewhere within the City limits, the City of Logan proposes to create mitigation wetlands on a site adjacent to the sanitary landfill. The mitigation will provide large areas of contiguous wetlands representing a variety of wetland types. The mitigation areas will be protected from the impacts of future development and will be set aside for nonconsumptive, nondisruptive uses only. By consolidating the wetland mitigation required by numerous projects within the 1000 West corridor and elsewhere within the City of Logan, a more valuable wetland resource will be created than would be provided by on-site or off-site mitigation for each individual project.

Evaluations of the environmental conditions at the landfill are currently underway. It is anticipated that these evaluations may indicate the need for adjustment of drainage patterns in and adjacent to the landfill to insure protection of water quality and existing wetlands. Such adjustments may require the use

of portions of the site adjacent to the landfill for the development of wetlands for the treatment of water quality or for the accommodation of surface water discharges from the landfill. The necessity for such uses of the site is currently unknown and will be determined at a future date. Such uses would be designed to be compatible with the wetland mitigation areas on the site and hydrologically separate from them.

The following wetland mitigation plan describes conceptually the activities to be implemented on the borrow site adjacent to the Logan municipal landfill in order to create wetlands for use as mitigation for impacts of development within the proposed 1000 West industrial corridor and elsewhere in the City of Logan.

Objectives

The specific objectives of the mitigation plan are:

1) To describe the proposed site for wetland creation;

2) To provide a conceptual plan for the development of mitigation wetlands to compensate for impacts to wetlands within the 1000 West industrial corridor and/or elsewhere in the City of Logan; and

3) To describe the mitigation activities to be implemented to accomplish the establishment of the mitigation wetlands.

Proposed Wetland Mitigation Site

The proposed wetland mitigation site consists of approximately 153 acres of land located in two parcels approximately 1000 feet west of the existing Logan sanitary landfill (Figure 4). Approximately 128 acres of the mitigation site are presently used for farming and grazing cattle, with the remaining 25 acres being used as a borrow area for fill for the landfill. The site ranges in elevation from 4415 feet to 4430 feet MSL.

The geology of the proposed wetland mitigation site consists of Quaternary alluvial and floodplain deposits (JMM 1989). These deposits include thick layers of fine-grained sediments interbedded with lenses of coarser sediments that were deposited by Lake Bonneville from approximately 13,000 to 25,000 years ago (Figure 5). The coarser layers represent aquifers, many of which are characterized by artesian conditions (JMM unpublished). At least one artesian well is currently flowing in the southwest portion of the larger mitigation parcel.

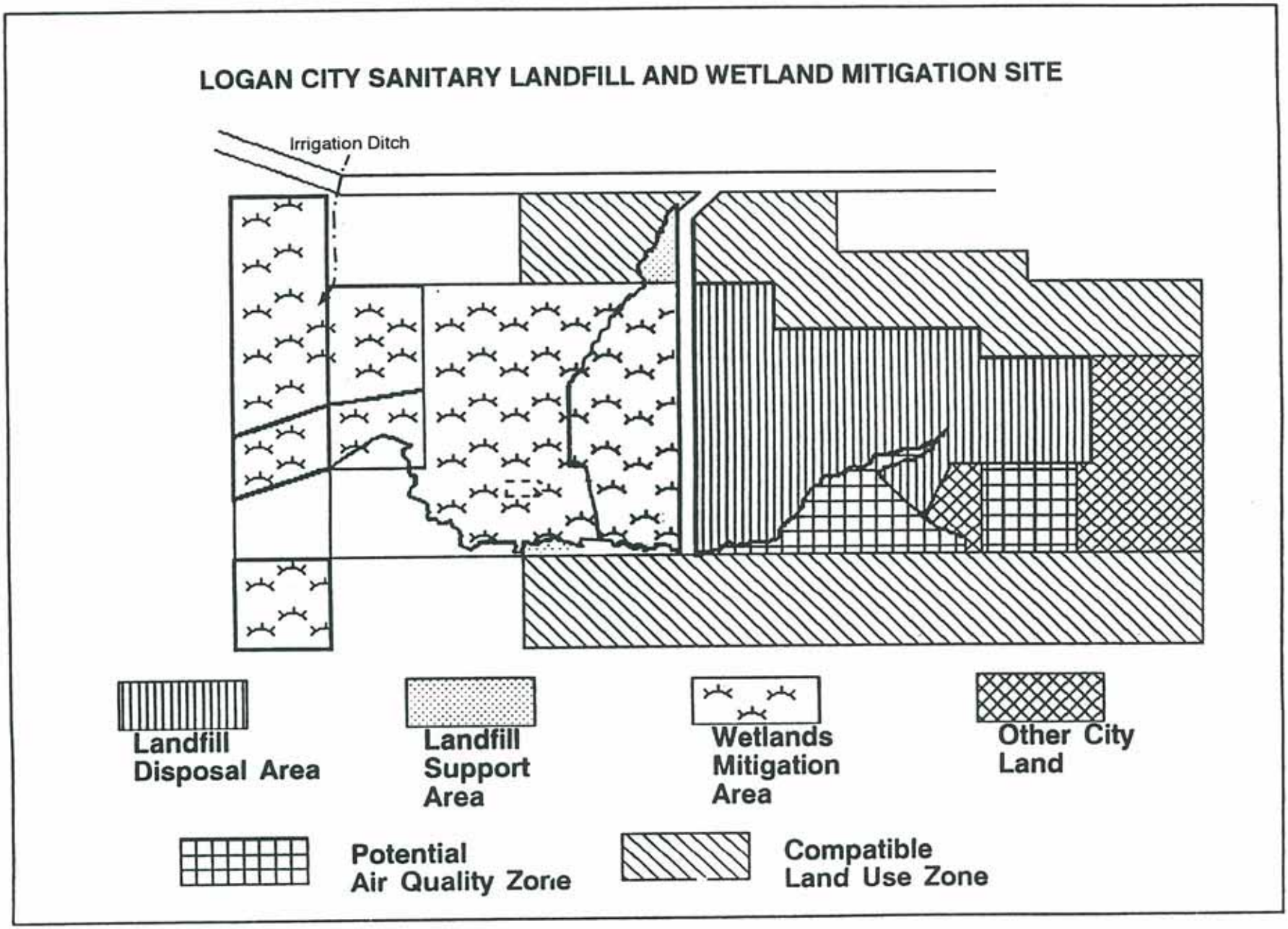
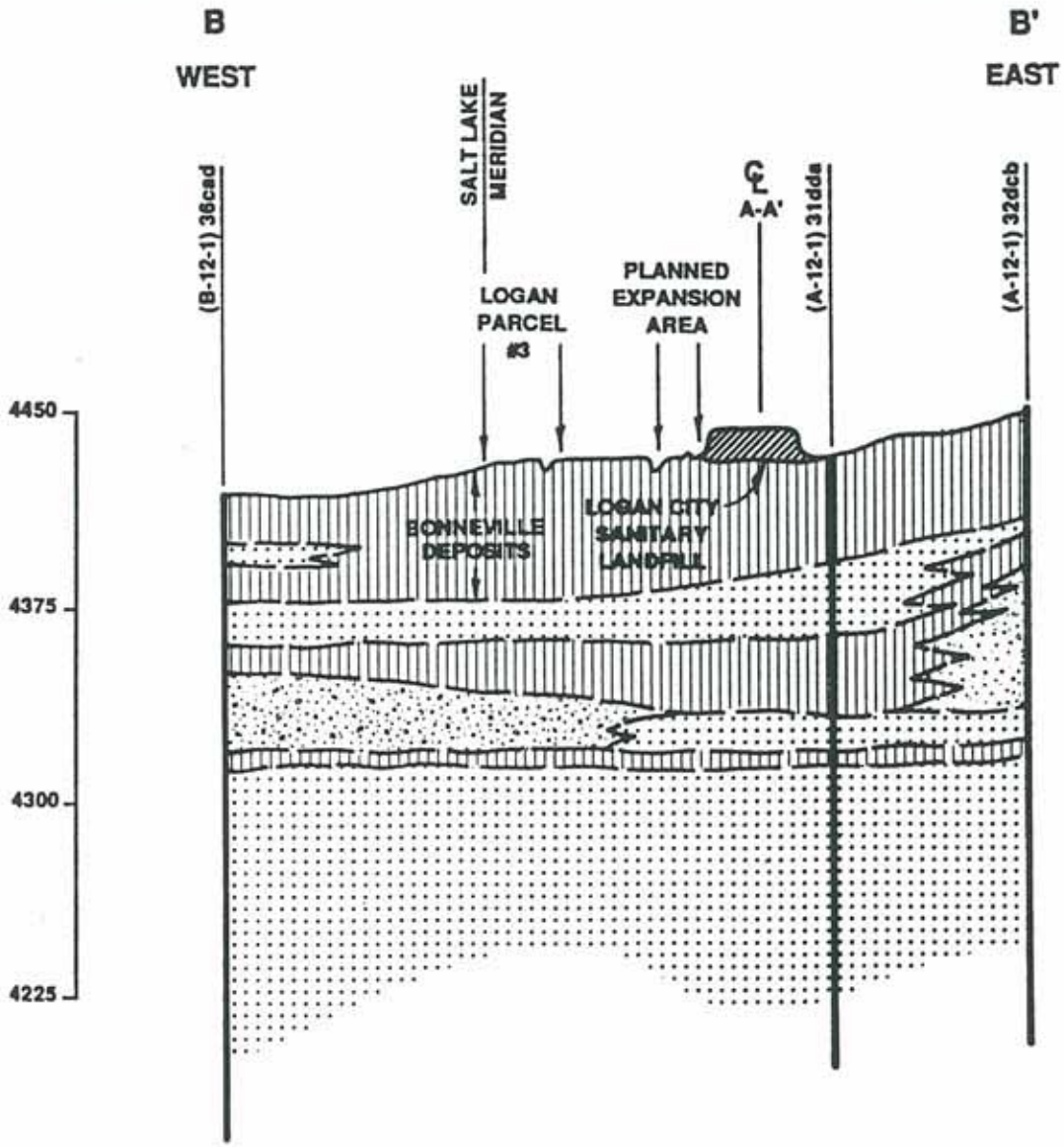
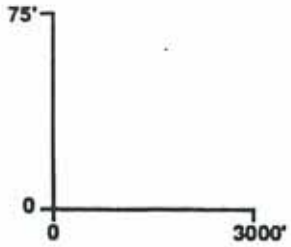


FIGURE 4. Proposed wetland mitigation site and adjacent landfill.





HORIZONTAL 1"= 3000'
VERTICAL 1"= 75'

LEGEND

- SAND / GRAVELS
- CLAY
- DIRTY SAND

NOTE: SOILS NOT CLASSIFIED UNDER UNIFIED SOIL CLASSIFICATION SYSTEM -DESIGNATIONS INFERRED FROM BOREHOLE DATA

* UTAH WELL-NUMBER BASED ON THE CADASERAL LAND SURVEY SYSTEM OF THE U.S. GOVERNMENT

James M. Montgomery
Consulting Engineers Inc.

FIGURE 5. Surficial materials cross-section of wetland mitigation site.

Surficial and near-surface soil types in the wetland mitigation study area are described as interbedded silty clays and clayey silts with occasional silty fine sand seams. Below depths of about 14 feet, the soils contain less fine sand and silt and are described as highly plastic clays. Laboratory percolation tests indicate that the vertical permeability in these soil types range from 6×10^{-7} to 4×10^{-8} cm/sec (JMM 1989). The highly plastic clays act as an aquiclude that perches shallow groundwater above and confines deeper, artesian groundwater below.

Beneath most of the wetland mitigation study area, shallow groundwater is present at depths ranging from about one foot to about five feet. Depths can vary locally with seasonal fluctuations in the amount of surface recharge (i.e., infiltration from precipitation and irrigation) (Figure 6 and Table 5). The shallow groundwater generally flows downgradient from the northeast toward the southwest. Data obtained from ongoing monitoring of piezometers on the site will be analyzed later this year in order to more accurately describe the direction and rate of flow of shallow groundwater under the landfill and the wetland mitigation site. According to available well logs from the area, the deeper artesian aquifers lie at depths ranging from about 100 to 150 feet below the ground surface (JMM 1989).

Surface water flows east to west through a channel along the southern edge of the larger parcel of the wetland mitigation site and north to south through a channel that divides that parcel into two unequal areas (Figure 7). Both channels are incised as much as 10 feet below the surrounding land surface and probably act as drains that lower the shallow groundwater in their immediate vicinity. Surface water flowing in these channels originates from seeps and springs, irrigation water, and precipitation run-off from commercial, industrial and farmland areas to the east and north. Water in the streams ultimately drains to the Logan River southwest of the study area.

Vegetation cover types on the wetland mitigation site include 7.6 acres that have been classified as wetland by the wetland delineation (ERI/WHA 1990, 1991a). Wetland and upland cover types on the proposed mitigation site are summarized in Table 6 and illustrated in Figure 8.

The proposed wetland mitigation site will be used as a borrow area for the Logan sanitary landfill. In order to provide cover material for future operation of the existing landfill, the City proposes to remove several feet of soil material from portions of the upland cover types on the proposed wetland mitigation area as needed over the next thirty years. Removal of surface material from the mitigation site will provide conditions conducive to the creation of wetlands due to the shallow water table under the site.

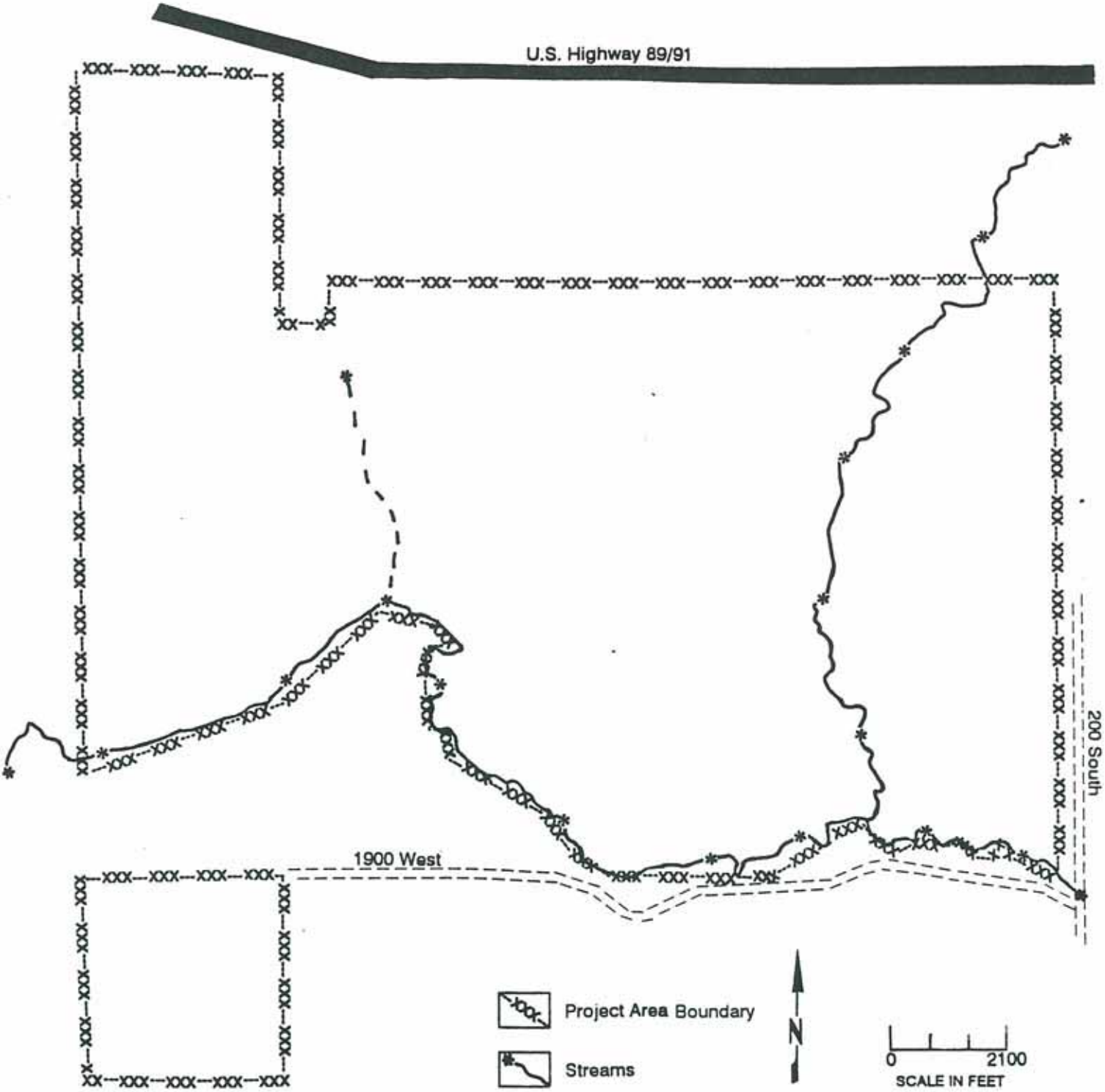


FIGURE 7. Site map of wetland mitigation area.

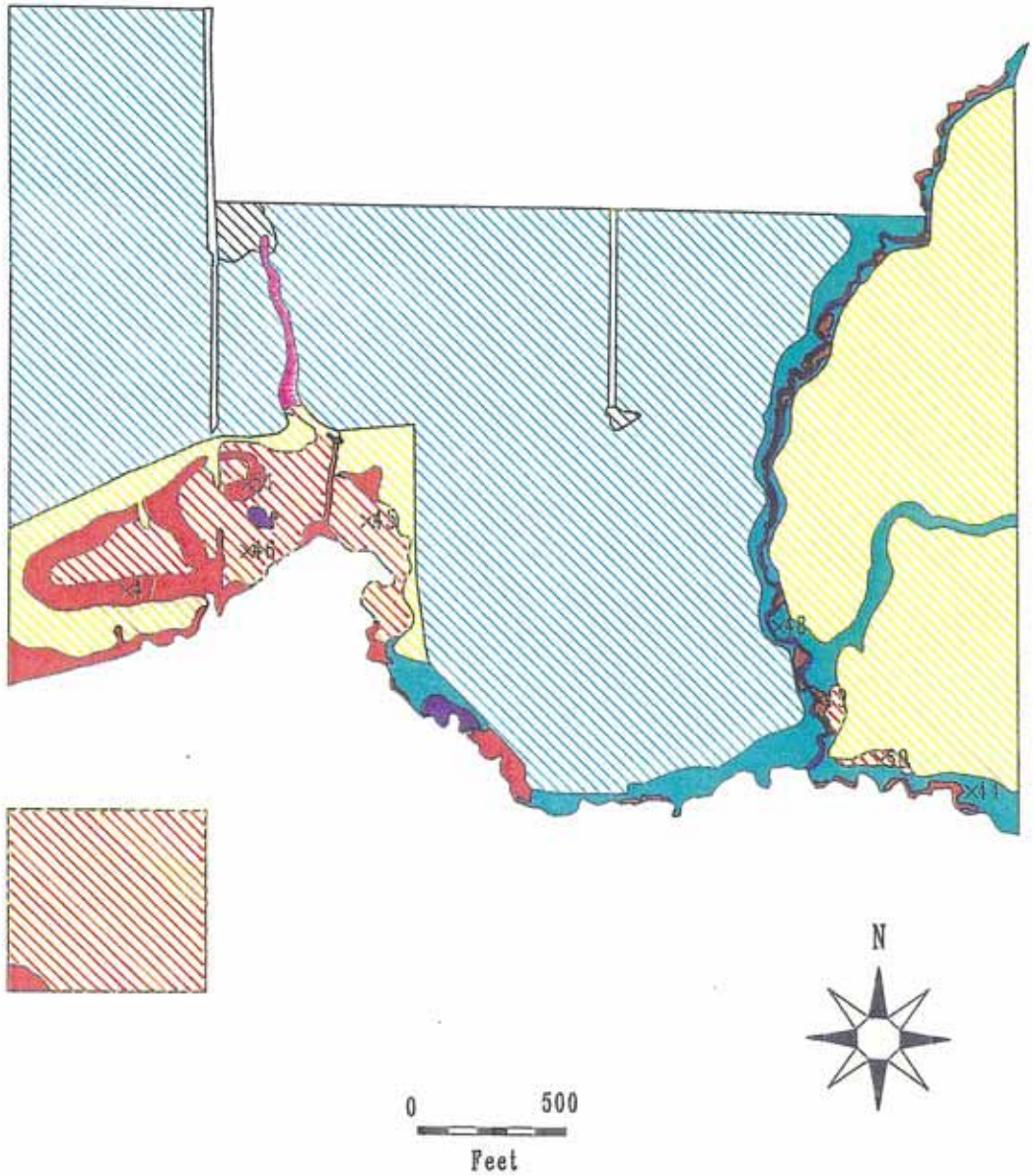


FIGURE 8.

Existing vegetation types on proposed wetland mitigation site.

Legend

- Pond°
- Marsh°
- Wet Meadow°
- Mesic Meadow
- Dry Meadow
- X Description Site
- Crop Land
- Riparian Weeds
- Willow
- Filled
- Road
- ° Wetland

TABLE 5. Water table elevations between November and April on the proposed wetland mitigation site.

LOCATION	WATER TABLE ELEVATIONS BY DATE					
Piezometer Designation	11/08/90	12/06/90	01/07/91	02/05/91	03/06/91	04/08/91
P-10	4412.24	4418.67	4419.44	4419.81	4421.36	4419.71
P-11	4420.70	4421.34	4421.56	4421.66	4422.82	4421.96
P-12	4421.43	4421.75	4422.35	4422.35	4422.97	4422.85
P-13	<4404.40	4405.29	4405.65	4405.80	4410.20	4411.40
P-14	4416.07	4416.23	4416.12	4416.05	4416.64	4416.16
P-15	4415.96	4416.52	4416.88	4416.88	4418.08	4417.48
P-16	4424.91	4423.03	4424.39	4424.14	4427.64	4425.99

TABLE 6. Acreage and relative extent of wetland types on the proposed mitigation site.

VEGETATION TYPE	STATUS	ACRES	PERCENT
Pond	Wetland	0.76	0.5
Marsh	Wetland	0.49	0.3
Wet Meadow	Wetland	6.08	4.0
Willow	Wetland	0.25	0.2
TOTAL		**7.58**	**5.0**
Mesic Meadow	Upland	15.95	10.4
Dry Meadow	Upland	35.08	22.9
Riparian Weeds	Upland	8.44	5.5
Cropland	Upland	84.49	55.0
Filled	Upland	0.82	0.5
Road	Upland	1.04	0.7
TOTAL		**145.82**	**95.0**

Conceptual Wetland Mitigation Plan

The goal of the wetland mitigation is to create wetlands on the mitigation site that will provide compensation for the wetland functions and values that will be lost due to impacts by development to wetlands within the 1000 West industrial corridor and at other sites. In order to accomplish this goal, mitigation activities will be implemented to provide conditions adequate for the development of wetlands similar to those to be impacted within the industrial corridor. Replacement of wetlands will not be strictly in-kind in order to provide greater habitat diversity on the mitigation site than is currently present on the area to be impacted. However, the types of wetlands to be created on the mitigation site will be representative of the predominant wetland types within the proposed industrial corridor and within other areas of potential development in the City of Logan.

Topography - In order to meet the projected requirements of the landfill over the next 30 years, an estimated 1.4×10^6 cubic yards of fill material must be removed from the proposed mitigation site. The removal of the material will lower the surface elevation of the entire area by several feet, which will result in the proximity of the soil surface to the shallow water table that underlies the mitigation site. The resulting shallow water table conditions will provide the opportunity to create wetlands as mitigation for impacts to wetlands elsewhere. Wetland habitat diversity will be created by the establishment of topographic diversity on the mitigation site. Topographic diversity will result in the establishment of a diversity of water regimes that will support different wetland plant community types with their associated habitat values.

Figures 9a through 9d illustrate one configuration of post-excavation topographic conditions that would provide both the required amount of fill material for the landfill and the necessary topographic and hydrologic conditions conducive to the establishment of self-sustaining mitigation wetlands. The surface contours depicted in Figures 9a and 9c are the **target elevations**, which represent the elevations of the soil surface over the mitigation site following successful completion of wetland construction activities. The establishment of final topography on the wetland mitigation site will take place in phases as fill material is required by the landfill. In general, each phase of excavation will include site preparation for wetland mitigation within a subbasin between 5 and 10 acres in size. Most of the area within each wetland mitigation subbasin will be excavated to the current elevation of the water table or below. The elevation

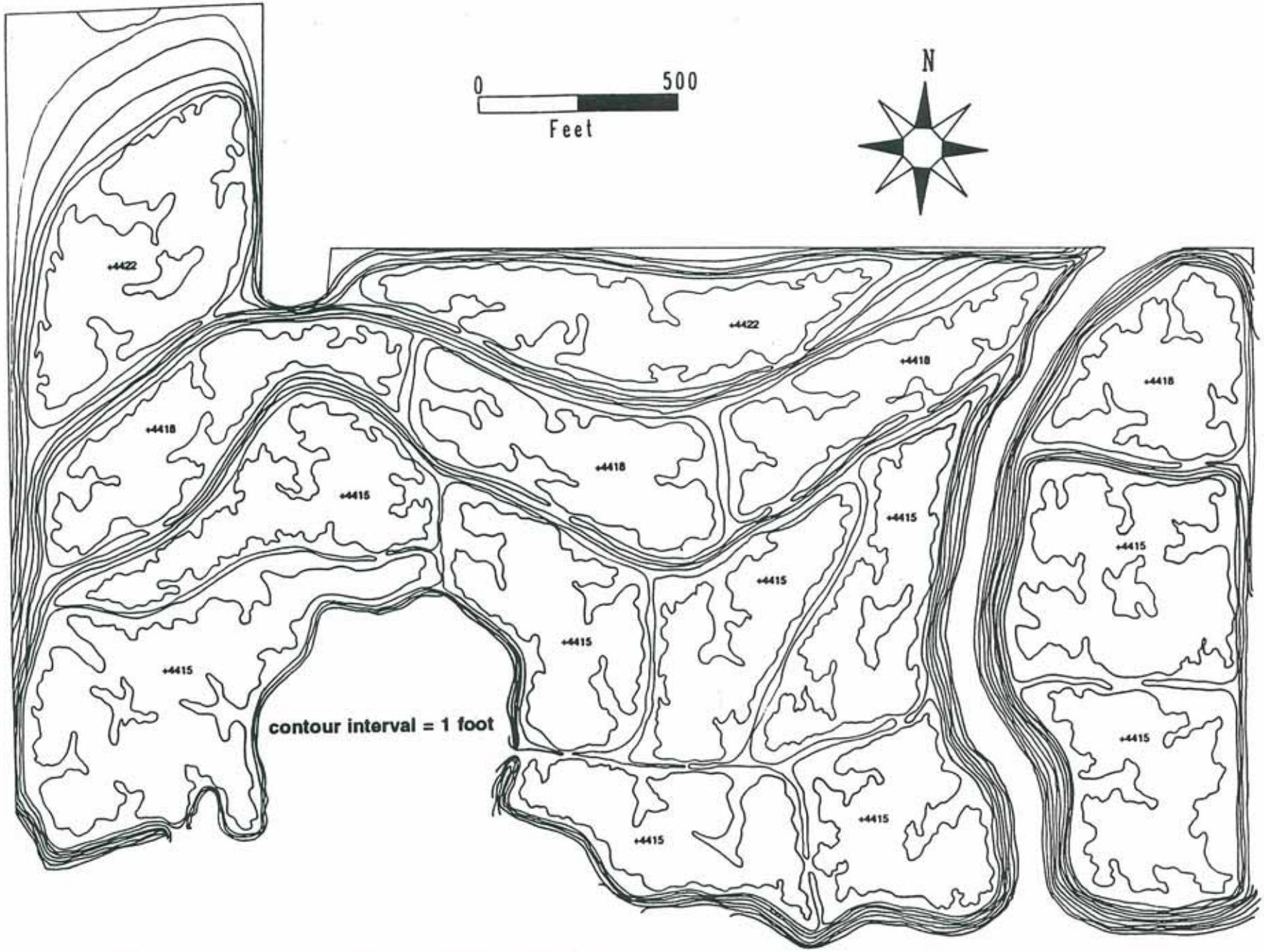


FIGURE 9a. Proposed topography on wetland mitigation site.

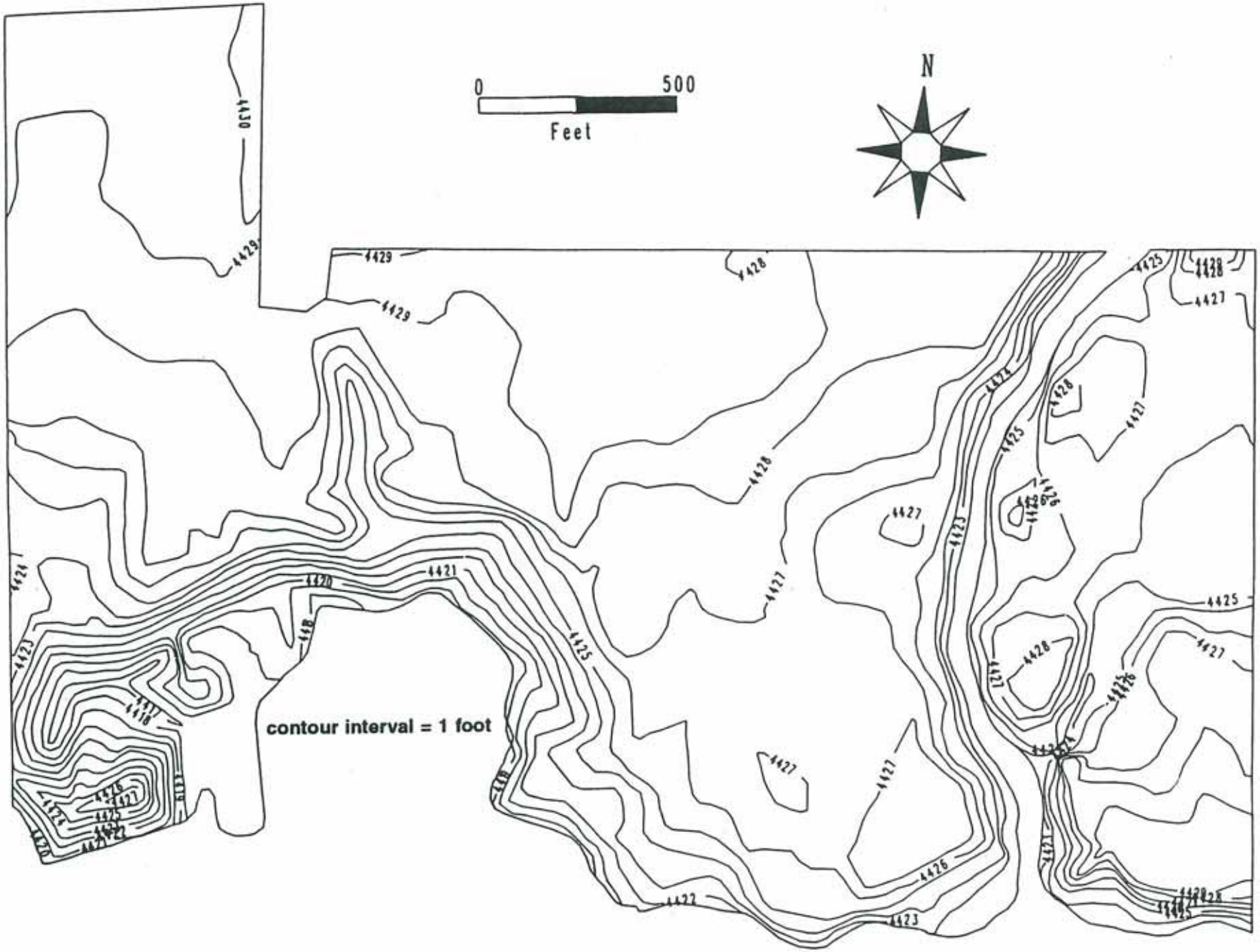


FIGURE 9b. Existing topography on wetland mitigation site.

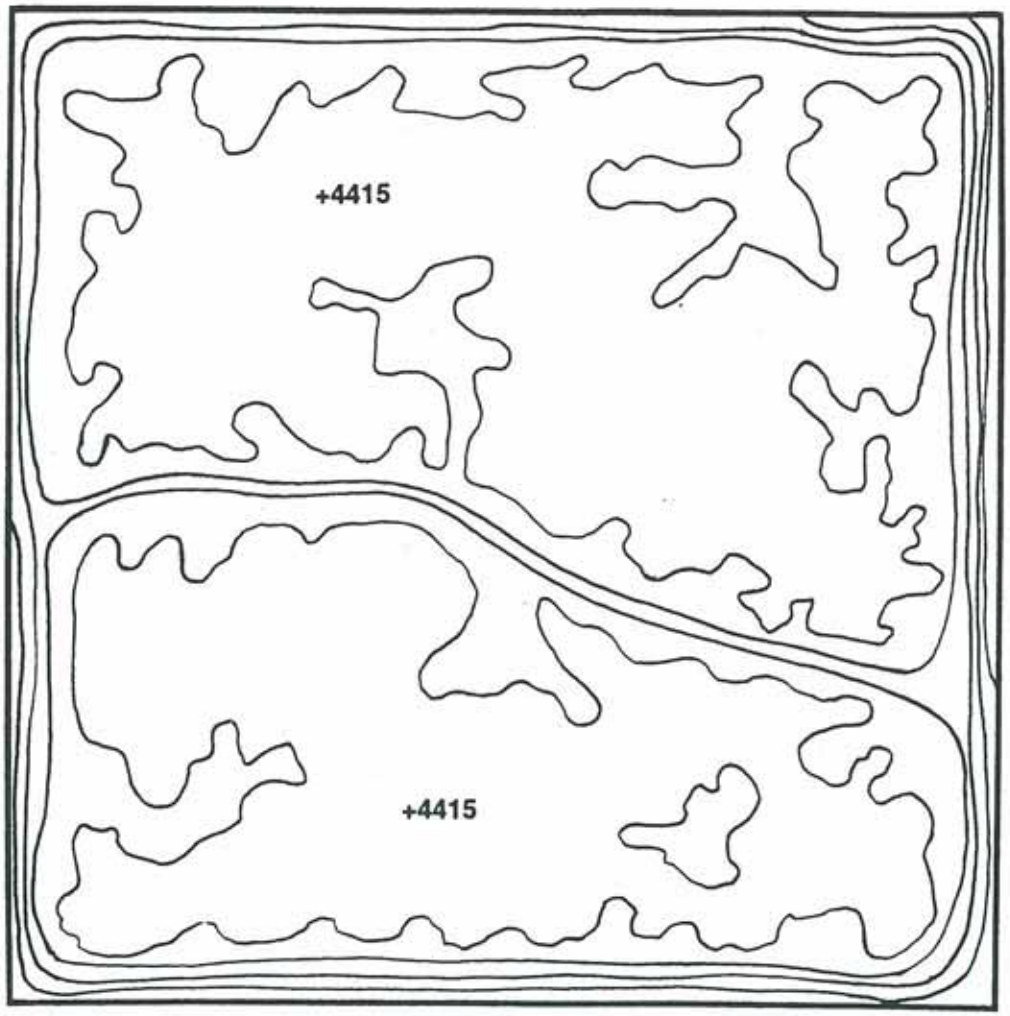


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FIGURE 9c. Proposed topography on smaller parcel of wetland mitigation site.

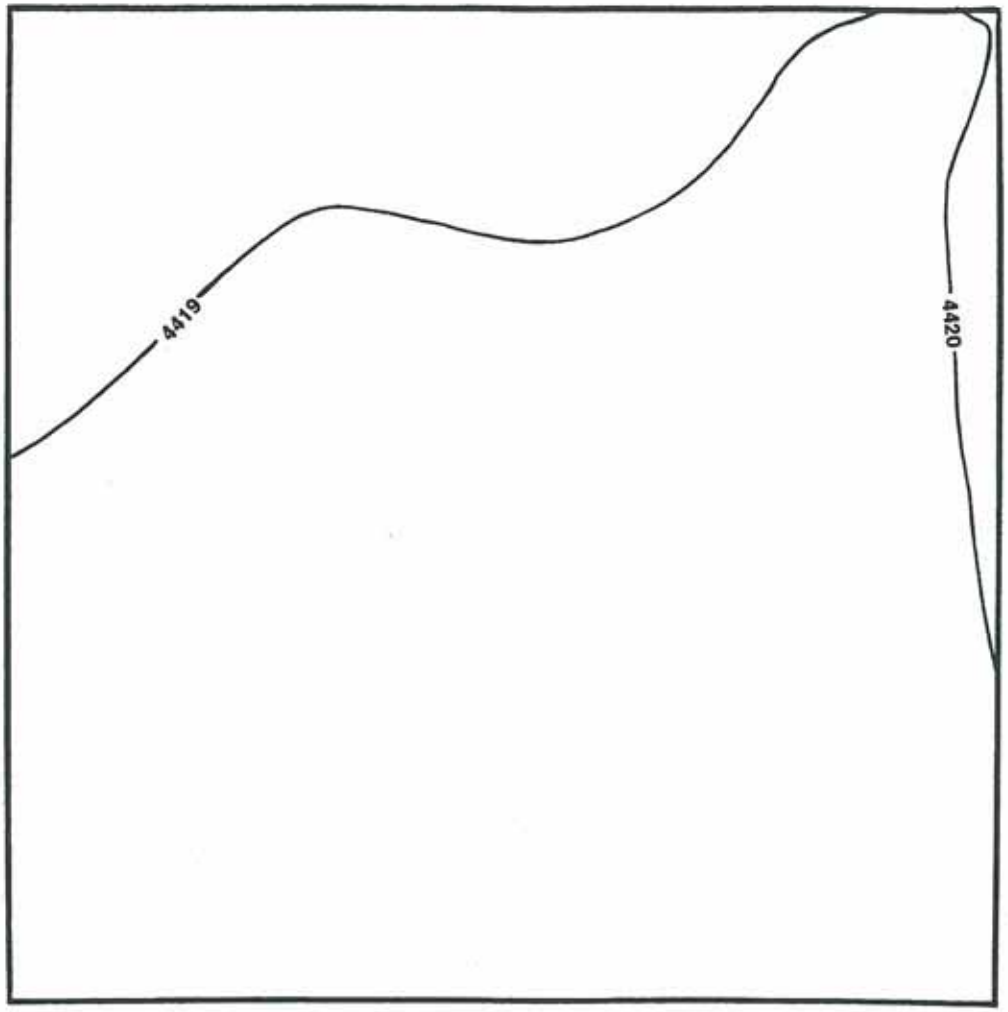

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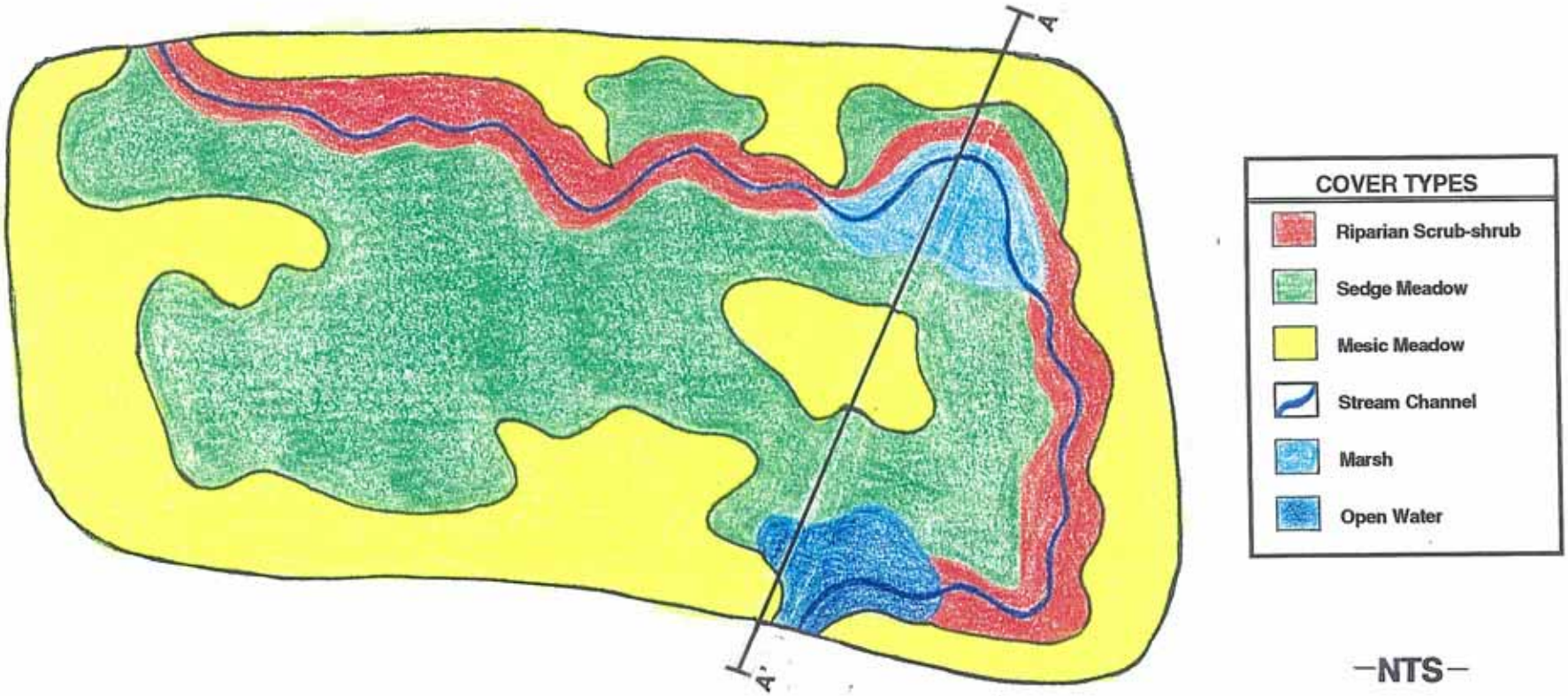
FIGURE 9d. Existing topography on smaller parcel of wetland mitigation site.

of the ground surface following excavation will be located at least one foot below the target elevation, to allow for the application of one foot or more of topsoil. If more than 5 to 10 acres of wetland mitigation is required before the landfill has a need for the fill material, it will be possible to excavate the material from the mitigation site and store it elsewhere until it is required by the landfill.

The final topography represented by the target elevations will resemble the natural topography of wetland mosaics elsewhere in Cache Valley (Figures 9a and 9c). The soil surface will be gently undulating between elevations approximately 6 inches above the base level of the water table during the dry season and 18 inches above the base water table level during the dry season (Figure 10). The undulating topography will provide conditions adequate for the development of sedge meadows subject to seasonal inundation and permanent shallow depths to saturation on the lower elevation positions. Conditions on the higher elevation positions will be adequate to support mesic meadows subject to seasonal soil saturation and moderate depths to saturation during the dry season. Topographic relief will be designed to provide low ridges around the perimeters of the subbasins in order to separate developing mitigation wetlands within completed subbasins from surface flows off of adjacent areas in which excavation may be ongoing.

One or more very shallow, meandering stream channels will be excavated to a depth six inches below the base water table level during the dry season in order to intercept the groundwater and provide wetland habitat associated with surface flows. In particular, the stream channels will be located along the perimeters of the subbasins that separate them from subbasins to be developed later in order to take advantage of the screening properties of the riparian vegetation along the channels during subsequent construction periods. The gradient of the channels will be very flat (0.2% to 0.3%), but will tend very slightly toward the southwest in order to augment the natural groundwater flow pattern in that direction. One or more widened reaches will established along each stream channel to depths from 0 to 6 inches below the base level of the water table during the dry season in order to provide sites for marsh habitat establishment. In addition, deep (greater than 4 feet below the base water table level during the dry season) on-channel ponds will be excavated in at least some of the subbasins.

If it is not feasible to provide shallow groundwater conditions under the wetland mitigation site due to hydrologic constraints, the constructed topography of the subbasins will be slightly different than



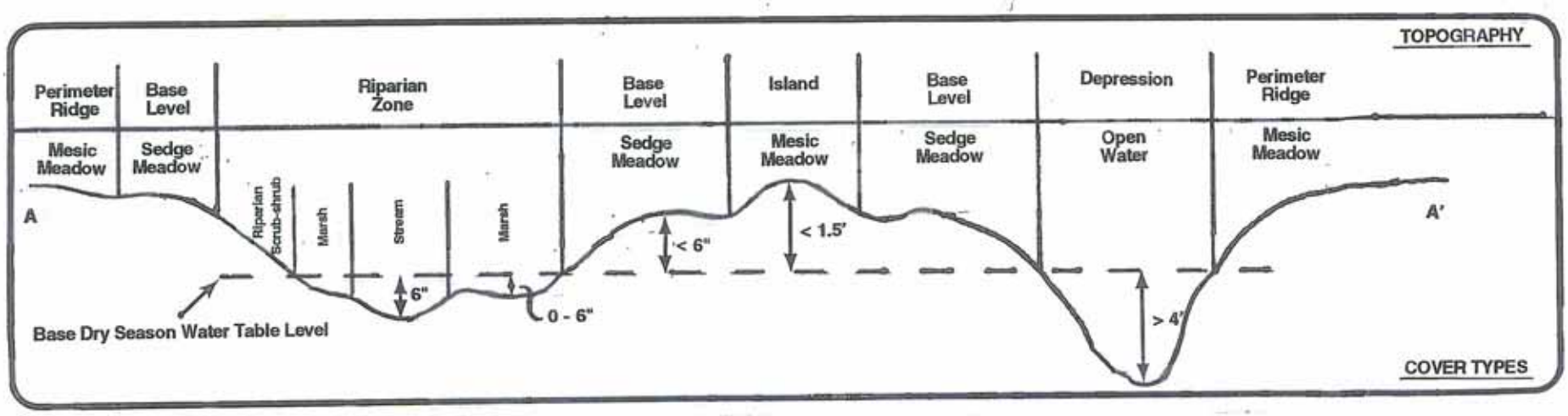
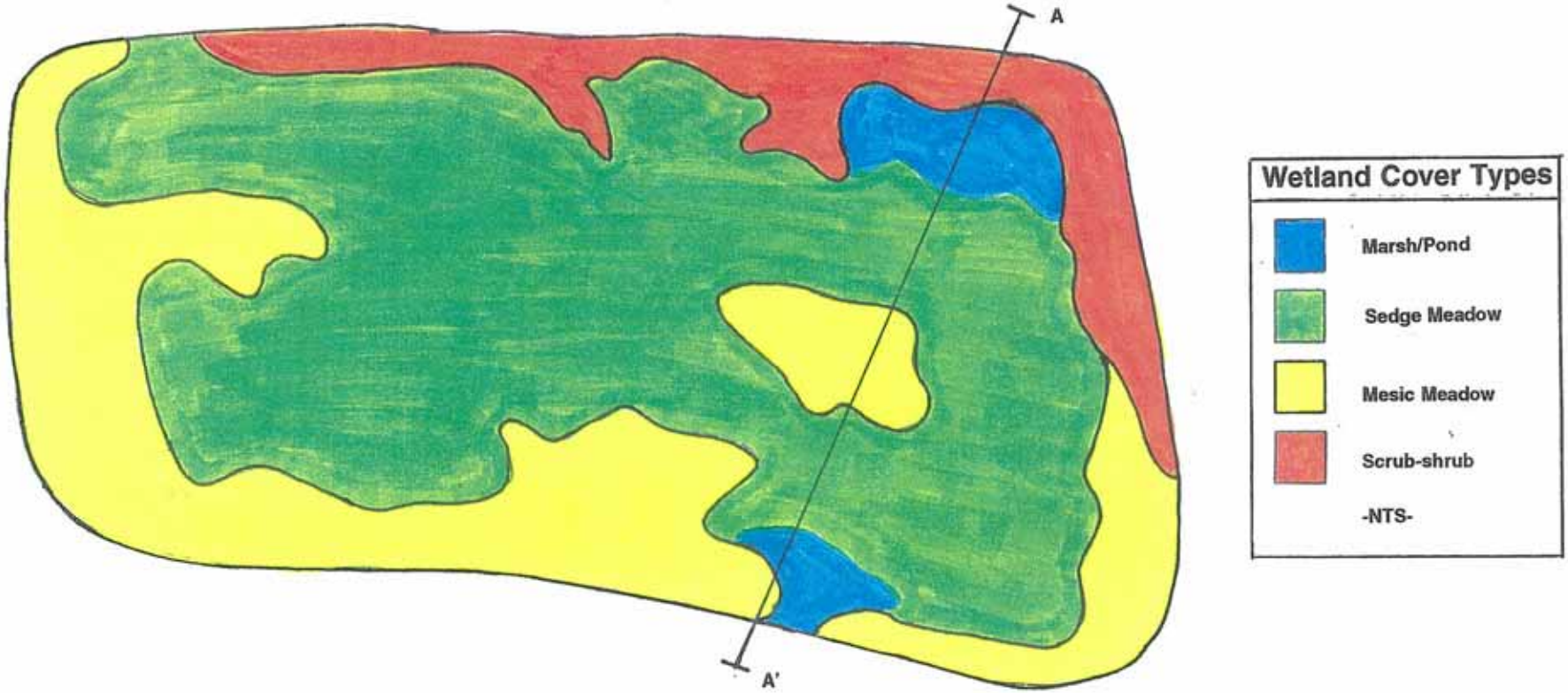


FIGURE 10. Plan view and profile of cover types within typical wetland subbasin with groundwater as source of wetland hydrology.

described above. The subbasins will be shallowly concave with the soil surfaces within the sedge meadow areas (Figure 11) between 0 and 6 inches above the crest elevations of the spillways connecting with downstream subbasins. The soil surfaces within the mesic meadow areas (Figure 11) will be located within 6 to 18 inches of the crest elevations of the spillways. The soil surface within the marsh areas (Figure 11) will be located within 0 to 12 inches below the crest elevations of the spillways between subbasins. A few of the marsh areas will include areas excavated to more than 4 feet below the crest elevation of the spillways in order to provide open water habitat on the site.

Hydrology - Shallow groundwater will be the preferred source of wetland hydrology for the mitigation wetlands. As described previously, most of the proposed mitigation site is currently underlain by shallow groundwater in sand lenses at depths from the soil surface ranging from less than two feet to more than 8.5 feet (Figure 6). As a result of excavation of the site to obtain fill material for the landfill, the average post-construction soil surface will be located in proximity to or below the current elevation of the groundwater at its lowest seasonal level (Figures 6, 9a, and 9c). It is anticipated that the post-construction base water table elevation during the dry season will be located approximately 6 inches above the bottoms of the stream channels and less than 18 inches below the soil surface over most of the mitigation site, as indicated in Figure 10. The resulting proximity of the soil surface to the water table will provide conditions adequate for the establishment of wetland vegetation.

Where excavation intercepts the current level of the water table, the groundwater will inundate the stream channels, with their widened reaches and deeper ponds. The base level of the water table during the dry season will be located up to six inches below the soil surface in the sedge meadow areas and up to eighteen inches below the soil surface in the mesic meadow areas (Figure 10). As planned, excavations for the wetland mitigation will not extend to depths below the top of the clay aquiclude (i.e., deeper than about 14 feet) and the proposed changes should not impact the hydrogeologic character of this unit. The upward hydraulic gradient that isolates the underlying deeper artesian aquifers from shallow groundwater infiltration will not be affected and impacts to the shallow groundwater will be limited to minor elevation changes in the immediate vicinity of the mitigation area. While some lowering of the shallow groundwater surface is likely due to increases in evapotranspiration rates, the amount and direction of shallow groundwater flow in the general area should not be significantly altered.



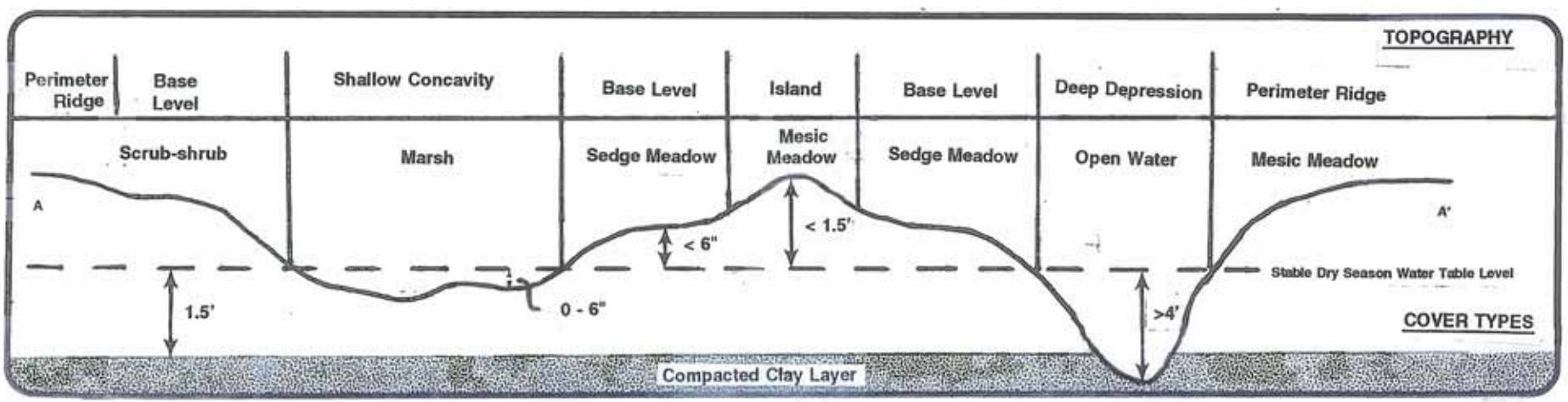


FIGURE 11. Plan view and profile of cover types within typical wetland subbasin with surface water as source of wetland hydrology.

Piezometer data indicate that water table levels are shallow enough to provide soil saturation or inundation of the wetland creation subbasins and that a clay layer at approximately elevation 4410' to 4413' will prevent drainage of the groundwater under the site. However, if the water table proves to be discontinuous or excavation fails to provide conditions of shallow inundation or at least seasonal soil saturation, surface water is available on the site to provide wetland hydrology to the larger mitigation parcel. The City owns water rights to irrigation water that enters the larger parcel near the northwest corner (Figure 7). This water source may be permanently established to supply flow into the mitigation wetland subbasins in at least the western two-thirds of the larger mitigation parcel. Alternatively, the water in the streams flowing south and west through the larger parcel may be diverted into the created wetlands if necessary to provide perennial wetland hydrology.

Long-term monitoring of piezometers within future areas to be excavated will provide the data from which the necessity of hydrologic augmentation of the groundwater with surface water will be determined. If surface water is required to augment the hydrology of the larger mitigation parcel, water will be distributed over the subbasins via sheet flow without stream channels. A compacted clay layer will be established at elevations two feet below the minimum target soil surface elevations indicated on Figures 9a, 9c, and 11 in order to confine water infiltrating from the surface. Stabilized spillways between subbasins will be established at elevations 18 inches above the elevation of the clay layer to maintain a stable water surface at that level. Topsoil will be applied to the subbasins to establish the target soil surface elevations and topography indicated on Figures 9a and 9c. The stable water surface above the clay layer will provide saturated conditions at elevations 6 inches or less beneath the areas designated for sedge meadow development and 18 inches or less beneath the areas designated for mesic meadow development (Figure 11). One foot of topsoil will be applied over the clay layer in the areas designated for marsh development, resulting in the location of the soil surface at elevations 6 inches below the stable water level. Areas designated for the development of open water conditions will be excavated to elevations greater than four feet below the minimum target soil surface elevations indicated on Figures 9a and 9c. Compacted clay will be applied to these areas but no topsoil will be added.

Soils - If groundwater will be the principal source of hydrology to the wetland mitigation site, one foot of topsoil will be applied over each wetland mitigation subbasin and the interbasin ridges to bring the

soil surface elevations to the target levels. Topsoil will provide a plant growth medium to facilitate the establishment of wetland vegetation. No topsoil will be applied within the stream channels, including the deeper on-channel ponds (greater than 4 feet deep). Topsoil will be applied within the shallow widened reaches of the stream channel in order to support marsh vegetation in those areas.

If surface water will be required to augment the groundwater hydrology of the mitigation site, a layer of compacted clay will be applied to provide a confining layer at elevations two feet below the subbasin minimum target soil surface elevations indicated on Figures 9a and 9c. Topsoil will then be applied to the subbasins to establish the target elevations and topography indicated on Figures 9a and 9c.

Vegetation - The establishment of wetland vegetation on the mitigation site will result in the development of a mosaic of habitat. The vegetation to be established on the wetland mitigation areas will be determined by the water regimes that develop as a result of the topography provided by the excavation activities. Central areas of sedge meadow will be surrounded by and interspersed with slightly higher and drier mesic meadow areas (Figures 12a, 12b, 13a, and 13b). If groundwater is the primary source of hydrology, shallow stream channels with riparian zones of variable width will be established along the perimeters of the subbasins that separate them from areas to be developed later (Figures 12a and 12b). Widened reaches along the stream channels will be shallowly inundated to support marshes and areas of deeper excavation will provide on-channel open water habitat (Figures 12a and 12b). If surface water is the primary source of hydrology, no stream channels will be excavated but zones of scrub-shrub vegetation will be planted along the subbasin perimeters to provide screens for constructed subbasins during subsequent construction (Figures 13a and 13b). Marshes and deeper ponds will be established in the lowest areas of the concave subbasins, which will be excavated below the base water table level.

If groundwater will be the source of the wetland hydrology, emergent hydrophytic plant species will be planted in the shallow, widened reaches along the stream channels. Sedges and rushes will be planted in areas that will be saturated seasonally and in which the ground surface will be located within six inches of the water table during the entire growing season (Figure 10). Mesic meadow vegetation, consisting primarily of hydrophytic grasses, will be planted within the areas in which the ground surface

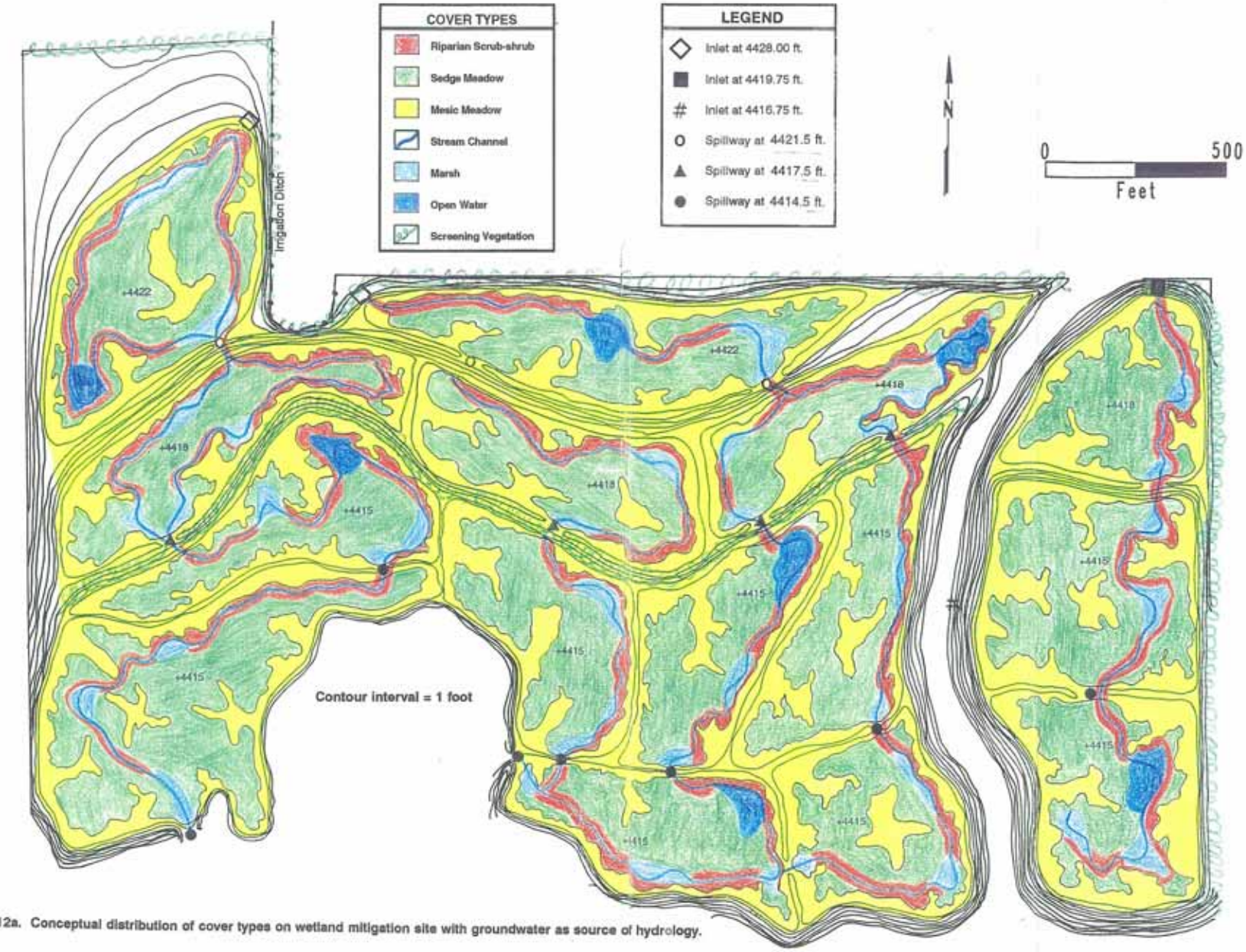


FIGURE 12a. Conceptual distribution of cover types on wetland mitigation site with groundwater as source of hydrology.

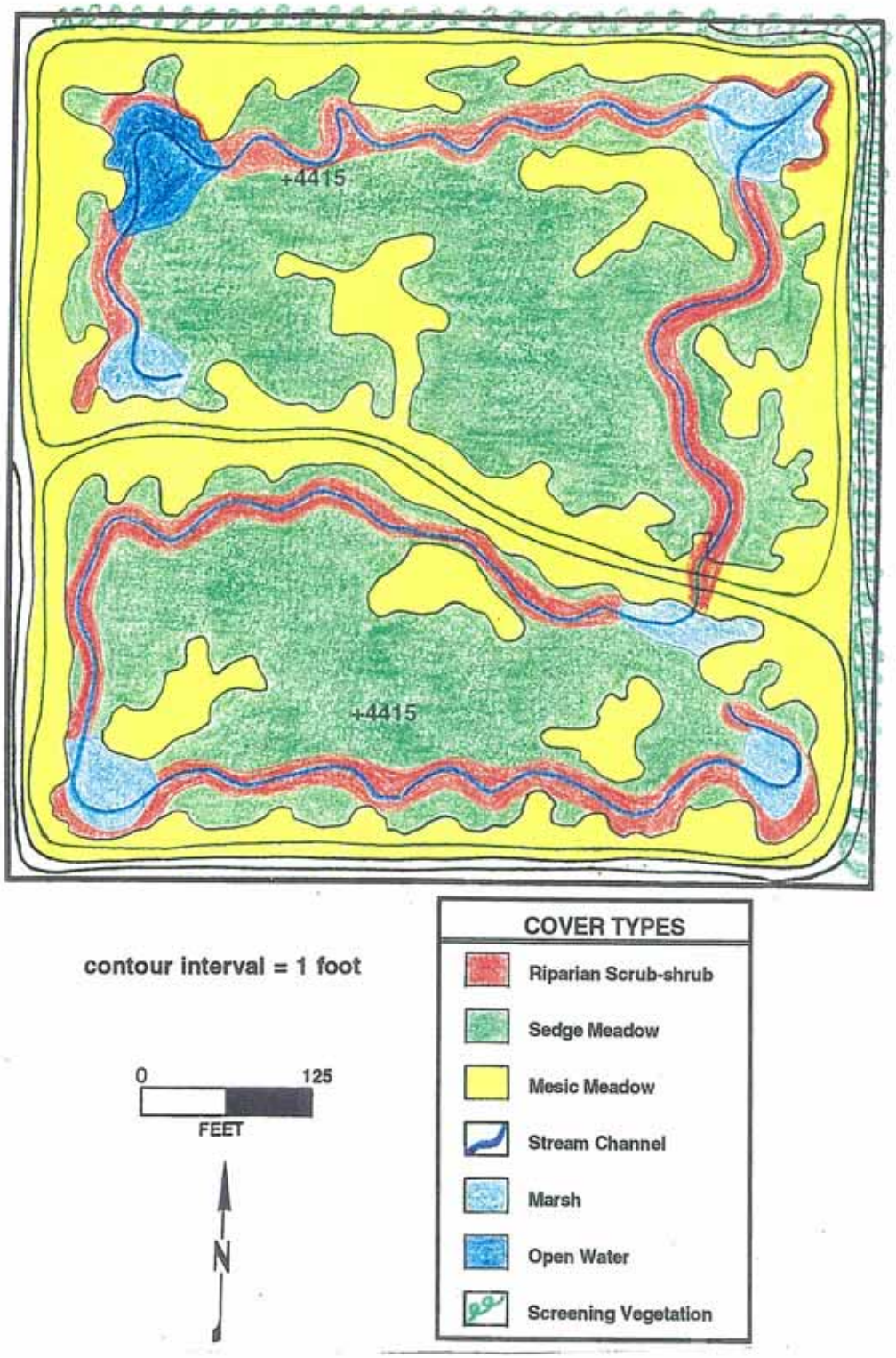


FIGURE 12b. Conceptual distribution of cover types on wetland mitigation site with groundwater as source of hydrology.

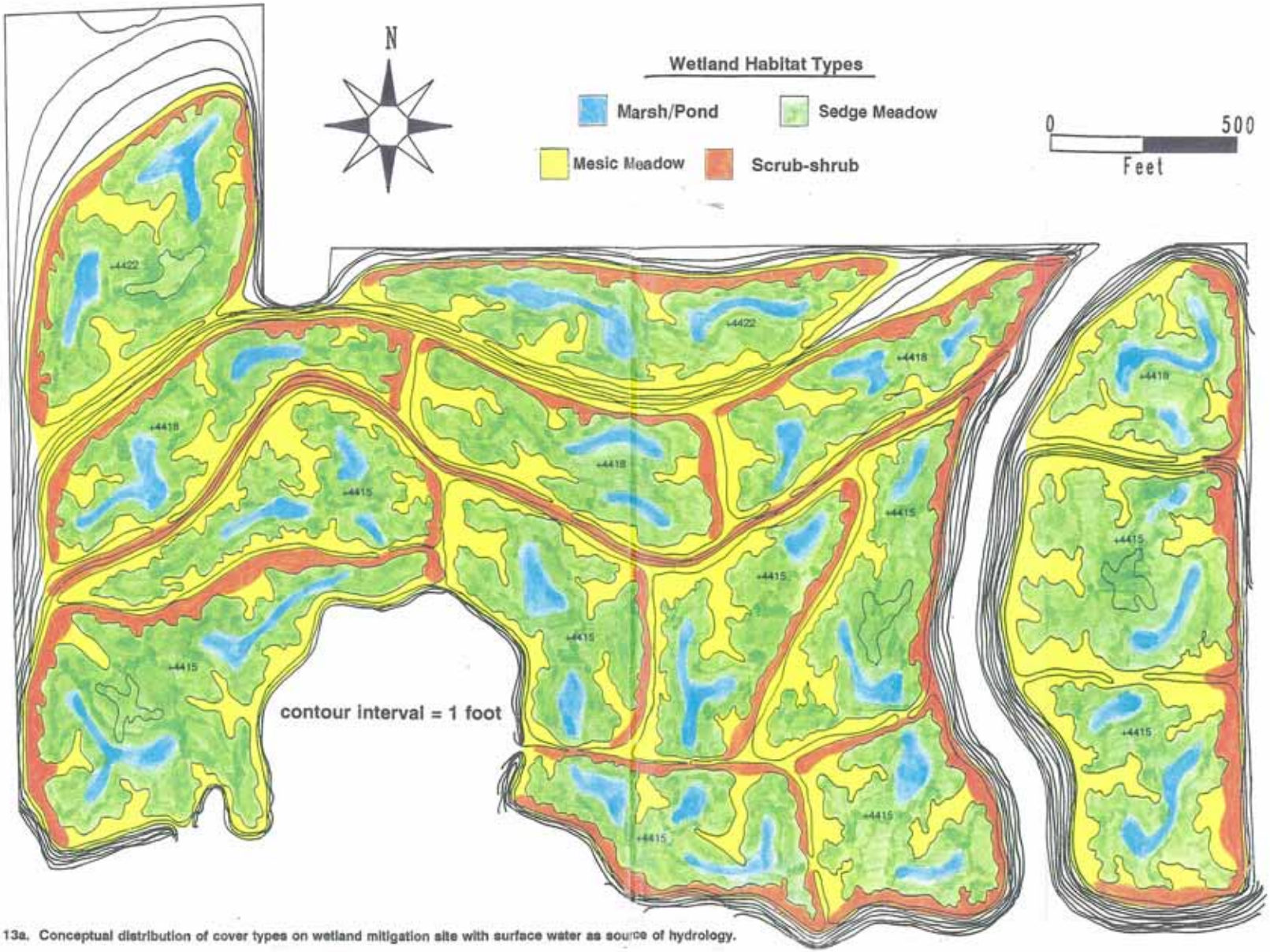


FIGURE 13a. Conceptual distribution of cover types on wetland mitigation site with surface water as source of hydrology.

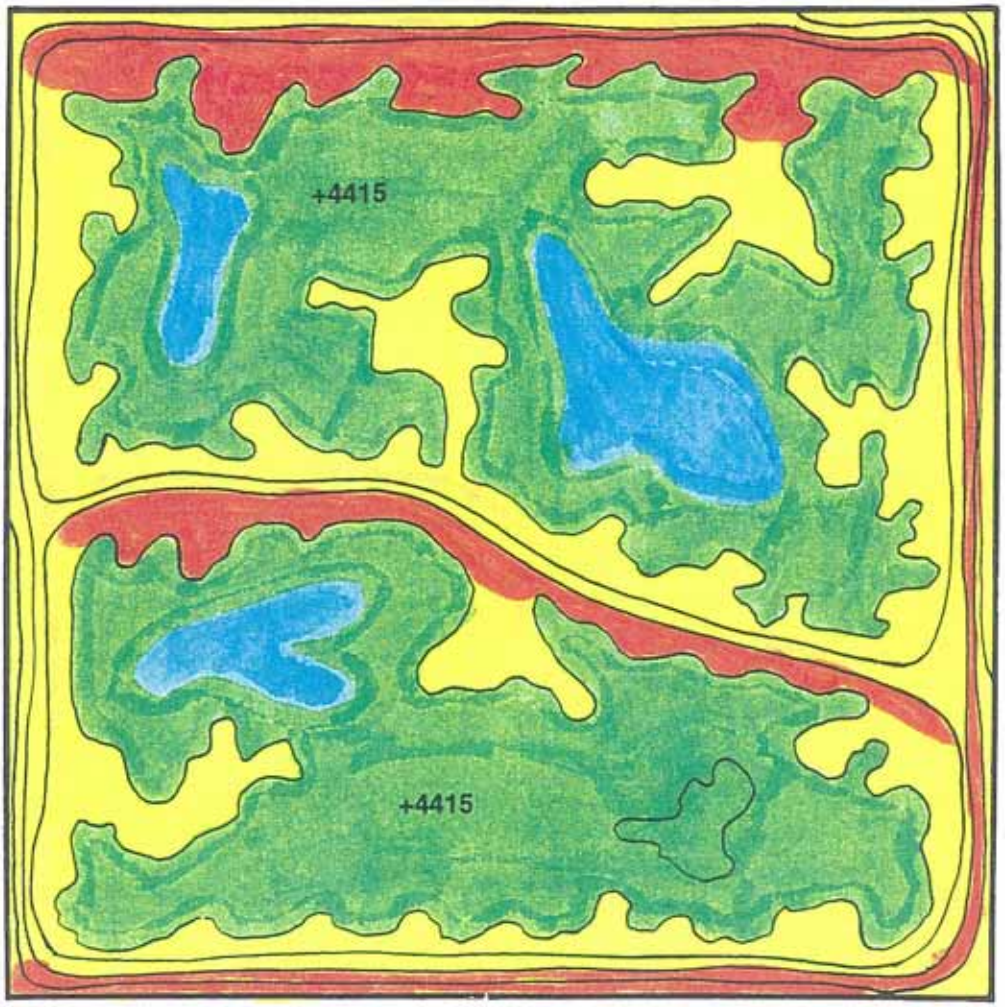


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FIGURE 13b. Conceptual distribution of cover types on wetland mitigation site with surface water as source of hydrology.

will be located between six and eighteen inches throughout the growing season (Figure 10). A canopy of mixed hydrophytic shrubs will be planted in a riparian zone of variable width along stream channels in order to provide riparian habitat. Some hydrophytic trees will also be planted in stands scattered throughout the wetland mitigation site. The location of the stream channels and the shrubby riparian habitat along the subbasin edges that separate each subbasin from the adjacent subbasins to be developed later will provide some privacy for wildlife during subsequent construction periods. Screening vegetation will also be planted along the perimeters of the mitigation parcels and along the haul road through the center of the larger mitigation parcel (Figures 12a and 12b). No vegetation will be planted within the stream channels themselves or within the deeper pond areas to be excavated to more than 4 feet below the base water table level.

If surface water provides the source of hydrology to the subbasins, emergent hydrophytic plant species will be planted in the shallowly inundated areas of the subbasins. Sedges and rushes will be planted in the areas within which the soil surface is located 6 inches or less above the stable water level over the confining clay layer (Figure 11). Mesic meadow vegetation, consisting of primarily hydrophytic grass species, will be planted in the areas within which the stable water level over the confining clay layer will be located between 6 and 18 inches below the soil surface (Figure 11). Hydrophytic shrubs will be planted within mesic meadow areas along the perimeters that separate constructed subbasins from adjacent subbasins to be developed later (Figure 11). The objective of these plantings will be to provide privacy for wildlife during subsequent construction periods, as well as to provide habitat structural diversity. Screening vegetation along the perimeters of the mitigation parcels and along the central haul road in the larger parcel will be planted (Figures 13a and 13b).

All of the 5 to 10 acre mitigation subbasins will provide wet meadow, marsh, scrub-shrub, and slow-moving open water wetland habitat (Figure 12a, 12b, 13a, and 13b). Only those subbasins in which a deep (greater than 4 feet deep) on-channel pond is excavated will provide significant expanses of stationary open water.

Mitigation Activities

As mentioned previously, mitigation wetlands will be created in phases as fill material is removed for use on the landfill. Each phase of mitigation will be initiated when fill material for the landfill has been

removed from within a subbasin encompassing between 5 and 10 acres, bringing the ground surface to one foot below the target soil surface elevations of the created wetland. If additional wetland mitigation acreage is required, more than one subbasin may be excavated at a time or the size of individual subbasins may be increased, with the additional fill material stockpiled for later use on the landfill. Once initiated, mitigation activities will proceed with the objective of completion prior to the start of the subsequent growing season. For example, if the excavation of fill material from a given subbasin is completed in the spring of a given year and mitigation activities can be initiated immediately, plant establishment within the created wetland should begin no later than the following spring. The result of a single phase of wetland mitigation will be one or more 5 to 10 acre or larger subbasins of created wetland that are self-contained and not dependent for full development on any subsequent mitigation activities.

Excavation - At the initiation of construction on the larger parcel within the wetland mitigation site, a haul road wide enough for two-way traffic will be constructed along the projected 4415' contour line (Figure 14a). A trench will be excavated to elevation 4415' along the south side of the haul road in order to lower the water table between the road and the stream along the south edge of the parcel to elevation 4415'. The trench will drain to the existing stream where it crosses the western property boundary at approximately elevation 4415'. Water draining from the trench will flow through a filter berm or filter fence prior to discharge to the stream in order to prevent sedimentation of the stream channel. A cutoff trench filled with compacted clay to elevation 4417' will be installed along the north side of the haul road in order to maintain groundwater levels above that elevation north of the construction zone.

A berm at least 20 feet wide will remain undisturbed between the area of excavation and the stream channel (Figure 14a). The crest of the berm will be located at the elevation of the existing ground surface, which is at least three feet above the elevation of the stream. The berm will function to prevent the diversion of surface flows from the stream into the excavation area. Within portions of the mitigation area that will be excavated to an elevation below that of the adjacent stream, a cut-off trench will be excavated adjacent to the streamside berm and filled with compacted clay to prevent depletion of the flows in the stream and the alluvial groundwater into the excavation area. A cutoff trench will also be constructed along the western edge of the excavation area in order to prevent drawdown of groundwater levels under adjacent property.

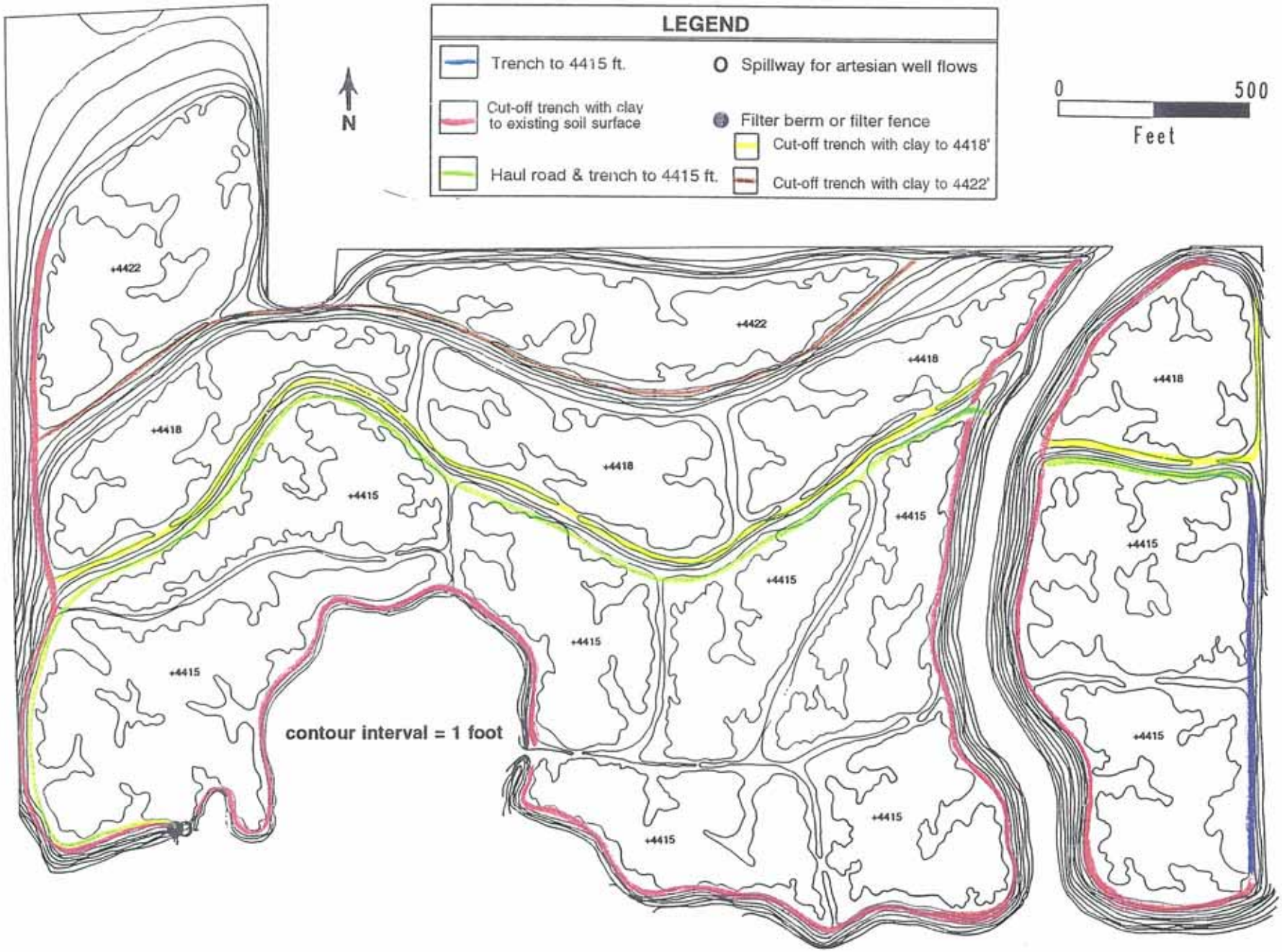
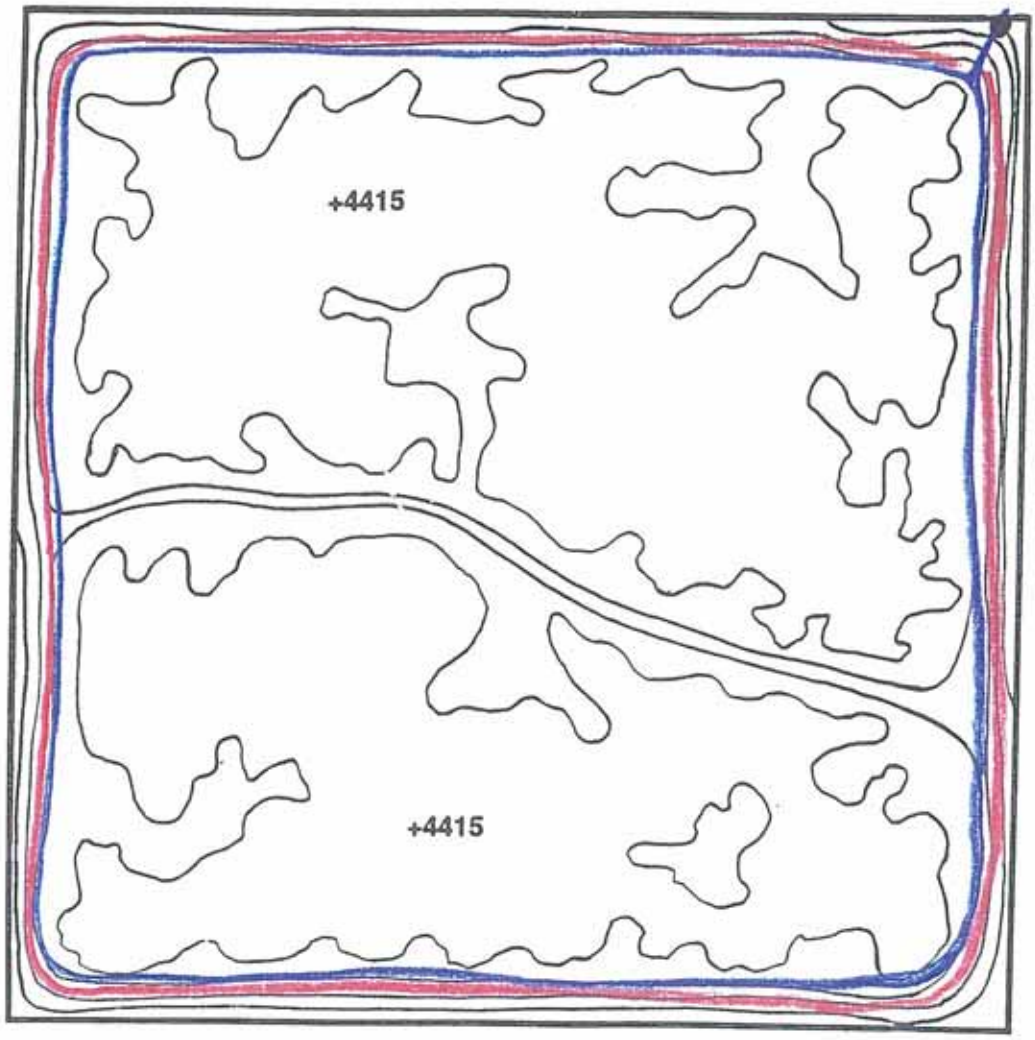


FIGURE 14a. Water level control features during construction of mitigation wetlands.



contour interval = 1 foot

0 125
FEET

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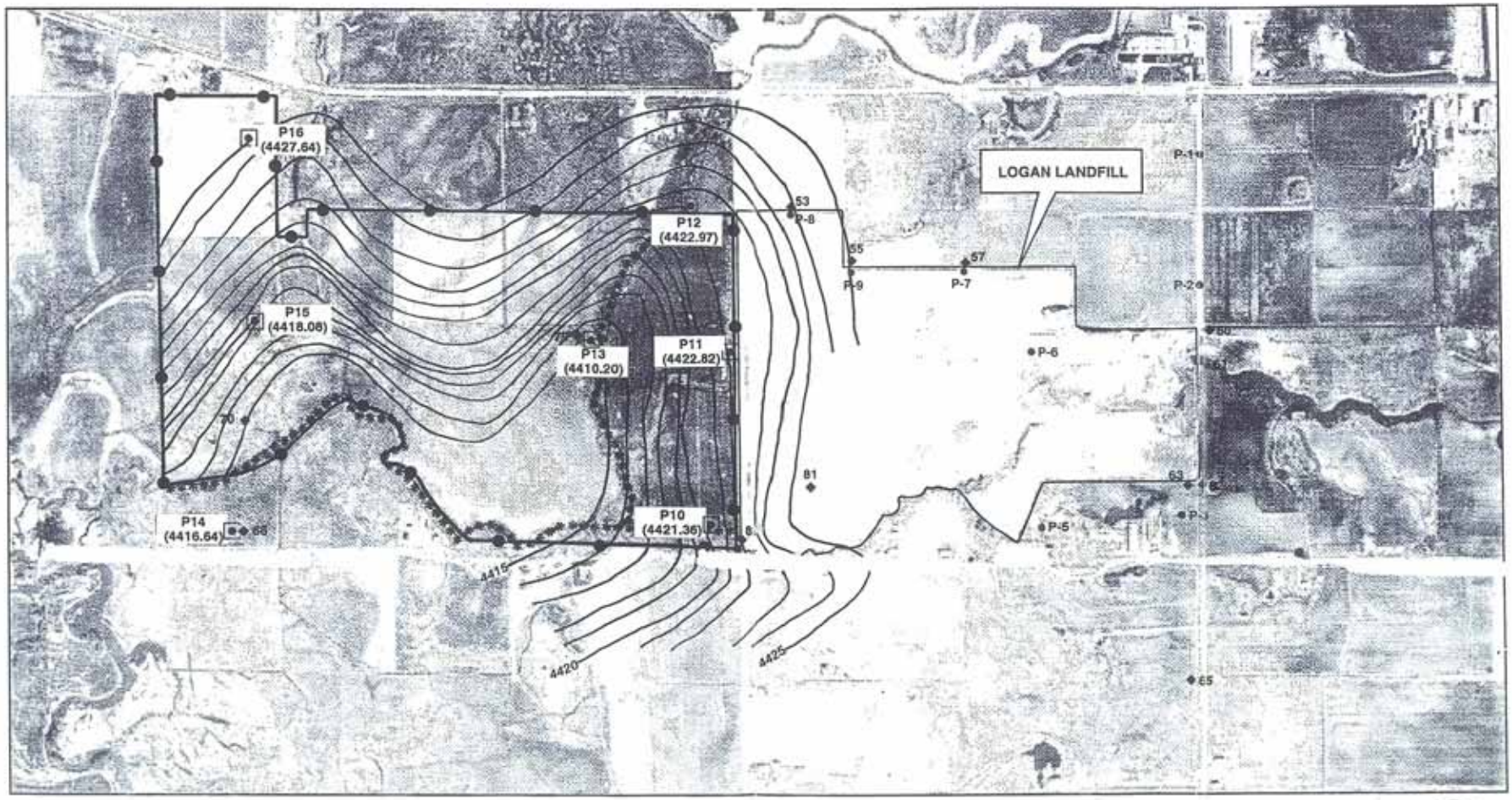
LEGEND

Trench to 4415 ft.

Cut-off trench with clay to existing soil surface

Filter berm or filter fence

FIGURE 14b. Water level control features during construction of mitigation wetlands.



P-2 Piezometer location

70 Surface water elevation measurement & location

Project boundary

Stream channels

N

0 300 600

Scale in Feet

JMM James M. Montgomery Consulting Engineers Inc.

FIGURE 6. Piezometer locations and water table elevations on wetland mitigation site during March 1991.

A trench will also be excavated to elevation 4415' inside the perimeter of the smaller parcel prior to initiation of construction on that site. The perimeter trench will drain off-site to an existing ditch that connects the smaller parcel to the stream along the south edge of the larger mitigation parcel (Figure 14b). A cut off trench filled with compacted clay will be installed outside of the perimeter drainage trench in order to prevent dewatering of adjacent wetland areas.

Excavation of the ground surface to elevation 4415' will begin in the southwest corners of both parcels within the mitigation site. Upland areas interspersed with wetlands in the southwest corner of the larger parcel (mesic meadow and dry meadow areas depicted in Figure 8) will be lowered to the elevation of the water table and topsoil will be applied to bring the soil surface to an elevation contiguous with that of the existing wetlands in that area. Proximity to the water table will provide the water regime necessary for the creation of new wetland areas contiguous with the existing wetland areas. If trenching results in drawdown of the water table under the existing wetlands on the mitigation site, the wetland areas will also be excavated in order to reestablish the necessary proximity of the soil surface to the water table at elevation 4415'. Mitigation credit will not be granted for wetland development on areas that are currently designated as wetlands.

Subsequent excavation of other upland areas on both parcels will proceed by phases involving excavation of 5 to 10 acres during each phase, unless additional mitigation acreage is required. If additional acreage is required, more than one subbasin may be excavated at the same time or two or more subbasin areas may be combined into one larger subbasin. If subbasins are to be combined, revised plans for stream channel placement and subbasin hydrology will be submitted to the U.S. Army Corps of Engineers for prior approval.

In addition to the trench along the 4415' contour, auxiliary trenches will be dug immediately uphill of the areas of active excavation to facilitate lowering of the water table under the adjacent upland areas to be excavated next for fill material. The pattern and density of the auxiliary trenches will be left to the discretion of the construction contractor. Once the water table has lowered sufficiently to allow excavation, the subbasins will be excavated to the appropriate elevations necessary in order to establish the approximate contours conceptually illustrated in Figures 9a and 9c with the addition of one foot of topsoil or of topsoil above a confining layer of compacted clay. Slopes within subbasins will be no

road serving as the haul road. Excavation within the larger parcel will continue from the southwest toward the northeast but will be initially confined to the area south of the haul road. Once the fill material has been removed from the area south of the haul road, excavation will begin north of the haul road. The cutoff trench along the haul road will be maintained, with compacted extending to elevation 4417'. An additional cutoff trench will be located between the northernmost mitigation subbasins and the subbasins adjacent to the haul road, with compacted clay to extending to elevation 4422'. Excavation activities will be similar north of the haul road, except that the minimum target soil surface elevations relative to which excavation depths will be set are higher within these subbasins than in the subbasins south of the haul road.

All fill material removed from the mitigation site will be directly applied to the landfill or hauled to the landfill and stored near the area of future application.

Hydrology - Excavation of trenches will lower the water table under the smaller parcel and south of the haul road on the larger parcel to elevation 4415'. The target surface elevations of the mitigation subbasins in these areas will be established relative to elevation 4415' as necessary in order to provide the shallow depths to water table, seasonal saturation, seasonal inundation, and permanent inundation required for the development of mesic meadow, sedge meadow, scrub-shrub, marsh, and open water habitat. Piezometer data indicate that the water table north of the northernmost subbasins is currently located at approximately elevation 4427' (Figure 6). It is anticipated that the compacted clay in the cutoff trenches along the perimeters of the mitigation site, along the haul road, and between the northernmost subbasins and the subbasins adjacent to the haul road will maintain base groundwater elevations at or above 4417' in the subbasins immediately north of the haul road and at or above 4422' in the northernmost subbasins. Piezometers will be monitored throughout the construction of mitigation subbasins and design changes will be developed as necessary if resulting water table conditions are significantly different from the anticipated conditions.

Assuming that groundwater will be the source of wetland hydrology to the mitigation subbasins, application of one foot to 18 inches of topsoil over excavated mitigation subbasins will provide conditions adequate to qualify as wetland hydrology. Those conditions will be characterized by a depth to the water table of less than 6 inches over the sedge meadow portions of the subbasins during periods of base

water table level. Depths to water table under the mesic meadow portions of the subbasins will be less than 18 inches during periods of base water table level. Stream channels will be inundated by up to six inches of water during periods of base water table level and the very slight channel gradient will enhance the general direction of flow of the groundwater from the northeast toward the southwest. The shallow widened reaches will be saturated or shallowly inundated and the water depths in the on-channel ponds will be four feet or more. During periods of elevated water table in response to fluctuating precipitation, most of the mitigation subbasins will be saturated or inundated and the depth to the water table under the mesic meadow portions of the subbasins will be less than 6 inches, assuming that water table fluctuations after construction are similar to those measured in piezometers during late 1990 and early 1991 (Table 5).

During excavation, the artesian well that is currently flowing near the wetlands in the southwest portion of the larger parcel within the mitigation site will be temporarily capped. When excavation of the mitigation subbasins in the vicinity of the artesian well is complete, the well will be uncapped and allowed to flow into the mitigation wetland. A stabilized spillway will be constructed in the perimeter ridge surrounding the mitigation subbasin in order to allow overflow into the stream channel. The crest of the spillway will be stabilized with rock at elevation 4415.5' to limit inundation of the subbasin to less than 6 inches (Figure 14a).

If monitoring of water levels in piezometers north of the haul road indicate that excavation to the water table will not be feasible or will not be adequate to provide the hydrologic conditions necessary for the establishment of mitigation wetlands, the irrigation water that is currently delivered to the mitigation site near the northwest corner will be developed as the source of wetland hydrology. The water delivery system that conveys the water to the site will be upgraded to ensure maintenance-free operation throughout the growing season. Auxiliary water delivery systems within the site will be developed to ensure delivery of adequate flows to completed subbasins during subsequent construction of additional mitigation subbasins. The final configuration of the mitigation subbasins upon completion of construction over the entire site will allow the irrigation water to be delivered to one or two subbasins in the northwest corner of the larger parcel within the mitigation site and to flow from subbasin to subbasin, with final discharge to the stream channel near the southwest corner of the parcel (Figure 15). The subbasins will

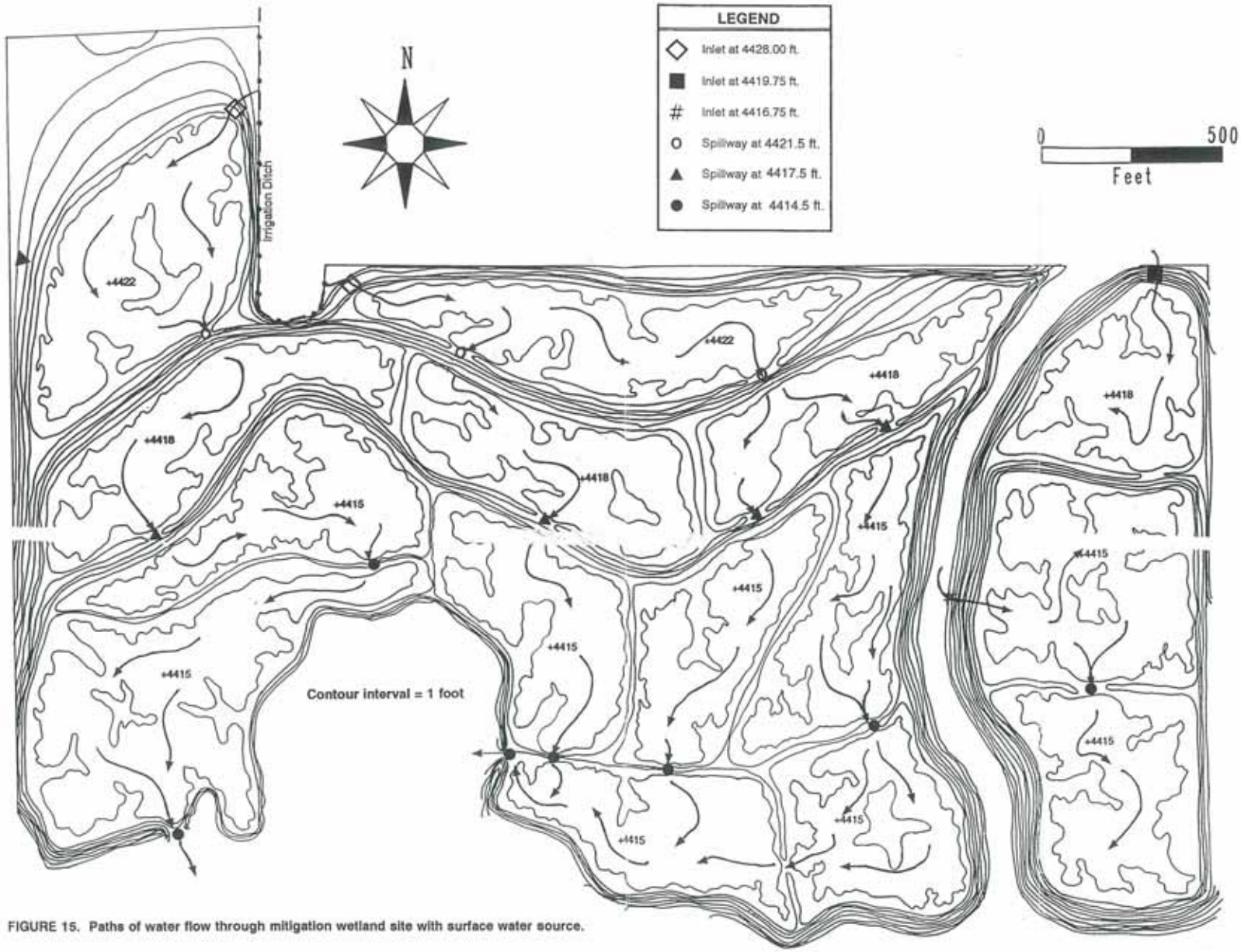


FIGURE 15. Paths of water flow through mitigation wetland site with surface water source.

be interconnected with rock-stabilized spillways in the perimeter ridges that separate the subbasins. The threshold of each spillway will be located at an elevation 18 inches above the confining clay layer in the upstream subbasin and 6 inches below the soil surface within the sedge meadow portions of the upstream subbasin. The spillway and the confining clay layer will create stable water level conditions beneath each subbasin at an elevation shallow enough to support wetland vegetation. The soil surface at all points within each subbasin will be located less than 18 inches above the stable water level beneath the subbasin.

If it is necessary to use flows from the streams to augment the groundwater within the larger mitigation parcel in order to provide hydrology adequate for wetland development, inlet structures could be constructed in the berm that separates the excavation area from the stream channels (Figure 15). The elevation of those inlets would be stabilized with rock at an elevation slightly below the average annual flood elevation in order to ensure flooding in all but the driest years. The interconnection of subbasins with spillways, as described previously for the use of irrigation water north of the haul road, would minimize the number of inlets required along the stream channel. Flows diverted from the stream would not discharge back to the stream. The resulting water regime would be characterized by flooding of subbasins to maximum levels during high flow periods, with water levels receding as a result of evaporation and percolation. Seasonal flooding and soil saturation on an annual basis would be adequate to support wetland vegetation within the mitigation subbasins.

Alternatively, drop structures could be installed in the stream channel to control stream stage at the elevations necessary to provide saturation or shallow inundation of the mitigation wetlands. The berm along the stream channel would be breached at several locations or totally removed as construction progressed from southwest to northeast. A water delivery system would be installed to provide water to the highest elevation subbasins, from which it would flow through the lower elevation subbasins to the stream via the overflow spillways between subbasins. The upland areas along the stream channel, designated as riparian weeds in Figure 8, would be excavated to an elevation in proximity with the alluvial water table in order to provide the necessary hydrology for the conversion of those areas to riparian wetlands.

As stated previously, the preferred source of wetland hydrology to the mitigation site will be the

groundwater that has been shown to be present at relatively shallow depths below the site. Data from ongoing monitoring of piezometers throughout the site will be used to adapt the wetland mitigation plans as necessary in order to accommodate changing groundwater conditions or to improve the probability of wetland establishment success based on the new information. However, surface water is available on the site to augment the groundwater source to the larger mitigation parcel if necessary. Detailed contingency plans will be developed in the event that the use of surface water to establish wetland hydrology on the site becomes necessary.

Soil - Topsoil will be removed separately from the subsoil over the portions of the mitigation site to be developed in preparation for fill removal. If possible, topsoil will be immediately respread over the wetland mitigation subbasins within which excavation and grading are complete. If immediate application to mitigation subbasins is not possible, topsoil will be stored separately in shallow stockpiles on adjacent undisturbed areas of the mitigation site. If stockpiling will be necessary for less than two months, stockpiles will be mulched with weed-free straw or hay and crimped to reduce evaporation of soil moisture and loss of soil due to wind erosion. If stockpiling will be necessary for more than two months, stockpiles will be seeded with a sterile cover crop, mulched with weed-free straw or hay, and crimped. Sprinkling with water may be necessary in order to enhance establishment of the cover crop if stockpiles are seeded during dry seasons.

Stockpiled or freshly stripped topsoil will be spread over the excavated wetland mitigation subbasins to a depth of one foot or more as necessary to bring the soil surface to the target elevations. Variability in topsoil depth will contribute to the establishment of a mosaic of conditions to which the development of mitigation wetlands will respond. Topsoil will not be spread over the stream channels or open water areas within the subbasins. Those areas will provide open water habitat and the lack of topsoil will maintain open water conditions by discouraging invasion by emergent vegetation.

Vegetation - The wetland vegetation types to be established within the mitigation subbasins will be determined by the hydrologic conditions resulting from excavation and grading. The stream channels and deeper (greater than 4 feet deep) ponds will provide open water habitat. The widened reaches of the streams or shallow concave areas that will be subject to shallow inundation for most of the growing season will be planted with marsh vegetation. The sedge meadow areas will be planted with sedges,

rushes, and other herbaceous obligate hydrophytes. The mesic meadow areas will be planted with primarily hydrophytic grasses that are adapted to conditions of seasonal soil saturation and depths to water table of 6 to 18 inches during the dry season. The riparian or scrub-shrub areas of the subbasins will be planted with a mixture of hydrophytic grasses and forbs under a canopy of hydrophytic shrubs and trees (Figures 12a, 12b, 13a, and 13b).

Plantings of marsh vegetation will include transplants of at least four of the following species: hardstem bulrush (*Scirpus acutus*), alkali bulrush (*Scirpus maritimus*), Olney three-square (*Scirpus americanus*), Baltic rush (*Juncus arcticus*), swordleaf rush (*Juncus ensifolius*), spikerushes (*Eleocharis parvula, E. rostellata*), and burreeds (*Sparganium* spp.). No single species will comprise more than 50 percent of the plant material planted on the site and each species planted will comprise at least 10 percent of the transplants. No cattail (*Typha latifolia*) or common reed (*Phragmites australis*) plants or vegetative propagules will be included in the plantings on the wetland mitigation site.

Transplants of marsh vegetation will consist of either commercially grown individual plants (tubelings or bare root stock) or plugs of the designated plant species obtained from native stands of vegetation in the vicinity of the wetland mitigation site. Commercially obtained plant material will originate from as near to Cache Valley as possible. Plugs shall consist of one or more individual plants of the designated species with their associated root masses. No more than 20 percent of any given donor stand of vegetation will be harvested to provide plugs for the mitigation subbasins.

Marsh transplants will be planted at three foot intervals over the widened reaches of the streams or the areas designated for marsh establishment in order to provide centers for vegetative reproduction. Root masses of transplants will be completely buried with topsoil and unbroken stems and leaves will emerge above the surface of the water present on the site at the time of planting. Planting of marsh vegetation will take place early in the growing season after danger of killing frost is past.

Plantings of sedge meadow vegetation will include seeding with the following seed mix:

Species	Scientific Name	Seeding Rate (lbs PLS/acre)
Nebraska sedge	*Carex nebrascensis*	3
Beaked sedge	*Carex rostrata*	2
Clustered field sedge	*Carex praegracilis*	2
Baltic rush	*Juncus arcticus*	3
Creeping spikerush	*Eleocharis palustris*	0.5
Beaked spikerush	*Eleocharis rostellata*	0.5
Missouri iris	*Iris missouriensis*	0.25
Idaho blue-eyed grass	*Sisyrinchium idahoenesis*	0.25
Silverweed cinquefoil	*Potentilla anserina*	0.25

The sedge meadow seed mix will be drill-seeded over portions of the mitigation area that will be subject to seasonal inundation, with the water table within 6 inches of the soil surface for the entire growing season (Figure 10 and 11). Seeding will take place after October 15 of the year during which site preparation and topsoil application is completed.

The areas designated for the establishment of mesic meadow within the subbasins of created wetland will be drill-seeded with the following seed mix after October 15 of the year during which site preparation and topsoil application is completed. Riparian areas along the stream channels will also be seeded with the following seed mix (Figures 10 and 11).

Species	Scientific Name	Seeding Rate (lbs PLS/acre)
Inland saltgrass	*Distichlis spicata*	2
Redtop bentgrass	*Agrostis stolonifera*	1.5
Foxtail barley	*Hordeum jubatum*	3
Alkali sacaton	*Sporobolus airoides*	2
Showy cinquefoil	*Potentilla gracilis*	0.5
Curly dock	*Rumex crispus*	0.5

Seed to be planted on the sedge meadow and mesic meadow areas (Figures 10 and 11) will be collected from weed-free stands of native vegetation within a 100 mile radius of the wetland mitigation site or will be purchased from a commercial supplier. If seed of any of these species are not available for collection or purchase, seed of ecotypically similar species may be substituted with the approval of the U.S. Army Corps of Engineers and the Utah Division of Wildlife Resources. If broadcast or hydroseeding

methods are used, the seeding rates will be doubled. The formula to be used for determining the quantity of pure live seed (PLS) shall be: Pounds of seed x purity x germination = pounds of pure live seed (PLS). Purity will exceed 99.5 percent. Viability by TZ will not be substituted for germination. If standard germination tests have not been developed for the plant species specified, best professional judgement of knowledgeable individuals should be used to predict germination percentage.

The sedge meadow and mesic meadow areas will be fertilized if it is determined to be necessary in order to accomplish the goals of wetland establishment from testing of topsoil immediately prior to planting. Mulch will be applied over the sedge meadow and mesic meadow areas and will be affixed using a uniform slurry mixture of hydrofiber mulch and tackifier. Mulch will consist of clean, latest harvest weed-free native grass hay, wheat, or barley straws and will be applied by the airblown broadcast method or by hand at a uniform rate of 4,000 pounds per acre to achieve a minimum of 80 percent ground cover. Mulch will be applied within 48 hours following completion of seeding and fertilization. The tackifying slurry will be evenly sprayed to coat the straw or hay in the following proportions per acre: water - 1,450 gallons (adjusted to achieve proper slurry consistency), mulch fiber - 450 pound, and tackifier - 150 pounds. The slurry mixture will be applied immediately following application of the mulch and within one hour of mixing in the hydraulic seeder. Mulching will not take place during periods of wind that would remove noticeable amounts of mulch from the designated areas.

Following mulch application, transplants of hydrophytic shrub and tree species will be planted over the riparian areas along the stream channels or the scrub-shrub areas separating the mitigation subbasins (Figures 10 and 11). Similar plantings will be installed along the perimeter of the wetland mitigation site and along the haul road on the 4415' contour in order to screen the developing wetlands from off-site disturbances or future on-site construction activities (Figures 12a, 12b, 13a, and 13b). Distribution of transplants should be random or clumped, rather than regularly spaced, but with an average density of one plant per each 25 square feet. Species to be included in the transplants will include at least five of the following species: red-osier dogwood (*Cornus sericea*), coyote willow (*Salix exigua*), peach-leaf willow (*Salix amygdaloides*), Wood's rose (*Rosa woodsii*), hawthorn (*Crataegus douglasii*), chokecherry (*Prunus virginiana* var. *melanocarpa*), skunkbush (*Rhus trilobata*), golden currant (*Ribes aureum*), and Fremont cottonwood (*Populus fremontii*). No one species will comprise more than

50 percent of the transplants and each species represented will comprise at least 10 percent of the individuals planted. At least one stand of thirty Fremont cottonwoods will be planted within the mitigation site as a whole, whether or not cottonwoods are planted within each mitigation subbasin.

Shrub and tree transplants will consist of tubelings or larger container plants. If cuttings are used, the average spacing will be decreased to one plant within each nine square feet in order to allow for losses due to mortality. Cuttings will be planted early in the spring before leaf buds swell and burst. Tubelings will be planted after danger of killing frost is past but before soil moisture has been depleted by evaporation. A fertilizer tablet will be buried in proximity to, but not in contact with, the roots of each transplant. Planting techniques and guidelines are presented in Appendix A.

MONITORING FOR WETLAND ESTABLISHMENT SUCCESS

Mitigation wetlands will be monitored at least annually for five years following completion of mitigation activities within each mitigation subbasin. During each monitoring visit, at least five random points will be selected on the perimeter of each subbasin to be monitored. Transects perpendicular to the perimeter will be established from these points to corresponding points on the subbasin perimeter directly opposite (Figure 16). These transects will be evaluated for cover by water, vegetation, bare soil, litter, etc. by the line intercept method. Ten 1m by 1m quadrats will be randomly located on each transect and will be evaluated for vegetation cover by plant species. Plant species frequency and the presence of infestations of weeds will also be determined from these quadrats. Twenty 10m by 10m quadrats will be randomly located within scrub-shrub wetland areas within each subbasin to be monitored. The larger quadrats will be evaluated for density of woody plant species. Survival of transplanted shrubs and trees will be calculated from the data. Revegetation goals include the establishment of vegetation cover greater than or equal to 80 percent of that measured on reference areas for each vegetation type, density of woody plants greater than or equal to 80 percent of the prescribed planting density, relative cover of weedy plant species less than or equal to 20 percent, and an absence of patches of common reed (*Phragmites australis*) larger than 500 square feet. Contingency plans will be implemented as necessary to accomplish revegetation goals.

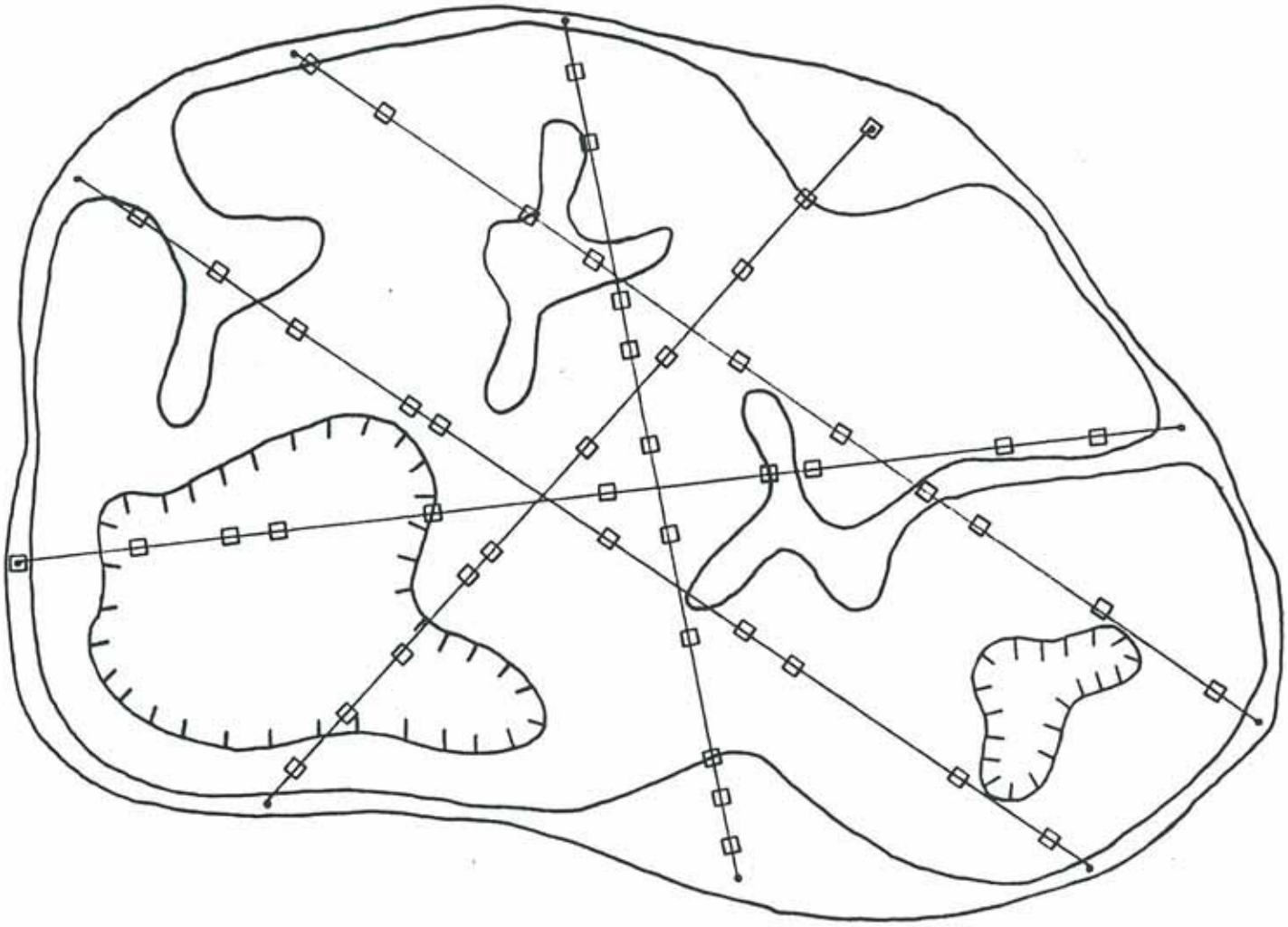


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FIGURE 16. Typical configuration of monitoring transects and quadrats within wetland mitigation subbasin.

Panoramic photographs of each completed wetland mitigation subbasin will be taken from permanent photopoints during high water table conditions in the spring (probably May) and at the peak of the growing season (probably July or early August) for the first three years following completion of plantings in each subbasin. Photo-monitoring at the peak of the growing season will be continued for two additional years, for a total of five years. Photographs will be used to document the development of wetland plant communities within the mitigation subbasins for the first five years following construction.

Monitoring reports will be submitted to the U.S. Army Corps of Engineers, the Environmental Protection Agency, and other appropriate resource agencies after each monitoring visit. Reports will include copies of the photographs taken during photo-monitoring visits to the site, field data collected during the monitoring visit, an analysis of those data to determine whether progress toward the revegetation goals is being made, and recommendations for additional mitigation activities to be implemented in order to accomplish the revegetation goals. Monitoring will be discontinued after five years following completion of construction activities if the U.S. Army Corps of Engineers and other appropriate resource agencies are satisfied that the goals of the mitigation have been achieved.

MAINTENANCE AND USE OF THE MITIGATION WETLANDS

Although the mitigation wetlands are designed to be self-sustaining, the City of Logan will be responsible for maintenance of the wetlands and associated facilities into perpetuity. If surface water is required to supply the wetlands, the water delivery systems will be maintained indefinitely in operational condition. Other maintenance activities should be limited to occasional inspection of berms and repair of any active or incipient erosion. Control of noxious weed species may be necessary if infestations are extensive. The Utah Division of Wildlife Resources will be consulted as a technical advisor with respect to maintenance activities to be implemented on the mitigation site.

Plans for future educational and recreational uses of the mitigation wetlands will be developed by the City of Logan in cooperation with the Utah Division of Wildlife Resources, school districts, and local environmental groups once the acreage of created wetland is adequate to support such uses. All uses of the mitigation wetlands will be nonconsumptive and controlled to prevent disruption of the functions and values of the wetlands, including wildlife habitat values. Future plans for the adjacent landfill are to

be interconnected with rock-stabilized spillways in the perimeter ridges that separate the subbasins. The threshold of each spillway will be located at an elevation 18 inches above the confining clay layer in the upstream subbasin and 6 inches below the soil surface within the sedge meadow portions of the upstream subbasin. The spillway and the confining clay layer will create stable water level conditions beneath each subbasin at an elevation shallow enough to support wetland vegetation. The soil surface at all points within each subbasin will be located less than 18 inches above the stable water level beneath the subbasin.

If it is necessary to use flows from the streams to augment the groundwater within the larger mitigation parcel in order to provide hydrology adequate for wetland development, inlet structures could be constructed in the berm that separates the excavation area from the stream channels (Figure 15). The elevation of those inlets would be stabilized with rock at an elevation slightly below the average annual flood elevation in order to ensure flooding in all but the driest years. The interconnection of subbasins with spillways, as described previously for the use of irrigation water north of the haul road, would minimize the number of inlets required along the stream channel. Flows diverted from the stream would not discharge back to the stream. The resulting water regime would be characterized by flooding of subbasins to maximum levels during high flow periods, with water levels receding as a result of evaporation and percolation. Seasonal flooding and soil saturation on an annual basis would be adequate to support wetland vegetation within the mitigation subbasins.

Alternatively, drop structures could be installed in the stream channel to control stream stage at the elevations necessary to provide saturation or shallow inundation of the mitigation wetlands. The berm along the stream channel would be breached at several locations or totally removed as construction progressed from southwest to northeast. A water delivery system would be installed to provide water to the highest elevation subbasins, from which it would flow through the lower elevation subbasins to the stream via the overflow spillways between subbasins. The upland areas along the stream channel, designated as riparian weeds in Figure 8, would be excavated to an elevation in proximity with the alluvial water table in order to provide the necessary hydrology for the conversion of those areas to riparian wetlands.

As stated previously, the preferred source of wetland hydrology to the mitigation site will be the

groundwater that has been shown to be present at relatively shallow depths below the site. Data from ongoing monitoring of piezometers throughout the site will be used to adapt the wetland mitigation plans as necessary in order to accommodate changing groundwater conditions or to improve the probability of wetland establishment success based on the new information. However, surface water is available on the site to augment the groundwater source to the larger mitigation parcel if necessary. Detailed contingency plans will be developed in the event that the use of surface water to establish wetland hydrology on the site becomes necessary.

Soil - Topsoil will be removed separately from the subsoil over the portions of the mitigation site to be developed in preparation for fill removal. If possible, topsoil will be immediately respread over the wetland mitigation subbasins within which excavation and grading are complete. If immediate application to mitigation subbasins is not possible, topsoil will be stored separately in shallow stockpiles on adjacent undisturbed areas of the mitigation site. If stockpiling will be necessary for less than two months, stockpiles will be mulched with weed-free straw or hay and crimped to reduce evaporation of soil moisture and loss of soil due to wind erosion. If stockpiling will be necessary for more than two months, stockpiles will be seeded with a sterile cover crop, mulched with weed-free straw or hay, and crimped. Sprinkling with water may be necessary in order to enhance establishment of the cover crop if stockpiles are seeded during dry seasons.

Stockpiled or freshly stripped topsoil will be spread over the excavated wetland mitigation subbasins to a depth of one foot or more as necessary to bring the soil surface to the target elevations. Variability in topsoil depth will contribute to the establishment of a mosaic of conditions to which the development of mitigation wetlands will respond. Topsoil will not be spread over the stream channels or open water areas within the subbasins. Those areas will provide open water habitat and the lack of topsoil will maintain open water conditions by discouraging invasion by emergent vegetation.

Vegetation - The wetland vegetation types to be established within the mitigation subbasins will be determined by the hydrologic conditions resulting from excavation and grading. The stream channels and deeper (greater than 4 feet deep) ponds will provide open water habitat. The widened reaches of the streams or shallow concave areas that will be subject to shallow inundation for most of the growing season will be planted with marsh vegetation. The sedge meadow areas will be planted with sedges,

rushes, and other herbaceous obligate hydrophytes. The mesic meadow areas will be planted with primarily hydrophytic grasses that are adapted to conditions of seasonal soil saturation and depths to water table of 6 to 18 inches during the dry season. The riparian or scrub-shrub areas of the subbasins will be planted with a mixture of hydrophytic grasses and forbs under a canopy of hydrophytic shrubs and trees (Figures 12a, 12b, 13a, and 13b).

Plantings of marsh vegetation will include transplants of at least four of the following species: hardstem bulrush (*Scirpus acutus*), alkali bulrush (*Scirpus maritimus*), Olney three-square (*Scirpus americanus*), Baltic rush (*Juncus arcticus*), swordleaf rush (*Juncus ensifolius*), spikerushes (*Eleocharis parvula, E. rostellata*), and burreeds (*Sparganium* spp.). No single species will comprise more than 50 percent of the plant material planted on the site and each species planted will comprise at least 10 percent of the transplants. No cattail (*Typha latifolia*) or common reed (*Phragmites australis*) plants or vegetative propagules will be included in the plantings on the wetland mitigation site.

Transplants of marsh vegetation will consist of either commercially grown individual plants (tubelings or bare root stock) or plugs of the designated plant species obtained from native stands of vegetation in the vicinity of the wetland mitigation site. Commercially obtained plant material will originate from as near to Cache Valley as possible. Plugs shall consist of one or more individual plants of the designated species with their associated root masses. No more than 20 percent of any given donor stand of vegetation will be harvested to provide plugs for the mitigation subbasins.

Marsh transplants will be planted at three foot intervals over the widened reaches of the streams or the areas designated for marsh establishment in order to provide centers for vegetative reproduction. Root masses of transplants will be completely buried with topsoil and unbroken stems and leaves will emerge above the surface of the water present on the site at the time of planting. Planting of marsh vegetation will take place early in the growing season after danger of killing frost is past.

Plantings of sedge meadow vegetation will include seeding with the following seed mix:

Species	Scientific Name	Seeding Rate (lbs PLS/acre)
Nebraska sedge	*Carex nebrascensis*	3
Beaked sedge	*Carex rostrata*	2
Clustered field sedge	*Carex praegracilis*	2
Baltic rush	*Juncus arcticus*	3
Creeping spikerush	*Eleocharis palustris*	0.5
Beaked spikerush	*Eleocharis rostellata*	0.5
Missouri iris	*Iris missouriensis*	0.25
Idaho blue-eyed grass	*Sisyrinchium idahoenesis*	0.25
Silverweed cinquefoil	*Potentilla anserina*	0.25

The sedge meadow seed mix will be drill-seeded over portions of the mitigation area that will be subject to seasonal inundation, with the water table within 6 inches of the soil surface for the entire growing season (Figure 10 and 11). Seeding will take place after October 15 of the year during which site preparation and topsoil application is completed.

The areas designated for the establishment of mesic meadow within the subbasins of created wetland will be drill-seeded with the following seed mix after October 15 of the year during which site preparation and topsoil application is completed. Riparian areas along the stream channels will also be seeded with the following seed mix (Figures 10 and 11).

Species	Scientific Name	Seeding Rate (lbs PLS/acre)
Inland saltgrass	*Distichlis spicata*	2
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Foxtail barley	*Hordeum jubatum*	3
Alkali sacaton	*Sporobolus airoides*	2
Showy cinquefoil	*Potentilla gracilis*	0.5
Curly dock	*Rumex crispus*	0.5

Seed to be planted on the sedge meadow and mesic meadow areas (Figures 10 and 11) will be collected from weed-free stands of native vegetation within a 100 mile radius of the wetland mitigation site or will be purchased from a commercial supplier. If seed of any of these species are not available for collection or purchase, seed of ecotypically similar species may be substituted with the approval of the U.S. Army Corps of Engineers and the Utah Division of Wildlife Resources. If broadcast or hydroseeding

methods are used, the seeding rates will be doubled. The formula to be used for determining the quantity of pure live seed (PLS) shall be: Pounds of seed x purity x germination = pounds of pure live seed (PLS). Purity will exceed 99.5 percent. Viability by TZ will not be substituted for germination. If standard germination tests have not been developed for the plant species specified, best professional judgement of knowledgeable individuals should be used to predict germination percentage.

The sedge meadow and mesic meadow areas will be fertilized if it is determined to be necessary in order to accomplish the goals of wetland establishment from testing of topsoil immediately prior to planting. Mulch will be applied over the sedge meadow and mesic meadow areas and will be affixed using a uniform slurry mixture of hydrofiber mulch and tackifier. Mulch will consist of clean, latest harvest weed-free native grass hay, wheat, or barley straws and will be applied by the airblown broadcast method or by hand at a uniform rate of 4,000 pounds per acre to achieve a minimum of 80 percent ground cover. Mulch will be applied within 48 hours following completion of seeding and fertilization. The tackifying slurry will be evenly sprayed to coat the straw or hay in the following proportions per acre: water - 1,450 gallons (adjusted to achieve proper slurry consistency), mulch fiber - 450 pound, and tackifier - 150 pounds. The slurry mixture will be applied immediately following application of the mulch and within one hour of mixing in the hydraulic seeder. Mulching will not take place during periods of wind that would remove noticeable amounts of mulch from the designated areas.

Following mulch application, transplants of hydrophytic shrub and tree species will be planted over the riparian areas along the stream channels or the scrub-shrub areas separating the mitigation subbasins (Figures 10 and 11). Similar plantings will be installed along the perimeter of the wetland mitigation site and along the haul road on the 4415' contour in order to screen the developing wetlands from off-site disturbances or future on-site construction activities (Figures 12a, 12b, 13a, and 13b). Distribution of transplants should be random or clumped, rather than regularly spaced, but with an average density of one plant per each 25 square feet. Species to be included in the transplants will include at least five of the following species: red-osier dogwood (*Cornus sericea*), coyote willow (*Salix exigua*), peach-leaf willow (*Salix amygdaloides*), Wood's rose (*Rosa woodsii*), hawthorn (*Crataegus douglasii*), chokecherry (*Prunus virginiana* var. *melanocarpa*), skunkbush (*Rhus trilobata*), golden currant (*Ribes aureum*), and Fremont cottonwood (*Populus fremontii*). No one species will comprise more than

50 percent of the transplants and each species represented will comprise at least 10 percent of the individuals planted. At least one stand of thirty Fremont cottonwoods will be planted within the mitigation site as a whole, whether or not cottonwoods are planted within each mitigation subbasin.

Shrub and tree transplants will consist of tubelings or larger container plants. If cuttings are used, the average spacing will be decreased to one plant within each nine square feet in order to allow for losses due to mortality. Cuttings will be planted early in the spring before leaf buds swell and burst. Tubelings will be planted after danger of killing frost is past but before soil moisture has been depleted by evaporation. A fertilizer tablet will be buried in proximity to, but not in contact with, the roots of each transplant. Planting techniques and guidelines are presented in Appendix A.

MONITORING FOR WETLAND ESTABLISHMENT SUCCESS

Mitigation wetlands will be monitored at least annually for five years following completion of mitigation activities within each mitigation subbasin. During each monitoring visit, at least five random points will be selected on the perimeter of each subbasin to be monitored. Transects perpendicular to the perimeter will be established from these points to corresponding points on the subbasin perimeter directly opposite (Figure 16). These transects will be evaluated for cover by water, vegetation, bare soil, litter, etc. by the line intercept method. Ten 1m by 1m quadrats will be randomly located on each transect and will be evaluated for vegetation cover by plant species. Plant species frequency and the presence of infestations of weeds will also be determined from these quadrats. Twenty 10m by 10m quadrats will be randomly located within scrub-shrub wetland areas within each subbasin to be monitored. The larger quadrats will be evaluated for density of woody plant species. Survival of transplanted shrubs and trees will be calculated from the data. Revegetation goals include the establishment of vegetation cover greater than or equal to 80 percent of that measured on reference areas for each vegetation type, density of woody plants greater than or equal to 80 percent of the prescribed planting density, relative cover of weedy plant species less than or equal to 20 percent, and an absence of patches of common reed (*Phragmites australis*) larger than 500 square feet. Contingency plans will be implemented as necessary to accomplish revegetation goals.

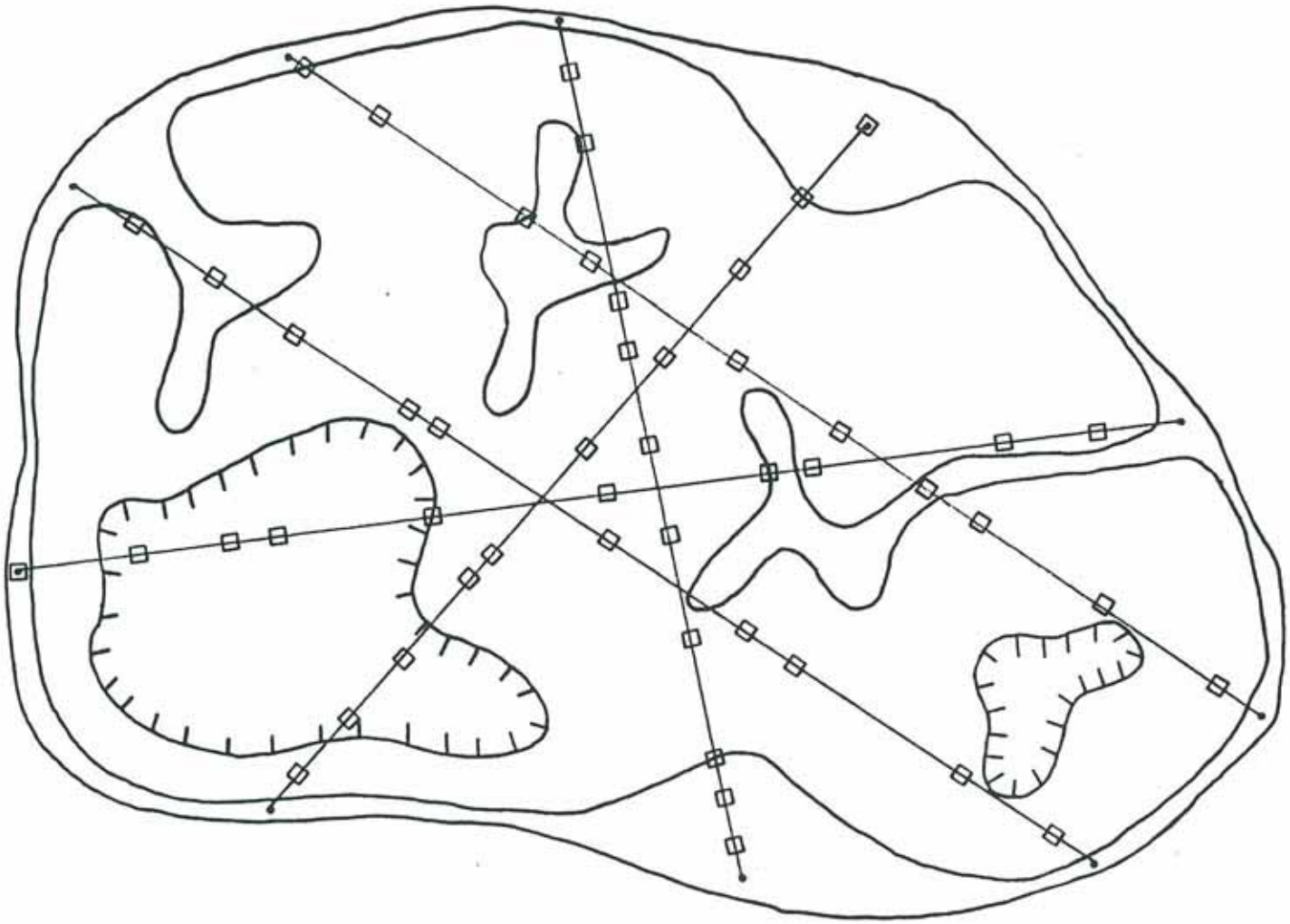

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FIGURE 16. Typical configuration of monitoring transects and quadrats within wetland mitigation subbasin.

Panoramic photographs of each completed wetland mitigation subbasin will be taken from permanent photopoints during high water table conditions in the spring (probably May) and at the peak of the growing season (probably July or early August) for the first three years following completion of plantings in each subbasin. Photo-monitoring at the peak of the growing season will be continued for two additional years, for a total of five years. Photographs will be used to document the development of wetland plant communities within the mitigation subbasins for the first five years following construction.

Monitoring reports will be submitted to the U.S. Army Corps of Engineers, the Environmental Protection Agency, and other appropriate resource agencies after each monitoring visit. Reports will include copies of the photographs taken during photo-monitoring visits to the site, field data collected during the monitoring visit, an analysis of those data to determine whether progress toward the revegetation goals is being made, and recommendations for additional mitigation activities to be implemented in order to accomplish the revegetation goals. Monitoring will be discontinued after five years following completion of construction activities if the U.S. Army Corps of Engineers and other appropriate resource agencies are satisfied that the goals of the mitigation have been achieved.

MAINTENANCE AND USE OF THE MITIGATION WETLANDS

Although the mitigation wetlands are designed to be self-sustaining, the City of Logan will be responsible for maintenance of the wetlands and associated facilities into perpetuity. If surface water is required to supply the wetlands, the water delivery systems will be maintained indefinitely in operational condition. Other maintenance activities should be limited to occasional inspection of berms and repair of any active or incipient erosion. Control of noxious weed species may be necessary if infestations are extensive. The Utah Division of Wildlife Resources will be consulted as a technical advisor with respect to maintenance activities to be implemented on the mitigation site.

Plans for future educational and recreational uses of the mitigation wetlands will be developed by the City of Logan in cooperation with the Utah Division of Wildlife Resources, school districts, and local environmental groups once the acreage of created wetland is adequate to support such uses. All uses of the mitigation wetlands will be nonconsumptive and controlled to prevent disruption of the functions and values of the wetlands, including wildlife habitat values. Future plans for the adjacent landfill are to

convert it to a park once closure is complete. In addition, the City is currently investigating the acquisition of additional parcels of land in the vicinity that could all be jointly managed along with the mitigation wetlands to optimize their educational and recreational value to the general public. For example, the City has purchased the land upstream of the wetland mitigation site that is adjacent to the stream that forms the southern boundary of the mitigation site. Plans are currently under development to move the stream from its current location along the toe of the landfill to a new channel farther from the landfill. The width of the area into which the stream will be located will be adequate to accommodate an appropriate meander width and the channel pattern and vegetation will be designed to maximize the wetland functions and values to be provided by the realigned stream and its adjacent floodplain.

MITIGATION DEBITS AND CREDITS

It is recommended that the currency for wetland debits and credits be acreage of wetlands impacted or created. The mitigation wetlands will not necessarily provide in-kind replacement of the wetlands to be impacted, which makes comparison of wetland functions and values between impacted wetlands and mitigation wetlands difficult. The guidelines provided by the Environmental Protection Agency suggest that a ratio of 1:1 is generally acceptable in compensation for impacted wetlands by the creation of mitigation wetlands from uplands or by the restoration of wetland hydrology to previously disturbed wetlands. Other mitigation activities, including the enhancement of existing wetland functions and values, may be required in ratios greater than 1:1 in order to provide adequate compensation for impacted wetlands. The actual amount of mitigation wetland acreage required to compensate for the projected wetland impacts of any given project will be dependent on the types of mitigation activities proposed and must be negotiated on a site-by-site basis with the U.S. Army Corps of Engineers.

Prior to the discharge of fill material into wetlands within the 1000 West corridor, a letter must be submitted to the U.S. Army Corps of Engineers describing the amount and type of fill material to be deposited into wetland areas. The letter must also describe the acreage of each type of wetland to be impacted by project activities. Mitigation must be proposed for those impacts and may consist of: 1) enhancement of wetland functions and values for wetlands identified as unsuitable for fill elsewhere on

the property to be developed; 2) restoration or creation of wetlands within buffer zones elsewhere on the property to be developed; 3) the creation, restoration, or enhancement of other wetlands either on or off of the project property; or 4) a letter from the City of Logan guaranteeing the exchange of wetland mitigation credits from the proposed mitigation project near the landfill. If the amount of wetland area to be impacted by the project is less than one acre, the U.S. Army Corps of Engineers will determine the adequacy of the proposed wetland mitigation within 30 calendar days of receipt of the letter describing the project. Once a determination of adequate mitigation for wetland impacts has been made or if no response from the U.S. Army Corps of Engineers is received within 30 calendar days, the project construction may proceed without further public notice or comment. If the amount of wetland area to be impacted by the project exceeds one acre, the Corps will be required to solicit comment from the other interested resource agencies. Processing of an application for a permit to impact more than one acre may require up to 60 calendar days from the receipt of the application letter.

Prior to the discharge of fill material into wetlands elsewhere in the City other than within the 1000 West corridor, individual applications for a 404 permits must be submitted. Applications may include a letter from the City of Logan guaranteeing the exchange of wetland mitigation credits from the proposed mitigation project near the landfill as the proposed means of mitigating for unavoidable impacts to wetlands. Standard procedures for the processing of individual permit applications will be followed, including release of public notices soliciting comments.

With respect to the mitigation wetlands to be created at the site adjacent to the sanitary landfill, the City of Logan will establish a wetland mitigation account with the U.S. Army Corps of Engineers. Acreage of created wetlands will be credited to the account when construction activities are complete within a wetland mitigation subbasin and the constructed wetland has been planted. An inspection visit to the mitigation wetland by the U.S. Army Corps of Engineers and other appropriate resource agencies may be required prior to assignment of wetland acreage credits to the mitigation account. The City will be responsible for continued monitoring and for implementation of the contingency measures necessary to guarantee the successful establishment of wetland functions and values within each completed wetland subbasin. Submittal of monitoring reports to the U.S. Army Corps of Engineers and periodic inspection visits by U.S. Army Corps of Engineers personnel will provide documentation of the development of full

value of the wetland acreage credits. Wetland acreage will be debited from the account upon approval by the U.S. Army Corps of Engineers of the discharge of fill material into a wetland by project development within the 1000 West corridor or elsewhere in the City.

The number of acres of mitigation wetlands guaranteed by the City from the wetland mitigation site will be debited from the City's account. A positive or zero balance must be maintained in the account at all times unless otherwise agreed to by the City of Logan and the U.S. Army Corps of Engineers.

SUMMARY

The City of Logan, Utah proposes to develop an industrial corridor centered on 1000 West between 300 South and 1800 North in Logan, Utah. According to a delineation of jurisdictional wetlands within the proposed corridor, 12.3 percent of the area within the corridor supports jurisdictional wetlands. Using an assessment of the functions and values associated with the wetlands within the corridor, a total of 18.09 acres of wetlands have been identified as unsuitable for future development involving any activities that would interfere with those functions and values. Buffer areas have also been proposed, within which project proponents will be restricted from development activities and encourages to provide mitigation for wetlands elsewhere on the property by enhancement and restoration activities. The remaining wetland areas within the 1000 West corridor will be included in a general 404 permit from the U.S. Army Corps of Engineers. The general 404 permit will allow the discharge of fill material into those wetlands in exchange for mitigation for projects that comply with a strict set of conditions to be specified by the U.S. Army Corps of Engineers. That mitigation may include a guarantee by the City to provide created wetland acreage on the proposed wetland mitigation site adjacent to the landfill. Mitigation activities to be implemented on the proposed mitigation area are described and a mitigation banking system is proposed.

REFERENCES

Ecosystems Research Institute and White Horse Associates. 1990. Wetland Delineation of the Tenth West Corridor. Prepared for the City of Logan, Utah.

Ecosystems Research Institute and White Horse Associates. 1991a. Revised Wetland Delineation of the Tenth West Corridor. Prepared for the City of Logan, Utah.

Ecosystems Research Institute and White Horse Associates. 1991b. Reconciliation of the Wetland Delineation of the Tenth West Corridor. Prepared for the City of Logan, Utah.

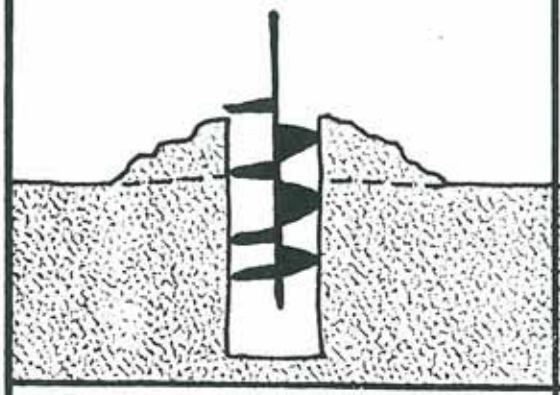
JMM. 1989. Feasibility Study for Logan City Sanitary Landfill Expansion/Closure and Cost Comparison. Prepared by James M. Montgomery Consulting Engineers. Salt Lake City, Utah.

Salt Lake City-County Health Department. 1987. Jordan River Wetlands Advance Identification Study. Wetland Functional Assessment Interpretive Report. Prepared by Division of Environmental Health, Bureau of Water Quality. Salt Lake City, Utah.

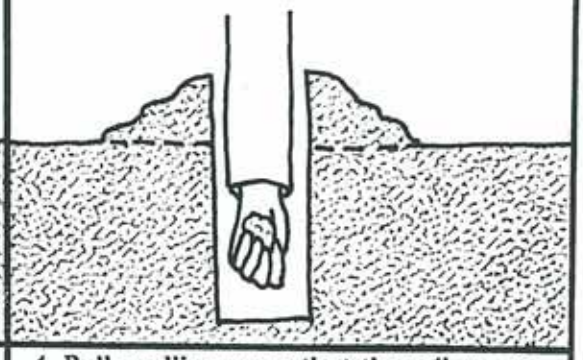
APPENDIX A

PLANTING SEEDLINGS IN AUGER HOLES

1. Drill hole 2" deeper than root length. Orient at an angle between perpendicular to the slope and true vertical.

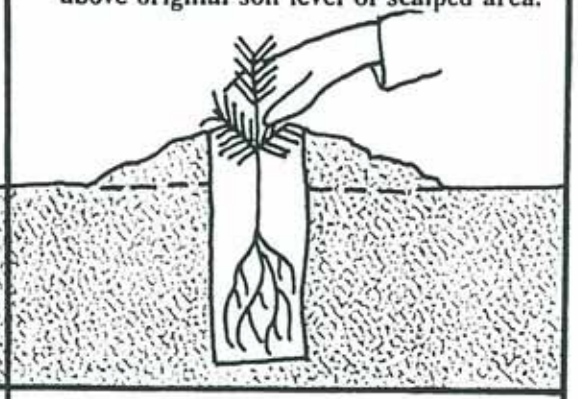


2. Remove loose dirt from the bottom of the hole.

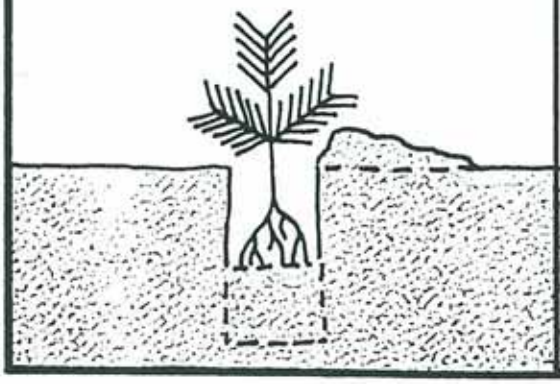


3. Place seedling into the hole and return loose moist soil into the hole around the roots.

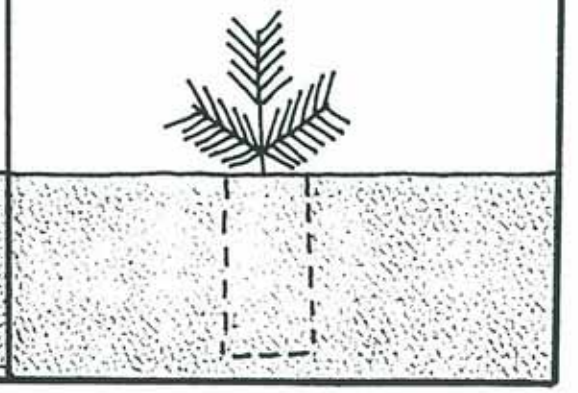
4. Pull seedling up so that the soil comes to a point within 1/2" of lowest needles or limbs. No lateral branches may be above original soil level of scalped area.



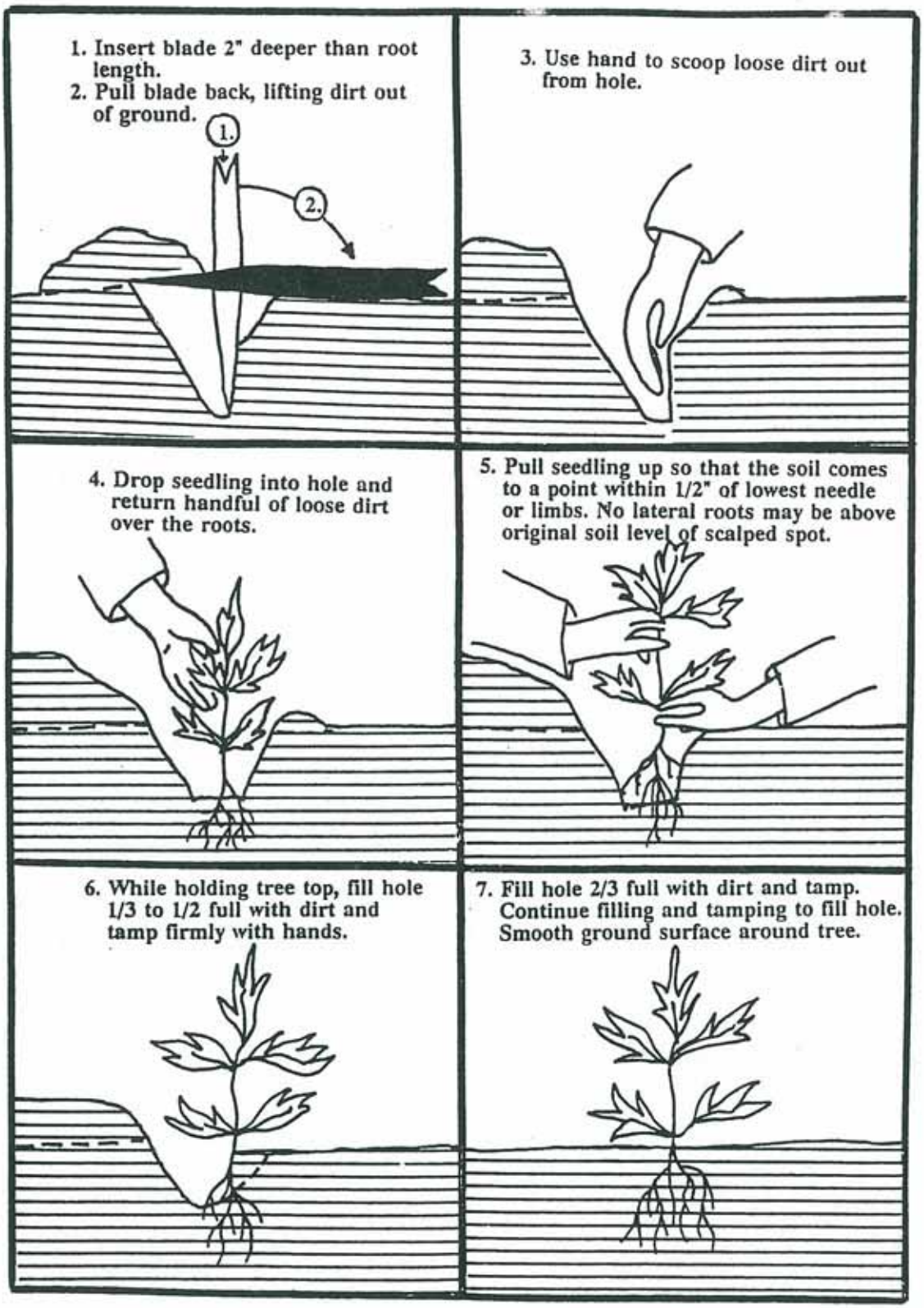
5. While holding seedling, fill hole 1/3 to 1/2 full with moist soil and tamp firmly with hands.



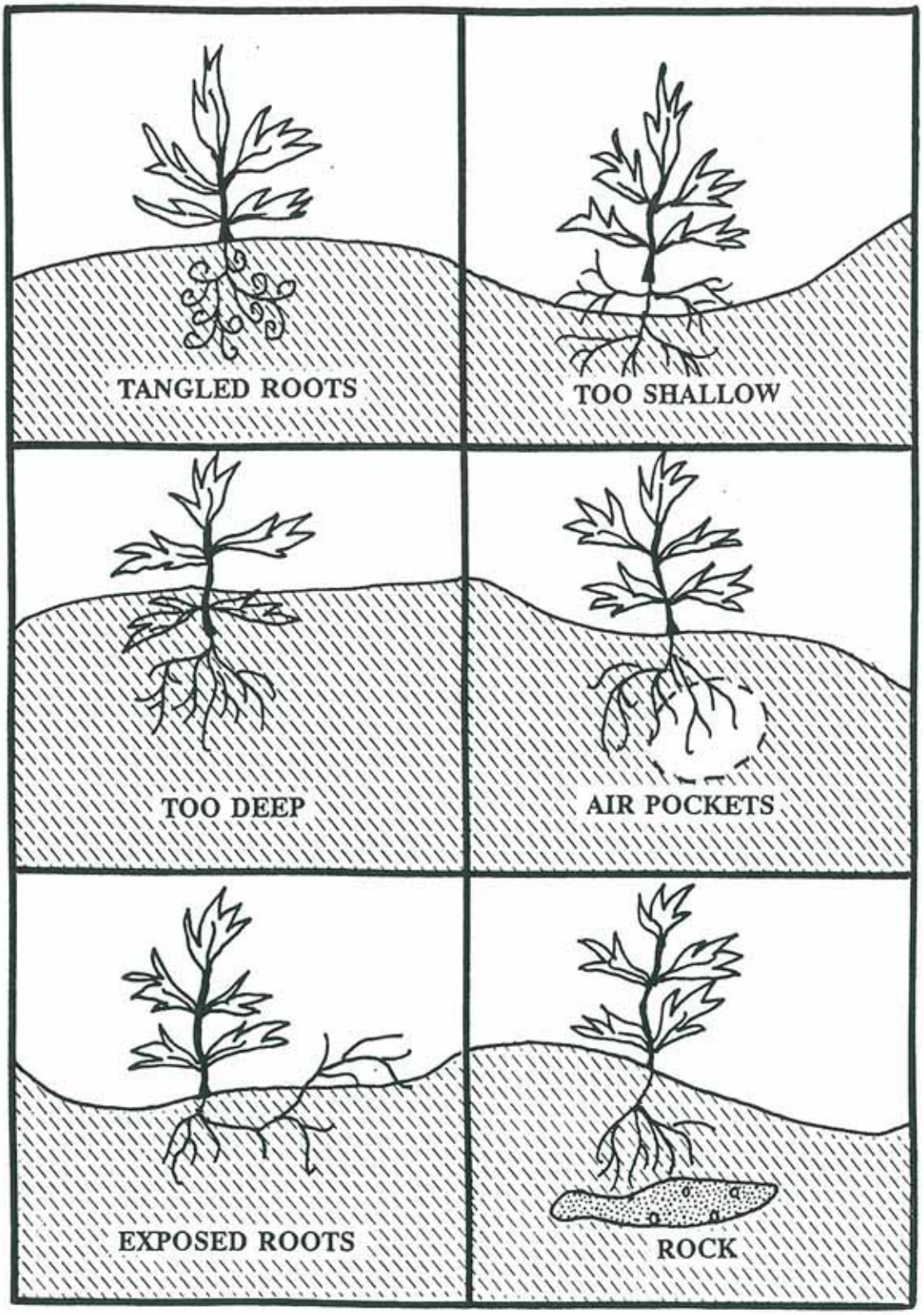
6. Fill hole 2/3 full with moist soil and tamp. Continue filling and tamping until full. Smooth the surface of the ground.



SHRUB AND TREE PLANTING
USING PLANTING BAR



CONDITIONS TO AVOID WHEN PLANTING



GENERAL PERMIT 047
CITY OF LOGAN
DISCHARGES OF DREDGED OR FILL MATERIAL
AND EXCAVATION ASSOCIATED WITH SPECIFIED WORK
IN THE 1000 WEST INDUSTRIAL CORRIDOR A
SPECIAL AREA MANAGEMENT PLAN

EFFECTIVE DATE: **EXPIRATION DATE:**
3 February 2000 **3 February 2005**

TO WHOM IT MAY CONCERN:

The District Engineer, Sacramento District, U.S. Army Corps of Engineers, hereby authorizes the discharge of dredged or fill material and excavation in waters of the United States within the 1000 West Industrial Corridor.

Location: Within a one-half mile wide corridor centered on 1000 West between 300 South and 1800 North, Logan City.

Authorized Material: Authorized materials include clean fill material such as rock, gravel, broken concrete, soils etc. Materials not authorized to be placed in wetlands are asphalt, construction debris, wood, trash, etc.

Duration of General Permit: This General Permit will be in effect for five years.

Excluded Waterways or Wetlands: Excluded from this General Permit are those waterways and wetlands which are areas designated as unsuitable for the discharge of fill material and within the proposed buffer areas. The City will not grant any building permits for these areas even if the proposed project does not require a 404 permit. This policy will provide protection of the proposed buffer areas even if the proposed development activity does not fall under the jurisdiction of the Corps of Engineers.

Definitions:

a. Discharge of dredged material - this term means any addition of dredged material into waters of the United States. The term includes, without limitation, the addition of dredged material to specified discharge sites located in waters of the United States and the runoff or overflow from a contained land or water disposal areas.

b. Fill material - this term means any material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of a water body or wetland.

c. Discharge of fill material - this term means the addition of fill material in waters of the United States which includes excavation activities.

d. Wetlands - this term means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Special Conditions:

1. The developer shall submit to the Corps of Engineers a notification and map of the wetland areas to be filled, a description of the amount and type of fill material to be used and a description of the mitigation activities to be implemented to compensate for unavoidable impacts to wetlands on the project site. This information will be submitted at least 30 days prior to initiation of the work for Corps approval. The description shall include:

a. responsible official's name, address, and telephone number, location of the proposed activity, and volume and type of material to be placed on wetlands.

b. identification of the wetlands unsuitable for the discharge of fill material and proposed buffer areas within the property proposed for development.

c. total avoidance of project impacts to wetlands designated as unsuitable for fill and buffer areas. Adjustment of project plans to avoid all other wetlands on the property to the extent practicable while maintaining the project purpose must be accomplished.

d. development of plans to provide mitigation for unavoidable wetland impacts. Of first priority will be the restoration and enhancement of on-site wetlands designated as unsuitable for the discharge of fill material. As part of such enhancement, contiguous wetlands will be created and screening vegetation will be planted within the proposed buffer areas associated with those wetlands. Second priority will be assigned to restoration and enhancement of other on-site wetlands within the property to be developed. Third priority will be assigned to the restoration and enhancement of off-site wetlands at the applicants discretion and the final priority will be assigned to the creation of off-
site wetlands as mitigation. Off-site wetland creation may include the use of mitigation provided by the city-sponsored wetland mitigation at the site adjacent to the landfill.

2. The City of Logan will not issue building permits for areas designated as unsuitable for the discharge of fill material and within buffer areas. An overlay of the areas unsuitable for the discharge of fill material and the buffer areas will be developed to aid in communication with developers and planners.

3. All mitigation associated with the Special Area Management Plan will be completed concurrent with or prior to the development within the corridor.

4. Logan City will contact Mr. Rory Reynolds with the Division of Wildlife Resources at (801) 479-5143 and resource agencies to coordinate the mitigation planning.

5. All mitigation wetlands will be monitored at least annually for five years following completion. A monitoring report containing photos from fixed reference points, and a written description of the wetlands development must be prepared. This report must be submitted to the Corps of Engineers, Utah Regulatory Office by August 30, of each year.

6. Activities authorized by this general permit must not effect any threatened or endangered species.

7. In the event the permittee encounters an archaeological or historic site during construction of an activity authorized by this general permit, the permittee shall report the find to the Utah State Historical Society, Division of State History, at (801-533-3500), and the Corps' Utah Regulatory Office.

8. The permittee shall exercise every reasonable precaution to protect the waters of the United States from pollution by contaminants or by turbidity and silting during and after construction.

9. Mitigation debits and credits report must be submitted to the Corps of Engineers, Utah Regulatory Office by August 30 of each year. This report shall contain areas of wetlands which have been created by the city, the project for which wetlands were mitigated, or the debits for wetlands which have been filled illegally in the past. Mitigation for fills placed in wetlands before this general permit was issued must be completed within two years after the permit was issued.

10. Conditions and plans are included in this permit in the Special Area Management Plan dated March 1994 for the 1000 West Industrial Corridor. If there are any changes in the project plans the permittee will send these changes to the Army Corps of Engineers Utah Regulatory Office for approval before any work is done.

11. A team of resource agencies will be used to recommend how mitigation credits are approved. The Corps will make the final decision on how many credits will be approved.

12. The permittee or developer will place all mitigation sites into a permanent conservation easement, which will be approved by the Corps, Utah Regulatory Office to guarantee habitat preservation in perpetuity via deed restrictions. This will be to offset unavoidable impacts to the wetlands. The restrictions shall include (but not be limited to) no grazing of cattle; and no placing within the Buffer Areas of any permanent structure, nonindigenous vegetation or fill material. The deed shall state, "The Conservation Easement shall be a perpetual easement which runs with the land and which shall be binding on all parties having or acquiring any right, title or interest in or to any portion of the Conservation Easement, whether or not such parties have actual notice of the provisions of the Conservation Easement."

Standard Conditions:

1. That all activities identified and authorized herein shall be consistent with the terms and conditions of this permit; and that any activities not specifically identified and authorized herein shall constitute a violation of the terms and condition of this permit which may result in the institution of such legal proceedings as the United States Government may consider appropriate, whether or not this permit has been previously modified, suspended, or revoked in whole or in part.

2. That all activities authorized herein shall be at all times consistent with applicable water quality standards, effluent limitations and standards of performance, prohibitations, and pretreatment standards established pursuant to Section 301, 302, 306, and 307 of the Federal Water Pollution Act of 1972 (PL 92-500; 86 Stat 816), or pursuant to applicable state and local law.

3. That all activities authorized herein shall, if applicable water quality standards are revised or modified during the term of this permit, be modified if necessary, to conform with such revised or modified water quality standards within 6 months of the effective date of any revision or modification of water quality standards, or as directed by an implementation plan contained in such revised or modified standards, or within such longer period of time as the District Engineer, in consultation with the Regional Administrator of the Environmental Protection Agency, may determine to be reasonable under the circumstances.

4. That the permittee agrees to make every reasonable effort to prosecute the work authorized herein in a manner so as to minimize any adverse impact of the work on fish, wildlife, and natural environmental values.

5. That the permittee shall permit the District Engineer or his authorized representative(s) or designee(s) to make periodic inspections at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

6. That the permittee shall maintain the work authorized herein in good condition and in accordance with submitted plans and drawings.

7. That this permit does not convey any property rights, either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to property or invasion of rights or infringement of Federal, State, or local laws or regulations, nor does it obviate the requirement to obtain State or local assent required by law for the activity authorized herein.

8. That this permit does not authorize the interference with any existing or proposed Federal project and that the permittee shall not be entitled to compensations for damage or injury to the work authorized herein which may be caused by or result from existing or future operations undertaken by the United States in the public interest.

9. That this permit may be summarily suspended, in whole or in part, upon a finding by the District Engineer that immediate suspension of an activity would be in the general public interest. Such suspension shall be effective upon receipt by the permittee of a written notice there of which shall indicate (a) the extent of a suspension, (b) the reasons for this action, and (c) any corrective or preventive measures to be taken by the permittee which are deemed necessary by the District Engineer to abate imminent hazards to the general public interest. The permittee shall take immediate action to comply with the provisions of the notice. Within ten days following receipt of this notice of suspension, the permittee may request a hearing in order to present information relevant to a decision as to whether his activity should be permitted, modified, or terminated. If a hearing is requested, it shall be conducted pursuant to procedures prescribed by the Chief of Engineers. After completion of the hearing, or within a reasonable time after issuance of the suspension notice to the permittee if no hearing is requested, the activity will either be permitted, modified, or terminated.

10. That any modification, suspension, or revocation of this permit shall not be the basis for any claim for damages against the United States.

11. That no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized by this permit.

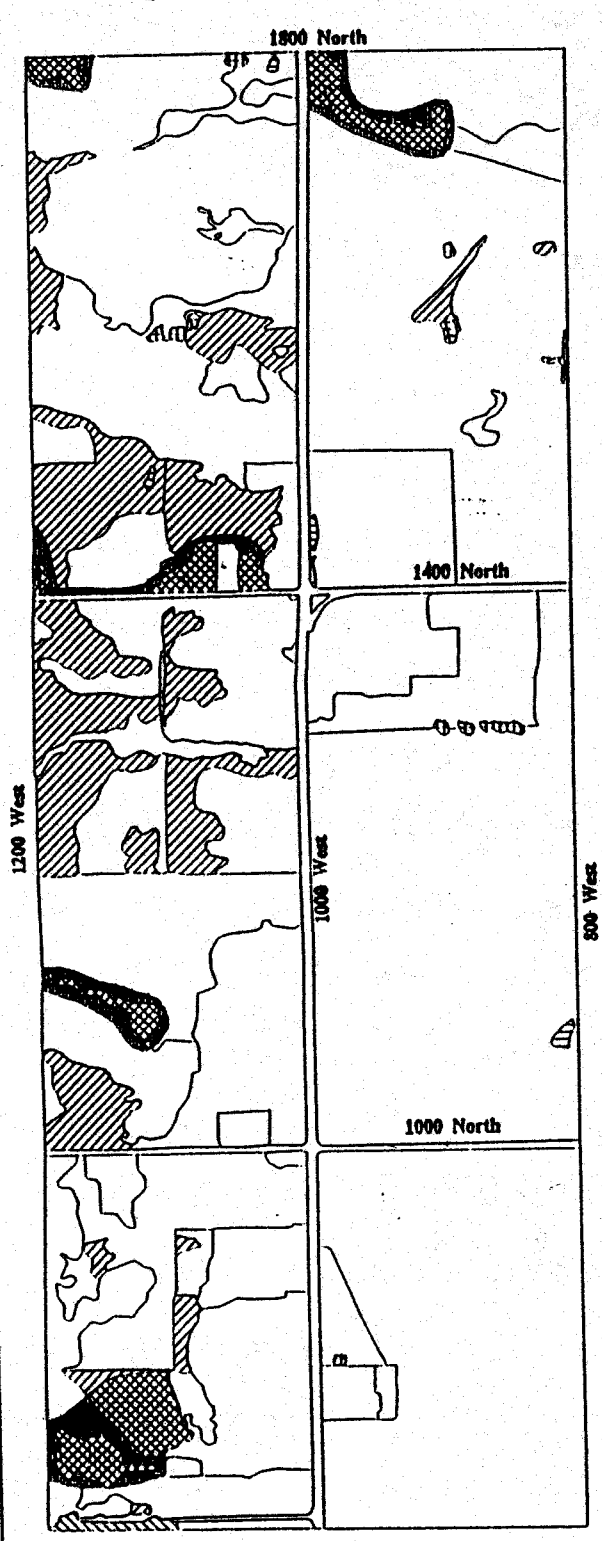
12. That this permit does not authorize or approve the construction of particular structures, the authorization or approval of which may require authorization by the Congress or other agencies of the Federal Government.

13. That, if and when the permittee desires to abandon the activity authorized herein, he must restore the area to a condition satisfactory to the District Engineer.

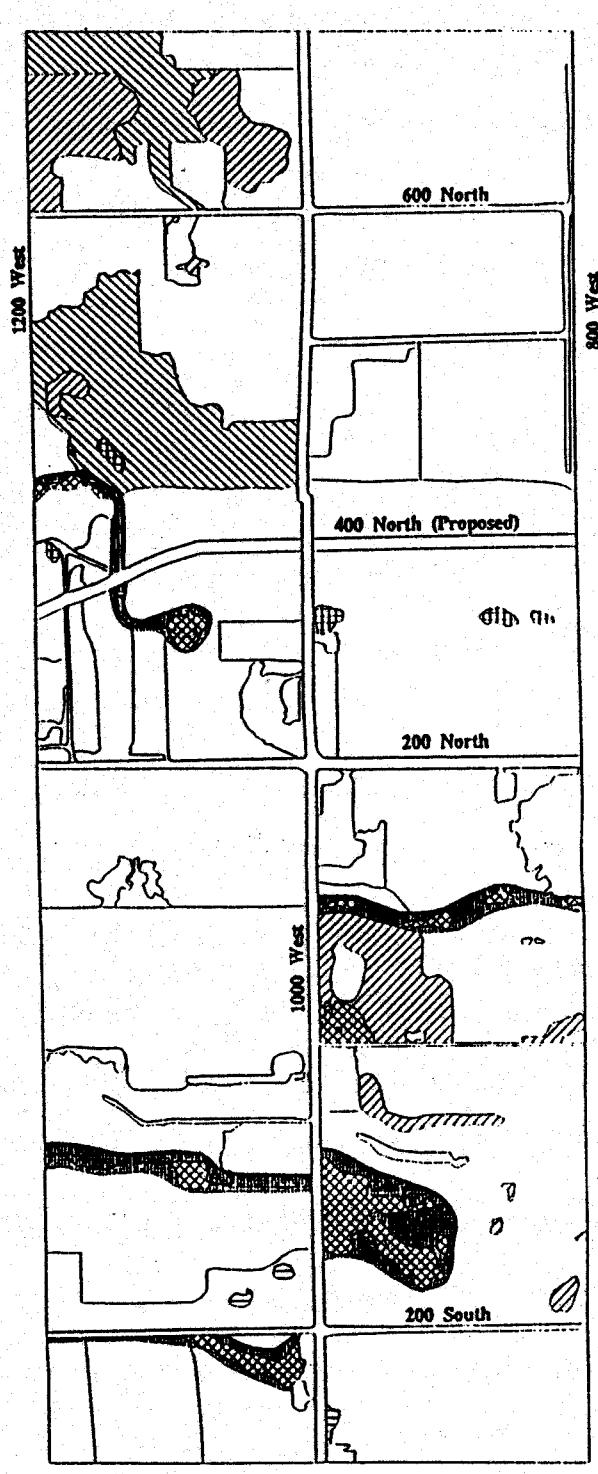
/s/
Arthur M. Champ
Chief, Regulatory Branch

Project Location
Mitigation Site
Greenville
LOGAN
Logan Fish Hatchery
Storage Bins
Gaging Station
Heliport
Radio Towers
Blue Spr
Spring
Well
Wells
GRADE
2ND NORTH
MAIN ST
LOGAN
Hosp
Cem
Ranch
River Heigh
North Log
CANAL
30
26
35
36
6
5

Proposed Management Status of Tenth West Corridor Wetlands



A) Northern Area



B) Southern Area

Figure 3.

0 1000
Feet

Areas Designated as Unsuitable for Fill

- Wetlands
- Proposed Buffer Areas

GP No. 47
Logan City
Cache County
Sheet 1 of 3

Areas Not Designated as Unsuitable for Fill

- Pond
- Marsh
- Wet Meadow
- Nonirrigated Mesic Meadow
- Trees

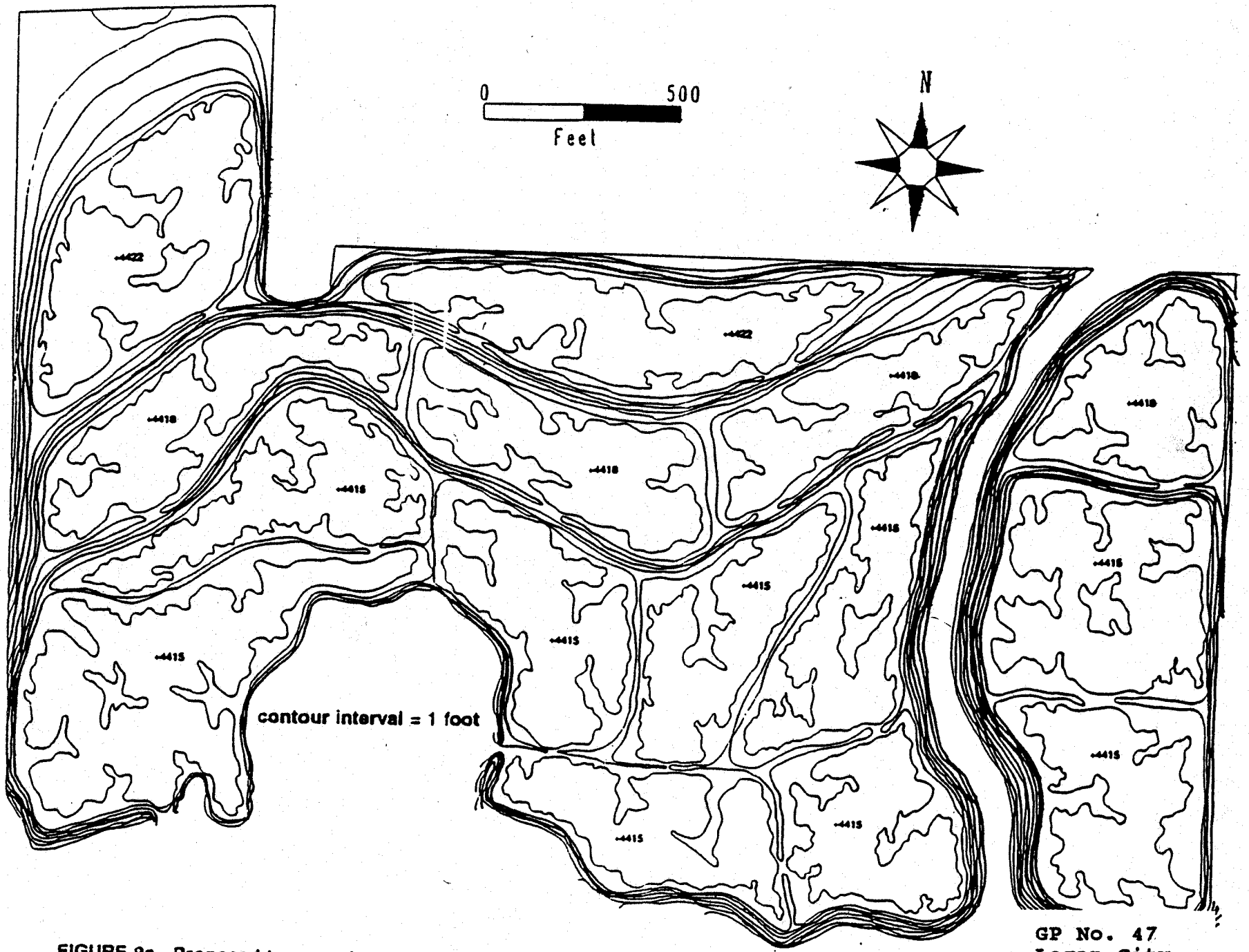


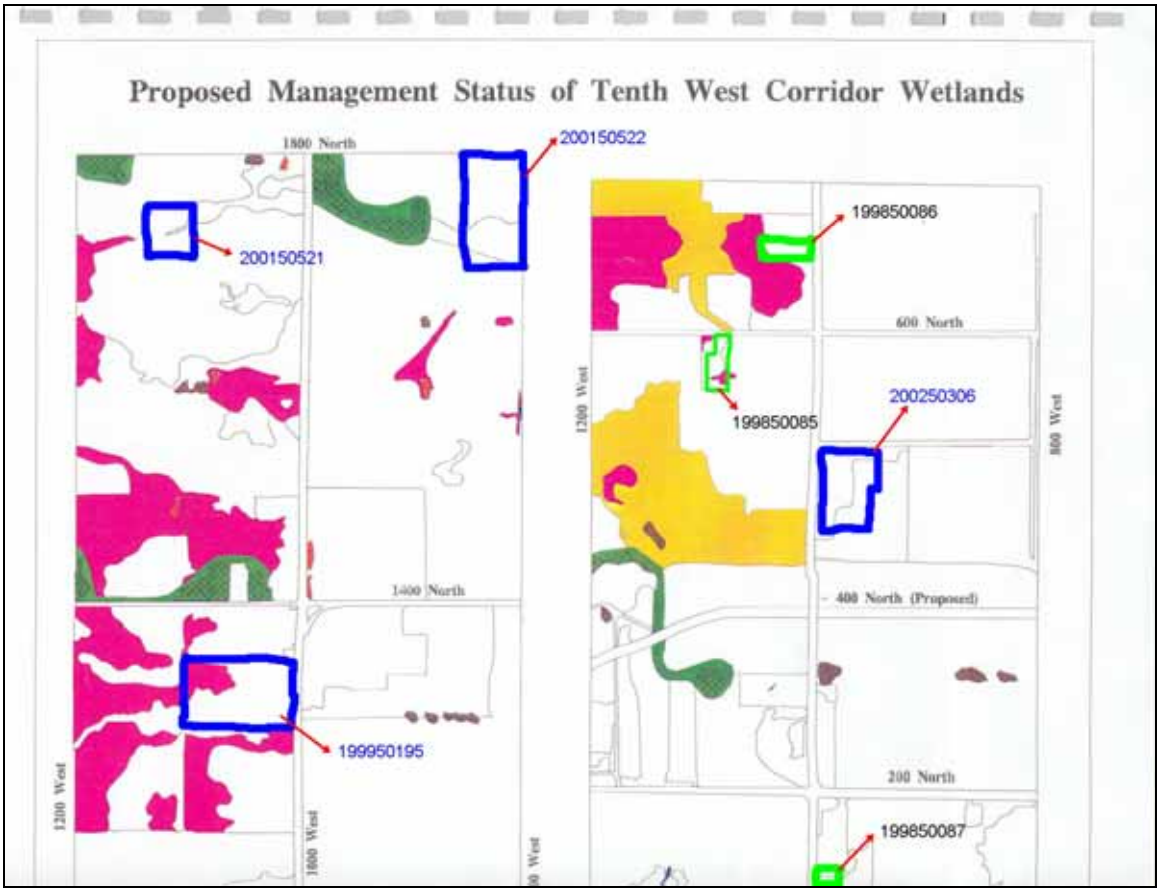
FIGURE 9a. Proposed topography on wetland mitigation site.

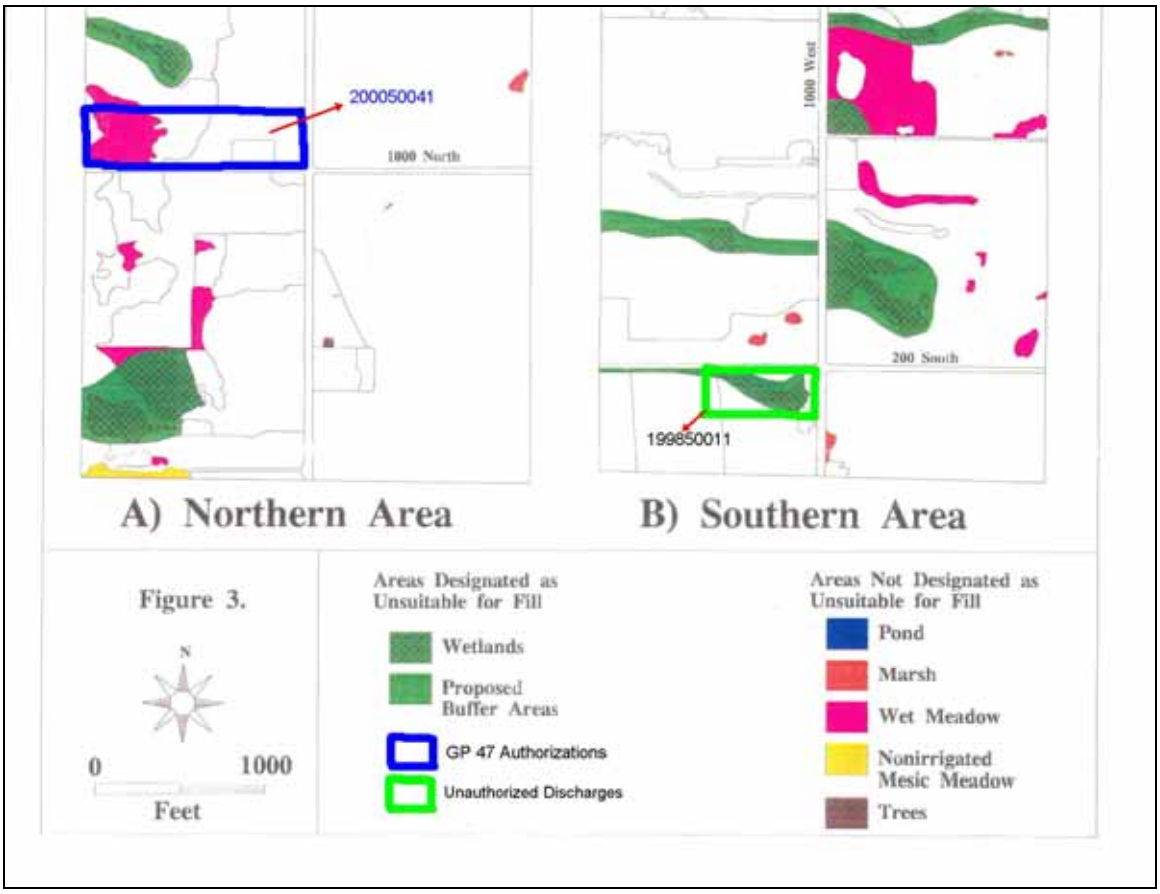
GP No. 47
Logan City
Cache County
Sheet 3 of 3

Table 1. GP 47 Authorizations

Project Number	Applicant	Project Name	Location	PropAcr.	Type of File	Acreage Delin./authorized	Type of wetlands	VIO Acreage	Mit. Requirements	Mitigation Status	Impacts within SAMP area?
200250306	Logan City	Environmental Center	SE Corn. 500 N. & 10th W	7.82	WD/GP47	1.89&.007/1.25 acres of wetmdw.	Wet Meadow/Marsh funded by springs		1.25 acres at bank	Not on City debit/credit list	Yes; but wetlands not identified on SAMP map
200150522	STI	10th W Industrial Corr II	(west) 10th W. b/w 17th&18th N.	4.62	WD/GP47	1.07 acres/1.07	Marsh/SS/WetMdw.		1.07 acres at bank	On City credit list; Area C (marsh); successful	Yes; not all wetlands id on SAMP map. Those that were, suit.
200150521	Frontier Scientific	10th W Industrial Corr.	North of 17th N b/w 11th&12th W.	10.72	GP47	0.15	wetmdw.		0.15 at bank	On City credit list; Area C (wet meadow); Successful	Yes; but wetlands not identified on SAMP map
200050041	Gossner Foods	Plant	N. of 10th N. b/w 10th&12th W.	~12	WD/GP47	8.83/3.5	1.35 pond&7.48 WM/3.5 WM		1.17 acre creation on-site, 1.54 acres buffer, 1.63 acres enhancement, 2 acres off-site at bank	Successful on-site creation (1.28 acres), buffer (1.54 acres), enhancement (1.63 acres); Off-site City credited 1.69 acres; Area D (marsh); Successful, but need additional 0.31 acres)	Yes; avoided wetlands unsuit.for fill; impacted wetlands suit.for fill; identified add'l wetlands not on SAMP map
199950195	Tony Nielson	Small Industrial park	W. of 10th W & S. of 14th N.	?	WD/GP47	1.05/0.44	WM/WM		on-site; 0.44 acres creation WM	No mon.reports or indication that mit.was done.	Yes; filled wet suit for fill. Delineation matches SAMP map.

Total Delin:	12.85	Mit @ Bank:	2.91
Total Auth:	6.41	Mit On-Site:	1.28 acres created and 1.63 enhancement
		Net Loss (acreage):	2.21 acres


Proposed Management Status of Tenth West Corridor Wetlands
1800 North
200150522
200150521
1400 North
199950195
1200 West
1000 West
199850086
600 North
1200 West
199850085
200250306
800 West
400 North (Proposed)
200 North
199850087


200050041
1800 North
1000 West
200 South
199850011
A) Northern Area
B) Southern Area
Figure 3.
N
0
1000
Feet
Areas Designated as Unsuitable for Fill
Wetlands
Proposed Buffer Areas
GP 47 Authorizations
Unauthorized Discharges
Areas Not Designated as Unsuitable for Fill
Pond
Marsh
Wet Meadow
Nonirrigated Mesic Meadow
Trees

WHEN RECORDED RETURN TO:

_____
Attention: _____
_____
_____

THIS SPACE FOR RECORDER'S USE ONLY

DECLARATION OF RESTRICTIONS

THIS DECLARATION OF RESTRICTIONS is made as of _____, 200@, by _____, a California (*for example*) Limited Liability Partnership ("Declarant").

WHEREAS, Declarant is the owner of certain real property located in the City of _____, County of _____, Utah, described in Exhibit "A" attached hereto and incorporated hereby by this reference (hereinafter "Preserve Area"); and

WHEREAS, Declarant intends to develop the above described property as wildlife habitat and a wetland preserve area, to be so held in perpetuity subject to restrictions in accordance with the provisions of the Section 404 Permit #_____ (Exhibit B) (hereinafter "Permit") issued to Declarant by the U.S. Army Corps of Engineers (hereinafter "Corps") and the _____ *Open Space Preserve Operations and Management Plan* (Exhibit C) (hereinafter "The Plan");

WHEREAS, this Declaration of Restrictions is intended to implement the provisions of the Permit requiring a binding covenant running with the land, but shall not be construed to impose restrictions in addition to those provided for in the Permit; and

WHEREAS, the Preserve Area consists of both jurisdictional wetland features and associated natural upland areas;

WHEREAS, the Declaration will benefit all parties to the Declaration in that it will assist in preserving and maintaining the drainage and wildlife habitat in the Preserve Area;

NOW THEREFORE, Declarant declares as follows:

1. Covenant Running with Land. In consideration of the foregoing benefits flowing to all parties; in consideration of the benefits obtained by the Declarant from the Permit, and other valuable consideration, the receipt and adequacy of which is hereby acknowledged, the Declarant does hereby covenant and agree to restrict, and does by this instrument intend to restrict, the future use of the Preserve Area as set forth below, by the establishment of this Covenant running with the land.

2. Restrictions Concerning the Preserve Area. Except for those actions necessary to accomplish preservation, maintenance, repair, fire prevention, or enhancement as has been, or in the future is authorized by the Corps, consistent with the Permit and The Plan, no person shall engage in any of the following restricted activities in the Preserve Area:

(a) No plowing or cultivation of the Preserve Area or any portion of such area, and no destruction or removal of any natural tree, shrub or other vegetation that exists upon the Preserve Area shall be done or permitted except by the Declarant or its successors and assigns to the Preserve Area, as described in The Plan and in consultation with the Corps, for the purpose of thatch management or the removal/management of newly introduced noxious or dangerous plants as necessary to maintain the Preserve Area;

(b) No materials or debris, including snow, shall be stored or placed (whether temporarily or permanently) within the Preserve Area or any portion of such area without prior written approval by the Corps;

(c) No discharge of any dredged or fill material shall be permitted within the Preserve Area or any portion of such area except as consistent with the terms and conditions of the Permit;

(d) No discharge, dumping, disposal, storage or placement of any trash, refuse, rubbish, grass clippings, cuttings or other waste materials within the Preserve Area or any portion of such area shall be permitted;

(e) No leveling, grading or landscaping within the Preserve Area or any portion of such area shall be done or permitted without prior written approval from the Corps;

(f) No destruction or removal of any natural tree, shrub or other vegetation that exists upon the Preserve Area shall be permitted except by the Declarant or its successors and assigns to the Preserve Area, for the purposes of thatch management or the removal of noxious or dangerous plants as necessary to maintain the Preserve Area;

(g) No motorized vehicles shall be ridden, brought, used or permitted on any portion of the Preserve Area, except as provided for in (a) and (f) above or with prior written approval by the Corps;

(h) The Preservation Area will not be used to store snow;

(i) No roads, utility lines, trails, benches, equipment storage, or other structures or activities shall occur within the Preserve Area without prior written approval by the Corps.

(j) No grazing of animals is allowed.

(k) No surface runoff (other than naturally occurring surface runoff) from any surrounding development shall be allowed to flow onto the protected area under normal conditions.

3. Not An Offer to Dedicate: No Rights of Public Use. The provisions of this Declaration of Restrictions do not constitute an offer for public use. This instrument does not constitute an irrevocable offer to dedicate.

4. Successors and Assign Bound. Declarant hereby agrees and acknowledges that the Preserve Area shall be held, sold, conveyed, owned and used subject to the applicable terms, conditions and obligations imposed by this Agreement relating to the use, repair, maintenance and/or improvement of the Preserve Area, and matters incidental thereto. Such terms,

conditions and obligations are a burden and restriction on the use of the Preserve Area, as applicable.

The provisions of this Agreement shall (subject to the limitations contained in this Agreement and without modifying the provisions of this Agreement) be enforceable as equitable servitudes and conditions, restrictions and covenants running with the land, and shall be binding on the Declarant and upon each and all of its respective heirs, devisees, successors, and assigns, officers, directors, employees, agents, representatives, executors, trustees, successor trustees, beneficiaries and administrators, and upon future owners of the Preserve Area and each of them.

5. Severability. The provisions of the Declaration are severable and the violation of any of the provisions of this Declaration by a Court shall not affect any of the other provisions which shall remain in full force and effect.

DECLARANT:

_____
a Limited Liability Partnership

Date: _____

By: _____

Its _____

STATE OF UTAH

County of _____

On _____, before me, _____,
Date Name and Title of Officer (e.g., "Jane Doe, Notary Public")

Personally appeared _____,
Name(s) of Signer(s)

___ personally known to me
___ proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

_____

Place Notary Seal Above

Signature of Notary Public

EXHIBIT A – LEGAL DESCRIPTION OF "PRESERVE AREA"
EXIBIT B – MAP OF "PRESERVE AREA"
EXIBIT C – Section 404 Permit #_____
EXHIBIT D – _____ OPEN SPEACE OPERATIONS AND MANAGEMENT PLAN FOR "PRESERVE AREA'