Willits Bypass Project
Mitigation and Monitoring Proposal

Appendices A and N – R

U.S. Highway 101

Mendocino County, near the City of Willits, California

PM 43.1-52.3

01-26200

USACE file no. 1991-194740N

April 2013

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

Appendix A Nomenclature of Plant and Animal Species Mentioned in the MMP

Appendix A Nomenclature of Plant and Animal Species Mentioned in the MMP

Table A-1. Plant Species

Common Name	Scientific Name	Status[a]
American slough-grass	*Beckmannia syzigachne*	OBL
Annual hairgrass	*Deschampsia danthonioides*	FACW
Arroyo willow	*Salix lasiolepis*	FACW
Avens	*Geum macrophyllum*	FACW
Baker's meadowfoam	*Limnanthes bakeri*	OBL
Baltic rush	*Juncus balticus*	OBL
Beardless wildrye	*Elymus triticoides*	FAC
Bedstraw	*Galium* sp.	N/A
Bird's foot trefoil	*Lotus corniculatus*	FAC
Black cottonwood	*Populus balsamifera* ssp. *trichocarpa*	FACW
Black oak	*Quercus kelloggii*	UPL
Blue elderberry	*Sambucus nigra* ssp. *caerula* (*Sambucus mexicana*)	FAC
Blue oak	*Quercus douglasii*	UPL
Blue wildrye	*Elymus glaucus* ssp. *glaucus*	FACU
Bluegrass	*Poa* sp.	N/A
Bolander's rush	*Juncus bolanderi*	OBL
Bolander's water-starwort	*Callitriche heterophylla* ssp. *bolanderi*	OBL
Box elder	*Acer negundo* var. *californicum*	FACW
Brackenfern	*Pteridium aquilinum*	FACU
Bracted popcornflower	*Plagiobothrys bracteatus*	OBL
Broadleaf cattail	*Typha latifolia*	OBL
Broadleaf water plantain	*Alisma plantago-aquatica* var. *americana*	OBL
Brown headed rush	*Juncus phaeocephalus*	FACW
Brown twig dogwood	*Cornus glabrata*	FACW
Bulrush	*Scirpus* sp.	N/A
Bur-clover	*Medicago polymorpha*	UPL
Buttercup	*Ranunculus* sp.	FACW
California barley	*Hordeum brachyantherum* ssp. *californicum*	FACW
California bay	*Umbellularia californica*	FAC
California blackberry	*Rubus ursinus* (*R. vitifolius*)	FACW
California brome	*Bromus carinatus*	UPL
California fescue	*Festuca californica*	FACU
California oatgrass	*Danthonia californica*	FACW
California poppy	*Eschscholzia californica*	UPL
California rose	*Rosa californica*	FAC
California semaphore grass	*Pleuropogon californicus*	OBL
Camas	*Camassia quamash*	FACW
Canyon live oak	*Quercus chrysolepis*	UPL
Chicory	*Cichorium intybus*	UPL

Table A-1. Continued

Common Name	Scientific Name	Status[a]
Clematis	*Clematis* sp.	N/A
Clustered dock	*Rumex conglomeratus*	FACW
Coast redwood	*Sequoia sempervirens*	UPL
Cocklebur	*Xanthium strumarium*	FAC
Common dandelion	*Taraxacum officinale*	FACU
Common meadow-rue	*Thalictrum polycarpum*	UPL
Common spikerush	*Eleocharis macrostachya*	OBL
Common yarrow	*Achillea millefolium*	FACU
Cow parsnip	*Heracleum lanatum* (*H. maximum*)	FACU
Coyote bush	*Baccharis pilularis*	UPL
Coyote thistle	*Eryngium aristulatum*	OBL
Cranesbill	*Geranium* sp.	N/A
Creeping bentgrass	*Agrostis stolonifera*	FACW
Creeping ryegrass	*Leymus triticoides*	FAC
Curly dock	*Rumex crispus*	FACW
Cutleaf geranium	*Geranium dissectum*	UPL
Davy's semaphore grass	*Pleuropogon californicus* var. *davyi*	OBL
Dense sedge	*Carex densa*	OBL
Dogwood	*Cornus* sp.	N/A
Douglas' meadowfoam	*Limnanthes douglasii*	OBL
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	UPL
Downingia	*Downingia* sp.	N/A
False Solomon's seal	*Smilacina racemosa*	FAC
Fendler's meadow rue	*Thalictrum fendleri*	FACU
Fescue	*Festuca* sp.	FACU
Field bindweed	*Convolvulus arvensis*	UPL
Field horsetail	*Equisetum arvense*	FAC
Field sedge	*Carex praegracilis*	FACW
Filaree	*Erodium* sp.	N/A
Foothill sedge	*Carex tumulicola*	FAC
Four-spot	*Clarkia purpurea* ssp. *quadrivulnera*	UPL
Fowl bluegrass	*Poa palustris*	FACW
Fremont cottonwood	*Populus fremontii* ssp. *fremontii*	FACW
Gooseberry	*Ribes* sp.	N/A
Greensheath sedge	*Carex feta*	OBL
Harding grass	*Phalaris aquatica*	FAC
Hawthorn	*Crataegus* sp.	N/A
Hedge nettle	*Stachys rigida*	FACW
Hedgehog dogtail grass	*Cynosurus echinatus*	UPL
Himalayan blackberry	*Rubus armeniacus*	FACW
Honeysuckle	*Lonicera* sp.	N/A
Howell's bluegrass	*Poa howellii*	UPL
Interior live oak	*Quercus wislizeni*	UPL
Iris-leaved rush	*Juncus xiphioides*	OBL
Italian ryegrass	*Lolium multiflorum*	FAC
Italian thistle	*Carduus pycnocephalus*	UPL

Table A-1. Continued

Common Name	Scientific Name	Status[a]
Kentucky bluegrass	*Poa pratensis*	FACU
Knotweed	*Polygonum* sp.	N/A
Lateral sedge	*Carex unilateralis*	FACW
Lythrum	*Lythrum hyssopifolium*	FACW
Manzanita	*Arctostaphylos manzanita*	UPL
Meadow barley	*Hordeum brachyantherum* ssp. *brachyantherum*	FACW
Meadow foxtail	*Alopecurus pratensis*	FACW
Meadowfoam	*Limnanthes* sp.	N/A
Mediterranean barley	*Hordeum marinum* ssp. *gussoneanum*	FAC
Medusa-head grass	*Taeniatherum caput-medusae*	UPL
Miniature lupine	*Lupinus bicolor*	UPL
Mountain mint	*Pycnanthemum californicum*	UPL
Mugwort	*Artemisia douglasiana*	FACW
Navarretia	*Navarretia* sp.	N/A
Nebraska sedge	*Carex nebrascensis*	OBL
North Coast semaphore grass	*Pleuropogon hooverianus*	FACW
Northwestern mannagrass	*Glyceria occidentalis*	OBL
Oniongrass	*Melica* sp.	UPL
Orchard grass	*Dactylis glomerata*	FACU
Oregon ash	*Fraxinus latifolia*	FACW
Oregon white oak	*Quercus garryana*	UPL
Owl's clover	*Castilleja* sp.	N/A
Pacific foxtail	*Alopecurus saccatus*	OBL
Pacific madrone	*Arbutus menziesii*	UPL
Pacific ninebark	*Physocarpus capitatus*	FACW
Pacific willow	*Salix lucida* ssp. *lasiandra*	NI
Pennyroyal	*Mentha pulegium*	OBL
Perennial ryegrass	*Lolium perenne*	FAC
Plantain	*Plantago* sp.	N/A
Poison hemlock	*Conium maculatum*	FACW
Poison-oak	*Toxicodendron diversilobum*	UPL
Ponderosa pine	*Pinus ponderosa*	FACU
Purple needlegrass	*Nassella pulchra*	UPL
Purslane speedwell	*Veronica peregrina* ssp. *xalapensis*	OBL
Rayless goldfields	*Lasthenia glaberrima*	OBL
Red alder	*Alnus rubra*	FACW
Red fescue	*Festuca rubra*	FAC
Red top	*Agrostis* sp.	N/A
Red willow	*Salix laevigata*	≥FAC[c]
Red-flowering currant	*Ribes sanguineum*	UPL
Red-twig dogwood	*Cornus sericea*	FACW
Reed canary grass	*Phalaris arundinacea*	OBL
Ripgut brome	*Bromus diandrus*	UPL
Rose clover	*Trifolium hirtum*	FACU
Rough bluegrass	*Poa trivialis*	FACW
Rough cat's ear	*Hypochaeris radicata*	UPL

Table A-1. Continued

Common Name	Scientific Name	Status[a]
Salmonberry	*Rubus spectabilis*	FAC
Sandbar willow	*Salix exigua*	OBL
Scouler's willow	*Salix scouleriana*	FAC
Sedge	*Carex* sp.	FACW
Semaphore grass	*Pleuropogon* sp.	N/A
Shamrock	*Trifolium dubium*	FACU
Short-awned foxtail	*Alopecurus aequalis*	OBL
Short-scale sedge	*Carex deweyana* ssp. *leptopoda* (*C. leptopoda*)	FACW
Slender beak sedge	*Carex athrostachya*	FACW
Slender fescue	*Vulpia octoflora*	UPL
Slender hairgrass	*Deschampsia elongata*	FACW
Slender rush	*Juncus tenuis*	FACW
Small bract sedge	*Carex subbracteata*	FACW
Small-fruited bulrush	*Scirpus microcarpus*	OBL
Soft chess	*Bromus hordeaceus*	FACU
Soft rush	*Juncus effusus*	OBL
Spanish lotus	*Lotus purshianus var. purshianus*	UPL
Spicebush	*Calycanthus occidentalis*	FAC
Spike bentgrass	*Agrostis exarata*	FACW
Spreading gooseberry	*Ribes divaricatum*	FACW
Spreading rush	*Juncus patens*	FAC
Stipulate popcornflower	*Plagiobothrys stipitatus*	OBL
Straight beaked buttercup	*Ranunculus orthorhynchus*	FACW
Straight-leaf rush	*Juncus orthophyllus*	FACW
Swordleaf rush	*Juncus ensifolius*	FACW
Tall fescue	*Festuca arundinacea*	FAC
Tanoak	*Lithocarpus densiflorus*	UPL
Teasel	*Dipsacus fullonum*	UPL
Thimbleberry	*Rubus parviflorus*	FAC
Tiger lily	*Lilium pardalinum*	OBL
Timothy grass	*Phleum alpinum*	FACW
Toad rush	*Juncus bufonius*	FACW
Tufted hairgrass	*Deschampsia cespitosa*	FACW
Tule	*Schoenoplectus acutus* (*Scirpus acutus*)	OBL
Twinberry	*Lonicera involucrata*	FAC
Valley oak	*Quercus lobata*	FAC
Velvet grass	*Holcus lanatus*	FAC
Vetch	*Vicia sativa*	FACU
Waterplantain buttercup	*Ranunculus alismifolius* var. *alismifolius*	FACW
Western buttercup	*Ranunculus occidentalis*	FACW
Western goldenrod	*Euthamia occidentalis*	OBL
Western rush	*Juncus occidentalis*	FACW
Western trillium	*Trillium ovatum*	NI
White alder	*Alnus rhombifolia*	FACW

Table A-1. Continued

Common Name	Scientific Name	Status[a]
White bark raspberry	*Rubus leucodermis*	UPL
White brodiaea	*Triteleia hyacinthina*	FACW
White clover	*Trifolium repens*	FACU
White snowberry	*Symphoricarpos* sp.	N/A
Wild grape	*Vitis californica*	FACW
Wild oat	*Avena* sp.	N/A

[a] Indicator Status Definitions:

OBL = Obligate, almost always occurs in wetlands (>99% probability of occurrence)
FACW = Facultative wetland, usually occurs in wetlands (66%–99% probability)
FAC = Facultative, equally likely to occur in wetlands or nonwetlands (34%–66% probability)
FACU = Facultative upland, usually occurs in nonwetlands but occasionally in wetlands (1%–33% probability)
UPL = Obligate upland, almost never occurs in wetlands (<1% probability)
NI = No indicator
N/A = Not applicable; no status because not identified to species level.

Source: Reed 1988.

[b] Not assigned status in Reed (1988), but appears to be at least FAC because its habitat as described in the Jepson Manual includes meadows (Hickman 1993).
[c] Appears to have a status of FAC or wetter based on habitat as described in the Jepson Manual: riverbanks, seepage areas, lake shores, canyons, and ditches (Hickman 1993).

Table A-2. Wildlife Species

Common Name	Scientific Name
American coot	*Fulica americana*
American wigeon	*Anas americana*
Black-tailed deer	*Odocoileus hemionus*
California coastal Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
California roach	*Lavinia symmetricus*
Cinnamon teal	*Anas cyanoptera*
Elk	*Cervus canadensis*
Largemouth bass	*Micropterus salmoides*
Mallard	*Anas platyrhynchos*
Northern California steelhead	*Oncorhynchus mykiss*
Northern shoveler	*Anas clypeata*
Sunfish	*Lepomis* sp.
Western pond turtle	*Actinemys marmorata*
Willow flycatcher	*Empidonax traillii*
Wood duck	*Aix sponsa*
Yellow warbler	*Dendroica petechia*
Yellow-breasted chat	*Icteria virens*

Appendix N
Assessment of Erosion Sites on Offsite Mitigation Parcels in Little Lake Valley

Willits Bypass Project

Little Lake Valley (Taylor Ranch), Looking South

Technical Memorandum:
Assessment of Erosion Sites
On Offsite Mitigation Parcels in Little Lake Valley

U.S. Highway 101

Mendocino County, near Willits, California

PM 43.31-52.3

01-26200

June 2010

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

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Willits Bypass Project

Technical Memorandum:
Assessment of Erosion Sites
On Offsite Mitigation Parcels in Little Lake Valley

U.S. Highway 101

Mendocino County, near Willits, California

PM 43.31-52.3

01-26200

June 2010

STATE OF CALIFORNIA
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Chapter 1 Introduction

1.1 Purpose of Technical Memorandum

The California Department of Transportation (Caltrans) submitted a Clean Water Act Section 401 water quality certification request (Caltrans 2010) to the North Coast Regional Water Quality Control Board (RWQCB) on March 1, 2010, for the Willits Bypass Project (project) in Mendocino County, California.

As part of their review of the Section 401 water quality certification request (Caltrans 2010), the RWQCB indicated that they were concerned about sedimentation in Little Lake Valley/Outlet Creek Basin and believed that repairing headcuts in the basin would be important to address sedimentation and that this should be included as part of the project's compensatory mitigation. The RWQCB provided Caltrans with two digital images that were taken by RWQCB staff during a 2005 field visit to the Valley as part of a field review of the offsite mitigation parcels. The images were said to be representative of headcuts that the RWQCB believed to be contributing sediment and causing water quality degradation to streams in the Valley. One digital image was of a headcut on the Lusher offsite mitigation parcel and the second digital image was of a headcut on the Hebrard parcel. The Hebrard parcel is privately held and at this time there are no plans to purchase this parcel as part of project mitigation. As such, the headcut on the Hebrard parcel is beyond the scope of this erosion site assessment (see below). However, recognizing the RWQCB's interest in this particular headcut, efforts were made to observe the headcut from adjacent parcels under Caltrans ownership. These qualitative observations are presented in Chapter 3, Results, in a separate section of the chapter but are not included further in this assessment.

In response to the RWQCB's concern about sedimentation, Caltrans conducted an assessment of existing erosion sites **at the offsite mitigation parcels** in May 2010. This erosion site assessment:

- documents existing erosion point (e.g., headcuts) and linear (e.g., eroding banks) features found on upland and instream areas (each erosion feature is mapped and documented with a unique identification number);
- evaluates existing erosion features in terms of contribution of sediment to swales and creeks, effects on adjacent sensitive resources, and ease of constructability/access;
- recommends five erosion features that could be addressed to satisfy the RWQCB's concerns regarding sedimentation and water quality in Outlet Creek Basin; and
- provides typical cross-sections that show techniques to address the recommended erosion sites to be repaired.

This technical memorandum summarizes the May 2010 erosion assessment. The technical memorandum is organized into the following chapters:

- Chapter 1, “Introduction.”
- Chapter 2, “Methods.”
- Chapter 3, “Results.”
- Chapter 4, “Summary and Recommendations.”
- Chapter 5, “References.”
- Chapter 6, “List of Preparers.”
- Appendix A, “Digital Images of Erosion Sites, By Parcel.”

Chapter 2 Methods

2.1 Assessment Dates and Team Qualifications

The erosion site assessment of offsite mitigation parcels occurred over a 5-day period on May 3 through May 7, 2010. During this period, the 35 offsite mitigation parcels were surveyed, covering approximately 2,000 acres. Table 2-1 lists the offsite mitigation parcel, its' Assessor's Parcel Number (APN), and when the parcel was surveyed during the erosion site assessment.

Table 2-1. Erosion Site Assessment Dates for Offsite Mitigation Parcels

Property Owner	APN	Size (acres)	Date Surveyed
Arkelian	103-230-04	9.96	5-3-10
Benbow	007-010-04	36.16	5-5-10
	007-020-03	33.54	5-5-10 and 5-6-10
	108-020-06	46.53	5-5-10
	108-030-07	54.74	5-5-10
	108-040-13	40.96	5-5-10
Brooke	108-020-03	9.20	5-4-10
	108-030-01	16.90	5-4-10
	038-020-11	11.89	5-4-10
	038-040-09	14.99	5-4-10
Ford	108-010-05	76.57	5-5-10
	108-010-06	144.77	5-3-10 and 5-4-10
	108-020-04	151.61	5-3-10 and 5-4-10
	108-030-02	50.99	5-3-10 and 5-4-10
	108-030-05	80.39	5-3-10
Frost	108-070-04	46.53	5-4-10
Goss	103-230-02	10.08	5-3-10
Huff	037-240-RW	12.65	5-6-10
Lusher	038-060-08	18.65	5-3-10 and 5-4-10
	108-030-04	66.17	5-3-10
	108-030-03	23.88	5-3-10 and 5-4-10
MGC Plasma North	103-230-06	18.22	5-3-10
MGC Plasma Middle	103-250-14	27.04	5-3-10
MGC Plasma South	103-250-16	66.27	5-3-10
Nance	108-050-06	73.90	5-5-10
Niesen	108-040-02	27.43	5-4-10
Taylor	037-221-68	161.29	5-7-10
	037-240-41	144.15	5-6-10
Watson	037-221-30	115.59	5-6-10
Wildlands	108-070-08	64.06	5-5-10
	108-070-09	121.87	5-4-10
	108-060-01	63.39	5-5-10
	108-060-02	106.81	5-4-10
	108-020-07	7.77	5-5-10
	108-030-08	8.00	5-5-10

The survey team consisted of a geomorphologist with expertise in channel, floodplain, and wetland restoration and erosion site assessment, and a fish biologist with similar qualifications and extensive knowledge on Outlet Creek Basin hydrology and physical geography of the offsite mitigation parcels. In order to ensure the greatest possible consistency of survey methods and the most accurate documentation, survey team members collected data together at the beginning of the survey period as part of field calibration efforts. After field calibration of methods was complete, the survey team usually split up and covered separate areas, as appropriate.

2.2 Assessment Methods and Definitions

Prior to beginning the erosion site assessment field work, aerial photographs were reviewed for evidence of headcuts and other erosion features at the offsite mitigation parcels. In addition, Appendix C of the project's Mitigation and Monitoring Proposal (MMP; Caltrans 2010) was reviewed for information on existing sensitive biological resources (e.g., special-status plants and jurisdictional wetlands) at the offsite mitigation parcels.

Each offsite mitigation parcel was surveyed via a walking survey. Each offsite mitigation parcel was evaluated by the survey team, with an emphasis on identifying erosion sites on channels or other areas of concentrated flow (e.g., swales and drainages). The concentrated flow could be perennial, intermittent, or ephemeral. If no channels or other areas of concentrated flow were present, the survey team walked separate diagonal transects on the parcel in order to cover its entirety. The emphasis on channels and other areas of concentrated flow was a result of the digital images provided by the RWQCB, where the headcuts of concern are located on channels. Erosion features not associated with concentrated flow conditions (e.g., stand-alone rotational slumps and eroding upland cattle trails) were not documented.

The three main erosion features usually found in areas of concentrated flow and that have the potential to contribute an excessive amount of sediment are eroding banks and eroding gullies, and headcuts. In riverine (and to a lesser extent, wetland) environments where no other significant land use practices that destabilize and introduce sediment to the surrounding topography occur, eroding banks and gullies are generally thought to be the principal source of excessive sedimentation locally (Hooke 1980; Lawler 1992, 1995; Lawler et al. 1997; Rosgen 1996). Much of Little Lake Valley has been used for livestock grazing. Livestock grazing in riverine environments can also lead to bank erosion as a result of trampled ground that becomes compacted enough to prohibit the establishment of vegetation but not so much as to prohibit the contribution of soil particles to the water column from high velocity flows (Myers and Swanson 1993). Bank erosion of streams running through Little Lake Valley likely delivers much of the fine sediment in the Outlet Creek Basin (LeDoux-Bloom and Downie 2008). Headcuts can also provide excessive sediment contribution, although the contribution of excess sediment is more pronounced in high-gradient gully systems than in low-gradient valleys such as Little Lake Valley (Knighton 1998; Patton and Schumm 1981; Schumm 1977).

Other erosion features, such as depressional wetlands, potholes, scour areas, and slumps (herein referred to as "other point features") that were observed during the erosion site assessment with

the potential to increase sedimentation to either the surrounding channels (both named and unnamed) and wetlands were also documented.

Figure 2-1 shows the data collection form that was used in the field to document pertinent information for each erosion site.

The following definitions for erosion sites are used in this technical memorandum:

- Depressional wetland: see definition for pothole below.
- Eroding bank: a streambank that is currently experiencing or has experienced significant bank retreat (i.e., the net linear recession of the streambank); usually, adequate bank-stabilizing vegetation or other cover is not present on the eroding bank.
- Eroding gully: a gully (i.e., small-scale drainage) that is experiencing either continuous or discontinuous erosion as evidenced by incision, localized slumping, or other erosion features.
- Headcut: the upslope limit of a gully or channel system, characterized by a steep wall which is cut back (i.e., mostly vertical) and migrating upslope (i.e., experiencing headward migration) as further erosion occurs.
- Headward migration: the lengthening of a gully or channel from erosion at its head, accomplished by concentrated water flow from rainwash, gullying, and/or slumping.
- Knickpoint: a break or interruption of slope in the longitudinal profile (i.e., channel bed) of a channel.
- Pothole: a depressional feature that has steep banks and is less than 15 feet in length and less than 10 feet in width.
- Scour area: an area on a gully or channel that is being deepened or widened as a result of concentrated flow, but that is not experiencing headward migration.
- Slump: an erosion feature at the head of an eroding gully that is more gravitationally-induced than scour-induced, but that has a definable headcut at its head.

2.3 Data Collection

Upon identification of an eroding bank, eroding gully, headcut, or other point feature, the following information was documented on a data collection form:

- Topographic position (whether or not the feature was located in a lowland channel or on an upland surface);
- Type of erosion site (e.g., headcut, eroding bank, eroding gully, depressional wetland, pothole, scour area, or slump);
- Vertical distance to the deepest portion at the base of the erosion site on the downstream or downslope end (called the “drop”; this variable is only applicable to headcuts, potholes, scour areas, and slumps);

- Average width of the erosion site (this variable measures the average width of the affected area downstream or downslope of the erosion site, and is only applicable to headcuts and other point features);
- Length of the erosion site (the total length of either the eroding bank or eroding gully, or the total length of the affected area downstream or downslope of a headcut, depressional wetland, pothole, scour area, or slump); and
- Ancillary notes describing the location, severity, and digital photograph number(s) of the erosion site.

Each erosion site was given a unique identification label. The erosion site was labeled based on its parcel owner, APN, and the order in which it was identified on that particular parcel. For example, Benbow 007-020-03_1 is the first documented erosion site on the Benbow APN 007-020-03 parcel. The location of each erosion site was hand-mapped on aerial photographs and precision-mapped with a sub-meter GPS, and photo-documented in the upstream and downstream direction, as applicable.

J Peters and J Kozlowski 5-3-10 | ***PARCEL: MGC Plasma North*** | ***APN: 103-230-06***

Category I: Vegetated areas where anadromous fish are known to occur (e.g., Haehl, Baechtel, Broaddus, Mill, Upp, Davis, Outlet).

Category II: Vegetated areas along tribs of Category I riparian corridors w/in 1000 ft u/s of confluence of Category I stream (e.g., Fulweiter).

Category III: Vegetated areas along tribs of Category I riparian corridors more than 1000 ft u/s of confluence of Category I stream (e.g., upper Fulweiter).

Perennial: flows year round

Intermittent: flow for only certain times of the year and receive water from both surface and gw

Ephemeral: channels are above water table year round and only receive water from surface runoff

Equipment:
measuring tape data forms
stadia rods maps
GPS
digital camera

SITE	INSTREAM / UPLAND	TYPE	DROP (ft)	AVE WIDTH (FT)	LENGTH (ft)	NOTES
1	IN	headcut	0.90	3.25	14.00	heacut on main drainage ditch on western end of parcel (photos 1-3)
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.						
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Figure 2-1
Example Data Collection Form

Chapter 3 Results

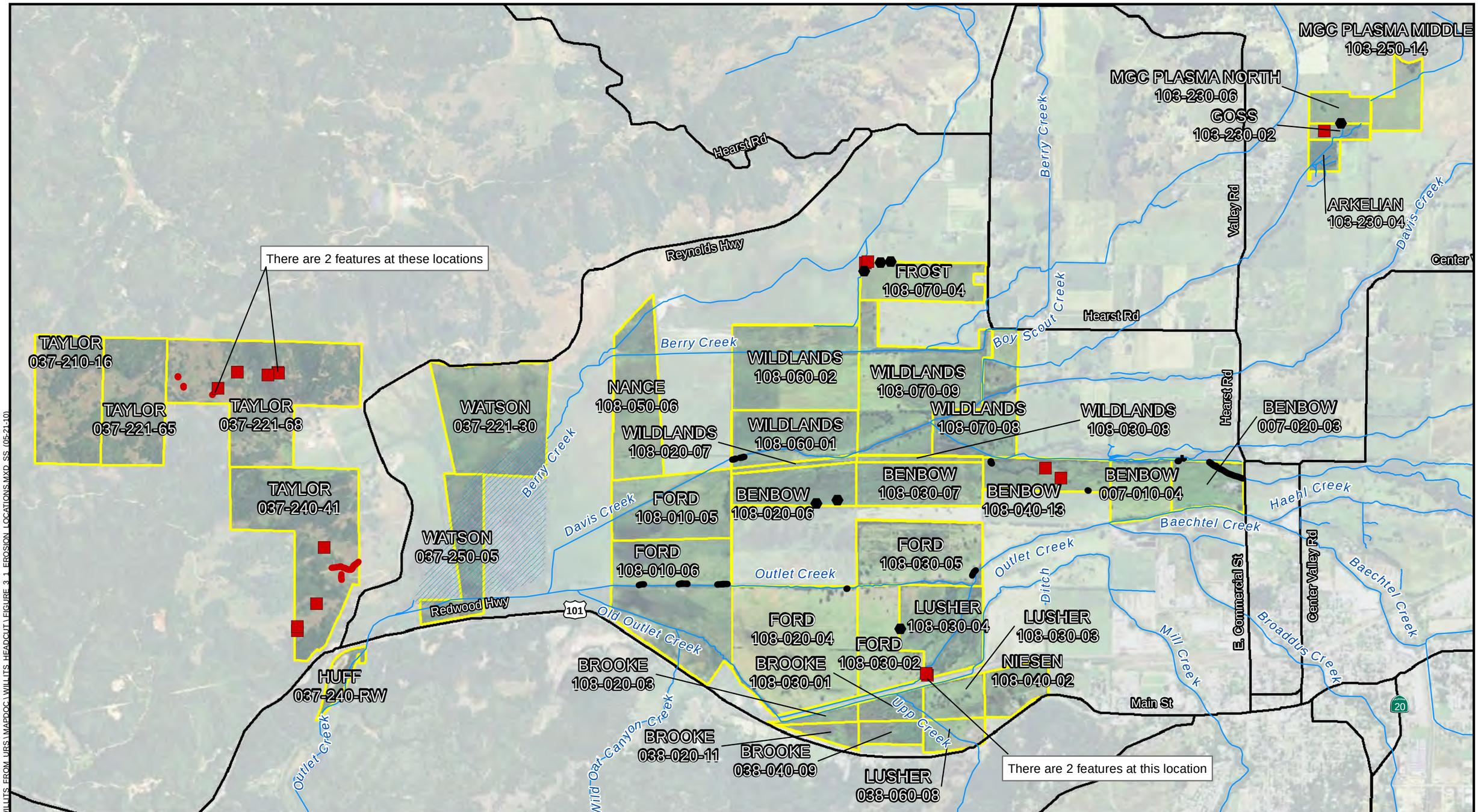
This chapter presents the results of the May 2010 erosion site assessment, by offsite mitigation parcel. Offsite mitigation parcels without erosion sites are not discussed herein.

Table 3-1 summarizes the relevant information that was collected for each erosion site at the offsite mitigation parcels, as applicable (Chapter 2). Figure 3-1 illustrates the location of each erosion site. As shown in Table 3-1 and on Figure 3-1, there are a total of 40 erosion sites on the offsite mitigation parcels: 11 eroding banks, 6 eroding gullies (5 with headcuts at their origin), 16 headcuts, and 7 other point features. On those offsite mitigation parcels located on the Little Lake Valley floor, most eroding bank sites are located on Outlet Creek and Davis Creek, and most headcuts and other point features are located in areas of concentrated flow with a slight increase in local gradient. On those offsite mitigation parcels located on the Outlet Creek Basin slopes (i.e., Taylor Ranch), almost all erosion sites are associated with culverts along Goat Rocks Road on the northern Taylor parcel (APN 037-221-68), and the PG&E access road on the southern Taylor parcel (APN 037-240-41).

Appendix A includes representative digital images of each erosion site, presented by parcel.

Table 3-1. Erosion Sites, by Offsite Mitigation Parcel

Parcel[a]	Identification Number	Instream/ Upland	Type	Drop (ft)	Average Width (ft)	Length (ft)	Notes
Benbow	108-020-06_1	Instream	Headcut	0.5	3.5	11.0	Very small headcut along drainage that flows north along western boundary of parcel
	108-020-06_2	Instream	Headcut	0.6	1.0	6.0	Small headcut on small tributary just upstream from larger channel that drains wetland
Benbow	108-040-13_1	Instream	Eroding bank	n/a	n/a	64.0	On left bank; scalloped; Category III abandoned channel; banks 2-3' high
	108-040-13_2	Upland	Pothole	2.5	5.0	12.0	Depressional pothole adjacent to swale; south and tributary to Category III abandoned channel
	108-040-13_3	Upland	Headcut	3.4	3.0	27.0	Large headcut on swale tributary to main swale that eventually connects to Category III abandoned channel
	108-040-13_4	Instream	Eroding bank	n/a	n/a	20.0	On left bank; scalloped; one of the main swales on parcel; at western end of parcel; banks ~ 2' high
Benbow	007-020-03_1	Instream	Eroding bank	n/a	n/a	30.0	Eroding berm/levee between two Category III channels; erosion primarily occurs at confluence
	007-020-03_2	Instream	Eroding bank	n/a	n/a	820.0	Incised gully that crosses southern boundary of parcel; erosion primarily on right bank; erosion locations extend south across to road but not accessible at time of survey
Ford	108-010-06_1	Instream	Eroding bank	n/a	n/a	110.0	Unstable, mostly unvegetated right bank associated with riffle convergence flow (i.e., outer bend cutbank); banks 6' tall from toe
	108-010-06_2	Instream	Eroding bank	n/a	n/a	180.0	Unstable, mostly unvegetated right bank associated with riffle convergence flow (i.e., outer bend cutbank); banks 6' tall from toe
	108-010-06_3	Instream	Eroding bank	n/a	n/a	180.0	Unstable, mostly unvegetated right bank associated with riffle convergence flow (i.e., outer bend cutbank); banks 6' tall from toe
	108-020-04_1	Instream	Eroding bank	n/a	n/a	35.0	On LB; scalloped erosional feature; nearly vertical in places; trampled by cattle; banks ~ 6-8' high into left bank levee
	108-030-05_1	Instream	Eroding bank	n/a	n/a	20.0	Rotational slump on right bank; main stem Outlet Creek; banks ~ 4-6' high; on southern boundary of parcel
Frost[b]	108-070-04_1	Instream	Headcut	3.5	12.0	75.0	Headcut leading off parcel to east at top of unstable Category III channel
	108-070-04_2	Instream	Headcut	4.0	7.0	20.0	Headcut in center of unstable Category III channel
	108-070-04_3	Upland	Headcut	1.5	3.0	20.0	Headcut on upland adjacent to first tributary to Category III channel
	108-070-04_4	Upland	Headcut	1.2	3.0	18.0	Headcut at top of second tributary to Category III channel



Legend

- Streams
- Major Road
- Offsite Mitigation Parcel

Headcut and Other Point Feature Locations

- Instream
- Upland

Eroding Gully/Bank Location

- Instream
- Upland

0 0.5 1 Miles

Data Sources
Aerials - ArcGIS Online (NAIP 2005)
Parcels - Caltrans (10/5/2009)
Stream - URS (2008)
Erosion Sites - ICF (2010)

N

Figure 3-1

Willits Bypass Project
Erosion Site Locations
On Offsite Mitigation Parcels

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Parcel[a]	Identification Number	Instream/ Upland	Type	Drop (ft)	Average Width (ft)	Length (ft)	Notes
	108-070-04_5	Instream	Headcut	1.4	8.0	68.0	Headcut in center of unstable Category III channel; close to first tributary
Goss	103-230-02_1	Upland	Headcut	0.70	3.0	7.0	Headcut at confluence of east to west swale with main drainage ditch on western end of parcel
Lusher	108-030-04_1	Instream	Depressional wetland	n/a	15.0	200.0	Large depressional wetland with slumping banks on swale in middle of Lusher parcel; not a true headcut because it is not progressing upstream
	108-030-04_2	Upland	Headcut	2.5	4.0	25.0	Large headcut on small swale to Old Outlet Creek near railroad crossing
	108-030-04_3	Upland	Headcut	1.2	6.0	22.6	Large headcut on small swale to Old Outlet Creek near railroad crossing
MGC Plasma North	103-230-06_1	Instream	Headcut	0.9	3.5	14.0	Headcut on main drainage ditch on western end of parcel
Taylor[c]	037-221-68_1	Upland	Headcut	3.5	5.5	13.5	Headcut upslope of Goat Rocks Road
	037-221-68_2	Upland	Scour area	3.5	4.0	14.5	Scour area downslope of road
	037-221-68_3	Upland	Scour area	2.3	2.0	3.3	Scour area downslope of road; associated with culvert; no headcut upslope
	037-221-68_4	Upland	Headcut	1.2	2.0	20.0	Small headcut on swale along upslope of road
	037-221-68_5	Upland	Scour area	1.3	3.0	5.0	Scour area downslope of road; associated with culvert; headcut (037-221-68_6) is upslope
	037-221-68_6	Upland	Headcut/eroding gully	3.0	2.5	60.0	Headcut at top of eroding gully upslope of 037-221-68_5
	037-221-68_7	Upland	Headcut/eroding gully	2.7	1.8	15.8	On same eroding gully as 037-221-68_6; a double headcut adjacent to road
	037-221-68_8	Upland	Headcut/eroding gully	3.2	7.0	6.0	Headcut on eroding gully in open area way from road
	037-221-68_9	Upland	Headcut/eroding gully	1.3	3.0	19.0	Headcut at edge of small livestock pond
	037-240-41_1	Upland	Eroding gully	n/a	n/a	680.0	Long incised gully adjacent to and most likely initiated by access road; eroding in areas but bedrock acts as grade control throughout
	037-240-41_2	Upland	Eroding gully/headcut	1.5	5.0	106.0	Incised eroding gully leading to headcut; deeper soil and not as much bedrock as 037-240-41_1
	037-240-41_3	Upland	Slump/headcut	2.0	18.0	36.0	Rotational slump with small headcut on downslope of road
	037-240-41_4	Upland	Headcut	1.6	2.0	5.5	Minor headcut on rocked gully on upslope of road
	037-240-41_5	Upland	Slump/headcut	4.0	7.0	32.0	Slump/headcut at start of swale

Parcel[a]	Identification Number	Instream/ Upland	Type	Drop (ft)	Average Width (ft)	Length (ft)	Notes
	037-240-41_6	Upland	Headcut	1.3	2.0	6.0	Small headcut on small east-facing swale; associated with cattle trail where flow collects and concentrates; entire swale downstream has pockets of moderate erosion
Wildlands	108-060-01_1	Instream	Eroding bank	n/a	n/a	90.0	Erosion on both banks; vertical banks lacking adequate vegetation cover; some slumping; extends to parcel boundary; banks 4-6' high
	108-060-01_2	Instream	Eroding bank	n/a	n/a	105.0	Erosion on both banks; vertical banks lacking adequate vegetation cover; some slumping; banks 4-8' high

[a] Overview map showing all eroding sites described in this table is provided in Figure 3-1.
[b] All five erosion sites on the Frost parcel are collectively referred to as the Frost Complex (Figure 3-2).
[c] Taylor sites 037-221-68_1 through 037-221-68_7 are collectively referred to as the Taylor Complex (Figure 3-3).

3.1 Little Lake Valley

3.1.1 Benbow 108-020-06

The Benbow 108-020-06 parcel has two erosion sites (Table 3-1, Figure 3-1, Appendix A). Both of these sites (108-020-06_1 and 108-020-06_2) are instream headcuts that occur on swales in the southwest corner of the parcel (Figure 3-1). Both have very small drops and any associated sediment derived from these headcuts is minimal and is spread out and deposited in the existing wetland complex to the north.

The areas of and adjacent to each headcut are well-vegetated wet meadow with sandy loam soils (Gielow sandy loam, 0 to 5 percent slopes). Concentrated flows from the swales upstream, combined with direct trampling by livestock, have likely initiated these headcuts; however, both headcuts appear relatively stable.

3.1.2 Benbow 108-040-13

The Benbow 108-040-13 parcel has four erosion sites (Table 3-1, Figure 3-1, Appendix A). There are two instream eroding bank sites (108-040-13_1 and 108-040-13_4) and two upland sites (108-040-13_2 and 108-040-13_3). Erosion site 108-040-13_1 is located in the northeast corner of the parcel and 108-040-13_4 is located in the southwest corner of the parcel (Figure 3-1). These two eroding bank sites have streambanks that range from 2 to 3 feet high, and although they are noticeably vertical in nature, the soil that binds the banks together is relatively compact and stable. The pothole feature (108-040-13_2), located in the center of the parcel (Figure 3-1), is isolated (i.e., not on a noticeable swale) and is not undergoing headward migration. The headcut (108-040-13_3), also located in the center of the parcel (Figure 3-1), is one of the largest observed during the course of the assessment and is discussed further in Chapter 4.

Any associated sediment derived from these erosion sites enters the Category III abandoned/discontinuous channel that runs along the eastern edge of the parcel. This watercourse appears to have once been connected to Davis Creek, but no longer has an active hydrologic connection to the creek. As such, potential sedimentation from these sites essentially enters an active sediment sink (the Category III abandoned/discontinuous channel). Furthermore, the potential contribution of sediment from 108-040-13_1 and 108-040-13_4 appears to be minimal, while dislodged sediment from 108-040-13_2 most likely never exits the pothole.

The areas of and adjacent to each erosion site are well-vegetated wet meadow, swale, and/or riparian woodland with clay loam soils (Cole clay loam, 0 to 2 percent slopes). Concentrated flows from the swales upstream, combined with direct trampling by livestock, have likely initiated these erosion features; however, all erosion sites except 108-040-13_2 appear relatively stable.

3.1.3 Benbow 007-020-03

The Benbow 007-020-03 parcel has two erosion sites (Table 3-1, Figure 3-1, Appendix A). Both of these sites (007-020-03_1 and 007-020-03_2) are instream eroding banks located along the eastern edge of the parcel (Figure 3-1). Erosion site 007-020-03_1 consists of an eroding berm/levee at the confluence of two Category III channels. Erosion site 007-020-03_2 is an incised gully with pockets of bank erosion that crosses the southern boundary of the parcel. Similar to the erosion sites in Benbow 108-040-13, potential sedimentation from these sites essentially enters the same active sediment sink as described above.

The area of and adjacent to 007-020-03_1 is well-vegetated valley oak riparian woodland with loam soils (Feliz loam, 0 to 2 percent slopes). The area of and adjacent to 007-020-03_2 is fairly well-vegetated upland grazing land with clay loam soils (Cole clay loam, 0 to 2 percent slopes). Channel flows from upstream, combined with direct trampling by livestock, have likely initiated these erosion features; however, both features appear relatively stable.

3.1.4 Ford 108-010-06

The Ford 108-010-06 parcel has three erosion sites (Table 3-1, Figure 3-1, Appendix A). Each of these sites (108-010-06_1, 108-010-06_2, and 108-010-06_3) is an instream eroding bank that occurs on Outlet Creek in the center of the parcel (Figure 3-1). All three sites are remarkably similar in nature in that they have unstable, mostly unvegetated right (i.e., east) cutbanks created by convergence flow on the riffle/gravel bar complex on the opposite side of the cutbank. The banks are approximately 6 feet tall from the toe of the bank. Each eroding bank site represents the largest contributors of sediment from streambanks observed during the course of the assessment and all three sites are discussed further in Chapter 4.

The erosion sites are located in Oregon ash riparian woodland. The areas adjacent to each erosion site on the east and west are well-vegetated wet meadow with soils that have been altered through levee construction. Channel flows from upstream, combined with direct trampling by livestock, have likely initiated these erosion features. All three erosion sites appear unstable, as evidenced by active slumping (Appendix A-9).

3.1.5 Ford 108-020-04

The Ford 108-020-04 parcel has one erosion site (Table 3-1, Figure 3-1, Appendix A). The site (108-020-04_1) is an instream eroding bank that occurs on Outlet Creek in the southeast corner of the parcel (Figure 3-1). The eroding bank is located on the left (i.e., west) bank, is scalloped, near vertical in places, with banks approximately 6 to 8 feet high from the toe. This site is not one of the larger contributors of sediment observed, and appears to have somewhat stabilized, based on the fair amount of vegetative growth on and adjacent to the bank.

The erosion site itself is located in well-vegetated mixed riparian woodland with fluvaquent soils (Fluvaquents, 0 to 1 percent slopes). The areas adjacent to the erosion site on the east and west

are well-vegetated wet meadow with similar soils. Channel flows from upstream, combined with direct trampling by livestock, have likely initiated this erosion feature.

3.1.6 Ford 108-030-05

The Ford 108-030-05 parcel has one erosion site (Table 3-1, Figure 3-1, Appendix A). The site (108-030-05_1) is an instream eroding bank that occurs on Outlet Creek on the southern boundary of the parcel (Figure 3-1). The eroding bank is located on the right (i.e., east) bank, is a slumped erosion feature, and is near vertical in places with banks approximately 4 to 6 feet high from the toe. This site is not one of the larger contributors of sediment observed, and appears to have stabilized based on the good amount of vegetative growth on and adjacent to the bank.

The erosion site itself is located in well-vegetated valley oak riparian woodland with Fluvaquent soils (Fluvaquents, 0 to 1 percent slopes). The areas adjacent to the erosion site on the east and west are well-vegetated wet meadow with sandy loam soils (Gielow sandy loam, 0 to 5 percent slopes). Channel flows from upstream, combined with direct trampling by livestock, have likely initiated this erosion feature.

3.1.7 Frost 108-070-04

The Frost 108-070-04 parcel has five erosion sites (Table 3-1, Figure 4-2, Appendix A), collectively referred to as the “Frost Complex” (Figure 3-2). There are three instream headcut sites (108-070-04_1, 108-070-04_2, and 108-070-04_5) and two upland headcut sites (108-070-04_3 and 108-070-04_4), each located in the northeast corner of the parcel (Figures 3-1 and 3-2). These are some one of the larger headcuts observed during the course of the assessment and are discussed further in Chapter 4.

Any associated sediment derived from these erosion sites enters an unnamed tributary that eventually connects to Berry Creek (under high flows). As such, potential sedimentation from these sites essentially enters an active channel. The potential contribution of sediment from each site (especially 108-070-04_1) appears to be significant.

The areas of and adjacent to each erosion site are located in a sparsely-vegetated, Oregon ash riparian woodland with Haplaquept soils (Haplaquepts, 0 to 1 percent slopes). Concentrated flows from the swales upstream, combined with direct trampling by livestock, have likely initiated these erosion features. All five erosion sites appear unstable.

3.1.8 Goss 103-230-02

The Goss 103-230-02 parcel has one erosion site (Table 3-1, Figure 3-1, Appendix A). This site (103-230-02_1) is an upland headcut that occurs at the confluence of an east-to west-swale with the main drainage ditch on the western end of parcel (Figure 3-1). It has a very small drop and no associated sediment derived from this headcut was observed on the parcel.

The areas of and adjacent to the erosion site is well-vegetated valley oak riparian woodland with sandy loam soils (Gielow sandy loam, 0 to 5 percent slopes). Concentrated flows from the swales upstream, combined with direct trampling by livestock, has likely initiated this headcut; however, the headcut appears relatively stable.

3.1.9 Lusher 108-030-04

The Lusher 108-030-04 parcel has three erosion sites (Table 3-1, Figure 3-1, Appendix A). There is one instream depressional wetland site (108-030-04_1) and two instream headcut sites (108-030-04_2 and 108-030-04_3), each located on the northern boundary of the parcel (Figure 3-1). The depressional wetland is located on a swale and has slumping banks; however, it does not have a headcut associated with it and is not undergoing headward migration in either direction. The instream headcuts, however, are two of the larger headcuts observed during the erosion site assessment and are discussed further in Chapter 4.

Any associated sediment derived from 108-030-04_1 is self-contained within the depressional wetland. Any associated sediment derived from 108-030-04_2 and 108-030-04_3 enter a swale that eventually connects to Old Outlet Creek (under high flows). As such, potential sedimentation from these sites essentially enters an active channel, and appears to be significant.

Erosion site 108-030-04_1 is located in well-vegetated Oregon ash riparian woodland with sandy loam soils (Gielow sandy loam, 0 to 5 percent slopes). The areas adjacent to 108-030-04_1 on the east and west are well-vegetated wet meadow with similar soils. Erosion site 108-030-04_2 and 108-030-04_3 are located in well-vegetated mixed riparian woodland, with Fluvaquent soils (Fluvaquents, 0 to 1 percent slopes). The areas adjacent to 108-030-04_2 and 108-030-04_3 on all sides are a mixture of well-vegetated oak woodland grassland, Oregon ash riparian woodland, mixed riparian woodland, and wet meadow (all with similar soils).

Direct trampling by livestock has likely initiated 108-030-04_1; however, it appears to be stable. Concentrated flows from the swale upstream, combined with direct trampling by livestock, have likely initiated 108-030-04_2 and 108-030-04_3. These erosion sites appear unstable.

3.1.10 MGC Plasma North 103-230-06

The MGC Plasma North 103-230-06 parcel has one erosion site (Table 3-1, Figure 3-1, Appendix A). This site (103-230-06_1) is an instream headcut that occurs on the main drainage ditch on western end of parcel (Figure 3-1). It has a very small drop and any associated sediment derived from this headcut is minimal and gets spread out and deposited in the local wetland complex to the north.

The areas of and adjacent to each erosion site are well-vegetated wet meadow with clay soils (Clear Lake clay, 0 to 2 percent slopes). Concentrated flows from the swales upstream, combined with direct trampling by livestock, has likely initiated this headcut; however, the headcut appears relatively stable.

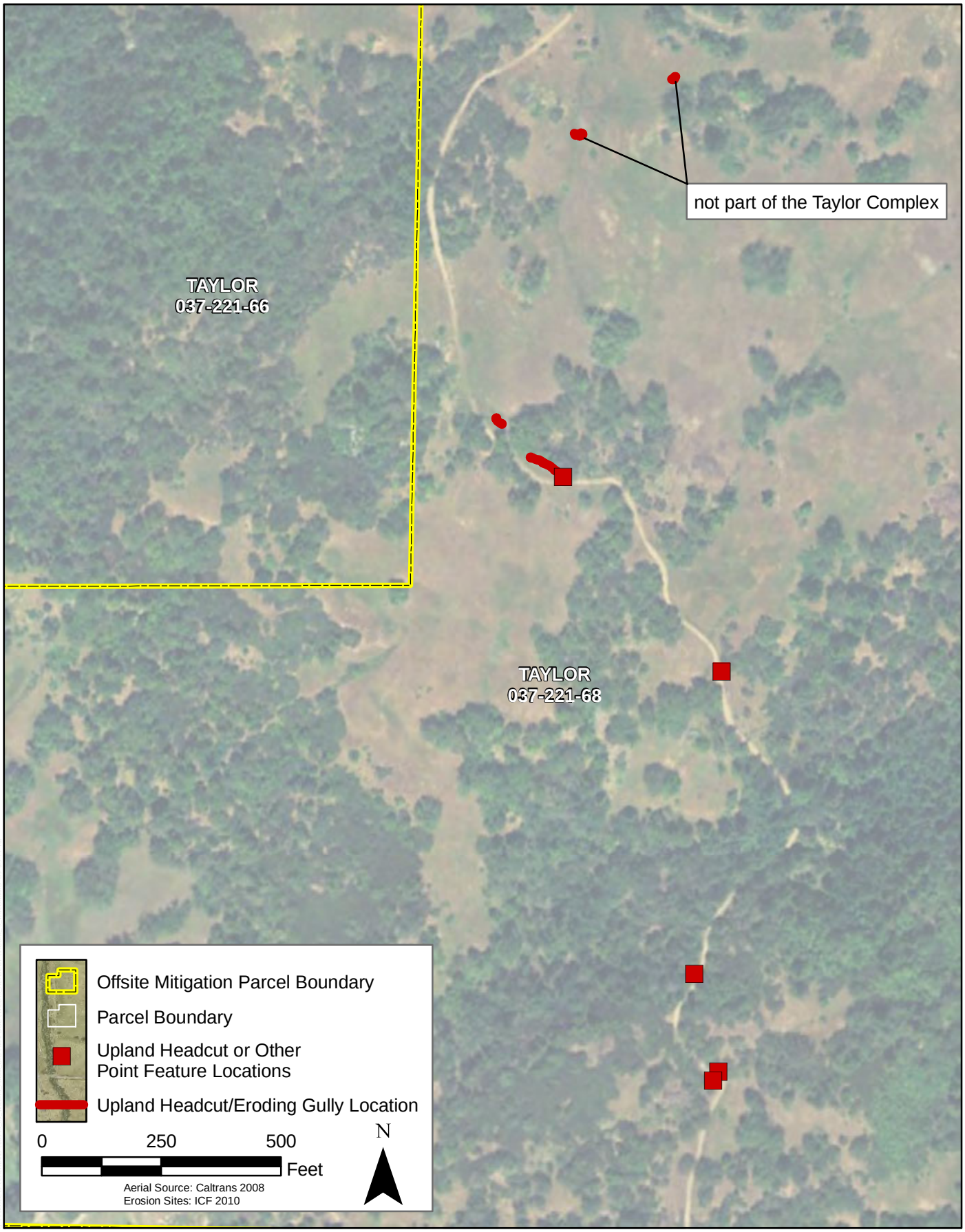


Figure 3-2
Taylor (APN 037-221-68) Complex
Erosion Site Locations

3.1.11 Wildlands 108-060-01

The Wildlands 108-060-01 parcel has two erosion sites (Table 3-1, Figure 3-1, Appendix A). Both of these sites (108-060-01_1 and 108-060-01_2) are instream eroding banks that occur on Davis Creek on the northern boundary of the parcel (Figure 3-1). Both sites are similar in that they have partially unstable banks on each side, with a noticeable absence of vegetation. They are not associated with the convergence of flow from a gravel bar as evidenced on the Ford 108-010-06 parcel; rather, the lower banks appear to be scoured from high flows. The banks range from 4 to 8 feet high from the toe. These sites are not of critical concern as they will be addressed with riparian planting mitigation actions.

The erosion sites themselves are located in sparsely-vegetated willow riparian scrub. The areas adjacent to each erosion site on the east and west are well-vegetated wet meadow with sandy loam soils (Gielow sandy loam, 0 to 5 percent slopes). Channel flows from upstream, combined with direct trampling by livestock, have likely initiated these erosion features.

3.2 Outlet Creek Basin Slopes

3.2.1 Taylor 037-221-68

The Taylor 037-221-68 parcel has nine erosion sites (Table 3-1, Figure 3-1, Appendix A), the first seven of which are collectively referred to as the “Taylor Complex” (Figure 3-2). All erosion sites are located in upland and are typified by headcuts, scour areas, and/or eroding gullies with headcuts. All erosion sites are located in the north-central portion of the parcel (Figures 3-1 and 3-2). Since the cause of all erosion sites within the Taylor Complex is the presence of the access road with its associated culvert crossings (and to a lesser extent direct trampling by livestock), the Taylor Complex (as well 037-221-68_8 and 037-221-68_9) are discussed further in Chapter 4.

Any associated sediment derived from these erosion sites enters unnamed tributaries that eventually connect to the lowlands (i.e., Little Lake Valley) below. However, all observed erosion sites are high up in the watershed and contribute a relatively small fraction of sediment to downstream receiving channels. Furthermore, any sediment that is eroded and transported most likely gets deposited and stored in the high-gradient unnamed tributaries as a sediment source and is only transported further downstream in slugs during large storm events. Finally, if the sediment is carried to the Valley floor, it would end up in an unnamed alluvial fan channel that eventually drains onto the Watson parcels. However, approximately one mile separates the Taylor 037-221-68 parcel and the Watson parcels and presumably much of the sediment load from upstream sources gets deposited in this reach of the alluvial fan channel as it is a low-gradient “response” reach, adjusting its channel bed to both water and delivered sediment. This channel on the Watson parcel does not have a noticeable hydrologic connection to any named channel, such as Berry Creek; rather, its terminus is a large existing wetland complex (on the eastern portion of Watson 037-221-30 and the western portion of Watson 037-250-05).

The areas of and adjacent to each erosion site are located in a moderately-vegetated upland forest setting with thin soils (Hopland-Witherell-Squawrock Complex, 30 to 50 percent slopes; Yorkville- Squawrock-Witherell Complex, 30 to 50 percent slopes).

3.2.2 Taylor 037-240-41

The Taylor 037-240-41 parcel has six erosion sites (Table 3-1, Figure 3-1, Appendix A). All erosion sites are located in upland and are typified by headcuts, slumps with headcuts, eroding gullies, and/or eroding gullies with headcuts. All erosion sites are generally located in the western portion of the parcel (Figure 3-1). Erosion site 037-240-41_1 is a long incised gully, approximately 680 feet in length (on the parcel), adjacent to and most likely initiated by the local access road. It is eroding in areas but the underlying bedrock acts as grade control throughout its length and it not an immediate erosion concern. Erosion site 037-240-41_2 is also a long incised gully approximately 106 feet in length (on the parcel), that has a headcut at its upper end. However, similar to 037-240-41_1, the underlying bedrock acts as grade control throughout its length and it not an immediate erosion concern.

The remaining four erosion sites consist of headcuts and/or slumps with headcuts. Three are associated with a PG&E access road and could be addressed in a similar manner to those discussed in Chapter 4 for the Taylor Complex. The fourth erosion site, 037-240-41_6, consists of a small headcut on a small east-facing swale. It is associated with a livestock trail where flow collects and concentrates, and the entire swale downstream has pockets of moderate erosion that are not considered significant due to the local bedrock control.

As with the Taylor 037-221-68 parcel, any associated sediment derived from these erosion sites enters unnamed tributaries that eventually connect to the lowlands (i.e., Little Lake Valley) below. Lowland sedimentation is not a significant concern for the same reasons described above. However, the receiving channels and wetlands in the lowlands are closer to Outlet Creek than the receiving channels associated with the Taylor 037-221-68 parcel.

The areas of and adjacent to each erosion site are located in a moderately-vegetated upland forest setting with thin soils (Shortyork-Yorkville- Witherell Complex, 15 to 30 percent slopes; Casabonne-Wohly loams, 30 to 50 percent slopes; Yorkville-Yorktree-Squawrock Complex, 30 to 50 percent slopes).

3.3 Erosion Potential on Offsite Mitigation Parcels

3.3.1 Literature Review

Prior to development if this technical memorandum, a complete review of the *Outlet Creek Basin Assessment Report* (LeDoux-Bloom and Downie 2008) was performed to gage the overall stability of Little Lake Valley/Outlet Creek Basin. Little Lake Valley is situated in the Southern Subbasin of the Outlet Creek Basin (it is also in the Lower Davis Creek CalWater 2.2a Planning Watershed).

Based on the *Outlet Creek Basin Assessment Report* (LeDoux-Bloom and Downie 2008), identified watershed issues that are relevant to erosion and stability on the offsite mitigation parcels include the following:

- The six dams in the Southern Subbasin[1] collect early winter rain which decreases or eliminates the stream flow at that time of year. From a geomorphic perspective, these dams act as sediment traps, limiting the transport of gravels. The channels below dams often become incised, straighter, and typically experience more bank erosion than systems that are not downstream of dams (Knighton 1998; Thorne et al. 1996).
- Channel volume has been reduced because of sediment deposition.
- Realignment of portions of Outlet Creek and other tributaries has exacerbated channel incision and bank erosion.
- Poorly maintained and undersized Mendocino County residential roads and road culverts have created sedimentation.
- Wildlife and livestock grazing in riparian areas have caused streambank erosion.

Based on the *Outlet Creek Basin Assessment Report* (LeDoux-Bloom and Downie 2008), findings that are relevant to erosion and stability in the offsite mitigation parcels include the following:

- Fine sediment deposits in low gradient reaches contribute to shallow pool depth and small spawning substrate (and can lead to an increase in flooding through loss of channel capacity, which in turn exacerbates bank erosion).
- Embeddedness levels are unsuitable in many streams (which signals fine-sediment deposition from bank and near-bank processes).
- The six dams have significantly decreased downstream gravel recruitment.

Other pertinent issues in the *Outlet Creek Basin Assessment Report* (LeDoux-Bloom and Downie 2008) include the idea that the geology of the highlands in the Southern Subbasin is very soft and highly erodible. Fine sediment is consistently contributed from Little Lake Valley downstream and into the Eel River. Additionally, high precipitation and high peak flows have created flashy instream conditions and increased fine sediment delivery. High erosion potential combined with flashy instream conditions on banks covered by shallow rooted and annual species has created easily eroded stream banks.

3.3.2 Observed Erosion Potential

Eleven eroding bank sites were identified on the offsite mitigation parcels during the erosion site assessment in Little Lake Valley (an area that encompasses approximately 1,700 acres). Of these

[1] These include Lake Emily Dam (on Willits Creek with a surface area of 275 acre-feet [af]); Ada Rose Dam (on Willits Creek with a surface area of 138 af); Boy Scout Camp Dam (on Boy Scout Creek with a surface area of 800 af); Pine Mountain Dam (on Moore Creek with a surface area of 45 af); Morris Dam (on Davis Creek with a surface area of 620 af); and Centennial Dam (on Davis Creek with a surface area of 512 af).

eleven eroding bank sites, only three are significant contributors of sediment. As will be discussed in Chapter 4, only Ford 108-010-06_1, 108-010-06_2, and 108-010-06_3 were observed to have the potential to significantly increase sedimentation to downstream channels.

Most of the channels and streams in Little Lake Valley are incised as a result of artificial straightening and limited access to their floodplains from levee and berm construction. However, most of the channels and streams have adequate vegetation cover and the observed small amount of eroding banks in proportion to the total linear feet of streams in the offsite mitigation parcels does not point to any large-scale channel instability within the offsite mitigation parcels.

Twelve headcuts were identified on the offsite mitigation parcels during the erosion site assessment Little Lake Valley. Of these twelve headcuts, five occur together as the Frost Complex, three are located on various Benbow parcels, two are located on the Lusher parcel, and the remaining two are located on the Goss and MGC Plasma North parcels, respectively. As will be discussed in Chapter 4, only the Frost Complex, Lusher 108-030-04_2 and 108-030-04_3, and Benbow 108-040-13_3 were observed to have the potential to significantly increase sedimentation to either the surrounding wetlands or channels.

Prior to the relocation and dredging of stream channels in the 1900s, Little Lake Valley functioned as a large, shallow lake and wetland until late spring or early summer, depending upon the amount of rainfall of that given year. The resultant topography of the offsite mitigation parcels observed during this study is a low-gradient, mostly stable landscape. Even though sedimentation has been identified as a major concern (LeDoux-Bloom and Downie 2008), the headcuts and other point features generally associated with a subtle rise in topography do not signify a landscape in a degradation phase. In fact, no mention of the term “headcut” exists in the *Outlet Creek Basin Assessment Report* (LeDoux-Bloom and Downie 2008).

However, this erosion site assessment was performed once and represents a snapshot of stability. It is entirely plausible that base level changes downstream in the Outlet Creek watershed could potentially affect the headward migration of the observed eroding banks, headcuts, and other point features, as well as create additional erosion features in the future. Furthermore, continued grazing practices (especially close to and within riparian habitat) could also lead to further channel instability (Myers and Swanson 1993).

3.4 Qualitative Observations for Hebrard 103-030-01

The RWQCB provided Caltrans with a digital image of two headcuts that the RWQCB believed to be contributing sediment and causing water quality degradation to streams in Little Lake Valley. During the erosion site assessment, these two headcuts were observed: one is located on one of the Lusher offsite mitigation parcels while the other is located on the Hebrard parcel. The Hebrard parcel is privately held and at this time there are no plans to purchase this parcel as part of project mitigation. As such, the headcut on the Hebrard parcel is beyond the scope of this erosion site assessment. However, recognizing the RWQCB’s interest in this particular headcut, efforts were made to observe the headcut from the adjacent Benbow 007-010-04 parcel under

Caltrans ownership. Qualitative observations of the headcut on the Hebrard parcel are presented below but are not discussed further in this assessment.

The Hebrard 103-030-01 parcel has one known erosion site. This site appears to be an instream headcut that occurs on the tributary to the channel that runs along the eastern edge of Benbow 007-010-04. This headcut was one of the largest observed during the course of the assessment. Similar to the erosion sites on Benbow 108-040-13 and 007-020-03, potential sedimentation from this headcut essentially enters the same active sediment sink as described above for the Benbow 108-040-13 and 007-020-03 parcels.

The area surrounding the erosion site is well-vegetated valley oak riparian woodland with loam soils (Feliz loam, 0 to 2 percent slopes). Channel flows, combined with direct trampling by livestock, have likely initiated this erosion feature. This erosion site appears highly unstable, as evidenced by the incision downstream of the headcut.

Chapter 4 Summary and Recommendations

This chapter summarizes the results of the erosion site assessment, and provides recommendations for five erosion features that could be addressed to satisfy the RWQCB's concerns regarding sedimentation and water quality in Outlet Creek Basin based primarily on data collected during the field assessment, as presented in Chapter 3.

4.1 Summary of Erosion Sites

The survey team walked each of the offsite mitigation parcels and recorded the location of each erosion site using GPS units and aerial photograph base maps (Chapter 2, Methods) for a variety of environmental indicators related to erosion features (Chapter 3, Results). Surveys took place in May 2010. Various types of erosion features with the potential to significantly increase sedimentation in Little Lake Valley were identified. The following list summarizes these erosion features and their significance:

- Depressional wetland: One depressional wetland (Lusher 108-030-04_1) was identified and this feature appears stable due to the lack of headward migration.
- Eroding bank: Eleven discrete portions of streambank that are currently experiencing or have experienced significant bank retreat were identified. Of these eleven sites, three appear to be the most significant sediment contributors: Ford 108-010-06_1, 108-010-06_2, and 108-010-06_3.
- Eroding gully: Six gullies experiencing either continuous or discontinuous erosion as evidenced by incision, localized slumping, or other erosion features were identified. All erosion sites are located on the Taylor 037-221-68 and 037-240-41 parcels.
- Headcut: A total of 16 headcuts were identified. Of the 16 headcuts, four appear to be significant sediment contributors: Frost Complex, Lusher 108-030-04_2 and 108-030-04_3, and Benbow 108-040-13_3.
- Pothole: One pothole (Benbow 108-040-13_2) was identified and this feature appears stable due to the lack of headward migration.
- Scour area: Three scour areas where a gully is being deepened or widened as a result of concentrated flow on the downslope end of a culvert were identified. All erosion sites are located on the Taylor 037-221-68 parcel.
- Slump: Two slumps at the head of an eroding gully (with headcuts) were identified on the Taylor 037-240-41 parcel.

4.2 Prioritization of Restoration Opportunities

Erosion features on the offsite mitigation parcels that are contributing excessive sediment and causing water quality degradation to channels and streams in Little Lake Valley have been prioritized for restoration as follows:

- The erosion feature contributes significantly to water quality degradation, as related to the contribution of excessive sediment from erosion of native soil.
- The erosion feature can be restored without impacts to existing sensitive biological resources, including special-status plants and jurisdictional wetlands.
- The erosion feature can be restored in coordination with planned mitigation actions.
- The erosion feature can be restored using restoration approaches that are very constructable (ease of constructability and access to the feature is direct).
- The erosion feature's restoration will create a synergy, as related to combining site-specific restoration opportunities to create a major effect at a cumulative level.

4.2.1 Restoration Sites

Priority status is given to particular erosion sites because restoration actions at these sites can immediately address many of the priority items above. The following are considered to be the top five priority erosion sites:

1. Ford 108-010-06_1, 108-010-06_2, and 108-010-06_3 (Figure 4-1; these individual eroding bank sites are grouped together because of their close proximity and their identical nature)
2. Frost 108-070-04 Complex (Figure 4-2; there are five headcut sites located in the northeast corner of the parcel: three are instream headcut sites [108-070-04_1, 108-070-04_2, and 108-070-04_5] and two are upland headcut sites [108-070-04_3 and 108-070-04_4])
3. Lusher 108-030-04_2 (Figure 4-3; headcut)
4. Lusher 108-030-04_3 (Figure 4-3; headcut)
5. Benbow 108-040-13_3 (Figure 4-4; headcut)

The potential restoration actions and designs presented below are conceptual do not represent the only restoration approach for the erosion sites. Rather, they are presented as typical and generalized treatment examples for the types of erosion sites identified during the surveys. Prior to restoration planning, each erosion site should be re-visited and various site-specific treatment alternatives should be developed.

4.2.1.1 Ford 108-010-06_1, 108-010-06_~~1~~2, and 108-010-06_3

Problem/Need Statement

All three erosion sites (Figure 4-1) are contributing excessive sediment and causing water quality degradation in Outlet Creek. Lawler (1992) groups unstable banks into three categories:

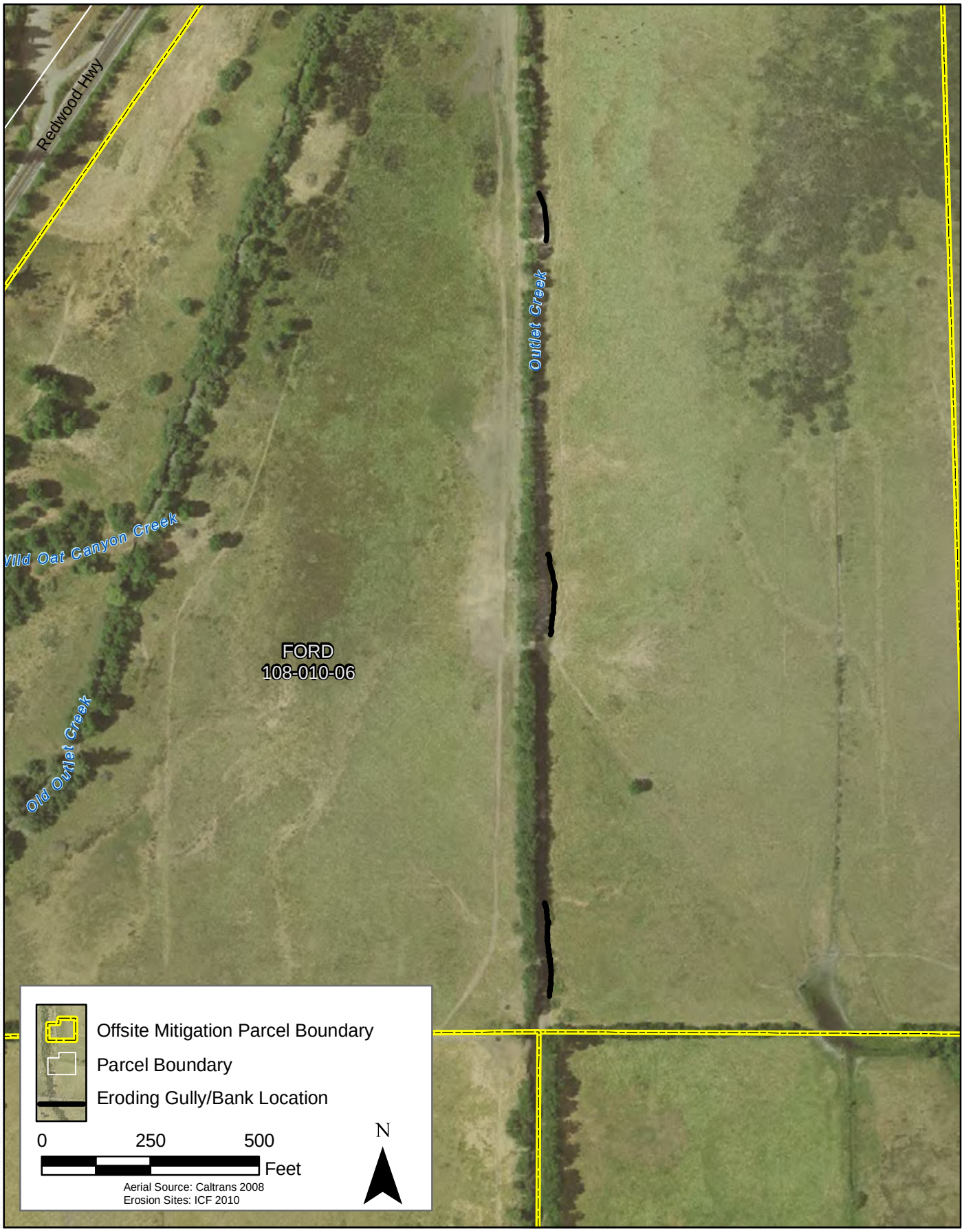


Figure 4-1
Ford (APN 108-010-06)
Erosion Site Locations

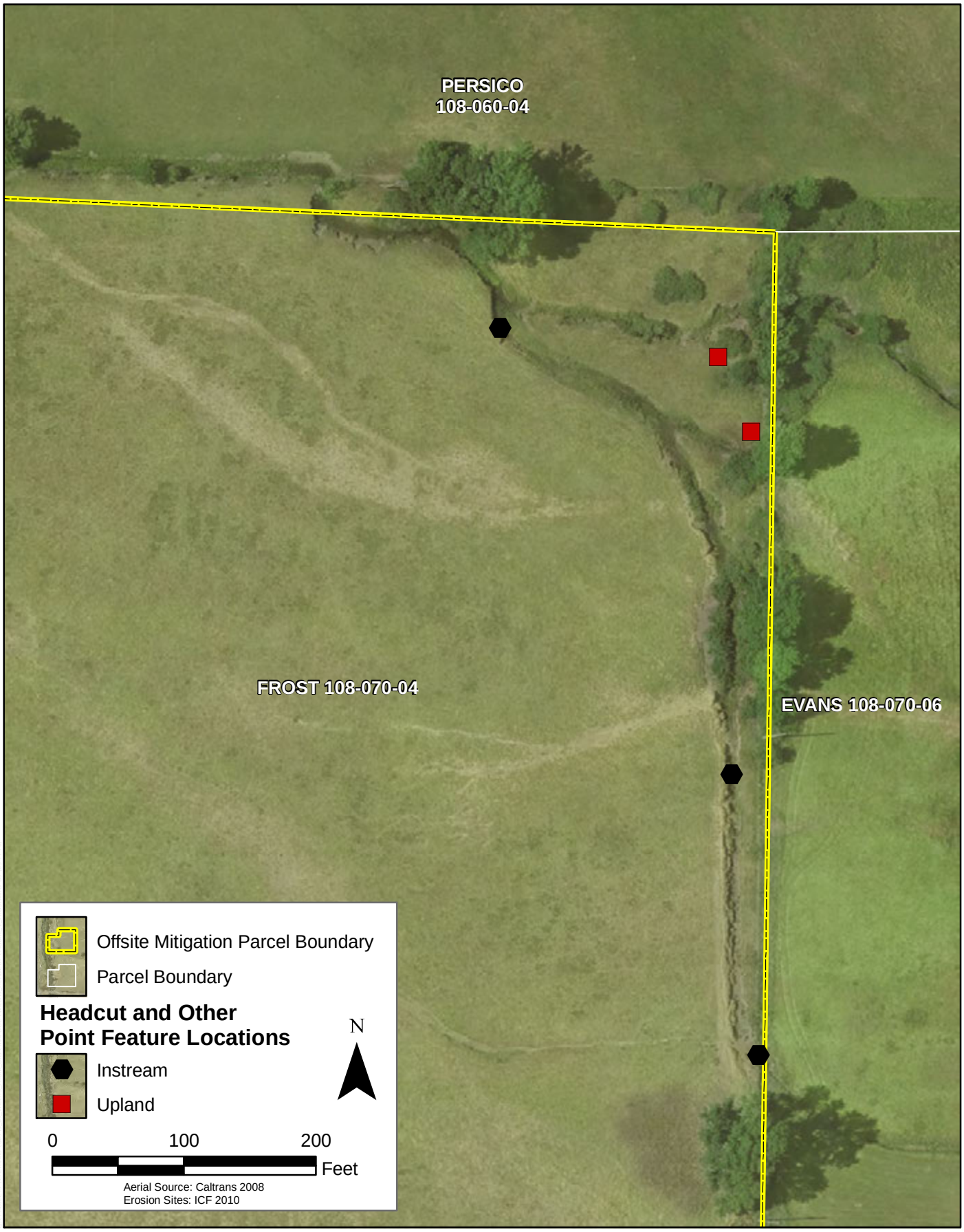


Figure 4-2
Frost (APN 108-070-04) Complex
Erosion Site Locations

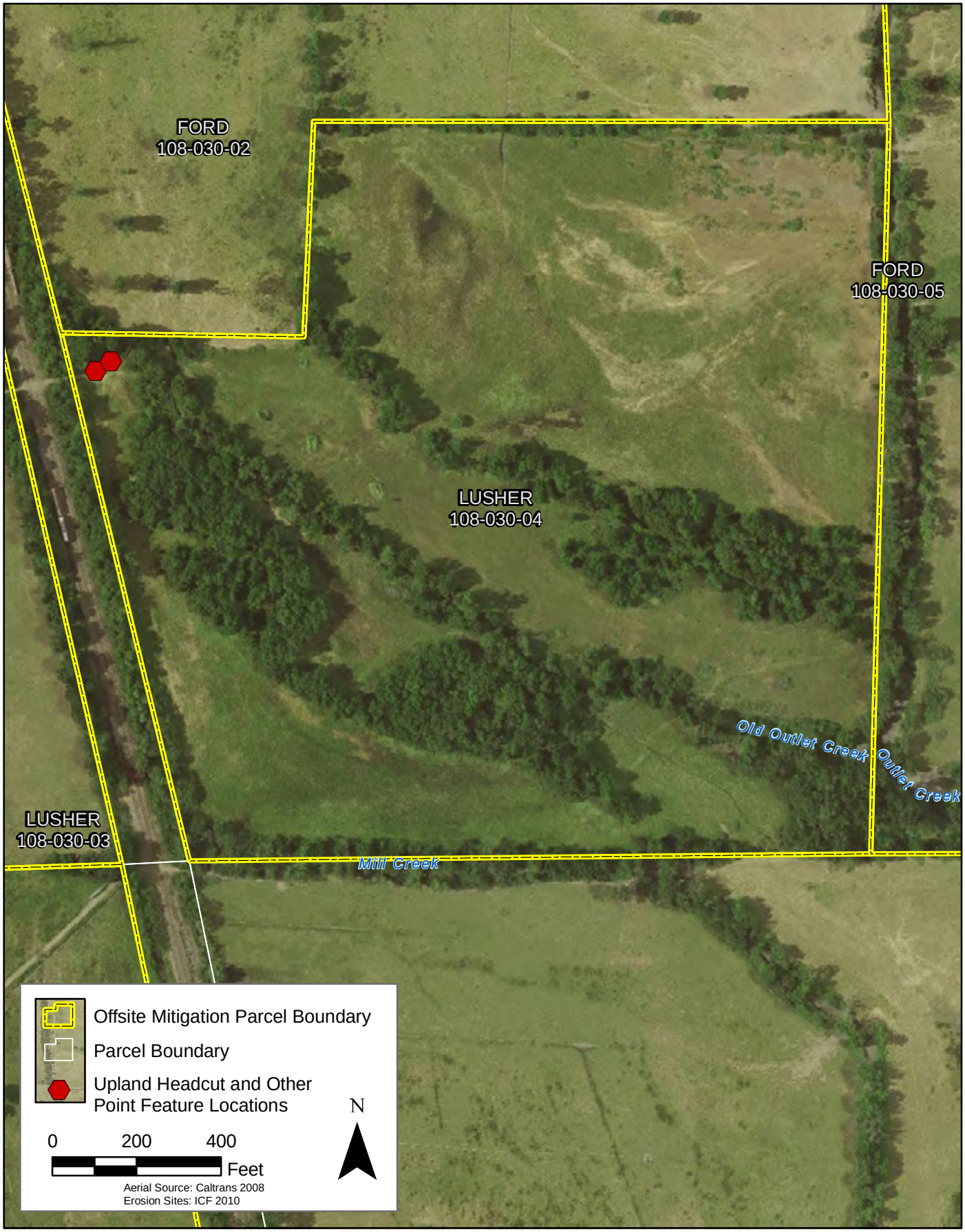


Figure 4-3
Lusher (APN 108-030-04)
Erosion Site Locations

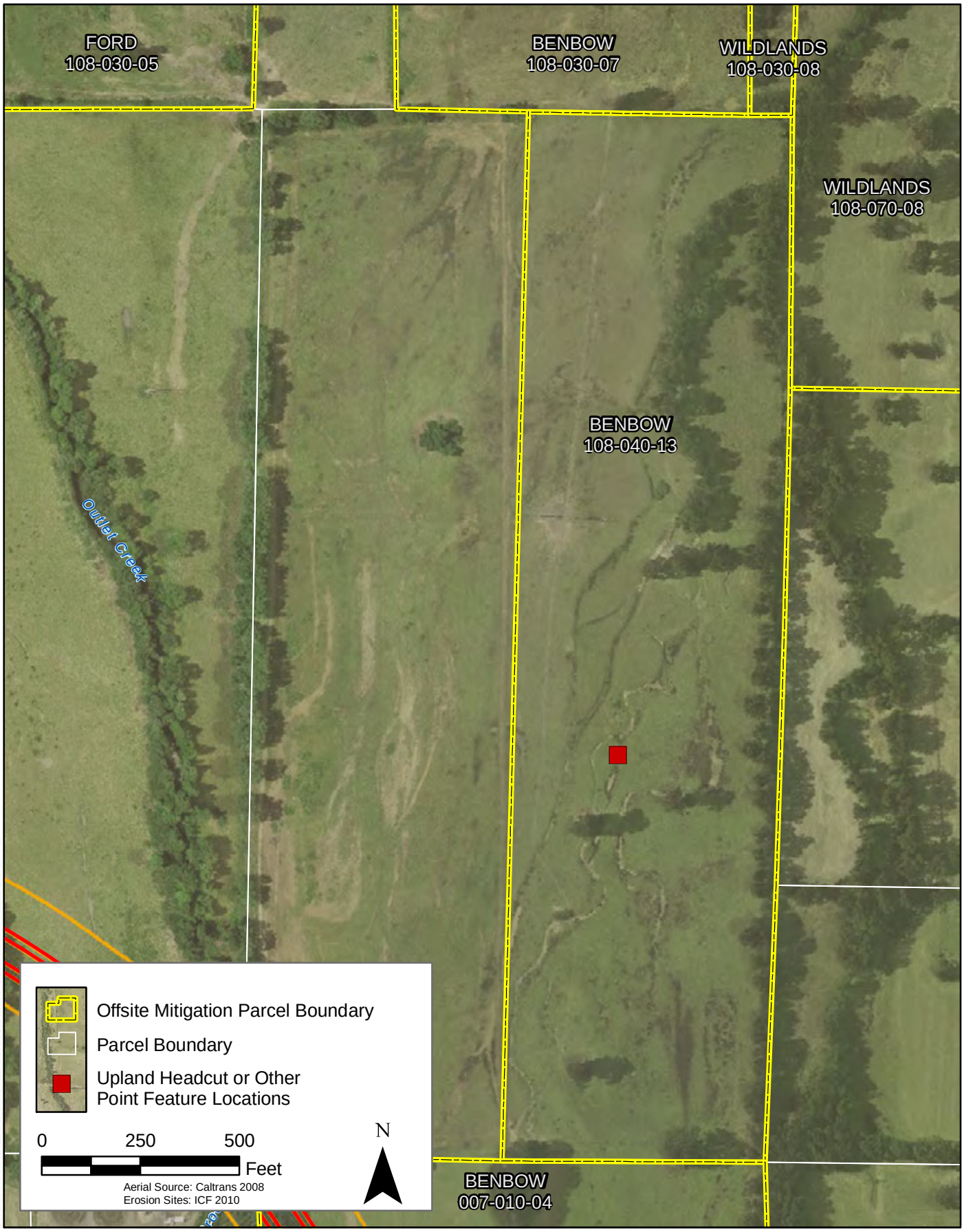


Figure 4-4
Benbow (APN 108-040-13)
Erosion Site Locations

weakening, fluvial erosion, and mass-failure processes. Weakening processes erode or prepare banks for further erosion (e.g., storm events that dislodge individual particles on the banks). Fluvial erosion processes (i.e., erosion by water) are related to the energy of flow (i.e., boundary shear stress). Mass-failure processes cause gravitational collapse of all or part of the bank. Weakening, fluvial, and mass-failure processes are acting together at these sites on the Ford 108-010-06 parcel.

All three erosion sites are remarkably similar in that they have unstable, mostly unvegetated right (i.e., east) cutbanks created by convergence flow on the riffle/gravel bar complex on the opposite side of the cutbank. The banks are approximately 6 feet tall from the toe of the bank. Channel flows from upstream, combined with direct trampling by livestock, have likely initiated these erosion features. All three erosion sites appear unstable, as evidenced by active slumping (Appendix A-9).

Impacts to Existing Sensitive Biological Resources

The floodplain adjacent to each erosion site is considered potential habitat for Baker's Meadowfoam, with known occurrences further away from Outlet Creek (Caltrans 2010a). However, no Baker's Meadowfoam was observed on the streambanks/levees adjacent to the creek. Nonetheless, potential construction staging areas and access routes would need to avoid Baker's Meadowfoam plants. Wet meadow and mixed marsh are the existing jurisdictional wetlands adjacent to the creek. Standard Best Management Practices (BMPs) would reduce temporary construction impacts to a less-than-significant level.

Desired Condition and Construction Methods

Bank stabilization can be divided into two main categories: biotechnical stabilization and hardscaping. Biotechnical stabilization involves the use of natural materials (e.g., vegetation and large woody material) to stabilize banks. Often, these natural materials are placed on the unstable bank once the bank has been re-graded to a less steep slope that will decrease the likelihood of erosion due to mass failure. Hardscaping involves the use of rip-rap, concrete, gabions, and other hard materials for stabilizing banks. These methods are not as environmentally sensitive as biotechnical stabilization methods and typically are only used when biotechnical stabilization methods are not feasible.

Construction methods for bank stabilization are site-specific. Methods may include:

- revegetation of the stream bank (biotechnical)
- re-grading of the stream bank followed by revegetation (biotechnical)
- stabilizing the bottom (i.e., toe) of the stream bank with natural materials (biotechnical) or hard materials (hardscaping)
- stabilizing the entire stream bank with hardscape (hardscaping)

Figure 4-5 illustrates a typical eroding bank treatment that could be applied to these erosion sites. In brief, the east bank could be re-graded to produce a gentler vegetated slope, and a low riparian bench could be constructed to dissipate the energy of high flows. The contact point between the toe of the east bank and the low riparian bench could be secured and stabilized using a rootwad

bundle. This rootwad bundle would also hypothetically promote localized scour, which is a normal and beneficial component of a cutbank area.

Access, Scheduling, and Cost

The easiest access to these erosion sites is from the north and east along Highway 101. Bank stabilization activities should occur during late summer or early fall when water levels in the creek are at their lowest. Cost associated with bank stabilization is approximately $500 per linear foot. However, cost varies significantly because of accessibility, the type of bank material, and the specific methods of construction.

4.2.1.2 Frost Complex (108-070-04_1, 108-070-04_2, 108-070-04_3, 108-070-04_4, and 108-070-04_5)

Problem/Need Statement

All five erosion sites in the Frost Complex (Figure 4-2) are contributing excessive sediment and causing local water quality degradation. Sediment from these erosion sites enters an unnamed tributary that eventually connects to Berry Creek (under high flows). As such, sediment from these sites enters an active channel. The potential contribution of sediment from each site (especially 108-070-04_1) appears to be significant. Concentrated flows from the swales upstream, combined with direct trampling by livestock, have likely initiated these erosion features. All five erosion sites appear unstable.

Additionally, the headcuts have led to deepened incised pools in their respective downstream directions. This incision is detrimental for the following reasons:

- Channel incision leads to a deepened channel. A deepened channel limits channel-floodplain interaction, thereby increasing such variables as unit stream power (Brizga and Finlayson 1990). This increase in unit stream power further increases the instability of the streambanks locally (and is possibly responsible for the erosion observed at Benbow 007-020-03_1), as all the energy of the streamflow is contained within the bed and banks of the channel and does not have the opportunity to dissipate onto the floodplain. Limited channel-floodplain interaction also restricts ecological interactions between the channel and the floodplain (Doyle et al. 2000).
- The incised nature of this reach increases the flashy response of hydrologic events, where winter precipitation events dominate geomorphic effectiveness (Wolman 1988).
- Channel habitat units, such as pool-riffle sequences, are rare in incised channels such as the unnamed Category III stream that the erosion sites are located on, and those that do exist do so for only limited time intervals (Shields et al. 1998).
- The increased depth of flow associated with incision, combined with an increased flashy regime, results in bed armoring and a decreased frequency of bed mobilization (Doyle et al. 2000).
- Eroded material from unstable streambanks is added to the channel bed of the creek (often in the form of sandy, lateral bars), decreasing channel capacity and exacerbating flooding.

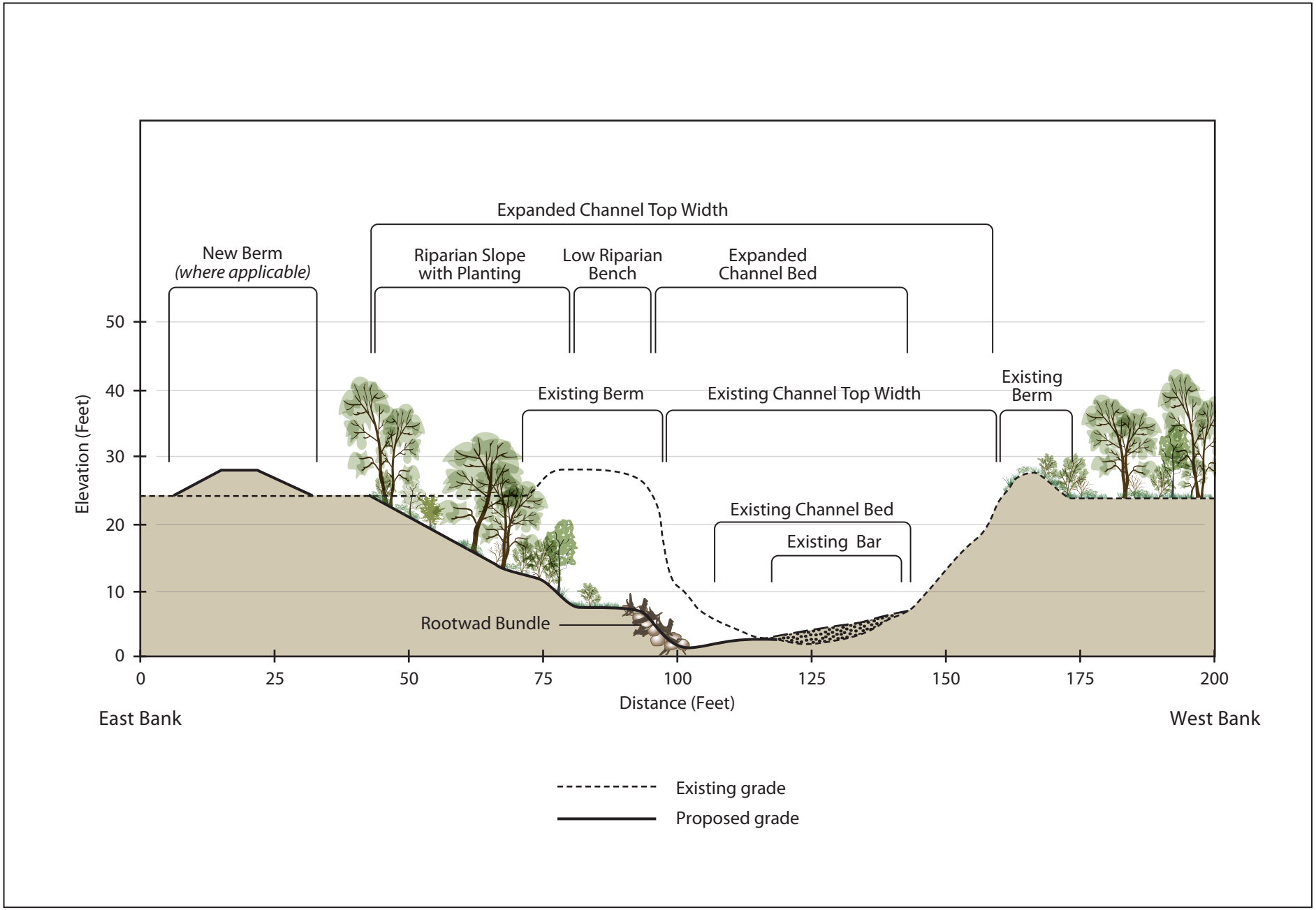


Figure 4-5
Typical Eroding Bank Treatment

Impacts to Existing Sensitive Biological Resources

No special-status plants (i.e., (Baker's Meadowfoam and North Coast semaphore grass) have been observed on or adjacent to the erosion sites (Caltrans 2010a). The erosion sites are located in the vicinity of a sparsely-vegetated, Oregon ash riparian woodland. Some loss of these riparian species could be expected due to restoration activities and appropriate mitigation strategies would need to be developed to offset these impacts. Standard BMPs would reduce temporary construction impacts to a less-than-significant level.

Desired Condition and Construction Methods

Similar to bank stabilization, headcut stabilization can be divided into two main categories: biotechnical stabilization and hardscaping. Biotechnical stabilization involves the use of natural materials (e.g., vegetation, keyed-in logs, and sod plugs) to stabilize headcuts. Often, these natural materials are placed in the headcut itself or downstream of the headcut to promote stability. Hardscaping involves the use of constructed step-pool structures for stabilizing headcuts. This hardscaping is generally as environmentally sensitive as biotechnical stabilization methods and is typically employed when channels and gullies have similar channel bottom and bank substrates to that of the step-pool structures (i.e., gravels and cobbles).

Construction methods for headcut stabilization are site-specific. Methods may include:

- Re-grading (i.e., laying back) and re-vegetating the headcut in the upstream direction and placing native soil and/or sod plugs in the downstream direction (biotechnical, referred to as the "Soil Fill Placement Method")
- Filling the downslope area of the headcut with native soil and/or sod plugs and incorporating (i.e., keying in) logs into the body of the headcut itself (biotechnical, referred to as the "Log Step-Pool Design")
- Placing native soil and incorporating step-pool structures in the downstream direction (biotechnical/hardscaping, referred to as the "Rock Step-Pool Design")

Figure 4-6 illustrates a typical headcut treatment that could be applied to these erosion sites ("Rock Step-Pool Design"). In brief, the area downstream of the headcut could be filled with native soil and rock step-pool structures could be incorporated throughout the length of the affected area. The rock step-pool structures would mimic a natural step-pool in an undisturbed environment, and the erosive force of the water in the swale, channel, or gully would be readily dissipated. Furthermore, the undercutting action that leads to headward migration in a typical headcut would be minimized due to the stepped nature of the design.

Figure 4-6 shows three separate rock step-pool structures. However, the amount of rock step-pool structures depends on the drop of the headcut and the average width and total length of the affected area. For the headcuts in the Frost Complex, the lengths of the affected areas (the entrenched pools at the base of the headcuts) range from approximately 20 to 75 feet. Accordingly, and depending on the drop of the headcut, more rock step-pool structures would be required for longer affect areas. As a general rule, rock step-pool structures are employed every 5 to 7 channel widths as measured in a non-disturbed portion of the stream upstream or downstream of the headcut. For example, if the width of the channel in an area not affected by

the headcut is 3 feet, then rock-step pools should be incorporated every 15 to 21 feet downstream of the headcut.

Access, Scheduling, and Cost

The easiest access to these erosion sites is from the south along Hearst Road. Headcut stabilization activities should occur during later summer or early fall when water levels in the channels are at their lowest or the channels are dry. Cost associated with headcut stabilization is approximately $100 per linear foot. However, cost varies because of accessibility, the types of material used, and the specific methods of construction.

4.2.1.3 Lusher 108-030-04_2

Problem/Need Statement

The Lusher 108-030-04_2 erosion site (Figure 4-3) is contributing excessive sediment and causing local water quality degradation. Sediment from 108-030-04_2 enters an unnamed tributary that eventually connects to Old Outlet Creek (under high flows). As such, sediment from this site enters an active channel. Concentrated flows from the swale upstream, combined with direct trampling by livestock, have likely initiated 108-030-04_2. This erosion site appears unstable.

Impacts to Existing Sensitive Biological Resources

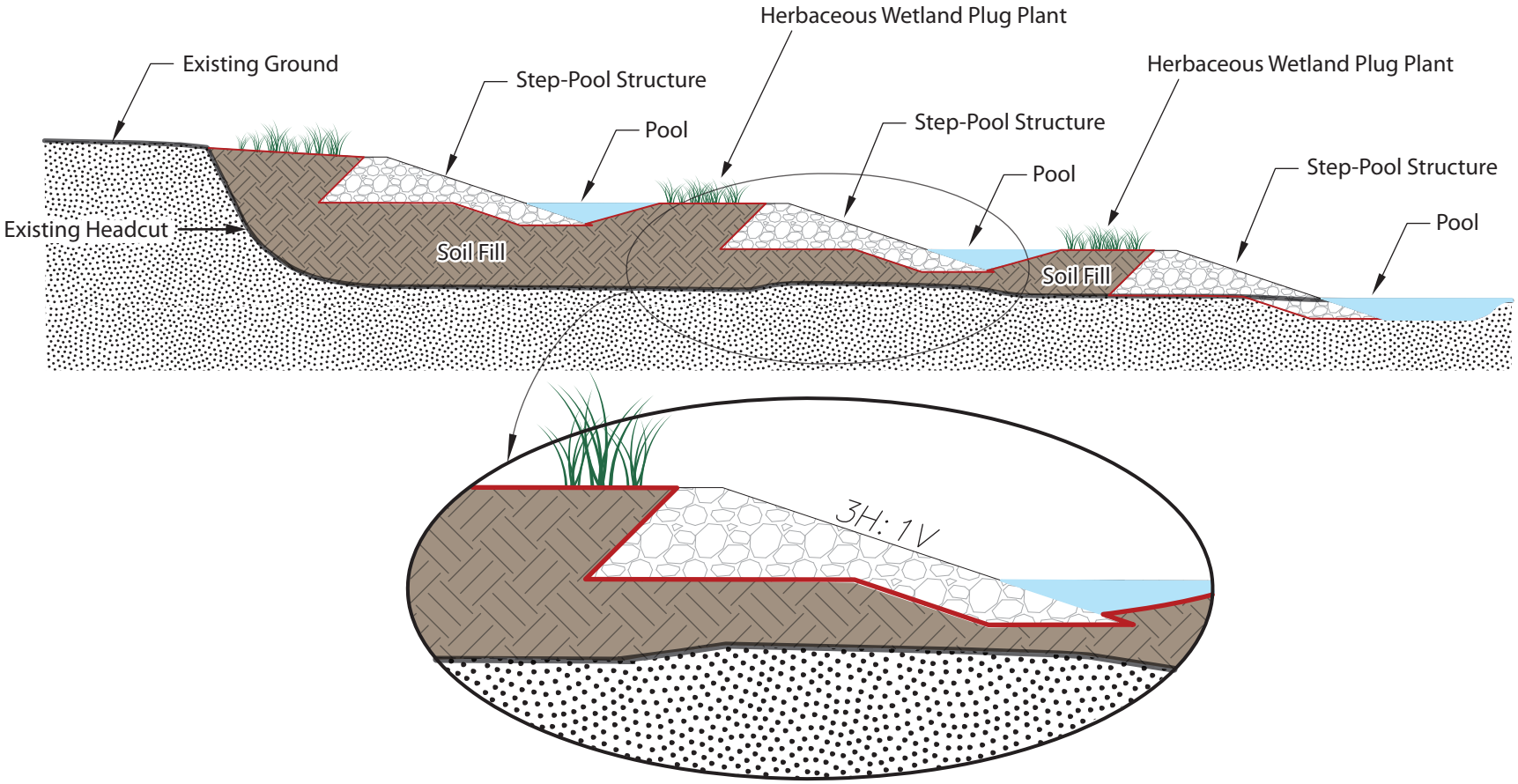
No special-status plants (i.e., (Baker's Meadowfoam and North Coast semaphore grass) have been observed on or adjacent to the erosion site (Caltrans 2010a). Erosion site 108-030-04_2 is located in well-vegetated mixed riparian woodland, and the areas around the site are a mixture of well-vegetated oak woodland grassland, Oregon ash riparian woodland, mixed riparian woodland, and wet meadow. No significant loss or disruption to these habitats is expected because of the isolated location and accessibility of the site. Standard BMPs would reduce temporary construction impacts to a less-than-significant level.

Desired Condition and Construction Methods

Construction methods for headcut stabilization at Lusher 108-030-04_2 are similar to those described above for the Frost Complex headcuts. A Rock Step-Pool Design would be appropriate for this site. Figure 4-6 shows three separate rock step-pool structures. For Lusher 108-030-04_2, one or two rock step-pool structures would be required based on the headcut and surrounding channel dimensions.

Access, Scheduling, and Cost

The easiest access to this erosion site is from the west along Highway 101, where an access road leads to the old railroad crossing between Old Outlet Creek and Mill Creek. The erosion site is few hundred feet away from the railroad tracks. Headcut stabilization activities should occur during the late summer or early fall when water levels in the channels are at their lowest or the channels are dry. Cost associated with headcut stabilization is approximately $100 per linear foot. However, cost varies because of accessibility, the types of material used, and the specific methods of construction.



Notes:

1. Depth of headcut and slope are not to scale. Rock step pools will be designed using this method and adjusted based on site specific conditions.
2. Rock fill and soil to be gathered from adjacent upland areas.
3. Soil fill will be seeded and planted.

NOT TO SCALE

Figure 4-6
Typical Headcut Treatment

4.2.1.4 Lusher 108-030-04_3

Problem/Need Statement

The Lusher 108-030-04_3 erosion site (Figure 4-3) is contributing excessive sediment and causing local water quality degradation. Sediment from 108-030-04_3 enters an unnamed tributary that eventually connects to Old Outlet Creek (under high flows). As such, sediment from this site enters an active channel. Concentrated flows from the swale upstream, combined with direct trampling by livestock, have likely initiated 108-030-04_3. This erosion site appears unstable.

Impacts to Existing Sensitive Biological Resources

No special-status plants (i.e., (Baker's Meadowfoam and North Coast semaphore grass) have been observed on or adjacent to the erosion site (Caltrans 2010a). Erosion site 108-030-04_3 is located in well-vegetated mixed riparian woodland, and the areas around the site are a mixture of well-vegetated oak woodland grassland, Oregon ash riparian woodland, mixed riparian woodland, and wet meadow. No significant loss or disruption to these habitats is expected due to the isolated location and accessibility of the site. Standard BMPs would reduce temporary construction impacts to a less-than-significant level.

Desired Condition and Construction Methods

Construction methods for headcut stabilization at Lusher 108-030-04_3 are similar to those described above for the Lusher 108-030-04_2 site. A Rock Step-Pool Design would be appropriate for this site. Figure 4-6 shows three separate rock step-pool structures. For Lusher 108-030-04_3, one or two rock step-pool structures would be required based on the headcut and surrounding channel dimensions.

Access, Scheduling, and Cost

The easiest access to this erosion site is from the west along Highway 101, where an access road leads to the old railroad crossing between Old Outlet Creek and Mill Creek. The erosion site is few hundred feet away from the railroad tracks. Headcut stabilization activities should occur during the late summer or early fall when water levels in the channels are at their lowest or the channels are dry. Cost associated with headcut stabilization is approximately $100 per linear foot. However, cost varies because of accessibility, the types of material used, and the specific methods of construction.

4.2.1.5 Benbow 108-040-13_3

Problem/Need Statement

The Benbow108-040-13_3 erosion site (Figure 4-6) is contributing excessive sediment and causing local water quality degradation. However, sediment derived this site enters a Category III abandoned/discontinuous channel that runs along the eastern edge of the parcel. This watercourse appears to have once been connected to Davis Creek, but no longer has an active hydrologic connection to it. As such, sedimentation from this site enters an active sediment sink (the Category III abandoned/discontinuous channel).

Nonetheless, the potential contribution of sediment from this site appears to be significant, as this is the largest headcut observed on any of the offsite mitigation parcels during the surveys. Concentrated flows from the swales upstream, combined with direct trampling by livestock, have likely initiated this erosion feature. This erosion site appears unstable.

Impacts to Existing Sensitive Biological Resources

The area adjacent to the site is considered potential habitat for Baker's Meadowfoam, with one known occurrence to the northeast (Caltrans 2010a). However, no Baker's Meadowfoam was observed on the site itself, and no North Coast Semaphore grass is known to exist in the vicinity of the site. Nonetheless, potential construction staging areas and access routes would need to avoid any Baker's Meadowfoam plants. Wet meadow and swale are the existing jurisdictional wetlands adjacent to the site. Standard BMPs would reduce temporary construction impacts to a less-than-significant level.

Desired Condition and Construction Methods

Construction methods for headcut stabilization at Benbow108-040-13_3 are similar to those described above for the headcuts in the Frost Complex. A Rock Step-Pool Design would be appropriate for this site. Figure 4-6 shows thee separate rock step-pool structures. For Benbow108-040-13_3, two rock step-pool structures would be required based on the headcut and surrounding channel dimensions.

Access, Scheduling, and Cost

The easiest access to this erosion site is from the south along Hearst Road. Headcut stabilization activities should occur during the late summer or early fall when the channel is dry. Cost associated with headcut stabilization is approximately $100 per linear foot. However, cost varies because of accessibility, the types of material used, and the specific methods of construction.

4.2.2 Restoration Sites on the Taylor Parcels

Although not identified by the assessment as a priority for restoration, erosion sites on the Taylor parcels provide a unique opportunity to limit sedimentation from an upland environment and could be undertaken as part of general maintenance efforts based on the simplicity of the restoration methods required to address the erosion sites.

4.2.2.1 Taylor Complex 037-221-68_1 through 037-221-68_7

The seven erosion sites that comprise the Taylor Complex (Figure 3-2) are spaced at regular intervals along Goat Rocks Road. Culverts on either side of the road have created headcuts upslope of the road, and scour areas downslope of the road. The headcuts could easily be addressed using the same treatments for headcuts previously described but at a smaller scale (use of hand tools and local materials such as small boulders located near the erosion sites). For the scour areas, appropriate dissipation of energy with placement of rocks and/or extending the culvert length and reconfiguring the outlet of the culvert to meet the channel bed on the downslope would eliminate or reduce the erosive power of the water in the culvert.

The areas of and adjacent to each erosion site are located in a moderately-vegetated upland forest setting. However, all work would occur in the vicinity of Goat Rocks Road and standard BMPs would reduce temporary construction impacts to a less-than-significant level. Access to these erosion sites is from Goat Rocks Road on the southern end of the parcel (right off the Reynolds Highway). Site stabilization activities should occur during the summer and fall when water levels in the channels, gully, and culverts are at their lowest. Cost associated with site stabilization is approximately $1,000 per site if only headcut repair and boulder placement were to occur. The cost would increase if culvert extension/reconfiguration were to occur. Restoration activities on the Taylor Complex could be performed by local landowners with minimal need for agency permitting.

4.2.2.2 Taylor 037-221-68_8 and 037-221-68_9

The Taylor 037-221-68_8 erosion site consists of a headcut on an eroding gully in an open area near Goat Rocks Road. The headcut could be addressed using the same treatments for the headcuts previously described. However, the eroding gully would benefit from the incorporation of grade control structures at specific intervals throughout its length, and the banks should be re-graded and planted with native vegetation. The Taylor 037-221-68_9 erosion site consists of a headcut at the edge of small livestock pond. The headcut could be addressed using the same treatments for the headcuts described above; however, it is recommended that an approximately 3 foot high berm be constructed around the livestock pond so that once the headcut is repaired, it would not have further opportunity to compromise the stability of the pond outlet and surrounding areas.

The areas of and adjacent to each of these two erosion site are located in a sparsely-vegetated upland forest setting. The sites are close to Goat Rocks Road and standard BMPs would reduce temporary construction impacts to a less-than-significant level. Access to these erosion sites is from Goat Rocks Road on the southern end of the parcel (right off the Reynolds Highway). Site stabilization activities should occur during the summer and fall when water levels in the gully and the livestock pond are at their lowest. Cost associated with site stabilization for Taylor 037-221-68_8 is approximately $100 per linear foot for the headcut. Cost associated with the eroding gully is approximately $500 per linear foot plus approximately $1,000 per grade control structure. Cost associated with site stabilization for Taylor 037-221-68_9 is approximately $100 per linear foot, plus approximately $1,000 to build the berm. However, cost varies because of accessibility, the types of material used, and the specific methods of construction.

4.2.2.3 Taylor 037-240-41

The same methods previously described could also be used to address the two slump and headcut and two headcut erosion sites on the Taylor 037-240-41 parcel associated with the PG&E access road. The areas of and adjacent to each of these four erosion sites are located in a sparsely-vegetated upland forest setting. The sites are all on the PG&E access road and standard BMPs would reduce temporary construction impacts to a less-than-significant level. Access to these erosion sites is from the main access road on the Taylor 037-240-41 parcel (right off the Reynolds Highway). Site stabilization activities should occur during the summer and fall when water levels at their lowest. Cost associated with site stabilization is approximately $100 per

linear foot. However, cost varies because of accessibility, the types of material used, and the specific methods of construction.

Chapter 5 References

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Chapter 6 List of Preparers

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Dan Schiff	GIS Analyst
John Durnan	Graphic Artist
Darle Tilly	Technical Editor
Corrine Ortega	Publications Specialist

Appendix A Digital Images of Erosion Sites, By Parcel

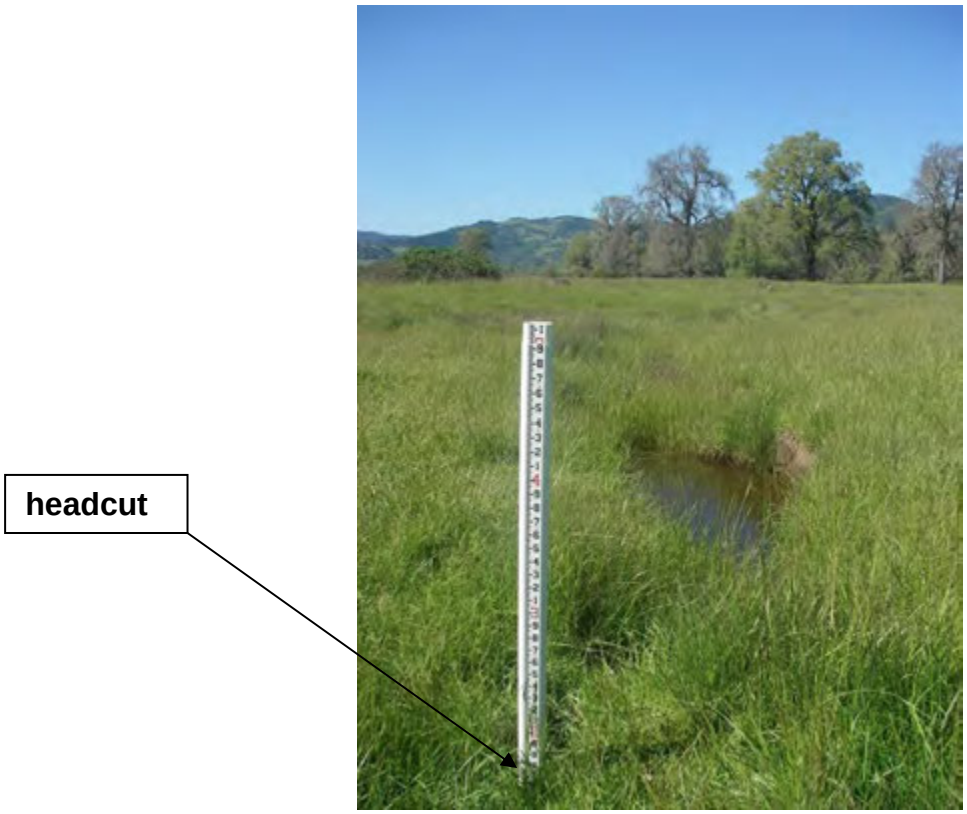
headcut

headcut

headcut

headcut

pothole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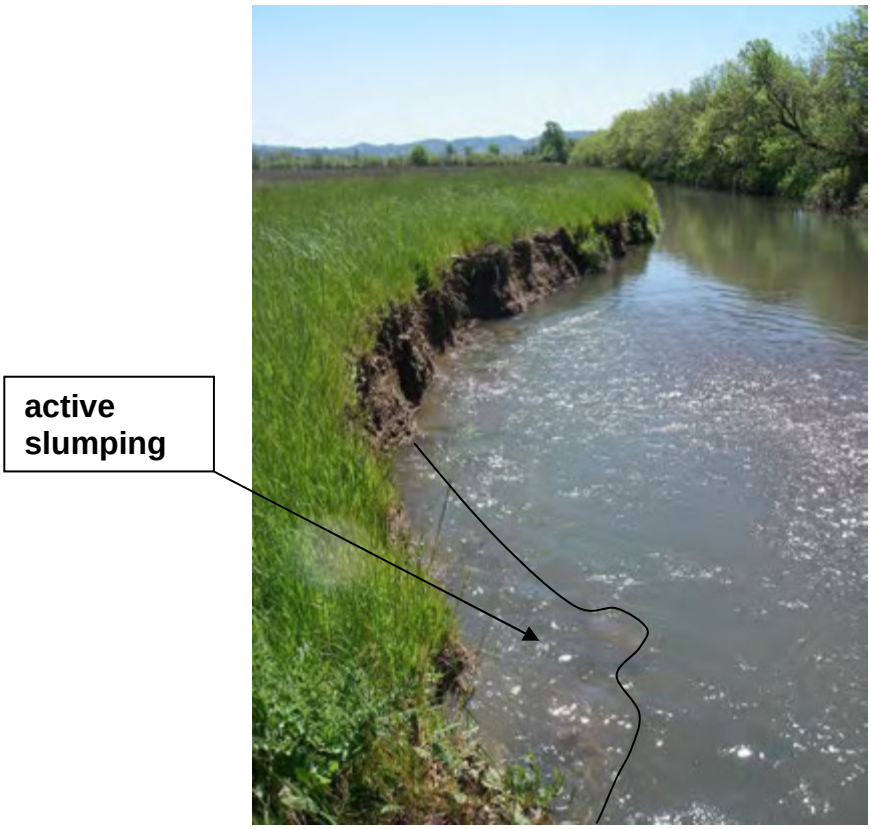
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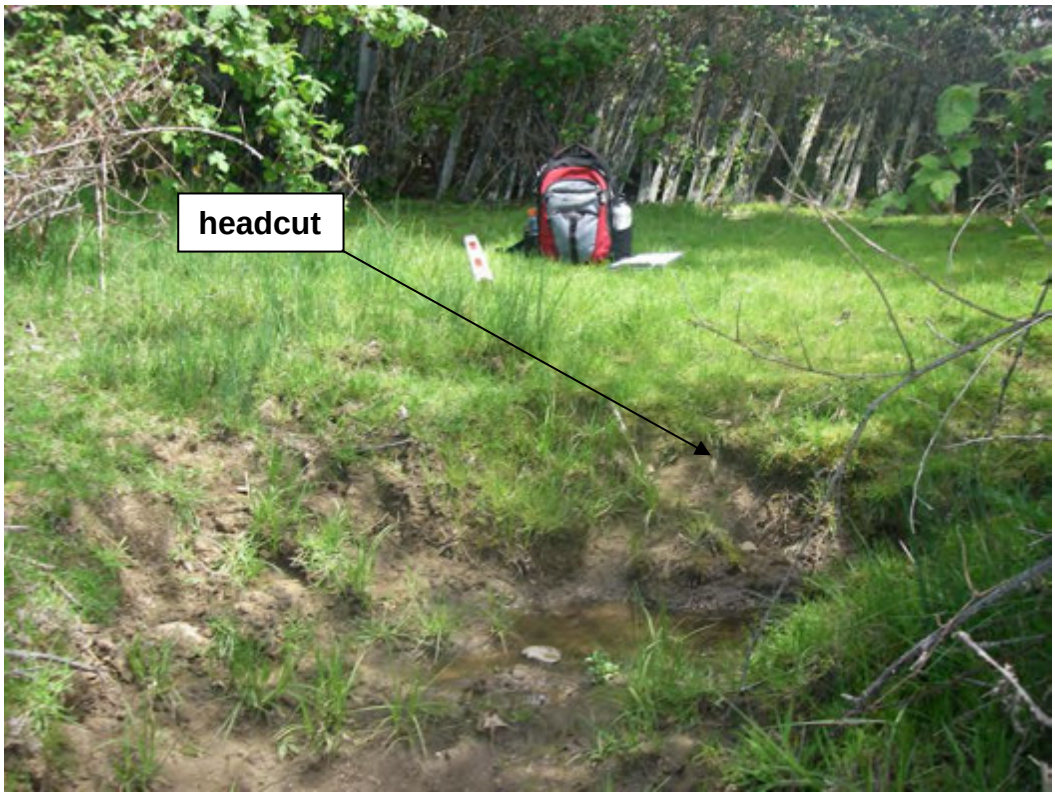
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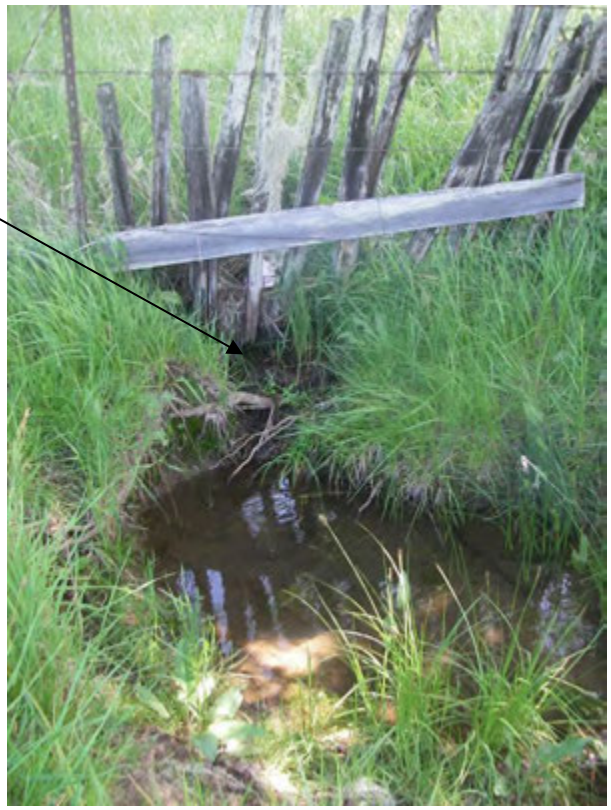

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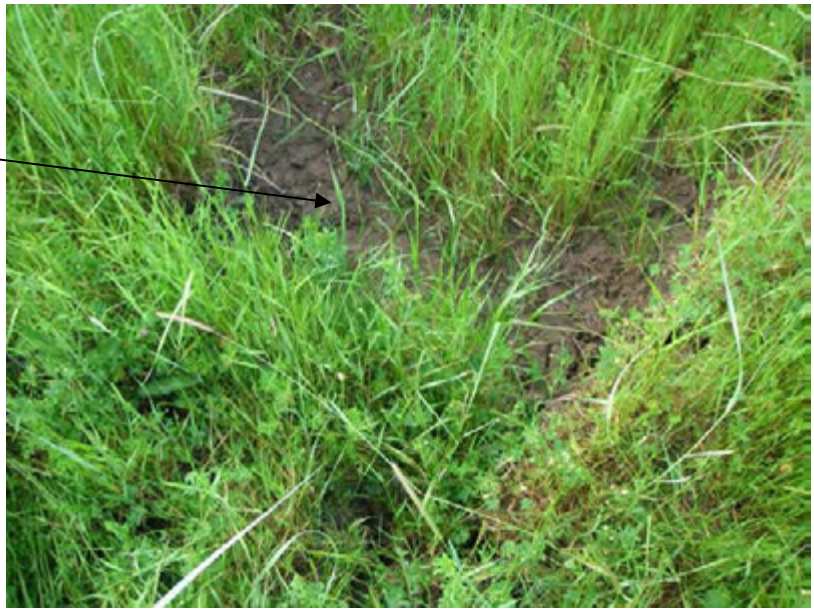
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culvert

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scour area

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eroding gully

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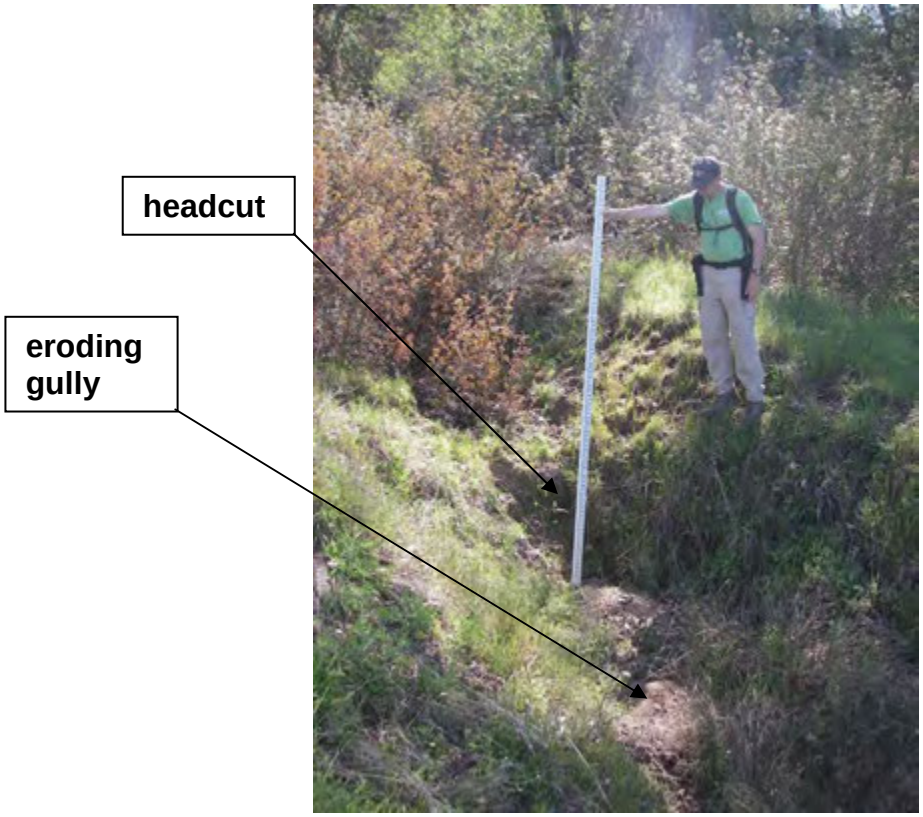
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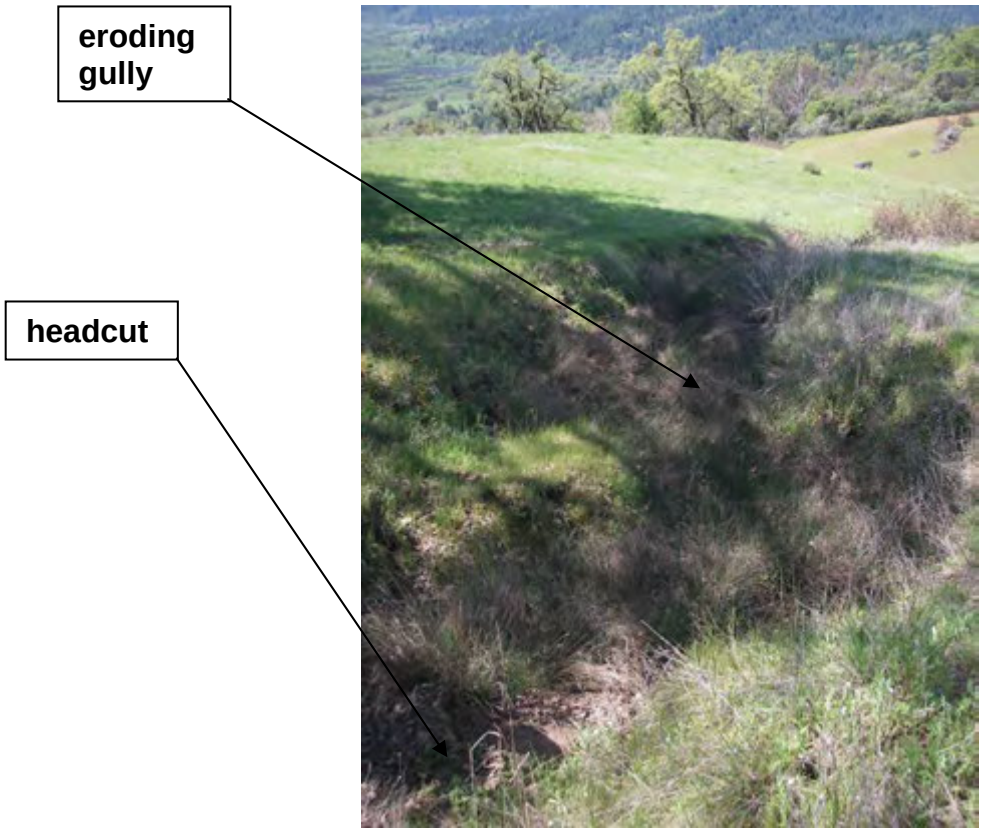
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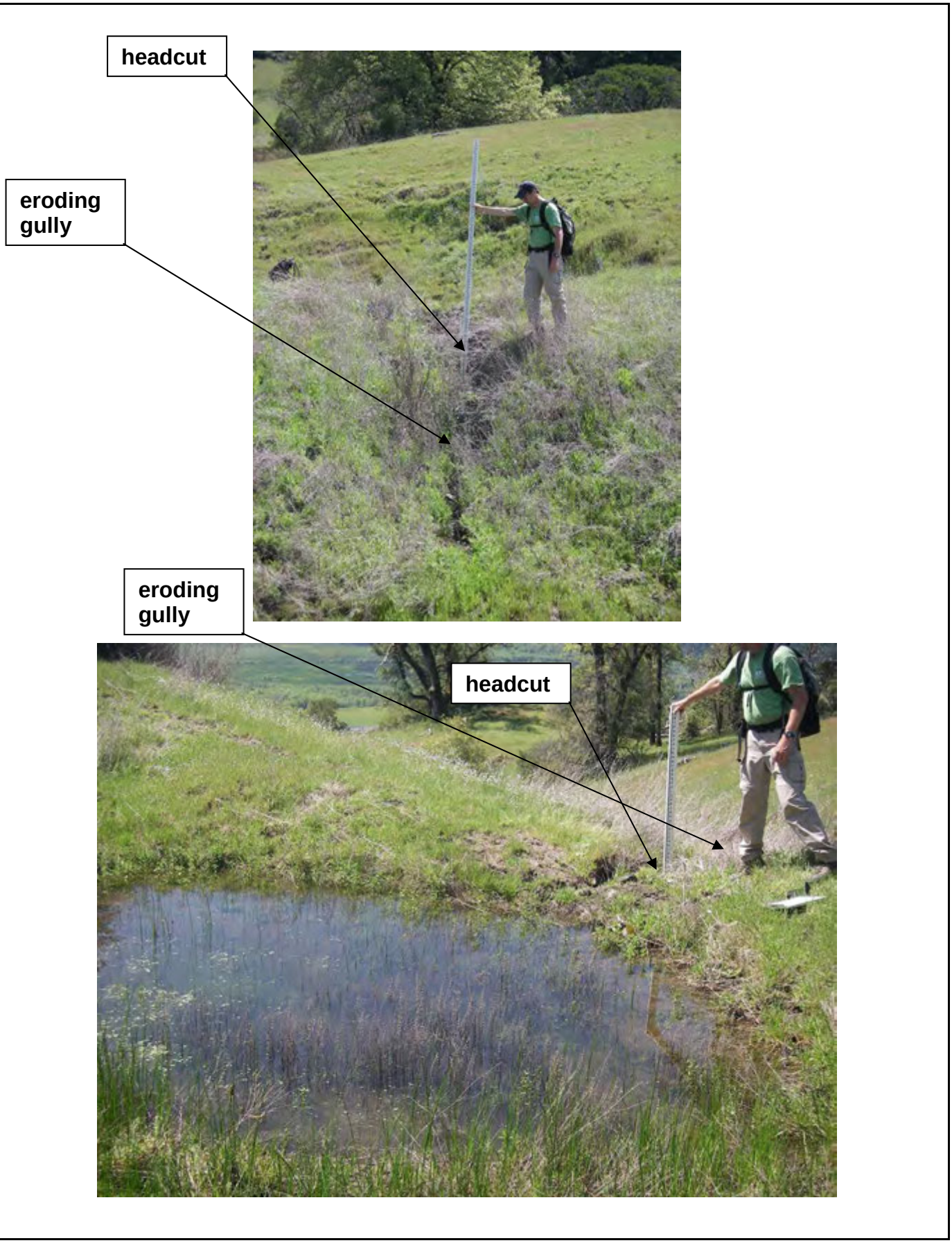
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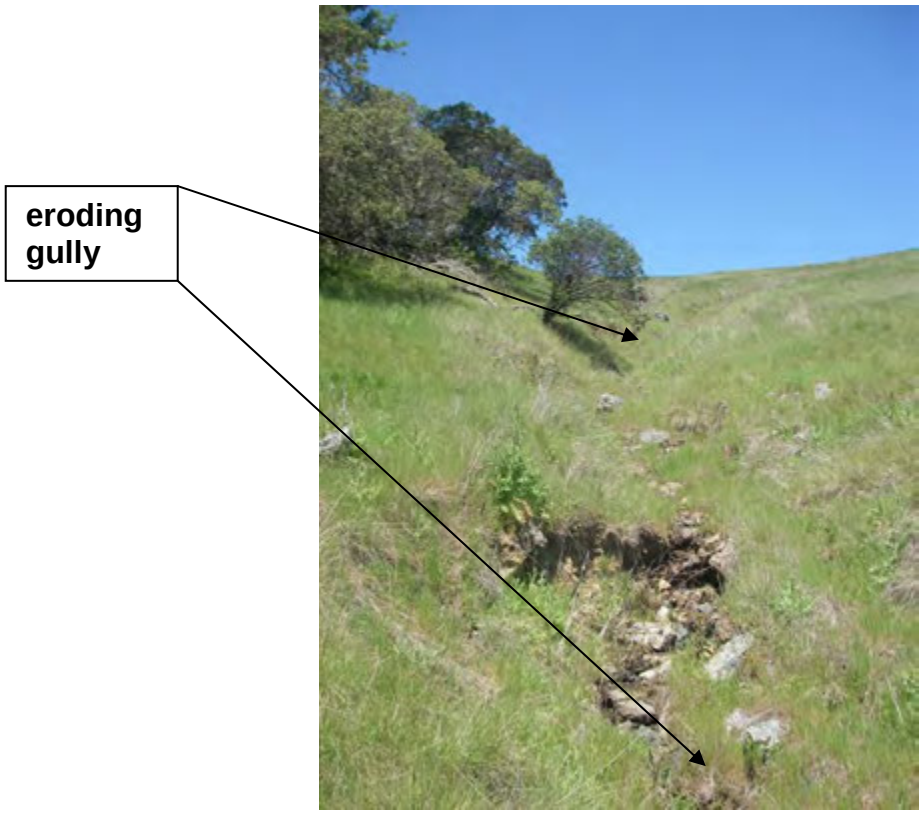
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gully

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gully

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eroding gully
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slump/
headcut
access
road

access
road
slump/
headcut

Appendix A-36. Taylor 037-240-41_4

slump/
headcut

slump/
headcut

headcut

headcut

Appendix O
Wetland Hydrology and Soil Analysis for Offsite Wetland Establishment Areas

Memorandum

Date:	July 29, 2010
To:	Dave Wickens U.S. Army Corps of Engineers - San Francisco District 1455 Market Street San Francisco, CA 94103-1398
Cc:	Laurie Monarres, U.S. Army Corps of Engineers Melissa Scianni, U.S. Environmental Protection Agency Jeremiah Puget, North Coast Regional Water Quality Control Board Craig Martz, California Department of Fish and Game
From:	Shanna Zahner California Department of Transportation
Subject:	**Willits Bypass Project – Hydrology at Proposed Wetland Establishment Sites in Little Lake Valley**

1 Introduction

The Willits Bypass Project (bypass project) has several compensatory mitigation components, including wetland establishment. As part of the Clean Water Act (CWA) Section 404 individual permit process for the bypass project, the U.S. Army Corps of Engineers (Corps) has requested information related to hydrology at the six offsite mitigation parcels where wetland establishment is proposed. (Corresponding information on soils and vegetation has also been requested by the Corps and will be provided under separate cover.) Table 1 lists the offsite mitigation parcels and the wetland establishment habitat type and acreage proposed at each parcel.

Table 1. Proposed Wetland Establishment Sites at the Offsite Mitigation Parcels

Offsite Mitigation Parcel	Assessor's Parcel Number	Proposed Wetland Establishment Habitat Type	Proposed Wetland Establishment at Parcel (acres)
Ford	108-010-06	Mixed marsh and wet meadow	2.85
Goss/MGC Plasma Middle/MGC Plasma North	103-230-02/ 103-250-14/ 103-230-06	Wet meadow	7.47
Niesen	108-040-02	Mixed marsh and wet meadow	5.66
Watson - Eastern	037-221-30	Wet meadow	8.33 (north area is 4.42 and south area is 3.91)
		Total	24.31

Attachment 1, "July 9, 2010, letter from Corps to California Department of Transportation (Caltrans)," lists the Corps' minimum information necessary to make a permit decision for the bypass project. This technical memorandum addresses Items 4a(1) and 4a(2) on pages 2 and 3 in Attachment 1 – hydrology at each proposed wetland establishment site. At the July 12 and 13, 2010, meeting between resource agencies (i.e., Corps, U.S. Environmental Protection Agency [USEPA], North Coast Regional Water Quality Control Board [RWB], and California Department of Fish and Game [CDFG]) and Caltrans, each of the items in the July 9, 2010 letter were discussed. With respect to Items 4a(1) and 4a(2), Caltrans indicated that site specific data on field-measured hydrology indicators for each proposed wetland establishment site were limited and that these data limitations would affect Caltrans ability to respond to Items 4a(1) and 4a(2) at the level of detail indicated in the July 9, 2010 letter. As an example, groundwater monitoring wells have been installed at the Goss and MGC Plasma North parcels (as part of Caltrans' study of North Coast semaphore grass) in the vicinity of the proposed wetland establishment sites but have not been installed at the other parcels where wetland establishment sites are proposed. As a result, groundwater availability at these parcels has been determined based on qualitative (non-field measured) information and extrapolated from valley-wide data. The Corps and USEPA agreed that some site specific hydrology data that was not available (e.g., existing wetland hydroperiod information) would need to be collected during the appropriate time of the year and would therefore not be included as part of this submittal.

This technical memorandum presents information on the following items for each proposed wetland establishment site per the July 9, 2010 letter:

- Site specific functions being replaced.
- Existing hydrologic conditions at wetland monitoring reference sites.
- Groundwater availability.
- Existing wetland hydroperiod information (i.e., frequency of flooding, depth, duration, timing of inundation, percent of open water).
- Historical hydrology of wetland establishment site if different from current conditions.
- Acres of contributing drainage areas.
- Water budget for wet and dry years that includes water sources (i.e., precipitation, surface runoff, groundwater, and stream flow).

A seventh item, results of water quality analysis (i.e., surface water, groundwater, redox, nutrients, organic content, suspended matter, dissolved oxygen, and heavy metals), was requested in the July 9, 2010 letter. Field measurements and laboratory analyses of these water quality constituents is slated to begin in late August 2010 and continue through June 2011 (or until ground disturbance and/or vegetation removal occurs as part of bypass project construction) to document baseline conditions at the offsite mitigation parcels. These data were not available prior to the submittal of this technical memorandum but will be provided as they become available.

2 Site Specific Functions and Values Being Replaced

Table 2 lists the target functions and values being replaced by wetland establishment at the proposed establishment sites. Please see Chapter 2 (pages 2-16 through 2-23) in the bypass project's Mitigation and Monitoring Proposal (Caltrans 2010a) for a description of each function and value listed in Table 2.

Table 2. Target Functions to be Replaced at Proposed Wetland Establishment Sites

Offsite Mitigation Parcel	Assessor's Parcel Number	Proposed Wetland Establishment Habitat Type	Target Functions and Values Replaced
Ford	108-010-06	Mixed marsh and wet meadow	Groundwater recharge, nutrient removal, wildlife diversity, and aquatic diversity
Goss/MGC Plasma Middle/MGC Plasma North	103-230-02/ 103-250-14/ 103-230-06	Wet meadow	Groundwater recharge, nutrient removal, wildlife diversity, and uniqueness
Niesen	108-040-02	Mixed marsh and wet meadow	Groundwater recharge, nutrient removal, wildlife diversity, and aquatic diversity
Watson - Eastern	037-221-30	Wet meadow	Groundwater recharge, nutrient removal, wildlife diversity, and uniqueness

Note:

a. MMP = Willits Bypass Project Mitigation and Monitoring Proposal (Caltrans 2010a).

3 Existing Hydrology at Wetland Monitoring Reference Sites

Currently, wetland monitoring reference sites have been identified for each proposed wetland establishment site and are located on the same offsite mitigation parcel as the proposed establishment site (MMP Appendix C, sheets C-30, C-54, C-69, C-77, and C-87). As such, the hydrology for the wetland monitoring reference site is the same as the hydrology for the proposed establishment site. Information on the hydrology of the wetland monitoring reference sites and proposed wetland establishment sites is described in Section 6. Please note that the wetland monitoring reference sites may be adjusted per Corps and USEPA direction.

4 Groundwater Availability

Site specific data on field-measured groundwater availability for each proposed wetland establishment site are limited. Groundwater monitoring wells have been installed at the Goss and

MGC Plasma North offsite mitigation parcels (as part of Caltrans' study of North Coast semaphore grass) in the vicinity of the proposed wetland establishment sites at these parcels but groundwater monitoring wells have not been installed at the other offsite mitigation parcels where wetland establishment sites are proposed. As a result, groundwater availability at some of the proposed wetland establishment sites has been determined based on qualitative (non-field measured) information and extrapolated from valley-wide data. Section 8, as part of the water budget discussion, presents information on groundwater availability at the proposed wetland establishment sites. Specifically, Sections 8.1.2 and 8.1.3 address groundwater availability.

5 Existing Wetland Hydroperiod Information

The July 9, 2010 letter requests that hydroperiod data for existing wetlands include frequency of flooding, depth, duration, timing of inundation, and percent of open water. Site specific field-measured data for the hydroperiod of existing wetlands occurring adjacent to the proposed wetland establishment sites are limited. As a result, existing wetland hydroperiod data at some of the proposed wetland establishment sites have been determined based on qualitative (non-field measured) information and extrapolated from valley-wide data. Qualitative information on existing wetland hydroperiod for each offsite mitigation parcel where wetland establishment is proposed is presented in Sections 6.2 through 6.5.

6 Historical and Current Hydrology

Historical and current hydrology for the offsite mitigation parcels where wetland establishment is proposed is provided below. Information on seasonal precipitation patterns is also included to provide context for environmental conditions.

6.1 Seasonal Precipitation Patterns

Precipitation data are available for Little Lake Valley from the Western Regional Climate Center (WRCC) for the Willits 1 NE station located just north of the City of Willits. Missing values were filled in with data from nearby stations, mostly with data from the California Data Exchange Center (CDEC) station WIL, located approximately 5 miles south of the City of Willits. Precipitation data from water years 2008 through 2010, which corresponds to wetland studies and site visits to the offsite mitigation parcels made by Caltrans and the Corps during wetland delineation efforts for the bypass project, are presented in Table 3. Seasonal precipitation patterns influenced observations of wetland hydrology on the mitigation parcels.

Table 3 shows the seasonal amount of precipitation from water years 2008 through 2010. Seasonal precipitation patterns for water years 2008 and 2009 were significantly below average and below average for the months of February through June, the months when most wetland data-points and field observations occurred. Seasonal precipitation patterns for water year 2010 were close to

average, with nearly average or above average precipitation for the months of February through June.

Table 3. Precipitation Data from Water Years 2008 through 2010 from Western Regional Climate Center Willits 1NE Station

Water Year	Precipitation (inches)	Percentile	Percent of 50th Percentile
2008	38.6	26%	75%
2009	29.7	2%	57%
2010	47.4	43%	92%
1961 – 2010 Average	51.2		
1961 – 2010 50th Percentile	51.8		

6.2 Ford Offsite Mitigation Parcel

Wetland delineations on the Ford parcel were conducted by Wildlands, Inc., and wetland boundaries have been field verified by the Corps. Caltrans has access to ArcMap Shapefiles for jurisdictional wetland and other waters features but does not have access to the wetland datasheets and the information provided therein. This parcel was observed by Caltrans, Corps, USEPA, CDFG, RWB, Willits Environmental Center (WEC), and Caltrans (including contractor ICF International) on July 26, 2010. Figure 1 shows the Ford parcel.

The Ford parcel is situated in the flat section at the toe of the slope that forms the western border of the Little Lake Valley. The existing Highway 101 (US 101) and the Northwestern Pacific Railroad is located at the toe of this slope and the fill terraces associated with these features form the western boundary of the Ford parcel. A wide fill terrace occurs at the northern end of the Ford parcel (the area proposed for wetland establishment). The Ford parcel lies at the bottom of the Valley, in the area where "Little Lake" historically formed. Early soil survey information (Dean 1920) indicates that a lake historically formed at the northern end of Little Lake Valley during the rainy season, even during very low rainfall years. At the end of a series of heavy rainfall events in February 1915, the lake extended over 1,875 acres and was 12 feet deep over a 300-acre area. At that time, the high water mark of the lake was at the 1,330-foot contour, which would have covered all but the southernmost tip of the Ford parcel.

Old Outlet Creek forms the eastern boundary of the Ford parcel, and flows from southwest to northeast. Oat Canyon Creek, an intermittent stream, enters at the western boundary of the parcel. Oat Canyon Creek originates in the hillsides to the west of the Ford parcel and crosses the center of the parcel travelling from west to east before merging with Old Outlet Creek on the east side of the parcel. Additionally, it appears that another un-named drainage originating from hills to the west of the Ford parcel may have historically entered this parcel approximately 1,000 feet to the north of Oat Canyon Creek. Analysis of the USGS 7.5-minute quadrangle indicates that this system is now impounded off of the Ford parcel by a dam that forms a pond approximately 1,000 feet west of existing US 101. Evidence of this former channel on the Ford parcel to the east of US 101 is provided by a deep swale-like feature that supports mixed marsh vegetation, and flows to the northeast,

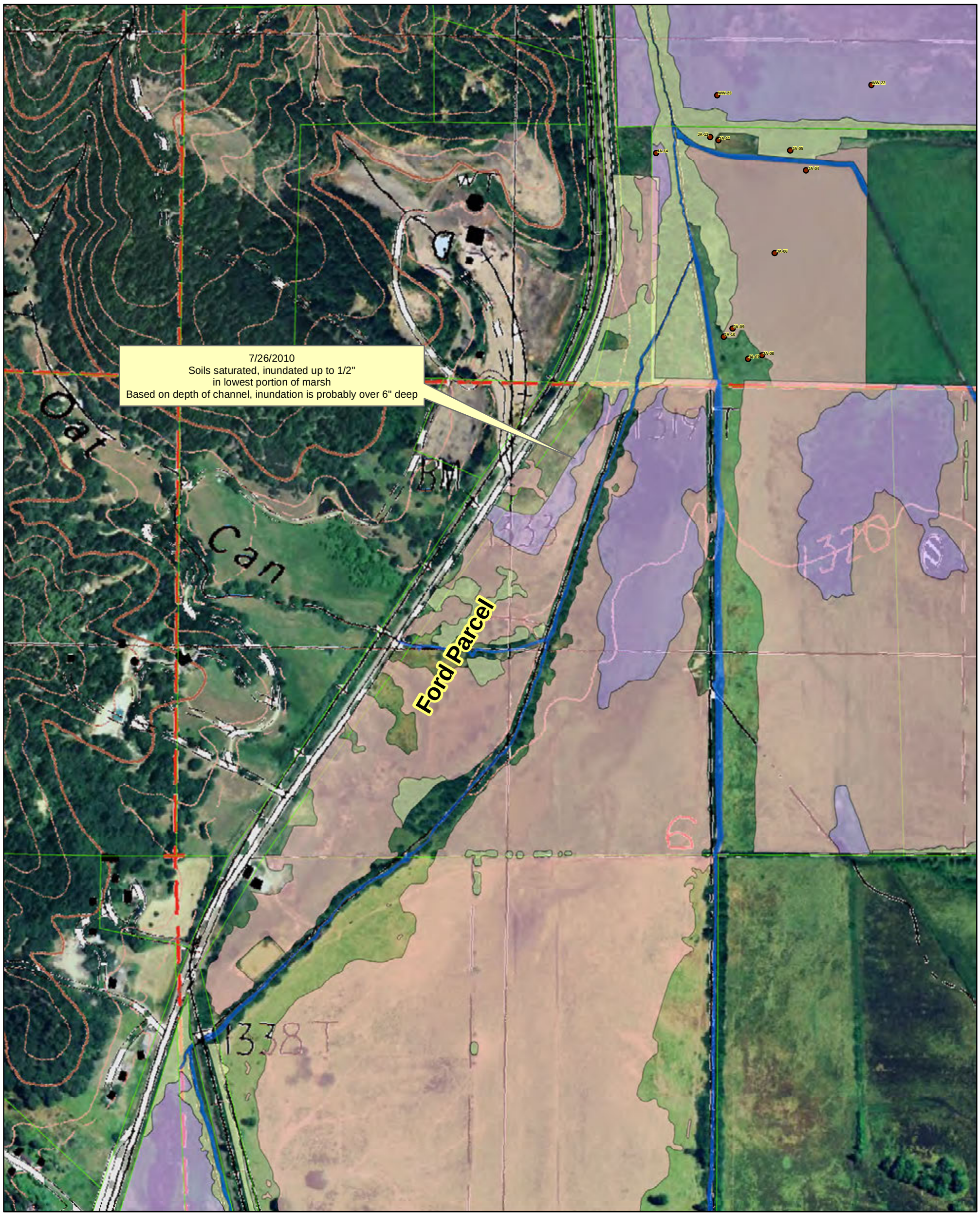


Figure 1
Ford
Caltrans Willits Bypass Project
State Route 101
EA: 01-26200

In: Tributaries to the Eel River
At: Little Lake Valley and the City of Willits
County of Mendocino, State of California

Layout View Delineation Map Prepared By:
Jason Meigs, Caltrans Associate Biologist
2800 Gateway Oaks Drive
Sacramento, CA 95833
July 28, 2010

Legend

- Parcel Boundaries
- Mixed Marsh
- Other Waters
- Riparian Scrub
- Riparian Woodland
- Swale
- Wet Meadow

0 125 250 500 750 1,000 1,250 Feet

1:6,000

1 inch = 500 feet

N W E S

Datum/Projection:
NAD 1983 California State Plane Zone 2

eventually merging with Outlet Creek. Additional surface water flows, including highway stormwater discharges, are conveyed through culverts crossing US 101 from west to east. Although some surface subsurface water is probably entering the Ford parcel from the hillsides to the west (as evidenced by the placement of highway and railroad culverts and the flow of Oat Canyon Creek), observations of drainage patterns onsite indicate that surface and subsurface flows are generally moving from south to north and roughly parallel Outlet Creek.

Based on field observations on July 26, 2010, and based on the hydrologic patterns observed in adjacent and nearby parcels (Watson - West, Jacobs, Lusher, and Brooke), it appears that wet meadow and riparian wetlands on the Ford parcel most likely display soil saturation within 12" of the surface, or above surface inundation, depending upon site topography, between approximately November (based on precipitation patterns) and March in most years. Based on the observation of ½" of surface water and saturated soils in the lowest area of the marsh located on the parcel, surface water may persist in the marsh areas of the parcel until April or May, and soils in this area may remain saturated until late May or early June in most years.

6.3 Goss/MGC Plasma Middle/MGC Plasma North Offsite Mitigation Parcels

Analysis of the Willits United States Geological Survey (USGS) 7.5-minute quadrangle indicates that that an unnamed intermittent tributary of Davis Creek historically traversed the MGC Plasma Middle, MGC Plasma North, and Goss parcels from southeast to northwest and continued onto the adjacent parcel to the west (Arkelian parcel; Figure 2). The former channel indicated on the Willits USGS quadrangle is no longer distinguishable on the Goss or MGC Plasma parcels; a stand of mature riparian forest on the Goss parcel and a swale-like strip of wet meadow on the MGC Middle and MGC North parcels indicates the general area of the former stream channel. The Willits USGS 7.5-minute quadrangle also indicates a historical tributary to this stream which flows from east to west across the MGC Plasma North parcel, merging with the first historic stream at the western edge of the MGC Plasma North parcel. This former channel is also no longer distinguishable on the parcel. The presence of wetlands along these former stream channels may indicate that subsurface flows may still be occurring in these areas.

The eastern boundary of the MGC Plasma Middle parcel is bounded by a small hill situated at the toe of the hills forming the eastern boundary of Little Lake Valley. The toe of this hill supports a seasonal spring discharge. Surface water seeping from this hillside enters an artificial drainage ditch that has been constructed in the area of the historic northwest-flowing creek channel and is directed to the northwest toward, and onto, the MGC Plasma North parcel. This artificial drainage ditch runs for approximately 450 feet before it becomes indistinguishable from the wet meadow on the MGC Plasma North parcel.

Hydrology on the Goss and MGC Plasma North parcels is currently influenced by a series of artificial drainage ditches that appear to have been created to drain surface water away from the center of each parcel in order to drain these parcels to produce hay. Linear drainage swales form the west, south, and eastern boundaries of the Goss parcel generally direct surface water flows in a south to

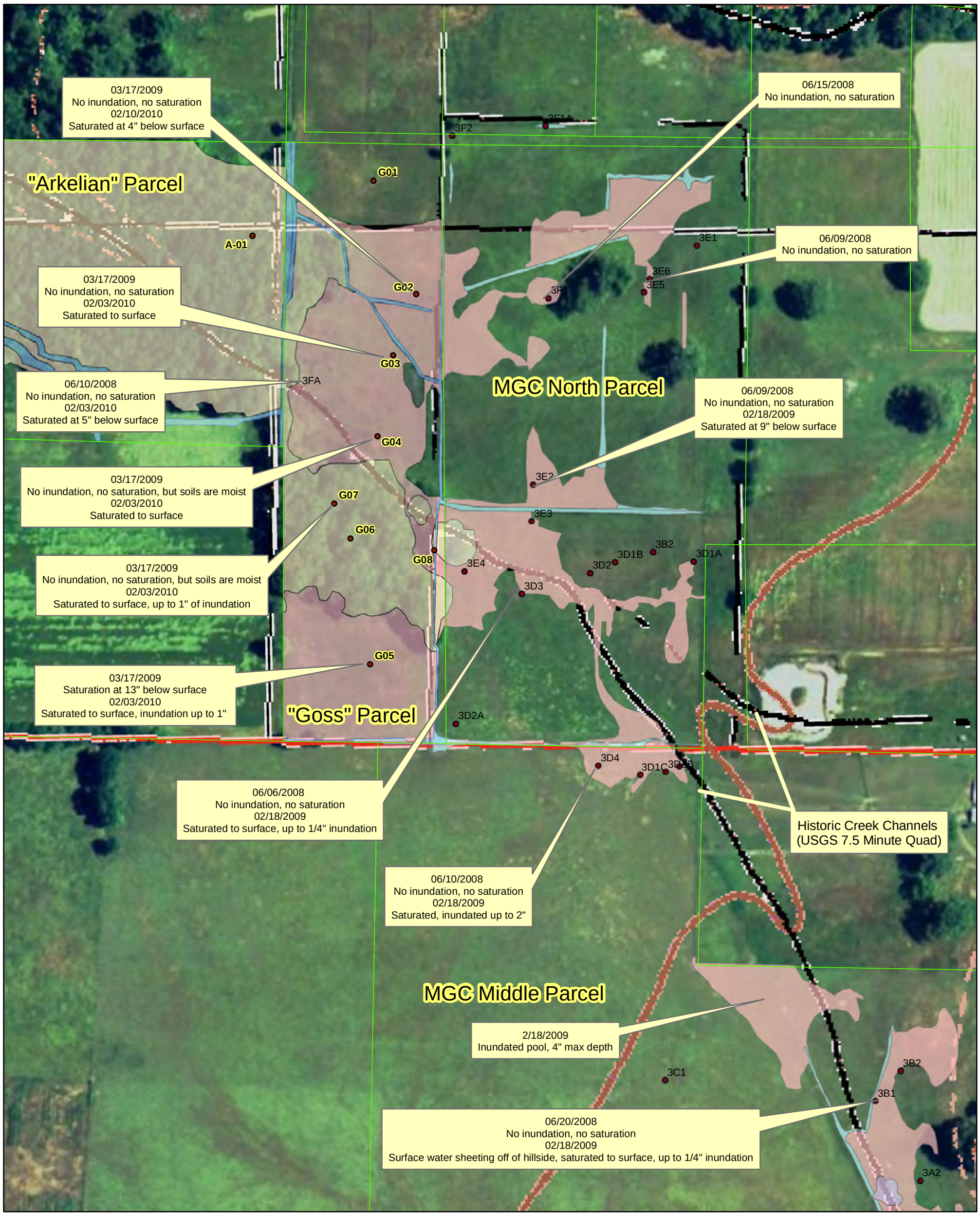


Figure 2
Goss/MGC Plasma
Caltrans Willits Bypass Project
State Route 101
EA: 01-26200

In: Tributaries to the Eel River
At: Little Lake Valley and the City of Willits
County of Mendocino, State of California

Layout View Delineation Map Prepared By:
Jason Meigs, Caltrans Associate Biologist
2800 Gateway Oaks Drive
Sacramento, CA 95833
On July 28, 2010

Legend

- Parcel Boundaries
- Mixed Marsh
- Other Waters
- Riparian Scrub
- Riparian Woodland
- Swale
- Upland
- Wet Meadow

0 50 100 200 300 400 500 Feet

1:2,400

1 inch = 200 feet

N W E S

Datum/Projection:
NAD 1983 California State Plane Zone 2

northwest direction. An additional artificial drainage ditch bisects the Goss parcel and drains surface water from the southeast to northwest, and includes a corrugated metal culvert that allows equipment to access the south end of the parcel for mowing. It appears as if the excavation of this additional drainage ditch has allowed the northern part of the Goss parcel to develop into, or to remain, as uplands.

Wetland data for the MGC Plasma North and MGC Plasma Middle parcels were collected on June 5-16, 2008, and were field verified by the Corps on February 18, 2009. Data collected in June 2008 indicate that surface water and groundwater within 12"-18" of the soil surface were not available, even in the wettest sections (e.g., center of swales, bottom of ditches). Wetland datasheets were not filled out during the Corps verification in February 2009 and the descriptions above of "spring time" hydrologic conditions are based on personal observations (Meigs pers. comm.) across the four site visits to these parcels conducted between June 2008 and July 2010.

Based on field observations, it appears that wet meadow, swale, and riparian wetlands on the Goss and MGC Plasma North parcels display soil saturation within 12" of the surface, or above surface inundation, depending upon site topography, between approximately November (based on precipitation patterns) and March (based on wetland delineation datasheets and personal observations [Meigs pers. comm.]) in most years.

6.4 Niesen Offsite Mitigation Parcel

Based on a 1956 aerial photograph, the topography, and presumably the hydrology, on the Niesen parcel appears to have been altered some time during or just prior to 1956 for the production of hay or irrigated pasture, as evidenced by linear patterns that appear as berms on the aerial photograph. The current hydrology of the Niesen parcel, which is situated in the flat land at the toe of the slope that forms the western border of the Little Lake Valley, is dominated by a seasonal high water table.

Existing Highway 101 (US 101), which is located at the toe of the slope that forms the western border of Little Lake Valley, forms the western boundary of the Niesen Parcel (Figure 3). Surface water flows, including US 101 storm water discharges, are conveyed through a series of culverts crossing US 101 from west to east. The Northwestern Pacific Railroad line and its associated drainage ditch forms the eastern boundary of the parcel. Water in the railroad ditch flows from south to north, eventually discharging into Upp Creek approximately 1,500 feet to the north on the Brooke parcel. The southern boundary of the Niesen parcel is bound by the presence of an upland berm that mostly separates the majority of the parcel from an artificial drainage ditch that flows from west to east, discharging into the railroad ditch system on the eastern boundary of the site. Although some surface subsurface water is probably entering this parcel from the hillsides to the west (evidenced by the presence of the southern drainage ditch), observations of drainage patterns onsite indicate that surface and subsurface flows are generally moving from south to north, roughly paralleling the railroad ditch system, and are eventually concentrated into an artificial drainage to the north (on the Lusher parcel) that discharges into Upp Creek.

The Niesen parcel is relatively flat. An elevated overburden area has been constructed on the western side of the parcel, apparently to build structures that would be protected from damage due

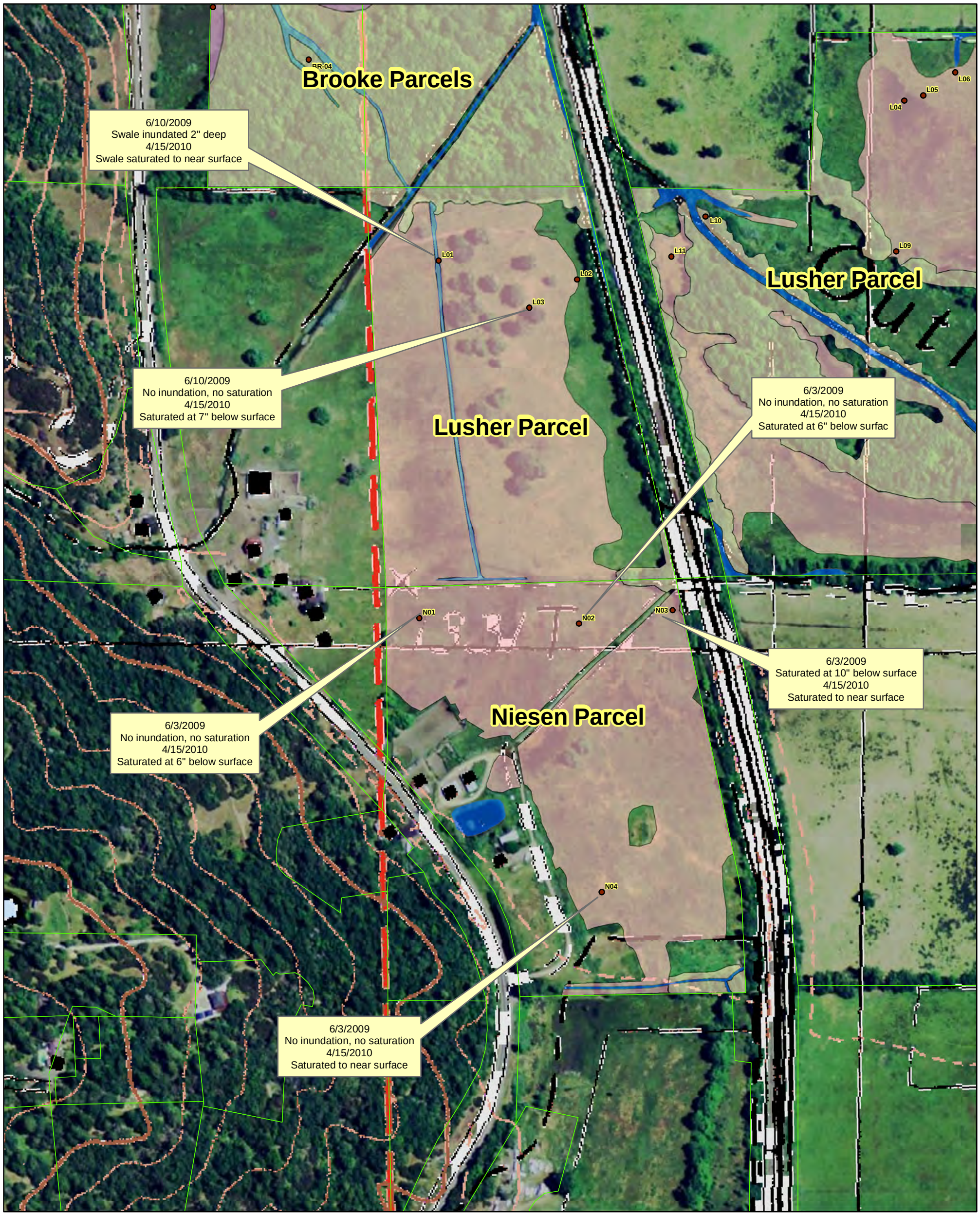


Figure 3
Niesen
Caltrans Willits Bypass Project
State Route 101
EA: 01-26200

In: Tributaries to the Eel River
At: Little Lake Valley and the City of Willits
County of Mendocino, State of California

Layout View Delineation Map Prepared By:
Jason Meigs, Caltrans Associate Biologist
2800 Gateway Oaks Drive
Sacramento, CA 95833
On July 28, 2010

Legend

- Parcel Boundaries
- Mixed Marsh
- Other Waters
- Riparian Scrub
- Riparian Woodland
- Swale
- Upland
- Wet Meadow

0 75 150 300 450 600 750 Feet

1:3,600
1 inch = 300 feet

N
W E
S

Datum/Projection:
NAD 1983 California State Plane Zone 2

to seasonal ponding of the adjacent wetlands or occasional flooding of the parcel. A small artificial stock pond currently exists on the upland overburden area. It is unknown if this pond is filled naturally (precipitation and/or groundwater) or artificially (water pumps), but its position on the elevated overburden area suggests that the pond is filled artificially. The earthen dam of the pond is subject to some leakage, discharging into the adjacent wet meadow system.

No named streams or mapped un-named streams appear to enter or influence the hydrology of this parcel; the hydrology of the Niesen parcel appears dominated by the presence of a seasonal high water table. Small micro-topographic depressions are subject to shallow ponding.

Wetland data for the Niesen parcel were collected in June 2009 and field verified by the Corps in April 2010. Data collected in June 2009 indicate that surface water and groundwater within 12”-18” of the soil surface were not available, except in the northeastern corner of the parcel, where subsurface water was observed at 10” below the soil surface. Wetland datasheets were not filled out during the Corps field verification in April 2010 and the descriptions above of “spring time” hydrologic conditions are based on personal observations (Meigs pers. comm.) across the three site visits to this parcel conducted between April 2009 and July 2010.

Based on field observations, it appears that wet meadow wetlands on the Niesen parcel display soil saturation within 12” of the surface, or above surface inundation, depending upon site topography, between approximately November (based on precipitation patterns) and March (based on wetland datasheets and personal observations [Meigs pers. comm.]) in most years.

The following information on post-construction hydrology at the Niesen parcel is being provided in response to questions from the Corps and USEPA during the July 26, 2010 field visit to the proposed wetland establishment sites. The current hydrology on the Niesen parcel will be altered as part of project construction and wetland establishment actions. The land surface at the proposed wetland establishment site will be lowered to match the elevation of the existing adjacent wet meadow. The land surface will slope gently to the north from the southern parcel boundary. A culvert will enter the southwest corner of the established wetland and flow north to south across the wetland. In addition, another culvert will enter the parcel midway along its western boundary and flow across the established wetland from west to east and eventually drain into the existing wetland on the east side of the bypass through a culvert under the bypass embankment.

6.5 Watson (East and West) Offsite Mitigation Parcels

The Watson parcels are situated at the toe of the hills forming the northern rim of Little Lake Valley. The eastern edges of the Watson East parcel has areas of alluvium originating from the hills above and slopes gently to the west. The Watson West parcel lays at the bottom of the Valley, in the area where “Little Lake” historically formed. Early soil survey information (Dean 1920) indicates that a lake historically formed at the northern end of Little Lake Valley during the rainy season, even during very low rainfall years. At the end of a series of heavy rainfall events in February 1915, the lake extended over 1,875 acres and was 12 feet deep over a 300-acre area. At that time, the high water mark of the lake was at the 1,330-foot contour, which includes the western half of the Watson East parcel and the entirety of the Watson West parcel.

According to the USGS 7.5-minute quadrangle, the modern soil survey (Howard and Bowman 1991), and an historical soil survey (Dean 1920), Berry Creek enters the southern boundary of the Watson East parcel (Figure 4). The USGS quadrangle shows Berry Creek continuing northward through the parcel as a channelized ditch. Aerial photographs show a line of riparian trees following the path of the ditch indicated by the USGS quadrangle, demonstrating that flows from Berry Creek were historically discharged into this channel. Flows from this stream currently enter the southeastern corner of the Watson East parcel and quickly dissipate into an alluvial fan. Review of the aerial photography indicates that some of the flows from Berry Creek are diverted westward into an artificial east-west drainage ditch just south of the southern boundary of the Watson East and Watson West parcels.

Surface and groundwater are generally travelling from east to west across the parcels. A series of three ephemeral streams originating from the hills to the east enter the Watson East parcel through culverts crossing Reynolds Highway. These streams are incised as they travel eastward across the alluvial terrace but quickly lose stream characteristics and become wet meadow wetlands as they dump their sediment loads where the grade begins to flatten out. These three streams were observed with water in the channel during April 1, 2009 and February 3, 2010 site visits. Generally, the Watson parcels exhibit a groundwater and surface water gradient from drier to wetter from east to west as the topography gradually flattens out from east to west.

Wetland types range from marginal wet meadow (on the alluvial terrace, groundwater within 12" of the soil surface, but no surface water, and supporting hydric vegetation during the spring season) to wet meadow (near border of Watson East and Watson West parcels, surface water ½ -4 inches deep during winter and potentially deeper pools or swales), to mixed marsh (Watson East parcel, surface water greater than 4 inches during spring).

Areas on the Watson East parcel experiencing inundation during the spring season are indicated on Figure 4. The large inundation zone observed along the southwestern and northwestern portion of the parcel is likely the result of flooding from the major creeks in Little Lake Valley (e.g., Outlet and Davis Creeks).

Wetland data for the Watson parcels was collected in August 2009, and were field verified by the Corps in April 2010. Data collected in August 2009 indicate that surface water and groundwater within 12"-18" of the soil surface were not available, even in the wettest sections (mixed marsh habitat on the Watson West parcel). Some wetland data was collected on the northern-most section of the Watson East parcel during delineation of the adjacent Taylor parcel on April 1, 2009. Wetland datasheets were not filled out during the Corps field verification in February 2010 and the descriptions above of "spring time" hydrologic conditions are based on personal observations [Meigs pers. comm.] across the five site visits to this parcel conducted between April 2009 and July 2010.

Based on the field observations, it appears that wet meadow, swale, and riparian wetlands on the Watson parcels display soil saturation within 12" of the surface, or above surface inundation, depending upon site topography, between approximately November (based on precipitation patterns) and March (based on wetland datasheets and personal observations [Meigs pers. comm.]) in most years. Surface water may persist in the Watson West parcel until April or May, and soils in this area may remain saturated until late May or early June in most years.

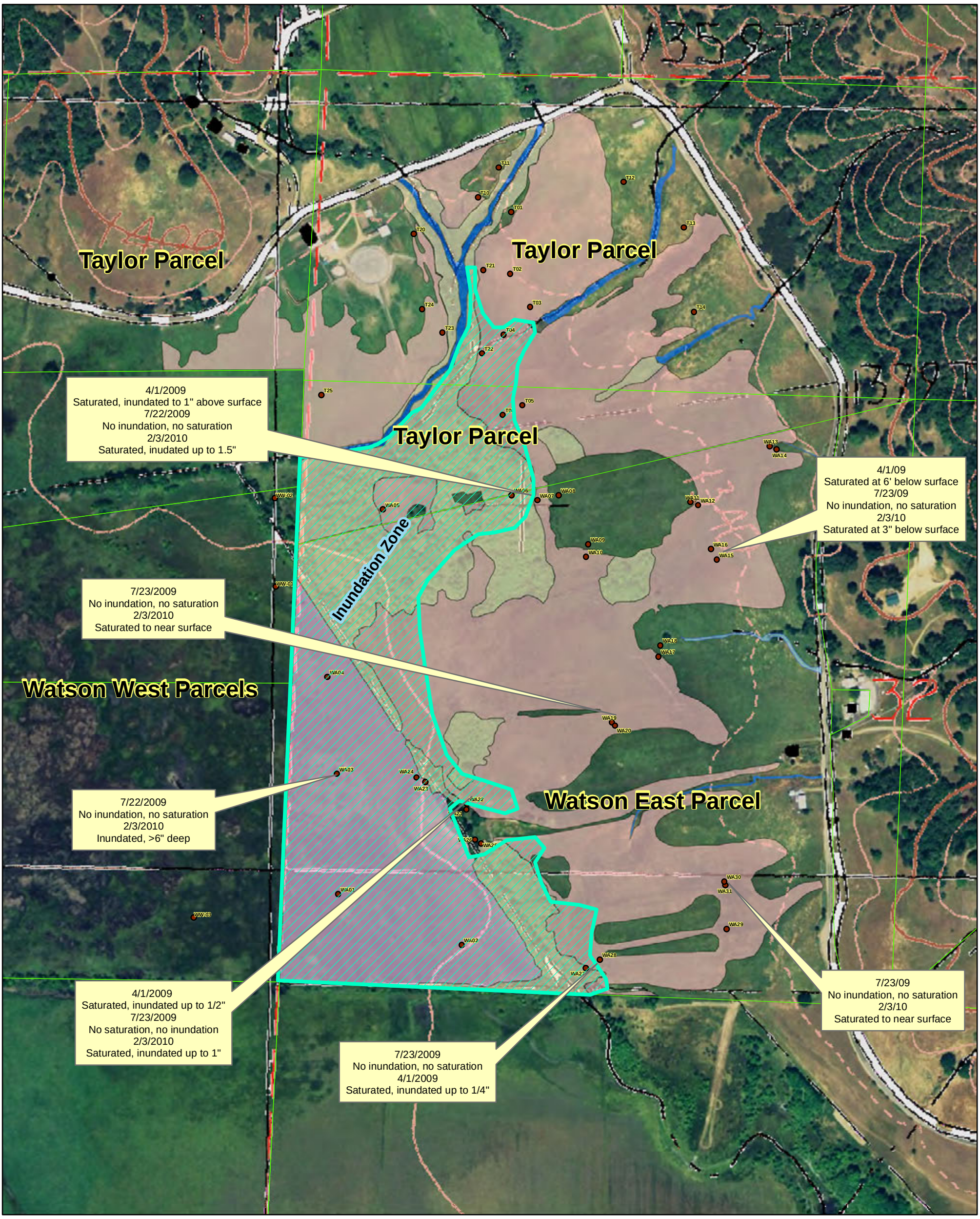


Figure 4
Watson
Caltrans Willits Bypass Project
State Route 101
EA: 01-26200

In: Tributaries to the Eel River
At: Little Lake Valley and the City of Willits
County of Mendocino, State of California

Layout View Delineation Map Prepared By:
Jason Meigs, Caltrans Associate Biologist
2800 Gateway Oaks Drive
Sacramento, CA 95833
On July 28, 2010

Legend

- Parcel Boundaries
- Mixed Marsh
- Other Waters
- Riparian Scrub
- Riparian Woodland
- Swale
- Upland
- Wet Meadow

0 100 200 400 600 800 1,000 Feet

1:4,800

1 inch = 400 feet

N W E S

Datum/Projection:
NAD 1983 California State Plane Zone 2

7 Contributing Drainage Areas

Five sub-watersheds drain into the offsite mitigation parcels in Little Lake Valley where wetland establishment is proposed. These sub-watersheds, and the offsite mitigation parcels that occur in the sub-watersheds, are shown in Figure 5. The largest sub-watershed is Davis Creek, at 9,875 acres, and it includes the Goss/MGC Plasma Middle/MGC Plasma North parcels. Berry Creek sub-watershed is next in size, at 5,780 acres, and it includes the Watson – East parcel. Outlet Creek sub-watershed is 2,625 acres and it includes most of the Ford parcel. Wild Oat Canyon Creek sub-watershed is 590 acres and it includes a small section of the Ford parcel. Upp Creek sub-watershed is 1,135 acres and it includes the Niesen parcel.

8 Water Budget

To further evaluate the potential success of established wetlands, this technical memorandum presents a water budget for the proposed wetland establishment sites at the offsite mitigation parcels.

Existing wetlands in Little Lake Valley do not have a simple pattern of filling and draining. Preliminary data from the July 2010 soil suitability assessment of the proposed wetland establishment sites (see Section 8.1.1.4) and other sources of soils data indicate that existing wetlands in Little Lake Valley primarily result from a seasonally high water table. As a result of precipitation, the underlying aquifer rises in response to surface and subsurface inflow from the encircling mountains as well as from local infiltration on the Valley floor.

Wetland hydrology may also be influenced by the lateral movement of water, either subsurface flow, sheet flow, or overbank flow. In general the water in the aquifer slowly flows downhill towards the Valley floor and then north in the direction of the Valley's main waterways. With winter rains, however, lateral movement may increase near and above the soil surface as soil becomes saturated and moves downhill and drains to surface waterways. In the lowest portion of the northern part of the Valley, some wetlands may receive significant inflow from flooding by the major creeks.

This water budget assessment reviews data collected in Little Lake Valley that is pertinent to the evaluation of wetland hydrology at the wetland establishment sites. Available data were used to estimate wetland water elevations for a range of precipitation levels. This was necessary as field measurements of the hydroperiod of existing wetlands are not available. The water budget is based on the hypothesis that the established wetlands are expected to behave in a manner similar to the adjacent existing wetlands because soil types and depths to the aquifer are similar.

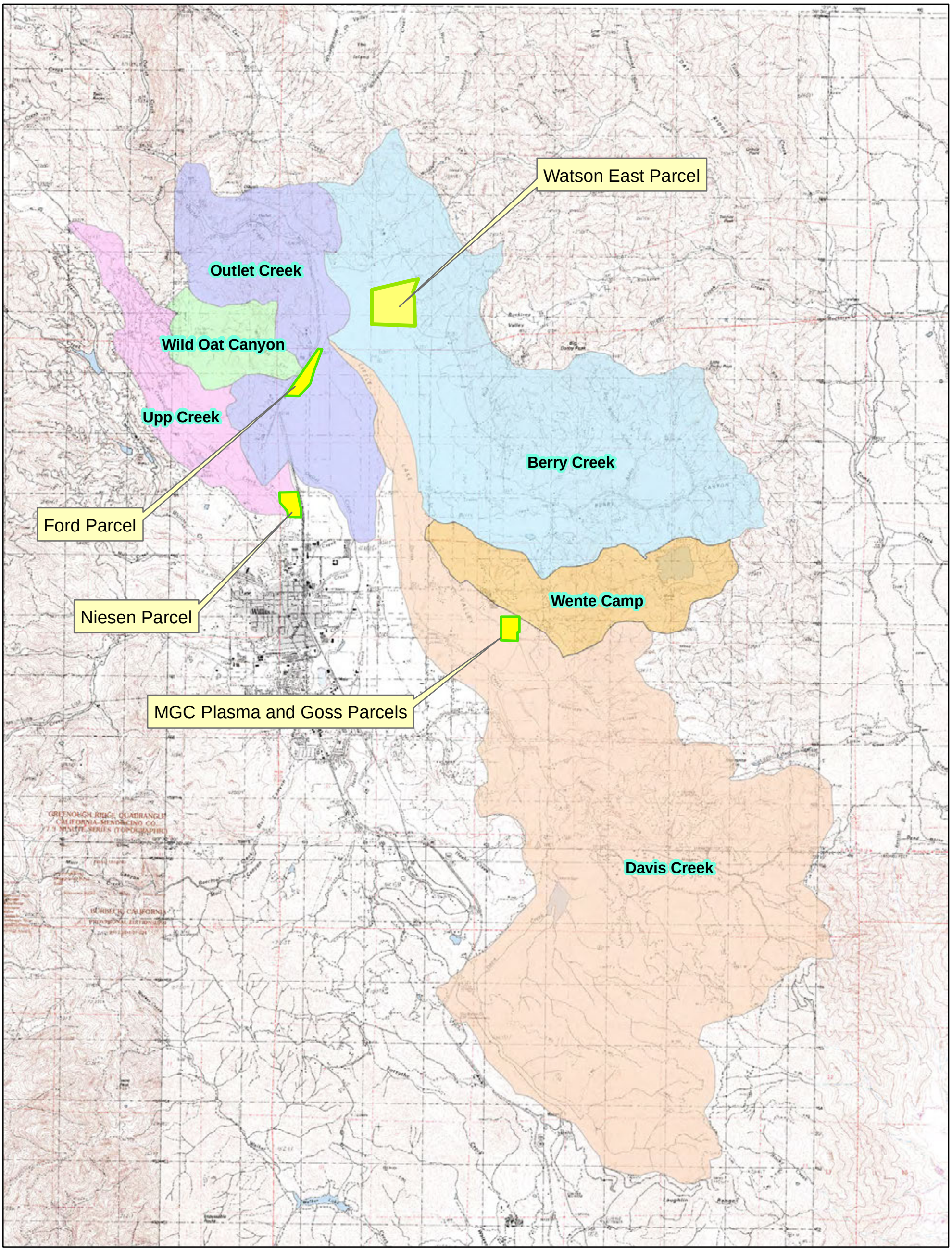


Figure 5
Sub-Watersheds Associated With Wetland Establishment Parcels

In: Tributaries to the Eel River
At: Little Lake Valley and City of Willits
County of Mendocino, Sate of California

Layout View Map Prepared By:
Jason Meigs, Caltrans Associate Biologist
2800 Gateway Oaks Drive, Sacramento, CA 95833
On July 28, 2010

Legend

- Berry Creek
- Davis Creek
- Outlet Creek
- Upp Creek
- Wente Camp
- Wild Oat Canyon

0 1,250 2,500 5,000 7,500 10,000 Feet

1:60,000

1 inch = 5,000 feet

N W E S

Datum/Projection:
NAD 1983 California State Plane Zone 2

8.1.1 Soil Types

8.1.1.1 Natural Resources Conservation Service (NRCS) Soil Surveys

As shown in the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for Mendocino and Trinity Counties (Howard and Bowman 1991), the soils in Little Lake Valley are generally not strongly developed, such that the surface, subsurface, and subsoil layer textures do not differ markedly within a given profile. The soils formed under well to poorly drained conditions, but in some areas the internal drainage has been increased as a result of stream incision and drainage ditch construction to more quickly remove water from the parcels as a way of improving pasture land. Table 4 provides a summary of USDA NRCS soil survey results for Little Lake Valley at the offsite mitigation parcels where wetland establishment is proposed (Ford, Goss/MGC Plasma North/MGC Plasma Middle, Niesen, and Watson).

Table 4. Characteristics of Soils in Little Lake Valley as Mapped by USDA NRCS Soil Survey[a]

Soil Map Symbol	Soil Map Unit Name	Landform	Natural/ Existing Drainage Class	Generalized Typical Profile (Surface, Subsurface, and Subsoil)	Parcel Occurrence
112	Clear Lake clay, 0 to 2% slopes	basins	poor/partially drained	clay over clay loam	Goss, MGC Plasma North, MGC Plasma Middle
115	Cole clay loam, 0 to 2% slopes	alluvial plains and basins	somewhat poor/ somewhat poor	clay loam over clay loam	MGC Plasma North, MGC Plasma Middle, Niesen, Watson
123	Feliz loam, 0 to 2% slopes	alluvial plains and fans	well/well	loam over clay loam	Watson
126	Feliz clay loam, gravelly substratum, 2 to 8 percent slopes	alluvial plains and fans	well/well	clay loam over gravelly sandy clay loam	Watson
127	Fluvaquents, 0 to 1% slopes	floodplains	poor and very poor/poor and very poor	very fine sandy loam over silt loam[b]	Ford, Watson
128	Gielow sandy loam, 0 to 5% slopes	alluvial plains and fans	somewhat poor/somewhat poor	sandy loam and loam over sandy loam and fine sandy loam	Goss, MGC Plasma North, Niesen, Ford

Table 4. Continued

Soil Map Symbol	Soil Map Unit Name	Landform	Natural/ Existing Drainage Class	Generalized Typical Profile (Surface, Subsurface, and Subsoil)	Parcel Occurrence
133	Haplaquepts, 0 to 1% slopes	basins and floodplains	poor/poor	clay loam over silty clay loam over silty clay[b]	Ford, Watson
178	Pinole gravelly loam, 2 to 8% slopes	terraces	well/well	gravelly loam over clay loam over sandy clay loam	Ford, Watson

Notes:

a. The characteristics described above for each soil map unit do not cover map unit inclusions where drainage class and profile characteristics may be different from the primary soil component of the map unit.

b. Because of their variability, fluvaquents and haplaquepts have no typical profile. The profile described is one that commonly occurs in the USDA soil survey area.

Source: Howard and Bowman 1991.

8.1.1.2 Soil Texture at Wetland Delineation Sites

As part of wetland delineations, soil texture data is collected from soil sample pits. The texture data indicates the permeability of the soil. Table 5 provides a summary of the soil texture data that were collected as part of the wetland delineations for the proposed wetland establishment parcels. Clay loam and loam (or variants thereof) were the most abundant soil types detected. As discussed below, these soils are probably too permeable to create wetland conditions without a high water table or other external source of water. A limited number of sites had soils with clay or silty clay texture, which are better able to retain water (3 out of 35 at Watson, 2 out of 9 at MGC Plasma Middle, and 1 out of 12 at MGC Plasma North).

Table 5. Soil Texture Data Collected during Wetland Delineations at the Proposed Wetland Establishment Sites (soil textures with slow or very slow permeability are highlighted)

Texture of Least Permeable Soil Type in Pit	Number of Sites with Similar Texture		
	Upland	Wetland	Total
Watson			
clay		3	3
clay loam	2	9	11
gravelly clay loam	1		1
gravelly loam	7	6	13
gravelly sandy loam	1		1
loam	2	2	4
sandy loam	1		1
very gravelly loamy sand	1		1
Total	15	20	35

Table 5. Continued

Texture of Least Permeable Soil Type in Pit	Number of Sites with Similar Texture		
	Upland	Wetland	Total
Plasma Middle			
clay		1	1
clay loam	1	2	3
sandy clay		1	1
sandy clay loam	2		2
sandy loam		1	1
silty clay	1		1
Total	4	5	9
Plasma North			
clay		1	1
clay loam	1	5	6
loam	1		1
sandy clay	1		1
sandy clay loam	2		2
sandy loam	1		1
Total	6	6	12
Goss			
clay loam	1	6	7
loam		1	1
Total	1	7	8
Ford			
loam	3	5	8
sandy loam	1		1
Total	4	5	9
Niesen			
clay loam		4	4

8.1.1.3 Spring 2010 Soil Surveys at North Coast Semaphore Grass Study Sites

During the spring of 2010, soils were assessed in the vicinity of North Coast semaphore grass (*Pleuropogon hooverianus*; PLHO) populations as part of an ongoing Caltrans study of the special-status plant in Little Lake Valley.

Surface layer soil textures within PLHO populations were observed to be loamy to fine-loamy, generally ranging from loam to silty clay loam. Surface and subsurface layer soil textures in soils located outside of PLHO populations were observed to be similar to that of PLHO populations, generally ranging from loam to silty clay loam. Relatively few areas had surface layer soils that were

outside of this textural range. These included gravelly clay loam, sandy loam, silt loam, and silty clay. Subsurface soil layer textures were also generally loamy to fine-loamy.

Table 6 summarizes the soil surface textures that were found. The soil texture for the majority of soil samples were clay loam or loam, which are generally assumed to have moderately slow to moderate permeability. Of the parcels evaluated, two (Goss and MGC Plasma North) are also proposed wetland establishment sites. On these parcels, clay loam texture was present at 11 soil sites out of 29 and only two soil samples had potential to be less permeable, one with silty clay and the other with clay. A more complete description of this survey was provided in a May 28, 2010 technical memorandum (Caltrans 2010). As described below, the soils detected at these sites are fairly permeable for wetland, suggesting that the wetlands are sustained by exogenous sources of water (a high water table being most likely) and not local precipitation.

Table 6. Summary of Soil Surface Layer Texture in Soil Sample Pits in the Vicinity of North Coast Semaphore Grass in Little Lake Valley

Texture	Number of Sites with Similar Texture
City of Willits and Huffman Parcels	
Clay loam	11
Loam	3
Silt loam	1
Silty clay	1
Lusher Parcel	
Loam	4
Sandy loam	2
Evans and Frost Parcels	
Clay loam	3
Gravelly clay loam	1
Hebrard Parcel	
Clay loam	2
Loam	5
Arkelian Parcel	
Clay loam	6
Silty clay	1
Goss and MGC Plasma North Parcels	
Clay loam	11
Loam	8
Silty clay	3
Silty clay loam	6
Clay	1

8.1.1.4 July 2010 Soil Surveys at Wetland Establishment Sites

Soils at the proposed wetland establishment sites were evaluated in July 2010 to further address soil information requirements in the July 9, 2010 letter (Item 4b on page 3). For this evaluation, 24-inch pits were dug in the proposed wetland establishment sites on Goss/MGC Plasma Middle/MGC Plasma North and Watson and up to 6-foot pits were dug in the proposed wetland establishment sites on Ford and Niesen. Preliminary results from 19 pits for the Goss/MGC Plasma Middle/MGC Plasma North proposed wetland establishment site (6 in wetlands, 12 in uplands, and 1 in a wetland-upland transition) show evidence that the average seasonal high level of soil saturation is within the top foot of the soil surface at all test pits (as evidenced by the presence of redoximorphic soil features). Soil texture from the pits was mostly clay loam, loam, and silty clay loam regardless of whether the pit was located in an existing wetland or an upland area. Soil from a few pits were less permeable; one of the six wetland pits contained a layer of fine silty clay and five of the twelve upland pits contained layers of clay, silty clay, or very gravelly heavy clay. As described below, the majority of the soils detected at these sites are fairly permeable for wetlands, suggesting that the wetlands are sustained by external sources of water (a high water table being most likely) and not local precipitation.

Once the July 2010 soil surveys at the wetland establishment sites are complete, a full discussion of the survey results will be provided to the Corps and USEPA. This is expected by August 2, 2010.

8.1.1.5 Permeability

The majority of the soils found on the wetland establishment sites were clay loam or loam. Soils with this texture are considered to have permeability that is moderately slow. Only a few sites had soil with lower permeability. Table 7 shows the estimated conversion between soil texture and saturated hydraulic conductivity. Saturated hydraulic conductivity is an indication of how quickly water may percolate downward. The saturated hydraulic conductivity is approximately equal to the infiltration rate of water on the soil surface when the water is fully saturated (Bedient and Huber 1992). The Food and Agricultural Organization of the United Nations (FAO) reports (2010) that clay loam has a basic infiltration rate (infiltration rate when the soil is saturated) of 5-10 mm/hour or an average value of about 7 inches per day. This is not much different than the 9.6 inches per day shown in Table 7.

The soil permeability labels are for general characterization of all soil types and are not wetland specific. In order for soil to retain precipitation for a sufficiently long duration to sustain a wetland, it generally needs to have very slow permeability or an alternate water source. Because the wetlands in Little Lake Valley generally have “moderately slow” permeability, they are most likely sustained by a high water table. Overbank and subsurface flow may also contribute at some locations. A further consequence of soil type and permeability in Little Lake Valley is that most precipitation is likely to infiltrate the soil and, as a result, the size of the sub-watershed around a wetland is unlikely to be important to wetland success.

Table 7. Estimated Conversion between Soil Texture and Saturated Hydraulic Conductivity

Permeability	Example Soil Texture	Saturated Hydraulic Conductivity (inches/hour)	Estimated Average Conductivity (inches/day)
Very slow	Clay	0.06 – 0.2	2.2
Slow	Silty clay	0.06 – 0.2	3.1
Moderately slow	Clay loam	0.2 – 0.6	9.6
Moderate	Loam	0.6 – 2.0	31.2
Moderately rapid	Gravelly loam	2.0 – 6.0	96.0

8.1.2 Aquifer

Little Lake Valley is underlain by a layer of Holocene alluvium that is estimated to be a maximum of 250 feet deep. The alluvium is composed of silt, clay, gravel, and sand. A layer of continental basin deposits is located under the alluvium and Franciscan Complex bedrock is located under the continental basin deposits.

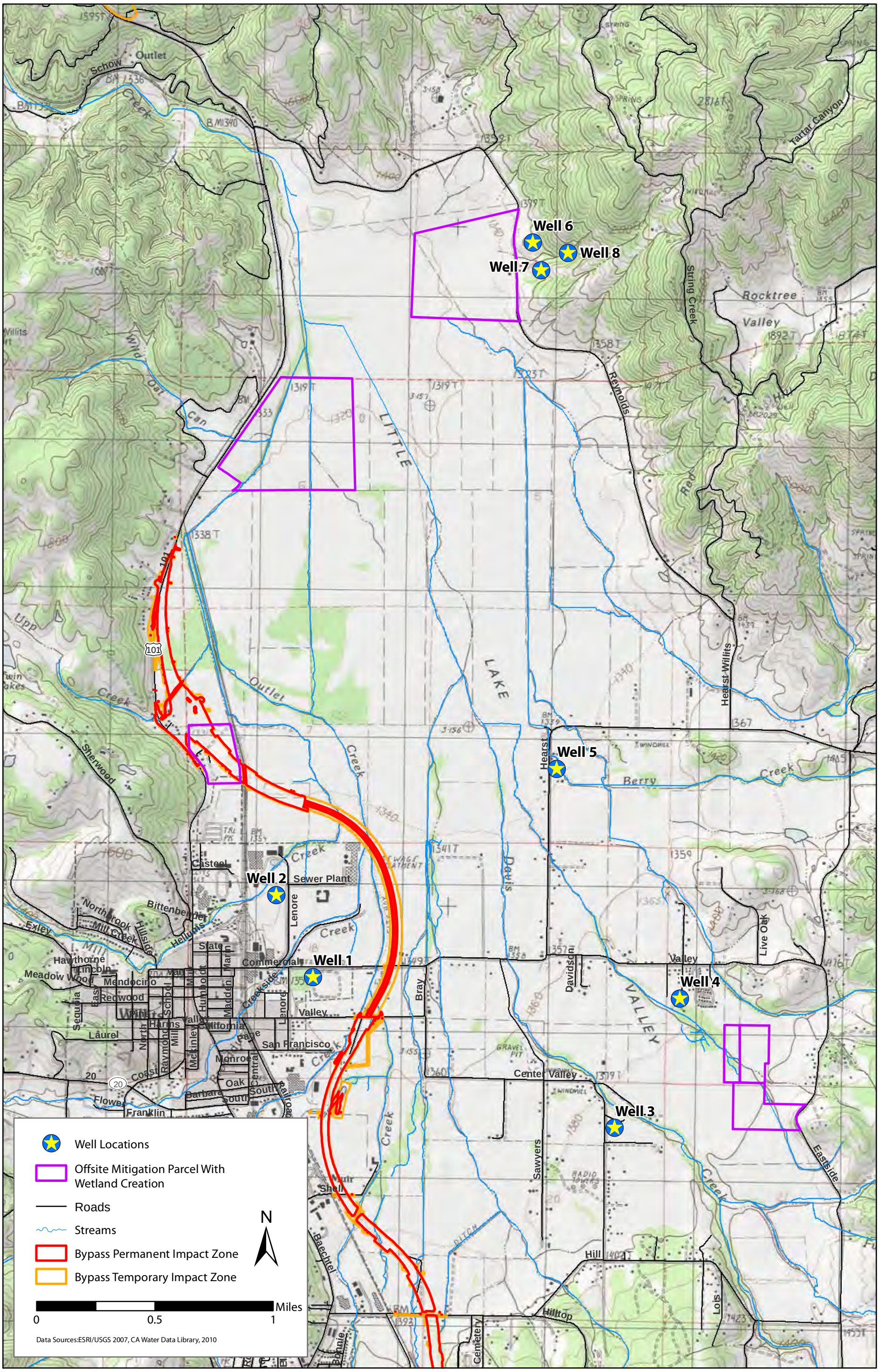
The alluvium layer is the most productive aquifer for groundwater wells because it generally has relatively high porosity and permeability (Farrar 1986). The presence of sheets of fine-grained sediments in the alluvium causes much of the aquifer to be confined or semiconfined (California Department of Water Resources 2004). While the City of Willits obtains its water from Morris Reservoir, groundwater wells are used for agriculture and residential use outside of Willits (Farrar 1986).

8.1.2.1 California Department of Water Resources Wells

The California Department of Water Resources (DWR) maintains records on groundwater elevations from seven wells in Little Lake Valley. The approximate locations of these wells are shown in Figure 6. The water elevations measured in these wells tend to peak at about 1340-1350 feet, although there were some exceptions (Figure 7). Measurements of depths to groundwater (Figure 8) indicate that groundwater is close to the ground surface. This shallow groundwater supports many depressional wetlands that occur throughout Little Lake Valley.

Groundwater levels measured in wells represent piezometric water surface levels. For an unconfined aquifer, the well elevations are roughly the same as the elevation of the top of the aquifer, but for confined aquifers, well elevations may be higher than the elevation at the top of the aquifer. Given the abundance of wetlands in Little Lake Valley, along with the moderately permeable soil, it seems likely that the top of the groundwater aquifer is close to the soil surface during the rainy season.

The presence of groundwater discharge at a large marsh at the north end of the Valley, located where water leaves the valley via Outlet Creek, further indicates that groundwater levels are close to the soil surface. During particularly wet winters, the marsh becomes a shallow lake as a result of both groundwater and surface water inflow. (Farrar 1986).



Path: Q:\Projects\Caltrans\00543_09_Willits_from_URS\mapdoc\OtherFigs\WDL_Well_Locations.mxd Author: DS Date: 7/26/2010

Figure 6
Location of DWR Groundwater Monitoring Wells in Little Lake Valley

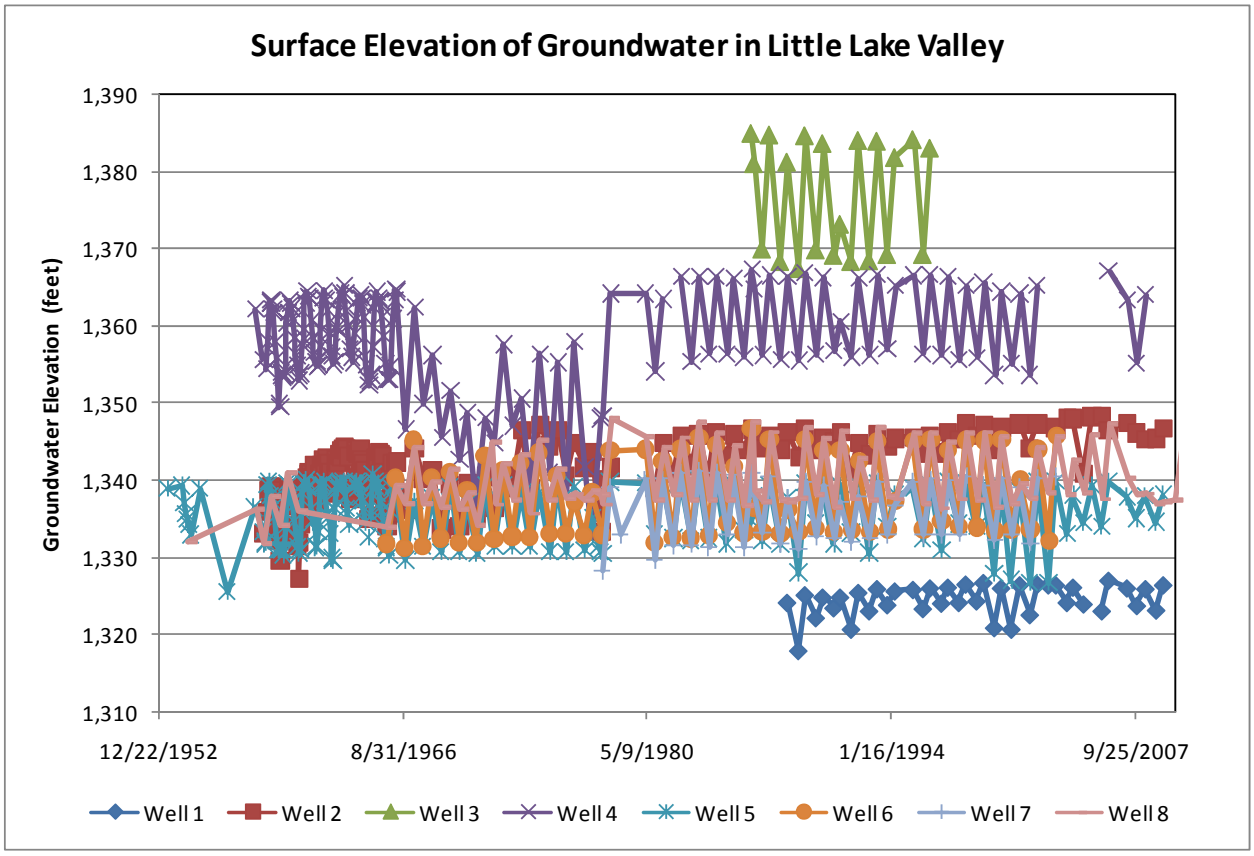
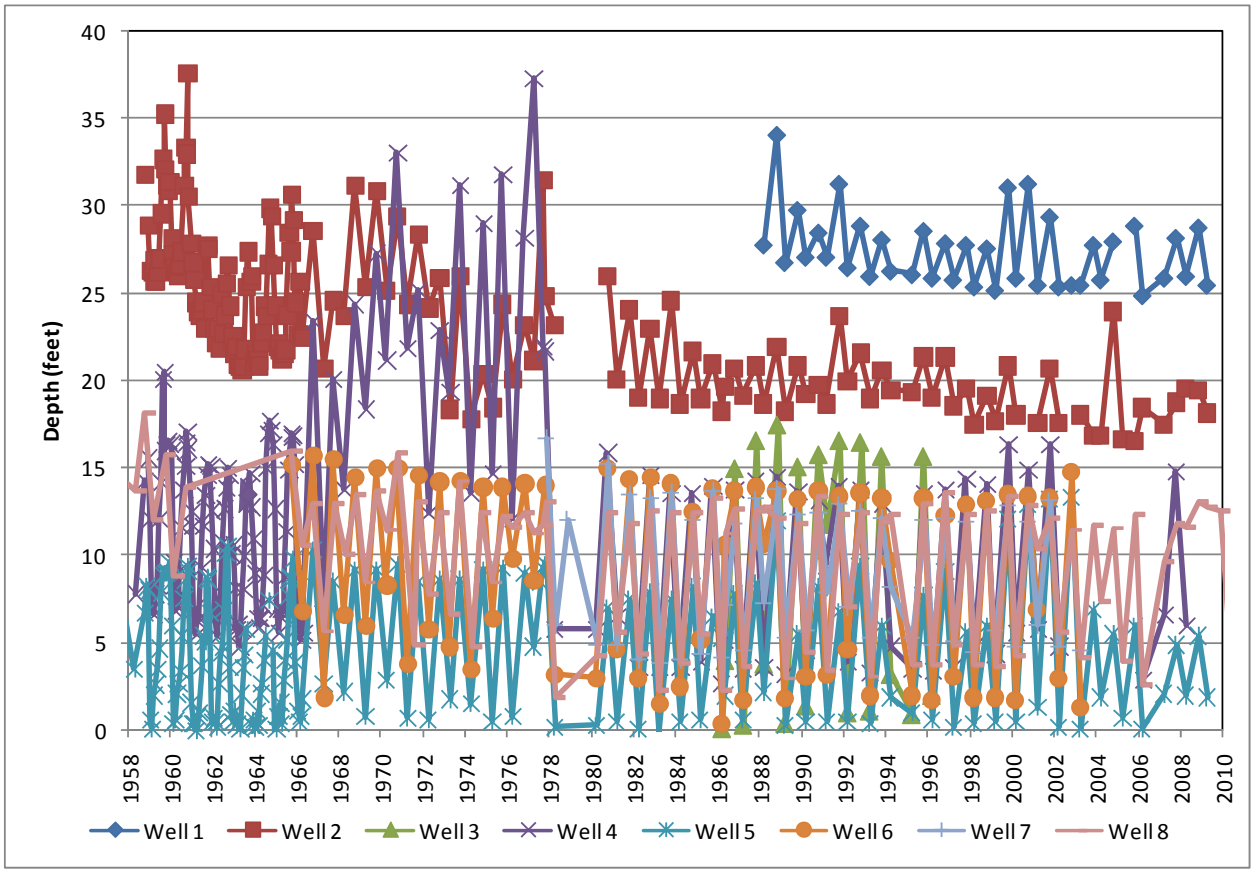


Figure 7. Groundwater Elevations Measured in Seven Department of Water Resources Wells Located in Little Lake Valley



Data source: California Department of Water Resources 2010

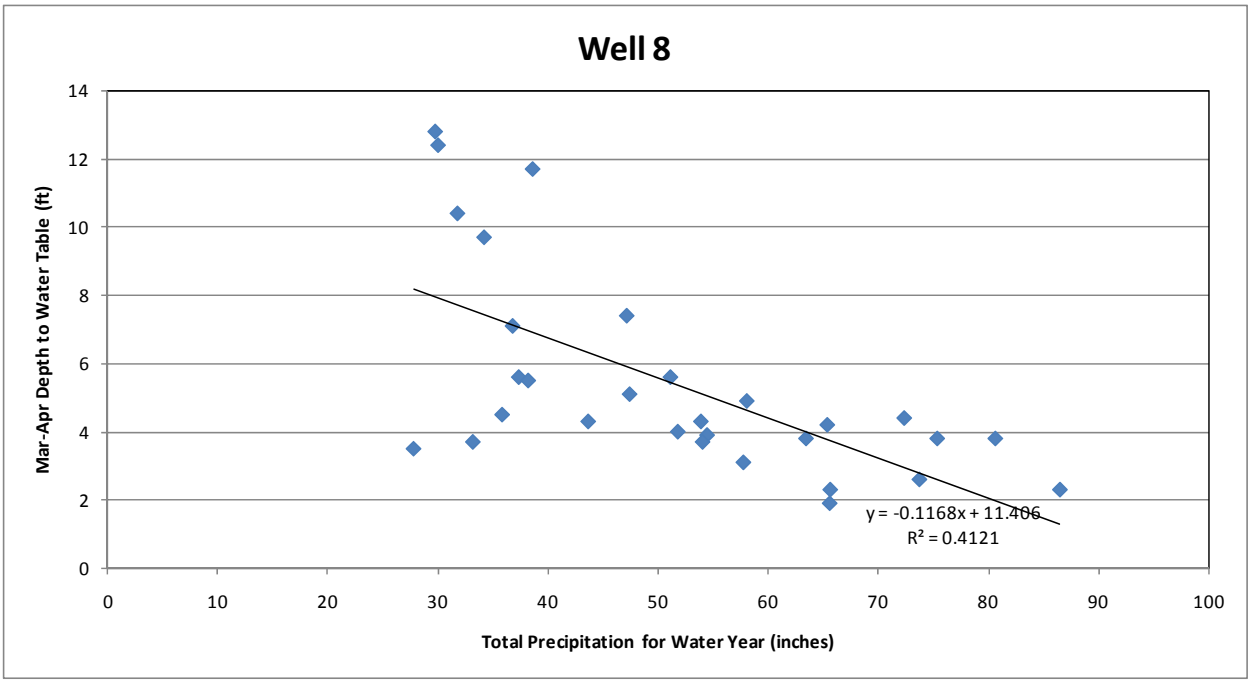
Figure 8. Depth to Groundwater Measured in Seven Department of Water Resources Wells Located in Little Lake Valley

The DWR well data indicate that groundwater elevations may fluctuate seasonally from 5 to 15 feet (Figures 7 and 8). Seasonal fluctuations in groundwater level result primarily from pumping and precipitation (Farrar 1986), although other factors such as groundwater movement to and from streams, evapotranspiration, and recharge from irrigation play a role. Wells 2, 3, 4, 6, and 8 are no longer in use; fluctuations in their water levels are not a result of pumping by these wells, although pumping at other wells could be affecting the levels in Wells 2, 3, 4, 6, and 8.

The DWR well data also indicate that groundwater levels in the Valley may decrease slightly during periods of drought. For example, well-level recovery was slightly reduced in some wells during some dry winters such as 1977. However, it appears that in general there has been little change in well levels from year to year.

Portions of the aquifer that are most likely to support wetlands are those areas where the aquifer is close to the soil surface. It appears that during most years, there is sufficient rainfall to bring the water table close to the soil surface at some locations such as well 5. Once the aquifer approaches the surface, lateral runoff to surface waters is more likely to occur. Figure 9 shows a comparison of spring well elevations versus precipitation for a well with elevations close to the surface and a well

with deeper water (Well 5 versus Well 8). It appears that total precipitation has more of an effect on spring aquifer elevations in well 8 than in well 5. For well 5, there is generally enough water to bring the aquifer close to the surface, which indicates that there is usually enough water to have a high water table at the lower elevations in Little Lake Valley. For both wells, there are other sources of year-to-year variability such as rain pattern and the particular timing of the measurements.



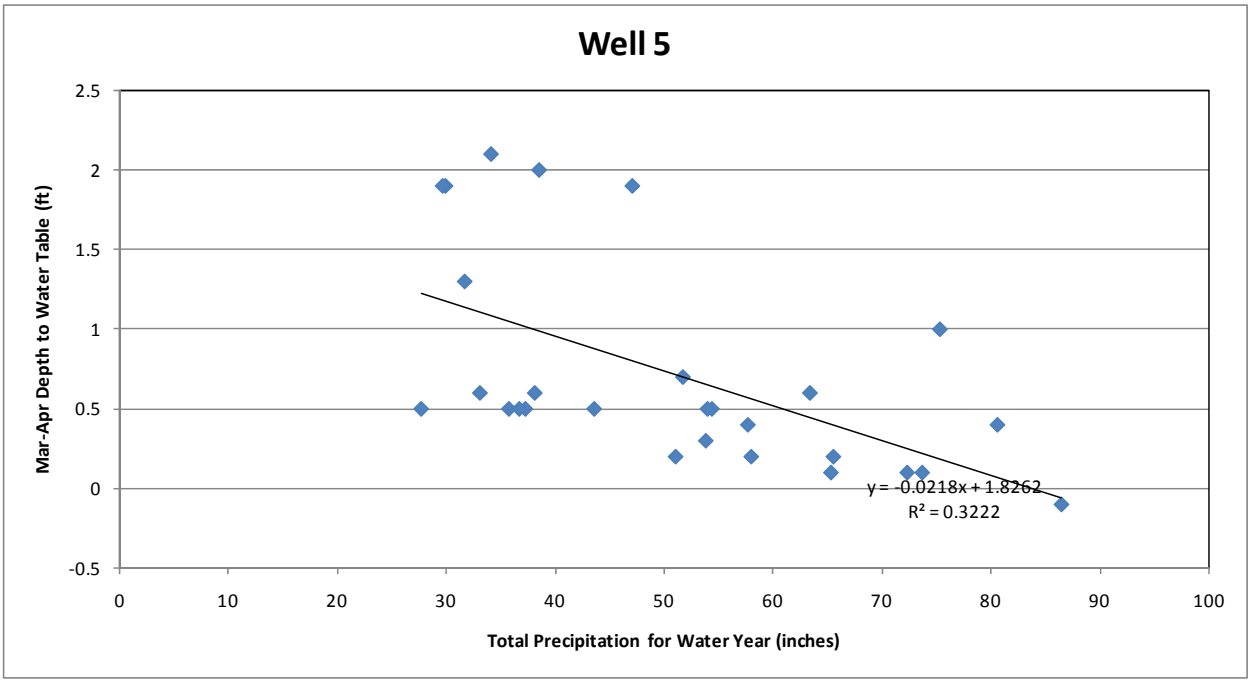


Figure 9. Comparison of Total Precipitation to Spring Well Elevations in a Well with Water Levels Close to the Soil Surface (within 2 feet, Well 5) and in a Well where the Elevations are Further from the Soil Surface (Well 8)

8.1.2.2 Aquifer Drawdown Rates

If a wetland is dependent on an aquifer, the ability of the wetland to be sustained in the spring will depend on how long the aquifer remains at high elevations and then how rapidly the water table declines.

Most of the DWR well measurements were collected twice a year, once in the spring when the aquifer is high and once in the fall, when the aquifer is low. During the early 1960s, however, data were collected approximately monthly in wells 4 and 5. These data show that the aquifer tends to remain high starting sometime between the beginning of December and mid February and then declines rapidly between March and mid May depending on rainfall patterns.

The DWR well data for the spring and fall were used to estimate aquifer drawdown rates for wells 4 through 8 for all data starting in 1978 (data from wells 1 and 2 were not used because the depth to the aquifer was too great to be representative of a portion of the aquifer that might be supporting wetlands and the data from well 3 was not used because the period of record was too short). The average drawdown rates for each well varied between about 0.4 and 0.6 inches per day, with an overall average of 0.5 inches per day.

8.1.3 Hydrologic Monitoring of North Coast Semaphore Grass Populations

As part of the evaluation of North Coast semaphore grass habitat in Little Lake Valley, 30-inch deep groundwater monitoring wells were installed in the vicinity of PLHO habitat in both wetlands (8 wet meadow sites and 5 riparian woodland sites) and uplands (7 sites). These wells are located on the Arkelian Parcel (2 sites), Frost Parcel (2 sites), Goss Parcel (6 sites), Huffman Parcel (6 sites), Lusher Parcel (2 sites), and MGC Plasma North Parcel (2 sites). Of these, only the Goss and MGC Plasma North parcels are proposed for wetland establishment. However, the data from the other parcels may be indicative of the variation in hydrology that might be expected at other establishment sites that do not have groundwater monitoring wells. Water levels were monitored intermittently in the wells between April 24, 2010 and June 27, 2010.

Data from these wells indicate that most wells behaved in a similar manner in response to rainfall and drain rates (Figure 10). Water elevations generally:

- increased between April 24, 2010 and April 29, 2010 (precipitation = 2.24 inches);
- decreased between April 29, 2010 and May 19, 2010 (precipitation = 1.15 inches);
- increased again between May 19, 2010 and June 7, 2010 (precipitation = 2.41 inches); and
- decreased after June 7, 2010.

There were exceptions to this pattern. Most notably, water levels in a few wells (e.g., Arkelian 3, Huffman 2, and Goss 9) continued to decline instead of increase between May 19 and June 7. A speculative explanation for this difference is that the groundwater aquifer at these sites may have declined such that drainage rates were increased and rainfall no longer could fill the wells in those

sites. Surface water was only present briefly (as indicated by water depths greater than 30 inches) and only at a few sites.

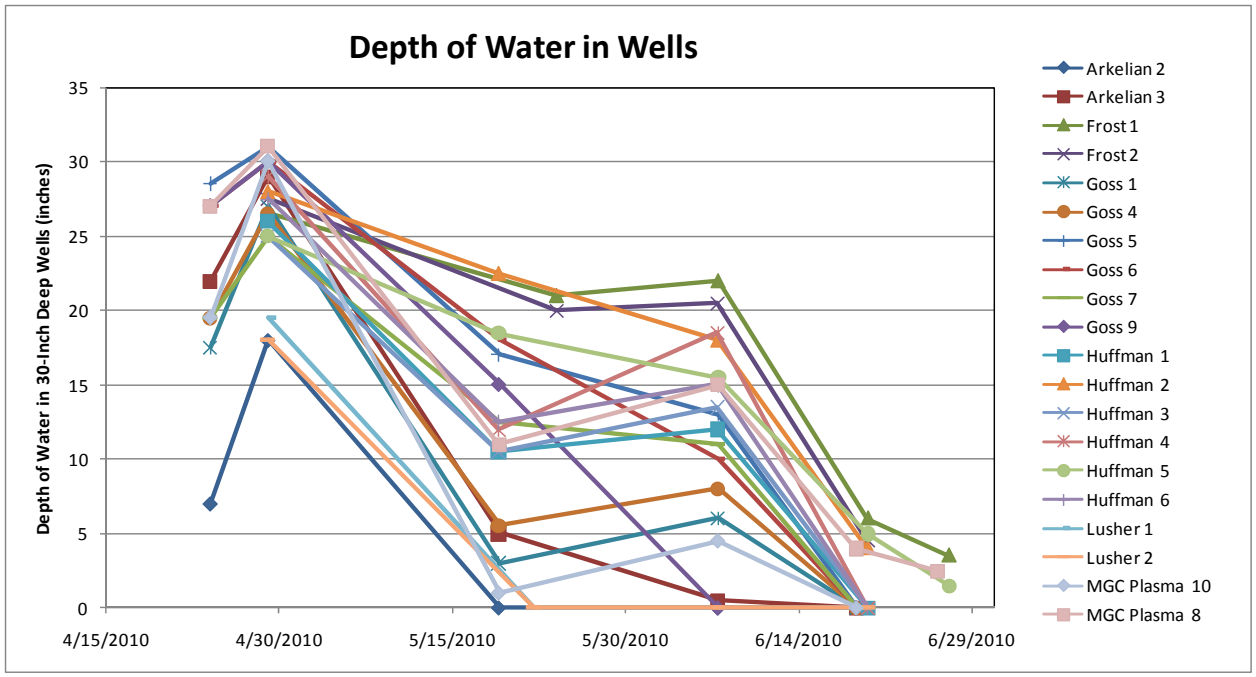


Figure 10. Depth of Water in Hydrologic Monitoring Wells near North Coast Semaphore Grass Populations

Precipitation data (from the WRCC for the Willits 1 NE site) was used along with the well data to algebraically estimate the effect of rainfall on water depths in the wells (the rainfall multiplier) and the drainage rates. These values can be estimated for each set of 3 surveys with most water depths greater than zero (April 24-April 29-May 19 and April 29-May 19-June7). The results of these calculations are shown in Table 8.

Table 8. Drainage Rates and Effect of Rainfall on Depth of Water in Wells (Rainfall Multiplier) Calculated from Precipitation and Depth of Water in Wetland Monitoring Wells

	Drain Rate (inches/day)	Rainfall Multiplier	Drain Rate (inches/day)	Rainfall Multiplier
Site	**Results Derived from Surveys 1 -3**		**Results Derived from Surveys 2 - 4**	
Arkelian 3	1.58	6.66	2.00	13.89
Frost 1			0.41	3.18
Frost 2			0.51	3.67
Goss 1	1.66	7.94	2.33	19.58
Goss 4	1.41	6.27	2.03	17.04
Goss 5	0.88	3.07	1.11	7.06
Goss 6	0.78	3.07	0.75	2.58
Goss 7	0.88	4.42	1.08	7.87
Goss 9	0.95	3.46		
Huffman 1			1.48	12.31
Huffman 2			0.31	0.55
Huffman 3			1.46	12.73
Huffman 4			1.84	17.19
Huffman 5			0.46	2.41
Huffman 6			1.48	12.71
MGC Plasma 10	1.97	9.09	2.81	23.57
MGC Plasma 8	1.27	4.61	2.00	17.46
Average	1.26	5.40	1.38	10.86
Average for Uplands	1.43	6.75	1.52	12.75

Notes:

Wells with insufficient data or that were dry on June 7, 2010 were not used in the analysis.

Upland sites used in the calculations were Goss 7, Huffman 3-6, and MGC Plasma 10.

An inch of rainfall may result in an increase of multiple inches of soil moisture. This can be seen clearly in the differences between the first and second survey. For example, the well elevations at site Arkelian 2 increased about 11 inches between April 24 and 29 even though it only rained about 2.2 inches. The primary explanation for this effect is that only a fraction of the soil volume is empty space available to be filled with water. The ratio between increase in groundwater level and precipitation could also be increased by local effects of water moving laterally into a wetland area. For the water budget discussed below, this multiplier is assumed to directly result from the limited amount of space available for water to fill the soil. A direct consequence of this value is that for an inch of surface water to infiltrate the soil, the water in the soil must be moving downward at a much faster rate that is estimated as the infiltration rate times the observed ratio.

The drain rates were relatively low, with an overall average of 1.3 to 1.4 inches per day, considerably lower than the estimated average basic infiltration rate or saturated hydraulic conductivity of 7-9.6 inches per day for clay loam soil. For 7 to 9.6 inches of surface water to move through the soil in a day, the water must move through the soil much faster because of limited soil space available for the water. There was little difference between the overall average values and the average values for the upland sites.

8.1.4 Water Budget Methods

In order to evaluate the potential for wetland establishment success, a water budget analysis was performed using a range of precipitation and hydrologic assumptions, including variable aquifer conditions and soil percolation and lateral movement drainage rates.

Water elevations were estimated with and without a high water table. If the water table is low, water in the wetlands must be perched on a semi-permeable soil layer and the water budget is dependent mostly on precipitation and soil permeability. If the water table is high, local precipitation may be retained by either the semi-permeable soil layer or by the presence of the aquifer. If water is retained by the presence of the aquifer, it becomes the upper portion of the aquifer. For the case of a high water table, three types of water levels were evaluated: the base aquifer elevation, the elevation of water perched on a semi-permeable soil layer, and the elevation of rainfall that may have percolated through the soil and become perched on top of the aquifer.

8.1.4.1 Precipitation

Daily precipitation data from 1960 to 2010 was obtained from the WRCC for the Willits 1 NE station located just north of the City of Willits. Missing values were filled in with data from nearby stations, mostly with data from the CDEC station WIL, located approximately 5 miles south of the City of Willits. Average annual precipitation for this dataset is 51.2 inches. Data from water years 1987 and 2006 were chosen to represent relatively dry (10th percentile, with 33.1 inches of precipitation) and wet (90th percentile, with 73.7 inches of precipitation) conditions. Data from water year 2010 (47.4 inches of precipitation) were also used in order to compare estimated water elevations with those that were measured in the PLHO wetland monitoring wells.

8.1.4.2 Evapotranspiration

Evapotranspiration was not explicitly included in the analysis. The effect of evapotranspiration is minimal compared to the permeability of the soils that are most abundant in the Valley (i.e., evapotranspiration would have little effect on the amount of water perched on the wetland soils). Furthermore, the drain rates used for the water perched on the aquifer were measured empirically (with the PLHO wetland monitoring wells) and therefore include any effects of evapotranspiration. Evaporation can have some affect on the aquifer as a whole if the top of the aquifer is located near the soil surface. However, aquifer elevations used in this water budget assessment are based on the measured DWR well data, which already include evaporation effects.

8.1.4.3 Elevation of Precipitation Perched on Wetland Soils

Elevation of local precipitation perched on the semi-permeable wetland soils is dependent on precipitation, the permeability of the soil (the basic infiltration rate), and the depth to the most restrictive soil layer. In addition, because much of the soil volume is occupied by the soil material itself as well as moisture, an inch of rain results in much more than an inch of saturated soil in the absence of infiltration. This ratio of inches of saturated soil to inches of precipitation is labeled here as the rainfall multiplier and is expected to be similar to 1 divided by the specific yield of the soil. However, it may also be affected other things. For example, lateral movement of water could increase or decrease this value. The elevation of local precipitation perched on wetland soils is estimated with the following equation in MicroSoft Excel:

$$EPS_t = \min(\ Emax,\ if\ (or(EPS_{t-1}>EL,\ Precip=0),\ EPS_{t-1},\ EL) + RainMult * Precip - Infilt*RainMult)$$

Where:

EPS_t	=	Top elevation of water perched on wetland soils for current day
EPS_{t-1}	=	Top elevation of water perched on wetland soils for previous day
Emax	=	maximum elevation of water allowed before water would flow off site (assumed to be 10 inches)
EL	=	Elevation of least permeable soil
Precip	=	precipitation in inches for current day
RainMult	=	Conversion between inches of precipitation and inches of saturated soil
Infilt	=	Estimated infiltration rate for water on the soil surface (inches/day)

Note: Elevation of water above the soil surface is converted to actual elevations by dividing by RainMult.

8.1.4.4 Elevation of Aquifer

In the water balance assessment, the aquifer was assumed to either be deep enough that it would not affect wetlands or be relatively shallow. For the shallow aquifer scenario, the aquifer was assumed to behave in a manner similar to DWR's well #5, which frequently has a top elevation that approaches the soil surface during the rainy season. The regression equation in Figure 9 was used to estimate the elevation for the top of the aquifer. The elevation for the top of the aquifer was estimated in Excel with the following equation:

$$EA = if\ (PCum>15,\ AC + AMult * PCum,\ -50) + Drop$$

Where:

EA	=	Elevation of aquifer in inches
PCum	=	cumulative precipitation for the rainy season (inches)
AC	=	Aquifer constant, from regression for spring elevation for well 5 shown in Figure 9
AMult	=	Aquifer coefficient, from regression for spring elevation for well 5 shown in Figure 9
Drop	=	Decline in aquifer level, assumed to begin after March 1 when precipitation for the past 20 days has been less than 3 inches. The aquifer drain rate was assumed to be 0.4 inches per day based on the Well 5 data.

8.1.4.5 Elevation of Water Perched on Aquifer

The equation for estimating the aquifer level described above is an estimate of the general regional level. As the aquifer approaches the soil surface recent rain events could temporarily place additional water on top of the aquifer. In a sense, this water would be perched on the main body of the aquifer. Because of its high elevation, it would likely drain more rapidly than the main aquifer either into adjoining surface waters. The surface elevation of this temporary top layer of the aquifer was estimated with the following Excel equation:

$$EPA_t = EA + ETA_{t-1} + RainMult*Precip - drain$$

Where:

EPA_t	=	Elevation of the water perched on the aquifer for the current day. This value is not allowed to exceed Emax
Drain	=	Estimated water drainage rate for water level within the soil (inches/day)

Note 1: precipitation is only allowed to contribute to this layer when the aquifer elevation is greater than -24 inches, otherwise precipitation is assumed to contribute directly to the main aquifer.

Note 2: Elevation of water above the soil surface is converted to actual elevations by dividing by RainMult.

8.1.4.6 Scenarios

Two basic types of scenarios were evaluated:

1. High Water Table Scenario: An estimate of most likely hydrologic conditions, which includes a relatively high aquifer and a higher more realistic level of soil permeability.
2. Low Water Table Scenario: An estimate of hydrologic conditions that would be more favorable for soil-perched wetlands, which includes a relatively low aquifer and a very slow soil permeability.

Both of these scenarios were evaluated with precipitation data from 2010, 1987 (10th percentile), and 2006 (90th percentile).

8.1.4.6.1 High Water Table Scenario

For this scenario, the following assumptions were used:

Aquifer:

Depth to water table was assumed to be similar to the depth to water table measured at DWR well 5. During the winter and early spring, the water table was set to rise to within 3 to 18 inches of the soil surface.

Water perched on soil:

- An infiltration rate of 7 inches per day was used to represent clay loam, one of the most abundant soil textures found in the wetland areas.
- The clay loam was assumed to first occur at a depth of 5 inches.
- The rainfall multiplier was set to 5.4 based on the measurements at the test wells. This value is multiplied by the infiltration rate to estimate the speed that the water moves through the soil.

Water perched on aquifer:

- The rainfall multiplier was set to 5.4 based on the measurements at the test wells.
- The drain rate was set equal to 1.4 inches per day based on the measurements at the test wells. Note: this value is not multiplied by RainMult because it was a direct measurement of the decrease in water level within the soil.

8.1.4.6.2 Low Water Table Scenario

For this scenario, the following assumptions were used:

Aquifer:

Depth to water table was assumed to be at least 50 inches

Water perched on soil:

In this scenario the parameters for water perched on soil were chosen to be most favorable.

- An infiltration rate of 2 inches per day was used to represent clay. Of the 19 soil pits dug at the Goss and MGC Plasma parcels for the wetland soils evaluation, three (all located in uplands) contained clay or very gravelly heavy clay soil that was estimated to have very slow permeability.
- The clay was assumed to first occur at a depth of 1 inch (as occurred at one of the 19 soil pits).
- The rainfall multiplier was set to 3. A low multiplier helps retain water perched on soil because the multiplier is used to estimate how fast the water must move through the soil in order to

attain a certain infiltration rate. For example, an infiltration rate of 2 inches per day implies that the water must be moving through the soil at 6 inches per day if the rainfall multiplier is 3 (i.e., 1 inch of surface water fits into 3 inches of soil). A rainfall multiplier of 3 implies that the specific yield of the soil would be about 33% (i.e., 33% of the volume of saturated soil would contain extractable water). A low rainfall multiplier reduces the elevation increase associated with rainfall, but this effect is smaller than the reduced elevation associated with infiltration.

Water perched on aquifer:

Because of the depth to the aquifer, water was assumed not to become perched on the aquifer.

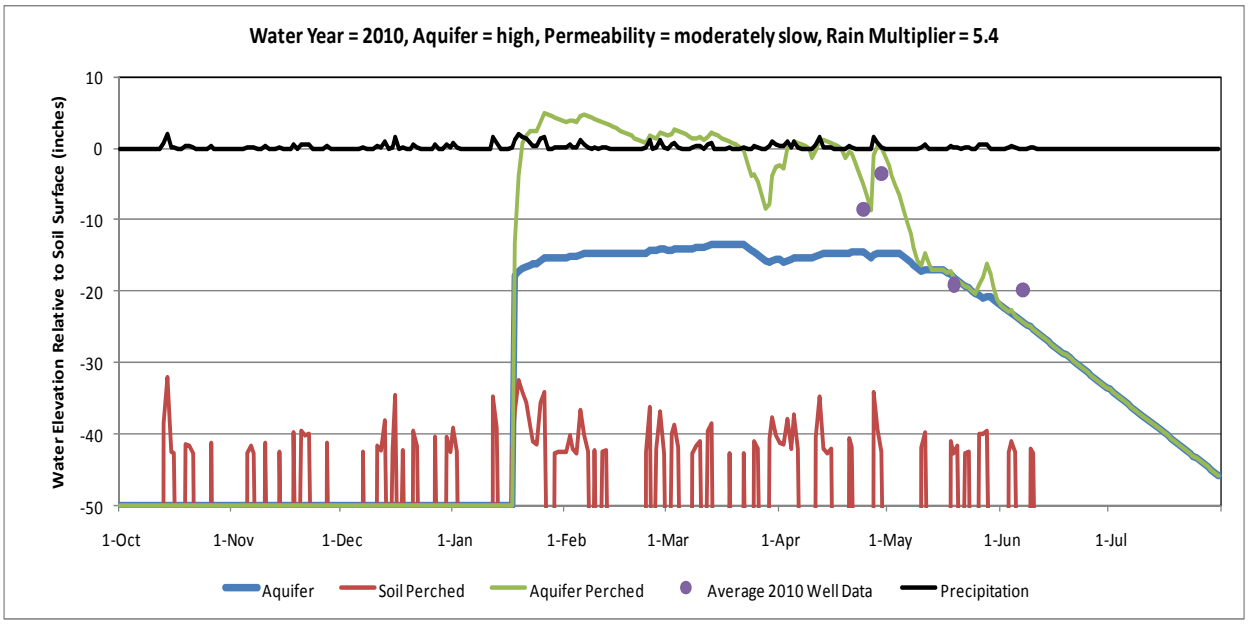
8.1.5 Results and Discussion

Water budget results are shown in Figures 11 through 13 for 2010, 1987, and 2006, respectively. Each figure shows the high water table scenario at the top (the most likely hydrologic scenario) and the low water table scenario at the bottom (the most optimistic parameter values for water perched on soil). All results are presented in terms of elevation in inches relative to the soil surface.

The results for 2010 precipitation show that both the high water table and low water table scenarios have elevations that are similar to those observed in the test wells. The average well elevation data shown in the graphs are a fairly close match to either the elevation of the water perched on the aquifer for the high water table scenario or the elevation of the water perched on the wetland soil for the low water table scenario. However, because the parameter values chosen for the low water table scenario were fairly extreme and not representative of the majority of the data, it is likely that most wetlands in Little Lake Valley exist as a result of the presence of a high water table. Under the high water table scenario, wetland water elevations were estimated to be much higher (frequently above the soil surface) than under the low water table scenario (elevations generally 4 inches or more below the soil surface.

The results for 1987 precipitation (Figure 12) show that during relatively dry years, wetland functionality would be limited, although much better under the high aquifer scenario than under the low aquifer scenario. One of the requirements of a wetland is that there be saturation within 12 inches of the surface for at least 2 consecutive weeks during the year. This condition is not quite met under the low aquifer scenario with 1987 precipitation.

The results for 2006 precipitation (Figure 13) show that both scenarios may produce wetland conditions, although the high water table scenario would generate much more water above the soil surface than the low water table scenario.



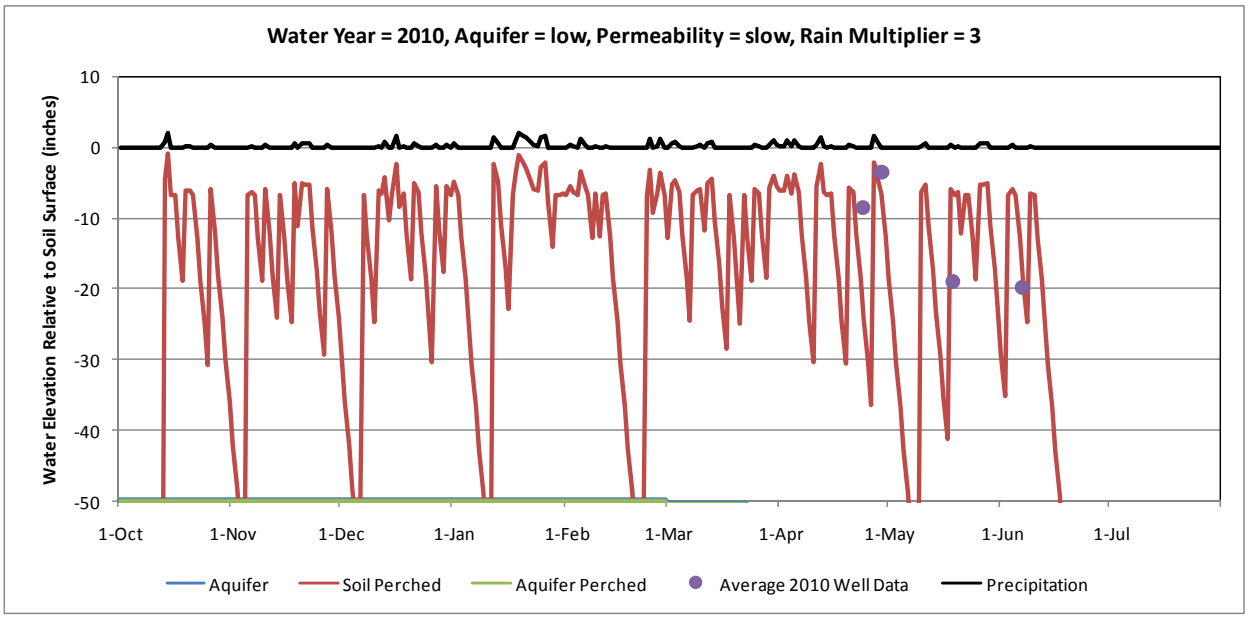
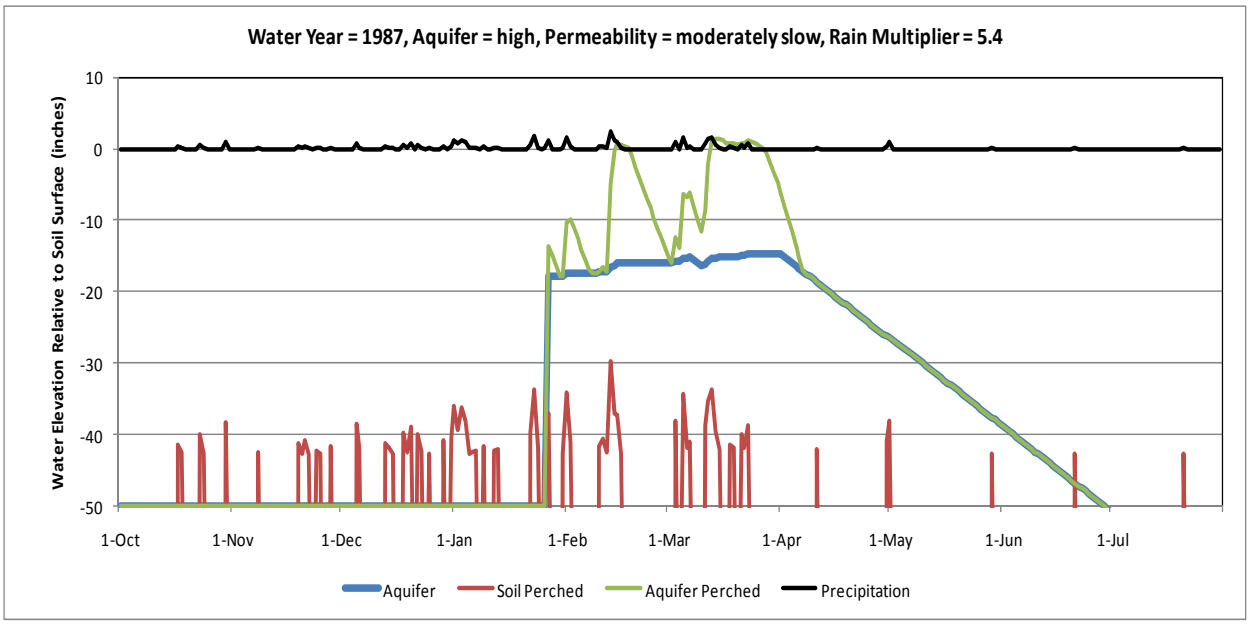


Figure 11. Estimated Water Surface Elevations for a High Aquifer and Low Aquifer Scenario with 2010 Precipitation



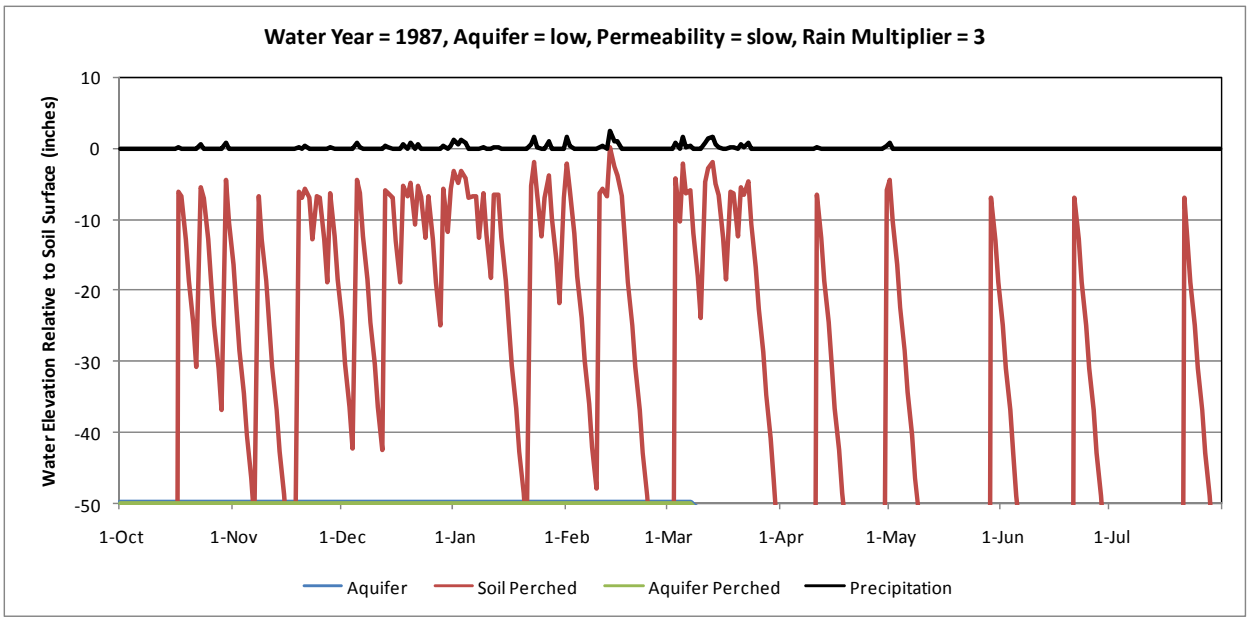
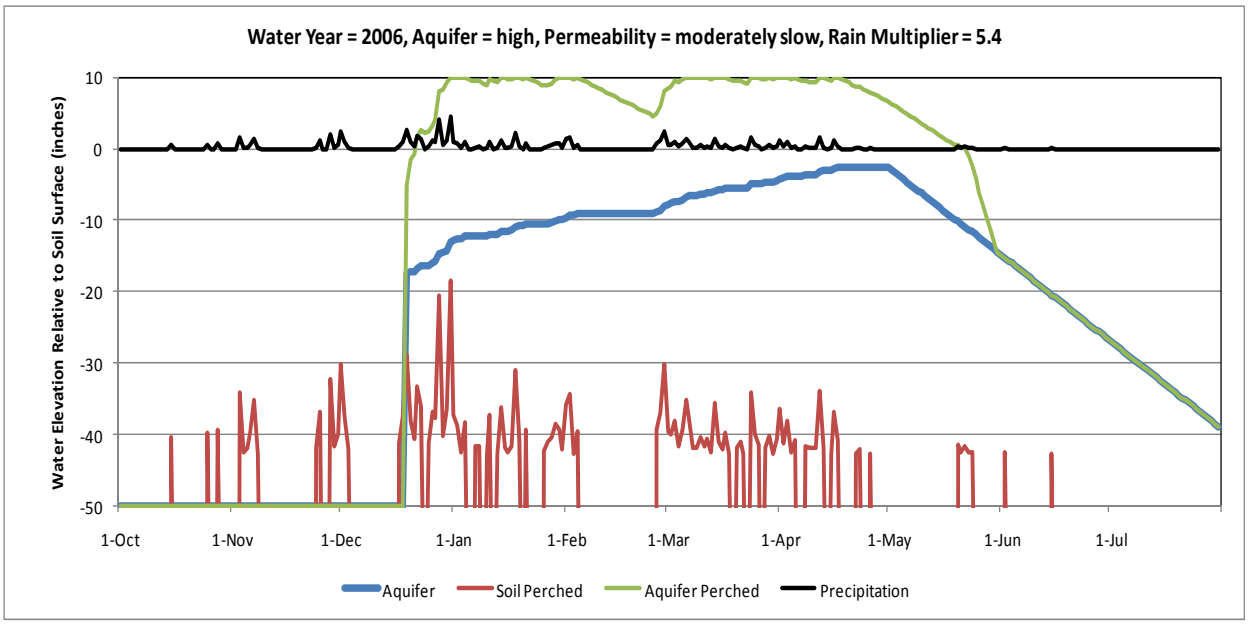


Figure 12. Estimated Water Surface Elevations for a High Aquifer and Low Aquifer Scenario with 1987 Precipitation



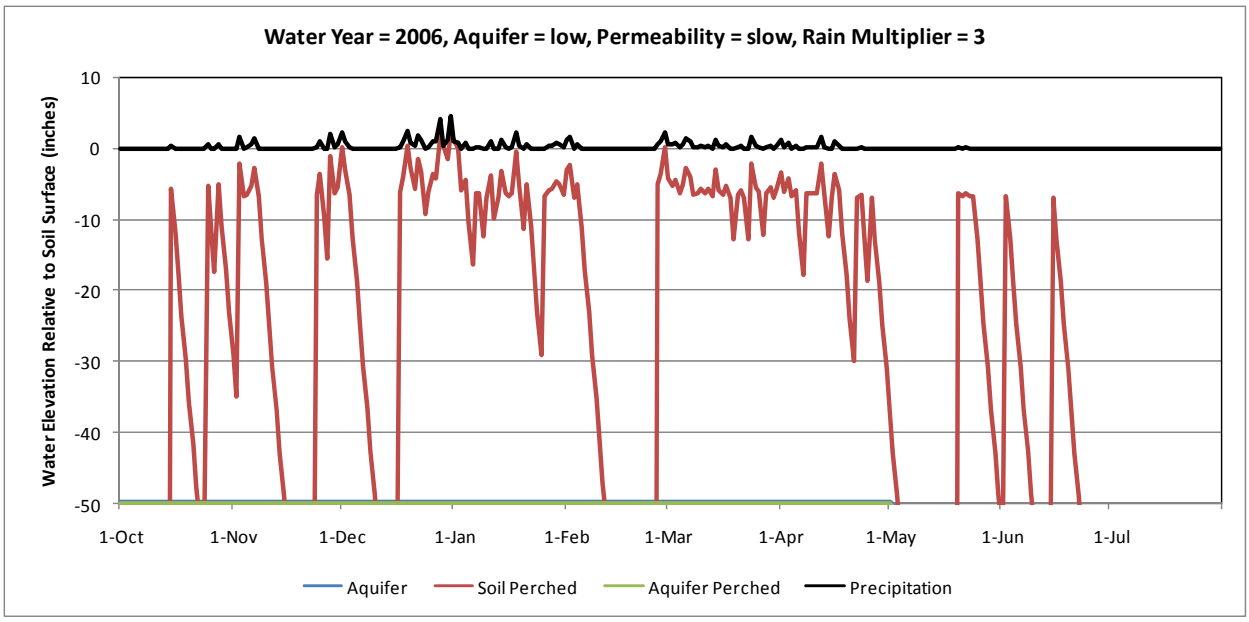


Figure 13. Estimated Water Surface Elevations for a High Aquifer and Low Aquifer Scenario with 2006 Precipitation

Based on existing soils data, it seems likely that most wetlands in Little Lake Valley could not be sustained merely by soils retaining local precipitation. It seems likely that the wetlands are sustained by the presence of a high water table or other sources of inflow.

There is limited data available to distinguish the potential differences between proposed wetland establishment sites in terms of the water budget assessment. Table 9 summarizes the available site specific data.

Table 9. Hydrologic and Soil Texture Information for Offsite Mitigation Parcels where Wetland Establishment is Proposed

Establishment Site	Water Elevation Data from Monitoring Wells for PLHO Study	Soil Texture Data from PLHO Soil Surveys and Wetland Delineations	Soil Texture and Redoximorphic Data from July 2010 Soil Surveys of Proposed Wetland Establishment Sites	Approximate Elevation of Soil Surface (feet above msl)	Field Observations
Ford Parcel 108-010-06		mostly clay loam and loam		1320 - 1330	Located at the bottom of the valley where Little Lake historically formed. Outlook Creek, Oat Canyon Creek, and an unnamed drainage present. Mixed marsh area near wetland establishment site had shallow inundation in July 2010.
Goss	√ [a]	mostly clay loam and loam	mostly clay loam and loam, redoxymorphic soil features generally within the top foot of the soil surface	1394	Presence of wetlands along former stream channels may indicate subsurface flows. Shallow inundation in winter.
MGC Plasma North	√ [a]	mostly clay loam and loam	mostly clay loam and loam, redoxymorphic soil features generally within the top foot of the soil surface	1394-1402	Presence of wetlands along former stream channels may indicate subsurface flows. Spring discharge carried by a ditch seeps into the soil at this site. Shallow inundation in winter.

Table 9. Continued

Establishment Site	Water Elevation Data from Monitoring Wells for PLHO Study	Soil Texture Data from PLHO Soil Surveys and Wetland Delineations	Soil Texture and Redoximorphic Data from July 2010 Soil Surveys of Proposed Wetland Establishment Sites	Approximate Elevation of Soil Surface (feet above msl)	Field Observations
MGC Plasma Middle		mostly clay loam and loam		1398-1402	Presence of wetlands along former stream channels may indicate subsurface flows. Shallow inundation in winter.
Nieson		mostly clay loam and loam		1344	Railroad ditch conveys water north through the site. Saturated soil during April 2010.
Watson 037-221-30		mostly clay loam and loam	a small area of clay pan detected	1330-1340	Receives seepage from ephemeral drainages. Floodwaters from the major creeks (e.g., Davis and Outlet Creeks) contribute to large area of winter inundation on the western (lower) portion of the site.

[a] MGC Plasma North tended to have higher drain rates and rainfall multipliers than Goss, but there were only two sample sites for MGC Plasma North and the wetland to be created on the Goss, MGC Plasma North, and MGC Plasma Middle will be contiguous.

There is little data available that distinguishes the proposed wetland establishment sites, although the soil surveys at the wetland establishment sites have not yet been completed. Because there is very little soil with very low permeability (e.g., clay), it is likely that wetlands are controlled by local aquifer conditions. Field observations of local drainages and topographic conditions suggest that a few of the wetland sites may benefit from lateral movement of surface and subsurface waters.

Based on available information, there is little hydrologic difference between upland sites and nearby wetlands in terms of soil permeability and well hydrology. It seems that the main difference between existing wetlands and nearby upland establishment sites is the ground surface elevation, which would be lowered for wetland establishment.

9 Citations

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California Department of Transportation (Caltrans). 2010b. Willits Bypass Technical Memorandum: Soil and Hydrology Site Characterization Monitoring Methods (Work Plan Task 4-4.1). May 28, 2010. District 3 North Region Environmental Division. Sacramento, CA.

10 Personal Communications

Meigs, Jason. Associate Biologist. California Department of Transportation. July 28, 2010 - notes provided on field observations at the offsite mitigation parcels where wetland establishment is proposed.

Attachment 1

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

JUL - 9 2010

REPLY TO
ATTENTION OF

Regulatory Division

SUBJECT: File Number 1991-19474N

Mr. Charlie Fielder
District 1 Director
California Department of Transportation
P.O. Box 3700
Eureka, California 95502

Dear Mr. Fielder:

Per our District Commander's June 29, 2010 e-mail communication to you, we are hereby providing you with the list of items Caltrans must provide to the Corps by August 15, 2010, in order for us to come to a permit decision by August 30, 2010. To adequately address the three items specified by the District Commander, including the 401 Certification, a complete long-term management plan, and complete endowment calculations broken down by parcel (must use spreadsheet provided by the Corps by e-mail on June 2, 2010 for **each parcel**), you must provide the following 6 items to meet the spirit and intent of our commitments.

These items are a subset of the larger list provided today to you by the RWQCB representing the complete information needs of the Corps, the RWQCB, and the EPA. The list below represents the minimum information necessary for us to complete our public interest review, ensure compliance with mandatory "no net loss" policy, and ensure compliance with our Mitigation Regulations (33 CFR Part 332). To date, you have only proposed 23 acres of wetland establishment (creation) and have not shown how you will effect "no net loss" of the 83 acres of fill that is proposed.

1. A **clear accounting** of existing conditions on each mitigation parcel specific to waters of the U.S. including aquatic resource type (you must specify either wetlands, non-wetland waters of the U.S., OR riparian buffer) and acreage in a table with associated drawings. We also require a clear accounting of proposed conditions (i.e. climax community) on each mitigation parcel specific to waters of the U.S. including proposed aquatic resource types and acreages.

2. Compensation types must be clarified throughout the Mitigation and Monitoring Plan (MMP) and only Corps-recognized definitions are to be used. "Protection" is not a recognized Corps definition per 33 CFR Part 332 and any mitigation parcel areas

classified under this term **must be reclassified** according to one of the Corps-recognized definitions. The word "protection" may not be used in the final MMP.

You have counted returning areas that will be temporarily impacted to their original contours as "restoration". "Restoration" is not defined per 33 CFR Part 332 as "areas temporarily affected by onsite or offsite construction activities that will be restored to pre-project conditions." Any areas classified this way within the MMP **must be removed** from the mitigation totals, as the Corps does not recognize them as "restoration" areas.

3. As specified in our April 23, 2010 letter, information justifying areas proposed for preservation must be provided pursuant to 33 CFR Part 332.3(h).

4. Each and every area proposed for **establishment** must have the following details and baseline information: 1) Caltrans needs to describe the process used in selecting each site. 2) Caltrans needs to clearly define the purpose of each establishment site. What functions and values are being replaced at the establishment site? Performance standards and success criteria will be based on this. 3) Caltrans needs to provide **fully developed** construction plans: existing contours, proposed contours, planting plans, construction sequence. 4) Caltrans needs to clearly define the location and the size of each mitigation site (not give us the size of the actual parcel, we need to know the size of the mitigation site). 5) Caltrans must have a corresponding reference site for each establishment site. The enhancement plans must contain the following information:
   a. Hydrology. The following information is needed for each proposed wetland establishment site:
      1) Current conditions information:
         - Analysis of existing hydrologic conditions in reference sites.
         - Hydrologic testing of the mitigation sites. Testing must include:
            - Examination of the groundwater availability.
            - Hydroperiod Information: the frequency of flooding, depth, duration, timing of saturation or inundation, percent of open water.
            - Historical hydrology of mitigation site if different from present conditions.
            - Acres of contributing drainage areas.
            - Results of water quality analysis: data on surface water, groundwater, redox, nutrients, organic content, suspended matter, DO, heavy metals.
      2) Information to estimate proposed hydrological conditions:
         - A reliable water budget must be presented. You must be able to show that net inflows are greater than net outflows. Water budget must include: water source(s): precipitation, surface runoff, groundwater, stream. Water losses.

- Provide a water budget for wet years and dry years.
- Modification of the hydrologic characteristics should be kept to a minimum.
- Site should be hydrologically self sustaining.

b. Soil Characteristics. The following information is needed for each wetland establishment site:
   1) Soil profile. The MMP provided the soil survey information. Caltrans needs to locate those soils on site. Submit a report of soil samples with a map showing data sample points.
   2) Standard soil analysis: percent organic matter, structure, texture, permeability.
   3) What will be the source of the soils? (e.g., existing soil, imported hydric soil from impact site).
   4) Also need: erosion and soil compaction control measures.

c. Vegetation.
   1) Existing conditions: We generally have a list of the species that occur on site from the delineations that were completed. For each wetland establishment site we need:
      - Species characteristics such as: densities, age, health, natives/non natives.
      - Percent cover.
      - Community structure (canopy stratification).
      - Map showing the correct location of plant communities with representative site photos.
      - Proposed site should be located adjacent to existing waters of the U.S. or a high functioning buffer adjacent to waters of the U.S. to create a wildlife corridor. Provide documentation of this connectivity.

d. Watershed context/surrounding land use for each wetland establishment site:
   1) Impairment status and impairment type of aquatic resources.
   2) Description of watershed land uses (percent agriculture, forested, wetland, developed).
   3) Size of natural buffers (show on map and do not call them "riparian").
   4) Description of landscape connectivity: proximity and connectivity of existing aquatic resources and natural upland areas (and show on map).
   5) Relative amount of aquatic resource area that the impact site represents for the watershed and/or ecoregion (by individual type and by overall resources).

e. Goals of each wetland establishment site:
   1) Types and areas of habitat to be established.
   2) Specific functions of the habitat types.
   3) Time lapse between jurisdictional impacts of the project and mitigation site success.

4) Total cost of the establishment site: site preparation, planting, maintenance, monitoring.
5) Overall watershed improvement to be gained by the wetland establishment site.

f. Wetland Establishment Site Implementation:
   1) For each establishment site Caltrans must:
      - Provide a rationale for expecting implementation success.
      - Name responsible parties.
      - Provide financial assurance information.
      - Provide a construction schedule.
      - Provide a site preparation plan.
      - Provide a planting plan. The planting plan design must emulate a reference site in terms of plant species and spacing. Planting design must place plants relative to the water source supporting them specific to what the optimal condition would be for that species.
      - Prior to planting the site soil conditions must be confirmed: soil moisture, ph, salinity, organic matter, nitrogen, soil type. Be advised that the native soils must support the proposed wetland establishment. Clay liners or other artificial barriers are not permitted.
      - Provide as-builts within 45-days of construction of establishment wetland site.

g. Maintenance Activities During Monitoring Period for each wetland establishment site:
   1) Provide the list of maintenance activities
   2) Responsible parties
   3) Schedule

h. Monitoring Plan for each wetland establishment site:
   1) Target dates for performance standards and success criteria
   2) Target functions
   3) Target hydrological regime. Hydrologic functions must be compared to what is occurring at the reference site.
   4) Target mitigation acreage of establishment
   5) Monitoring method and schedule
   6) Annual monitoring report

i. Completion of each Mitigation Site:
   1) Written notification is required
   2) Agency confirmation will be required before mitigation is considered complete.

j. Contingency Measures for each mitigation site:

1) Initiation Procedures. Circumstances necessitating the initiation of contingency measures must be described.
2) Funding mechanism (See item 5. below)
3) Responsible parties

5. The Corps requires a performance bond or other Corps-approved financial assurance mechanism payable at the direction of the District Engineer to his designee or to a standby trust agreement. This financial assurance mechanism shall be posted **within 30 days of permit issuance** or else the Corps permit will be revoked. In order to determine the appropriate assurance amount, Caltrans must provide **sufficient and itemized calculations** by August 15, 2010 for the cost of the following: collection of all necessary baseline information, parcel-specific mitigation plan preparation based on a watershed approach, land acquisition, planning and engineering, legal fees, mobilization, construction, and monitoring, and a contingency fund for any necessary remediation.

6. As specified in our April 23, 2010 letter, the Corps believes discharge of fill for project construction should be carried out concurrently with project phase construction. Caltrans must provide us with the fill amount associated with Phase I alone, the additional fill amount associated with Phase II, and the associated drawings demonstrating the two separate Phases as described by Dave Kelley in our May 10, 2010 conference call.

These items collectively are the minimum information necessary (to be supplied by August 15, 2010) for the Corps to complete the application evaluation process.

Should you have any questions regarding this matter, please call me at (415) 503-6771. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter.

Sincerely,

Jane M. Hicks

Jane M. Hicks
Chief, Regulatory Division

Copy Furnished:

US EPA, San Francisco, CA (Attn: A. Strauss/J. Brush/ M. Scianni)
CA RWQCB, Santa Rosa, CA (Attn: C. Kuhlman/J. Puget)
California Department of Transportation, Sacramento, CA (Attn: R. Land)
California Transportation Commission, Sacramento, CA (Attn: J. Earp)

Memorandum

Date:	August 10, 2010
To:	Dave Wickens U.S. Army Corps of Engineers - San Francisco District 1455 Market Street San Francisco, CA 94103-1398
Cc:	Laurie Monarres, U.S. Army Corps of Engineers Melissa Scianni, U.S. Environmental Protection Agency Jeremiah Puget, North Coast Regional Water Quality Control Board Craig Martz, California Department of Fish and Game
From:	Shanna Zahner California Department of Transportation
Subject:	**Willits Bypass Project—Soil Characteristics at Proposed Wetland Establishment Sites in Little Lake Valley**

1 Introduction

The Willits Bypass Project (bypass project) has several compensatory mitigation components, including wetland establishment. As part of the Clean Water Act (CWA) Section 404 individual permit process for the bypass project, the U.S. Army Corps of Engineers (USACE) has requested information related to soils at the six offsite mitigation parcels where wetland establishment is proposed. (Corresponding information on hydrology and vegetation has also been requested by the Corps; the hydrology information was provided on July 29, 2010 (Caltrans 2010a) and the vegetation information and will be provided on August 10, 2010.) Table 1 lists the offsite mitigation parcels and the wetland establishment habitat type and acreage proposed at each parcel.

Table 1. Proposed Wetland Establishment Sites at the Offsite Mitigation Parcels

Offsite Mitigation Parcel	Assessor's Parcel Number	Proposed Wetland Establishment Habitat Type	Proposed Wetland Establishment at Parcel (acres)
Ford	108-010-06	Mixed marsh and wet meadow	2.854
Goss	103-230-02		
MGC Plasma Middle	103-250-14	Wet meadow	7.477
MGC Plasma North	103-230-06		
Niesen	108-040-02	Wet meadow	5.666
Watson—Eastern	037-221-30	Wet meadow	8.336 (north area is 4.420 and south area is 3.916)
		Total	**24.31**

Attachment 1, "July 9, 2010, letter from Corps to California Department of Transportation (Caltrans)," lists the Corps' minimum information necessary to make a permit decision for the bypass project. This technical memorandum addresses Items 4b(1-4) on page 3 in Attachment 1 – soil characteristics at each proposed wetland establishment site. At the July 12 and 13, 2010, meeting between resource agencies (i.e., USACE, U.S. Environmental Protection Agency [USEPA], North Coast Regional Water Quality Control Board [RWB], and California Department of Fish and Game [CDFG]) and Caltrans, each of the items in the July 9, 2010 letter were discussed. With respect to Item 4b(2), the resource agencies agreed that that site specific soils data on percent organic matter and permeability could be inferred from field conditions and did not require laboratory analysis.

This technical memorandum presents information on the following items for each proposed wetland establishment site per the July 9, 2010 letter:

- Soil profile (see discussion below).
- Standard soil analysis for percent organic matter, structure, texture, and permeability; see discussion below).
- Source of soils for wetland establishment. The source for topsoil for wetland establishment will be onsite salvage of topsoil at the Ford, Goss/MGC Plasma Middle/MGC Plasma North, and Niesen offsite mitigation parcels. The source for topsoil at the Watson East offsite mitigation parcel will be 1-2 inches of topsoil and plant duff harvested together within the bypass project alignment where Baker's Meadowfoam (*Limnanthes bakeri*) populations have been observed and will be impacted by the bypass project (Caltrans 2010c).

A fourth item, soil erosion and compaction measures, was requested in the July 9, 2010 letter. This information was previously provided to the USACE on August 3, 2010, as part of the construction drawings submittal.

1.1 Importance of Soil Characteristics to Wetland Establishment Suitability

The suitability of a proposed site for wetland establishment is controlled by its hydrologic characteristics and by its soil characteristics. With regard to the hydrologic *suitability of th*e proposed sites, a hydrology suitability assessment, including a water budget, was prepared and provided to the resource agencies on July 29, 2010 (Caltrans 2010a). Because discussion of soil characteristics is somewhat inseparable from discussing hydrologic characteristics, there is overlap in the information presented in this technical memorandum and the information presented in the hydrology technical memorandum (Caltrans 2010a). The soil characteristics most important to determining the suitability of a site for wetland establishment, as used in this evaluation, are soil texture (i.e., the proportions of sand-, silt-, and clay-sized particles) and redoximorphic ("redox") features (i.e., features formed by the processes of reduction, translocation, and/or oxidation of iron and manganese oxides [formerly called mottles and low-chroma colors] [USDA Natural Resources Conservation Service 2010]). Soil texture is the most important factor in controlling soil permeability. Permeability affects infiltration capacity, the rate of lateral groundwater movement, and the potential for a shallow perched water table to occur. Unless the soil has been drained, redox

features are widely used as an indication of the depth at which prolonged soil saturation occurs, such as that caused by a seasonal high water table (USDA Natural Resources Conservation Service 2010). Redox features also can be used as an indication of surface water ponding/flooding. The use of redox features not only can provide an indication of long term average depths to the water table, but they are particularly useful when the soil is being evaluated during the dry season when the water table depth cannot be directly observed, such as in the present evaluation.

Other soil morphological characteristics useful in evaluating the suitability of wetland establishment include soil structure and organic matter content. Soil structure (or the lack thereof) affects water and gas permeability and root penetration. Soil organic matter content affects soil structure, water- and nutrient-holding capacity, nutrient cycling, and other processes (Donahue et al. 1983). In the context of wetland establishment, soil organic matter exerts a greater effect on vegetation growth than on controlling the presence or absence of saturated soil conditions necessary for wetland hydrologic conditions.

1.2 Wetland Establishment Parcel Descriptions

1.2.1 Landforms and Topography

1.2.1.1 Ford Offsite Mitigation Parcel

The Ford offsite mitigation parcel is proposed for 2.854 acres of wetland establishment (Figure 1). Based on field observations, the wetland establishment site on this parcel exists in the general vicinity of a floodplain landform.

The proposed wetland establishment site is elevated approximately four to five feet above the adjoining floodplain that exists to the north, south, and east. As evidenced by soil profile observations made for the present evaluation, the establishment site consists of fill material. The slope shape is planar to broadly convex, but one depressional area exists in the south-central part of the site. Sideslopes of the fill are approximately 2:1 horizontal:vertical.

The existing, adjoining wetlands have slope shapes that are mostly planar; some areas are slightly hummocky, which may be a result of the nearby fill placement. Slope gradients are 0 to 2%.

1.2.1.2 Goss/MGC Plasma Middle/MGC Plasma North Offsite Mitigation Parcels

The Goss/MGC Plasma Middle/MGC Plasma North offsite mitigation parcels are proposed for 7.477 acres of wetland establishment (Figure 2). Based on the soil survey map units and on field observations, the proposed wetland establishment site exists in the vicinity of alluvial fan, alluvial plain, and basin landforms.

The topography of these parcels appears to be comparatively similar. The slope shape is usually planar, but a few areas are slightly convex. The establishment site overall slopes downward westerly at gradients ranging from 0 to 3%.

The existing, adjoining wetlands have slope shapes that are planar or slightly concave and have slope gradients that are 0 to 3%.

1.2.1.3 Niesen Offsite Mitigation Parcel

The Niesen offsite mitigation parcel is proposed for 5.666 acres of wetland establishment (Figure 3). Based on the soil survey map units and field observations, the proposed wetland establishment site exists in the vicinity of alluvial fan and alluvial plain landforms.

The wetland establishment site is elevated up to approximately 9 feet above the adjoining alluvial plain that exists to the north, south, and east. As evidenced by soil profile observations made for the present evaluation, most of the establishment site consists of fill material, but some areas appear to have fill material mixed in with the surface layer of the native soil. Because the site has been highly altered, slopes are complex. Sideslopes of the fill are approximately 3:1 to 5:1 horizontal:vertical.

The existing, adjoining wetlands have slope shapes that are mostly planar. Slope gradients are 0 to 2%.

1.2.1.4 Watson East Offsite Mitigation Parcel

The Watson East offsite mitigation parcel is proposed for 8.336 acres of wetland establishment (Figure 4). Based on the soil survey map units and field observations, the proposed wetland establishment sites (two establishment sites are proposed in the north [4.420 acres] and south [3.916 acres] areas of the parcel, respectively) exist in alluvial fan and alluvial plain landforms.

The topography of both sites suggests that no fill material that has been placed in either site.

The slope shape of the north establishment site varies locally between planar and slightly convex, but as a whole it is broadly convex. The establishment site overall slopes downward westerly at gradients ranging from 0 to 3%.

The slope shape of the south establishment site is overall planar, but a slightly convex area occurs in the central part. The establishment site overall slopes downward westerly at gradients ranging from 0 to 3%.

The existing wetlands adjoining the north site are planar to broadly concave. The existing wetlands adjoining the south site are planar to slightly concave. The wetlands adjoining both sites have slope gradients that are 1 to 3%.

1.3 Natural Resources Conservation Service Soil Survey Mapping

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for parts of Mendocino and Trinity counties (Howard and Bowman 1991) provides the most recent mapping of soils at the offsite mitigation parcels. Table 2 summarizes the NRCS soil survey information for those soil map units that occur at the offsite mitigation parcels.

As mapped by the NRCS, the soils at the offsite mitigation parcels generally are weakly to moderately developed, such that in many cases the surface, subsurface, and subsoil layer textures do not differ markedly within a given profile. None of the mapped soil series and other soils mapped at the subgroup taxonomic level have profiles that usually contain a well-defined subsurface restrictive layer, such as a claypan or a duripan. Claypans and duripans are commonly found in most California vernal pools and some seasonal wetlands[1]. Among the soil series mapped at the wetland establishment sites and their adjoining wetlands, the most strongly developed soils are the Cole and Pinole series, which are both Argixerolls, indicating that they have an argillic (subsoil) horizon with a minimum 20% increase in clay content relative to the overlying horizon.[2] However, in the modal pedon (i.e., most commonly occurring profile) described for the Cole and Pinole series, the argillic horizons have only a clay loam texture, which would be too permeable to cause a shallow perched water table. For the Cole series, the NRCS soil survey indicates that in some areas the argillic horizon subsoil may be silty clay or clay, which could cause a perched water table to form and persist for an undetermined period. (The presence of such a clayey subsoil in the Cole series was observed in profiles described in a few of the existing wetlands at all of the wetland establishment sites.)

The soils that occur at the establishment sites and their adjoining wetlands formed under well to poorly drained conditions, but in some areas the internal drainage has been changed as a result of stream incision and drainage ditch construction (Howard and Bowman 1991).

Table 2. Characteristics of Soils at the Offsite Mitigation Parcels as Mapped by USDA NRCS Soil Survey[a]

Soil Map Symbol	Soil Map Unit Name	Landform	Natural/ Existing Drainage Class	Generalized Typical Profile (Surface, Subsurface, and Subsoil)	Parcel Occurrence
112	Clear Lake clay, 0 to 2% slopes	basins	poor/partially drained	clay over clay loam	Goss, MGC Plasma Middle, MGC Plasma North
115	Cole clay loam, 0 to 2% slopes	alluvial plains and basins	somewhat poor/ somewhat poor	clay loam over clay loam	MGC Plasma Middle, MGC Plasma North, Niesen, Watson East
123	Feliz loam, 0 to 2% slopes	alluvial plains and fans	well/well	loam over clay loam	Watson East
126	Feliz clay loam, gravelly substratum, 2 to 8 percent slopes	alluvial plains and fans	well/well	clay loam over gravelly sandy clay loam	Watson East

[1] Although the Clear Lake series soil (map unit 112) does not have a claypan or a duripan, it is typically clay to the surface, which could cause ponding to occur in depressional areas.

[2] For reference, Haplaquepts may contain subsoil layers and substrates that are silty clay or clay. These layers appear to be depositional, rather than pedodenic layers and therefore do not indicate strong soil development.

Soil Map Symbol	Soil Map Unit Name	Landform	Natural/ Existing Drainage Class	Generalized Typical Profile (Surface, Subsurface, and Subsoil)	Parcel Occurrence
127	Fluvaquents, 0 to 1% slopes	floodplains	poor and very poor/poor and very poor	very fine sandy loam over silt loam[b]	Ford, Watson East
128	Gielow sandy loam, 0 to 5% slopes	alluvial plains and fans	somewhat poor/somewh at poor	sandy loam and loam over sandy loam and fine sandy loam	Goss, MGC Plasma North, Niesen, Ford
133	Haplaquepts, 0 to 1% slopes	basins and floodplains	poor/poor	clay loam over silty clay loam over silty clay[b]	Ford, Watson East
178	Pinole gravelly loam, 2 to 8% slopes	terraces	well/well	gravelly loam over clay loam over sandy clay loam	Ford, Watson East

Notes:

[a] The characteristics described above for each soil map unit do not reflect map unit inclusions, whose drainage class and profile characteristics may be different from the primary soil component of the map unit.

[b] Because of their variability, Haplaquepts and Fluvaquents have no typical profile. The profiles described are those that commonly occur in the soil survey area.

Source: Howard and Bowman 1991.

The NRCS soil survey also provides information on the type, depth, and timing of a seasonal high water table that typically occurs in the soil map units. Table 3 shows water table information for those soil map units in the offsite mitigation parcels where wetland establishment is proposed and that are subject to a seasonal water table within six feet of the surface. Those soil map units that occur in the offsite mitigation parcels that are not shown in the table have a seasonal high water table depth that is deeper than six feet below grade in most areas of the soil map unit.

Table 3. Water Table Characteristics of Selected Soil Map Units that Occur in the Offsite Mitigation Parcels

Soil Map Symbol	Soil Map Unit Name	Depth to Seasonal High Water Table (ft.)	Kind of Water Table[1]	Months of Water Table Presence[4]
112	Clear Lake clay, 0 to 2% slopes	1.5–3.0	Perched[3]	Dec.–Mar.
115	Cole clay loam, 0 to 2% slopes	1.5–3.0	Apparent	Nov.–May
128	Gielow sandy loam, 0 to 5% slopes2	1.5–3.0	Apparent	Dec.–Mar.

[1] "Apparent" refers to the stabilized level of water in a fresh, unlined borehole; "perched" refers to a water table that lies above an unsaturated layer (Schoenberger et al. 2002).

[2] Although the NRCS soil survey shows the Gielow series to be an Argixeroll, the official series description for the Gielow series shows the soil is classified as an Endoaquoll (Soil Survey Staff 1991). Soils in the "endo" taxonomic subgroup are saturated with water in all layers from the upper boundary of saturation to a depth of six feet or more from the soil surface. This is opposed to soils subject to "epi" saturation, in which the soil is saturated with water in one or more layers within six feet of the soil surface of the surface and also has one or more unsaturated layers, with an upper boundary above a depth of six feet, below the saturated layer (i.e., a perched water table) (Soil Survey Staff 1999).

[3] The perched water table indicated for the Clear Lake series appears to refer to the ponding that may occur at the soil surface, since the restrictive layer begins at the surface (i.e., clay-textured topsoil layer.)

[4] The NRCS does not regard saturated zones lasting for less than one month to be a "water table". Accordingly, any soils that have a rapidly fluctuating, shallow water table would not be included in this table, although the minimum length of time (14 consecutive days of saturation) for wetland hydrology may be present.

Source: Howard and Bowman 1991.

Most of the soil map units occurring in the offsite mitigation parcels where wetland establishment is proposed contain soils that formed under hydric conditions, although the hydric soils may occur only as inclusions (a soil that is dissimilar from the primary soil of the map unit and occupying up to 15% of the mapped body of the soil). Table 4 provides the hydric soil information for the map units occurring at the offsite mitigation parcels where wetland establishment is proposed.

Table 4. Hydric Soil Information for the Map Units Occurring in the Offsite Mitigation Parcels

Soil Map Symbol	Soil Map Unit Name	Map Unit Component	Landform	Hydric Status
112	Clear Lake clay, 0 to 2% slopes	Clear Lake	Basin floors	Yes
		Cole loam, drained	(not specified)	No
		Cole loam	(not specified)	No
		Feliz	(not specified)	No
		Gielow	(not specified)	No
		unnamed	(not specified)	No
115	Cole clay loam, 0 to 2% slopes	Cole	Alluvial fans	No
		unnamed	Depressions	Yes
		Clear Lake	Basin floors	Yes
		Cole	(not specified)	No
123	Feliz loam, 0 to 2% slopes	Feliz	Alluvial fans	No
		Unnamed	Depressions	Yes
		Cole	(not specified)	No
		Pinnobie	(not specified)	No
		Pinole	(not specified)	No
		Russian loam	(not specified)	No

Soil Map Symbol	Soil Map Unit Name	Map Unit Component	Landform	Hydric Status
		Talmage	(not specified)	No
		Xerofluvents	(not specified)	No
126	Feliz clay loam, gravelly substratum, 2 to 8 percent slopes	Feliz	Alluvial fans	No
		Unnamed	(not specified)	Yes
		Cole	(not specified)	No
		Pinole	(not specified)	No
		Russian	(not specified)	No
127	Fluvaquents, 0 to 1% slopes	Fluvaquents	Floodplains	Yes
		Cole	(not specified)	No
		Gielow	(not specified)	No
		Haplaquepts	Basin floors	Yes
128	Gielow sandy loam, 0 to 5% slopes	Gielow	Alluvial flats, floodplains	Yes
		Clear Lake	Basin floors	Yes
		Cole	(not specified)	No
		Feliz	(not specified)	No
		Russian	(not specified)	No
		Talmage	(not specified)	No
		unnamed	(not specified)	No
133	Haplaquepts, 0 to 1% slopes	Haplaquepts	Basin floors	Yes
		Cole clay loam	(not specified)	No
		Gielow sandy loam	Alluvial flats	Yes
		Fluvaquents	Floodplains	Yes
178	Pinole gravelly loam, 2 to 8% slopes	Pinole	Terraces	No
		Yokayo	Terraces	No
		unnamed	(not specified)	No
		Pinnobie	Terraces	No

Source: Soil Survey Staff 2010.

Owing to the texture and thicknesses of the surface, subsurface, and upper subsoil horizons (where the majority of the plant roots are concentrated), the soils at the proposed wetland establishment sites and in the adjoining existing wetlands generally have relatively high available water holding capacities (Donahue et al. 1983). As mapped in the NRCS soil survey (and as observed in the present evaluation), the soil textural classes of loam, silt loam, and clay loam are the most common textures in the upper 18 inches of the profile at the establishment sites and in the adjoining existing wetlands. For all the sites, these textural classes, low gravel content, and lack of a root-restrictive layer generally provide an abundant reservoir of plant-available soil-water to sustain perennial hydrophytic plant species.

1.4 Soil and Hydrologic Characteristics at Wetland Delineation Areas

Soil characteristics and hydrologic characteristics were also recorded from shallow soil pits as part of wetland delineations conducted on the offsite mitigation parcels. Those characteristics recorded that are relevant to this suitability evaluation are soil texture, depth to redox features, and depth to the water table. Table 5 provides a summary of the soil texture data that were collected as part of the wetland delineations. Clay loam and loam (or variants thereof) were the most common soil textures observed. As discussed below, these loamy to fine-loamy soils are too permeable to cause a perched water table to form, indicating that most of the delineated wetlands probably are supported by a high water table from an unconfined aquifer, rather than by a perched water table from a subsurface restrictive layer.

Table 5. Soil Texture Data Collected during Wetland Delineations at the Proposed Wetland Establishment Sites

Texture of Soil Horizon with Slowest Permeability in Pit	Number of Sites with Similar Texture		
	Upland	Wetland	Total
Ford			
loam	3	5	*8*
sandy loam	1		*1*
Total	*4*	*5*	*9*
Goss			
clay loam	1	6	*7*
loam		1	*1*
Total	*1*	*7*	*8*
MGC Plasma Middle			
clay		1	*1*
clay loam	1	2	*3*
sandy clay		1	*1*
sandy clay loam	2		*2*
sandy loam		1	*1*
silty clay	1		*1*
Total	*4*	*5*	*9*
MGC Plasma North			
clay		1	*1*
clay loam	1	5	*6*
loam	1		*1*
sandy clay	1		*1*
sandy clay loam	2		*2*
sandy loam	1		*1*
Total	*6*	*6*	*12*

Texture of Soil Horizon with Slowest Permeability in Pit	Number of Sites with Similar Texture		
	Upland	Wetland	Total
Niesen			
clay loam		4	*4*
Watson East			
clay		3	*3*
clay loam	2	9	*11*
gravelly clay loam	1		*1*
gravelly loam	7	6	*13*
gravelly sandy loam	1		*1*
loam	2	2	*4*
sandy loam	1		*1*
very gravelly loamy sand	1		*1*
Total	*15*	*20*	*35*

1.5 Spring 2010 Soil Evaluations at North Coast Semaphore Grass Study Sites

During the spring of 2010, soil and hydrologic conditions were assessed in the vicinity of North Coast semaphore grass (*Pleuropogon hooverianus*; PLHO) occurrences as part of an ongoing Caltrans study of the special-status plant in Little Lake Valley. PLHO's wetland indicator status is facultative wetland (FACW), and accordingly, PLHO usually occurs in wetlands. In the PLHO soil evaluations, the plant was nearly always observed to be associated with a wet meadow or riparian woodland wetland. Accordingly, the discussion of the soils in this section generally can be regarded as also pertaining to the soil characteristics found in existing wetlands.

Surface layer soil textures within the PLHO occurrences were observed to be loamy to fine-loamy, generally ranging from loam to silty clay loam.

Table 6 summarizes the soil surface textures that were found during the spring 2010 PLHO soil evaluations. The texture for the majority of the soil surface layers was clay loam or loam, which are generally regarded as having moderately slow to moderate permeability. Of the parcels evaluated, two (Goss and MGC Plasma North) are also proposed wetland establishment sites. On these parcels, clay loam texture was present at 11 soil sites out of 29 and only two sites had a potential to be more slowly permeable, one with silty clay and the other a clay texture. A more complete description of this survey was provided in a May 28, 2010 technical memorandum from Caltrans to CDFG and USFWS (Caltrans 2010b). Most of the soils observed at these sites are generally moderately to moderately slowly permeable, suggesting that the wetlands supporting PLHO are sustained by a high water table from an unconfined aquifer and not by a shallow perched water table.

Table 6. Summary of Soil Surface Layer Texture in Soil Pits in the Vicinity of North Coast Semaphore Grass Occurrences in Little Lake Valley

Soil Texture	Number of Sites with Similar Texture
City of Willits and Huffman Parcels	
Clay loam	11
Loam	3
Silt loam	1
Silty clay	1
Lusher Parcel	
Loam	4
Sandy loam	2
Evans and Frost Parcels	
Clay loam	3
Gravelly clay loam	1
Hebrard Parcel	
Clay loam	2
Loam	5
Arkelian Parcel	
Clay loam	6
Silty clay	1
Goss and MGC Plasma North Parcels	
Clay loam	11
Loam	8
Silty clay	3
Silty clay loam	6
Clay	1

2 Methods

The July 2010 soil evaluation to determine proposed wetland establishment site suitability was conducted on July 19 and 27-30 by a soil scientist. Soil pits were excavated at the wetland establishment site, the adjoining existing wetlands, and near the wetland reference monitoring site (Figures 1-4 and Appendix B-1) on the offsite mitigation parcels where wetland establishment is proposed: Ford, Goss/MGC Plasma Middle/MGC Plasma North, Niesen, and Watson East.

The number and location of the soil pits to be evaluated were determined in advance of the field work by considering the size and shape of the wetland establishment site, the type(s) of existing wetlands in the vicinity of the wetland establishment site, and the range of soils as mapped by the NRCS occurring within the establishment site and vicinity. Upon field review of conditions, the number and locations of the pits were adjusted to ensure that the pits would be representative of the range of conditions in the proposed wetland establishment sites and adjoining existing wetlands.

At a given establishment site, the existing wetland pits were excavated and described before the establishment site pits in order to provide a basis for assessing the suitability of the upland pit sites for wetland establishment.

The pits were excavated either using a sharpshooter shovel or a backhoe. The sharpshooter pits were excavated to 20 to 28 inches depth. The backhoe pits were excavated to 24 to 104 inches depth, with the deeper pits being excavated on the Ford and Niesen parcels where fill material was present on top of the native soil.[3] Table 7 summarizes the types and locations of pits excavated. The depth of excavation was based on the grading plan depth for the wetland establishment sites, plus an additional 12 more to assess soil characteristics below the targeted finish grade (Appendix D in June 2010 Mitigation and Monitoring Proposal [Caltrans 2010c]).

Table 7. Summary of Soil Pits Excavated In Wetland Establishment Sites and Adjoining Existing Wetlands

	Number of Pits	
Parcel	Wetland Establishment Sites	Existing Wetlands
Watson East		
Northern site	6 (all backhoe)	3 (all backhoe)
Southern site	6 (all backhoe)	5 (all backhoe)
Goss		
MGC Plasma Middle	13 (all sharpshooter)	6 (all sharpshooter)
MGC Plasma North		
Ford	4 (all backhoe)	4 (all sharpshooter)
Niesen	10 (all backhoe)	5 (all backhoe)
Total	**39**	**23**

Note: Included in the pits at the Goss/MGC Plasma Middle/MGC Plasma North parcels were two detailed soil profiles (numbers 18 and 19) that were described for the spring 2010 soil evaluations (PLHO study).

The following information was recorded for the soil profiles exposed in the soil pits on data forms developed specifically for this soil suitability study (Appendix A): horizon type and thickness; texture; structure; organic matter content (inferred)[4]; redoximorphic feature abundance, size, contrast, type, and location; and permeability (inferred). The soil organic matter content was inferred based on color, abundance of very fine roots, and presence of granular structure. Soil permeability was inferred by correlating texture to the saturated hydraulic conductivity range provided in the USDA soil survey (Howard and Bowman 1991), which was then correlated to the (qualitative) permeability class using the previous version of the Soil Survey Manual (Soil Survey

[3] Before excavation, Underground Service Alert (USA) was contacted to determine the possible presence and location of underground utilities at the Niesen and Ford wetland establishment sites due to the depth of soil pit excavation.

[4] The organic matter content ratings of low, medium, and high as used in this evaluation should be regarded as approximate and relative to other soils occurring at the wetland establishment sites.

Staff 1951).[5] Table 8 shows the inferred relationships between soil texture, saturated hydraulic conductivity, and permeability.

Table 8. Estimated Conversion between Soil Texture and Saturated Hydraulic Conductivity

Soil Texture	Saturated Hydraulic Conductivity (inches/hour)	Inferred Permeability Class
Clay	0.06–0.2	Very slow
Silty clay	0.06–0.2	Slow
Clay loam	0.2–0.6	Moderately slow
Loam	0.6–2.0	Moderate
Gravelly loam	2.0–6.0	Moderately rapid

Note: Not all textural classes observed during the field evaluation are shown.

Source: Howard and Bowman 1991, Soil Survey Staff 1951.

In addition to the soil profile descriptions, the following site characteristics were recorded on the data forms: land surface shape, landform, slope gradient, whether the pit was located in an existing wetland or in wetland establishment site, depth to soil saturation, presence of a biotic crust and drift lines, proximity to existing wetlands, and other characteristics that may have provided further indications as to the suitability for wetland establishment at the site.

Lastly, the following information was also recorded on the data forms: soil map unit as mapped in the NRCS soil survey, soil series observed, and digital image code for representative soil profiles. Digital images were taken at soil pits with representative soil profiles (Appendix B) and GPS coordinates were taken for each soil pit.

The above soil, hydrologic (as evidenced by redox features and other indirect indicators of wetland hydrology), and site characteristics, as well as the composition of the existing vegetation, were considered in evaluating the likelihood that wet meadow and/or mixed marsh habitat will establish in the immediate vicinity of each pit as a result of implementing the grading plan provided in the MMP (Caltrans 2010c). Each soil pit was given a suitability rating of low, medium, or high, or rated at intermediate levels between these primary ratings. The suitability rating is qualitative and based on professional judgment. Rather than using a fixed set of quantitative suitability criteria that would be applied to all the establishment sites, each evaluation was instead made on a site-by-site basis, in which the observed soil and site characteristics in wetlands adjacent to a given establishment site were used as points of reference only to the pits in the adjoining wetland establishment site. This was done in recognition of the fact that each establishment site differs with respect to the type and degree of influence of wetland hydrology, a primary factor in determining wetland establishment suitability (Caltrans 2010a).

[5] Since approximately 2003, the NRCS has used saturated hydraulic conductivity (expressed in inches per hour) as the primary way of describing the rate at which liquids, gases, and plant roots move through a soil layer. However, the term "permeability" is used in this technical memorandum for ease of use.

3 Results and Discussion

The soil pit locations are shown in Figures 1-4. The data forms are provided in Appendix A. Representative digital images taken at the pits are provided in Appendix B.

3.1 Ford Offsite Mitigation Parcel

3.1.1 Existing Wetlands

The wetlands that occur adjacent to the establishment site at the Ford offsite mitigation parcel occur on an overall planar floodplain. The wetlands exist below the elevated "bench" of the establishment site.

Based on the four pit excavations made in the existing wetlands, the subsoils range from sandy loam to silty clay and show the stratification expected in the floodplain environment in which the soils formed. All of the soils had redox features beginning within three inches of the surface and all had redox features in the subsoil, suggesting the presence of a seasonal high water table. These wetlands had been delineated as mixed marsh and wet meadow.

The existing wetlands appear to be sustained by a high water table and shallow flooding, based on the presence of redox features throughout the profile, a biotic crust, and sediment deposits.

3.1.2 Wetland Establishment Site

The four soil pits excavated in the establishment site show that the fill material consists of a heterogeneous mixture of gravelly loam, lumber waste, tree bark, and ash approximately 52 to 80 inches thick. (Appendix B-7). The native soil beneath the fill material was clay loam or silty clay loam. The upper boundary of the native soil appeared to be roughly level with that of the surrounding, existing wetlands. Redox features were observed in only one of the underlying native soils; however, this may be a result of the soil being permanently anerobic under the fill material, which would tend to produce the more gleyed-like colors observed. (Appendix B-8). Based on the lack of soil structure that is normally associated with a surface layer in the native soil material, it is possible that the upper part of the native soil profile was first removed before placement of the fill material, exposing a substrate layer without redox features.

Groundwater was observed in two of the pits, at 60 and 98 inches depth, respectively.

3.1.3 Suitability Evaluation

All the soil pits were rated as having a "medium-high" suitability because native alluvial, marsh-type soil material exists at the elevation of the proposed finish grade. Further, the buried native soils were saturated or very moist to the depth excavated. It is expected that once wetland construction is complete, the established wetland will be supported primarily by a high water table that will lead to moist soil conditions in the root zone of plants. Occasional overbank flows from Outlet Creek are expected to also provide hydrology to the site, based on the wetland hydrology indicators described above for the existing wetlands.

3.2 Goss/MGC Plasma Middle/MGC Plasma North Offsite Mitigation Parcels

3.2.1 Existing Wetlands

The wetlands that occur adjacent to the establishment site on the Goss/MGC Plasma Middle/MGC Plasma North offsite mitigation parcels occur on an overall planar alluvial fan and alluvial plain. Some of the wetlands occur on locally planar surfaces, others occur in subtle shallow depressions, while the remainder occur in swales. The wetlands exist upgradient, lateral to, and downgradient of the establishment site.

Based on the six pit excavations made in the existing wetlands, all but one had a clay loam or silty clay loam subsoil. The other soil had a fine sandy clay subsoil in which the upper boundary is approximately 13 inches beneath the surface. Most of the soils had redox features in the surface layer and all had redox features in the subsoil (Appendices B-2 and B-5), suggesting the presence of a seasonal high water table.

Depending on microtopographic location, the wetlands appear to be sustained by a high water table, sheetflow runoff (into depressional and planar areas), and locally, the slowly permeable subsoils.

3.2.2 Wetland Establishment Site

The soils in the establishment site had subsoil textures ranging from gravelly clay loam to clay. Of the 13 soil pits excavated, redox features were present in the surface layer of approximately half the pits. This suggests that saturation presently occurs at the soil surface at these sites and could be the result of soil compaction caused by livestock. Redox features were present in the subsoils in all but one of the soils (Appendix B-11), which suggest the presence of a water table at this depth. One soil profile (soil pit number 5) was clay nearly to the surface (Clear Lake clay) (Appendix B-6) and was the only Vertisol observed during the evaluation.

3.2.3 Suitability Evaluation

All the sites were rated as having a “medium” or higher suitability because one or more of the following characteristics were present at each pit site: favorable microtopograpy, redox features either at the surface or at depth, a restrictive layer, and hydrophytic species. It is expected that once wetland construction is complete, the established wetland will be sustained by a combination of a high water table (either the local water table or a perched water table), and local surface water from incident precipitation and upslope runoff contributions, depending on the location within the establishment site.

3.3 Niesen Offsite Mitigation Parcel

3.3.1 Existing Wetlands

The wetlands that occur adjacent to the establishment site at the Niesen offsite mitigation parcel occur on an overall planar alluvial fan and alluvial plain. The wetlands exist below the elevated "bench" of the establishment site.

Based on the five pit excavations made in the existing wetlands, the subsoils are mostly clay loam; one had a clay subsoil in which the upper boundary is 12 inches beneath the surface. All of the soils had redox features beginning within three inches of the surface (Appendix B-4) and all had redox features in the subsoil, suggesting the presence of a seasonal high water table.

The wetlands appear to be primarily sustained by a high water table.

3.3.2 Wetland Establishment Site

Gravelly to loamy fill material, ranging from 6 to 99 inches thick, was observed in most of the pits excavated in the establishment site. (Appendices B-9 and B-10). Two pits had fill material mixed into the surface layer of the native soil and in two pits, no fill material was detected. The native soil beneath the fill material ranged from silt loam to silty clay loam. The depth to the upper boundary of the native soil appeared to be roughly level with that of the surrounding, existing wetlands. Redox features were observed in most of the native soils below the fill material.

In the pit located downslope of the stock pond, groundwater was observed 40 inches depth. It is assumed that this water was a result of seepage from the pond.

3.3.3 Suitability Evaluation

All the sites were rated as having a "medium" or higher suitability because native alluvial, marsh-type soil exists at the elevation of the proposed finish grade, most of which have redox features in the buried topsoil layer. It is expected that once wetland construction is complete the established wetland will be sustained primarily by a high water table.

3.4 Watson East Offsite Mitigation Parcel

3.4.1 Watson East—North Establishment Site

3.4.1.1 Existing Wetlands

The existing wetland that adjoins the north establishment site on the Watson East offsite mitigation parcel occurs in a broad swale that begins east of the establishment site and continues along the southern boundary of the establishment site. The swale is roughly 1 to 1.5 feet below the existing grade of the north establishment site.

Based on the three soil pit excavations made in the existing wetland, the soils all have a slowly permeable subsoil ranging from a silty clay to a light clay, whose upper boundary is 9 to 24 inches beneath the surface. Redox features were present in the surface layer (Appendix B-3), but were absent in one pit below nine inches depth and absent in part of the subsoil in another pit. It is unknown whether the absence of redox in some of the subsoils of these pits was due to the fact the wetlands are supported by surface water, or have oxygenated, lateral-flowing groundwater that precludes the formation of redox features (less likely).

The existing wetlands appear to be sustained by sheetflow runoff and possibly by groundwater contributions from the adjoining uplands, and the slowly permeable soils. Additionally, as evidenced by a drift line that extends just upslope of the wetland boundary, the wetland may also be supported to a degree by floodwaters backing up from the lower end of Little Lake Valley and up into the swale.

3.4.1.2 Wetland Establishment Site

The soils in the establishment site had subsoil textures ranging from clay loam to light clay. Of the six soil pits excavated, redox features were present in the surface layer in five of the pits (Appendix B-12) and some of the profiles had redox in the subsoil. This suggests that saturation presently occurs at the soil surface and could be the result of soil compaction caused by livestock. Redox features were also present in some of the subsoils.

3.4.1.3 Suitability Evaluation

Four of the six soil pit sites were rated as having a “medium” suitability and two were rated as having a “low-medium” suitability. The two low-medium soil pit sites are positioned higher on the alluvial fan and therefore may have less favorable hydrologic support than the other pits positioned lower on the alluvial fan. It is expected that, once wetland construction is complete, the established wetland will be sustained by a combination of a high water table, upslope runoff contributions, and backwater inundation from down-valley flooding, depending on the location within the establishment site.

3.4.2 Watson East—South Establishment Site

3.4.2.1 Existing Wetlands

The wetlands that adjoin the south establishment site on the Watson East offsite mitigation parcel occur on a planar alluvial fan. The wetlands are roughly 0.5 to 1 foot below the existing grade of the south establishment site.

Based on the five pits excavations made in the existing wetlands, three have a moderately permeable subsoil of gravely clay loam. The other two have clay subsoils in which the upper boundary is approximately 16 inches beneath the surface. All of the soils had redox features in the surface layer and in some of the soils the redox features extended into the subsurface and subsoil horizons. It is unknown whether the absence of redox in some of the subsoils of these pits was due to the fact the wetlands are supported by surface water, or have oxygenated, lateral-flowing groundwater that precludes the formation of redox features (less likely).

The existing wetlands appear to be sustained by sheetflow runoff and possibly by groundwater contributions from the adjoining uplands, and locally, the slowly permeable soils. Additionally, as evidenced by a drift line that extends into the part of the wetland to the west of the establishment site, part of the wetland may also be supported to a degree by floodwaters backing up from the lower end of Little Lake Valley.

3.4.2.2 Wetland Establishment Site

The soils in the establishment site had subsoil textures ranging from gravelly loam to silty clay loam. Of the six soil pits described, redox features were present in the surface layer in all the pits. This suggests that saturation presently occurs at the soil surface and could be the result of soil compaction caused by livestock. Redox features were generally absent in the subsoils.

3.4.2.3 Suitability Evaluation

All but one soil pit was rated as having a "medium" or higher suitability. The other site was rated as having a "low-medium" suitability. The low-medium site is positioned higher on the alluvial fan and therefore may have less favorable hydrologic support than the other pits positioned lower on the alluvial fan. It is expected that once wetland construction is complete, the established wetland will be sustained by a combination of local surface water from incident precipitation, upslope runoff contributions, and by backwater inundation from down-valley flooding, depending on the location within the establishment site.

4 Conclusions

Based on published soil survey data, data collected from wetland delineations and the PLHO soil evaluations, and soil/site data collected specifically for this evaluation, it appears that most of the existing wetlands at the offsite mitigation parcels are primarily supported by the presence of a high water table, rather than primarily by a perched water table over a subsurface restrictive layer. However, depending on the wetland establishment site, "backwaters" from down-valley flooding, and/or a perched water table also appear to contribute the existing wetlands' hydrology locally.

This conclusion is consistent with the conclusions of the hydrologic study (Caltrans 2010a) of the establishment parcels, which observed that because there are relatively few soils with slow to very slow permeability (e.g., clay), it is likely that most of the existing wetlands are primarily sustained by local aquifer conditions (Caltrans 2010a). The hydrologic study also observed that field observations of local drainageways and topographic conditions suggest that a few of the wetlands also may benefit from lateral movement of groundwater into the subsurface layer and subsoil of the wetlands (Caltrans 2010a).

At the Ford and Niesen parcels, the present evaluation has determined that it will be feasible to establish wet meadow and mixed marsh habitat by removing the fill material to an elevation that is roughly the same as that of the adjoining, existing wetlands, such that the establishment site will be subject to a seasonal high water table level and periodic flooding. The soil pits excavated in support of this evaluation show that the native topsoil layer exists beneath the fill material, at a level that is approximately at the proposed finish grade of the established wetlands.

At the Goss/MGC Plasma Middle/MGC Plasma North parcels, the present evaluation has determined that it will be feasible to establish wet meadow habitat by lowering the grade such that it will be closer to the seasonal high water table and by creating a more planar-to-broadly concave slope shape that tends to "collect" runoff rather than "shedding" it. A perched water table may form locally. The presence of hydrophytic species and some soil redox features at the soil pits suggest existing mesic conditions, such that the proposed grading will be sufficient to establish a dominance of hydrophytes and wetland hydrologic conditions.

At the Watson East parcel, the present evaluation has determined that it will be feasible to establish wet meadow habitat by lowering the grade such that it will be closer to the seasonal high water table and by creating a more planar-to-broadly concave slope shape that tends to "collect" runoff rather than "shedding" it. A perched water table may form locally. The grading is also expected to make the downslope parts of both establishment sites subject to inundation by occasional backwater flooding from down-valley. The presence of hydrophytic species and some soil redox features at the soil pits suggest existing mesic conditions, such that the proposed grading will be sufficient to establish a dominance of hydrophytes and wetland hydrologic conditions.

5 Citations

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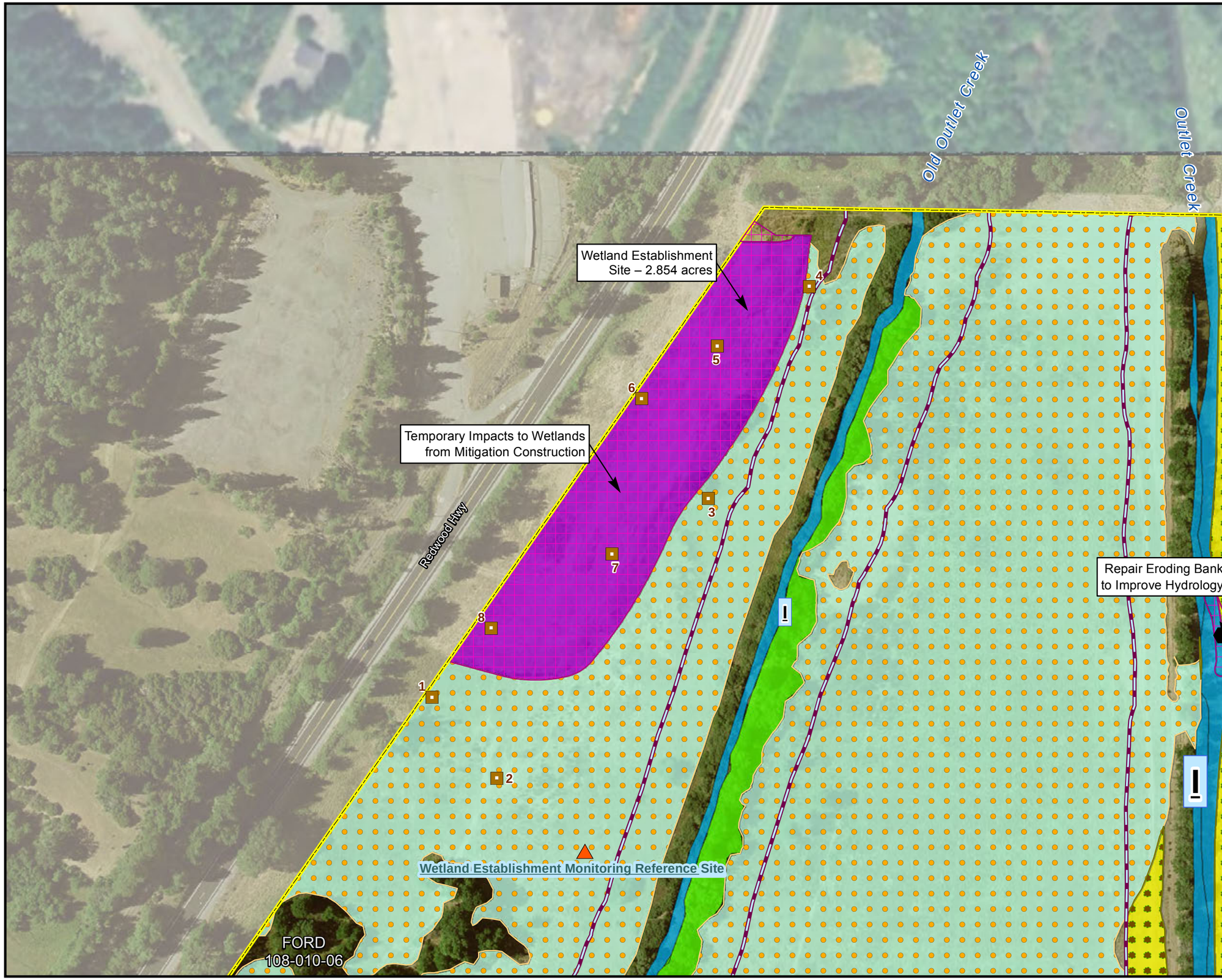


Offsite Mitigation Parcel

Habitat Mitigation Type

- Riparian Establishment
- Wetland Establishment
- Oak Woodland Establishment
- Riparian Enhancement
- Wetland Enhancement
- Other Waters Enhancement

Mitigation Actions

- Improve Hydrology (Grading)
- Headcut or Eroding Bank
- Control Invasive Plants
- Plant Oaks
- Plant Riparian
- Implement Grazing Plan
- Monitoring Reference Site
- Soil Pit Location

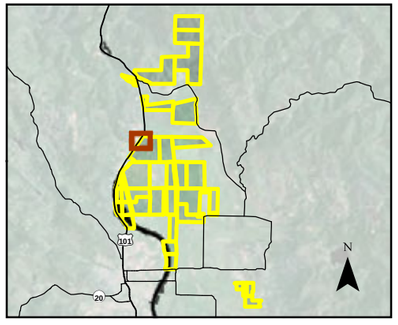
Riparian Corridors

- Category I Riparian Corridor
- Category II Riparian Corridor
- Category III Riparian Corridor

Project Bypass Footprint

- Permanent Impact Area
- Temporary Impact Area
- Right of Way

N



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Scale in Feet

Figure 1
Mitigation Actions
Ford
APN 108-010-06

Proposed Willits Bypass
Riparian, Wetland, and Oak
Establishment and Enhancement

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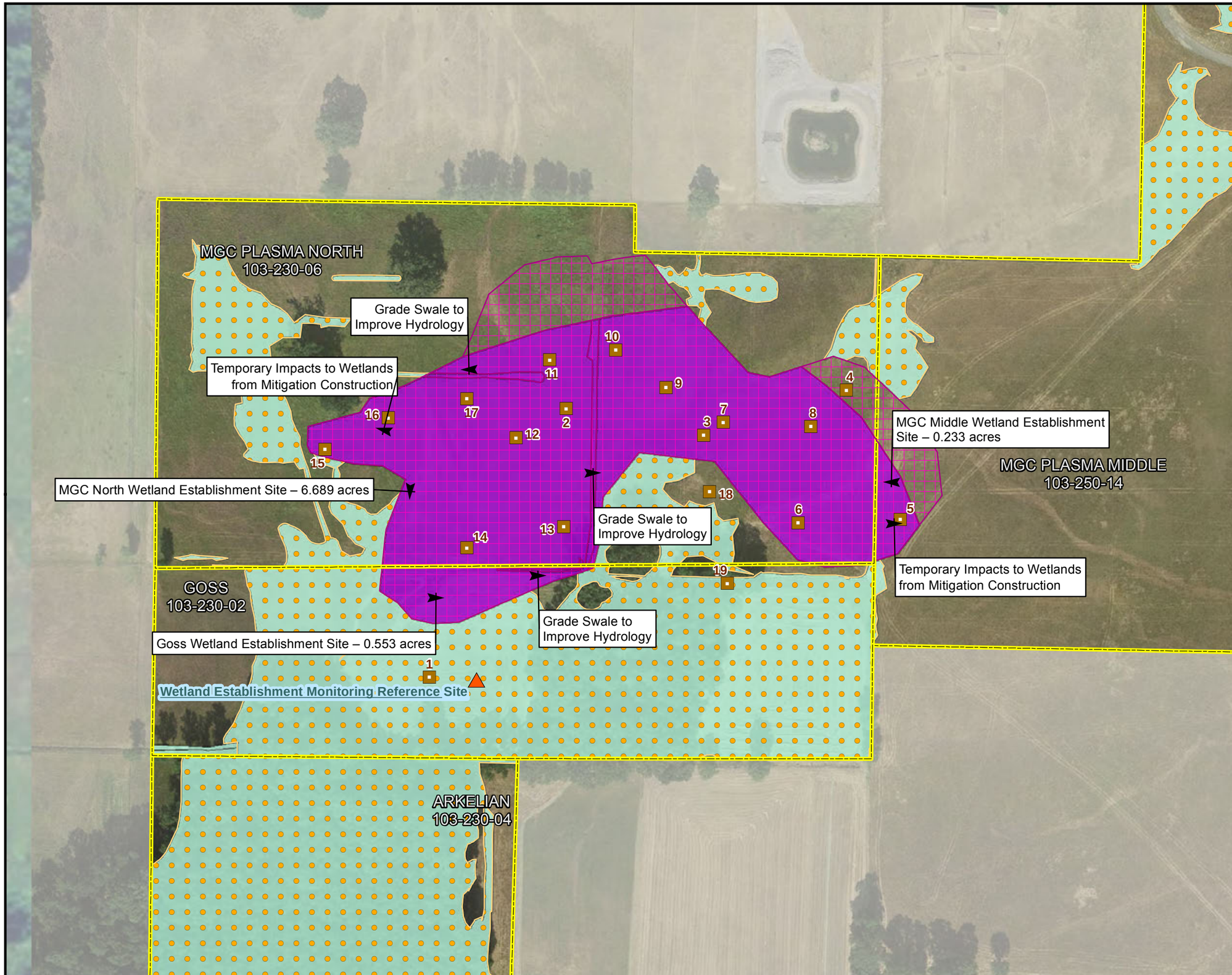


Offsite Mitigation Parcel

Habitat Mitigation Type

- Riparian Establishment
- Wetland Establishment
- Oak Woodland Establishment
- Riparian Enhancement
- Wetland Enhancement
- Other Waters Enhancement

Mitigation Actions

- Improve Hydrology (Grading)
- Headcut or Eroding Bank
- Control Invasive Plants
- Plant Oaks
- Plant Riparian
- Implement Grazing Plan
- Monitoring Reference Site
- 7 Soil Pit Location

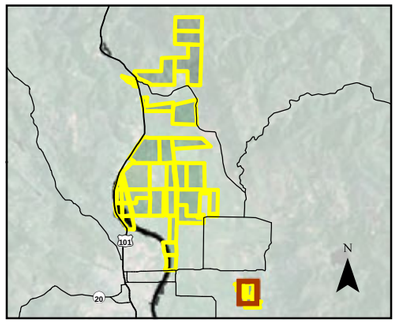
Riparian Corridors

- Category I Riparian Corridor
- Category II Riparian Corridor
- Category III Riparian Corridor

Project Bypass Footprint

- Permanent Impact Area
- Temporary Impact Area
- Right of Way

N



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Scale in Feet

Figure 2
Mitigation Actions
Goss & MGC Plasma
103-230-02, 103-230-06, & 103-250-14

Proposed Willits Bypass Riparian, Wetland, and Oak Establishment and Enhancement

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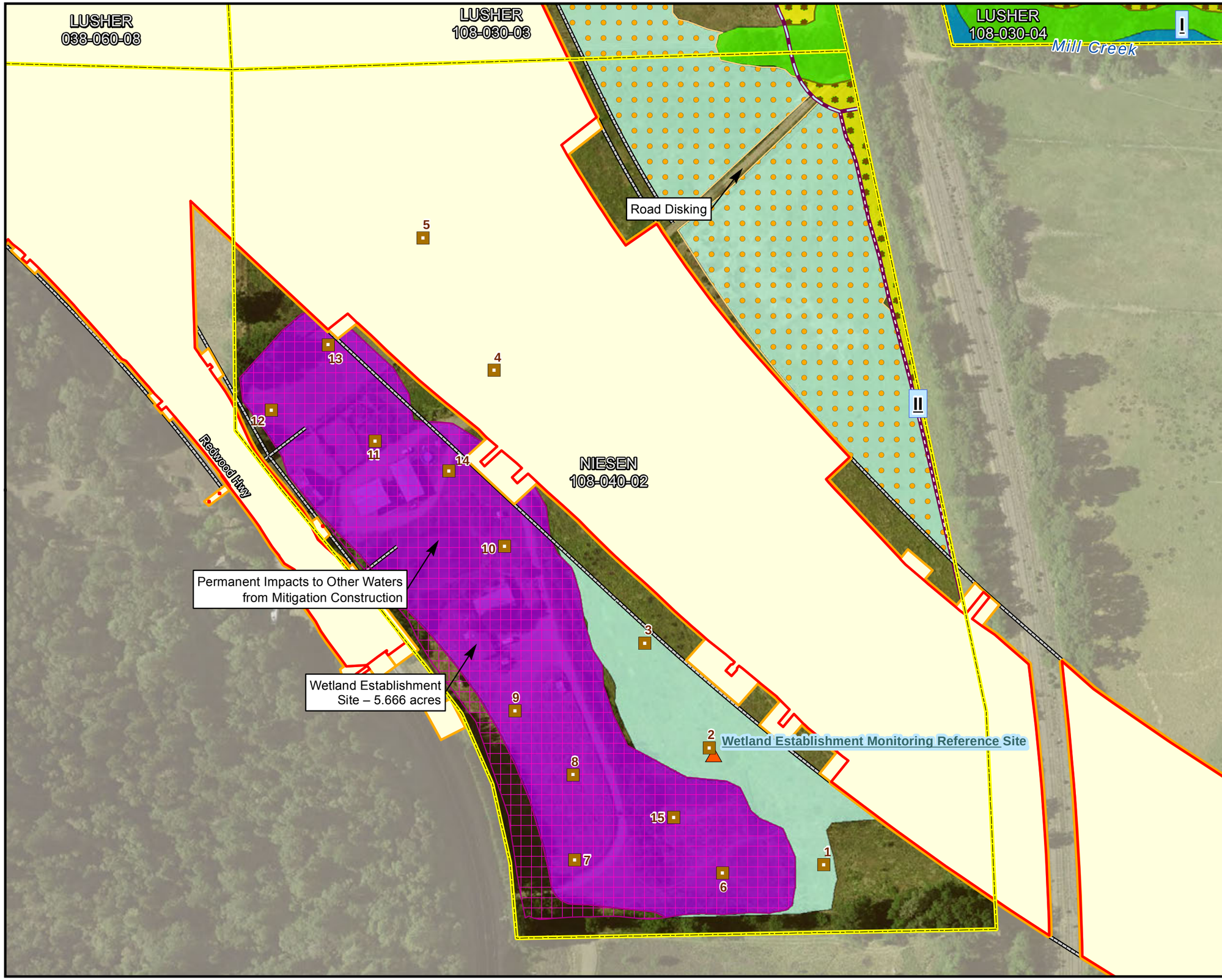


Offsite Mitigation Parcel

Habitat Mitigation Type

- Riparian Establishment
- Wetland Establishment
- Oak Woodland Establishment
- Riparian Enhancement
- Wetland Enhancement
- Other Waters Enhancement

Mitigation Actions

- Improve Hydrology (Grading)
- Headcut or Eroding Bank
- Control Invasive Plants
- Plant Oaks
- Plant Riparian
- Implement Grazing Plan
- Monitoring Reference Site
- 7 Soil Pit Location

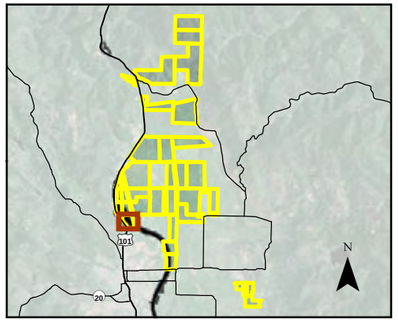
Riparian Corridors

- Category I Riparian Corridor
- Category II Riparian Corridor
- Category III Riparian Corridor

Project Bypass Footprint

- Permanent Impact Area
- Temporary Impact Area
- Right of Way

N



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Scale in Feet

Figure 3
Mitigation Actions
Niesen
APN 108-040-02

Proposed Willits Bypass
Riparian, Wetland, and Oak
Establishment and Enhancement

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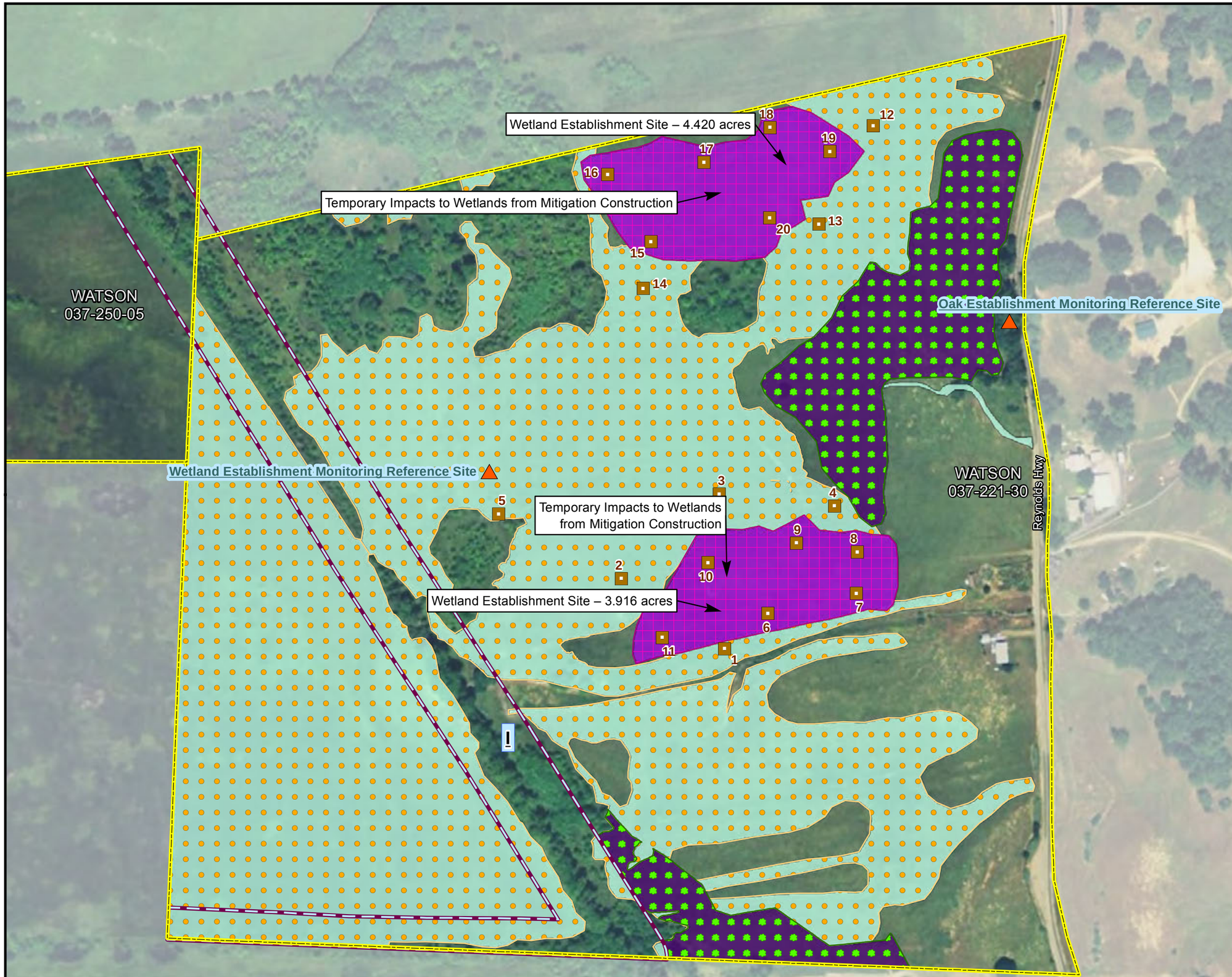


Offsite Mitigation Parcel

Habitat Mitigation Type

- Riparian Establishment
- Wetland Establishment
- Oak Woodland Establishment
- Riparian Enhancement
- Wetland Enhancement
- Other Waters Enhancement

Mitigation Actions

- Improve Hydrology (Grading)
- Headcut or Eroding Bank
- Control Invasive Plants
- Plant Oaks
- Plant Riparian
- Implement Grazing Plan
- Monitoring Reference Site
- Soil Pit Location

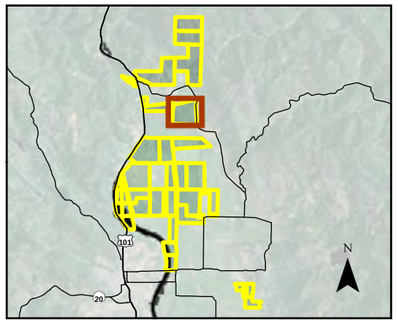
Riparian Corridors

- Category I Riparian Corridor
- Category II Riparian Corridor
- Category III Riparian Corridor

Project Bypass Footprint

- Permanent Impact Area
- Temporary Impact Area
- Right of Way

N



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Scale in Feet

Figure 4
Mitigation Actions
Watson
APN 037-221-30

Proposed Willits Bypass
Riparian, Wetland, and Oak
Establishment and Enhancement

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Appendix A

Data Forms

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 1
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex Slightly hummocky	Landform: alluvial fan low terrace swale <u>floodplain</u> basin Slope Gradient (%): 2
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed: Haplaquepts
General Comments: Elevated ~ 6" above area to southeast.	
Jurisdictional Status at Pit: <u>existing wetland</u> (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	gr, 2	High	None	Mod – slow	
3-11	A2	cl	abk, 1	Mod	c, m/f, D, Fe-x, RC & M	Mod –slow	A2 contains highly weathered sandstone fragments
11-26	Bw	cl	m	Low	m, m, P, Fe-x, M	Mod – slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 2
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: alluvial fan low terrace swale <u>floodplain</u> basin Slope Gradient (%): 0-1
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed: Haplaquepts
General Comments: Moderate biotic crust	
Jurisdictional Status at Pit: <u>existing wetland</u> (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 27
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0 – 1	A1	cl	gr,2	High	m, f, D, Fe-x, RC	Mod – slow	
1 – 15	A2	cl	m	Mod	m, m, D, Fe-x, M/PL	Mod – slow	
15 – 19	Bw1	l	m	Low	m, c, D, Fe-x, M	Mod	10% gravel
19 – 27	Bw2	sl	m	Low	c, m, F, Fe-x, M	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 3
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: 0220 (knife at bottom of A2)	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: alluvial fan low terrace swale <u>floodplain</u> basin Slope Gradient (%): 0-1
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed: Haplaquepts
General Comments: weak biotic crust	
Jurisdictional Status at Pit: <u>existing wetland</u> (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 31
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0 – 1	A1	cl	abk, 2	High	None	Mod – slow	
1 – 10	A2	sicl	abk, 1	Mod	m, m, D, Fe-x, M	Mod – slow	
10 – 21	Bw	sil	m	Low	m, m, D, Fe-x & D, M	Mod	
21 – 24	C1	ls	sg	Low	c, m, F, Fe-x, M	Mod – rapid	
24 – 31	C2	sil	m	Low	c, m, D, Fe-x, M+m, c, D, D, M	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 4
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex Slightly hummocky	Landform: alluvial fan low terrace swale <u>floodplain</u> basin Slope Gradient (%): 0-2
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed: Haplaquepts
General Comments: Sediment deposits; 30' east of edge of overburden	
Jurisdictional Status at Pit: <u>existing wetland</u> (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): free water in pit at 31
Depth to Restrictive Layer (in.): 1" (slightly restrictive)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	cl	gr, 1	High	None	Mod – slow	
1-7	A2	sic	m	Mod	m, m, D, Fe-x, M	Slow	
7-17	Bw1	sic	m	Low	m, m, D, Fe-x, M+PL	Slow	
17-22	Bw2	sil	m	Low	m, m, D, Fe-x, M	Mod	
22-32	Bw3	sic	m	Low	m, m, D, Fe-x, M	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 5
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0230	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill area with in flood plain area
	Slope Gradient (%): 0-2
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed: N/A
General Comments: Native soil may have been truncated before fill placement	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 98
Depth to Restrictive Layer (in.): 80 (Ab somewhat restrictive)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-80	FILL	grl	m	High	None	Mod	Ashy/burnt consistency; high bark and wood content
80-98	Ab	sic	m	Unknown	f, m, D, Fe-x, PL	Slow	Very moist

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 6
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0231	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill within alluvial fan Slope Gradient (%): 3-5
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed:
General Comments: native soil may have been truncated prior to fill placement	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): 94
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-49	FILL1	vgsl	m	Low	None	Mod – rapid	
49-72	FILL2	wood	m	High	None	---	Bark and lumber
72-91	Ab	sicl	m	Unknown	None	Mod – slow	Very moist

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 7
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill area within flood plain Slope Gradient (%): 0-3
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed: undetermined
General Comments: native soil may have been truncated before fill placement	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 57
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-52	FILL	grsl	m	Low	None	Mod – rapid	Contains lumber and tree bark
52-57	Ab	sicl	m	Unknown	None	Mod – slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Ford	Pit No.: 8
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0226 & 0228 (knife not at a horizon boundary)	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill area within alluvial fan
	Slope Gradient (%): 7
Soil Map Unit: Haplaquepts, 0 to 1% slopes (133)	Soil Series as Observed:
General Comments: Fill material also contains telephone pole and t-post; native soil may have been truncated before fill placement	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): 69
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-58	FILL	grl and cl	m	Low	None	Mod – mod slow	Mixed with wood fragments; angular gravel
59-69	Ab	sicl	m	Unknown	None	Mod - slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 1
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole
General Comments: In distal part of alluvial fan	
Jurisdictional Status at Pit: <u>existing wetland</u> (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	Ap	sil	gr, 3	Mod	None	Mod	
4-11	A	cl	sbk, 2	Mod	c, 2, F, Fe-x, M	Mod – slow	
11-26	Bt	cl	sbk, 2	Low	c, 2, F, Fe-x, M	Mod - slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 2
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: 0184, 0186	

Land Surface Shape: <u>(slightly)</u> planar <u>concave</u> convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 3
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: <u>existing wetland</u> (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 28
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	l	gr, 2	Mod	c, l, D, Fe-x, RC	Mod	
3-11	A2	l	sbk, 1	Mod	c, 2, D, Fe-x, M	Mod	
11-21	Bt1	cl	sbk, 2	Mod – low	c, 2, D, Fe-x, M	Mod – slow	
21-28	Bt2	cl	sbk, 2	Low	c, 2, P, Fe-x, M	Mod - slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 3
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex Broad swale	Landform: alluvial fan low terrace (swale) floodplain basin Slope Gradient (%): 2-3
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland (Near wetland/non-wetland boundary)	Depth to Soil Saturation (in.): None to 24
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	gr, 2	Mod	c, l, D, Fe-x, RC	Mod	
2-10	A2	l	abk, 2	Mod	c, l, D, Fe-x, M	Mod	
10-15	Bt1	sicl	abk, 1	Mod-Low	c, l, D, Fe-x, M	Mod – slow	5% gravel
15-24	Bt2	sicl	abk, 1	Low	c, l, D, Fe-x, M	Mod – slow	5% gravel

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 4
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0188 Knife at top of Bt1	

Land Surface Shape: (slightly) planar concave convex Broad, poorly-defined swale	Landform: alluvial fan low terrace (swale) floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole; trending slightly towards Clear Lake
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 23
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A	l	gr, 2	Mod	c, l, F, Fe-x, RC	Mod	
6-9	Bt1	cl	abk, 3	Mod-Low	None	Mod – slow	
9-23	Bt2	sicl	abk, 3	Low	c, 2, D, Fe-x, M	Mod – slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size
1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location
M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 5
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: 0190	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: alluvial fan low terrace swale floodplain <u>basin</u>
	Slope Gradient (%): 1-2
Soil Map Unit: Clear Lake clay, 0 to 2% slopes (112)	Soil Series as Observed: Clear Lake
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 23
Depth to Restrictive Layer (in.): 1	Overall Soil and Site Suitability for Wetland Establishment: low medium <u>high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	l	gr, 1	High	None	Mod	
1-9	A2	c	abk, 3	Mod	None	Very slow	
9-23	Bss	c	pr, 3	Mod	m, 2, D, Fe-x, M	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 6
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: Clear Lake clay, 0 to 2% slopes (112)	Soil Series as Observed: undetermined
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 24
Depth to Restrictive Layer (in.): 12	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	cl	gr, 2	Mod-high	none	Mod slow	
2-12	A2	cl	abk, 2	Mod	f, 2, F, Fe-x, M	Mod slow	
12-24	Bt	c-	abk, 3	Mod	f, 2, F, Fe-x, M	Very slow	10% gravel

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 7
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9	A	cl	abk, 1	Mod	m, 2, D, Fe-x, M	Mod slow	
9-26	Bt	sicl	abk, 2	Low	m, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 8
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: 0192	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 23
Depth to Restrictive Layer (in.): 13	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-13	A	cl	abk, 1	Mod	c, l, D, Fe-x, M	Mod. Slow	
13-33	Bt	sic	abk, 3	Low-Mod	m, 2, D, Fe-x, M	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 9
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: undetermined
General Comments: shift in veg to drier species; unusual profile	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 20
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium <u>high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	abk, 1	Mod	c, l, D, Fe-x, RC	Mod	
4-9	A2	grl	m	Mod	c, 2, D, Fe-x, M	Mod rapid	15% gravels, 10% cobbles
9-20	Btss	vgrc+	pr, 1	Low	c, 2, D, D, M	Very slow	Reddish brown matrix; 25% gravels, 15% cobbles

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 10
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole
General Comments: Bt horizon is slightly moist	
Jurisdictional Status at Pit: existing wetland (reference) <u>wetland-upland transition</u> upland	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium <u>high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A1	l	gr, 1	Mod	c, l, D, Fe-x, RC	Mod	
6-16	A2	l	abk, 2	Mod	c, 2, D, Fe-x, M	Mod	
16-26	Bt	cl	abk, 1	Low	c, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss–MGC Plasma	Pit No.: 11
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole transitioning toward Gielow
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium <u>high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	gr, 1	Mod	c, l, D, Fe-x, RC	Mod	
4-18	A2	l	abk, 1	Mod	c, 1+2, D, Fe-x, M+RC	Mod	
18-26	Bt	sicl	m	Low	M, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 12
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 24
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	sil	abk, 2	Mod	c, l, D, Fe-x, RC	Mod	
4-15	A2	sil +	abk, 2	Mod-low	c, 2, D, fe-x, M	Mod	
15-24	Bw	cl	abk, 1	Low	M, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 13
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 2
Soil Map Unit: Clear Lake clay, 0 to 2% slopes (112)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 24
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	gr, 2	Mod	None	Mod	
4-12	A2	cl	abk, 1	Mod	c, 2, D, Fe-x, M	Mod slow	
12-24	Bt	cl	abk, 1	Low	M, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 14
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: <u>(slightly)</u> planar <u>concave</u> convex Broad, very poorly-defined swale	Landform: <u>alluvial fan</u> low terrace <u>(swale)</u> floodplain basin Slope Gradient (%): 1
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 24
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium</u> high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	gr, 2	Mod	c, l, D, Fe-x, RC	Mod	
4-11	A2	cl	abk, 2	Mod	c, 2, D, Fe-x, M	Mod slow	
11-15	Bt1	cl	abk, 2	Low - mod	None	Mod slow	
15-24	Bt2	cl	abk, 2	Low	c, 2, P, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 15
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Undetermined
General Comments: Bt horizon may be somewhat restrictive	
Jurisdictional Status at Pit: <u>existing wetland (reference)</u> wetland-upland transition upland	Depth to Soil Saturation (in.): None to 22
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	m	High	none	Mod	
2-13	A2	cl	m	Mod	c, l, D, Fe-x, M	Mod slow	
13-22	Bt	fsc	m	Low	m, 2, D, Fe-x, M	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss–MGC Plasma	Pit No.: 16
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Undetermined
General Comments: Shovel refusal at 21”. AB horizon may be somewhat restrictive	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 21
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium</u> high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	l	gr, 3	Mod	None	Mod	
1-8	A2	l	gr, 2	Mod	c, l, D, Fe-x, RC	Mod	
8-18	AB	sic	abk, 2	Mod low	None	Slow	
18-21	Bw	grcl	m	Low	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 17
Investigator(s): Joel Butterworth	Date: July 19, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 2
Soil Map Unit: Gielow sandy loam, 0 to 5% slopes (128)	Soil Series as Observed: Gielow
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 22
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium</u> high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9	A1	l	gr, 2	Mod-high	none	Mod	
9-17	A2	cl	abk, 1	Mod	c, 2, D, Fe-x, M	Mod slow	
17-22	AB	cl	abk, 1	Low	c, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 18
Investigator(s): Joel Butterworth	Date: June 14, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: 0137	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin Slope Gradient (%): 0-1
Soil Map Unit: Clear Lake clay, 0 to 2% slopes (112)	Soil Series as Observed: Cole
General Comments: Profile data originally collected for North Coast semaphore grass study (site Goss 3) All but upper 3 inches of profile moderately moist when described	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): none to 25
Depth to Restrictive Layer (in.): n/a	Overall Soil and Site Suitability for Wetland Establishment: low <u>medium</u> high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	gr, 2	Mod	none	Mod	
2-12	A2	l	sbk, 1	Mod	none	Mod	Gravel layer between 9-11 in.
12-21	Bt1	cl	m	Mod-low	m, 2, D, Fe-x, M	Mod slow	
21-25	Bt2	cl	m	Low	c, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Goss-MGC Plasma	Pit No.: 19
Investigator(s): Joel Butterworth	Date: June 14, 2010	
Method of Excavation: backhoe <u>sharpshooter</u> hand auger	Photo Number: 0140	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: <u>alluvial fan</u> low terrace swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: Clear Lake clay, 0 to 2% slopes (112)	Soil Series as Observed: Cole, trending toward Clear Lake
General Comments: Profile data originally collected for North Coast semaphore grass study (site Goss 4)	
Jurisdictional Status at Pit: <u>existing wetland (reference)</u> wetland-upland transition upland	Depth to Soil Saturation (in.): none to 26
Depth to Restrictive Layer (in.): n/a	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A	cl	sbk, 1	Mod	c, 1, P, Fe-x, PL	Mod slow	
6-11	Bt1	cl	sbk, 1	Mod	none	Mod slow	
11-20	Bt2	cl	m	Mod-low	m, 2, D, Fe-x, M	Mod slow	
20-26	Bt3	sicl	m	Low	m, 2, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 1
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0218 (knife at bottom of A1)	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments: Biotic crust present (moderate)	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 27
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	gr, 3	High	None	Mod slow	
3-17	A2	cl	abk, 3	Mod	m, m, D, Fe-x, M	Mod slow	
17-27	A3	cl	m	Low	m, m, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 2
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 1
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl-	gr, 2	Mod	None	Mod slow	
3-16	A2	cl	abk, 2	Mod	c, m, D, Fe-x, M	Mod slow	
16-26	A3	cl	abk, 1	Low	m, m, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 3
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments: Moderate biotic crust	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 26
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	cl	gr, 3	High	c, f, P, Fe-x, RC	Mod slow	
4-22	A2	cl	abk, 3	Mod	c, m, D, Fe-x, M	Mod slow	
22-26	A3	cl	m	Low	c, m, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 4
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 29
Depth to Restrictive Layer (in.): 12	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	gr, 2	High	c, f, D, Fe-x, RC	Mod slow	
3-12	A2	cl	abk, 1	Mod	c, m, D, Fe-x, M	Mod slow	
12-29	Bt	c	m	Low	m, m, D, Fe-x, M	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 5
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0219	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 28
Depth to Restrictive Layer (in.): 25	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	cl	gr, 1	High	None	Mod slow	
1-11	A2	cl	abk, 2	Mod	c, f, D, Fe-x, RC, c, m, D, Fe-x, M	Mod slow	
11-25	Bt1	sicl	m	Low	c, f, D, Fe-x, M	Mod slow	
25-28	Bt2	c	m	Low	c, f, D, Fe-x, M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 6
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill within floodplain area
	Slope Gradient (%): 2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: N/A
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 37
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-15	FILL	grl	m	Low-mod	none	mod	Angular gravels
15-28	Ab1	sicl	m	Mod	m, m, P, Fe-x, PL+M	Mod slow	
28-37	Ab2	sicl	m	Low	m, m, P, Fe-x, PL+M	Mod slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 7
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0222 and 0223 native soil buried under fill material	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill within overall alluvial fan
	Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: N/A
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 104
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-49	FILL1	vgrl	m	Low-mod	None	Mod rapid	
49-59	FILL2	sc	m	Low	None	Slow	Saprolitic material; variegated
59-99	FILL3	grcosc	m	Low	None	Mod slow	___
99-104	Ab	sil	m	Mod	None	Mod	Partly decomposed detritus; dark grey

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 8
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill within overall alluvial fan
	Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: N/A
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 103
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-41	FILL1	xgrsl	m	Low-mod	None	Rapid	
41-97	FILL2	lsc	m	Low	None	Mod-slow	Variegated
97-103	Ab	sil	m	Mod	f, m, f, Fe-x, M	Mod	Partly decomposed detritus

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 9
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill within overall alluvial fan area
	Slope Gradient (%): 2-3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: N/A
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 99
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-72	FILL1	xgrl	m	Low-mod	None	Rapid	
72-87	FILL2	sicl	m	Low	None	Mod-slow	Variegated; partly decomposed organic material
87-99	Ab	sicl	m	Mod	m, m, D, Fe-x, M	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 10
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex *disturbed area	Landform: alluvial fan low terrace swale floodplain basin *fill area with in overall floodplain
	Slope Gradient (%): 3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments: shallow water table probably due to adjacent stock pond seepage	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): 40*
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9	A1/FILL	cl	abk, 1	High	m, m, D, Fe-x, M	Mod-slow	Fill mixed with A horizon; 10% gravel
9-18	A2	cl	m	Mod	c, m, F, Fe-x, M	Mod-slow	
18-31	Bt	sicl	m	Low	m, m, D, Fe-x, M	Mod-slow	
31-41	BtC	vgrcl	m	Low	c, c, D, Fe-x, M	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niessen	Pit No.: 11
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill area within alluvial fan Slope Gradient (%): 3-5
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Undetermined
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): Free water at 53
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	FILL	grcl	m	Mod	c, m, D, Fe-x, M	Mod	
6-13	Ab	cl	m	Mod	c, m, D, Mn-x, M	Mod	
13-22	Bt	cl	abk, 1	Low	c, m, F, Fe-x, M	Mod	
22-53	BC	fsc	m	Low	m, m, D, Fe-x, M	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 12
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 7
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments: No fill material present	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 63
Depth to Restrictive Layer (in.): 8 (Bt somewhat restrictive)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	abk, 1	Mod	c, f, D, Fe-x, RC	Mod-slow	
3-8	A2	cl	abk, 1	Mod	None	Mod-slow	
8-29	Bt	sic	abk, 1	Low	None	Slow	
29-63	C	cl	m	Low	m, m, D, Fe-x, M	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 13
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 41
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	m	Mod	c, f+m, D, Fe-x, RC+PL	Mod-slow	
3-11	A2	cl	abk, 2	Low-mod	m,m, P, Fe-x, PL	Mod-slow	
11-21	Bt	sicl	abk, 1	Low	c, m, F, Fe-x, M	Mod-slow	
21-41	cl	cl	m	Low	c, m, F, Fe-x, M	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 14
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill area within overall alluvial fan
	Slope Gradient (%): 5
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Undetermined
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): 47
Depth to Restrictive Layer (in.): 26	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9	A1/FILL	cl	abk, 2	Mod	None	Mod-slow	Fill mixed within A1 horizon
9-26	A2	cl	m	Mod	m, m, D, Fe-x, M	Mod-slow	
26-35	Bt1	c	m	Low	m, m, D, Fe-x, M	Very slow	
35-48	Bt2	sic	m	Low	m, m, D,D, M	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Niesen	Pit No.: 15
Investigator(s): Joel Butterworth	Date: July 29, 2010	
Method of Excavation: <u>backhoe</u> sharpshooter hand auger	Photo Number: 0221	

Land Surface Shape: (slightly) <u>planar</u> concave convex	Landform: alluvial fan low terrace swale floodplain basin *fill material within floodplain area
	Slope Gradient (%): 5
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: N/A
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition <u>upland</u>	Depth to Soil Saturation (in.): None to 53
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium <u>high</u> Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-35	FILL	n/a	sg	Low	None	Mod-rapid	Buried woody material and metallic fragments
35-53	Ab	sicl	m	Low	m, m, P, Fe-x, M	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 12
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0211 (knife at top of Bt), 0212 (weathered rock fragments in A2 horizon [not redox])	

Land Surface Shape: (slightly) planar concave convex broad swale	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments: 5% gravel in A1 and A2 horizons	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 29
Depth to Restrictive Layer (in.): 21”	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	grl	High	f, f, D, Fe-x, RC	Mod	
2-21	A2	cl	abk, 2	Mod	c, f, D, Fe-x, PL	Mod-slow	
21-29	Bt	c-	m	Low	c, m, D, Fe-x, M	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 13
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 32”
Depth to Restrictive Layer (in.): 9”	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	l	m	High	m, f, D, Fe-x, RC	Mod	
1-9	A2	cl-	m	Mod	c, f, D, Fe-x, PL	Mod-slow	
9-22	Bt	c-	abk, 3	Low	None	Very slow	
22-32	BtC	grcl	m	Low	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 14
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 30”
Depth to Restrictive Layer (in.): 24” (Bt somewhat restrictive)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	gr, 2	High	c, f, F, Fe-x, RC	Mod	
4-13	A2	sicl	gr, 3	Mod	c, m, F, Fe-x, M	Mod-slow	
13-24	Bt1	sicl	abk, 3	Low	None	Mod-low	
24-30	Bt2	sic	m	Low	m, m, D, Fe-x, M	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 15
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0213 (knife at top of Bt)	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Undetermined
General Comments: Approx. 1-1.5' higher than adjacent wetland	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 31
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	gr, 1	High	c, f, D, Fe-x, RC	Mod	
2-10	A2	cl	abk, 2	Mod	None	Mod-slow	
10-20	Bt	cl	abk, 3	Low	f, m, D, Fe-x, RC	Mod-slow	
20-31	BtC	grcl	m	Low	None	Slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 16
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: undetermined
General Comments: approx. 1' higher than adjacent wetland	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 28"
Depth to Restrictive Layer (in.): 18"	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	gr, 2	High	c, f, D, Fe-x, RC	Mod	
4-10	A2	cl	abk, 3	Low-mod	None	Mod-slow	
10-18	Bt	cl	abk, 3	Low	c, m, F, Fe-x, M	Mod-slow	
18-28	BC	c-	m	Low	None	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 17
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0217 (knife at top of Bt horizon)	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Undetermined
General Comments: approx. 1.5 – 2' above adjacent wetland	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 27"
Depth to Restrictive Layer (in.): 21"	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	cl	gr, 2	Mod	c, f, D, Fe-x, RC	Mod-slow	
4-13	A2	cl	abk, 2	Mod	c, m, F, Fe-x, M	Mod-slow	
13-21	Bt	cl	abk, 1	Low	None	Mod-slow	
21-27	BC	c-	m	Low	None	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 18
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 30
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	m	Mod	c, f, F, Fe-x, RC	Mod-slow	
3-13	A2	cl	abk, 1	Mod	None	Mod-slow	
13-28	A3	cl	m	Low	None	Mod-slow	
28-30	C	cl	m	Low	None	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 19
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 4
Soil Map Unit: Feliz loam, 0 to 2% slopes (123)	Soil Series as Observed: Feliz
General Comments: Approx. 1' higher than adjacent wetland	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 36"
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	grcl	m	Mod	c, f, F, Fe-x, RC	Mod	
3-19	A2	grcl	abk, 2	Mod	None	Mod	
19-32	C1	vgrcl	m	Low	None	Mod	
32-36	C2	cl+	m	Low	None	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (North)	Pit No.: 20
Investigator(s): Joel Butterworth	Date: July 28, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 5
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz
General Comments: Approx. 1' higher than adjacent wetland	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 31"
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl	gr, 1	Mod	None	Mod-slow	10% gravel
3-15	A2	cl	m	Low-mod	None	Mod-slow	10% gravel
15-30	A3	cl	m	Low	None	Mod-slow	10% gravel
30-31	AC	cl	m	Low	f, m, D, Fe-x, M	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size
1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location
M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 1
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 037	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Feliz clay loam, gravely substratum 2 to 8% slopes (126)	Soil Series as Observed: Feliz
General Comments: about 30' south of establishment area; edge of small alluvial fan within floodplain	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 32"
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-5	A1	l	abk, 3	Mod	m, f+m, d, Fe-x, RC	Mod	
5-10	A2	grl	abk, 2	Mod	c, m, F, Fe-x, M	Mod	
10-32	A3	grcl	abk, 1	Low	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 2
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0200	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Feliz clay loam, gravely substratum 2 to 8% slopes (126)	Soil Series as Observed: Feliz, transitioning to Cole
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 25”
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	l	gr, 2	Mod	c, f, D, Fe-x, RC	Mod	
3-17	A2	l	abk, 2	Mod	None	Mod	
17-25	A3/Bt	grcl	abk, 1	Low	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 3
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0201 Knife is at top of Bt	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 2-3
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Cole
General Comments: shallow mud casts (about 1")	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 30"
Depth to Restrictive Layer (in.): 17"	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	l	gr, 3	Mod-high	c, f, D, Fe-x, RC	Mod	
4-17	A2	l	abk, 2	Mod	c, m, F, fe-x, M	Mod	
17-30	Bt	c	m	Low	m, m, F, Fe-x, M	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 4
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0202	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz grading towards Cole
General Comments: 5-10% gravel throughout	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 24”
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A1	l	gr, 1	High	c, f, D, Fe-x, RC	Mod	
6-19	A2	l+	abk, 1	Low-mod	None	Mod	
19-24	BC	grcl	abk, 1	Low	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 5
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0203 (overall), 0204 (of pit; knife at top of BT)	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 2-3
Soil Map Unit: Feliz clay loam, gravely substratum 2 to 8% slopes (126)	Soil Series as Observed: Cole transitioning to Fluvaquents
General Comments: distal part of alluvial fan; sediment deposits	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 27”
Depth to Restrictive Layer (in.): 15”	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	gr, 2	Mod-high	c, f, D, Fe-x, RC	Mod	
2-15	A2	cl	abk, 3	Mod	m, m, D, Fe-x, M	Mod-slow	
15-27	Bt	c-	m	Low	m, m, D, Fe-x, M	Very slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 6
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: None	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Feliz clay loam, gravely substratum 2 to 8% slopes (126)	Soil Series as Observed: Feliz
General Comments: Biotic crust (weak); shallow mud casts (~1"); 5-10% gravel in profile.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 29"
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: Pit is approx. 6"-12" higher than adjacent wetland to south

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	gr, 2	Mod	c, f, D, fe-x, RC	Mod	
2-22	A2	l	abk, 2	Mod	None	Mod	
22-29	A3	sicl-	m	Low	None	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 7
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 2
Soil Map Unit: Feliz clay loam, gravely substratum 2 to 8% slopes (126)	Soil Series as Observed: Feliz
General Comments: 10% gravel throughout	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 28
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	l	abk, 1	Mod-high	c, f, D, Fe-x, RC	Mod	
3-13	A2	l	abk, 2	Mod	None	Mod	
13-28	AC	cl	m	Low	None	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 8
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz
General Comments: adventitious Lolium roots; 10% gravel in all horizons	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 29
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	cl-	abk, 1	Mod	m, f, D, Fe-x, RC	Mod-slow	
3-16	A2	cl	m	Mod	None	Mod-slow	
16-29	AC	cl	m	Low	None	Mod-slow	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 9
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0205 knife at top of AC horizon	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz
General Comments: weak, spotty biotic crust; 5% gravel in A1, A2 and AC horizons.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 32”
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	abk, 1	Mod	c, f, D, Fe-x, RC	Mod	
2-12	A2	l	abk, 1	Mod	None	Mod	
12-19	AC	l	m	Low	None	Mod	
19-32	C	grl	m	Low	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 10
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 0207, 0208	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin Slope Gradient (%): 1-2
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): None to 27”
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	grl	abk, 1	Mod	m, f, D, Fe-x, RC	Mod	
3-20	A2	l	abk, 1	Mod	None	Mod	
20-27	AC	grl	m	Low	c, m, F, Fe-x, M	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Offsite Mitigation Parcel: Watson East (South)	Pit No.: 11
Investigator(s): Joel Butterworth	Date: July 27, 2010	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: N/A	

Land Surface Shape: (slightly) planar concave convex	Landform: alluvial fan low terrace swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: Cole clay loam, 0 to 2% slopes (115)	Soil Series as Observed: Feliz
General Comments:	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): none to 27”
Depth to Restrictive Layer (in.): N/A	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A1	l	abk, 2	Mod	m, f, D, Fe-x, RC	Mod	
6-14	A2	cl	abk, 1	Mod	None	Mod-slow	
14-27	AC	l	m	Low-mod	None	Mod	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

“-“ = “light” (as in a clay textural class with relatively low clay content)
“+“ = “heavy” (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

Appendix B

Representative Digital Images from July 2010 Soil Evaluations at Wetland Establishment Sites

Appendix B-1. Ford Offsite Mitigation Parcel Wetland Establishment Site (Soil Pit 5)
Overview of backhoe pit excavation.

Appendix B-2. Goss/MGC Plasma Offsite Mitigation Parcels Existing Wetland (Soil Pit 2)
Clay loam subsoil; redox extends to surface.

Appendix B-3. Watson East Offsite Mitigation Parcel Existing Wetland (Soil Pit 3)
Knife at top of clay subsoil; redox extends to surface.

Appendix B-4. Niesen Offsite Mitigation Parcel Existing Wetland (Soil Pit 1)
Clay loam subsoil; redox begins at 3 inches depth (at knife).

Appendix B-5. Goss/MGC Plasma Offsite Mitigation Parcels Existing Wetland (Soil Pit 19)
Clay loam subsoil; redox at 0–6 inches and below 11 inches depth.

Appendix B-6. Goss/MGC Plasma Offsite Mitigation Parcels Wetland Establishment Site (Soil Pit 5)
Dense roots in A1 horizon, suggesting surface ponding or root restriction from clay soil (Clear Lake series) below; redox begins at 9 inches depth.

Appendix B-7. Ford Offsite Mitigation Parcel Wetland Establishment Site (Soil Pit 7)
Woody refuse in fill material, which extends to 52 inches.

Appendix B-8. Ford Offsite Mitigation Parcel Wetland Establishment Site (Soil Pit 6)
Investigator standing on native soil at 72 inches; excavated fill in background.

Appendix B-9. Niesen Offsite Mitigation Parcel Wetland Establishment Site (Soil Pit 15)
Very gravelly fill material containing metal fragments and woody material.

Appendix B-10. Niesen Offsite Mitigation Parcel Wetland Establishment Site (Soil Pit 7)
Close-up of buried A horizon (with partly decomposed organic matter),
taken from 99 inches depth; reddish excavated fill is at right.

Appendix B-11. Goss/MGC Plasma Offsite Mitigation Parcels Wetland Establishment Site (Soil Pit 8)
Silty clay subsoil; redox extends to surface.

Appendix B-12. Watson East Wetland Establishment Site (Soil Pit 9)
Loam/gravelly loam soils; knife at bottom of subsurface layer; redox at 0–12 inches depth, suggesting short duration ponding on nearly level slope.

Attachment 1

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

JUL - 9 2010

REPLY TO
ATTENTION OF

Regulatory Division

SUBJECT: File Number 1991-19474N

Mr. Charlie Fielder
District 1 Director
California Department of Transportation
P.O. Box 3700
Eureka, California 95502

Dear Mr. Fielder:

Per our District Commander's June 29, 2010 e-mail communication to you, we are hereby providing you with the list of items Caltrans must provide to the Corps by August 15, 2010, in order for us to come to a permit decision by August 30, 2010. To adequately address the three items specified by the District Commander, including the 401 Certification, a complete long-term management plan, and complete endowment calculations broken down by parcel (must use spreadsheet provided by the Corps by e-mail on June 2, 2010 for **each parcel**), you must provide the following 6 items to meet the spirit and intent of our commitments.

These items are a subset of the larger list provided today to you by the RWQCB representing the complete information needs of the Corps, the RWQCB, and the EPA. The list below represents the minimum information necessary for us to complete our public interest review, ensure compliance with mandatory "no net loss" policy, and ensure compliance with our Mitigation Regulations (33 CFR Part 332). To date, you have only proposed 23 acres of wetland establishment (creation) and have not shown how you will effect "no net loss" of the 83 acres of fill that is proposed.

1. A **clear accounting** of existing conditions on each mitigation parcel specific to waters of the U.S. including aquatic resource type (you must specify either wetlands, non-wetland waters of the U.S., OR riparian buffer) and acreage in a table with associated drawings. We also require a clear accounting of proposed conditions (i.e. climax community) on each mitigation parcel specific to waters of the U.S. including proposed aquatic resource types and acreages.

2. Compensation types must be clarified throughout the Mitigation and Monitoring Plan (MMP) and only Corps-recognized definitions are to be used. "Protection" is not a recognized Corps definition per 33 CFR Part 332 and any mitigation parcel areas

classified under this term **must be reclassified** according to one of the Corps-recognized definitions. The word "protection" may not be used in the final MMP.

You have counted returning areas that will be temporarily impacted to their original contours as "restoration". "Restoration" is not defined per 33 CFR Part 332 as "areas temporarily affected by onsite or offsite construction activities that will be restored to pre-project conditions." Any areas classified this way within the MMP **must be removed** from the mitigation totals, as the Corps does not recognize them as "restoration" areas.

3. As specified in our April 23, 2010 letter, information justifying areas proposed for preservation must be provided pursuant to 33 CFR Part 332.3(h).

4. Each and every area proposed for **establishment** must have the following details and baseline information: 1) Caltrans needs to describe the process used in selecting each site. 2) Caltrans needs to clearly define the purpose of each establishment site. What functions and values are being replaced at the establishment site? Performance standards and success criteria will be based on this. 3) Caltrans needs to provide **fully developed** construction plans: existing contours, proposed contours, planting plans, construction sequence. 4) Caltrans needs to clearly define the location and the size of each mitigation site (not give us the size of the actual parcel, we need to know the size of the mitigation site). 5) Caltrans must have a corresponding reference site for each establishment site. The enhancement plans must contain the following information:
   a. Hydrology. The following information is needed for each proposed wetland establishment site:
      1) Current conditions information:
         - Analysis of existing hydrologic conditions in reference sites.
         - Hydrologic testing of the mitigation sites. Testing must include:
            - Examination of the groundwater availability.
            - Hydroperiod Information: the frequency of flooding, depth, duration, timing of saturation or inundation, percent of open water.
            - Historical hydrology of mitigation site if different from present conditions.
            - Acres of contributing drainage areas.
            - Results of water quality analysis: data on surface water, groundwater, redox, nutrients, organic content, suspended matter, DO, heavy metals.
      2) Information to estimate proposed hydrological conditions:
         - A reliable water budget must be presented. You must be able to show that net inflows are greater than net outflows. Water budget must include: water source(s): precipitation, surface runoff, groundwater, stream. Water losses.

- Provide a water budget for wet years and dry years.
- Modification of the hydrologic characteristics should be kept to a minimum.
- Site should be hydrologically self sustaining.

b. Soil Characteristics. The following information is needed for each wetland establishment site:
   1) Soil profile. The MMP provided the soil survey information. Caltrans needs to locate those soils on site. Submit a report of soil samples with a map showing data sample points.
   2) Standard soil analysis: percent organic matter, structure, texture, permeability.
   3) What will be the source of the soils? (e.g., existing soil, imported hydric soil from impact site).
   4) Also need: erosion and soil compaction control measures.

c. Vegetation.
   1) Existing conditions: We generally have a list of the species that occur on site from the delineations that were completed. For each wetland establishment site we need:
      - Species characteristics such as: densities, age, health, natives/non natives.
      - Percent cover.
      - Community structure (canopy stratification).
      - Map showing the correct location of plant communities with representative site photos.
      - Proposed site should be located adjacent to existing waters of the U.S. or a high functioning buffer adjacent to waters of the U.S. to create a wildlife corridor. Provide documentation of this connectivity.

d. Watershed context/surrounding land use for each wetland establishment site:
   1) Impairment status and impairment type of aquatic resources.
   2) Description of watershed land uses (percent agriculture, forested, wetland, developed).
   3) Size of natural buffers (show on map and do not call them "riparian").
   4) Description of landscape connectivity: proximity and connectivity of existing aquatic resources and natural upland areas (and show on map).
   5) Relative amount of aquatic resource area that the impact site represents for the watershed and/or ecoregion (by individual type and by overall resources).

e. Goals of each wetland establishment site:
   1) Types and areas of habitat to be established.
   2) Specific functions of the habitat types.
   3) Time lapse between jurisdictional impacts of the project and mitigation site success.

4) Total cost of the establishment site: site preparation, planting, maintenance, monitoring.
5) Overall watershed improvement to be gained by the wetland establishment site.

f. Wetland Establishment Site Implementation:
   1) For each establishment site Caltrans must:
      - Provide a rationale for expecting implementation success.
      - Name responsible parties.
      - Provide financial assurance information.
      - Provide a construction schedule.
      - Provide a site preparation plan.
      - Provide a planting plan. The planting plan design must emulate a reference site in terms of plant species and spacing. Planting design must place plants relative to the water source supporting them specific to what the optimal condition would be for that species.
      - Prior to planting the site soil conditions must be confirmed: soil moisture, ph, salinity, organic matter, nitrogen, soil type. Be advised that the native soils must support the proposed wetland establishment. Clay liners or other artificial barriers are not permitted.
      - Provide as-builts within 45-days of construction of establishment wetland site.

g. Maintenance Activities During Monitoring Period for each wetland establishment site:
   1) Provide the list of maintenance activities
   2) Responsible parties
   3) Schedule

h. Monitoring Plan for each wetland establishment site:
   1) Target dates for performance standards and success criteria
   2) Target functions
   3) Target hydrological regime. Hydrologic functions must be compared to what is occurring at the reference site.
   4) Target mitigation acreage of establishment
   5) Monitoring method and schedule
   6) Annual monitoring report

i. Completion of each Mitigation Site:
   1) Written notification is required
   2) Agency confirmation will be required before mitigation is considered complete.

j. Contingency Measures for each mitigation site:

1) Initiation Procedures. Circumstances necessitating the initiation of contingency measures must be described.
2) Funding mechanism (See item 5. below)
3) Responsible parties

5. The Corps requires a performance bond or other Corps-approved financial assurance mechanism payable at the direction of the District Engineer to his designee or to a standby trust agreement. This financial assurance mechanism shall be posted **within 30 days of permit issuance** or else the Corps permit will be revoked. In order to determine the appropriate assurance amount, Caltrans must provide **sufficient and itemized calculations** by August 15, 2010 for the cost of the following: collection of all necessary baseline information, parcel-specific mitigation plan preparation based on a watershed approach, land acquisition, planning and engineering, legal fees, mobilization, construction, and monitoring, and a contingency fund for any necessary remediation.

6. As specified in our April 23, 2010 letter, the Corps believes discharge of fill for project construction should be carried out concurrently with project phase construction. Caltrans must provide us with the fill amount associated with Phase I alone, the additional fill amount associated with Phase II, and the associated drawings demonstrating the two separate Phases as described by Dave Kelley in our May 10, 2010 conference call.

These items collectively are the minimum information necessary (to be supplied by August 15, 2010) for the Corps to complete the application evaluation process.

Should you have any questions regarding this matter, please call me at (415) 503-6771. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter.

Sincerely,

Jane M. Hicks

Jane M. Hicks
Chief, Regulatory Division

Copy Furnished:

US EPA, San Francisco, CA (Attn: A. Strauss/J. Brush/ M. Scianni)
CA RWQCB, Santa Rosa, CA (Attn: C. Kuhlman/J. Puget)
California Department of Transportation, Sacramento, CA (Attn: R. Land)
California Transportation Commission, Sacramento, CA (Attn: J. Earp)

DEPARTMENT OF TRANSPORTATION
DISTRICT 3 – SACRAMENTO AREA OFFICE
GATEWAY OAKS
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Flex your power!
Be energy efficient!

August 25, 2010

Jane M. Hicks
Chief, Regulatory Division
U.S. Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103-1398

Mr. Jason Brush
Wetlands Regulatory Office
US EPA, Region 9
75 Hawthorne Street, WTR-8
San Francisco, CA 94105-3901

Dear Ms. Hicks and Mr. Brush:

The U.S. Army Corps of Engineers (USACE) provided the California Department of Transportation (Caltrans) a letter on July 9, 2010, that listed the minimum information necessary for the USACE to come to a Clean Water Act Section 404 permit decision on the Willits Bypass Project (bypass project). A meeting was held on July 12 and 13, 2010 in Santa Rosa with the USACE, Environmental Protection Agency (USEPA), North Coast Regional Water Quality Control Board (RWB), California Department of Fish and Game (CDFG), and other stakeholders to discuss the requested information in the July 9 letter and other agency-requested information and capture all of it in a permitting "punch list" for the bypass project. Since that time, Caltrans has been conducting field work, reviewing and analyzing data, running models, and documenting these efforts in technical memoranda submitted per the permitting punch list due dates. On August 15, 2010, Caltrans submitted the remaining requested information from the July 9 letter and permitting punch list, as well as miscellaneous requests from the July 12 and 13, 2010 meetings and the July 26, 2010 field meeting, and submitted these items to the USACE, USEPA, RWB, CDFG, and other stakeholders.

To-date, Caltrans has received the following comments from USACE and USEPA on some of the July 9 letter and punch list submittals:

- August 11, 2010 letter from USEPA regarding Niesen Parcel and Monitoring Reference Sites
- August 11, 2010 e-mail from Melissa Scianni of USEPA regarding the Long-term Management Plan (Chapter 11 of the MMP)
- August 13, 2010 e-mail from Melissa Scianni of USEPA regarding soil characteristics at wetland establishment sites
- August 5, 2010 e-mail from Melissa Scianni of USEPA regarding the preservation technical memorandum submitted on August 2, 2010
- July 29, 2010 e-mail from Dave Wickens of USACE regarding location in MMP of requested information from the July 9 letter from USACE to Caltrans

Caltrans is providing this letter to address the above comments on submittals in an effort to ensure that the USACE has as much information as is available at this time in order to issue a Clean Water Act Section 404 permit for the Willits Bypass Project by August 30, 2010. The permit is needed by this date so that the bypass project can continue to move forward by receiving approval from the Federal Highway Administration for federal matching funds.

Responses to August 11, 2010 letter from USEPA regarding Niesen Parcel and Monitoring Reference Sites

1) Reference Sites

USEPA has expressed concern over the currently identified wetland establishment monitoring reference sites. According to USEPA, since the reference sites are targeted for enhancement in the bypass project Mitigation and Monitoring Proposal (MMP), they may not represent the highest function attainable. However, due to their adjacency Caltrans believes the proposed reference sites provide the most similar vegetation, hydrologic, and soils information for the establishment sites. Caltrans appreciates the suggestion of using the Huff and Watson West offsite mitigation preservation parcels to come to resolution on the subject. However, replicating the riparian woodlands and scrub wetlands on Huff and the marsh wetlands on Watson West parcels at the proposed wetland establishment sites in Little Lake Valley would result in a disrupted ecological landscape at these sites.

Improved functions and values at the enhancement sites is a component of the mitigation plan. Grazing will be one action used to improve functions and values at the enhancement sites. Over the long-term, similar grazing prescriptions used at the enhancement sites would be used at the establishment sites resulting in the most continuous ecological landscape possible. Since this issue was not a "punch list" item, Caltrans expects that a permit decision can be made irrespective of a decision on this issue. As proposed by USEPA, and affirmed here by Caltrans, a quick resolution of the topic is a mutually desired outcome. However, if any changes are needed, then there is likely insufficient time to further inform the discussion or edit relevant document sections prior to the end of the month. Caltrans proposes that USACE approval of the final reference sites be included as a special condition in the 404 permit.

2) Wetland Establishment Site Hydrology

A telephone conference call was held on August 13 to discuss site-specific wetland establishment hydrology. Agency staff and staff from the Willits Environmental Center (WEC) noted the need for additional site-specific wetland establishment hydrology data to confirm that establishment would be successful and naturally sustainable.

Caltrans remains committed to continuing to collect site-specific hydrology data for the establishment areas, but believes that data currently available can be used to confirm the future success of proposed wetland establishment sites . Based on verified wetland delineations, field observations, the hydrology technical memorandum (July 29 submittal), and the soils technical memorandum (August 10 submittal), the established wetlands are expected to have the same hydrologic regime as the adjacent, existing wetlands. The elevation of the wetland establishment sites will be lowered to match that of adjacent wetlands so that any high water table, overbank channel flow, or sheetflow experienced by existing wetlands would extend into the adjacent wetland establishment sites. The soils technical memorandum indicates little difference between the soils in the establishment sites and adjacent existing wetlands, a further indication that the established wetlands will have hydrological conditions similar to the existing wetlands. Furthermore, the soils technical memorandum indicates that the restrictive layer of soils that was found in some soil pits was thick and extended below planned excavation depths. As a result, excavation planned for the wetland establishment sites would not remove the restrictive layer that could help support wetland hydrology at some locations (see mitigation construction plans – August 2 submittal). If the wetland establishment sites do not function as expected, the MMP protocols ensure that such a failure would be detected and remedial actions would be taken.

The hydrology technical memorandum (July 29 submittal) provided all available site specific information regarding surface water and groundwater observed at the Goss/MGC Plasma establishment site. The memorandum also provided water balance time series estimates of water level elevations under a wet and dry water year for a wetland supported by a high water table and a wetland supported by a restrictive layer, but it did not provide water balance time series estimates of water level elevations at each wetland establishment site. Since the hydrology technical memorandum was submitted, additional information has become available as presented in the soils technical memorandum (August 10 submittal). This additional information can be used to refine the hydrology discussion. However, to generate time series estimates of water level elevations for each establishment site, more data is needed such as rainfall runoff models for each site that may receive upslope sheetflow (such models need time series hydrological data for calibration), time series information regarding aquifer elevation at each site, and time series information regarding flooding at each site (e.g., from Old Outlet Creek at the Ford site or from backwater inundation at the Watson East parcel resulting from down-valley flooding). Fortunately, site-specific time series estimates are not necessary to be confident that the establishment sites will function as wetlands.

Table 1 and the following discussion provide site-specific hydrologic information from the soils technical memorandum.

Table 1. Site Specific Hydrologic Information for Wetland Establishment Sites from Soils Technical Memorandum (August 10 Submittal)

Wetland Establishment Site	Evidence for High Water Table at Site[a]	Evidence of Restrictive Layer	Other Potential Sources of Water[b]
Ford[c]	Subsurface redox features at reference and establishment sites and very moist surface soil at 2 of 4 establishment pits	Slow permeability in 1 of the 4 reference pits and 1 of the 4 establishment pits	Shallow flooding from Old Outlet Creek
Goss/MGC Plasma	Subsurface or subsoil redox features at reference and establishment sites. In addition, shallow groundwater present at North Coast semaphore grass groundwater monitoring sites (which usually occur in wetlands) despite lack of restrictive layer.	No sites with slow permeability in 6 reference pits, but slow or very slow permeability in 5 of the 12 establishment pits	Upslope sheetflow runoff
Niesen[c]	Subsurface redox features at reference and establishment sites	Very slow or slow permeability at 1 of the 5 reference pits and 3 of the 10 establishment pits	Seepage from pond
Watson East (North)	Subsurface redox features at some reference and establishment sites	Very slow or slow permeability at 3 of the 4 reference pits and 3 of the 6 establishment pits	Backwater inundation from down-valley flooding and upslope sheetflow runoff
Watson East (South)	Subsurface redox features at some reference and establishment sites	Very slow or slow permeability at 2 of the 5 reference pits, but none of the establishment pits	Backwater inundation from down-valley flooding and upslope sheetflow runoff

a. A high water table means that the top of an unconfined aquifer is near the soil surface. Redoximorphic (redox) features present in the subsurface are indicative of a high water table, although they can also form as a result of prolonged inundation from flooding (potentially at Ford and Watson East parcels) or the retention of water by a restrictive layer that retains water in subsurface soils (a condition not common at the wetland establishment sites).
b. Additional sources of water that support existing wetlands would also support adjacent established wetlands.
c. The redox features and other soil characteristics described for the soil pits excavated within the Ford and Niesen establishment sites refer to the native soil below the fill material.

At all wetland establishment sites except Watson East (South), soils with slow or very slow permeability were detected in some, but not all, soil pits. At the locations where the soils have slow or very slow permeability, there is a potential for the water to be retained in a manner similar to what was illustrated in the bottom (low aquifer) graphs shown in Figures 11 – 13 of the hydrology technical memorandum. However, because many soil pits did not contain soils with a restrictive layer, it is likely that the wetlands at the 5 establishment sites are dependent on outside sources of water (a high water table being most likely, but water from flooding and upslope sheetflow runoff may also contribute). At locations supported by a high water table or flooding (i.e., almost all sites), the wetlands are likely to behave in a manner similar to that shown in the top graphs (high aquifer) in Figures 11-13 of the hydrology technical memorandum. However, the exact water surface elevations (whether groundwater or surface water) will depend on the local groundwater table and pattern of flooding. If a site were supported by upslope sheetflow runoff, the hydrologic pattern would show the same "spiky" pattern dependent on rainfall that is shown in the perched aquifer line (red) shown in Figures 11-13 of the hydrology technical memorandum, but higher water elevations would be attained (see paragraph below for more information).

Figure 1 represents a hypothetical example where the soil is assumed to have moderately slow permeability of 5.4 inches per day, a value expected for typical (not very restrictive) soil textures found at the wetland establishment sites. In the sheetflow scenario, sheetflow is assumed to occur if daily rainfall is greater than 0.33 inches and it is assumed to increase the effect of precipitation by a factor of fifteen. Note that the values shown for no sheetflow are the same as the "soil perched" line that appears in the upper graph of Figure 11 of the hydrology technical memorandum (July 29 submittal).

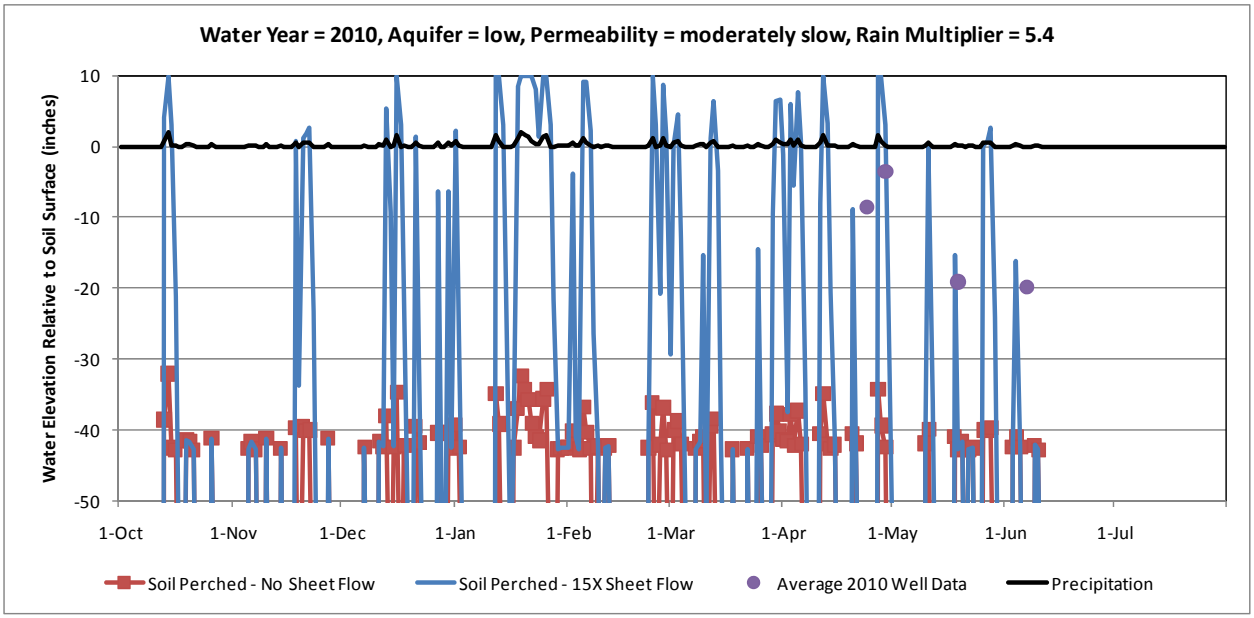

Figure 1. Estimated Water Surface Elevation for Water Perched on Soil with and without Sheetflow

Based on the information in Table 1, the following site-specific hydrologic inferences can be drawn at the wetland establishment parcels:

Ford. Existing wetlands at the Ford parcel are most likely supported by a high water table and/or overflow from Old Outlet Creek. Once the establishment site is excavated to the same elevation as the adjacent, existing wetlands, the establishment site is expected to have the same hydrology as the existing wetlands.

Goss/MGC Plasma. Existing wetlands at the Goss/Plasma site are most likely supported by a high water table. Upslope runoff to local depressions may provide some contribution, but because the soils upslope of the parcel are likely to absorb most precipitation, runoff contributions into the parcel are generally not expected to be large. None of the soil pits in existing wetlands had slow or moderately slow permeability, although 5 of the 12 pits in the establishment area had slow or moderately slow permeability. The presence of water in the PLHO monitoring wells during spring 2010, despite the lack of a restrictive layer, is indicative of a high water table. The Goss/ MGC Plasma wetland establishment site is expected to be supported by the same hydrologic conditions as the existing wetlands. In addition, the localized presence of soils with a restrictive layer may further benefit the established wetlands.

Niesen. Existing wetlands at the Niesen parcel are most likely supported by a high water table. Once the establishment site is excavated to the same elevation as the adjacent, existing wetlands, the establishment site is expected to have the same hydrology as the existing wetlands.

Watson East (North and South). There are multiple potential water sources for the existing wetlands at the Watson parcel, depending on location: backwater effects from down-valley flooding, upslope sheetflow runoff, retention of incident precipitation by restrictive layer soils, and a high water table. It is likely that the lower portions of the parcel receive more water from down-valley flooding than the locations farther upslope. Wetlands to be established on the site are likely to be supported by the same water sources as the existing wetlands. The soil pits indicate that there may be more areas with restrictive layer soils in the existing wetlands than in the establishment sites, but because the restrictive layer soils are not present everywhere, other sources of water are likely to be more important.

Caltrans will be collecting additional site-specific hydrology data at the wetland establishment sites as part of baseline studies that will begin in fall 2010 and continue through spring 2011. Additional groundwater wells and soil moisture data loggers are proposed to be installed to collect this data.

3) Niesen Wetland Establishment Site
USEPA has indicated that they have doubts regarding the Niesen wetland establishment site. The site is surrounded on three sides with non-native and invasive plants being prevalent.

The Niesen wetland establishment site has been included in the bypass project's mitigation plan in an effort to address agency direction to provide as much wetland establishment in Little Lake Valley as possible. Efforts to identify mitigation lands in the valley that would support wetland establishment are documented in the Feasibility Study (2005) and Mitigation Parcels Report (2007). Agency determinations that lands delineated by Caltrans as uplands were wetlands and changing preferences of land owner willingness to sell led to very little remaining wetland establishment opportunities in the valley. In July 2008 Caltrans briefed the agencies on the lack of viable wetland establishment opportunities within Little Lake Valley. The RWB response letter indicated that Caltrans needed to re-double their efforts for identifying wetland establishment both within and outside of Little Lake Valley. Considerable effort and cost has gone into the research and development of these sites. Caltrans understanding in moving forward with this work was that despite the costs, the maximum amount of wetland establishment should be pursued.

The Niesen wetland establishment site was presented in the March 2010 MMP and its location alone did not result in substantive comment at that time. However, Caltrans infers that the USEPA's concern is not based entirely on the fact that it is surrounded by roadways. Rather the concern is that since it is surrounded by roadways the site will pose problems from an invasive species maintenance standpoint and benefits of the established wetland site will be reduced due to poor hydrological connectivity. With respect to invasive species control, Caltrans has developed a Property Analysis Record (PAR) that provides for invasive species management in perpetuity at the wetland establishment sites. If invasive species are not controlled on this parcel, either as a result of enhancement or establishment efforts, then this parcel would continue to be degraded with invasive species infestations. With respect to hydrologic connectivity, it will be maintained at the Niesen parcel post-construction. The land surface at the wetland establishment site will be lowered to match the elevation of the existing adjacent wet meadow. The land surface will slope down gently to the north from the southern parcel boundary. A culvert will enter the southwest corner of the established wetland and flow north across the wetland. In addition, another culvert will enter the parcel midway along its western boundary and flow across the established wetland from west to east and eventually drain into the existing wetland on the east side of the bypass through a culvert under the bypass embankment. If the Niesen establishment site is eliminated from the bypass project's mitigation plan, there are limited options available to make up for the expected 5.66 acres of wet meadow to be established at this parcel. If the Niesen establishment site is eliminated, Caltrans will need to determine how the elimination of this establishment site affects permits already issued by the RWB and CDFG based on the inclusion of the Niesen establishment site.

The USEPA letter of August 11, 2010 also states that hydrology and plant community information have not yet been received for the Niesen parcel. Hydrology data was provided as part of the hydrology technical memorandum submitted on July 29 and vegetation/plant community data was provided as part of the vegetation technical memorandum submitted on August 10.

Response to August 11, 2010 e-mail from Melissa Scianni of USEPA regarding the Long-term Management Plan (Chapter 11 of the MMP)

Caltrans provided a Long-term Management Plan (LTMP) in the June 2010 MMP (Chapter 11). During the July 12-13th meeting the USEPA and USACE provided verbal comments on the MMP. All comments received from the July meeting were addressed in the August 9, 2010 version provided to the agencies. Caltrans anticipated either concurrence or comments focused on the new changes. Many of the comments in the August 11 e-mail are new requests for additional details based on a re-review of the entire document. Due to the timing of these new requests, Caltrans will address these comments in the next planned revision of the LTMP.

Responses to August 13, 2010 e-mail from Melissa Scianni of USEPA regarding Soil Characteristics at Wetland Establishment Sites

1) The topsoil at the Ford property consists of fill material and is not appropriate for placement on the wetlands after construction. Please remove the replacement of topsoil language from the MMP for this parcel. Since the topsoil cannot be replaced at this site, is there any need to treat the new surface layer to facilitate plant growth?

The requested change has been made to Chapter 7 in the MMP (provided as part of the August 15 submittal). With respect to treating the buried native soil surface layer, it appears from some of the soil pits excavated at the proposed wetland establishment site at the Ford parcel (e.g., soil pits #5 and #7) that the top of the native soil is below the finish grade elevation (0.8 meter and 0.4 meter, respectively). However, there appear to be areas at the Niesen parcel that have suitable, native topsoil that could be applied at the Ford parcel, or there may be areas in the bypass project alignment where native topsoil could be salvaged prior to disturbance and applied at the Ford parcel. There should be no need to treat/amend the new, applied surface layer soil.

2) Is there any evidence that the old mill site treated wood (e.g. with creosote), or did it only process natural wood? Was there any evidence of treated wood in the fill material at the Ford Parcel? If there is evidence of treated wood, some soil chemistry analysis may be necessary at the Ford parcel.

During the July 2010 soil evaluation at the wetland establishment site at the Ford parcel, no treated wood was observed where soil pits were excavated in the fill material. Crews did uncover a utility pole in one of the pits, but because it had been buried for many years, it was

difficult to determine whether the pole had been treated with creosote; however, the crew did not observe any obvious creosote coating on the pole. Based on the results of the July 2010 soil evaluation, the fill material consists mostly of bark, natural wood and lumber pieces, partly burned wood, and ash.

In addition, Caltrans has conducted hazardous materials reconnaissance and assessment for the mitigation parcels, including Ford. The results of the assessment identified no significant hazardous waste/material issues at the parcel (see attached).

3) As I understand, the material to be removed from the Ford parcels is currently proposed for road base in the bypass. Given what was learned about the material present at this site, is it still appropriate for road base material? If not, can the wetland construction at the Ford parcel be moved up in the schedule?

Caltrans has determined that the fill material can be used for fill in the bypass project alignment. As such, the schedule in the MMP for wetland establishment at the Ford parcel (with the proposed wetland establishment site being constructed toward the end of the Phase 1 construction schedule) is still accurate.

4) The Niesen property contains gravelly fill material that appears to have been incorporated into the native soil in some locations. Will all of the foreign material be removed under the currently proposed grading plans? If not, they will need to be revised to ensure that all of the gravelly material is removed.

Based on the July 2010 soil evaluation at the wetland establishment site at the Niesen parcel, the amount of gravelly fill mixed in with the native soil is minor, and does not extend very deep. Excavating to the finish grade elevation will most likely remove most or all of the mixed-in gravel.

5) As with the Ford property, placement of the topsoil back on the wetlands after construction is not appropriate for the Niesen property. For this parcel, please remove the language about replacing the topsoil from the MMP. Since the topsoil cannot be replaced at this site, is there any need to treat the new surface layer to facilitate plant growth?

Based on the soil pits excavated at the Niesen property, it appears that the top of the native soil is at or just above finish grade. Therefore, it is expected that there will be no need to treat the soil at finish grade.

6) The soils memo suggests that the hydrology at Watson and Goss/MG Plasma may not be driven only by groundwater and is more complicated that what was presented in the MMP and hydrology memo. I will comment more on this once I have a chance to review the hydrology report in more detail.

The hydrology technical memorandum describes the Watson East and Goss/MGC Plasma establishment sites and adjoining wetlands at a broader scale than does the soils technical memorandum, the latter which was based on a more intensive site evaluation. For example, the hydrology technical memorandum necessarily did not factor-in the influence of microtopographic variations on the presence of wetland hydrologic conditions. Although the hydrology technical memorandum accurately identifies the hydrology of these sites to be predominately groundwater-driven, the soils technical memorandum also identified that surface water (i.e., shallow ponding) and a shallow perched water table are also localized factors in controlling the hydrology of the existing wetlands. Such factors are also expected to operate in the established wetlands on a localized basis.

<u>Responses to August 5, 2010 e-mail from Melissa Scianni of USEPA regarding the Preservation Memorandum submitted on August 2, 2010</u>

Caltrans provides the following additional technical information regarding the Watson West and Huff offsite mitigation parcels. Caltrans asserts that these parcels meet the standards pursuant to 33 CFR Part 332, Section 332.3(h) for inclusion of these parcels for preservation as part of the mitigation plan. Please see specific responses below.

1) The document states that preservation of the two parcels will contribute to the ecological sustainability of Baker's meadowfoam and North Coast semaphore grass populations in the Valley. However, the plant community section does not identify meadowfoam and semaphore grass on Watson or semaphore grass on Huff.

There is an observed population of Baker's meadowfoam on the Huff parcel (0.08 acre; see June 2010 MMP Appendix C, Sheet C-55); however, there is no observed population of North Coast semaphore grass on the Huff parcel. Surveys for Baker's meadowfoam and North Coast semaphore grass and have not been conducted on the Watson West parcel. Preservation of the Huff parcel would directly contribute to the sustainability of habitat for Baker's meadowfoam.

2) Are there downstream populations that will benefit from the preservation? Please clarify how preservation of Huff and Watson will benefit these plant species.

There are no known downstream populations of Baker's meadowfoam which would benefit from preservation of the species on the Huff parcel. However, preserving the Huff parcel will directly benefit the existing Baker's Meadowfoam population that has been observed on this parcel from future disturbance from development or trespass.

3) Please describe in more detail the condition of Outlet Creek on these parcels. For

example, is there riffle habitat, salmonid spawning areas, salmonid rearing habitat, etc. (for fish habitat information, please see #4 and #5)

Per the erosion site assessment conducted for the offsite mitigation parcels in May 2010 and the Outlet Creek Basin Assessment Report (LeDoux-Bloom and Downie 2008), relevant findings for instream habitat in Outlet Creek include:

- A majority of habitat units consist of long runs dominated by fine sediments (silts and sands); shallow pool depths were noted, probably resulting from the fine sediments; and riffles (although present near gravel bars) were not abundant.
- Fine sediment deposits contribute to small spawning substrate (and can lead to an increase in flooding through loss of channel capacity, which in turn exacerbates bank erosion).
- Embeddedness levels are unsuitable in many streams (which signals fine sediment deposition from bank and near-bank processes).
- Woody debris influence was generally low.
- The six dams in the Outlet Creek Basin have significantly decreased downstream gravel recruitment.

4) Do these reaches of Outlet Creek represent critical migration corridors for salmonids to reach upstream high quality spawning habitat?

Stream habitat quality for most streams in Little Lake Valley generally decreases as the channel geomorphology changes from a high gradient stream occurring on basin slopes to a low gradient stream occurring on the valley floor. This decrease in habitat quality is largely due to past and present land uses. Nonetheless, the lower stream reaches, including Outlet Creek, are important to varying degrees for coho and Chinook salmon and steelhead and support migration habitat for all species, seasonal rearing habitat for all species, year-round rearing habitat for steelhead, and spawning habitat for Chinook salmon. In addition, the lower reaches are designated critical habitat for coho and Chinook salmon and steelhead, and are designated as Essential Fish Habitat (EFH) for coho and Chinook salmon.

5) How does the condition of Outlet Creek on these parcels compare to other reaches of the Creek (e.g. is the Creek higher functioning here than in other areas)?

Based on consultation with the resource agencies, the streams and riparian corridors in Little Lake Valley have been categorized based on their relationship to designated critical habitat areas for listed anadromous fish. The category of the Outlet Creek stream and riparian corridor on the Huff and Watson West parcels is considered Category I Stream/Riparian Corridor. Category I Riparian Corridor represents those vegetated areas that occur along salmonid-bearing streams (i.e., Category I streams). These streams and riparian corridors are designated critical habitat for listed salmonids, including coho salmon. The health of these streams and riparian corridors has an immediate and direct effect on anadromous fish populations. Parts of Category I streams and riparian corridors fall under USACE jurisdiction as wetlands or other waters.

6) How do the riparian and wetland habitats on these parcels compare to the other wetland and riparian habitats in the valley?

The preservation technical memorandum (August 2 submittal, Section 4) describes site-specific plant community conditions on the Huff and Watson West parcels. Based on qualitative observations and information contained in the verified wetland delineations, wetland and riparian habitats on the Huff and Watson West parcels are relatively undisturbed and provide important linkages across the northern part of Little Lake Valley and along Outlet Creek. The wetland and riparian types present on Watson West are more mesic than those occurring further south in the valley based on overall valley hydrology. The riparian habitats on the Huff parcel are dense and in some places impenetrable. They also support a well-developed understory.

7) Are there any unique species/habitats present? Do the habitats on these parcels represent the highest functioning wetlands/riparian areas in the Valley?

The Huff parcel supports riparian scrub which is uncommon on the offsite mitigation parcels (August 15 submittal, Table 2). The Watson West parcel supports marsh which is also uncommon on the offsite mitigation parcels (August 15 submittal, Table 2).

8) What proportion of mature, high functioning riparian habitat around Outlet Creek occurs on these parcels (i.e. do these parcels represent a significant portion of the good riparian habitat in the Valley)?

Please refer to the watershed technical memorandum (August 10 submittal) and the preservation technical memorandum (August 2 submittal). Table 1 of the watershed technical memorandum lists the total existing wetlands occurring on the offsite mitigation parcels by habitat type. The total riparian woodland wetland occurring on the offsite mitigation parcels is 107.557 acres.

9) What proportion of mixed marsh in the Valley is present on Watson (i.e. is this a significant portion of the mixed marsh present in the Valley)?

Please refer to the watershed technical memorandum (August10 submittal) and the preservation technical memorandum (August 2 submittal). Table 1 of the watershed technical memorandum lists the total existing wetlands occurring on the offsite mitigation parcels by habitat type. The total marsh wetland habitat type is 141.051 acres. Watson West has 39.69 acres of marsh (Table 2 of the preservation technical memorandum), which is 28% of the marsh on the offsite mitigation parcels.

10) The document identifies several invasive plant species on both parcels (e.g. Himalayan blackberry, teasel). Please describe the extent of these invasive plant populations and how they affect aquatic resource functions on the parcels.

Please refer to the preservation vegetation sites technical memorandum (August 15 submittal). There is currently no data available showing the boundaries and density of invasive plant populations. However, point-intercept transect data was collected for plant communities and the information collected is summarized below.

On the Huff parcel, within the wet montane meadow community, two invasive plant species, medusahead and teasel were observed with 3% absolute cover in transect 4. In the Oregon ash grove community, one invasive plant, Himalayan blackberry, was observed with 1% absolute cover in a single transect. In the annual brome grassland alliance, yellow star thistle was observed with an absolute cover of 10% in a transect, and medusahead was also observed with 12% absolute cover in a transect.

On the Watson West parcel, the only invasive plant observed was Himalayan blackberry, which was 5% of the absolute cover in one Oregon ash grove community transect.

11) The document states that the parcels are important for maintaining habitat linkages. Please provide additional detail about how Huff and Watson connect with other high functioning habitat in the Valley, including whether or not Huff and Watson are critical components to maintaining connectivity of high functioning habitat.

Figure 4 in the watershed technical memorandum (August 10 submittal) shows the landscape connectivity of all offsite mitigation parcels. This includes the connection of Huff and Watson West with Outlet Creek and other stream corridors and the wetlands surrounding them. Outlet Creek is the main drainage of the valley and as such serves as a major wildlife corridor. Outlet Creek supports salmonids and provides a water source for wildlife throughout the year. The Watson East offsite mitigation parcel is connected to the Watson West parcel which creates an east-west wildlife migration corridor that includes Outlet Creek on its western border. The Huff offsite mitigation parcel also contains a portion of Outlet Creek downstream of the Watson West parcel, and riparian woodlands there are extensive and completely shade the Outlet Creek channel.

12) Outlet Creek and the Eel River are 303(d) listed for temperature and sediment. Yet the document does not address how the preservation of the Huff and Watson parcels will advance the sediment and temperature TMDLs. Please provide a discussion of how the habitats on these parcels are important for achieving the specific goals presented in the TMDLs. Please provide quantitative discussions for the above items to the extent possible.

Please refer to the memorandum titled "*TMDL Nexus, Willits Bypass Project*" David Melendrez, Caltrans, August 4, 2010 (attached).

The Willits Bypass Project is located in the Upper Main Eel River Hydrologic Area (111.60), Outlet Creek Hydrologic Sub-area (111.61). The Outlet Creek HAS is listed in the current, 2006, Clean water Act 303(d) List of Water Quality Limited Segments, as impaired for Sedimentation/Siltation and Temperature.

As stated in the Upper main Eel River TMDL: "*The primary purpose of the TMDL program for the California's Eel River is to assure that beneficial uses of water (such as salmonid habitat) are protected from adverse increases in natural sediment and temperature. <u>The water quality problems in the Upper Main Eel River and tributaries addressed in this report are related to the decline of west coast salmon and steelhead populations</u>.*"

The following activities are listed for contributing Temperature impairment:

- Channelization
- Habitat Modification
- Removal of Riparian Vegetation
- Streambank Modification/Destabilization
- Drainage/Filling of Wetlands and
- And Nonpoint Sources

The following activities are listed for contributing Sediment/Siltation impairment:

- Agriculture/Grazing
- Silviculture
- Harvesting, Restoration, Residue Management
- Logging Road Construction/Maintenance
- Silviculture Point Sources
- Construction/Land Development
- Highway/Road/Bridge Construction
- Removal of Riparian Vegetation
- Streambank Modification/Destabilization and
- Erosion and Siltation

Offsite Mitigation Lands

The bypass project's MMP was developed by evaluating Little Lake Valley through historical research and study of current conditions with an objective of developing a comprehensive and successful ecosystem restoration project with positive effects on listed plants, sensitive habitats, and fish. The objective of the compensatory mitigation proposed for the bypass project is to establish, enhance, repair, preserve, and protect a mosaic of high-functioning habitats in perpetuity and increase the ecological values of Little Lake Valley and the Upper Main Eel River watershed.

Under the bypass project's Clean Water Act Section 401 water quality certification, an extensive Monitoring and Reporting Program (MRP) issued by the RWB will apply to both the onsite impact areas and to the offsite mitigation parcels. Both sediment and temperature will be monitored on a continuous basis for a minimum of seven years, following implemented mitigation actions, and in years five and ten.

Temperature and sediment are grouped together because mitigation actions implemented to address these two parameters should have beneficial effects that apply to both. For example, riparian planting and stabilization of eroding headcuts will likely have a beneficial effect on temperature, as well as decreasing localized turbidity of the receiving waters.

Caltrans has prepared and submitted a Technical Memorandum to the Resource Agencies for consideration and proposed as part of the MMP: *Assessment of Erosion Sites On Offsite Mitigation Parcels in Little Lake Valley, May 2010*. The technical memorandum is written in a fashion that models previous studies and information developed by the RWB to address sediment delivery sites.

Implementation of specific plans will be further supported by baseline data collection efforts. Baseline shade /canopy data within the offsite mitigation parcels will be established according to California SWAMP protocols, and may go beyond SWAMP protocols due to the length of the various stream reaches. Mitigation constructiton plans for riparian planting, erosion restoration (headcut sites), wetland establishment, and fish passage are being finalized by Caltrans staff.

Implementing actions identified in the *Assessment of Erosion Sites On Offsite Mitigation Parcels in the Little Lake Valley* technical memorandum will have positive benefits to address both sediment and temperature. Additionally, preserving the Huff and Watson West mitigation parcels for their ecological values in perpetuity will ensure that future developments and activities contributing to temperature, sediment, and siltation impairment of the Outlet Creek basin (such as stream channelization, riparian vegetation removal, drainage/filling of wetlands, logging road construction, silviculture, and land development) are not conducted on these parcels. No grazing is proposed on these two preservation parcels, thereby further reducing contributions to temperature, sediment, siltation, and nutrient impairment to the Outlet Creek basin.

Preservation of the Watson West offsite mitigation parcel provides a connection to the Watson East offsite mitigation parcel creating an east-west wildlife migration corridor that includes Outlet Creek on its western border, and will preserve existing high-quality marsh habitat, including a portion of the historic "Little Lake" situated at the north end of the Little Lake Valley. The Huff offsite mitigation parcel will preserve a portion of Outlet Creek downstream of the Watson West parcel that supports riparian woodlands that are mature, extensive, and completely shade the Outlet Creek channel. Additionally, the Huff parcel is unique in its geographic position, in that it is the point at which Outlet Creek exits Little Lake Valley and enters a more canyon-like landscape. Maintaining the naturally high functions of the marsh system at the Watson West parcel and the mature dense riparian woodland on the Huff parcel in perpetuity is important in achieving the TMDL goals for this basin.

Responses to July 29, 2010 e-mail from Dave Wickens of USACE regarding location in MMP of requested information from the July 9, 2010 letter from USACE to Caltrans

In response to the USACE July 9 letter that requested information related to the bypass project's mitigation plan, Caltrans provided the location for the requested information in the June 2010 MMP, where applicable. USACE responded in their July 29 e-mail that most of the requested information was not in the June 2010 MMP and provided additional detailed information requests. Caltrans respectfully disagrees that most of the requested information in the July 9 letter was not included in the June 2010 MMP. Caltrans also notes that USACE provided the comments in the July 29 e-mail in advance of the submittal of the series of technical memoranda on hydrology, soils, vegetation, preservation parcels, and miscellaneous information prepared by Caltrans that further refined available information and presented new information (e.g., plant communities present at the wetland establishment sites and preservation parcels). Please consult these memoranda for the requested information. Caltrans has additional responses to some of the comments in the July 29 e-mail and these are provided below.

1) How are we measuring groundwater re-charge, biomass, wildlife diversity, aquatic diversity. What is baseline for these functions (pages 2-3)?

The bypass project's mitigation plan identifies the functions that the Outlet Creek Basin provides – among them being groundwater re-charge, biomass, wildlife diversity, and aquatic diversity. Through the Clean Water Act Section 401 water quality certification Monitoring and Reporting Plan (MRP), aquatic diversity data under baseline, project, and post-project changes will be collected.

Groundwater re-charge will be measured through the use of groundwater monitoring wells, which will be placed in appropriate locations at each of the offsite mitigation parcels, including the establishment parcels and the Huff and Watson West preservation parcels. Some groundwater monitoring wells have been installed as part of hydrologic studies relating to North Coast semaphore grass (Goss, Huffman, and Lusher parcels). Additional wells are proposed to be installed and measurements will begin prior to the start of construction of the bypass and mitigation projects.

Biomass changes will be measured as a function of changes in vegetative cover. As per the MMP, the establishment of the target vegetative communities and meeting vegetation success criteria includes meeting the targeted increases in native plant and riparian cover at each mitigation site, as described in Chapters 9 and 10 of the MMP. Additionally, changes in plant cover will be noted by aerial photography. Aerial photographs will be taken the year that the mitigation areas meet their final success criteria and compared to pre-project photographs. Additional aerial photographs are proposed to be taken in years 5, 10 and 15, and then every ten years after mitigation areas meet their final success criteria in order to detect landscape level changes in vegetation patterns.

Aquatic diversity will be measured as part of baseline studies (currently in progress) and will be monitored throughout the bypass project and mitigation project implementation and reporting period, as described in the MMP and supporting documentation. Data will be collected using the following protocol, as directed by the RWB: *"Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California (updated 02/01/07)"*. This protocol includes a biological component (macro-invertebrate surveys) as well as physical components including measurements of wetted width, bank-full width, substrate measurements, cobble embeddedness, canopy cover, sinuosity and gradient, chemical composition, etc.

It should also be noted that the Upper Main Eel River TMDL states that: "*The primary purpose of the TMDL program for the California's Eel River is to assure that beneficial uses of water (such as salmonid habitat) are protected from adverse increases in natural sediment and temperature. <u>The water quality problems in the Upper Main Eel River and tributaries addressed in this report are related to the decline of west coast salmon and steelhead populations</u>.*" The extensive Monitoring Reporting Program (MRP) issued by the North Coast RWB will apply to both the onsite impact areas and to the offsite mitigation parcels; ultimately these measures

intend to benefit west coast salmon and steelhead populations. Furthermore Caltrans' riparian mitigation strategy, developed in conjunction with the CDFG and National Marine Fisheries Service (NMFS), is also driven by the requirements of west coast salmon and steelhead populations.

2) MMP does not speak to what the watershed improvement will be (page 3)?

Part of the mitigation vision for the bypass project articulated in the June 2010 MMP is that, once mitigation construction is complete and after approximately 10 years of management and monitoring, the Valley as a whole will provide enhanced wetland functions and exhibit greater ecological value than existed prior to bypass project construction. The Valley will experience a long-term benefit to habitat because the offsite mitigation parcels will not be developed and will be managed for the benefit of biological resources in perpetuity. Existing wetlands and riparian and oak woodland will be increased (24.33 acres of wetland establishment are proposed), and physical barriers to wildlife passage and movement will be reduced or eliminated. The offsite mitigation parcels will be publicly owned in trust for the people of California and will be adaptively managed to benefit wildlife and water quality in the Valley. Functions to be improved by the mitigation plan are provided in the June 2010 MMP (Chapter 2, pages 2-16 through 2-23).

For example, the overall health of streams in Little Lake Valley will be guided by the Clean Water Act Section 401 water quality certification and Monitoring and Reporting Plan (MRP). The MRP requires that an extensive list of water quality constituents and bioassessment parameters be monitored to track watershed surface water quality improvement. As part of watershed surface water quality improvement efforts, it is expected that implementation of a grazing management plan will help to reduce sedimentation and organic nutrients in valley streams because access to stream/riparian corridors by cattle will be restricted except for a minimum number of controlled crossings (see mitigation construction plans and special provisions submitted on August 2).

3) Develop self sustaining ecosystems that allow for natural succession…. Is this (really) the goal of your mitigation (page 3)?

The mitigation plan's goal with respect to wetland establishment is to have both self-sustaining *target* ecosystems and *natural* ecosystems where succession is managed through adaptive grazing practices. At the proposed wetland establishment sites (i.e., Ford, Goss/MGC Plasma Middle/MGC Plasma North, Niesen, and Watson West), once the sites achieve success criteria they will be evaluated to determine when and what level of grazing intensity is appropriate as part of management actions to achieve a target ecosystem. At some wetland enhancement sites in the north (more mesic) section of the valley, grazing will be excluded from some wet meadow to support the natural succession of this habitat to riparian woodland wetland. For example, at the Brooke offsite mitigation parcels, grazing is proposed to be excluded on the eastern portion of the parcels to allow for the re-generation of Oregon ash and other riparian species that are starting to become established. Riparian planting is proposed to expedite this successional

change. See the August 15 version of the Chapter 7 for more information.

Caltrans has worked diligently to respond to all agency questions. In addition, per the June 30 suggestion by Alexis Strauss of the USEPA, the services of former USEPA staff member Mike Monroe have been retained. Mr. Monroe is knowledgeable about the bypass project and mitigation plan due to his former involvement as a NEPA 404 team member. Given Mr. Monroe's past involvement, Caltrans further offers that resolution of any outstanding issues may be accelerated by using Mr. Monroe as moderator for future discussions.

We remain available to answer any further questions.

Please do not hesitate to contact me at (916) 274-0621, or by e-mail at Jeremy_Ketchum@dot.ca.gov, if you have any questions or concerns.

Thank you.

Sincerely,

Jeremy Ketchum, Chief
Environmental Management, S1

Cc: Ms. Melissa Scianni, EPA
Mr. Jeremiah Puget, NCRWQCB
Mr. Craig Martz, CDF&G
Ms. Janet Olave, MCRCD
Mr. David Drell, WEC

Attachments: TMDL Nexus, Willits Bypass Project
Potential Mitigation Properties, Hazardous Waste Clearance

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHGR	Pit No.: 108-030-04
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0 – 1
Soil Map Unit: GIELOW	Soil Series as Observed: GIELOW
General Comments:	
Dominant Plant Species: JUNCUS SP, MENPUL, DESCHAMPSIA SP, PHALARIS SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 21
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high N/A Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0–10	A	l	abk, 2	L	m, 2, P, Fe-x, M	MOD.	ROOT MAT AT BASE
10–16	C1	grsl	sg	VL	NONE	HIGH	
16–21	C2	s	sg	VL	"	HIGH	
21+	2Ab	cl	m	L	m, 2, P, Fe-x, M	MOD	RELATIVELY MOIST

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: 108-030-04 2
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: GIELOW	Soil Series as Observed: ?
General Comments:	
Dominant Plant Species: BROHOR, AVENA SP, LOLIUM SP, DECHAMPSIA SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 24
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7	A	sl	sg	M	NONE	MOD	
7-13	C1	ls	sg	L	NONE	HIGH	
13-19	C2	grls	sg	L	NONE	HIGH	
19-24	2Ab/C3	sil	m	M	M, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: 108-030-04 3
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex SOMEWHAT DISTURBED, ESPECIALLY TO EAST	Landform: natural levee artificial levee swale floodplain* basin Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed:
General Comments: GLASS SHARD (SLIGHTLY WORN) AT 8" * NEAR TOE OF NATURAL LEVEE (?)	
Dominant Plant Species: TAECAPMED, BROHOR, CENSOL, AVENA SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 28
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: DIFFICULT TO ASSESS WITH REGARD TO REDOX BECAUSE OF GRAVELLY MATERIAL FROM 2 TO 26, WHICH DOES NOT PROMOTE

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments REDOX
							1/4" ORGANIC MAT AT SURFACE*
0-2	A	l	M	LOW	C, 2, D, Fe-x, PL	MOD.	* FROM INUNDATION ?
2-11	AC	xgrsl	sg	LOW	NONE	HIGH	
11-26	C	vgrls	sg	LOW	NONE	HIGH	
26-28	2Ab/C	sil	M	MOD	C, 2, D, Fex-M	MOD	RELATIVELY MOIST

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name:	Pit No.: 108-030-04 4
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: GIELOW	Soil Series as Observed: GIELOW
General Comments:	
Dominant Plant Species: LOLIUM SP, HORMARGUS, DECHAMPSIA SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 26
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	m	MOD	m, 2, D, Fe-x, RC	MOD	
2-11	A2	l	m	LOW-MOD	m, 2, D, Fe-x, m	"	
11-22	AC	sl	m	LOW	NONE	"	
22-26	C	sl	sg	LOW	c, 2, D, Fe-x, m	"	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-010-06 1
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin (VERY SUBTLE) Slope Gradient (%): 2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: STRATIFIED	
Dominant Plant Species: UNIDENTIFIABLE GRASSES, JUNCUS SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 27
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7	A1	sl	m	MOD.	NONE	MOD	
7-15	A2	sl	m	MOD	C, 2, F, Fe-x, M	MOD	
15-19	C1	grsl	sg	LOW	NONE	HIGH	
19-27	C2	sil	m	LOW	M, 2, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-010-06 2
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: UNIDENTIFIABLE GRASSES, JUNCUS SP., MINOR PHALARIS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 27
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9	A1	FSL	gr	HIGH	(NONE)	MOD	
9-20	A2	FSL	M	MOD	M, 2, D, Fe-x, M	MOD	
20-27	Bg	CL	M	LOW	M, 2, P, Fe-x + Mn-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance
- f - few
- c - common
- m - many

Redox Size
- 1 - fine (<2mm)
- 2 - medium 2–5mm)
- 3 - coarse (5–20mm)
- 4 - very coarse (20–76mm)
- 5 - extremely coarse (>76mm)

Redox Contrast
- F - faint
- D - distinct
- P - prominent

Redox Type
- Fe-x - iron concentration (soft mass)
- Fe-nc - iron nodule or concretion
- Mn-x - manganese concentration (soft mass)
- Mn-nc - manganese nodule or concretion
- D - depletion

Redox Location
- M - soil matrix
- P - ped face
- PL - pore lining
- RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-010-06 3
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: HAPLAQUEPTS	Soil Series as Observed: HAPLAQUEPTS
General Comments:	
Dominant Plant Species: UNIDENTIFIABLE GRASSES, MINOR JUNCUS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 21
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7	A1	L	gr	HIGH	M, 1, P, Fe-x, RC	MOD	
7-15	A2	VFSL	M	MOD	M, 2, D, Fe-x, M	MOD	
15-21	Bg	SICL	M	LOW	"	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-010-06 4
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2 (NEAR TOE)
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed:
General Comments:	
Dominant Plant Species: UNIDENTIFIABLE GRASSES (PASTURE)	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	VFSL	gr	MOD	NONE	MOD	
3-22	A2	VFSL	M	MOD	C, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: ~~108-070-09~~ 1
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POAPRA (?), FESTUCA (?), MINOR JUNCUS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 22
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	SG	HIGH	F, 1, D, Fe-x, RC	MOD	
2-16	A2	l	M	MOD	NONE	MOD	
16-22	Bg	sil	M	LOW	M, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 2
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA, FESTUCA (?), LEY TRI (?),	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	l	SG	HIGH	NONE	MOD	
1-12	A2	l	M	HIGH	M, 2, D, Fe-x, M	MOD	
12-25	C	FSL	M	LOW	ALONG STRATA: M, 2, D, Fe-x, M	MOD	STRATIFIED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 3
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex LOCAL, SMALL DEPRESSION	Landform: natural levee artificial levee swale floodplain basin Slope Gradient (%): 0-1
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA (?), FESTUCA (?), JUN PAT,	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	VFSL	GR	HIGH	M, 1, D, Fe-x, RC	MOD	
1-7	A2	VFSL	M	MOD	M, 2, D, Fe-x, M	MOD	
7-23	C	FSL	M	LOW	M, 3, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 4
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee (TOE) artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA (?), FESTUCA (?) (PASTURE GRASSES)	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 23
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	SL	GR	HIGH	NONE	MOD	
1-9	A2	SL	SG	MOD	c,2,n,Fe-x,RC,M	MOD	1/2" GRAVEL LENS AT BASE
9-23	C	FSL	SG	LOW	M,2,P,Fe-x,M	MOD	VERY FINELY STRATIFIED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 5
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee (SUBTLE) artificial levee swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: UNIDENTIFIABLE GRASSES, POA PRA(?), MINOR JUNPAC	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 27
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7	A1	FSL	SG & M	MOD	NONE	MOD	
7-14	A2	FSL	M	LOW	c, 2, D, Fe-x, M	MOD	
14-27	C	FSL	M	LOW	m, 2, P, Fe-x, M	MOD	DISTINCT BOUNDARIES ON REDOX; MAY BE RELICTUAL.

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FURD	Pit No.: 108-030-021
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: GIFLOW
General Comments: APPARENT SURFACE INUNDATION	
Dominant Plant Species: BRONOR, DESCHAMPSIA SP, CHEINT	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A	l	m	L	c, 2, D, Fe-x, M	MOD.	
2-25	AC	vgrsl	sg	L	NONE	HIGH	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance
- f - few
- c - common
- m - many

Redox Size
- 1 - fine (<2mm)
- 2 - medium 2–5mm)
- 3 - coarse (5–20mm)
- 4 - very coarse (20–76mm)
- 5 - extremely coarse (>76mm)

Redox Contrast
- F - faint
- D - distinct
- P - prominent

Redox Type
- Fe-x - iron concentration (soft mass)
- Fe-nc - iron nodule or concretion
- Mn-x - manganese concentration (soft mass)
- Mn-nc - manganese nodule or concretion
- D - depletion

Redox Location
- M - soil matrix
- P - ped face
- PL - pore lining
- RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 2
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: FESTUCA SP (?), CYNECH	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 28
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-5	A	SI	m	L/M	NONE	MOD	
5-26	AC	L + GRSL	sg	L	IN CERTAIN STRATIFICATIONS ONLY	MOD	
26-28	Ab/C	I	m	L/M	m, 3, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 3
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed:
General Comments:	
Dominant Plant Species: POAPRA, FESTUCA, MINOR RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 22
Depth to Restrictive Layer (in.): NONE	Overall Soil and Site Suitability for Wetland Establishment: low medium high N/A Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A1	l	m	M	NONE	MOD	
6-17	A2	l	m	L	c, 2, D, Fe-x, M	MOD	
17-22	Bg	vfsl	m	L	m, 3, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 4
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: STRATIFIED	
Dominant Plant Species: FESTUCA SP (?), LOLIUM SP., MINOR RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.):
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A	sl	m	L	f, 2, D, Fe-x, M	MOD	ROOT MAT AT BASE
4-19	A/C	vgrsl	sg	L	NONE	HIGH	
19-25	C	sl	m	L	m, 2, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FURD	Pit No.: 108-030-02 5
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: STRATIFIED	
Dominant Plant Species: LOLIUM SP., FESTUCA SP (?), BROHOR; MINOR RUMCRI, MENPUL, & CHIINT	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 22
Depth to Restrictive Layer (in.): NONE	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-5	A1	sl	m	L	c, 3, D, Fe-x, M	MOD	
5-11	A2	vgrls	sg	VL	NONE	HIGH	
11-18	C1	s	sg	VL	"	HIGH	
18-22	C2/2Ab	sil	m	L	m, 3, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: ~~108-030-02~~ 6
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: FESTUCA SP(?), POA PRA, PHALARIS SP.(?), MINOR RUMEX	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.):
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-8	A	vfsl	m	MOD	NONE	MOD	
8-19	ABg	l	sbk	LOW	c, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - singla grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 109-030-02 7
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: NOT STRATIFIED	
Dominant Plant Species: FESTUCA SP. (?), BROHOR, DESCHAMPSIA (?), CYNECH, MINOR RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	sl	GR	HIGH	NONE	MOD	
3-11	A2	sl	M	MOD	c, 2, D, Fe-x, M PL	MOD	
11-23	AC	sl	M	LOW	f, 2, D, Fex - M	MOD	
23-25	C	fsl	M	LOW	M, 3, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 8
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS / GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: FESTUCA (?), POAPRA, MINOR CONVOLVULUS SP.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	M	MOD	c, 2, D, Fe-x, M	MOD	
2-12	A2	sl	M	LOW	NONE	MOD	
12-25	Bg	l	M	LOW	M, 2, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 9
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA, FESTUCA (?), MENPUL, CONVOLVULUS SP.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 24
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	l	gr	HIGH	C, 2, D, Fe-x, RC	MOD.	
3-10	A2	l	m	MOD	C, 2, D, Fe-x, M	MOD.	
10-20	AC	vfsl	m	LOW	"	"	
20-24	C	scl	m	LOW	"	"	RELATIVELY MOIST

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 10
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex SPLAY?; TOE OF NATURAL LEVEE	Landform: natural levee artificial levee swale floodplain basin Slope Gradient (%): 2 (GRADIENT)
Soil Map Unit: GIELOW	Soil Series as Observed: GIELOW
General Comments: GLASS SHARD (WORN) AT 10"; STRATIFIED THROUGHOUT PROFILE	
Dominant Plant Species: BROMUS, AVENA SP.,	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 23
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-20	A/C	LOAM TO VGRLS	M TO SG	L-M	ONLY IN LOAM, NON-GRAVELLY LAYERS	MOD-HIGH	STRATIFIED
20-23	C	SIL	M	L	C, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name:	Pit No.: 108-030-02 11
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: GIELOW/ FLUVAQUENTS	Soil Series as Observed: GIELOW
General Comments: GLASS SHARD (SLIGHTLY WORN)	
Dominant Plant Species: BROMOR, HORMARGUS, LOLIUM SP., AND MINOR CHLINT AND RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 24
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
							1/4" THICK ORGANIC LAYER
0-2	A1	sl	m	M	C, 1, D, Fe-x, RC	MOD	
2-18	A2	sl	m	L	REDOX IN NON-	"	STRATIFIED
18-24	C	l	m	L	GRAVELLY LAYERS	"	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance
- f - few
- c - common
- m - many

Redox Size
- 1 - fine (<2mm)
- 2 - medium 2–5mm)
- 3 - coarse (5–20mm)
- 4 - very coarse (20–76mm)
- 5 - extremely coarse (>76mm)

Redox Contrast
- F - faint
- D - distinct
- P - prominent

Redox Type
- Fe-x - iron concentration (soft mass)
- Fe-nc - iron nodule or concretion
- Mn-x - manganese concentration (soft mass)
- Mn-nc - manganese nodule or concretion
- D - depletion

Redox Location
- M - soil matrix
- P - ped face
- PL - pore lining
- RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 12
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA, FESTUCA SP., JUNCUS SP.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	vfsl	m	MED	f, 1, D, Fe-x, M	MOD	
4-17	A2	vfsl	m	LOW	NONE	MOD	
17-25	C	sl	m	LOW	c, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

Memorandum

Date:	January 4, 2012
To:	Shanna Zahner California Department of Transportation 703 B Street Marysville, CA 95901
Cc:	
From:	Harry Oakes
Subject:	**Willits Bypass Project – Soil Characteristics at Proposed Group 2 Wetland Establishment Sites**

Introduction and Background

The Willits Bypass Project (bypass project) has several compensatory mitigation components, including wetland establishment. As part of the Clean Water Act (CWA) Section 404 individual permit process for the bypass project, the U.S. Army Corps of Engineers (USACE) has requested information related to soils at the offsite mitigation parcels where Group 2 wetland establishment is proposed. Table 1 lists these parcels and the wetland establishment acreage planned at each parcel.

Table 1. Proposed Group 2 Wetland Establishment Sites on the Offsite Mitigation Parcels

Offsite Mitigation Parcel	APN	Planned Acreage of Wetland Establishment (less temporary wetland impact acreage)
Ford	108-020-04	6.48
Ford	108-030-02	1.86
Lusher	108-030-04	5.22
Wildlands	108-020-07	2.18
Benbow	108-020-06	1.34
Wildlands	108-060-01	4.80
Wildlands	108-070-09	4.27
Benbow	108-040-13	1.65

This memorandum presents soils information that was collected on August 15 and 16 and December 12 and 13, 2011 in response to concerns expressed by USACE in the form of response to comments (dated December 9, 2011) on the October 2011 MMP. Appendix A is composed of the soil data field forms for the August and December 2011 soil evaluations. Photographs of representative soil pits are presented in Appendix B.

Natural Resources Conservation Service Soil Survey Mapping

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for parts of Mendocino and Trinity counties (Howard and Bowman 1991) provides the most recent mapping of soils at the offsite mitigation parcels where Group 2 wetland establishment is proposed. Table 2 summarizes the NRCS soil survey information for the three soil map units that occur at the offsite mitigation parcels.

Table 2. Summary of Soil Characteristics at the Offsite Mitigation Parcels as Mapped by USDA NRCS Soil Survey[a]

Soil Map Symbol	Soil Map Unit Name	Landform	Natural Drainage Class	Generalized Typical Profile (Surface, Subsurface, and Subsoil)	Parcel Occurrence (Wetland Establishment Area)
115	Cole clay loam, 0 to 2% slopes	Alluvial plains, basins	Somewhat poor	Clay loam over clay loam over clay	Benbow 108-040-13
127	Fluvaquents, 0 to 1% slopes	Floodplains	Poor and very poor	Very fine sandy loam over silt loam[b]	Ford 108-020-04 Lusher 108-030-04 Wildlands 108-060-01 Wildlands 108-070-09
128	Gielow sandy loam, 0 to 5% slopes	Alluvial plains, fans	Somewhat poor	Sandy loam and loam over sandy loam and fine sandy loam	Ford 108-020-04 Lusher 108-030-04 Wildlands 108-020-07 Benbow 108-020-06

Source: Howard and Bowman 1991.

Notes:

a. The characteristics described above for each soil map unit do not reflect map unit inclusions, whose drainage class and profile characteristics may be different than that of the primary soil component of the map unit.

b. Because of their variability, Fluvaquents have no typical profile. The profile described above occurs approximately 2,000 feet north of Ford parcel 108-020-04 along Outlet Creek.

Based on field observations within the offsite mitigation parcels where Group 2 wetland establishment is proposed, the Fluvaquents, 0 to 1 percent slopes map unit was observed to generally correspond to the low natural levees that straddle Outlet and Davis creeks. The soil survey shows the width of this map unit (and therefore roughly the width of the natural levee) ranging between nearly zero to 700 feet beyond the top of bank of the corresponding stream channel. The Gielow sandy loam, 0 to 8 percent slopes map unit appears to occupy nearly level alluvial plains and fans beyond the distal edge of the natural levee.

Topographic expression of the boundary between the Fluvaquents unit (natural levee areas) and adjoining areas of Gielow unit is very apparent within Wildlands parcels 108-070-09 and particularly 108-060-01, where a distinct slope break occurs. However, within the remaining offsite mitigation parcels where Group 2 wetland establishment is proposed, there is no clear topographic indication of the boundary between the two soil map units. Consequently, topographically, the Fluvaquents unit grades nearly imperceptivity into the Gielow unit.

For reference, a narrow artificial levee has been constructed along sections of Outlet and Davis creeks. Fill material placed to construct the artificial levee (where present) has increased the height of the natural levee by approximately one to three feet,

As mapped by the NRCS, the soils at the offsite mitigation parcels generally are weakly to weak-moderately developed, such that in many cases the surface, subsurface, and subsoil layer textures do not differ markedly within a given profile, at least as a result of soil-forming processes. Instead, the textural differences among the horizons for both the Fluvaquents and Gielow soils appear to be more a result of depositional variations, rather than clay weathering and significant clay illuviation. Because of the relatively recent deposition of their parent materials, neither of the mapped soils have profiles that contain a well-defined subsurface restrictive layer, such as a claypan or a duripan. The Gielow soil shows slightly more development than the Fluvaquents soil (because of its more stable landscape position), as evidenced by the BAt and Btg horizons.

The Cole soil is mapped only at Benbow parcel 108-040-13 and is the most developed of the three soil map units that occur within the parcels. There is no clear topographic indication of the boundary between the Cole soil and adjoining map unit (i.e., Feliz loam, 0 to 2 percent slopes) that exists along the unnamed tributary to Davis Creek to the east.

Following are descriptions of the horizons, textures, and permeability of the three soils.

Fluvaquents, 0 to 1 Percent Slopes

The representative profile described by the soil survey for the Fluvaquents unit occurs approximately 2,000 feet north of Ford parcel 108-020-04 along Outlet Creek. The profile is presented in Table 3. Despite the fact that the representative profile is located rather close to the Group 2 wetland establishment sites, the Fluvaquents profiles at the offsite mitigation parcels may differ markedly from it, which is a result of the variability in local depositional characteristics.

Because of the variability in the composition of Fluvaquents from place to place, the permeability ranges from moderately slow to moderately rapid (Howard and Bowman 1991).

Table 3. Soil Profile for Fluvaquents (0 to 1 Percent Slopes)

Horizon	Depth (inches	Texture
A1	0 – 2	Very fine sandy loam
A2	2 – 4	
Bg	4 – 25	Silt loam
C	25 – 30	Loamy sand
Ab	30 – 42	Silt loam
Cg1	42 – 56	Alternating sand and loamy sand
Cg2	56 – 63	Silt loam

Gielow Sandy Loam, 0 to 5 Percent Slopes

The representative profile described by the soil survey for the Gielow soil (which is located in Talmage) is presented in Table 4. The permeability of the Gielow soil is moderate (Howard and Bowman 1991).

Table 4. Soil Profile for Gielow Sandy Loam (0 to 5 Percent Slopes)

Horizon	Depth (inches	Texture
Ap1	0 – 4	Sandy loam
Ap2	4 – 8	Loam
A1	8 – 11	Loam
A2	11 – 18	Sandy loam
BAt	18 – 37	Fine sandy loam
Btg	37 – 48	Sandy loam
C	48 – 65	Sandy loam

Cole Clay Loam, 0 to 2 Percent Slopes

The representative profile described by the soil survey for the Cole soil (which is located in Potter Valley) is presented Table 5. The permeability of the Cole soil is slow (Howard and Bowman 1991).

Table 5. Soil Profile for Cole Clay Loam (0 to 2 Percent Slopes)

Horizon	Depth (inches	Texture
Ap	0 – 8	Clay loam
Bt1	8 – 15	Clay loam
Bt2	15 – 27	Clay
Bt3	27 – 41	Clay loam
C	41 – 60	Silty clay loam

Methods

The soil evaluations were conducted by an ICF soil scientist. A preliminary soil evaluation, using sharpshooter-excavated soil pits, was performed on August 15 and 16, 2011. A detailed soil evaluation, using backhoe pits, was performed on December 12 and 13, 2011.

Preliminary Soil Evaluation

The August 2011 soil pits were positioned in the proposed wetland establishment areas as well as in adjoining existing wetlands. The pits positioned in existing wetlands were intended to serve as a reference for assessing the suitability of the soils in the wetland establishment areas. Table 6 shows the number of profiles that were described within each parcel. Figure 1 shows the locations of the soil pits.

The pits were excavated to a depth of 19 to 28 inches and soil profile and site information was recorded on soil profile and site description forms. The profiles were described with respect to horizon; texture; coarse fragments (i.e., pebbles [>2 mm diameter] or larger-sized particles); structure; organic matter content (inferred from structure, color, and abundance of very fine roots); redoximorphic feature abundance, size, contrast, type, and location; and permeability (inferred from texture and coarse fragment content). Site characteristics that were described were landform, percent slope, slope shape, soil series as mapped and as observed (where apparent), dominant plant species, and depth to saturated soil. Based on these characteristics, particularly the depth to redoximorphic features, each evaluation site was rated (low, medium, or high, or intermediate levels between these primary ratings) with respect to its suitability for wetland establishment. (*Note: the existing wetlands in Little Lake Valley are supported by seasonal flooding and by shallow groundwater, rather than a shallow subsurface restrictive layer, such as a claypan. Accordingly, the factors considered in assessing the suitability of the establishment areas did not include the presence of a restrictive layer.*)

The soil profile information obtained during the preliminary evaluation was later used to supplement the profile information collected for the detailed evaluation by comparing the preliminary information to the designed finish grade at each soil pit site.

Table 6. Numbers of Soil Profiles Described in Existing Wetland Sites and Wetland Establishment Sites

	Number of Profiles	
Parcel	Backhoe-Excavated Pits	Sharpshooter-Excavated Pits
Ford 108-020-04		
Existing Wetland Sites	0	3
Wetland Establishment Sites	7	5
Ford 108-030-02		
Existing Wetland Sites	0	1
Wetland Establishment Sites	5	3
Lusher 108-030-04		
Existing Wetland Sites	0	1
Wetland Establishment Sites	4	3
Wildlands 108-020-07		
Existing Wetland Sites	0	0
Wetland Establishment Sites	4	0
Benbow 108-020-06		
Existing Wetland Sites	0	0
Wetland Establishment Sites	1	0
Wildlands 108-060-01		
Existing Wetland Sites	0	0
Wetland Establishment Sites	3	1
Wildlands 108-070-09		
Existing Wetland Sites	0	1
Wetland Establishment Sites	3	3
Benbow 108-040-13		
Existing Wetland Sites	0	0
Wetland Establishment Sites	1	0

Note: Not included in figures above are soil pit locations outside the area of grading: one backhoe pit excavated within Ford (108-020-04) and within Lusher (108-030-04), both in the natural levee/upland area along Outlet Creek.

Detailed Soil Evaluation

Nearly all the December 2011 soil pits were positioned in the proposed wetland establishment areas (Table 6); two were positioned on or adjacent to the artificial levee that separates the establishment areas from the nearby stream channel. The soils at these two pits were evaluated to assess the permeability of the soils adjacent to the stream channel and therefore whether significant subsurface hydrologic connectivity caused by rapidly permeable soils exists between the establishment area and the stream channel. (Significant subsurface hydrologic connectivity could cause a given establishment area to drain towards the adjoining stream channel when the water surface elevation in the channel is low, thereby causing the establishment area to not be supported by shallow saturated or inundated conditions for a duration sufficient to support wetlands.) Figure 1 shows the locations of the backhoe pits.

The pits were excavated to a depth of 29 to 51 inches, with all but two excavated to at least 41 inches. In all cases, the pits were excavated to at least 24 inches below the targeted finish grade of the established wetland at that location.

The profiles were described with respect to the same morphological characteristics as were recorded for the preliminary evaluation, but because the backhoe pits afforded a view of a larger section of the profile, it was possible to better assess the *in situ* characteristics of the soil and to assess the continuity of any relatively permeable, coarse-textured layers. The backhoe pits also better enabled an estimation of root diameter and abundance and the percent coarse fragment of each horizon[1]. The other site characteristics that were described were the same as that of the preliminary evaluation pits. Particular attention was directed to those characteristics that would indicate whether the soils in the establishment areas would lose excessive amounts of surface water to deep percolation or to excessive lateral movement of in-profile water (i.e., interflow) towards the adjoining creek (Outlet Creek and Davis Creek). The profile characteristics at each evaluation site, particularly the inferred permeability of a given horizon, were evaluated relative to the designed finish grade at that location (as shown on Figure 1) and rated with respect to its suitability for wetland establishment.

Results and Discussion

The soil profile and site description forms and photographs taken of representative backhoe pit profiles are provided at the end of this report.

In general, those profiles that were assigned a medium to high suitability rating were regarded as being overall suitable for wetland establishment. Those profiles that were assigned a low or low-medium suitability rating were regarded as being overall unsuitable for wetland establishment. Such profile sites and their surrounding areas were then excluded from the area proposed for wetland establishment. The associated grading plans have been revised accordingly.

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[1] Unless otherwise specified on the soil/site description forms, a given horizon had less than two percent coarse fragments.

Ford (APN 108-020-04)

Soils in this parcel were assigned suitability ratings ranging from low-medium to high. Some of the profiles were inferred to have moderate permeability at or just below finish grade (for example, profile Q as shown in Appendix B), and therefore suitable for wetland establishment. However, profiles N and O (see Appendix B) contained loamy sand or very gravelly sand layers that would exist at or just below the planned finish grade elevation. Such layers were determined to be excessively permeable, such that wetlands established in and near these locations could be subject to excessive lateral movement of in-profile water toward Outlet Creek.

Consequently, the grading plan that covers this parcel was revised to exclude areas in the vicinity of profiles N and O from the proposed mitigation.

Ford (APN 108-030-02)

Soils in this parcel were assigned suitability ratings ranging from low to high. Some of the profiles were inferred to have moderate permeability at or just below finish grade (for example, profile V) and therefore suitable for wetland establishment. However, profile Y (see Appendix B) contained loamy sand and pebbly layers that would exist at or just below the planned finish grade elevation. Such layers were determined to be excessively permeable, such that wetlands established in and near these locations could be subject to excessive lateral movement of in-profile water toward Outlet Creek.

Consequently, the grading plan that covers this parcel was revised to exclude areas in the vicinity of profile Y from the proposed mitigation.

Lusher (108-030-04)

Soils in this parcel were assigned suitability ratings ranging from low-medium to high. Some of the profiles were inferred to have moderate permeability at or just below finish grade (for example, profile Z) and therefore suitable for wetland establishment. However, profiles AA and BB (Figure 1) contained continuous gravelly sand, fine loamy sand, and very gravelly sand layers that would exist at or just below the planned finish grade elevation. Such layers were determined to be excessively permeable, such that wetlands established in and near these locations could be subject to excessive lateral movement of in-profile water toward Outlet Creek.

Consequently, the grading plan that covers this parcel was revised to exclude areas in the vicinity of profiles AA and BB from the proposed mitigation.

Wildlands (108-020-07)

All the soils in this parcel were assigned a suitability rating of high. All of the profiles were inferred to have moderate permeability at or just below finish grade (for example, profile I) and therefore suitable for wetland establishment.

Benbow (108-020-06)

The single detailed soil evaluation profile (K) described at this parcel was assigned a suitability rating of medium-high. The profile was inferred to generally have moderate permeability, but with a moderate to high permeability in part of the depth range of 11 to 19 inches because of the presence of fine loamy sand material. However, the soil will be a moderately permeable loam at and just below finish grade and therefore suitable for wetland establishment.

Wildlands (108-060-01)

Soils in this parcel were assigned suitability ratings of medium or high. With the exception of profile E (see Appendix B), the profiles were inferred to have moderate permeability at or just below finish grade and therefore suitable for wetland establishment. Profile E will have a gravelly loam layer at finish grade, but because that layer has only 20% gravel content, it is expected to be moderately permeable. The profile also contains a sand lens between 15 and 16 inches depth, but because it appears to not be continuous, it is not expected to cause significant losses of water from the profile. Because the soil will be a moderately permeable loam at and just below finish grade, it will therefore be suitable for wetland establishment.

Wildlands (108-070-09)

Soils in this parcel were assigned suitability ratings of medium-high or high. The profiles were inferred to have moderate permeability at or just below finish grade and therefore suitable for wetland establishment (Appendix B). Profile C will have a stratified silt loam and loamy sand layer 15 inches below finish grade and a continuous, one inch thick loamy sand layer 18 inches below finish grade. A clay loam Bg horizon below these stratified layers should prevent excessive deep percolation losses. Because the soil will be a moderately permeable loam at and just below finish grade, it will therefore be suitable for wetland establishment.

Benbow (108-040-13)

The single detailed soil evaluation profile (L) (see Appendix B) described at this parcel was assigned a suitability rating of high. The profile was inferred to have moderate permeability with loam or light clay loam textures throughout. The soil will be a light clay loam at and just below the planned finish grade and therefore will be suitable for wetland establishment.

Conclusion

Based on the soil/site data collected for this evaluation, the soils are suitable for wetland establishment at all the Group 2 wetland establishment sites except parts of Ford 108-020-04 , Ford, 108-030-02, and Lusher 108-030-04. These soils are unsuitable because of apparent rapidly permeable layers or horizons that could cause excessive deep percolation below the root zone or lateral movement of in-profile water toward the adjoining stream channels when the water surface elevation in the channels is lower than that of the soil water table.

Areas of unsuitable soils on these parcels have been excluded from the wetland mitigation program and the wetland grading and planting plans have been revised accordingly.

Citation

Howard, R.F. and R.H. Bowman. 1991. Soil survey of Mendocino County, eastern part, and Trinity County, southwestern part, California. USDA Soil Conservation Service in cooperation with the USDA Forest Service, USDI Bureau of Land Management and Bureau of Indian Affairs, and Regents of the University of California.

Appendix A Soil Data Collection Forms

SOIL PROFILE AND SITE

SUITABILITY DESCRIPTION

FORMS

FUND

108-020-04

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: M
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5325 KNIFE AT TOP OF LOAMY SAND LAYER	
Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin	
	Slope Gradient (%): 1-2%	
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS	
General Comments: THE FINISH GRADE IS 0.5' BELOW THE EXISTING GRADE, LOAMY SAND LAYER AT 29" to 33", CONTINUOUS, CHARCOAL AT 26", LOAMY SAND LAMBRIS 2% SUBANGULAR GRAVEL		
Dominant Plant Species: FESTUCA, LOLIUM, PHALARIS		
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 41"	
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:	

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-3"	A1	sil	2, gr	MOD	NONE	MOD	ROOTS COMMON FINE
3"-7"	A2	l	1, sbk	MOD	NONE	MOD	ROOTS COMMON FINE
7"-16"	B	l	1, sbk	LOW	NONE	MOD	ROOTS FEW FINE
16"-41"	Bg	l	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS FEW FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: N
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5326, KNIFE AT TOP OF B1	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1 %
Soil Map Unit: 128	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE 0.4' BELOW EXISTING GRADE, CHARCOAL AT 14", PROFILE IS CRUDELY STRATIFIED BETWEEN 4" & 29"	
Dominant Plant Species: FESTUCA, LOLIUM, PHALARIS, GEDI, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 29"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-2"	A1	l	3 gr	HIGH	NONE	MOD	ROOTS MANY MEDIUM, MANY FINE
2"-4"	A2	l	2 sbk	HIGH	c, 1, D, Fe-x, PL	MOD	ROOTS COMMON MEDIUM, COMMON FINE
4"-7"	B1	l	0, M	LOW	c, 2, D, Fe-x, M	MOD	ROOTS FEW FINE
7"-14"	B2	ls	0, M	LOW	NONE	HIGH	ROOTS FEW FINE, GRAVEL CONTENT 5%
14"-17"	B3	sil	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS FEW FINE
17"-26"	Bg	sil	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS FEW VERY FINE
26"-29"	B	fls	0, M	LOW	NONE	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: O
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5327, KNIFE @ BOTTOM OF C	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1 %
Soil Map Unit: 128	Soil Series as Observed: GIELO
General Comments: FINISH GRADE 0.8' BELOW EXISTING GRADE, GLASS SHARD CONTAINED IN THE C HORIZON, CHARCOAL @ 34", PROFILE CRUDE LY STRATIFIED 9"-17", SANDY LAYERS CONTINUOUS	
Dominant Plant Species: GEDI, TRIFOLIUM, FESTUCA, LOLIUM, PHALARIS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 49"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-9"	A	l	2, gr	MOD	NONE	MOD	ROOTS MANY FINE
9"-15"	C	vgrs	0, M	LOW	NONE	HIGH	ROOTS MANY VERY FINE, 60% GRAVEL, ROUNDED & SUBANGULAR
15"-17"	Cg1	sil	0, M	LOW	c, 1, D, Fe-x, PL	MOD	ROOTS NONE
17"-22"	Cg2	cos	0, M	LOW	m, 3, F, Fe-x, M	HIGH	ROOTS NONE
22"-26"	Cg3	sil	0, M	LOW	m, 3, D, Fe-x, M	MOD	ROOTS NONE
26"-30"	Cg4	cos	0, M	LOW	m, 3, F, Fe-x, M	HIGH	ROOTS NONE
30"-47"	Cg5	sl	0, M	LOW	m, 3, D, Fe-x, M	MOD HIGH	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: P
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5329, KNIFE AT TOP OF C1	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin ADJACENT TO ARTIFICIAL LEVEE (LOW)
	Slope Gradient (%): 2%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE 1.0' LOWER THAN EXISTING GRADE 35' FROM TOP OF BANK, SUBSURFACE TOPOGRAPHY OF Bw & C1 HORIZONS VARIES GREATLY	
Dominant Plant Species: LOLIUM, FESTUCA, GEBI, TRIFOLIUM, PLANTAGO, BROMUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 51"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7"	A	l	2,sbk	MOD	NONE	MOD	ROOTS COMMON FINE MEDIUM
7"-13"	Bw	sl	0,M	LOW	NONE	MOD	ROOTS FEW FINE
13"-32"	C1	vgrs	0,M	LOW	NONE	HIGH	ROOTS NONE, 65% GRAVEL ROUNDED & SUBANGULAR
32"-43"	C2	sl	0,M	LOW	NONE	HIGH	ROOTS NONE, CRUDELY STRATIFIED
43"-51"	Cg	sil	0,M	LOW	m,2,D,Fe-x,M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismetic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: Q
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5330, KNIFE @ TOP OF C	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin TRANSITIONAL
	Slope Gradient (%): 1 - 2 %
Soil Map Unit: 127/128 BOUNDARY	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE IS 1.0' BELOW EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM, PHALARIS, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 48"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-3"	A1	sicl	3 gr	MOD	NONE	MOD	ROOTS FEW MEDIUM COMMON FINE
3"-8"	A2	sil	1 sbk	MOD	NONE	MOD	ROOTS COMMON FINE
8"-16"	Bw	l	0, M	LOW	m, 3, D, Fe-x, M	MOD	ROOTS FEW, VERY FINE
16"-29"	Bg	sil	0, M	LOW	c, 2, D, Fe-x, M	MOD	ROOTS FEW, VERY FINE
29"-37"	Cg	sil	0, M	LOW	c, 3, D, Fe-x, M	MOD	ROOTS FEW, VERY FINE
37"-48"	C	ls	0, M	LOW	NONE	HIGH	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: R
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5331, KNIFE @ TOP OF Bw2	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE IS 0.4' BELOW EXISTING GRADE,	
Dominant Plant Species: FESTUCA, LOLIUM, RANUNCULUS, TRIFOLIUM, JUN PAT	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 44"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A	sicl-	1, sbk	MOD	NONE	MOD	ROOTS MANY VERY FINE
4"-15"	Bw1	l-	0, M	LOW	NONE	MOD	ROOTS FEW FINE
15"-18"	Bw2	sl	0, M	LOW	c, 2, D, Fe-x, M	MOD	ROOTS FEW FINE
18"-44"	Bg	sil	0, M	LOW	c, 1, P, Fe-x, PL	MOD	ROOTS FEW VERY FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: S
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: ~~0~~	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 127	Soil Series as Observed: GIELOW
General Comments: FINISH GRADE 0.4' BELOW EXISTING GRADE,	
Dominant Plant Species: FESTUCA, LOLIUM, GEDI, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 42"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-6"	A	l	1, sbk	Mod	NONE	Mod	ROOTS COMMON FINE AND MEDIUM, 5% GRAVEL
6"-15"	Bw	sil	0, M	Low	NONE	Mod	ROOTS COMMON VERY FINE
15"-18"	C1	grfsl	0, M	Low	NONE	HIGH	ROOTS FEW VERY FINE, 5% GRAVEL, ROUNDED
18"-22"	Bg	l	0, M	Low	m, 3, D, Fe-x, M	MOD	ROOTS FEW VERY FINE
22"-31"	C2	ls	0 M	Low	c, 3, F, Fe-x, M	HIGH	ROOTS NONE
31"-40"	Cg	sil	0 M	Low	m, 3, D, Fe-x, M	Mod	ROOTS NONE
40"-47"	C3	grs	0, M	Low	NONE	HIGH	ROOTS NONE, 25% GRAVEL, ROUNDED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: T
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5332, KNIFE @ BOTTOM OF BW	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE IS 0.5' BELOW EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): SAT @ 51"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-5"	A	sl	0, M	MOD	NONE	MOD	ROOTS COMMON FINE
5"-12"	Bw	grsl	0, M	LOW	NONE	MOD HIGH	ROOTS FEW, VERY FINE, 20% GRAVEL ROUNDED
12"-24"	Bg1	sil	0, M	LOW	m, 3, D, Mn-x Fe-x, M	MOD	ROOTS FEW, VERY FINE
24"-28"	C	s	0, M	LOW	NONE	HIGH	ROOTS NONE
28"-37"	Bg2	l	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS NONE
37"-51"	C	s	0, M	LOW	NONE	HIGH	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	Redox Location
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"5b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FURO	Pit No.: ~~108-030-02~~ 5
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: STRATIFIED	
Dominant Plant Species: LOLIUM SP., FESTUCA SP (?), BROMOR; MINOR RUMCRI, MENPUL, & CHIINT	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 22
Depth to Restrictive Layer (in.): NONE	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-5	A1	sl	m	L	c, 3, D, Fe-x, M	MOD	
5-11	A2	vgrls	sg	VL	NONE	HIGH	
11-18	C1	s	sg	VL	"	HIGH	
18-22	C2/2Ab	sil	m	L	m, 3, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"6b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-~~030~~-02 6
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: FESTUCA SP(?), POA PRA, PHALARIS SP.(?), MINOR RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.):
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-8	A	vfsl	m	MOD	NONE	MOD	
8-19	ABg	l	sbk	LOW	c, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance

f - few
c - common
m - many

Redox Size

1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Contrast

F - faint
D - distinct
P - prominent

Redox Type

Fe-x - iron concentration (soft mass)
Fe-nc - iron nodule or concretion
Mn-x - manganese concentration (soft mass)
Mn-nc - manganese nodule or concretion
D - depletion

Redox Location

M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"76"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 109-030-02 7
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: NOT STRATIFIED	
Dominant Plant Species: FESTUCA SP. (?), BROMOR, DESCHAMPSIA (?), CYNECH, MINOR RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	sl	GR	HIGH	NONE	MOD	
3-11	A2	sl	M	MOD	c, 2, D, Fe-x, PL M	MOD	
11-23	AC	sl	M	LOW	f, 2, D, Fex - M	MOD	
23-25	C	fsl	M	LOW	M, 3, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"8b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: Ford	Pit No.: ~~108-030-02~~ 8
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS / GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: FESTUCA (?), POAPRA, MINOR CONVOLVULUS SP.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	M	MOD	c, 2, D, Fe-x, M	MOD	
2-12	A2	sil	M	LOW	NONE	MOD	
12-25	Bg	l	M	LOW	M, 2, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"9b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 9
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA, FESTUCA (?), MENPUL, CONVOLVULUS SP.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 24
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-3	A1	l	gr	HIGH	C, 2, D, Fe-x, RC	MOD.	
3-10	A2	l	m	MOD	C, 2, D, Fe-x, M	MOD.	
10-20	AC	vfsl	m	LOW	"	"	
20-24	C	scl	m	LOW	"	"	RELATIVELY MOIST

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content).

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"105"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 10
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex SPLAY?; TOE OF NATURAL LEVEE	Landform: natural levee artificial levee swale floodplain basin (GRADIENT) Slope Gradient (%): 2
Soil Map Unit: GIELOW	Soil Series as Observed: GIELOW
General Comments: GLASS SHARD (WORN) AT 10"; STRATIFIED THROUGHOUT PROFILE	
Dominant Plant Species: BROMUS, AVENA SP.,	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 23
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-20	A/C	LOAM TO VGRLS	M TO SG	L-M	ONLY IN LOAM, NON-GRAVELLY LAYERS	MOD-HIGH	STRATIFIED
20-23	C	SIL	M	L	C, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grein	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"11b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name:	Pit No.: 108-030-02 11
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2
Soil Map Unit: GIELOW/ FLUVAQUENTS	Soil Series as Observed: GIELOW
General Comments: GLASS SHARD (SLIGHTLY WORN)	
Dominant Plant Species: BROMOR, HORMARGUS, LOLIUM SP., AND MINOR CHAINT AND RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 24
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
							1/4" THICK ORGANIC LAYER
0-2	A1	sl	m	M	C, 1, D, Fe-x, RC	MOD	
2-18	A2	sl	m	L	REDOX IN NON-	"	STRATIFIED
18-24	C	l	m	L	GRAVELLY LAYERS	"	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"126"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: Ford	Pit No.: 108-030-02 12
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: GIELOW	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA, FESTUCA SP., JUNCUS SP.	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A1	vfsl	M	MED	f, 1, D, Fe-x, M	MOD	
4-17	A2	vfsl	M	LOW	NONE	MOD	
17-25	C	sl	M	LOW	c, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

FOND

108-030-02

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 4
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE IS 0.25' LOWER THAN EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): SAT @ 50"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-2"	A1	l	1, gr	HIGH	NONE	MOD	ROOTS MANY FINE, 10% GRAVEL ROUNDED
2"-6"	A2	grl	1, sbk	LOW	NONE	MOD HIGH	ROOTS COMMON FINE 15% GRAVEL ROUNDED
6"-19"	BA	l	0, M	LOW	F, 2, D, Fe-x-M	MOD	ROOTS FEW FINE, 5% GRAVEL ROUNDED
19"-23"	Bg1	sil	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS NONE
23"-50"	Bg2	fsl	0, M	LOW	c, 3, F, Fe-x, M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	O - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: V
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin TRANSITION
	Slope Gradient (%): 1%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISHED GRADE IS 0.3' BELOW EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 42"
Depth to Restrictive Layer (in.): N/A ☑(Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A'	l	1, sbk	MOD	NONE	MOD	ROOTS COMMON FINE
4"-12"	AB	l	0, M	LOW	NONE	MOD	ROOTS FEW FINE
12"-26"	Bw	sil	1, sbk	LOW	c, 2, F, Fe-x, M	MOD	ROOTS FEW FINE
26"-42"	Bg	sicl	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS FEW FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: W
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5334, KNIFE @ BOTTOM OF A2	
Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin	
	Slope Gradient (%): 1%	
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS	
General Comments: FINISHED GRADE IS 0.25' BELOW EXISTING GRADE		
Dominant Plant Species: GEDI, TRIFOLIUM, FESTUCA, LOLIUM, PHALARIS		
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): SAT @ 46"	
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:	

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-2"	A1	fsl	1, sbk	HIGH	NONE	MOD	ROOTS MANY VERY FINE
2"-4"	A2	fsl	1, sbk	MOD	NONE	MOD	ROOTS FEW VERY FINE
4"-9"	Bg1	sil	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS FEW VERY FINE
9"-36"	Bg2	fsl	0, M	LOW	m, 3, D, Fe-x, M	MOD	ROOTS FEW VERY FINE
36"-46"	C	ls	0, M	LOW	NONE	HIGH	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: X
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5335, KNIFE @ TOP OF C	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE 0.75' LOWER THAN EXISTING	
Dominant Plant Species: TRIFOLIUM, ERODIUM, HYPOCRUS, PHALARIS, LOLIUM, FESTUCA	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 41"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-2"	A1	l	1-sbk	MOD	NONE	MOD	ROOTS COMMON VERY FINE
2"-5"	A2	l	1-sbk	MOD	NONE	MOD	ROOTS COMMON VERY FINE, GRAVEL 5%
5"-13"	AB	l	0,M	LOW	NONE	MOD	ROOTS FEW FINE
13"-15"	C	s	0,M	LOW	NONE	HIGH	ROOTS NONE, DISCONTINUOUS, GRAVEL 5%
15"-41"	Bg	l	0,M	LOW	m,2,D,Fe-x,M	MOD	ROOTS FEW VERY FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: Y
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5338, KNIFE @ TOP OF PEBBLE LINE	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISHED GRADE IS 0.2' LOWER THAN EXISTING GRADE	
Dominant Plant Species: BRASSICA, GEDI, FESTUCA, LOLIUM, ERODIUM, HYPOCRUS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 35"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-3"	A	l	0, m	Low	NONE	MOD	ROOTS MANY VERY FINE
3"-6"	Bw	ls	0, m	Low	c, 3, F, Fe-x, M	HIGH	ROOTS FEW VERY FINE
6"-7"	—	PEBBLES	—	—	—	HIGH	ROOTS NONE, 90% PEBBLES, SMALL ROUNDED, DISCONTINUOUS
7"-35"	C	grls	0, m	Low	NONE	HIGH	ROOTS NONE, 15-65% GRAVEL, ROUNDED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"1b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-021
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: GIFLOW
General Comments: APPARENT SURFACE INUNDATION	
Dominant Plant Species: BROHOR, DESCHAMPSIA SP, CHEINT	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A	l	m	L	c, 2, D, Fe-x, M	MOD.	
2-25	AC	vgrsl	sg	L	NONE	HIGH	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance
- f - few
- c - common
- m - many

Redox Size
- 1 - fine (<2mm)
- 2 - medium 2–5mm)
- 3 - coarse (5–20mm)
- 4 - very coarse (20–76mm)
- 5 - extremely coarse (>76mm)

Redox Contrast
- F - faint
- D - distinct
- P - prominent

Redox Type
- Fe-x - iron concentration (soft mass)
- Fe-nc - iron nodule or concretion
- Mn-x - manganese concentration (soft mass)
- Mn-nc - manganese nodule or concretion
- D - depletion

Redox Location
- M - soil matrix
- P - ped face
- PL - pore lining
- RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"2b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 2
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: FESTUCA SP (?), CYNECH	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 28
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0 - 5	A	SI	m	L/M	NONE	MOD	
5 - 26	AC	L + GRSL	sg	L	IN CERTAIN STRATIFICATIONS ONLY	MOD	
26-28	Ab/C	L	m	L/M	m,3,P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"3b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 3
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2-3
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed:
General Comments:	
Dominant Plant Species: POAPRA, FESTUCA, MINOR RUMCRI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 22
Depth to Restrictive Layer (in.): NONE	Overall Soil and Site Suitability for Wetland Establishment: low medium high N/A Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6	A1	l	m	M	NONE	MOD	
6-17	A2	l	m	L	c, 2, D, Fe-x, M	MOD	
17-22	Bg	vfsl	m	L	m, 3, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"4b"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: FORD	Pit No.: 108-030-02 4
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0-1
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments: STRATIFIED	
Dominant Plant Species: FESTUCA SP (?), LOLIUM SP., MINOR RUMEX	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.):
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-4	A	sl	m	L	f, 2, D, Fe-x, M	MOD	ROOT MAT AT BASE
4-19	A/C	vgrsl	sg	L	NONE	HIGH	
19-25	C	sl	m	L	m, 2, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

LUSHER

108 - 030 - 04

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: Z
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 128	Soil Series as Observed:
General Comments: FINISHED GRADE IS 0.7' LOWER THAN EXISTING GRADE	
Dominant Plant Species: LOLIUM, FESTUCA, PHALARIS, CAREX,	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 45"
Depth to Restrictive Layer (in.): N/A ☒ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A1	l	2,gr	HIGH	NONE	MOD	ROOTS MANY FINE
4"-6"	A2	l	2,gr	MOD	m,1,D,Fe-x,PL	MOD	ROOTS MANY FINE, OX RHIZ
6"-23"	BA	fsl	0,M	LOW	c,2,D,Fe-x,M	MOD	ROOTS COMMON FINE
23"-45"	Bg	sil	0,M	LOW	m,3,D,Fe-x,M	MOD	ROOTS FEW FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint

D - distinct

P - prominent

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: AA
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex SLIGHTLY HUMMOCKY, DISTURBED LOOKING	Landform: natural levee artificial levee swale floodplain basin Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISH GRADE IS 1.4' BELOW EXISTING GRADE, ALL COARSE TEXTURED LAYERS ARE CONTINUOUS	
Dominant Plant Species: TRIFOLIUM, FESTUCA, ERODIUM, HYPOCEUS, GEDI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 46"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-2"	A1	l	1-sbk	MOD	NONE	MOD	ROOTS COMMON FINE, CHARCOAL PRESENT
2"-9"	A2	sil	0, M	LOW	NONE	MOD	ROOTS FEW FINE
9"-18"	C1	grs	0, M	LOW	NONE	HIGH	ROOTS NONE, 35% GRAVEL
18"-20"	Bg1	fls	0, M	LOW	m, 2, D, Fe-x, M	HIGH	ROOTS NONE
20"-33"	Bg2	fls	0, M	LOW	m, 3, D, Fe-x, M	HIGH	ROOTS NONE
33"-37"	C2	xgrls	0, M	LOW	NONE	HIGH	ROOTS NONE, 70% GRAVEL
37"-46"	C3g	sil	0, M	LOW	m, 3, F, Fe-x, M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: BB
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5340, KNIFE C TOP OF C	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin TRANSITIONAL
	Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISHED GRADE IS 1.0' LOWER THAN EXISTING GRADE	
Dominant Plant Species: GEDI, LOLIUM, FESTUCA, PHALARIS, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 45"
Depth to Restrictive Layer (in.): N/A (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A	l	3gr	MOD	NONE	MOD	ROOTS COMMON FINE
4"-11"	BA	fsl	0, M	LOW	NONE	MOD	ROOTS FEW FINE
11"-16"	B	ls	0, M	LOW	c, 2, F, Fe-x, M	HIGH	ROOTS FEW FINE
16"-21"	C	vgrs	0, M	LOW	NONE	HIGH	ROOTS NONE, 55% GRAVEL, ROUNDED, CONTINUOUS
21"-45"	Bg	sil	0, M	LOW	m, 3, D, Fe-x, M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: CC
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5343, KNIFE @ TOP OF C3	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin LOW ARTIFICIAL LEVEE 30' +/- TO EAST, 85' +/- TO TOP OF BANK Slope Gradient (%): 1-2 %
Soil Map Unit: 127	Soil Series as Observed: FLUVAQUENTS
General Comments: FINISHED GRADE IS 0.2' LOWER THAN EXISTING GRADE	
Dominant Plant Species: GEDI, TRIFOLIUM, FESTUCA, LOLIUM, HYPOCRUS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 47"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-2"	A1	l	2, gr	MOD	NONE	MOD	ROOTS COMMON FINE
2"-5"	A2	sil	1, sbk	LOW	e, 2, D, Fe-x-M	MOD	ROOTS FEW FINE
5"-11"	C1	fsl	0, M	LOW	NONE	HIGH	ROOTS FEW FINE
11"-14"	C2	l	0, M	LOW	NONE	MOD	ROOTS NONE
14"-30"	C3	cos	0, M	LOW	NONE	HIGH	ROOTS NONE, 10% GRAVEL ROUNDED, CONTINUOUS
30"-47"	Bg	sil, vfsl	0, M	LOW	m, 2, D, Fe-x, M & PL	MOD	ROOTS NONE,

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extramely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: DD
Investigator(s): Joel Butterworth, Paul Weller	Date: December 13, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: #5344, KNIFE @ TOP OF Bg	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2%
Soil Map Unit: 127/128 BOUNDARY	Soil Series as Observed:
General Comments: FINISH GRADE IS 1.5' BELOW EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM, TRIFOLIUM, GEDI, HYPOCRUS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 50"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-3"	A1	l	3,gr	HIGH	NONE	MOD	ROOTS MANY, FINE
3"-7"	A2	l+	2,sbk	MOD	f, F, D, Fe-x, PL	MOD	ROOTS COMMON FINE
7"-15"	C1	ls	0,0	LOW	NONE	HIGH	ROOTS FEW, FINE
15"-18"	C2	grs	0,0	LOW	NONE	HIGH	ROOTS NONE, 15% GRAVEL ROUNDED, CONTINUOUS
18"-40"	Bg	l	0,0	LOW	m, 2, D, Fe-x, M	MOD	ROOTS NONE
40"-50"	Cg	sil+	0,0	LOW	c, 1, P, Fe-x, M	MOD	ROOTS NONE, GLEYED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"1a"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: 108-030-04
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0 – 1
Soil Map Unit: GIELOW	Soil Series as Observed: GIELOW
General Comments:	
Dominant Plant Species: JUNCUS SP, MEAPUL, DESCHAMPSIA SP, PHALARIS SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 21
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high N/A Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0–10	A	l	abk, 2	L	m, 2, P, Fe-x, M	MOD.	ROOT MAT AT BASE
10–16	C1	grsl	sg	VL	NONE	HIGH	
16–21	C2	s	sg	VL	"	HIGH	
21+	2Ab	cl	m	L	m, 2, P, Fe-x, M	MOD	RELATIVELY MOIST

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"2a"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: 108-030-04 2
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: GIELOW	Soil Series as Observed: ?
General Comments:	
Dominant Plant Species: BROHOR, AVENA SP, LOLIUM SP, DECHAMPSIA SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 24
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7	A	sl	sg	M	NONE	MOD	
7-13	C1	ls	sg	L	NONE	HIGH	
13-19	C2	sr/s	sg	L	NONE	HIGH	
19-24	2Ab/C3	sil	m	M	M, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granuler	0 - structureless
abk - angular blocky	1 - weak
pl - plety	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance
- f - few
- c - common
- m - many

Redox Size
- 1 - fine (<2mm)
- 2 - medium 2–5mm)
- 3 - coarse (5–20mm)
- 4 - very coarse (20–76mm)
- 5 - extremely coarse (>76mm)

Redox Contrast
- F - faint
- D - distinct
- P - prominent

Redox Type
- Fe-x - iron concentration (soft mass)
- Fe-nc - iron nodule or concretion
- Mn-x - manganese concentration (soft mass)
- Mn-nc - manganese nodule or concretion
- D - depletion

Redox Location
- M - soil matrix
- P - ped fece
- PL - pore lining
- RC - root channel (ox. rhizospheres)

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"3a"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: 108-030-04 3
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe **sharpshooter** hand auger	Photo Number:	

Land Surface Shape: (slightly) **planar** concave convex SOMEWHAT DISTURBED, ESPECIALLY TO EAST	Landform: natural levee artificial levee swale **floodplain*** basin Slope Gradient (%): 1 - 2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed:
General Comments: GLASS SHARD (SLIGHTLY WORN) AT 8"	* NEAR TOE OF NATURAL LEVEE (?)
Dominant Plant Species: TAECAPMED, BROHOR, CENSOL, AVENA SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition **upland**	Depth to Soil Saturation (in.): NONE TO 28
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low **medium** high Comments: DIFFICULT TO ASSESS WITH REGARD TO REDOX BECAUSE OF GRAVELLY MATERIAL FROM 2 TO 26, WHICH DOES NOT PROMOTE REDOX

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
							1/4" ORGANIC MAT AT SURFACE*
0-2	A	l	m	LOW	c, 2, D, Fe-x, PL	MOD.	* FROM INUNDATION ?
2-11	AC	xgrsl	sg	LOW	NONE	HIGH	
11-26	C	vgrls	sg	LOW	NONE	HIGH	
26-28	2Ab/C	sil	m	MOD	c, 2, D, Fex-M	MOD	RELATIVELY MOIST

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"4a"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: LUSHER	Pit No.: 108-030-04 4
Investigator(s): Joel Butterworth	Date: August 15, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1 - 2
Soil Map Unit: GIELOW	Soil Series as Observed: GIELOW
General Comments:	
Dominant Plant Species: LOLIUM SP, HORMARGUS, DECHAMPSIA SP	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 26
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-2	A1	l	M	MOD	M, Z, D, Fe-x, RC	MOD	
2-11	A2	l	M	LOW-MOD	M, Z, D, Fe-x, M	"	
11-22	AC	sl	M	LOW	NONE	"	
22-26	C	sl	sg	LOW	C, Z, D, Fe-x, M	"	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - vary cobbly
ls - loamy sand	cl - clay loam	xcb - extremaly cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with reletively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast

F - faint
D - distinct
P - prominent

WILDLANDS

108 - 020 - 07

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS/BENBOW	Pit No.: G
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: -0-	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 128	Soil Series as Observed: COLE
General Comments: FINISH GRADE 1' BELOW EXISTING GRADE	
Dominant Plant Species: LOLIUM, FESTUCA	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE to 49"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A1	l	1,sbk	MOD	NONE	MOD	ROOTS COMMON FINE
4"-11"	A2	sil	1,sbk	MOD	NONE	MOD	ROOTS FEW, VERY FINE
11"-20"	BA	sil	1,sbk	LOW	c,1,D,Fe-x,PL	MOD	ROOTS FEW, VERY FINE
20"-46"	B+	cl	2,sbk	LOW	m,2,D,Fe-x,M	MOD	ROOTS FEW, VERY FINE
46"-49"	B+C	cl-	0,M	MOD	m,2,F,Fe-x,M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS/BENBOW	Pit No.: H
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: Ø	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 128	Soil Series as Observed: COLE
General Comments: FINISH GRADE 1.2' BELOW EXISTING GRADE	
Dominant Plant Species: LOLIUM, FESTUCA, CAREX	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 48"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-5"	A1	sil	2, gr	MOD	NONE	MOD	ROOTS MANY FINE, FEW MEDIUM
5"-15"	A2	l	0, M	MOD	NONE	MOD	ROOTS FEW FINE, FEW MEDIUM
15"-30"	Bg	sil	0, M	LOW	m, 2, D, Mn-x Fe-x, M	MOD	ROOTS FEW VERY FINE
30"-48"	BgC	l	0, M	LOW	m, 3, D, Fe-x, M	MOD	ROOTS FEW VERY FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS/BENBOW	Pit No.: I
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5321 KNIFE @ TOP OF Btg	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 128	Soil Series as Observed: SIMULAR TO COLE
General Comments: FINISH GRADE IS 1.4' BELOW EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 42"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A1	l	3, gr	MOD	NONE	MOD	ROOTS COMMON FINE
4"-14"	A2	l	1, sbk	LOW	NONE	MOD	ROOTS FEW FINE
14-21"	BA	vfsl	0, M	LOW	NONE	MOD	ROOTS FEW FINE
21"-32"	Btg	sicl-	1, sbk	LOW	m, 2, D, Mn-x Fe-x, M	MOD	ROOTS FEW FINE
32-42"	Bg	cl	0, M	LOW	m, 3, D, Fe-x, M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay texture| class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS/BENBOW	Pit No.: J
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: Ø	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 128	Soil Series as Observed: UNDETERMINED
General Comments: FINISH GRADE 0.5' BELOW EXISTING GRADE	
Dominant Plant Species: FESTUCA, PHALARIS, LOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 37"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-3"	A1	l+	2,gr	MOD	NONE	MOD	ROOTS COMMON FINE
3"-9"	A2	l	2,gr	MOD	NONE	MOD	ROOTS COMMON FINE
9"-26"	C	sil	0,M	LOW	NONE	MOD	ROOTS FEW FINE
26"-37"	Cg	l	0,M	LOW	c,3,F,Fe-x,M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

BENBOW

108-020-06

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS/BENBOW	Pit No.: K
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: Ø	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 128	Soil Series as Observed:
General Comments: FINISH GRADE IS 0.5' LOWER THAN EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM, CAREX, RUBUS (ON 3 SIDES OF PIT)	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 39"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A1	l	2, gr	MOD	NONE	MOD	ROOTS COMMON FINE, FEW MEDIUM
4"-11"	A2	l	0, M	MOD	c, 2, F, Fe-x, M	MOD	ROOTS COMMON FINE, FEW MEDIUM
11"-19"	BA	fls&fsl	0, M	LOW	NONE	MOD-MH	ROOTS COMMON FINE
19"-39"	Bg	sicl	1, abk	LOW	m, 3, D, Fe-x, M	MOD	ROOTS FEW FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

WILDLANDS

108-060-01

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: D
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5318 KNIFE AT TOP OF C HORIZON	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1%
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE 0.3' BELOW EXISTING GRADE, UPPER 4" OF HORIZON C HAS LAMINATIONS	
Dominant Plant Species: LOLIUM, FESTUCA, PHALARIS, JUN PAT, TRIFOLIUM	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 63"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9"	A	fsl	1, gr	HIGH	NONE	MOD	ROOTS MANY FINE
9-25"	Bg	sil	1, sbk	LOW	M, 2, D, Fe-x, M	MOD	ROOTS COMMON FINE
25"-63"	C	l	0, M	VERY LOW	m, 2, P, Fe-x, M	MOD	MODERATELY CONSOLIDATED FEW, VERY FINE ROOTS

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: E
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: # 5319, KNIFE @ SAND LENSE	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 2 %
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE 0.3' BELOW EXISTING GRADE, DISCONTINUOUS SAND LENSE AT 15-16"	
Dominant Plant Species: FESTUCA, LOLIUM, GEDI, JUN TEN	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 55"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A1	l	3, gr	HIGH	NONE	MOD	ROOTS MANY FINE
4"-12"	A2	grl	3, gr	HIGH	c, 2, D, Fe-x, M	MOD to HIGH	20% GRAVEL ROOTS COMMON FINE
12"-24"	Bg	sil	0, M	LOW	c, 3, P, Fe-x, M	MOD	ROOTS FEW VERY FINE
24"-55"	BgC	l	0, M	LOW	c, 3, P, Fe-x, M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: F
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5320 KNIFE @ BOTTOM OF A HORIZON	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE 0.75' LOWER THAN EXISTING GRADE, CHARCOAL PRESENT @ 31"	
Dominant Plant Species: LOLIUM, FESTUCA, CAREX	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 57"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-14"	A	sl, ls	O, M	MOD	NONE	MOD TO HIGH	5% GRAVEL ROOTS MANY FINE & MEDIUM
14"-19"	B1	vfsl	O, M	LOW	NONE	MOD	ROOTS FEW MEDIUM
19-57"	B2	sil	O, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS FEW VERY FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cost - coarse sandy loam	sic - silty clay	xst - extremely stony
st - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with ralatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size
1 - fine (<2mm)
2 - medium 2–5mm)
3 - coarse (5–20mm)
4 - very coarse (20–76mm)
5 - extremely coarse (>76mm)

Redox Location
M - soil matrix
P - ped face
PL - pore lining
RC - root channel (ox. rhizospheres)

Redox Contrast
F - faint
D - distinct
P - prominent

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"5c"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-095
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin (SUBTLE)
	Slope Gradient (%): 0-1
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: UNIDENTIFIABLE GRASSES, POA DICA (?), MINOR JUNPAR	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 27
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-7	A1	FSL	SG & M	MOD	NONE	MOD	ok
7-14	A2	FSL	M	LOW	C, 2, D, Fe-x, M	MOD	
14-27	C	FSL	M	LOW	M, 2, P, Fe-x, M	MOD	DISTINCT BOUNDARIES ON REDOX; MAY BE RELICTUAL.

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2--5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

WILDLANDS

108 - 070 - 09

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: A
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5314* KNIFE @ TOP OF Bg	

Land Surface Shape: (slightly) planar concave convex SLIGHTLY HUMMOCKY	Landform: natural levee artificial levee swale floodplain basin (TRANSITIONAL) Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE = 1' BELOW EXISTING	
Dominant Plant Species: LOLIUM, FESTUCA, GEDI	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 63"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-6"	A1	l	2, gr	M	C, 1, D, Fe-x, M	M	ROOTS MANY FINE, MF
6"-23"	A2	sil	1, sbk	L	C, 2, D, Fe-x, M	M	ROOTS COMMON FINE
23"-43"	Bg1	l	0, M	L	M, 3, D, Fe-x, M	M	ROOTS FEW, VERY FINE
43"-63"	Bg2	l+	0, M	L	M, 3, D, Fe-x, M	M	NO ROOTS, DENSER THAN Bg1

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay taxtural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
	D - depletion

Redox Size	Redox Location
1 - fine (<2mm)	M - soil matrix
2 - medium 2–5mm)	P - ped face
3 - coarse (5–20mm)	PL - pore lining
4 - very coarse (20–76mm)	RC - root channel (ox. rhizospheres)
5 - extremely coarse (>76mm)	

Redox Contrast
F - faint
D - distinct
P - prominent

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: B
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: Ø	

Land Surface Shape: (slightly) planar concave convex SLIGHTY HUMMOCKY	Landform: natural levee artificial levee swale floodplain basin TRANSITIONAL
	Slope Gradient (%): 1 TO 2 %
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE 0.75' BELOW EXISTING	
Dominant Plant Species: FESTUCA, LOLIUM, POA PRAT(?), JUN PAT, JUN TEN	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): 70"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments: ZONE FROM 40"-46" CONTAINS 15% ANGULAR GRAVEL

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-9"	A1	l	2, gr	MOD	NONE	MOD	MANY FINE ROOTS
9"-22"	A2	l	0, M	LOW	C, 2, D, Fe-x, M	MOD	ROOTS COMMON FINE
22"-37"	Bg1	vfsl	0, M	LOW	M, 2, D, Fe-x, M	MOD	ROOTS FEW FINE
37"-51"	Bg2	l+	0, M	LOW	M, 3, D, Fe-x, M	MOD	ROOTS NONE,
51"-70"	Ab	sicl	0, M	HIGH	C, 2, F, Fe-x, M	MOD	ROOTS NONE, BURIED SOIL

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ex. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: C
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5315 KNIFE @ TOP OF LOAMY SAND LENSE	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin TRANSITION
	Slope Gradient (%): 1-2%
Soil Map Unit: 127	Soil Series as Observed:
General Comments: FINISH GRADE 0.5' BELOW EXISTING STRATIFIED LOAMY SAND LAYER BETWEEN 22-23", CONTINUOUS	
Dominant Plant Species: LOLIUM, FESTUCA, POA, PHALARIS MINOR JUN PAT	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 47"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-6"	A1	l	1, gr	MOD	NONE	MOD	ROOTS MANY FINE
6"-18"	A2	l	0, M	MOD	c, 2, F, Fe-x, M	MOD	ROOTS COMMON FINE
18"-37"	B	sil & ls	0, M	LOW	m, 2, D, Fe-x, M	MOD-MOD-HIGH	STRATIFIED ROOTS FEW FINE
37"-47"	Bg	cl-	0, M	LOW	m, 2, D, Fe-x, M	MOD	ROOTS NONE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"1c"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: ~~108-070-09~~ 1
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1–2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: DOARRA (?), FESTUCA (?), MINOR JUNCUS	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 22
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0–2	A1	l	SG	HIGH	F, 1, D, Fe-x, RC	MOD	
2–16	A2	l	M	MOD	NONE	MOD	
16–22	Bg	sil	M	LOW	M, 2, D, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"20"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 2
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA, FESTUCA (?), LEYTRI (?),	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 25
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	l	SG	HIGH	NONE	MOD	
1-12	A2	l	M	HIGH	M, 2, D, Fe-x, M	MOD	OK
12-25	C	FSL	M	LOW	ALONG STRATA: M, 2, D, Fe-x, M	MOD	STRATIFIED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"3c"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 3
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex LOCAL, SMALL DEPRESSION	Landform: natural levee artificial levee swale floodplain basin Slope Gradient (%): 0-1
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POAPRA (?), FESTUCA (?), JUNBAL,	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments: N/A

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	VFSL	GR	HIGH	M, 1, D, Fe-x, RC	MOD	
1-7	A2	VFSL	M	MOD	M, 2, D, Fe-x, M	MOD	
7-23	C	FSL	M	LOW	M, 3, P, Fe-x, M	MOD	

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay taxtural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

SOIL PROFILE AND SITE DESCRIPTION FORM:
WETLAND ESTABLISHMENT SUITABILITY ASSESSMENT

"4c"

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: WILDLANDS	Pit No.: 108-070-09 4
Investigator(s): Joel Butterworth	Date: August 16, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number:	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin (TOE)
	Slope Gradient (%): 1-2
Soil Map Unit: FLUVAQUENTS	Soil Series as Observed: FLUVAQUENTS
General Comments:	
Dominant Plant Species: POA PRA (?), FESTUCA (?) (PASTURE GRASSES)	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 23
Depth to Restrictive Layer (in.): (NONE)	Overall Soil and Site Suitability for Wetland Establishment: low medium high Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0-1	A1	SL	GR	HIGH	NONE	MOD	
1-9	A2	SL	SG	MOD	c, 2, D, Fe-x, M RC	MOD	1/2" GRAVEL LENS AT BASE OK
9-23	C	FSL	SG	LOW	m, 2, P, Fe-x, M	MOD	VERY FINELY STRATIFIED

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	
2 - medium 2–5mm)	**Redox Location**
3 - coarse (5–20mm)	M - soil matrix
4 - very coarse (20–76mm)	P - ped face
5 - extremely coarse (>76mm)	PL - pore lining
	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

BENBOW

108-040-13

ICF INTERNATIONAL SOIL PROFILE AND SITE DESCRIPTION FORM: WETLAND ESTABLISHMENT/RESTORATION SUITABILITY ASSESSMENT

Client/Project: Caltrans/Willits Bypass Wetland Mitigation	Parcel Name: BEN BOW 13	Pit No.: L
Investigator(s): Joel Butterworth, Paul Weller	Date: December 12, 2011	
Method of Excavation: backhoe sharpshooter hand auger	Photo Number: 5323, KNIFE ON EXISTING GRADE	

Land Surface Shape: (slightly) planar concave convex	Landform: natural levee artificial levee swale floodplain basin
	Slope Gradient (%): 0-3%
Soil Map Unit: 115	Soil Series as Observed: Cole
General Comments: FINISH GRADE IS 1.0' LOWER THAN EXISTING GRADE	
Dominant Plant Species: FESTUCA, LOLIUM, PLANTAGO	
Jurisdictional Status at Pit: existing wetland (reference) wetland-upland transition upland	Depth to Soil Saturation (in.): NONE TO 40"
Depth to Restrictive Layer (in.): N/A ☑ (Check if no restrictive layer)	Overall Soil and Site Suitability for Wetland Establishment: low medium high n/a Comments:

Depth (in.)	Horizon	Texture[1]	Structure[2]	Organic Matter - inferred	Redox Features[3]	Permeability - inferred	Comments
0"-4"	A1	l	3-gr	HIGH	NONE	MOD	ROOTS MANY COMMON
4"-9"	A2	cl-	2-sbk	HIGH	NONE	MOD	ROOTS MANY COMMON
9"-24"	B+1	cl-	1-sbk	LOW	c,2,F,Fe-x,M	MOD	ROOTS FEW FINE
24"-36"	B+2	cl-	2-sbk	LOW	c,2,D,Fe-x,M	MOD	ROOTS FEW VERY FINE
36"-40"	C	l	0,M	LOW	m,3,F,Fe-x,M	MOD	ROOTS FEW VERY FINE

[1]Texture and Coarse Fragment Content

Texture		Coarse Fragments
cos - coarse sand	vfsl - very fine sandy loam	gr - gravelly
s - sand	l - loam	vgr - very gravelly
fs - fine sand	sil - silt loam	xgr - extremely gravelly
vfs - very fine sand	si - silt	cb - cobbly
lcos - loamy coarse sand	scl - sandy clay loam	vcb - very cobbly
ls - loamy sand	cl - clay loam	xcb - extremely cobbly
lfs - loamy fine sand	sicl - silty clay loam	st - stony
lvfs - loamy very fine sand	sc - sandy clay	vst - very stony
cosl - coarse sandy loam	sic - silty clay	xst - extremely stony
sl - sandy loam	c - clay	
fsl - fine sandy loam		

"-" = "light" (as in a clay textural class with relatively low clay content)
"+" = "heavy" (as in a clay textural class with relatively high clay content)

[2]Soil Structure

Structure Type	Structure Grade
gr - granular	0 - structureless
abk - angular blocky	1 - weak
pl - platy	2 - moderate
pr - prismatic	3 - strong
sg - single grain	
m - massive	

[3]Redoximorphic Feature Morphology

Redox Abundance	Redox Type
f - few	Fe-x - iron concentration (soft mass)
c - common	Fe-nc - iron nodule or concretion
m - many	Mn-x - manganese concentration (soft mass)
	Mn-nc - manganese nodule or concretion
Redox Size	D - depletion
1 - fine (<2mm)	**Redox Location**
2 - medium 2–5mm)	M - soil matrix
3 - coarse (5–20mm)	P - ped face
4 - very coarse (20–76mm)	PL - pore lining
5 - extremely coarse (>76mm)	RC - root channel (ox. rhizospheres)
Redox Contrast	
F - faint	
D - distinct	
P - prominent	

Appendix B Representatiave Photographs of Soil Pits

Photo at Profile C, Wildlands parcel 108-070-09. Overview of pit vicinity

Photo of Profile Q, Ford parcel 108-020-04. Profile is silty clay loam, silt loam, and loam to a depth of 37 inches. Knife is at the top of the loamy sand C horizon, which is well below the finish grade elevation. The soil was determined to be suitable for wetland establishment.

Photo of Profile O, Ford parcel 108-020-04. Profile contains very gravelly sand and coarse sand layers at or near the finish grade elevation. These layers were continuous through the pit and were assumed to extend to Outlet Creek. Knife is at the top of the very gravelly sand C horizon.

Photo of Profile Y, Ford parcel 108-030-02. Profile contains loamy sand layer and a discontinuous and undulating pebbly layer at or near the finish grade elevation, with a thick zone of gravelly loamy sand below seven inches depth. All but the pebbly layer was continuous through the pit and were assumed to extend to Outlet Creek. Knife is at the top of the pebbly layer.

Photo of Profile BB, Lusher parcel 108-030-04. Profile contains loamy sand layer at or near the finish grade elevation, with a five inch thick very gravelly sand layer beginning at 16 inches depth. This layer was continuous through the pit and were assumed to extend to Outlet Creek. Knife is at the top of the very gravelly loamy sand layer.

Photo of Profile I, Wildlands parcel 108-020-07. Profile is very fine sandy to silty clay loam throughout, with a thin very fine sandy loam layer to remain at the finish grade elevation. Knife is at the top of the silty clay loam Btg horizon.

Photo of Profile E, Wildlands parcel 108-060-01. Profile is silt loam to gravelly loam with a one inch thick, discontinuous sand lens beginning at 15 inches depth. A moderately permeable gravelly loam (20% gravel content) will remain at the finish grade elevation. Knife is at the top of the sand lens.

Photo of Profile A, Wildlands parcel 108-070-09. Profile is silt loam to heavy loam throughout. A moderately permeable silt loam will remain at the finish grade elevation. Knife is at the top of the loam Bg1 horizon.

Photo of Profile L, Benbow parcel 108-040-13. Profile is silt loam to light clay loam throughout. A moderately permeable light clay loam will remain at the finish grade elevation. Knife is at ground level.

Appendix C Soil Pit Location Map

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

LICENSED LANDSCAPE ARCHITECT

PLANS APPROVAL DATE

LICENSED LANDSCAPE ARCHITECT
Name & License No.
Signature
Renewal Date
Date
STATE OF CALIFORNIA

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Soil Pits
1a August 2011 Soil Pits
BB December 2011 Soil Pits

SOIL PIT LOCATIONS GROUP 2 WETLANDS SHEET 1

SCALE 1"=50'

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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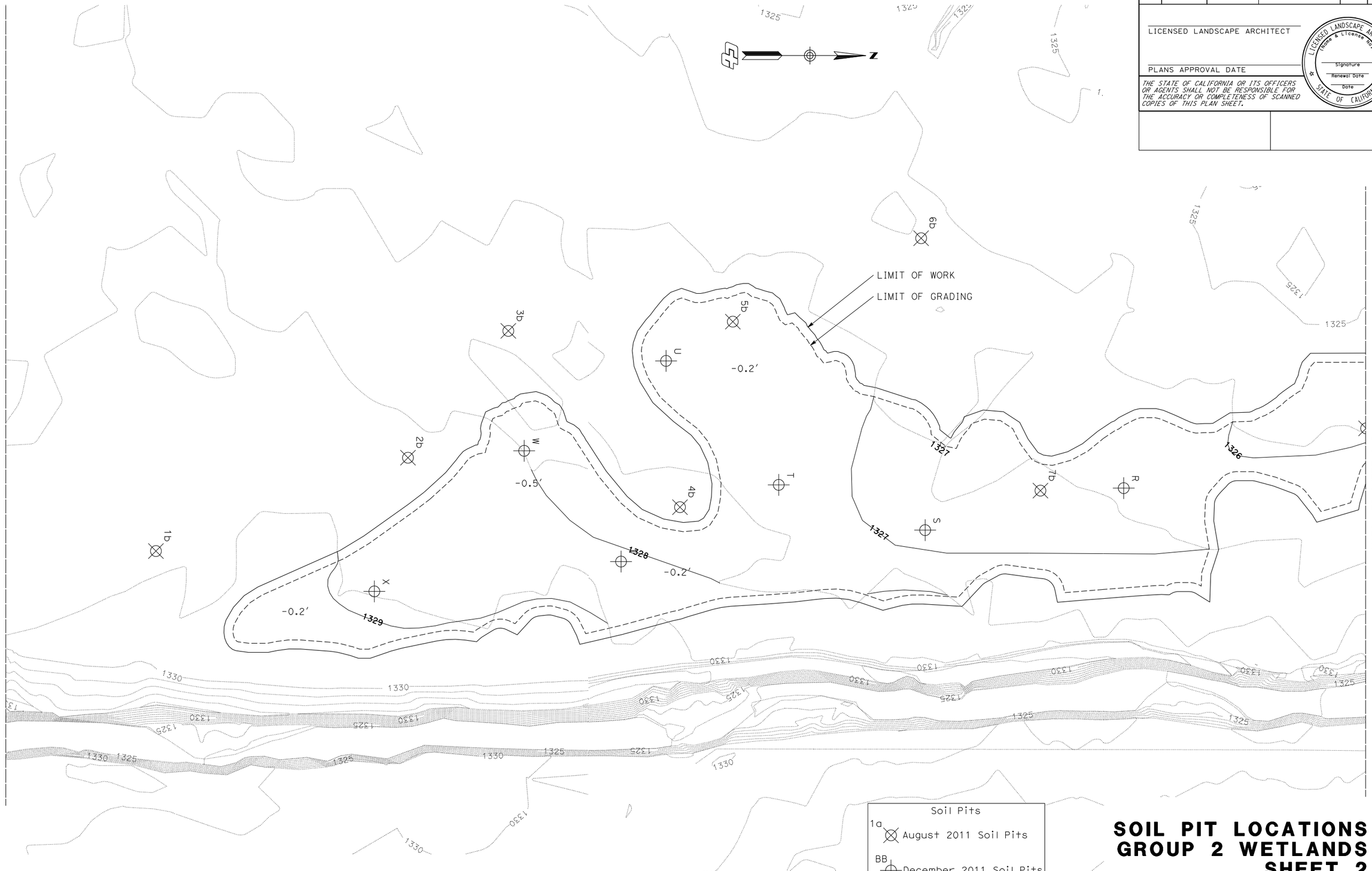

SOIL PIT LOCATIONS GROUP 2 WETLANDS SHEET 2

SCALE 1"=50'

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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SOIL PIT LOCATIONS GROUP 2 WETLANDS SHEET 3

SCALE 1"=50'

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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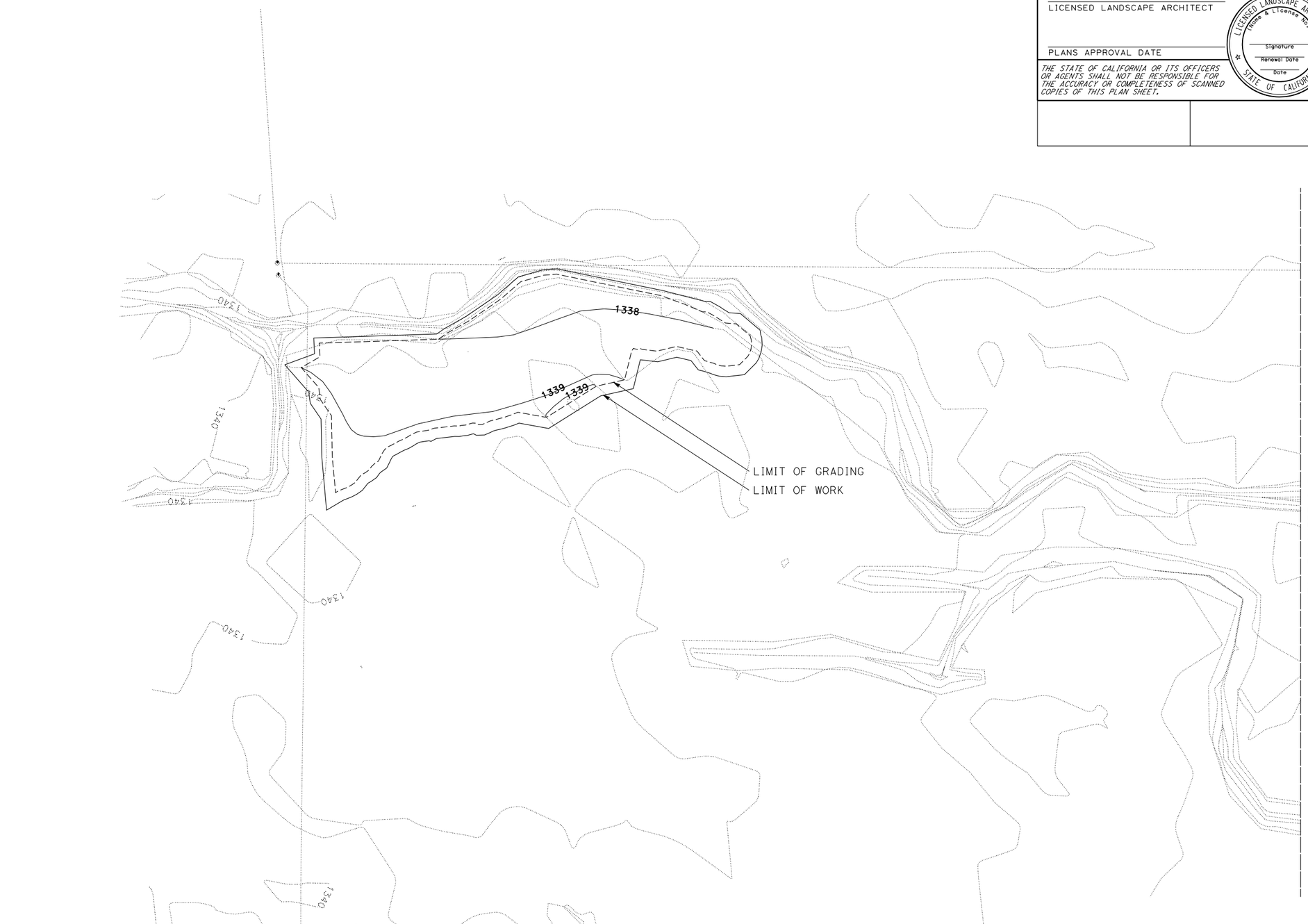

Soil Pits

1a August 2011 Soil Pits

BB December 2011 Soil Pits

SOIL PIT LOCATIONS GROUP 2 WETLANDS SHEET 4

SCALE 1"=50'

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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Name & License No.
Signature
Renewal Date
Date
STATE OF CALIFORNIA

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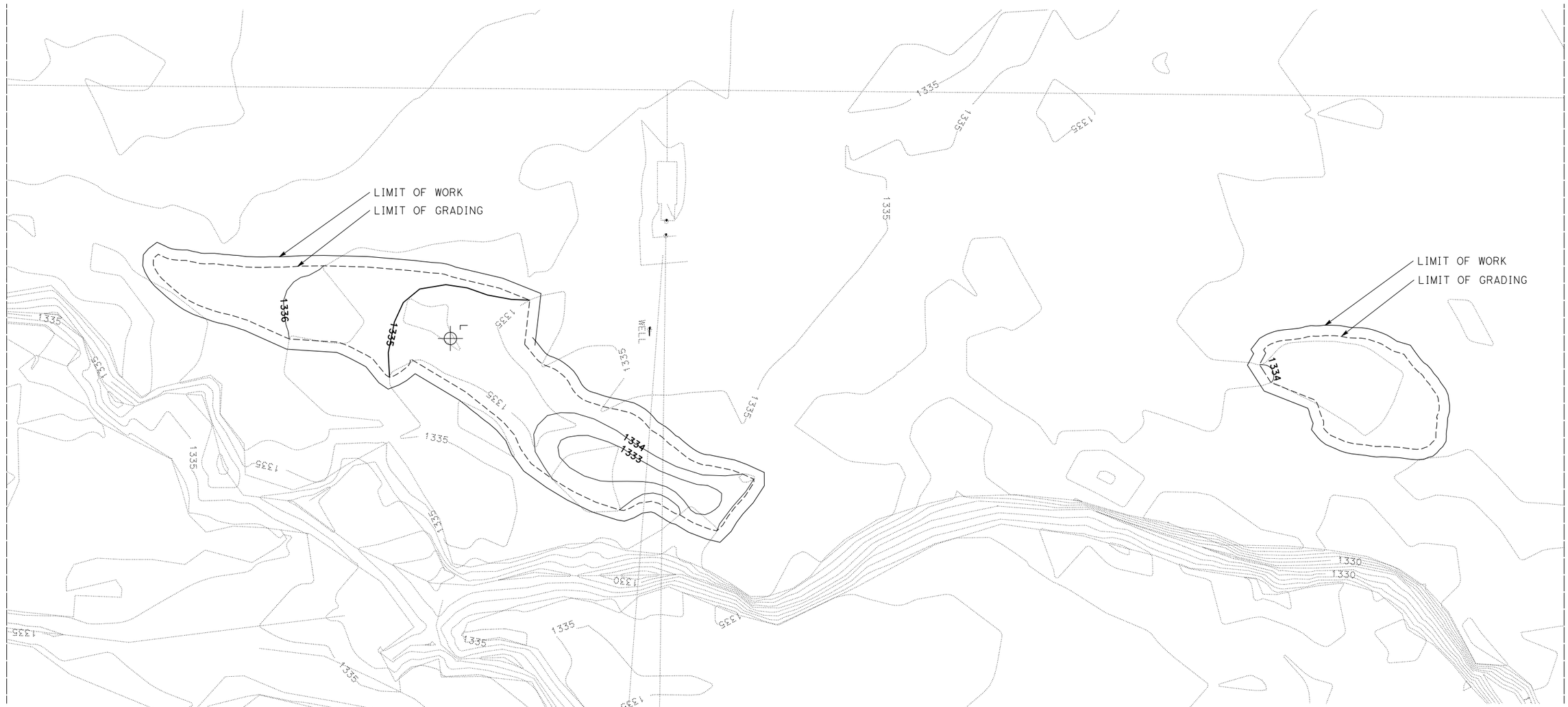
Soil Pits
1a August 2011 Soil Pits
BB December 2011 Soil Pits



SOIL PIT LOCATIONS GROUP 2 WETLANDS SHEET 5

SCALE 1"=50'

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01	MEN	101	R69.4/78.9		

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SOIL PITS LOCATIONS
GROUP 2 WETLANDS
SHEET 6

SCALE 1"=50'

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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Renewal Date
Date
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SOIL PITS LOCATIONS
GROUP 2 WETLANDS
SHEET 7

SCALE 1"=50'

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BORDER LAST REVISED 4/11/2008

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CU 00000

EA 000000

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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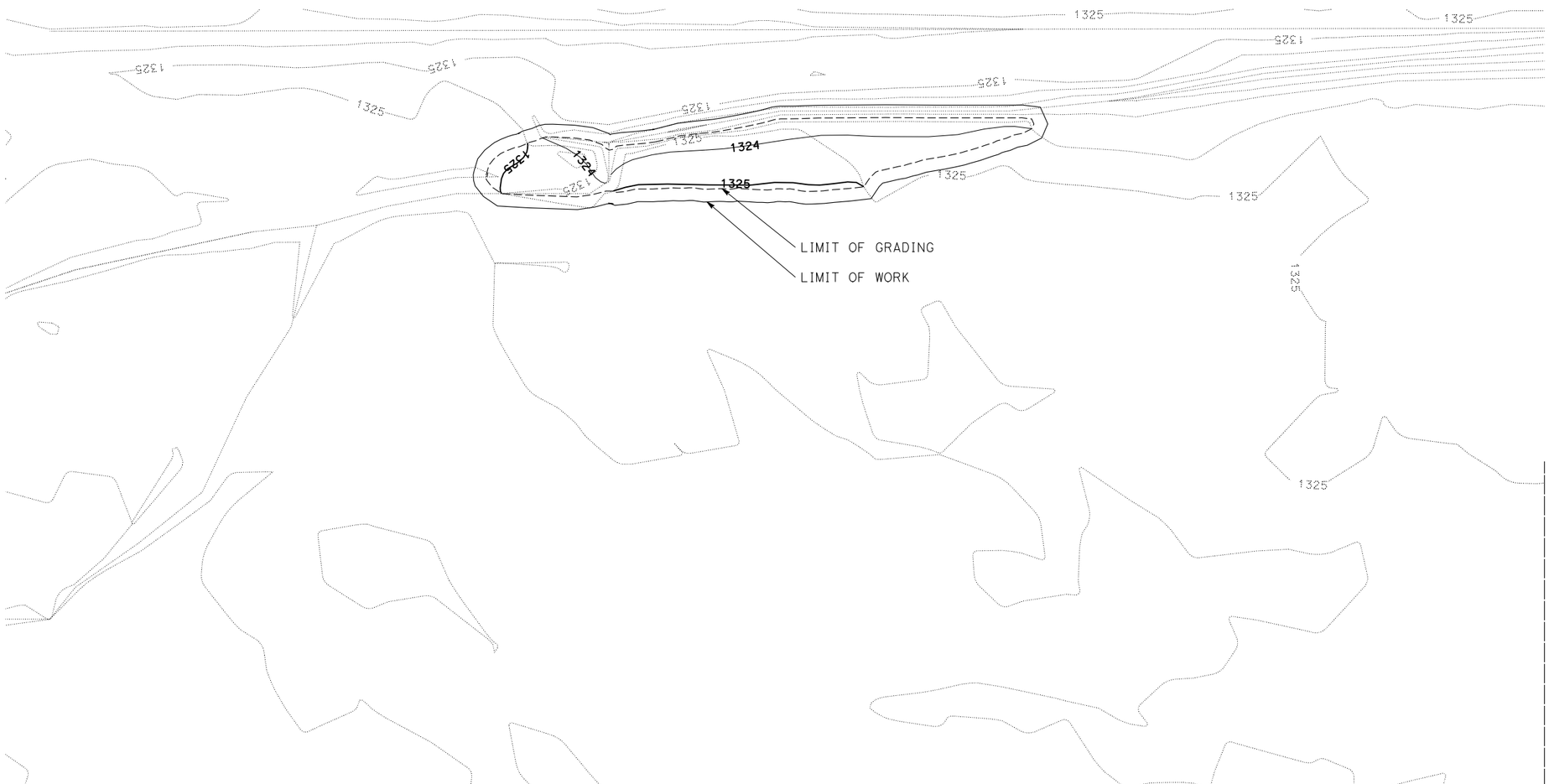

Soil Pits

1a August 2011 Soil Pits

BB December 2011 Soil Pits

SOIL PITS LOCATIONS GROUP 2 WETLANDS SHEET 8

SCALE 1"=50'

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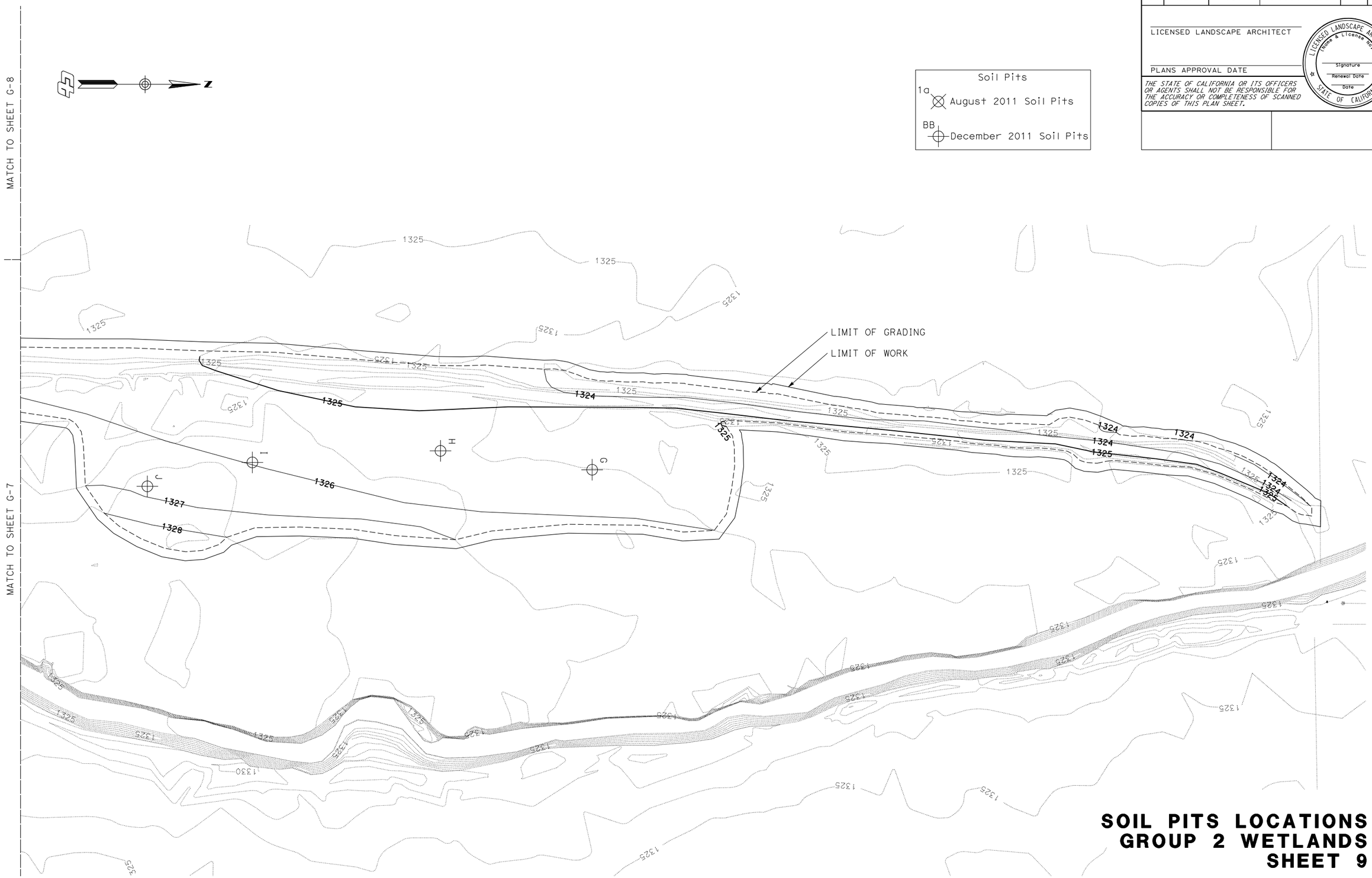
Soil Pits
1a August 2011 Soil Pits
BB December 2011 Soil Pits



SOIL PITS LOCATIONS
GROUP 2 WETLANDS
SHEET 9

SCALE 1"=50'

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TIME PLOTTED => 12:20

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EA 000000

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	MEN	101	R69.4/78.9		

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Soil Pits
1a August 2011 Soil Pits
BB December 2011 Soil Pits

SOIL PITS LOCATIONS GROUP 2 WETLANDS SHEET 10

SCALE 1"=50'

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Appendix P
Vegetation Sampling of Proposed (Group 1) Wetland Establishment Sites

Memorandum

Date:	August 10, 2010
To:	Dave Wickens U.S. Army Corps of Engineers, San Francisco District 1455 Market Street San Francisco, CA 94103-1398
Cc:	Laurie Monarres, U.S. Army Corps of Engineers Melissa Scianni, U.S. Environmental Protection Agency Jeremiah Puget, North Coast Regional Water Quality Control Board Craig Martz, California Department of Fish and Game
From:	Shanna Zahner California Department of Transportation
Subject:	Willits Bypass Project—Vegetation Sampling at Proposed Wetland Establishment Sites

1. Introduction

This technical memorandum addresses item 6 under the "Wetland Establishment" heading on the Willits Bypass Project (bypass project) "punch list" prepared by the North Coast Regional Water Quality Control Board (RWB), U.S. Army Corps of Engineers (USACE), and U.S. Environmental Protection Agency (USEPA) following a meeting held at the RWB Santa Rosa office on July 12 and 13, 2010. The punch list includes items necessary for permitting the bypass project under the Clean Water Act (CWA) Section 404. The punch list is meant to be a summary of all agency requests for information up to the meeting date of July 12 and 13. The list was also designed to capture all the information requested in a letter to Caltrans received from the USACE dated July 9, 2010 (July 9 letter). The July 9 letter also includes a section under wetland establishment which requests information on the existing conditions of the vegetation on the wetland establishment sites [bullets occurring after item 4.c.1.] Required items include:

1) Existing conditions: We generally have a list of the species that occur on site from the delineation that were completed. For each wetland establishment site we need:

- Species characteristics such as: ~~densities, age, health~~[1], natives/nonnative.
- Percent cover.
- ~~Community structure (canopy stratification)~~[1].
- Map showing the correct location of plant communities with representative site photos.

[1] During the July 12 and 13 meeting, the items shown as strikethrough were agreed to be removed from the requirements. The target wetland habitats to be established are wet meadow and mixed marsh, which include herbaceous plants. Therefore information which would be collected on woody plants was eliminated.

- Proposed site should be located adjacent to existing waters of the U.S. or a high functioning buffer adjacent to waters of the U.S. to create a wildlife corridor. Provide documentation of this connectivity.[2]

2. Context for Work

As part of the compensatory mitigation program for the Willits Bypass Project, wetland establishment (i.e., wet meadow or mixed marsh) is proposed on six offsite mitigation parcels in Little Lake Valley (Table 1). For ease of discussion the Goss, MGC Plasma Middle, and MGC Plasma North offsite mitigation parcels, which are adjacent to each other, are discussed together.

Table 1. Proposed Wetland Establishment Sites at the Offsite Mitigation Parcels

Offsite Mitigation Parcel	Assessor's Parcel Number	Proposed Wetland Establishment (acres)
Ford	108-010-06	2.854
Goss	103-230-02	0.553
MGC Plasma Middle	103-250-14	0.233
MGC Plasma North	103-230-06	6.691
Niesen	108-040-02	5.666
Watson East	037-221-30	8.336
	Total	**24.333**

3. Suitability for Wetland Establishment

On each establishment parcel, vegetation was sampled quantitatively to document existing conditions as part of justification for proposing establishment at the parcel (Figure 1). Information from the vegetation sampling will also be used to confirm the plant palettes and seed mixes for each establishment site. The following areas of each establishment parcel were sampled:

- Existing herbaceous vegetation within the proposed wetland establishment site.
- Existing vegetation in the surrounding herbaceous wetlands within 100 meters of the establishment site.
- Existing vegetation in the proposed wetland establishment monitoring reference site.

Please note that other information on hydrology and soils collected and developed as part of justification for proposing establishment on the offsite mitigation parcels is presented in separate technical memoranda.

4. Methods

4.1 Objectives

The intent of this study was to sample existing wetland vegetation present on the establishment parcels and use that information, then to identify the types of wetland plant communities and map

[2] This information is included in the Watershed Information Technical Memorandum dated August 10, 2010.

those communities on the parcels. In addition, the plant community information would be used to further refine plant palettes and seed mixes for each proposed established wetland site.

The vegetation was sampled in the proposed establishment sites, in surrounding existing wet meadow and/or mixed marsh, and in the proposed wetland establishment monitoring reference sites to collect quantitative data on plant cover that would be used to calculate the following wetland habitat characteristics (from the Mitigation and Reporting Plan [MRP; RWB 2010]):

- relative percent vegetation cover by native wetland species,
- absolute percent vegetation cover by native wetland plants,
- absolute percent vegetation cover by wetland species,
- native species richness, and
- absolute percent cover by invasive species.

4.2 Field Data Collection

Each offsite mitigation parcel where wetland establishment is proposed was sampled, with the exception of MGC Plasma Middle, which is immediately south of MGC Plasma North. Only a very small portion of this parcel is proposed to be graded to establish wetlands; the majority of the grading will occur on the adjacent MGC Plasma North and Goss parcels.

The sampling method generally followed the California Native Plant Society (CNPS) field sampling protocol (Sawyer and Keeler-Wolf 1995). Vegetation sampling was conducted on July 21, 22, 23, 26 and 27, 2010 by botanists experienced in California wetland and invasive plant identification and survey methods.

Transects were established in the proposed establishment sites, surrounding existing wet meadow and/or mixed marsh, and in the proposed wetland establishment monitoring reference sites. The transects were uniformly distributed across each area being sampled. Before the field survey, a series of parallel transects spaced approximately 100 meters apart, oriented parallel across the parcel's width were plotted on field maps. These transects were adjusted in the field to better represent vegetation diversity in each of the three areas being sampled. Once established, each transect was subdivided into 100 meter segments and each 100 meter segment was sub-sampled. Transect segments that were greater than 50 meters long but less than 100 meters long were also sampled. The location of transects, sampling plots, and the USACE verified jurisdictional wetlands is shown in Figure 1.

Within each 100 meter segment on the transect a 50 meter long point transect was established, centered in a 50 meter by 5 meter plot. The start point of each plot was randomly located along each 100 meter segment using a random number between 0 and 50. Point intercept sampling (Elzinga et al 1998) was performed at 0.5 meter intervals beginning at 0.5 meter and ending at 50.0 meters along each 50 meter transect. At each interval a point was projected vertically into the vegetation and each species intercepted by a point was recorded on a data collection form.

In addition to the point intercept sampling in the plot, a full census of species occurring in the plot (both native and nonnative) was conducted and recorded on a data collection form. As applicable, each plant species was assigned a wetland indicator status following Reed (1988). See Attachment 2

for the definition of wetland indicator status in Reed (1988). Plants with an indicator status of FAC or wetter were classified as wetland plants. Scientific names of plants follow Reed (1988) and *The Jepson Manual* (Hickman 1993) as updated by the Jepson Interchange, an online database maintained by the Jepson and University Herbaria (University of California Berkeley 2010).

Ground-level digital images of each plot were taken and the compass direction of the image was recorded on a data collection form (Attachment 1).

Percent cover for each species and plant community type was determined from the point intercept data. Species richness was determined by the full census survey of the plot.

4.3 Identification of Plant Communities

A plant community can be defined as a recognizable assemblage of plants that is relatively homogeneous in structure and plant composition and that can be distinguished from adjacent communities by a clear boundary (Grossman et al. 1998). Plant communities were identified following the classification system in *A Manual of California Vegetation* (Sawyer et al. 2009), which is a hierarchical system that combines broad habitat type and ecological modifiers at the highest levels of the hierarchy, and floristics (i.e., dominant plant species) at the lowest levels. The basic lower level vegetation unit recognized in the field is the alliance, identified using both qualitative and quantitative data, and based on the dominant plant species in the upper layer of vegetation or characteristic species.

Identification of plant communities was based on the quantitative vegetation data collected. The point-intercept data collected in the field was used to calculate the absolute and relative cover of each species. Absolute and relative cover was also calculated for native versus nonnative species, and wetland versus upland species. Using these data, the plant community in each plot was identified as an alliance as described in Sawyer et al. (2009) if it met *either* 1) the bolded narrative description of the alliance (provided at the start of each alliance description), *or* 2) one of the membership rules described for the alliance by other authors. Plant communities that did not meet a vegetation alliance description in Sawyer et al. (2009) were identified according to previous plant community lists (Holland 1986; DFG 2003; DFG 2007).

Once plant communities were identified using the quantitative data, polygons were drawn around the boundaries of each plant community using a combination of field reconnaissance and aerial photograph interpretation (Figure 2). Plant communities were only mapped for herbaceous communities since the goal for the wetland establishment areas will be to establish herbaceous wetland communities.

5. Results

Figure 1 shows the location of the vegetation sampling transects and plots. Figure 2 shows the location of herbaceous plant community types. Attachment 1 shows ground-level digital images of each plot and the compass direction of the digital image. In most cases the digital images are in order of plot start (west side of plot) and plot end (east side of plot). Attachment 2 contains a list of the plants observed in each plot as well as their wetland indicator status (Reed 1988), whether they are native or nonnative (Hickman 1993) and whether they are considered invasive as defined in the MMP (California Department of Transportation 2010, Appendix H, Table 2-1).

In total, 28 plots were sampled at the wetland establishment parcels. Since the intention of this study was to determine the existing wetland plant communities present on the parcels and to use that information to determine the type of wetland plant community to be established at each wetland establishment site, the following discussions highlight the differences between the observed current upland wetland establishment sites and the surrounding existing wetlands.

5.1 Summary of Cover Types, Species Richness and Plant Community Types Observed

A summary of the vegetation characteristics of each plot (including relative percent vegetation cover by native wetland species, absolute percent vegetation cover by wetland species, native species richness, and absolute percent cover by invasive species) is provided in Table 2. The plant community types are provided for each plot in Table 3. The rationale for assigning each plot to a particular plant community type is also provided in Table 3.

Table 2. Summary of Vegetation Characteristics at Offsite Mitigation Parcels where Wetland Establishment is Proposed

		Species Richness (Number of Species in Plot)			Wetland Plant Cover			Invasive Species
Mitigation Parcel	Plot	Total	Native	Nonnative	Absolute % Cover Wetland Plants	Relative % Cover Native Wetland Plants	Absolute % Cover Native Wetland Plants	Absolute % Cover
Ford	Plot 1	16	3	13	21	0	0	16
Ford	Plot 2	20	7	13	13	34	47	0
Ford	Plot 3	21	4	17	35	0	0	14
Ford	Plot 4	22	9	13	100	23	28	0
Ford	Plot 5	6	5	1	218	100	218	0
Goss	Plot 1	15	4	11	94	10	10	0
Goss	Plot 2	16	5	11	91	15	14	0
MGC Plasma North	Plot 1	20	7	13	108	25	27	0
MGC Plasma North	Plot 2	26	9	17	89	35	35	0
MGC Plasma North	Plot 3	23	8	15	95	18	18	0
MGC Plasma North	Plot 4	32	14	18	96	35	39	0
MGC Plasma North	Plot 5	27	8	19	93	31	34	0
Niesen	Plot 1	21	6	15	166	35	74	0
Niesen	Plot 2A	22	12	10	128	69	96	0
Niesen	Plot 2B	22	6	16	61	4	9	0
Niesen	Plot 3A	30	5	25	74	0	0	0
Niesen	Plot 3B	28	11	17	23	1	2	18
Niesen	Plot 5	21	4	17	69	0.5	1	0
Niesen	Plot 6	37	10	27	133	7	15	0
Niesen	Plot 7	28	7	21	100	0.5	1	0
Watson East	Plot 1	22	6	16	102	25	26	0
Watson East	Plot 2	24	7	17	88	27	29	0
Watson East	Plot 3	29	8	21	111	22	32	0
Watson East	Plot 4	33	16	17	111	29	39	0
Watson East	Plot 5	30	8	22	67	19	22	1
Watson East	Plot 6	32	12	20	135	52	79	0
Watson East	Plot 7	31	16	15	123	58	94	0

Table 3. Vegetation Alliances and Plant Community Types Identified at Each Offsite Mitigation Parcel where Wetland Establishment is Proposed

Parcel	Plot	Vegetative Alliance and Source (*Scientific Name*)	Comments
Ford	1	Annual Brome Grassland (Sawyer et al. 2009) (*Bromus* [*diandrus*, *hordeaceus*]–*Brachypodium distachyon* semi-natural herbaceous stand)	1. *B. hordeaceus* relative cover = 45%, total non-native relative cover = 89% 2. Meets one membership rule of >80% relative cover of B. hordeaceus co-dominant with non-natives. 3. Nearly meets a second membership rule of >50% relative cover of *B. hordeaceus*.
	2	Wet Montane Meadow (Holland 1986) *or* Rush Riparian Grassland (DFG 2003)	1. 34% relative cover of natives. 2. Several different species are dominant and data does not meet any membership rules in Sawyer et al. 2009.
	3	Annual Brome Grassland (Sawyer et al. 2009) (*Bromus* [*diandrus*, *hordeaceus*]–*Brachypodium distachyon* semi-natural herbaceous stand)	1. *B. hordeaceus* relative cover = 28%, total non-native relative cover = 95% 2. Meets one membership rule of >80% relative cover of *B. hordeaceus* co-dominant with non-natives.
	4	Wet Montane Meadow (Holland 1986) *or* Rush Riparian Grassland (DFG 2003)	1. 23% relative cover of natives. 2. Several different species are dominant and data does not meet any membership rules in Sawyer et al. 2009.
	5	Hardstem Bulrush Marsh (Sawyer et al. 2009) (*Schoenoplectus acutus* herbaceous)	1. *S. acutus* = 215% absolute cover. 2. Meets membership rule.
Goss	1	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 74%. 2. Meets verbal description of alliance but not membership rule.
	2	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 73%. 2. Meets verbal description of alliance but not membership rule.
MGC Plasma North	1	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 71%. 2. Meets verbal description of alliance but not membership rule
	2	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 47%. 2. Notably high relative cover of native perennial *Danthonia californica* = 21%. 3. Meets verbal description of alliance but not membership rule.
	3	Perennial Rye Grass Field (Sawyer et al. 2009) (*Lolium perenne* semi-natural herbaceous stand)	1. Relative cover of *L. multiflorum* = 35%, relative cover of all nonnatives = 82%. No plant with cover greater than *L. multiflorum*. 2. Meets verbal description of alliance but not membership rules.

Parcel	Plot	Vegetative Alliance and Source (*Scientific Name*)	Comments
	4	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* and *Agrostis* sp. = 39%. 2. Meets verbal description of alliance but not membership rule.
	5	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 49%. 2. Notably high relative cover of native perennial *Danthonia californica* = 17%. 3. Meets verbal description of alliance but not membership rule.
Niesen	1	Italian Ryegrass Grassland (DFG 2003)	1. Pasture is highly disturbed and covered mostly by two low growing annuals, *Juncus bufonius* and *Lythrum hyssopifolia*. 2. Community was classified by plant with highest cover that has a community defined by DFG 2003.
	2A (NW)	Wet Montane Meadow (Holland 1986) *or* Rush Riparian Grassland (DFG 2003)	1. Relative cover of native *Phalaris arundinacea* = 53%, relative cover of rushes = 13%. 2. Data does not meet any membership rules in Sawyer et al. 2009.
	2B (43m)	Wet Montane Meadow (Holland 1986)	1. Relative cover of nonnative *Phleum pretense* = 59%, very little cover of rushes. 2. Data does not meet any membership rules in Sawyer et al. 2009.
	3A	Annual Brome Grassland (Sawyer et al. 2009) (*Bromus* [*diandrus*, *hordeaceus*]–*Brachypodium distachyon* semi-natural herbaceous stand)	1. Relative *B. hordeaceus* cover = 36%, relative nonnative cover = 99%. 2. Meets verbal description of alliance with cover of nonnatives.
	3B	Annual Brome Grassland (Sawyer et al. 2009) (*Bromus* [*diandrus*, *hordeaceus*]–*Brachypodium distachyon* semi-natural herbaceous stand)	1. Relative *B. hordeaceus, B. diandrus* cover = 42%, relative nonnative cover = 97% 2. Meets verbal description of alliance with cover of nonnatives.
	5	Annual Brome Grassland (Sawyer et al. 2009) (*Bromus* [*diandrus*, *hordeaceus*]–*Brachypodium distachyon* semi-natural herbaceous stand)	1. Relative *B. hordeaceus* cover = 21%, relative nonnative cover = 90% 2. Meets verbal description of alliance with cover of nonnatives.
	6	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 43%, no other species with greater cover. 2. Meets verbal description of alliance but not membership rule.
	7	Bent Grass–Tall Fescue Meadow (Sawyer et al. 2009) (*Agrostis* (*gigantea*, *stolonifera*)–*Festuca arundinacea* semi-natural herbaceous stand)	1. Relative cover of *F. arundinacea* = 40%, no other species with greater cover. 2. Meets verbal description of alliance but not membership rule.

Parcel	Plot	Vegetative Alliance and Source (*Scientific Name*)	Comments
Watson East	1	Perennial Rye Grass Field (Sawyer et al. 2009) (*Lolium perenne* semi-natural herbaceous stand)	1. Relative cover of *L. multiflorum* = 53%, relative cover of all nonnatives = 75%. 2. Sawyer et al. 2009 does not recognize distinction between *L. perenne* and *L. multiflorum* 3. Meets verbal description of alliance but not membership rules.
	2	Perennial Rye Grass Field (Sawyer et al. 2009) (*Lolium perenne* semi-natural herbaceous stand)	1. Relative cover of *L. multiflorum* = 39%, relative cover of all nonnatives = 73%. 2. Meets verbal description of alliance but not membership rules.
	3	Perennial Rye Grass Field (Sawyer et al. 2009) (*Lolium perenne* semi-natural herbaceous stand)	1. Relative cover of *L. multiflorum* = 40%, relative cover of all nonnatives = 78%. 2. Meets verbal description of alliance but not membership rules.
	4	Perennial Rye Grass Field (Sawyer et al. 2009) (*Lolium perenne* semi-natural herbaceous stand)	1. Relative cover of *L. multiflorum* = 19%, relative cover of all nonnatives = 71%. No plant with cover greater than *L. multiflorum*. 2. Meets verbal description of alliance but not membership rules.
	5	Perennial Rye Grass Field (Sawyer et al. 2009) (*Lolium perenne* semi-natural herbaceous stand)	1. Relative cover of *L. multiflorum* = 20%, relative cover of all nonnatives = 81%. No plant with cover greater than *L. multiflorum*. 2. Meets verbal description of alliance but not membership rules.
	6	Wet Montane Meadow (Holland 1986) *or* Rush Riparian Grassland (DFG 2003)	1. Relative cover of two highest plants was *Mentha pulegium* = 20% and *Juncus ensifolius* = 26%. 2. Data does not meet any membership rules in Sawyer et al. 2009.
	7	Wet Montane Meadow (Holland 1986) *or* Rush Riparian Grassland (DFG 2003)	1. Relative cover of *Mentha pulegium* = 19% and perennial *Juncus* sp. = 35%. 2. Data does not meet any membership rules in Sawyer et al. 2009.

5.1.1 Ford Offsite Mitigation Parcel

5.1.1.1 Cover Types and Species Richness

Two plots were established in the proposed wetland establishment site and three in the adjacent wetlands on the Ford parcel.

For the two plots in the establishment site (1 and 3), vegetation was dominated by nonnative upland annual grasses, with few native or wetland plants. In fact, native wetland species were absent and absolute percent cover of all wetland species was 21% and 35% in the two plots with the main wetland species in both plots being Italian rye grass. Native species richness was low, with only three or four native species present. Yellow star thistle, an invasive plant, was common, with absolute cover of 14% and 16% in the two plots.

The three existing wetland plots (2, 4 and 5)consisted of two wet montane meadow/rush riparian grassland communities (plots 2 and 4) and one hardstem bulrush marsh community (plot 5).

The two sampled wet montane meadow/rush riparian grassland communities contained a diverse mix of native and nonnative wetland and upland plants. Relative percent cover of native wetland species was moderate at 23% and 34%, and absolute percent cover of all wetland species was approximately 100% in each plot. Native species richness was moderate, with seven and nine native species in the two plots. No invasive plants were recorded in either plot.

The hardstem bulrush marsh community was overwhelmingly dominated by hard stem bulrush, a native perennial obligate wetland plant, which was virtually the only plant present and formed 98% of the relative cover in the plot. Native species richness was low, with five native species recorded. No invasive plants were present in the marsh.

5.1.1.2 Plant Community Types Observed

Two sample plots were established within upland grassland proposed for wetland establishment (plots 1 and 3), and three transects were established in adjacent existing wetlands (plots 2, 4, and 5). A map of these plant communities is shown in Figure 2. The upland grasslands were assigned to the annual brome grassland alliance (Sawyer et al. 2009), and were dominated by soft brome, associated with several other nonnative annual grasses; native forbs had very low cover in this plant community.

Two wetland plots could not be identified as any alliance after Sawyer et al. (2009) and were closest to Holland's (1986) wet montane meadow or DFG's (2003) rush riparian grassland. This community type was characterized by higher diversity and a mix of native and nonnative plants, with no clear dominant species. The third wetland plot was overwhelmingly dominated by hard stem bulrush and was assigned to the hardstem bulrush marsh alliance (Sawyer et al. 2009).

5.1.2 Goss/MGC Plasma North Offsite Mitigation Parcels

5.1.2.1 Cover Types and Species Richness

Three plots were sampled in the proposed wetland establishment site (MGC plots 2, 4 and 5), one in a reference site (Goss plot 2), and four plots in adjacent wetlands on the Goss/MGC Plasma North

parcels (MGC plot 1 and 3, and Goss plots 1 and 3). The third plot on the Goss parcel was mowed on the date of the survey (July 26, 2010), so photographs were taken (Attachment 1) and a species list was collected for species richness, but no point counts were taken.

All but one of the sampled plots, both in the establishment site and adjacent existing wetlands, were assigned to the bent grass-tall fescue meadow alliance; the exception was identified as perennial rye grass field alliance. This was located at MGC plot 3 in the existing wetlands. The plots sampled on Goss/MGC Plasma North were relatively similar and were characterized by a relative percent cover of native wetland species ranging from 18% - 35% at MGC Plasma North, slightly lower at Goss at 10%-15%.

Absolute percent cover of all wetland species was 89% to 108%; tall fescue, a nonnative wetland plant, was the dominant species with 26% to 78% absolute cover in the plots. Native species richness was generally moderate, with only 7 to 9 native species present in most plots; the exception was MGC Plasma North plot 4, which had 14 native species, many of them wetland species. No invasive plants were recorded in any of the plots.

5.1.2.2 Plant Community Types Observed

The sampled plant communities on the Goss/MGC Plasma North parcels were perennial grasslands dominated by nonnative grasses. The dominant grasses were tall fescue and Italian ryegrass, and most sampled plots were assigned to the bent grass-tall fescue meadow alliance (Sawyer et al. 2009). This plant community is found in coastal prairie sites where the nonnative grasses have replaced native grasses such as California oatgrass. However, California oatgrass was common in the seven plots, with absolute cover of 5% to 21%. Other wetland native plants were also present, such as sedges and rushes. Overall, however, nonnative plants were dominant, with relative cover ranging from 62% to 82%.

5.1.3 Niesen Offsite Mitigation Parcel

5.1.3.1 Cover Types and Species Richness

Eight plots were established in the proposed Niesen wetland establishment parcel, one in a reference site (plot 6), four in the proposed establishment site (plots 1, 3A, 3B and 5), and three plots in adjacent wetlands (plots 2A, 2B, and 7).

For the four plots in the establishment site, three were assigned to the annual brome grassland alliance and one to the Italian rye grass field alliance. The reference site plot (plot 6) and one of the adjacent wetland plots (plot 7) were assigned to the bent grass-tall fescue alliance, and the remaining two wetland plots (plots 2A and 2B) could not be identified as any alliances after Sawyer et al. (2009) and were matched to wet montane meadow (Holland 1986)/rush riparian grassland (DFG 2003).

The sampled upland annual brome grassland and bent grass-tall fescue meadow plots were characterized by very low relative percent cover of native wetland plants (usually less than 2% cover). Absolute percent cover of all wetland species was more variable, ranging from 23% to 133%; the nonnative tall fescue and Harding grasses were the dominant wetland species. Native species richness varied from 4-11 native species recorded. One invasive species, yellow star thistle, was present in one plot (plot 3B), with absolute cover of 18%.

The characteristics of the wet montane meadow and Italian rye grass field were variable; the proposed wetland establishment site plot 1 (Italian rye grass field) had 35% relative cover of native wetland plants, consisting entirely of toad rush, a small native annual rush. The two wet montane meadow plots had relative cover by native wetland plants of 4% and 69% and absolute wetland plant covers of 61% and 128%. Native species richness varied from 6-12 native species recorded. No invasive plants were recorded in these plots.

5.1.3.2 Plant Community Types Observed

The plant communities sampled on the Niesen parcel were perennial grasslands, most of which were strongly dominated by nonnative plants—in six of the eight plots sampled, relative cover of nonnative plants was 90% or greater. Three of the sampled plots were annual brome grasslands dominated by upland plants, three were nonnative grasslands dominated by grasses with FAC or FACW indicator status, and two could not be matched to any alliance after Sawyer et al. (2009) and were assigned to Holland's (1986) wet montane meadow.

5.1.4 Watson East Offsite Mitigation Parcel

5.1.4.1 Cover Types and Species Richness

Two plots were established in the proposed wetland establishment sites (plots 1 and 5), one in a reference site (plot 7), and four plots in adjacent wetlands on the Watson East parcel (plots 2, 3, 4 and 6).

The two proposed wetland establishment sites, and three of the existing wetland plots were assigned to the perennial rye grass field alliance (Sawyer et al. 2009). The reference site plot (plot 7) and the existing wetland plot east of the north wetland establishment site (plot 6) could not be identified as an alliance after Sawyer et al. (2009) and were matched to wet montane meadow (Holland 1986)/rush riparian grassland (DFG 2003).

The sampled perennial rye grass field plots were relatively homogenous and were characterized by 19% to 29% relative cover of native wetland plants and 67% to 111% absolute cover of all wetland species. Perennial rye grass was the dominant species. Native species richness was generally moderate, with 6 to 8 native species present in all but one plot, in which 16 native species were recorded. The invasive species yellow star thistle was present in the north proposed wetland establishment site (plot 5), with an absolute cover of 1%.

The wet montane meadow plots, including the reference site plot, had higher relative cover of native wetland plants, 52% and 58%, and high absolute cover -- 135% and 123%. Native species richness was high, with 12 and 16 native species present in each plot. No invasive species were recorded in these plots.

5.1.4.2 Plant Community Types Observed

The plant communities sampled on the Watson East parcel were placed in two groups: five plots were assigned to the perennial rye grass field alliance (Sawyer et al. 2009) and the other two most closely matched Holland's (1986) wet montane meadow or DFG's (2003) rush riparian grassland. These two groups of plots were located in different portions of the parcel, perhaps because of the dominant hydrology on the parcel being wetter in the north and drier in the south. The drier

perennial rye grass field plots were located on the southeast portions of the parcel, and the wetter wet montane meadow plots were located in the northeast portion of the parcel, with the exception of the north wetland establishment site which occurrs on a high spot amidst surrounding wetter areas.

The perennial rye grass field occurs on seasonally moist to wet sites that are disturbed regularly by cattle grazing. Relative cover of nonnative plants was high, ranging from 71% to 81%. The two wet montane meadow plots were characterized by a high relative cover of native plants (55% and 64%) and a high species richness with no single species dominant; common species included the nonnative pennyroyal and the native spreading rush and sword-leaved rush.

6. Discussion

Caltrans is proposing to establish wetlands on six offsite mitigation parcels: Ford, Goss, MGC Plasma Middle, MGC Plasma North, Niesen, and Watson East. Previously, only target habitat types (e.g., wet meadow and mixed marsh) were identified for each wetland establishment site. Based on the plant community identifications developed as part of the July 2010 vegetation surveys at these proposed wetland establishment sites, the target plant communities can now be identified for each site. Table 4 lists the target habitat and plant community for each wetland establishment site.

Table 4. Proposed Wetland Establishment Sites at the Offsite Mitigation Parcels

Offsite Mitigation Parcel	Assessor's Parcel Number	Proposed Wetland Establishment Habitat Type	Proposed Wetland Establishment Plant Community
Ford	108-010-06	Mixed marsh and wet meadow	Wet Montane Meadow and Hardstem Bulrush Marsh
Goss/ MGC Plasma Middle/ MGC Plasma North	103-230-02/ 103-250-14/ 103-230-06	Wet meadow	Bent Grass-Tall Fescue Meadow
Niesen	108-040-02	Wet meadow	Wet Montane Meadow
Watson East	037-221-30	Wet meadow	Wet Montane Meadow

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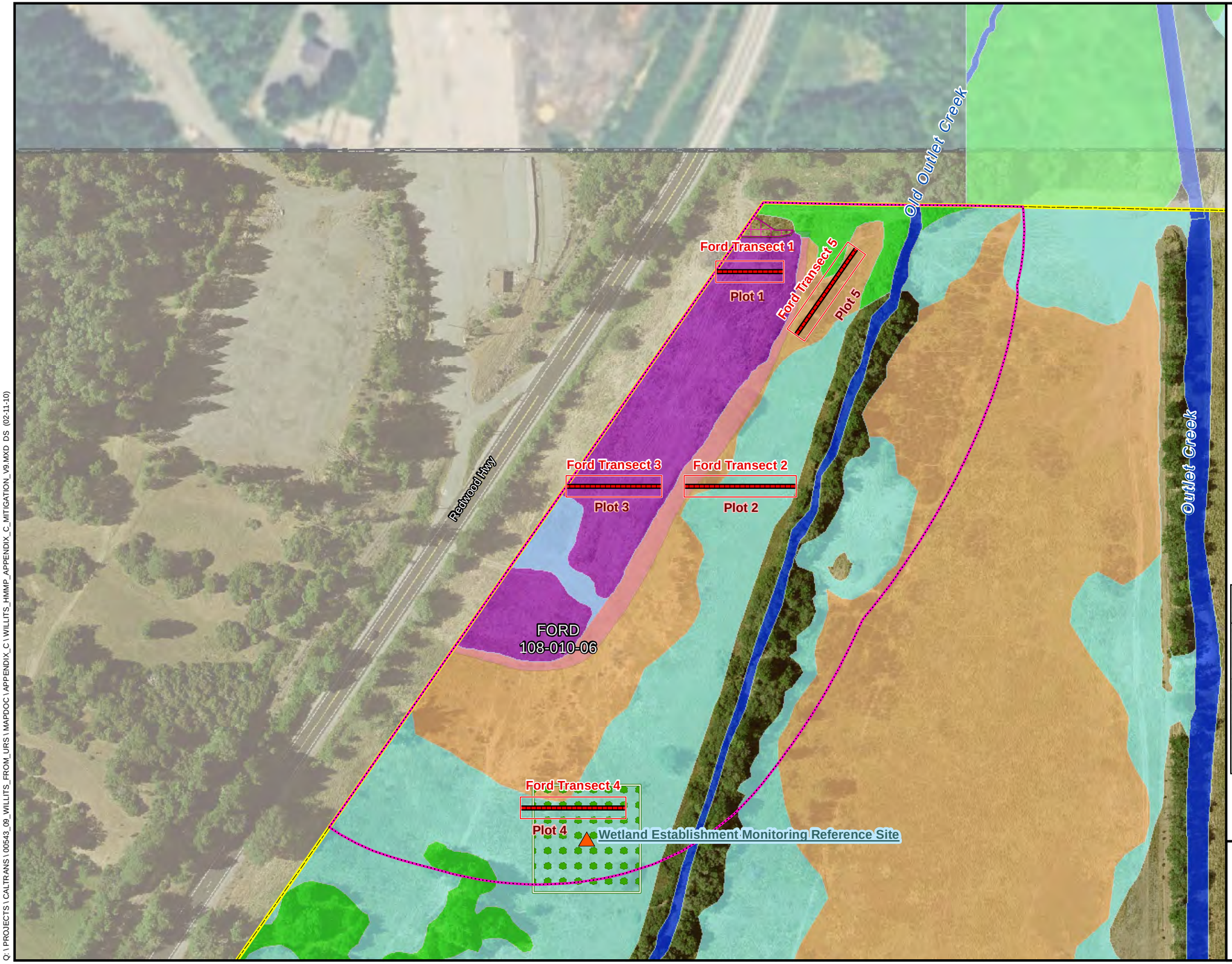


Offsite Mitigation Parcel
Transects
Plot Location
Wetland Establishment - 100m Buffer
Wetland Establishment Site
Monitoring Reference Site
Reference Plots

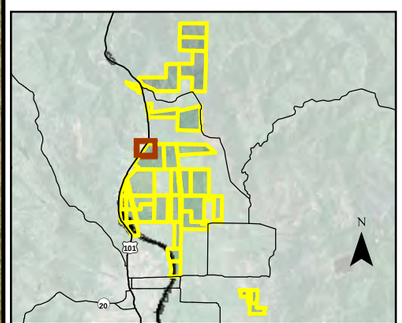
Existing Jurisdictional Wetlands

Mixed Marsh
Other Waters
Riparian Scrub
Riparian Woodland
Swale
Vernal Pool
Wet Meadow

Project Bypass Footprint

Permanent Impact Area
Temporary Impact Area
Right of Way

N



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Scale in Feet

Figure 1
Ford
APN 108-010-06

Proposed Willits Bypass
August 2010 Plant Community
Survey Transect Locations

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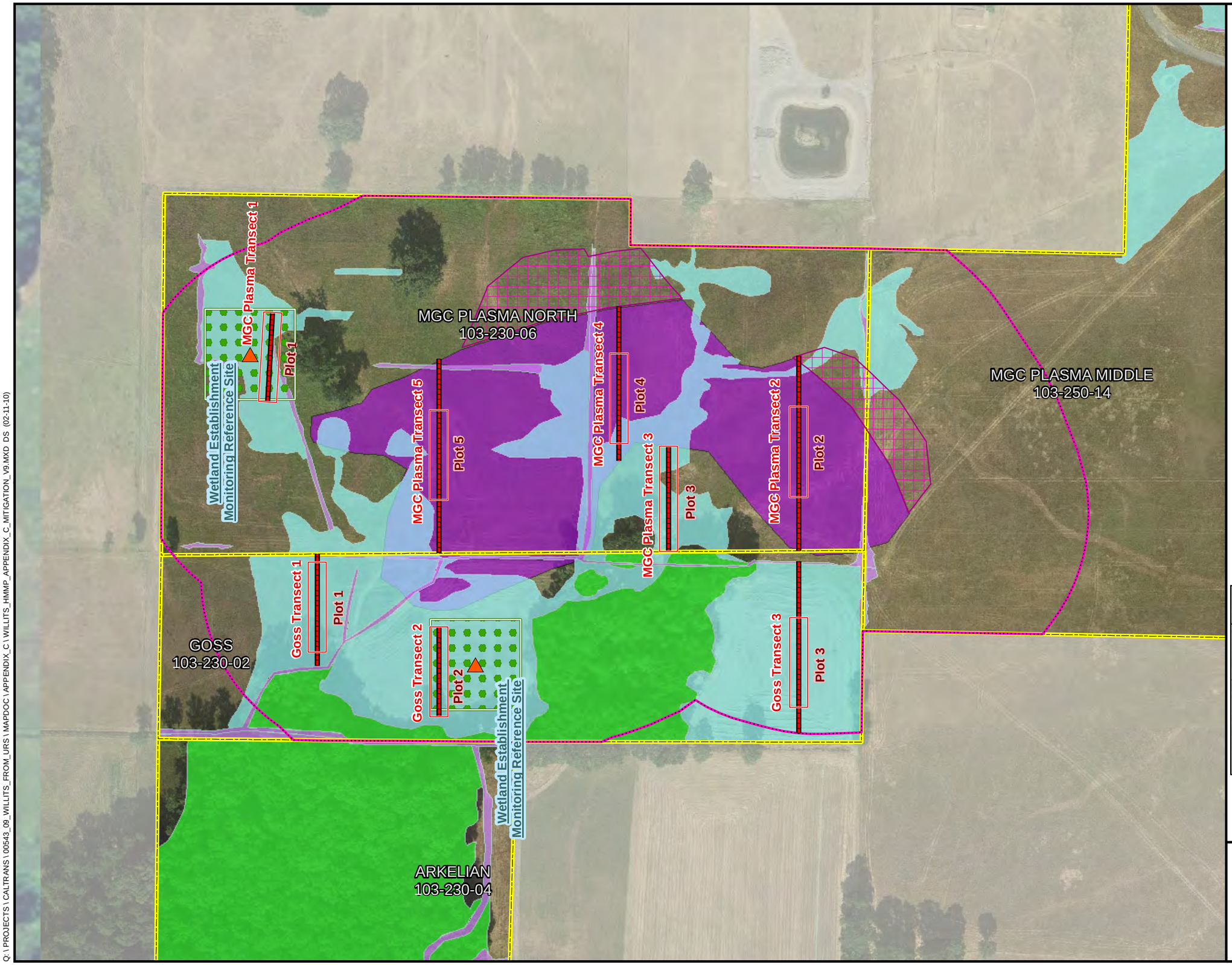


Offsite Mitigation Parcel
Transects
Plot Location
Wetland Establishment - 100m Buffer
Wetland Establishment Site
Monitoring Reference Site
Reference Plots

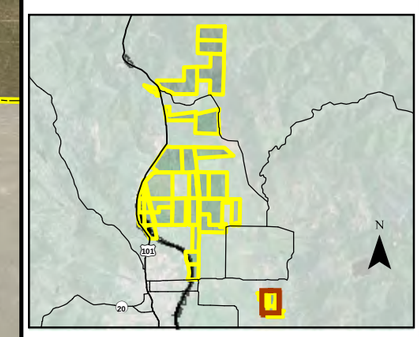
Existing Jurisdictional Wetlands

Mixed Marsh
Other Waters
Riparian Scrub
Riparian Woodland
Swale
Vernal Pool
Wet Meadow

Project Bypass Footprint

Permanent Impact Area
Temporary Impact Area
Right of Way

N



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Scale in Feet

Figure 1
Goss & MGC Plasma
103-230-02, 103-230-06, & 103-250-14
Proposed Willits Bypass
August 2010 Plant Community Survey Transect Locations

Q:\ PROJECTS \ CALTRANS \ 00543_09_WILLITS_FROM_URS \ MAPDOC \ APPENDIX_C \ WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

Offsite Mitigation Parcel
Transects
Plot Location
Wetland Establishment - 100m Buffer
Wetland Establishment Site
Monitoring Reference Site
Reference Plots

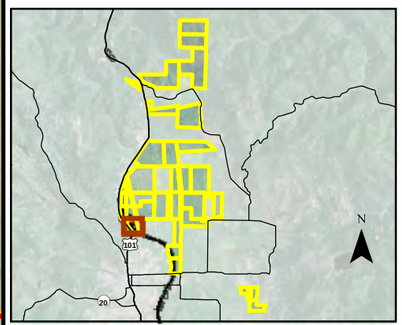
Existing Jurisdictional Wetlands

Mixed Marsh
Other Waters
Riparian Scrub
Riparian Woodland
Swale
Vernal Pool
Wet Meadow

Project Bypass Footprint

Permanent Impact Area
Temporary Impact Area
Right of Way

N



0 200
Scale in Feet

Figure 1
Niesen
APN 108-040-02

Proposed Willits Bypass
August 2010 Plant Community
Survey Transect Locations

Q:\PROJECTS\CALTRANS\00543_09_WILLITS_FROM_URS\MAPDOC\APPENDIX_C\WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

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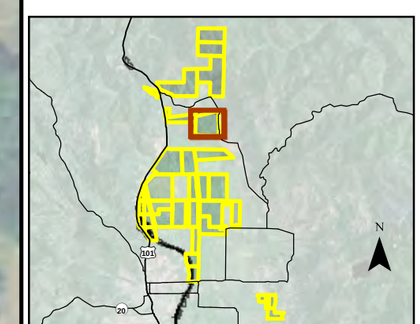

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Scale in Feet

Figure 1
Watson
APN 037-221-30

Proposed Willits Bypass
August 2010 Plant Community
Survey Transect Locations

Q:\ PROJECTS \ CALTRANS \ 00543_09_WILLITS_FROM_URS \ MAPDOC \ APPENDIX_C \ WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

Offsite Mitigation Parcel
Wetland Establishment Site
Wetland Establishment - 100m Buffer
Transects
Plot Location
Monitoring Reference Site
Reference Plots

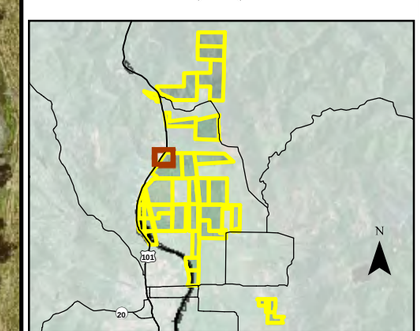
Vegetation Types

Annual Brome Grassland
Bent Grass - Tall Fescue Meadow
Hardstem Bulrush Marsh
Italian Ryegrass Grassland
Perennial Ryegrass Field
Wet Montane Meadow

Project Bypass Footprint

Permanent Impact Area
Temporary Impact Area
Right of Way

N



0 200
Scale in Feet

Figure 2
Ford
APN 108-010-06

Proposed Willits Bypass
August 2010 Plant Community Map

Q:\PROJECTS\CALTRANS\00543_09_WILLITS_FROM_URS\MAPDOC\APPENDIX_C\WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

Offsite Mitigation Parcel
Wetland Establishment Site
Wetland Establishment - 100m Buffer
Transects
Plot Location
Monitoring Reference Site
Reference Plots

Vegetation Types
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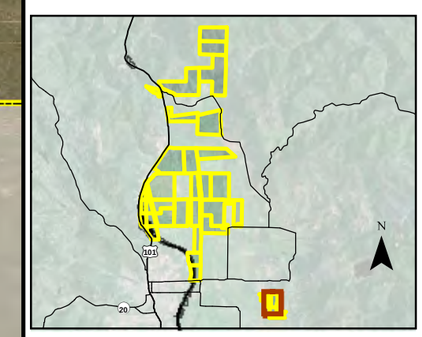
Hardstem Bulrush Marsh
Italian Ryegrass Grassland
Perennial Ryegrass Field
Wet Montane Meadow

Project Bypass Footprint
Permanent Impact Area
Temporary Impact Area
Right of Way

N



0 200
Scale in Feet

Figure 2
Goss & MGC Plasma
103-230-02, 103-230-06, & 103-250-14

Proposed Willits Bypass
August 2010 Plant Community Map

Q:\ PROJECTS \ CALTRANS \ 00543_09_WILLITS_FROM_URS \ MAPDOC \ APPENDIX_C \ WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

Offsite Mitigation Parcel
Wetland Establishment Site
Wetland Establishment - 100m Buffer
Transects
Plot Location
Monitoring Reference Site
Reference Plots

Vegetation Types

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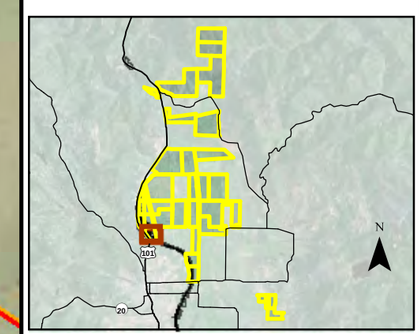
Bent Grass - Tall Fescue Meadow
Hardstem Bulrush Marsh
Italian Ryegrass Grassland
Perennial Ryegrass Field
Wet Montane Meadow

Project Bypass Footprint

Permanent Impact Area
Temporary Impact Area
Right of Way

N



0 200
Scale in Feet

Figure 2
Niesen
APN 108-040-02

Proposed Willits Bypass
August 2010 Plant Community Map

Q:\PROJECTS\CALTRANS\00543_09_WILLITS_FROM_URS\MAPDOC\APPENDIX_C\WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

Offsite Mitigation Parcel
Wetland Establishment Site
Wetland Establishment - 100m Buffer
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Plot Location
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Hardstem Bulrush Marsh
Italian Ryegrass Grassland
Perennial Ryegrass Field
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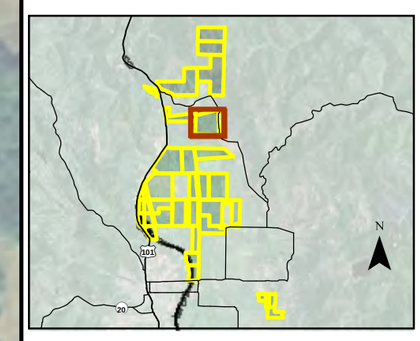
Project Bypass Footprint

Permanent Impact Area
Temporary Impact Area
Right of Way

N



0 200
Scale in Feet

Figure 2
Watson
APN 037-221-30

Proposed Willits Bypass
August 2010 Plant Community Map

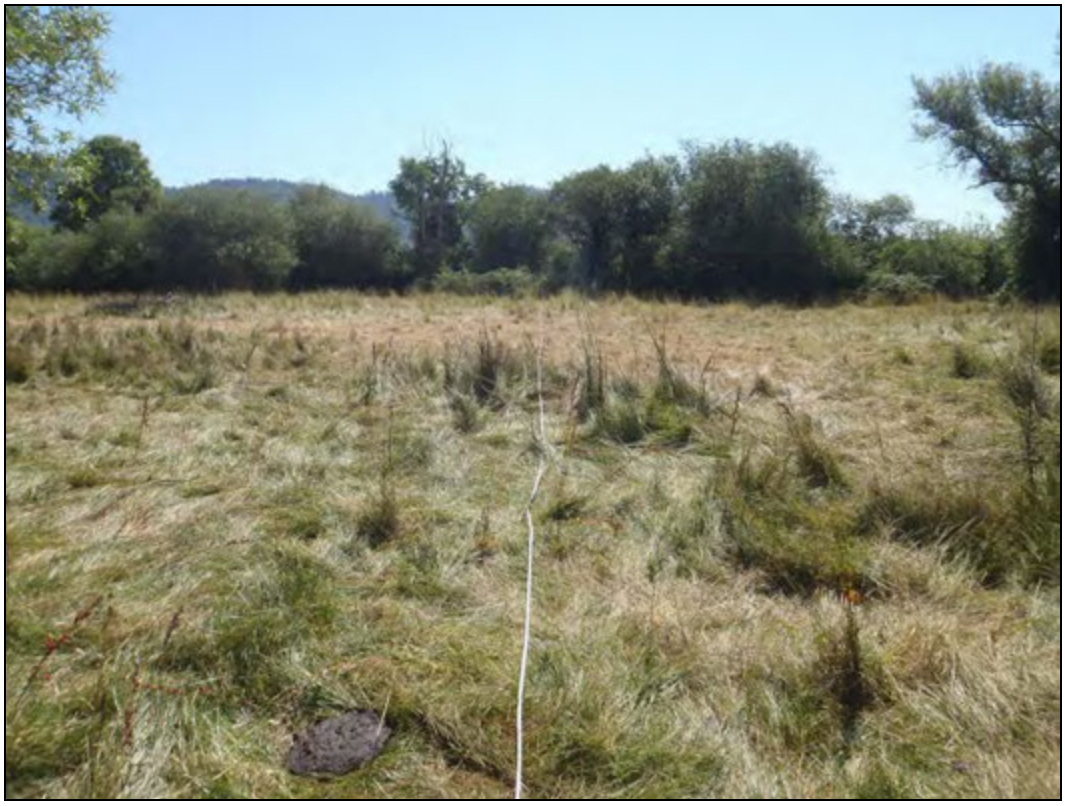
Q:\ PROJECTS \ CALTRANS \ 00543_09_WILLITS_FROM_URS \ MAPDOC \ APPENDIX_C \ WILLITS_HMMP_APPENDIX_C_MITIGATION_V9.MXD DS (02-11-10)

Attachment 1

Ford Plot 1 – West 248°

Ford Plot 1 – East 72°

00635.09 Willits RPP (08/10)



Ford Plot 2 – East 70°

Ford Plot 2 – West 250°

Ford Plot 3 – East 70°

Ford Plot 3 – West 250°

Ford Plot 4 – East 70°

Ford Plot 4 – West 250°

Ford Plot 5 – North 20°

Ford Plot 5 – South 200°

Goss Plot 1 – West 250°

Goss Plot 1 – East 70°

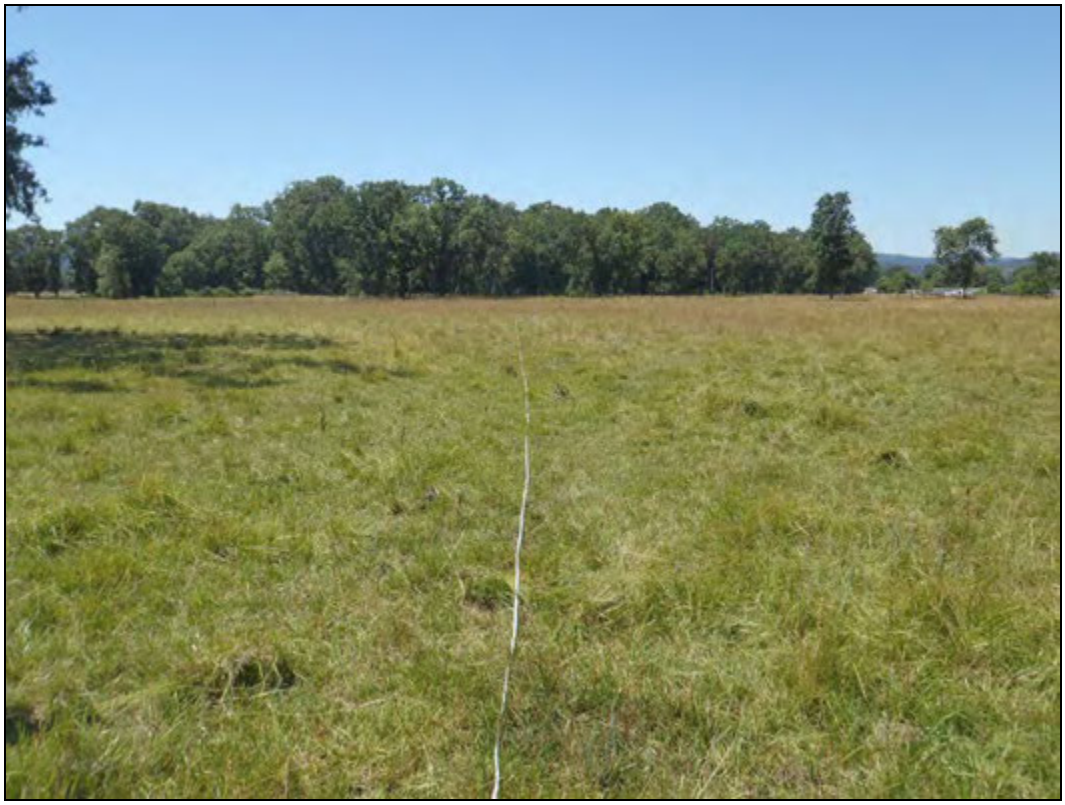
Goss Plot 2 – West 250°

Goss Plot 2 – East 70°

Goss Plot 3 – West 250°

Goss Plot 3 – East 70°

MCG Plasma North Plot1 – East 70°



MGC Plasma North Plot 1 – West 250°

MGC Plasma North Plot 2 – West 250°

MGC Plasma North Plot 2 – East 70°

MGC Plasma North Plot 3 – West 250°

MGC Plasma North Plot 3 – East 70°

MGC Plasma North Plot 4 – East 70°

MGC Plasma North Plot 4 – West 250°

MGC Plasma North Plot 5 – West 250°

MGC Plasma North Plot 5 – East 70°

Niesen Plot 1 – Northeast 50°

Niesen Plot 2a – East 80°

Niesen Plot 2b – East 75°

Niesen Plot 3a – Northeast 40°

Niesen Plot 3b – East 70°

Niesen Plot 3b – West 250°

Niesen Plot 5 – West 315°

Niesen Plot 5 – Southeast 135°

Niesen Plot 6 – East 70°

Niesen Plot 6 – West 250°

Niesen Plot 7 – East 70°

Niesen Plot 7 – West 250°

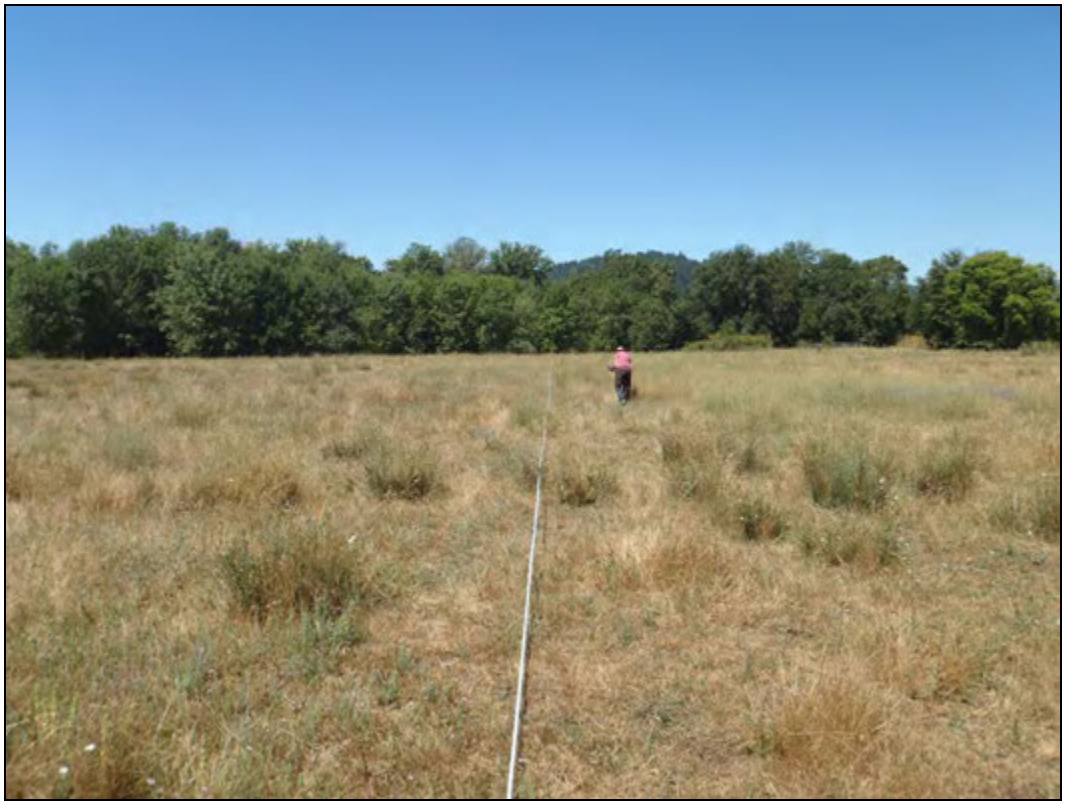
Watson Plot 1 – West 260°

Watson Plot 1 – East 80°

Watson Plot 2 – West 250°

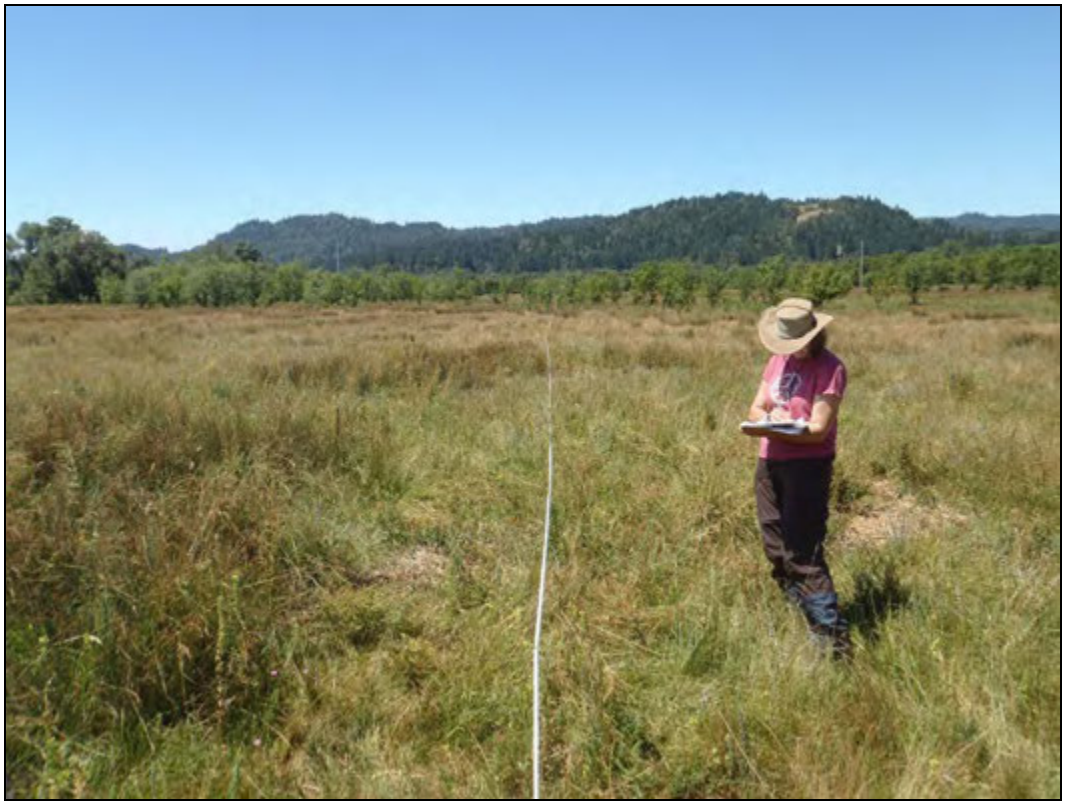
Watson Plot 2 – East 70°

Watson Plot 3 – East 65°



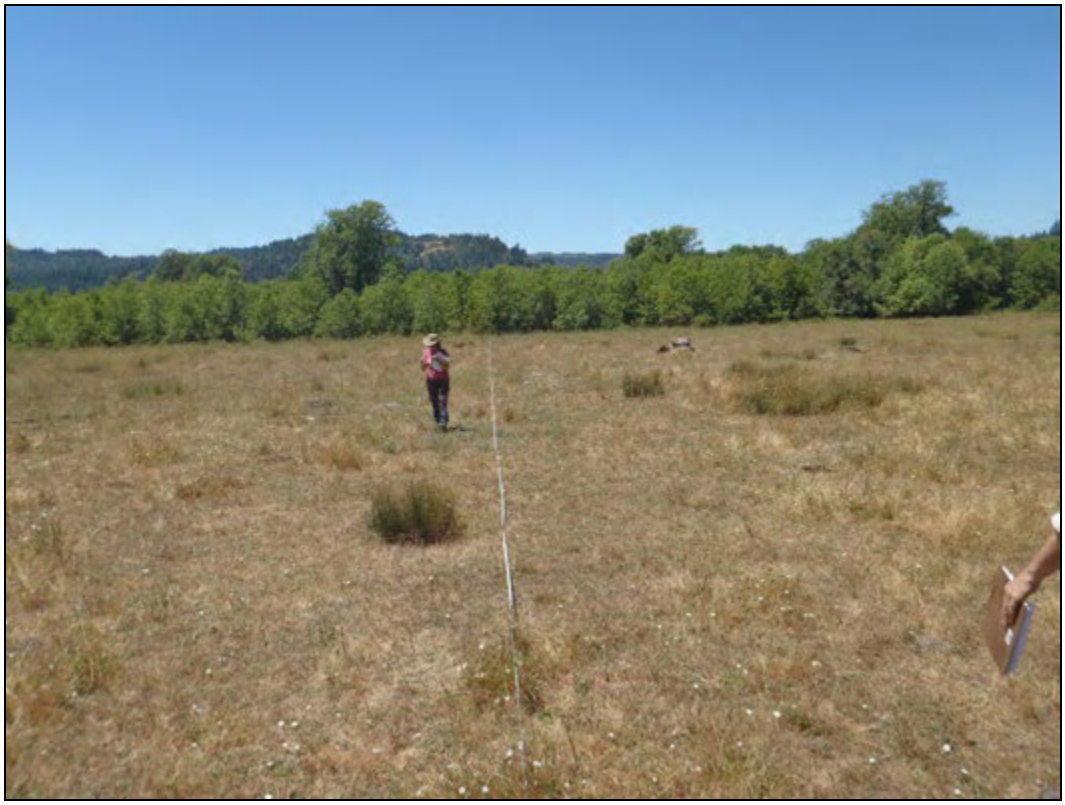
Watson Plot 3 – West 245°

Watson Plot 4 – East 65°



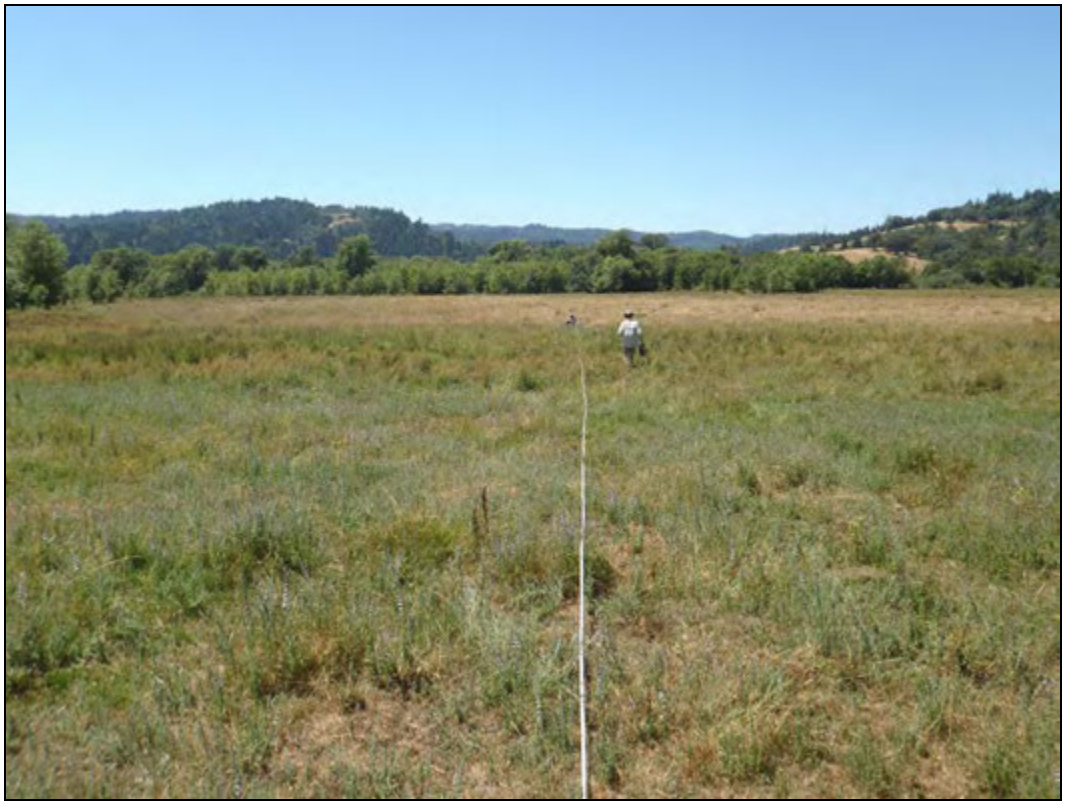
Watson Plot 4 – West 245°

Watson Plot 5 – East 70°



Watson Plot 5 – West 250°

Watson Plot 6 – East 90°



Watson Plot 6 – West 270°

Watson Plot 7 – East 70°

Watson Plot 7 – West 250°

Attachment 2

Attachment 2. List of Plants Observed on Each Wetland Establishment Parcel with Wetland Indicator Status, Native/Nonnative Status, and Invasive Status

Species	Native/ Introduced[1]	Invasive (Y/N)[2]	Wetland Indicator Status[3]	Ford					Goss			Niesen								MGC Plasma North					Watson						
				T1	T2	T3	T4	T5	T1	T2	T3	T1	T2a	T2b	T3a	T3b	T5	T6	T7	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T6	T7
Agrostis sp.	I	N	UPL			1	1					1						1	1	1			1	1						1	1
Aira caryophyllea	I	N	UPL	1		1									1	1	1						1	1					1		
Alisma plantago-aquatica	N	N	OBL					1																							
Alopecurus pratensis	I	N	FACW		1	1	1					1	1	1					1	1		1									
Anthemis cotula	I	N	FACU									1		1	1	1			1								1				
Asclepias fascicularis	N	N	FAC							1																					
Avena barbata	I	N	UPL			1					1														1				1		
Avena fatua	I	N	UPL	1																											
Beckmannia syzigachne	N	N	OBL					1																							1
Brachypodium distachyon	I	N	UPL																										1		
Briza minor	I	N	FACW-			1				1					1		1	1		1		1	1	1				1	1	1	
Brodiaea elegans ssp. *elegans*	N	N	UPL																				1								
Brodiaea sp.	N	N	UPL																												1
Bromus mollis (B. hordeaceus)	I	N	FACU-	1		1			1		1			1	1	1	1	1	1		1	1		1	1	1	1	1	1	1	
Camassia quamash (ssp. quamash)	N	N	FACW										1										1								1
Carex densa	N	N	OBL															1		1			1					1		1	1
Carex unilateralis	N	N	FACW				1																								1
Carex sp.	N	N	FACW		1				1		1		1					1			1	1		1							
Castilleja sp.	N	N	UPL			1																									
Centaurea solstitialis	I	Y	UPL	1		1										1									1				1		
Centaurium muehlenbergii	N	N	FAC	1		1			1	1				1	1	1		1	1	1	1	1	1	1		1	1	1	1		
Centaurium venustum	N	N	UPL										1																		
Cerastium viscosum (C. glomeratum)	I	N	FACU																		1										
Cichorium intybus	I	N	UPL	1		1	1		1						1		1	1	1	1		1	1	1	1	1	1	1	1	1	1
Cirsium vulgare	I	N	FACU							1				1		1		1	1												
Convolvulus arvensis	I	N	UPL	1	1		1	1	1	1	1	1		1	1		1	1	1		1	1	1	1	1	1	1	1	1		1
Croton setigerus	N	N	UPL																			1									
Cynosurus echinatus	I	N	UPL								1				1		1										1		1		
Cyperus eragrostis	N	N	FACW									1																1			
Cyperus sp.	I	N	>=FAC																						1		1				
Danthonia californica	N	N	FACW						1	1	1									1	1	1	1	1					1		
Daucus carota	I	N	UPL															1	1								1				
Daucus pusillus	N	N	UPL													1															
Deschampsia danthonioides	N	N	FACW								1							1			1		1	1							
Dipsacus sylvestris (D. fullonum)	I	N	NI*													1		1	1												
Eleocharis macrostachya	N	N	OBL		1			1																	1	1			1		
Elymus glaucus	N	N	FACU																1												
Epilobium ciliatum	N	N	FACW				1						1															1		1	1
Boisduvalia glabella (Epilobium pygmaeum)	N	N	OBL									1		1		1		1					1		1	1	1	1		1	1
Eryngium aristulatum	N	N	OBL																		1		1					1			1
Euthamia occidentalis	N	N	OBL										1																		
Festuca arundinacea	I	N	FAC-		1		1		1	1	1							1	1	1	1	1	1	1				1		1	1

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				T1	T2	T3	T4	T5	T1	T2	T3	T1	T2a	T2b	T3a	T3b	T5	T6	T7	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T6	T7
Festuca occidentalis	N	N	UPL										1																		
Filago sp.	I	N	UPL													1															
Fraxinus latifolia	N	N	FACW										1															1			1
Galium divaricatum	I	N	UPL						1																		1		1		
Geranium dissectum	I	N	UPL	1																				1							
Glyceria sp.	N	N	OBL				1	1																							
Gnaphalium sp.	N	N	undetermined									1				1									1						
Hemizonia congesta ssp. *leucocephala*	N	N	UPL														1														
Hirschfeldia incana	I	N	UPL													1															
Holcus lanatus	I	N	FAC						1								1	1	1	1			1							1	
Hordeum brachyantherum	N	N	FACW																												1
Hordeum hystrix (H. marinum ssp. *gussoneanum)*	I	N	FAC	1	1									1	1		1	1				1				1	1	1	1	1	
Horkelia californica	N	N	UPL													1															
Hypericum perforatum	I	N	UPL								1				1																
Hypochaeris glabra	I	N	UPL																				1								
Hypochaeris radicata	I	N	UPL			1			1	1					1	1			1		1			1					1		
Juncus bufonius	N	N	FACW+									1		1		1		1	1	1	1		1	1	1	1	1	1	1		
Juncus effusus	N	N	OBL				1															1									
Juncus ensifolius	N	N	FACW		1		1								1								1			1	1	1			1
Juncus patens	N	N	FAC		1		1			1	1		1		1		1	1				1			1	1	1	1	1	1	1
Juncus phaeocephalus (var. phaeocephalus)	N	N	FACW		1																						1	1		1	
Juncus tenuis	N	N	FACW														1	1	1	1	1	1	1	1	1	1		1	1		
Juncus sp.	N	N	>=FAC										1	1															1		
Lactuca saligna	I	N	NI*							1			1									1					1				
Leontodon taraxacoides	I	N	UPL								1							1			1	1	1	1	1						
Elymus triticoides (Leymus)	N	N	FAC+		1		1				1								1												
Limnanthes sp.	N	N	OBL																											1	
Linum usitatissimum	I	N	UPL	1		1			1	1										1	1	1	1	1					1		
Lolium perenne (L. multiflorum)	I	N	FAC	1	1	1	1				1	1		1	1			1			1	1	1	1	1		1	1	1		1
Lolium perenne	I	N	FAC								1																			1	
Lotus oblongifolius	N	N	OBL																												1
Lotus corniculatus	I	N	FAC		1		1		1	1	1	1		1				1		1				1	1	1	1	1	1		1
Lotus purshianus var. *purshianus*	N	N	UPL															1	1				1								
Lupinus bicolor	N	N	UPL													1														1	
Lythrum hyssopifolia	I	N	FACW									1		1						1		1	1	1			1	1	1	1	1
Madia glomerata	N	N	FACU-																						1						
Madia sativa	N	N	UPL												1			1	1												
Madia sp.	N	N	UPL	1		1								1		1	1				1		1	1			1		1		
Mentha pulegium	I	N	OBL		1	1	1			1	1	1	1	1				1		1	1	1	1	1	1	1	1	1	1	1	1
Mimulus guttatus	N	N	OBL				1																							1	
Myosotis discolor	I	N	NI*																											1	
Myosotis sp.	I	N	undetermined																		1										

Species	Native/ Introduced[1]	Invasive (Y/N)[2]	Wetland Indicator Status[3]	Ford					Goss			Niesen								MGC Plasma North					Watson						
				T1	T2	T3	T4	T5	T1	T2	T3	T1	T2a	T2b	T3a	T3b	T5	T6	T7	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T6	T7
Navarretia squarrosa	N	N	UPL									1				1															
Parentucellia viscosa	I	N	NI*	1									1	1		1		1	1	1			1	1	1	1	1	1	1	1	1
Polypogon monspeliensis	I	N	FACW+																							1					
Perideridia kelloggii	N	N	UPL																									1			1
Perideridia pringlei	N	N	UPL																											1	
Phalaris aquatica	I	N	FAC+						1	1	1				1		1	1	1		1			1	1	1	1		1	1	1
Phleum pratense	I	N	FACU		1	1	1				1							1	1	1	1	1	1			1		1		1	1
Plantago lanceolata	I	N	FAC-						1						1	1		1			1		1	1					1	1	
Plantago major	I	N	FACW-									1																			
Pleuropogon hooverianus	N	N	FACW								1																				
Poa annua	I	N	FACW-									1													1	1			1	1	
*Poa pratensis (*ssp. *pratensis)*	I	N	FACU		1		1				1	1	1	1	1		1	1	1	1	1					1	1	1		1	1
Polygonum arenastrum	I	N	UPL									1													1						
Polygonum sp.	N	N	>FAC																											1	
Polypogon monspeliensis	I	N	FACW+																						1						
Quercus lobata	N	N	FAC*												1	1															
Ranunculus sp. (leaves only)	N	N	undetermined										1							1								1		1	1
Rosa californica	N	N	FAC+								1																				
Rubus discolor (R. armeniacus)	I	N	FACW*								1				1																
Rumex acetosella	I	N	UPL	1		1									1	1	1				1		1								
Rumex conglomeratus	I	N	FACW		1		1						1													1	1	1	1	1	1
Rumex crispus	I	N	FACW-	1	1	1	1				1		1	1	1	1	1	1	1	1		1	1			1	1	1		1	1
Rumex pulcher	I	N	FAC+									1	1												1	1					
Scirpus acutus var. *occidentalis*	N	N	OBL		1			1																							
Sonchus asper	I	N	FAC												1				1												
Sonchus oleraceus	I	N	NI*															1													
Spergularia rubra	I	N	FAC-												1																
Spergularia sp.	N	N	assume FAC									1		1																	
Spiranthes romanzoffiana (S. diluvialis)	N	N	OBL										1																		
Stachys sp.	N	N	undetermined				1						1															1			
Taeniatherum caput-medusae	I	N	UPL								1																				
Torilis arvensis	I	N	UPL								1				1																
Toxicodendron diversilobum	N	N	UPL								1																				
Trifolium dubium	I	N	FACU*			1				1			1			1	1	1	1		1		1				1				
Trifolium fragiferum	I	N	NI*		1							1		1														1			
Trifolium glomeratum	I	N	UPL												1																
Trifolium hirtum	I	N	UPL													1															
Trifolium repens	I	N	FACU+		1		1					1						1													1
Trifolium sp.	I	N	UPL	1		1																									
Trifolium subterraneum	I	N	UPL											1	1		1							1			1				
Trifolium variegatum	N	N	FACW-																									1			1
Verbascum blattaria	I	N	FACW																						1						

Species	Native/ Introduced[1]	Invasive (Y/N)[2]	Wetland Indicator Status[3]	Ford					Goss			Niesen								MGC Plasma North					Watson						
				T1	T2	T3	T4	T5	T1	T2	T3	T1	T2a	T2b	T3a	T3b	T5	T6	T7	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T6	T7
Vicia hirsuta	I	N	UPL										1			1		1	1												
Vicia sativa	I	N	FACU												1			1	1											1	
Vicia villosa	I	N	UPL								1						1														
Vulpia bromoides	I	N	FACW			1			1	1				1	1		1	1			1	1		1		1	1		1		
Vulpia myuros(ssp. myuros)	I	N	FACU*												1	1	1				1										
Total Number of Species				**16**	**20**	**21**	**22**	**6**	**21**	**22**	**22**	**15**	**16**	**27**	**30**	**27**	**21**	**37**	**28**	**22**	**24**	**29**	**20**	**26**	**23**	**32**	**27**	**33**	**30**	**32**	**31**
Number of Native Species				***3***	***7***	***4***	***9***	***5***	***6***	***12***	***6***	***4***	***5***	***8***	***5***	***10***	***4***	***10***	***7***	***6***	***7***	***8***	***7***	***9***	***8***	***14***	***8***	***16***	***8***	***12***	***16***
Number of Introduced Species				***13***	***13***	***17***	***13***	***1***	***15***	***10***	***16***	***11***	***11***	***19***	***25***	***17***	***17***	***27***	***21***	***16***	***17***	***21***	***13***	***17***	***15***	***18***	***19***	***17***	***22***	***20***	***15***

Notes:

This list was compiled from ICF International site surveys in the study area in July, 2010. Nomenclature follows Reed (1988) and *The Jepson Manual* (Hickman 1993) and online updates.

[1] Native status from *The Jepson Manual* (Hickman 1993)

[2] Invasive status as defined in the Mitigation and Monitoring Plan (Caltrans 2010, Appendix H, Table 2-1)

[3] Wetland indicator status from Reed (1988) for Region 0, California:

OBL (obligate): almost always occurs in wetlands (99% probability of occurrence in wetlands).

FAC (facultative): equally likely to occur in wetlands or nonwetlands (34%–66% probability).

FACU (facultative upland): usually occurs in nonwetlands but occasionally occurs in wetlands (1%–33% probability).

FACW (facultative wetland): usually occurs in wetlands (67%-99% probability).

UPL (obligate upland): almost never occurs in wetlands (1% probability); in general, species that are not listed on the wetland plant list are assumed to be obligate upland species.

NI (no indicator): no indicator status assigned because regional status information is lacking; the indicator status assigned to the species in the nearest adjacent region is applied, in this case, Region 9 (Northwest).

Undetermined: cannot be assigned an indicator status because plant could not be identified to species.

A plus (+) modifier indicates more frequently found in wetlands, and a minus (-) modifier indicates less frequently found in wetlands; however, although these modifiers are used in Reed (1988), they are not used in the current Regional Supplements, e.g., FAC-, FAC, and FAC+ plants are all considered to be FAC.

An asterisk (*) placed after the indicator status signifies that the indicator status was derived from limited ecological information.

Appendix Q
Grazing Plan - Draft

Willits Bypass Project

Grazing Management Plan
Managing Grazing and Grazinglands

U.S. Highway 101

Mendocino County, near the City of Willits, California

PM 43.1-52.3

01-26200

March 2013

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

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List of Abbreviated Terms

ai/A	active ingredient per acre
APN	assessor parcel number
AUMs	animal unit months
BM	Baker's meadowfoam
Caltrans	California Department of Transportation
CNPS	California Native Plant Society
EMU	East Management Unit
FHWA	Federal Highway Administration
GMP	grazing management plan
MMPs	mitigation and monitoring proposals
MMU	Middle Management Unit
NCSG	North Coast semaphore grass
NMU	North Management Unit
NRCS	Natural Resource Conservation Service
OWMU	Oak Woodland Management Unit
project	Willits Bypass Project
RDM	Residual dry matter
NCSGMU	North Coast Semaphore Grass Management Unit
SMU	South Management Unit
US 101	U.S. Highway 101
WMU	West Management Unit

Chapter 1 Introduction

The California Department of Transportation (Caltrans), in conjunction with the Federal Highway Administration (FHWA), is proposing to construct the Willits Bypass Project (project), a new section of U.S. Highway 101 (US 101) that will bypass the city of Willits in Mendocino County (Figure 1-1). The project will result in unavoidable impacts on wetlands and waters of the State (i.e., aquatic resources), riparian, oak woodland, and special-status plant species habitat in and adjacent to the project's right-of-way.

Parcels located outside the bypass alignment footprint that are included in the project's compensatory mitigation package are referred to as *offsite mitigation parcels* (Figure 1-2). This grazing management plan (GMP) applies to the offsite mitigation parcels and supports an adaptive management approach to land management.

This introductory chapter identifies the purpose and goals of the GMP. The balance of the document is organized as shown below.

- Chapter 2, "Existing Conditions of the Offsite Mitigation Parcels," describes existing natural resources (soils, hydrology, vegetation and habitats), the existing grazing infrastructure, and management practices on the offsite mitigation parcels.
- Chapter 3, "Standard Grazing Management Practices," describes standard grazing management practices.
- Chapter 4, "Invasive Species Management Practices," describes management practices for targeted invasive species that occur on one or more of the offsite mitigation parcels.
- Chapter 5, "Mitigation Unit Objectives and Grazing Practices," describes the recommended grazing management practices for the grazing mitigation units, including pasture size and location size and recommended grazing infrastructure.
- Chapter 6, "References," lists the references and source materials used in preparation of the GMP.

Several appendices are included as part of the GMP.

- Appendix A, Glossary of Terms.
- Appendix B, Recommendations for Grazing to Maintain and Increase Baker's Meadowfoam.

- Appendix C, Recommendations for Grazing to Maintain and Increase North Coast Semaphore Grass.
- Appendix D, Willits Bypass—Websites that Support the Grazing Management Plan.
- Appendix E, Fence Guidelines.
- Appendix F, Riparian Corridor Grazing Guidelines.

Caltrans developed two mitigation and monitoring proposals (MMPs) for the project to offset the unavoidable project impacts on biological resources. The compensatory mitigation to offset project impacts on biological resources includes State special-status plant species establishment and rehabilitation; wetland establishment, reestablishment, rehabilitation and preservation; waters of the State rehabilitation and preservation; riparian establishment and rehabilitation; and oak woodland preservation. Compensatory mitigation will increase the functions of wetlands and waters of the State and will be self-sustaining in perpetuity.

As described in the MMPs, two wetland rehabilitation approaches will be implemented on the mitigation parcels—one that includes grazing and one that will prohibit grazing. This grazing plan applies only to those pastures on which grazing will continue.

One MMP was developed for the State of California resource agencies (North Coast Regional Water Quality Control Board [NCRWQCB] and California Department of Fish and Game [CDFG]). As part of the mitigation project, these agencies require that grazing continue as a management tool to offset unavoidable impacts on wetlands and special-status plant species. Special-status plant species affected by the project are Baker's meadowfoam (BM) (*Limnanthes bakeri*) and North Coast semaphore grass (NCSG) (*Pleuropogon hooverianus*). The second MMP was developed for U.S. Army Corps of Engineers (USACE) as mitigation for federally protected wetlands.

Grazing will continue to be used as a wetland and special-status plant species management tool for wetland mitigation under the State MMP (California Department of Transportation 2013). Grazing will be prohibited on federal wetland mitigation lands under the USACE MMP (California Department of Transportation 2012).

The vision of the State MMP mitigation strategy is to establish, reestablish, rehabilitate, and preserve a mosaic of high-functioning habitats in perpetuity, thus increasing the ecological value of Little Lake Valley and improving water quality in the Eel River basin. Grazing management to enhance wetlands and NCSG and BM habitat are some of the mitigation measures that will be

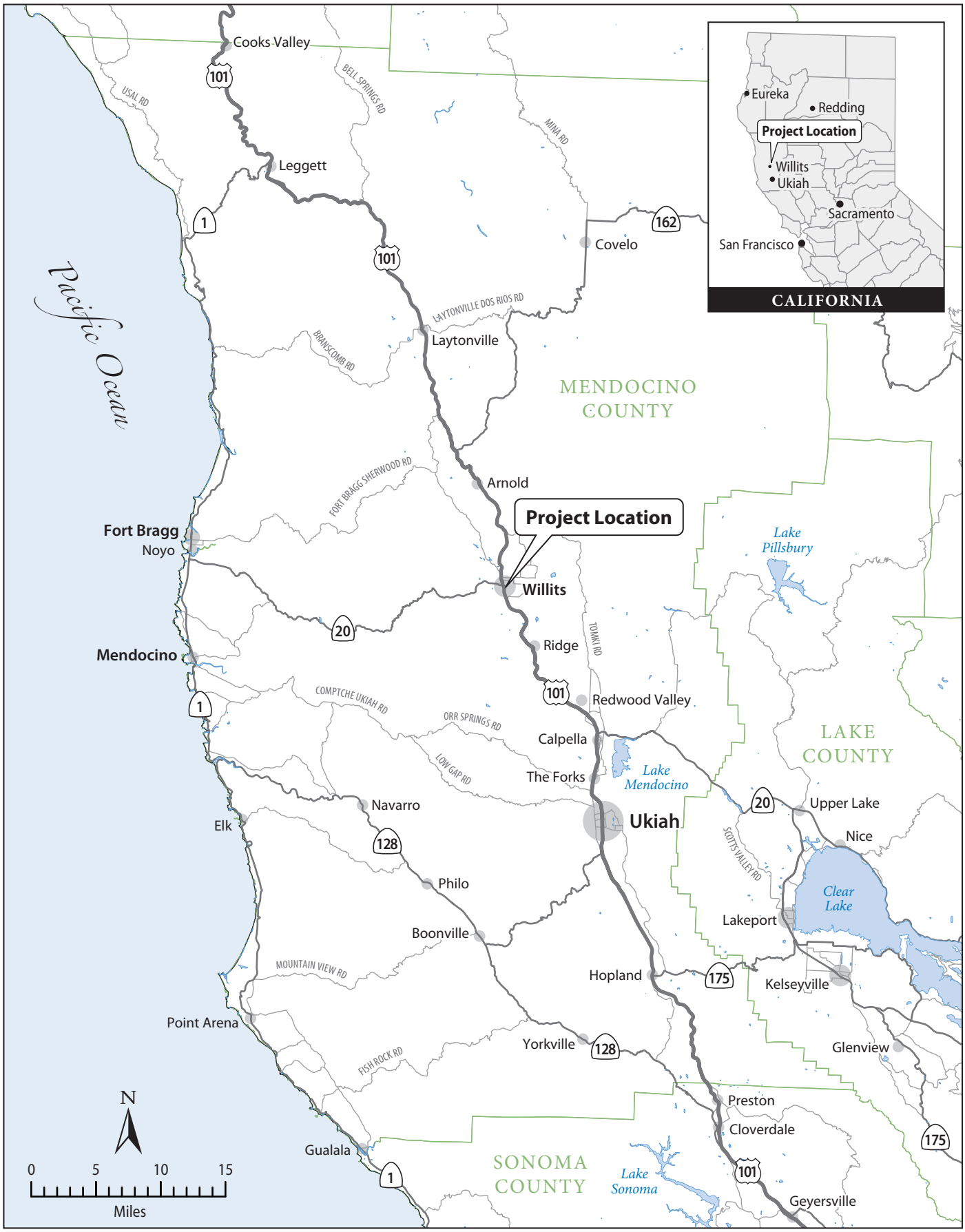

Figure 1-1
Regional Location

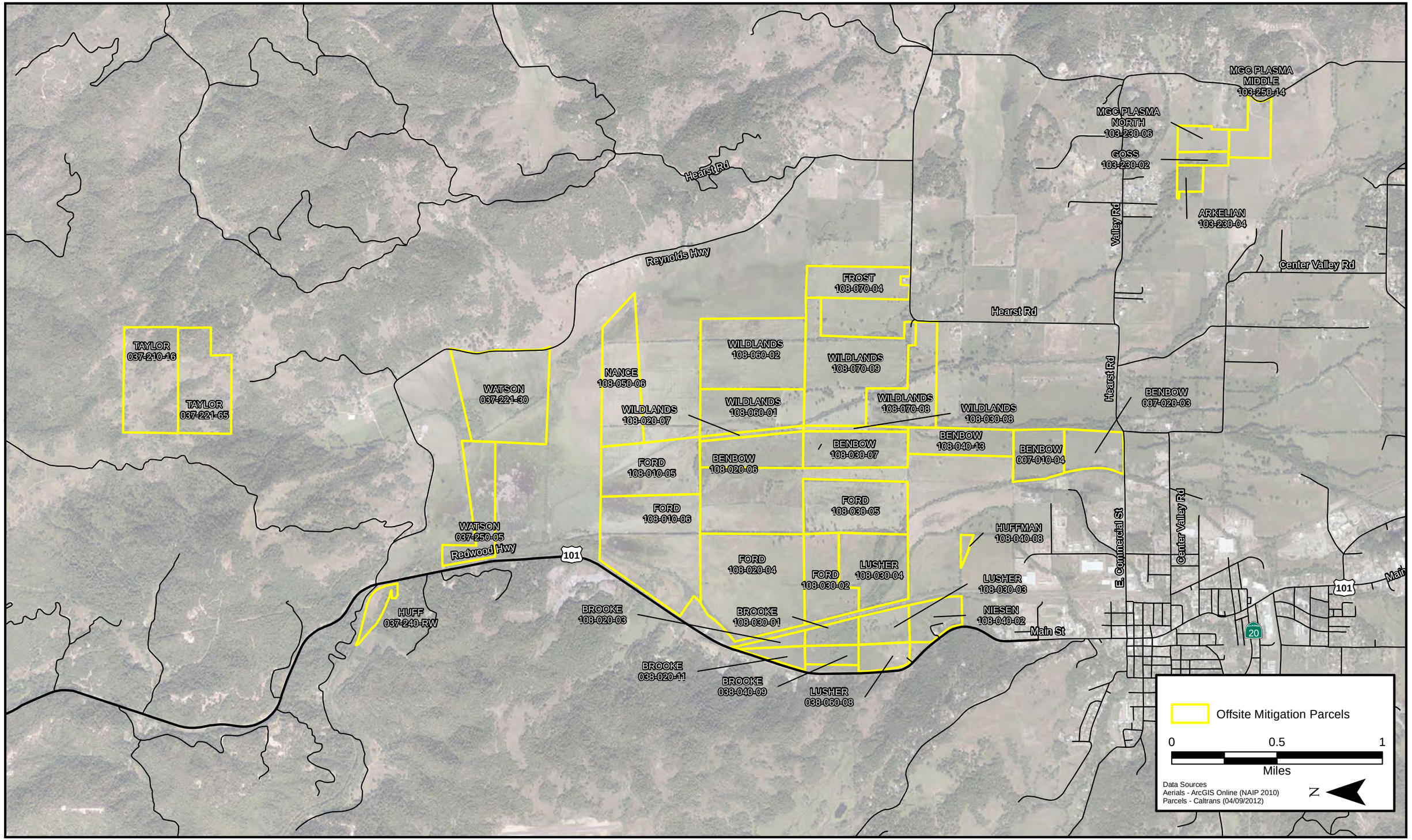

Figure 1-2
Location offsite Mitigation Parcels

implemented under the State MMP. This GMP is incorporated into the State MMP as an appendix.

1.1 Purpose of the Grazing Management Plan

The purpose of this GMP is to provide a grazing prescription and invasive species management alternatives for each offsite mitigation parcel. The GMP includes a prescription that is expected to promote the establishment and maintenance of wetland and riparian plant communities and associated plant species that will enhance wetlands and support and potentially increase the extent of currently occurring NCSG and BM populations.

Grazing management will be either retained or discontinued on all or portions of the parcels, depending on the designated mitigation and land management actions (Figure 1-3). Grazing management will be used to maintain and enhance habitat for two special-status species as well as enhance the existing wetland vegetation communities. Grazing will be used to improve areas that provide known occupied habitat and potential habitat for the purpose of maintaining and improving NCSG and BM habitat.

Additionally, as required by the USACE MMP (California Department of Transportation 2012), several parcels or subparcels will not be grazed to allow successional wetland plant community development or active wetland rehabilitation actions. Livestock will be excluded from all creek channels and riparian corridors except at designated channel crossings.

Appendix A is a glossary of grazing-related terms discussed in this GMP. The first occurrence of each of the terms in the glossary is presented in bold italics to facilitate review of this report.

1.2 Goals, Objectives, and Performance Standards

One goal of the GMP is to ensure that waters of the State (i.e., wet meadow, forested wetland, mixed marsh, streams) and riparian habitats on the parcels where grazing occurs are rehabilitated and provide increased habitat values to Little Lake Valley in perpetuity. Another goal of the GMP is to ensure that sensitive biological resources, including special-status plants, are managed such that these resources are maintained or improved.

Parcel-specific objectives were adapted from the goals and objectives in the following sources.

- Water quality goals and objectives for the GMP in the Monitoring and Reporting Program (No. R1-2010-0066, pg. 14) issued by the NCRWQCB (North Coast Regional Water Quality Control Board 2007).
- Draft State MMP, dated June 2012 (California Department of Transportation 2013).

The goals and objectives will be applied to each parcel as appropriate. Goals and objectives for grazing management include those following.

- Goal A: Maintain and improve the structure and function of seasonal wetland meadows, oak woodlands, and riparian habitats.
    - Objective 1: For wetlands, maintain or improve native seasonal wetland meadow species composition.
    - Objective 2: Maintain or improve native oak woodland species composition.
    - Objective 3: Maintain or increase native riparian vegetation.
- Goal B: Maintain and expand populations of special-status plants.
    - Objective 1: Maintain or expand populations of NCSG.
    - Objective 2: Maintain or increase populations of BM.
- Goal C: Reduce target invasive plant species.
    - Objective 1: Control medusahead (*Taeniatherum caput-medusae*).
    - Objective 2: Control yellow starthistle (*Centaurea solstitialis*).
    - Objective 3: Control Himalayan blackberry (*Rubus armeniacus*).
    - Objective 4: Control reed canarygrass (*Phalaris arundinacea*) and Harding grass (*Phalaris aquatica*).
- Goal D: Maintain grazed parcels in a productive, vigorous and competitive condition.
    - Objective 1: Residual dry matter (RDM) on seasonal wetland meadows no lower than 1,500 pounds per acre (lb/acre) at the end of the grazing season.
    - Objective 2: RDM no lower than 1,000 lb/acre on oak woodlands on or about October 1.

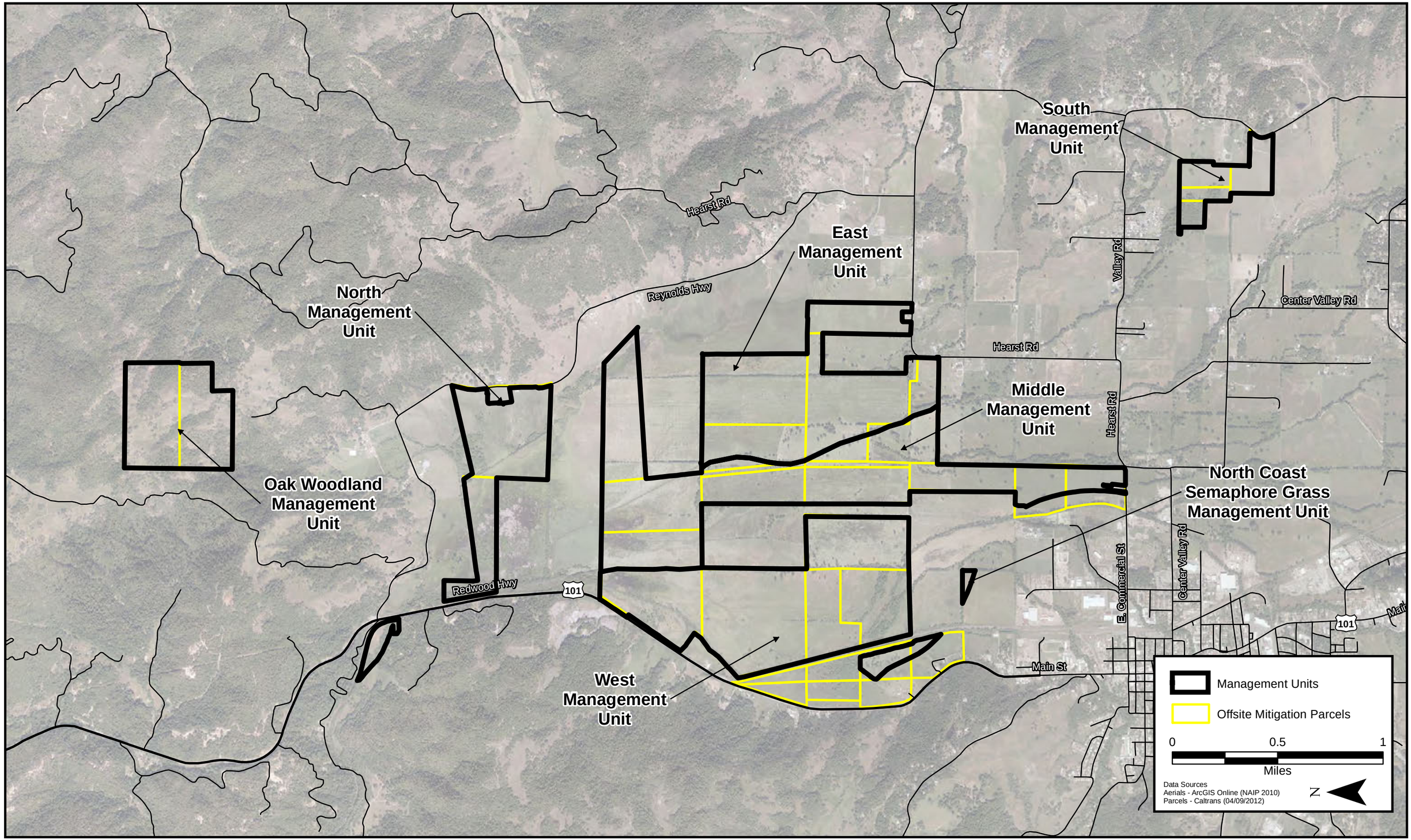

Figure 1-3
Location of Grazing Management Units and Offsite Mitigation Parcels

The performance standards for wetland, riparian, and special-status plant mitigation are presented in Chapter 9 of the State MMP.

To further assist in reaching the goals, the Land Manager is expected to coordinate and make a one-time grazing educational meeting with each lessee. The purpose of the meeting is to explain the goals of the mitigation project and how grazing is used to help reach those goals

Chapter 2 Existing Conditions of the Offsite Mitigation Parcels

The State MMP describes the soils, hydrology, vegetation, and habitats of Little Lake Valley. This section describes the existing conditions, productivity, and grazing infrastructure for each of the offsite mitigation parcels.

2.1 Defining Rangeland and Pasture

The offsite mitigation parcels are composed primarily of annual plant–dominated rangeland sites and perennial plant–dominated wet meadows that are managed as pasture and sometimes irrigated. These meadows will be referred to as *wet meadows* throughout the report. Table 2-1 identifies the vegetation types, including rangeland (grassland or oak woodland), riparian forest, and wet meadows occurring on the offsite mitigation parcels.

Rangeland is dominated by vegetation that is predominantly grasses, grass-like plants, forbs, or shrubs. Rangelands may include natural grasslands, savannas, shrublands, most deserts, tundra, and alpine communities. Rangeland is infrequently seeded or fertilized and not irrigated. Upland sites in Little Lake Valley are dominated by annual rangelands that tend to be less productive and have a shorter growing season and a lower carrying capacity than the wet meadows. These upland sites are dominated by annual plants that germinate and begin to grow with the first fall rains, grow slowly in winter, grow rapidly in the spring, and then dry in late spring (George et al. 2001).

The wet meadows occur mainly on poorly drained Fluvaquents, Haplaquents, and Gielow Series soils. Wet meadows are dominated by introduced cool-season plants such as tall fescue (*Festuca arundinacea*), orchard grass (*Dactylis glomerata*), perennial ryegrass (*Lolium perenne*), strawberry clover (*Trifolium fragiferum*), white clover (T. *repens*), and trefoil (*Lotus* spp.) that were seeded for improved forage quantity and quality. Creeping bentgrass (*Agrostis stolonifera*), reed canarygrass (*Phalaris arundinacea*), and Harding grass (*Phalaris tuberosa*) also occur on these soils and may have invaded or may have been seeded in the past. These meadows are most productive in April through June, with production slowing as the summer progresses and soil moisture becomes depleted. In some cases the wet meadows are irrigated to extend the productive season.

Table 2-1. Production Estimates, Vegetation Types, Pasture Numbers, and Acreage for Mitigation Areas to be grazed, by Management Unit

Management Unit	Parcel	APN	Area (Acres)	Pasture Number	Vegetation Type	Production Estimates 2011 (lb/ac)	
						June	Total
West Management Unit	Ford	108-010-06	65.31	W-1, W-2, W-3	WM, RG	6,900	8,625
	Ford	108-020-04	89.83	W-4, W-5, W-6	WM	8,000	10,000
	Ford	108-030-02	8.88	W-6	WM	7,500	9,375
	Lusher	038-060-08	0	N/A	WM	6,500	8,125
	Lusher	108-030-03	12.82	W-9	WM	6,500	8,125
	Lusher	108-030-04	20.69	W-7, W-8	WM	6,500	8,125
	Niesen	108-040-02	4.06	W-9	WM	7,000	8,750
	Total		**201.59**				
Middle Management Unit	Ford	108-010-06	45.04	M-1	WM, RG	6,900	8,625
	Ford	108-010-05	64.49	M-1, M-2, M-3	WM	8,100	10,125
	Nance	108-050-06	68.18	M-4, M-5, M-6, M-7	WM	7,100	8,875
	Benbow	007-010-04	0	N/A	WM	7,500	9,375
	Benbow	007-020-03	0	N/A	WM	8,000	10,000
	Benbow	108-020-06	41.74	M-8, M-9	WM	8,000	10,000
	Benbow	108-030-07	35.09	M-9, M-10	WM	7,500	9,375
	Benbow	108-040-13	0	N/A	WM	7,500	9,375
	Wildlands	108-070-08	25.24	M-11, M-12	WM	8,000	10,000
	Wildlands	108-030-08	4.84	M-11			
	Wildlands	108-020-07	1.28	N/A	WM	7,000	8,750
	Wildlands	108-060-01	0.12	M-8	WM	8,000	10,000
	Wildlands	108-070-09	4.27	M-11	WM	8,000	10,000
	Total						
East Management Unit	Frost	108-070-04	43.73	E-8, E-9	WM	7,500	9,375
	Wildlands	108-060-01	38.63	E1	WM	6,000	7,500
	Wildlands	108-060-02	92.55	E-2, E-3, E-4, E-5	WM	8,900	11,125
	Wildlands	108-070-08	14.89	E7	WM	8,000	10,000
	Wildlands	108-070-09	77.16	E-3, E-6	WM	8,000	10,000
	Total		**266.96**				
South Management Unit	Arkelian	103-230-04	9.95	S-1	RF, WM	5,700	7,125
	Goss	103-230-02	9.34	S-2	WM	5,700	7,125
	MGC Plasma North	103-230-06	10.99	S-2, S-3	WM	4,602	5,753
	MGC Plasma Middle	103-250-14	22.76	S-2, S-3, S-4	RG	3,649	3,649
	Total		**53.04**				
North Management Unit	Watson	037-221-30	59.28	N-1, N-2	RG	3,100	6,450
					WM	7,000	8,500
	Total		**59.28**				
North Coast Semaphore Grass Management	Huffman	108-040-08	3.27	SG-1	WM	4,600	7,125
	Total		**3.27**				
Oak Woodland Management Unit				OW-1	RO	3,000	3,300
	Taylor	037-210-16	83.20				
	Taylor	037-210-65	72.92				
	Total		**156.12**				

WM = wet meadow.
RG = Rangeland (grassland).
RO = Rangeland (oak woodland).
RF = Riparian forest.

Pasture is a unit of land that grows vegetation suitable for grazing and is fenced so that it can be grazed by livestock. In this report, *pasture* refers to a unit of rangeland or wet meadow that is fenced so that it can be grazed.

2.2 Parcel Productivity

2.2.1 Rangeland

Because of shallow soils and steep topography, rangeland productivity and growing season length are less than on wet meadows, where soils are deep and topography is relatively flat. Productivity on rangeland sites is often available in range or ecological site descriptions from U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS).

Recognizing that rangeland production varies greatly between years because of differing weather conditions, NRCS usually provides estimates for poor, normal, and good years. While production estimates for not all of the rangeland soils could be obtained from NRCS, there was a range of 1,500 lb/acre to 3,000 lb/acre for sites that identified soils on the mitigation parcels (Table 2-2). Field surveys performed during summer 2011 for this GMP estimated range forage production to be about 3,000 to 4,500 lb/acre for the 2010–11 growing season (Table 2-1).

Table 2-2. Productivity of Rangeland (Upland) Soils (USDA NRCS)

Management Unit	Area (Acres)	Mapping Unit			Productivity (lb/acre)		
		Number	Area (Acres)	Soil Complex	Good	Normal	Poor
WMU	581.89	NA	NA	NA	NA	NA	NA
MMU	447.76	115	143.51	Cole Clay Loam, 0 to 2% slopes	3,000	2,500	1,500
		105	4.19	Bearwallow, Hellman, Witherell, 30 to 50% slope	2,400	1,800	1,200
		203	1.40	Talmage Gravelly Sandy Loam, 0 to 2% slopes	2,200	1,500	800
EMU	346.37	115	56	Cole Clay Loam, 0 to 2% slopes	3,000	2,500	1,500
SMU	65.3	115	31.40	Cole Clay Loam, 0 to 2% slopes	3,000	2,500	1,500
NMU	131.5	115	37.90	Cole Clay Loam, 0 to 2% slopes	3,000	2,500	1,500
OWMU	149.70	111	7.81	Casabonne, Wohly, Pardaloe, 50 to 75 % slope	-	-	-
		172	30.31	Pardaloe, Kekawaka, Casabonne, 50 to 75% slopes	-	-	-
		211	38.91	Witherell, Hopland Squawrock (50 to 75% slope	2,500	2,000	1,300
		233	67.41	Yorkville, Squawrock, Witherell, 30 to 50%, slopes	2700	2100	1300
NCSGMU	2.97	105	4.19	NA	NA	NA	NA

NA = not applicable.
WMU = West Management Unit.
MMU = Middle Management Unit.
EMU = East Management Unit.
SMU = South Management Unit.
NMU = North Management Unit.
OWMU = Oak Woodland Management Unit.
NCSGMU = Semaphore Grass Management Unit.

2.2.2 Seasonal Wet Meadows

Forage production on the wet meadows from the beginning of the growing season to flowering in June 2012 was estimated before grazing using the comparative yield, double sampling method (Haydock and Shaw 1975; George et al. 2006). At that point in the growing season no parcels had been irrigated. Because the productivity was estimated prior to the application of seasonal irrigation, production estimates, which help determine the stocking rates, already reflect a situation of no supplemental water. These production estimates assumed that the pastures, including Ford parcels 108-020-04, 108-030-02, and 108-030-05 that routinely received supplemental water to improve late season forage, are not irrigated. Therefore, the production estimates or stocking rates presented in this grazing plan are appropriate for those parcels that have been historically irrigated but will not continue to be irrigated under the new grazing plan. Once grazing begins, it is difficult to accurately estimate regrowth following grazing. However, based on the irrigated pasture production curve of George and coauthors (1992), it is estimated that the additional forage produced in July and August before soil moisture was exhausted was about 20 to 30% of the total annual production. Table 2-1 reports that June 2012 production on wet meadows ranged from about 5,700 lb/acre to 8,900 lb/acre.

2.3 Grazing Infrastructure

Grazing infrastructure includes site features that support grazing management. Grazing infrastructure on the offsite mitigation parcels is fences, gates, and stockwater facilities. The location and condition of these features were inventoried and geo-positioned in June and August 2011 (Figures 2-1 through 2-7). There is occasional disagreement between existing fence lines and assessor parcel number (APN) boundaries. Specific infrastructure needs are recommended for each management unit in Chapter 5.

Repair or upgrading of perimeter and cross-fencing and gates on many parcels is needed. In several parcels removal of old fence posts and down wire is needed to reduce hazards for personnel, livestock, and wildlife. Some fences are overgrown by riparian vegetation, especially Himalayan blackberry. Along many riparian corridors, dense tree and shrub communities cannot be penetrated by livestock and are not fenced. Himalayan blackberry is frequently part of the vegetation structure that prevents livestock access to the stream channel.

Caltrans proposes to replace all existing perimeter fences, and cross-fences will be installed in accordance with the recommendations of this GMP. New fences also will be installed along stream corridors and to protect establishment and rehabilitation action areas, as required by the

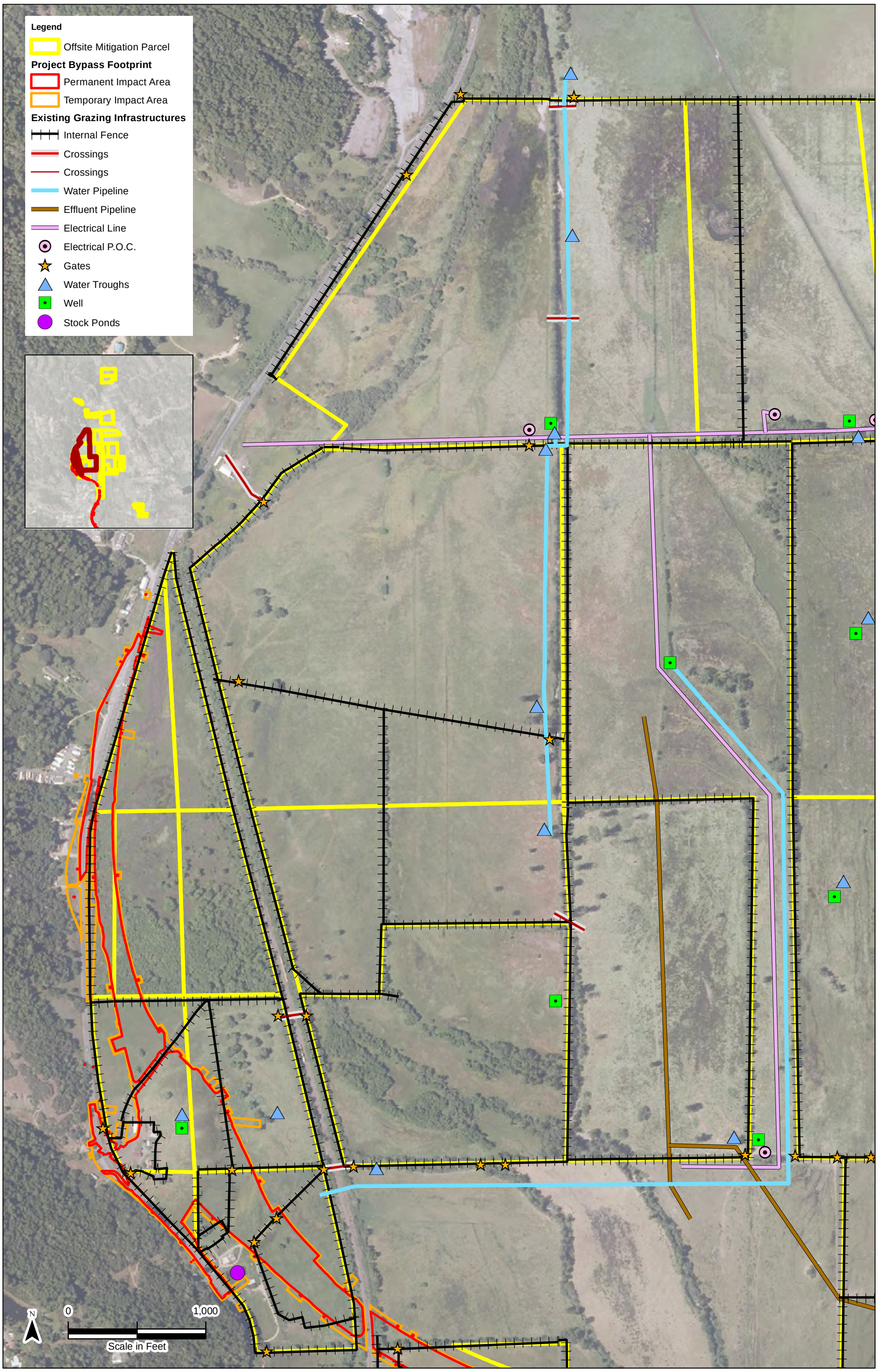

Figure 2-1
Location of Existing Grazing Infrastructure in the West Management Unit

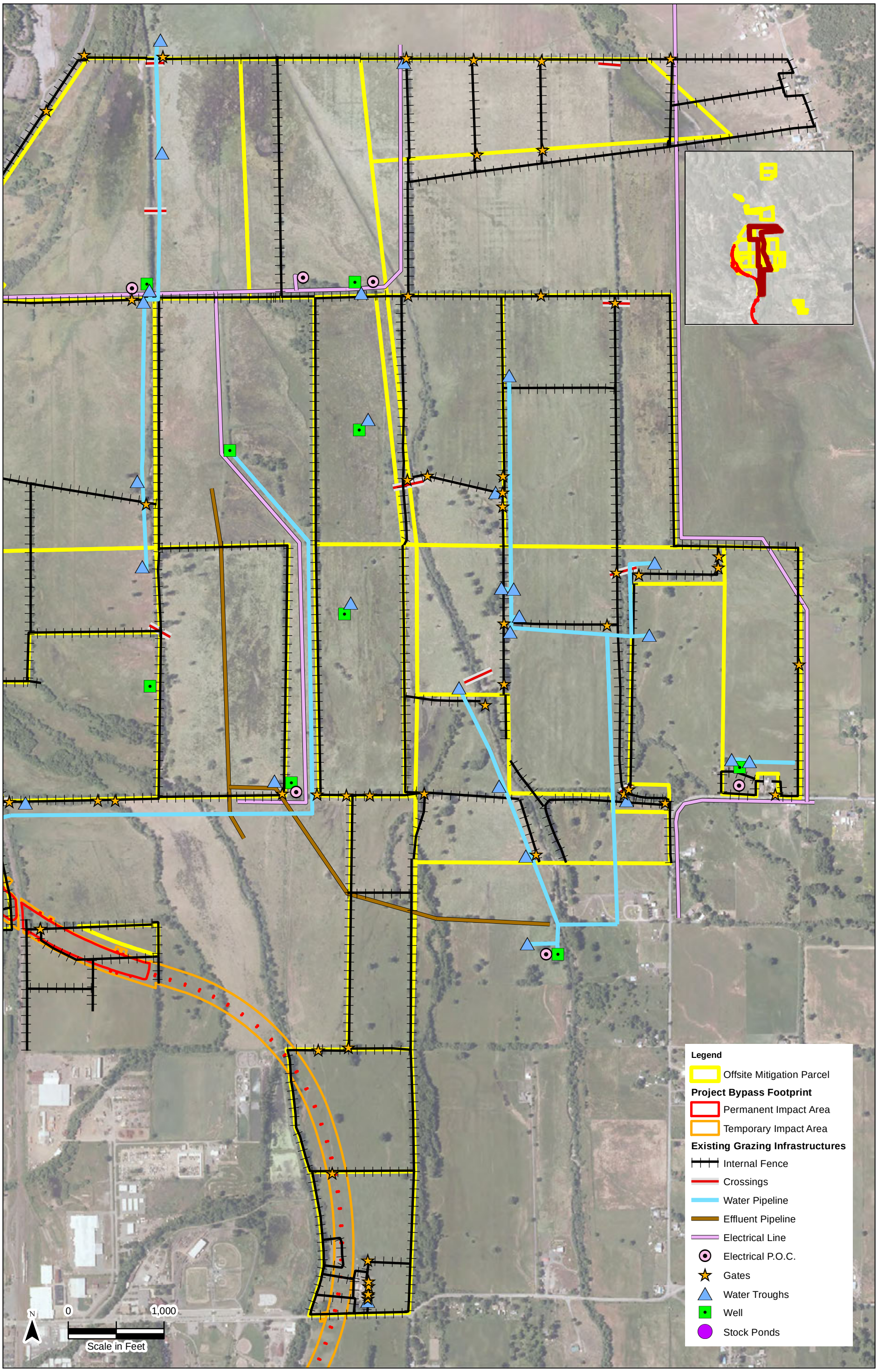

Figure 2-2
Location of Existing Grazing Infrastructure in the Middle Management Unit

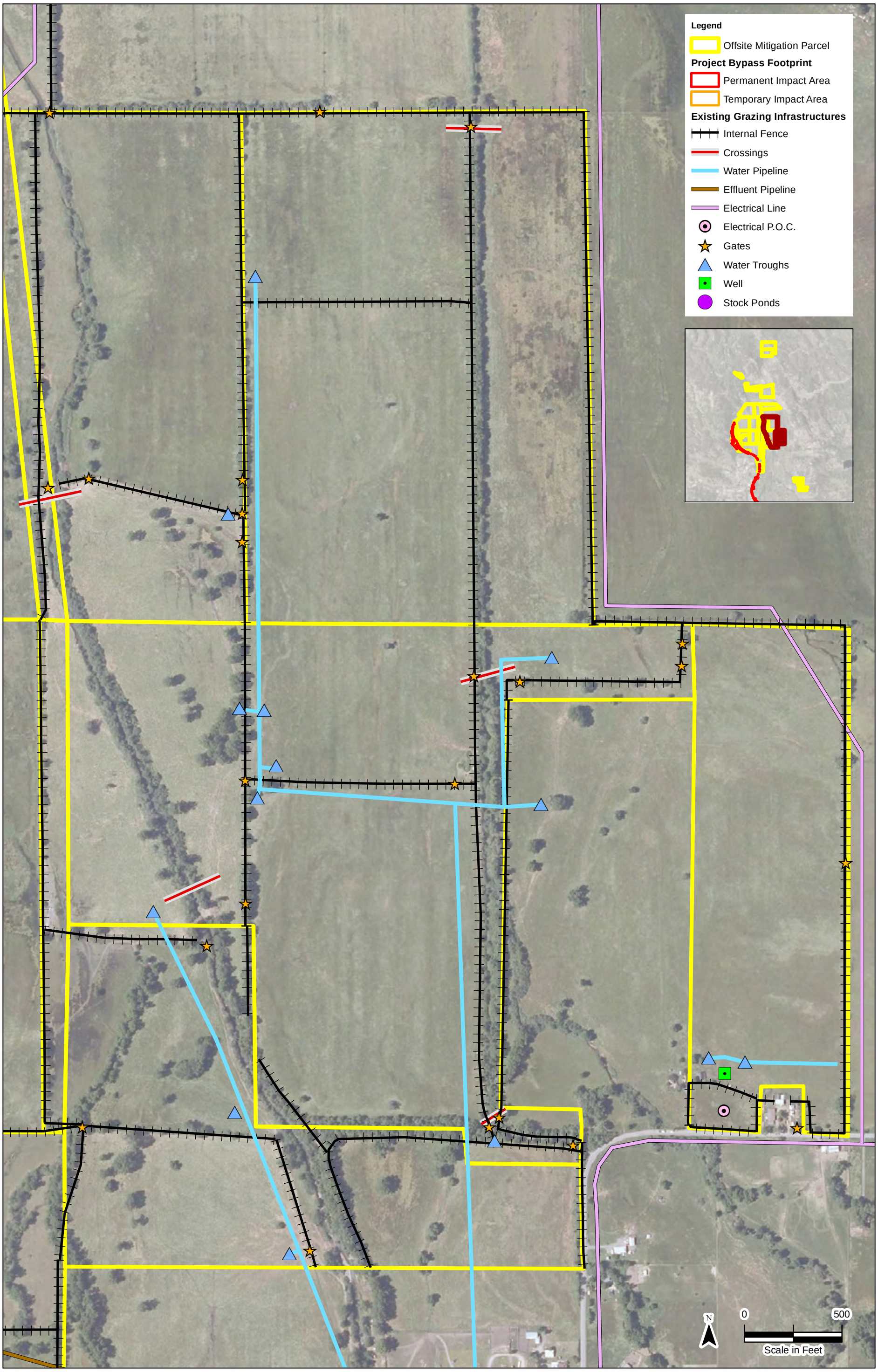

Figure 2-3
Location of Existing Grazing Infrastructure in the East Management Unit

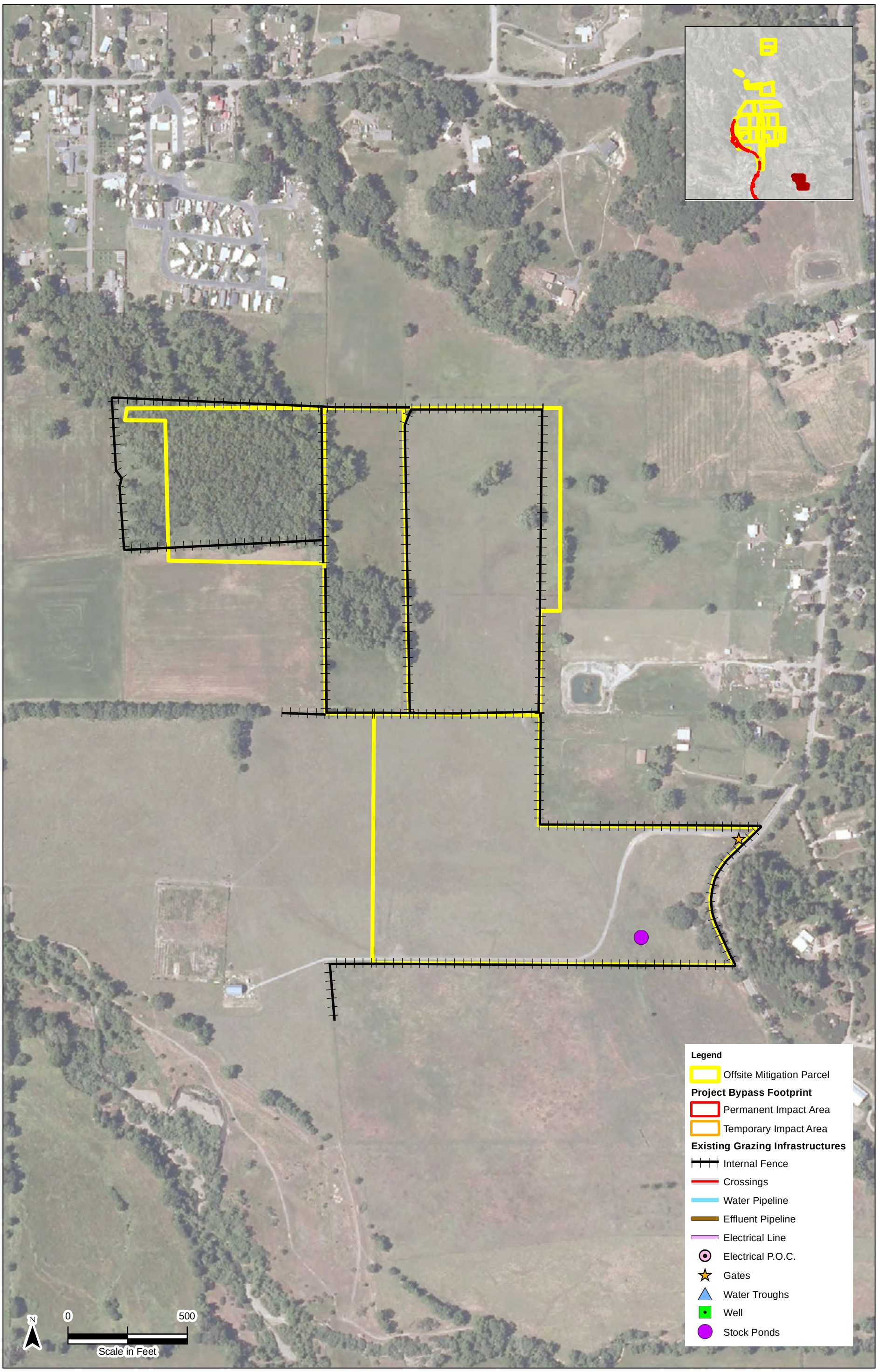

Figure 2-4
Location of Existing Grazing Infrastructure in the South Management Unit

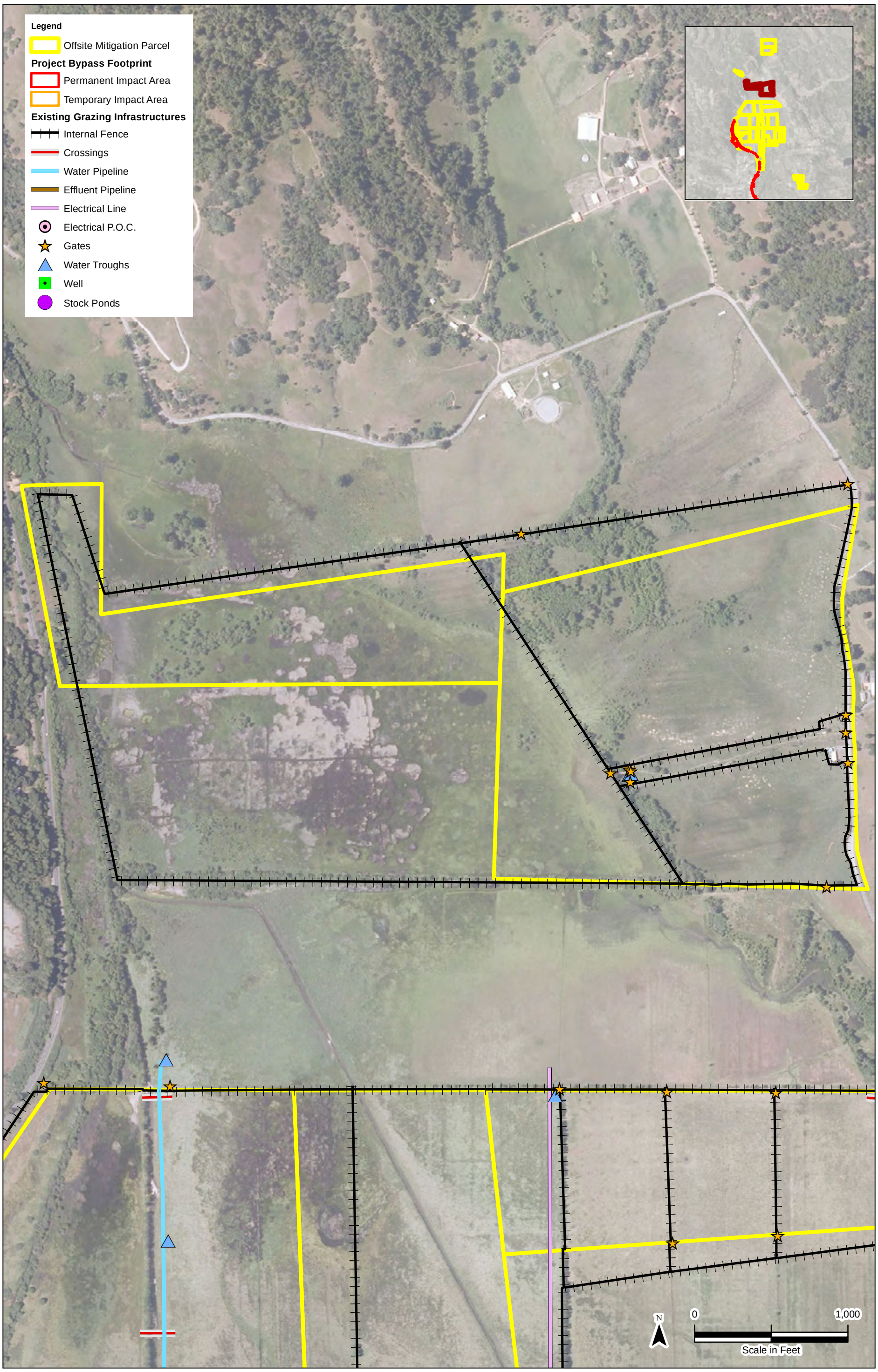

Figure 2-5
Location of Existing Grazing Infrastructure in the North Management Unit

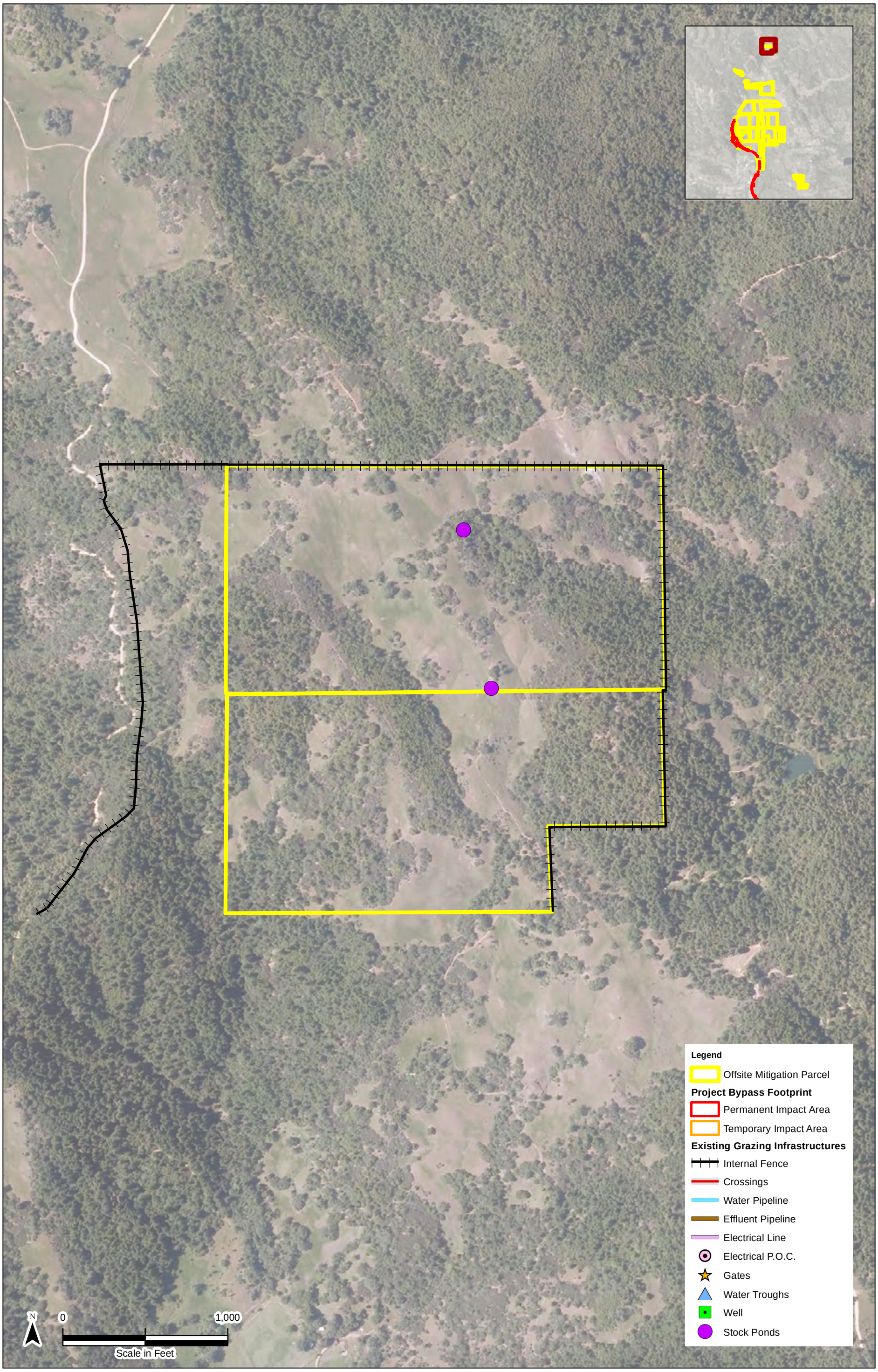

Figure 2-6
Location of Existing Grazing Infrastructure in the Oak Woodland Management Unit

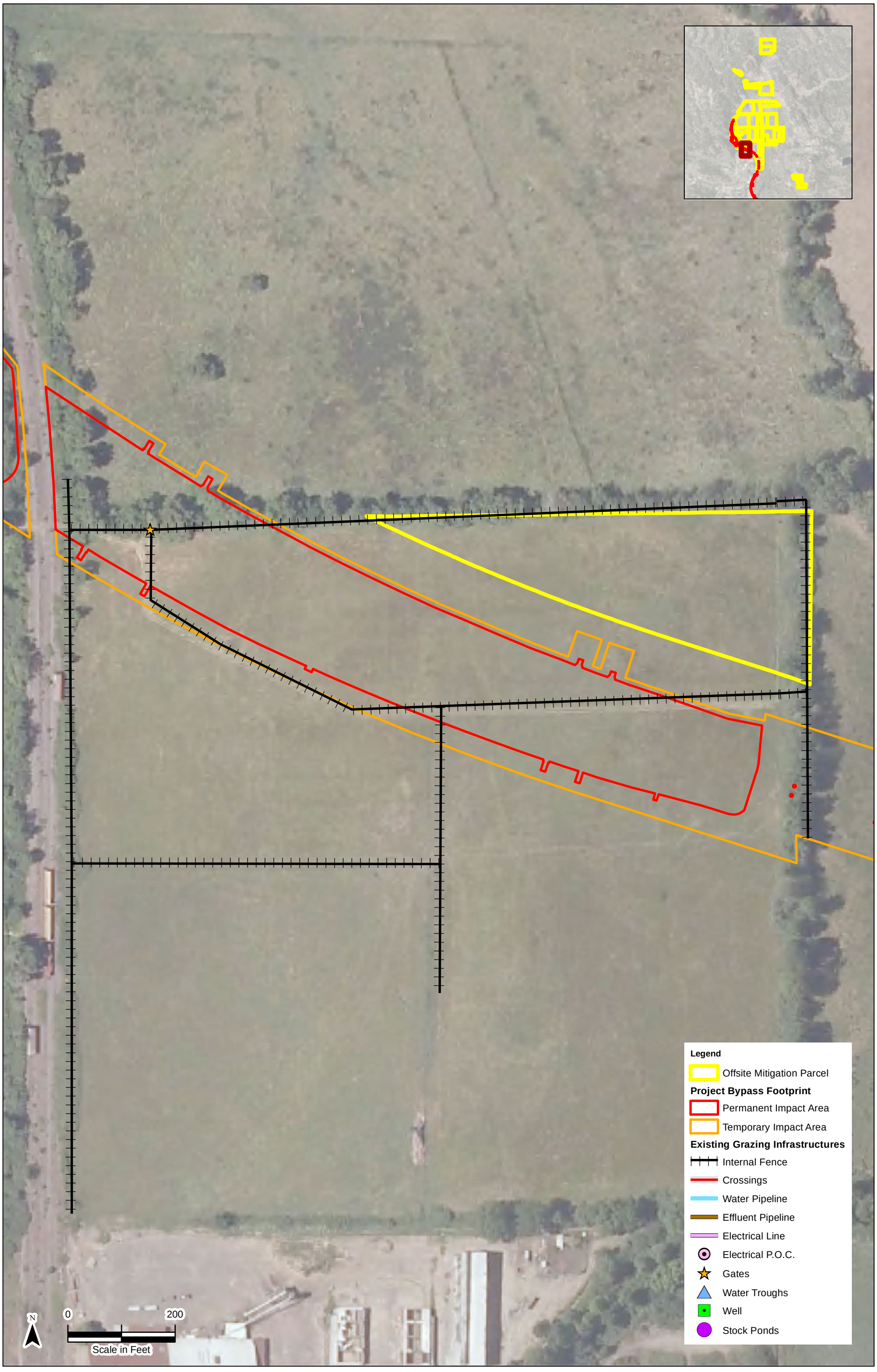

Figure 2-7
Location of Existing Grazing Infrastructure in the North Coast Semaphore Grass Management Unit

USACE and State MMP. New fences will be installed around wetland establishment areas as required by the USACE MMP.

New stockwater facilities will be required for each pasture that lacks them. New stockwater facilities also will be needed in subunits where adjacent creeks currently serve as the stockwater source. An 8-foot-diameter water trough can supply water to 200 cows. During hot weather mature beef cows can consume 20 to 30 gallons of water daily. Cows have a pecking order for who drinks first. If an adequate supply of water is not provided, cattle may panic and break fences to get to water. Therefore, it is recommended that adequate stockwater facilities be designed and installed to provide a reliable water source in each pasture.

It is recommended that the current grazing lessees be involved in the final decisions about where to place pasture infrastructure (internal fences, gates, water development, and stream crossings) because several of them have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs. Gates and stream crossings should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and typically is the best person to decide location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring. Recommendations for the general locations of fences, gates, water troughs, and crossings are identified in Chapter 5.

Chapter 3 Standard Grazing Management Practices

Grazing managers can influence or control the season, ***frequency, duration,*** and ***intensity*** of grazing. They also can choose the kind and class of animal and influence animal behavior and livestock distribution with the placement of pasture infrastructure. Using an ***adaptive management*** approach, grazing managers can apply grazing practices that maintain or improve seasonal wetland habitat, maintain or improve habitat for plant species of concern, target invasive species, reduce nonpoint-source pollution, and protect riparian corridors.

The grazing management practices described in this chapter are among the best management practices approved by the State Water Resources Control Board in the 1995 California Rangeland Water Quality Management Plan at:

- http://www.waterboards.ca.gov/publications_forms/publications/general/docs/ca_rangeland_wqmgmt_plan_july1995.pdf on pgs 54-58, and republished a
- http://californiarangeland.ucdavis.edu/Publications%20pdf/FS9.pdf.

The effectiveness of many of these practices has recently been reviewed by USDA (Briske et al. 2011 and George et al. 2011).

This section identifies and defines standard grazing management practices, including ***rotational grazing***, that potentially could be implemented on the offsite mitigation parcels and discusses how they can be applied to suppress nonnative vegetation so that native plant populations can be maintained or improved. A successful grazing management system needs to address environmental, economic, and social aspects of a grazing or ranching system. For the bypass project, the primary focus will be on achieving the wetland and special-status species mitigation goals and performance standards. If grazing operations under this GMP prove not to be profitable for the lessees, this issue will be addressed as part of the adaptive management process including review of alternative practices that can meet mitigation goals and performance standards within an adaptive process. Throughout this section, practices that support mitigation parcel objectives will be identified. Grazing management recommendations are provided in Chapter 5.

3.1 Season of Grazing

The typical ***season of grazing*** for most of the offsite mitigation parcels is late spring to fall with no grazing in the wet season. Only the North Management Unit (NMU) is grazed all year. Wet meadows generally are not grazed during the winter and early spring when productivity is low and soils are saturated as a result of rainfall and inundation and are subject to compaction. Thus, in most years and management units, the season of grazing for pastures that have these characteristics should be from May 1 to October 31. A late spring start date allows winter rains and floodplain inundation to subside and the parcels to begin to dry. A fall end date allows removal of livestock prior to the start of winter rains and periodic inundation. It is recommended that lessees have the flexibility to start grazing sooner or wait longer in response to prevailing soil moisture conditions.

Grazing during the May 1 to October 31 time period has several advantages. Spring grazing reduces taller nonnative vegetation that minimizes competition with shorter vegetation, including many native forbs (e.g., BM). This allows native forbs to bloom and complete their life cycles free of excessive shading. Spring and summer grazing also reduces vegetation levels during peak wildfire season. Grazing typically would be deferred until May; however, for the bypass project grazing in April may occur if it is determined to be beneficial to NCSG and BM (Section 3.6).

Seasonal grazing is the term for grazing restricted to a specific season or time of year. ***Season-long continuous grazing*** refers to continuous grazing for a season as opposed to season-long rotational grazing, which refers to a rotational grazing system during a particular season, as is recommended for many of the mitigation parcels.

3.2 Frequency and Duration of Grazing

Frequency of grazing and ***duration of grazing*** refer to how often a pasture (rangeland or wet meadow) is grazed, how long it is grazed, and how long it is rested between grazing periods. Differences between grazing methods ranging from continuous to very intensive rotational grazing are attributable to differences in frequency and duration of grazing. Rotation frequencies can vary from seasonal to daily, resulting in a continuum of grazing methods (Holechek 2004).

3.2.1 Continuous Grazing

The duration of grazing under continuous grazing is all year or all season in a single pasture. Historically in California and the U.S., pastures are often continuously grazed throughout the grazing season. In an adaptive grazing management program, continuous grazing can be used to

create a patchy herbaceous vegetation structure that may be desirable for some terrestrial and avian species. Under light stocking, animals are allowed maximum dietary selectivity throughout the year, which often creates a patchy herbaceous vegetation structure.

While continuous grazing can be practiced if proper stocking rates are followed, preferred plant species may be used more heavily while less preferred plant species are lightly used. If a native plant species is preferred it could be grazed too heavily and frequently could lead to reduced plant vigor and competitive ability. Preferences for semaphore grass by cattle, sheep, and goats are unknown. It has been observed that cattle do not graze BM (Hulse-Stephens pers. comm.), but sheep and goat preferences are not known.

3.2.2 Rotational Grazing

With most rotational grazing, only one pasture is grazed at a time while the other pastures rest. Resting grazed pastures allows native and nonnative herbaceous wet meadow vegetation to restore energy reserves, replace leaf area, rebuild vigor, deepen root systems, and lengthen maximum production. Rotational grazing can be practiced in a range of intensities from two pastures to more than 30. Intensive rotational grazing of pastures involves a higher level of management with greater pasture numbers (at least eight), shorter grazing periods, and longer rest periods. Generally, more intense management results in higher stock densities for shorter periods of time. Rotational grazing offers a number of potential advantages:

- More stable plant productivity.
- Potentially greater plant productivity.
- Decreased weed and erosion problems.
- More uniform distribution of grazing use, manure and urine.
- More uniform grazing reduces shading of NCSG by competing vegetation.
- Increased stock density and, therefore, trampling effects on BM patches.

Rotational grazing systems are set up so that livestock can move from one pasture to the next just by opening a gate and gently moving them to the next pasture. Sometimes they will move themselves. Rotational grazing is usually not effective in time or money if livestock must be moved long distances or hauling is required to rotate between pastures. Therefore, it is most efficient and effective if all pastures in a rotational grazing system are adjacent to each other.

Rotational grazing offers a means to reduce shading of NCSG and improve its competitive ability with the aggressive nonnative grasses in the wet meadows of Little Lake Valley. Because

NCSG often is mixed with aggressive nonnative pasture grasses, it is difficult to suppress the nonnatives without adversely affecting NCSG. In this mitigation project, the objective is to minimize shading of NCSG by nonnative grasses. Without grazing, the nonnatives, being taller and more aggressive, can shade and outcompete the native plants for sunlight. With continuous grazing, native plants (if they are preferred) may be preferentially grazed resulting in their suppression relative to the nonnatives. Rotational grazing, as applied in much of Little Lake Valley, tends to keep nonnatives from excessively shading natives, giving the natives a chance to maintain their presence and potentially expand. All the methods of grass expansion (tillering, rhizomes, and stolons) are stimulated by sunlight. Shading suppresses these physiological processes. There really is no other alternative for managing NCSG unless herbicides and cultivation are used to kill the nonnative grasses, but it is difficult to apply these practices without also destroying NCSG.

BM may be suppressed by taller vegetation that surrounds or invades BM patches. It has been learned that without grazing some desired native species, especially species with a decumbent (short-statured) growth habit (e.g., Baker's meadowfoam), will be suppressed by shading from taller ungrazed vegetation. According to the work of Marty (2005) and observed on the NMU, wetland species such as BM benefit from the removal of competing vegetation and are not harmed by the grazing treatment. It has been observed (Hulse-Stephens pers. comm.) that cattle do not graze BM. This may be because it is not palatable or because cattle preferences for taller vegetation that is easily ***prehended*** in large bites support their large daily forage intake requirements. Thus, both continuous and rotational grazing, at proper stocking rates guided by RDM targets, can be used to suppress taller vegetation that may compete with BM. In summary, targeted grazing for NCSG, BM, and other native wetland species can be accomplished with seasonal or year-round continuous grazing or rotational grazing if stocking rates are correct and RDM guides are followed.

3.2.3 Intensity of Grazing

Intensity of grazing refers to stock density, stocking rate, and carrying capacity. Determining the proper intensity of grazing (stocking rate) is a necessary step in developing any grazing management plan.

Stock density is the number of animals per unit area at any instant in time. Stocking rate is the number of specific kinds and ***classes of animals*** grazing or using a unit of land for a specified period of time. Stocking rate is commonly expressed as ***animal unit months*** (AUMs) per acre. One ***animal unit*** may be defined as one 1,000 lb cow. Animal unit equivalents for other kinds and classes of animals are shown in Table 3-1.

Table 3-1. Animal Unit Equivalents for Various Kinds and Classes of Livestock

Livestock Type	Animal Unit
Cattle	
Mature cows without a calf	1.0
Cow with a calf	1.2
Weaned calf to yearling	0.6
Steers and heifers (1-2 years)	1.0
Mature bulls	1.3
Sheep	
5 weaned lambs to yearlings	0.6
5 mature ewes with or without lambs	1.0
5 mature rams	1.3
Goats	
6 weaned kids to yearlings	0.6
6 does with or without kids	1.0
6 mature bucks	1.3
Horses and Mules	
Mature horse (1200 lb)	1 to 1.25
Mature mule	1 to 1.25
Wildlife	
6 deer	1.0
Antelope, mature	0.20
Bison, mature	1.00

Carrying capacity is the maximum stocking rate possible that is consistent with maintaining or improving vegetation or related resources. Carrying capacity is related to total production, but so many other factors influence carrying capacity that any estimate is fraught with uncertainty. In practice, proper stocking rates have been determined over many years of research, observation, and recordkeeping. Range managers often define a moderate stocking rate to be in the range of 40 to 60% utilization on a weight basis. In other words, “take half and leave half” as recommended by early range managers. Grazing above this range is defined as a heavy stocking rate, and grazing below this range is defined as light stocking. On California’s annual rangelands proper stocking is gauged by setting RDM guides to ensure that adequate ***litter*** is left behind to protect the soil and provide a good soil microclimate for germination. Excessive litter is often called thatch, which has gained common usage by restoration managers in California.

Varying stocking rate across the landscape can create a mosaic of vegetation structures and results in a diversity of ground habitats that can increase terrestrial wildlife diversity, especially of avian species. Knopf (1996) illustrated that grassland birds in the Great Plains respond to the

gradient of vegetation from bare ground through short and mixed grass to a mixed grass and shrub composition. Modern management practices that attempt to improve livestock distribution and reduce uneven grazing have reduced this landscape heterogeneity. Consequently some scientists believe that management practices that increase vegetation heterogeneity will be positive for grassland birds by increasing the variability in vegetation structure and composition (Derner et al. 2009).

3.2.4 Residual Dry Matter

RDM is the vegetative litter remaining in the fall at the end of the grazing season. RDM management has been used on California's annual plant–dominated foothill and valley rangelands for many decades. Only in the late 1970s did researchers with the University of California and USDA Forest Service begin to recommend target levels and measurement procedures for monitoring RDM. The University of California has published RDM guides based on precipitation, slope, and canopy cover (Bartolome et al. 2006). It is recommended that these guides be adapted to local conditions. The target RDM for rangelands in the offsite mitigation parcels is 800 to 1,200 lb/ac, reflecting the need for soil protection on steep slopes with high rainfall. Experience suggests that 1,200 lb/acre may be excessive on flat to gentle slopes; thus, 1,000 lb/acre is recommended in some of the management units. RDM management recommendations are presented in Chapter 5.

RDM targets for wet meadows have not been published. There are several considerations in developing RDM targets for wet meadows.

- Reduce shading of NCSG and BM by introduced perennial grasses and other competitors.
- Prevent vegetative litter buildup that may suppress BM.
- Maintain adequate cover to reduce the risk of erosion.
- Maintain adequate ground cover to provide filtration of pollutants from overland flow.

Shading from tall introduced pasture grasses is reduced as the height of these plants is reduced by grazing and trampling. Decreasing these grasses from 3–5 feet in height down to 1 foot in height during the grazing season will reduce the shading effect at the beginning of the next growing season.

Litter accumulates in a vertical and horizontal mosaic ranging from no litter (bare ground) to several inches. Vertical litter results when standing vegetation dries and dies. Horizontal litter results from trampling, wetting, or wind that lays vertical litter down to the ground surface. The

stubble of green perennial plants also varies in height depending on grazing pressure during the growing season. Buildup of litter (thatch) has been shown to suppress some annual plant species. Decumbent plants, such as many native and introduced annual forbs and some native grasses, are suppressed by litter because new seedlings of annual plants cannot grow through the thatch. BM falls in this category. Most perennial plants that regrow from stems and crowns near the soil surface are able to grow through accumulated litter. NCSG falls in this category. Reducing the vertical litter to less than 12 inches and the horizontal litter to less than 2 inches will reduce shading and suppression of seedling establishment, thus providing niches for decumbent plants to grow through the litter without affecting their vigor and competitive ability.

For BM patches, RDM of less than 1,500 lb/acre will reduce competition to BM while providing some trampling during grazing. For NCSG patches, RDM should not be less than 1,500 lb/acre to avoid close grazing that could destroy buds required by NCSG for regrowth following grazing. While a pasture-wide RDM greater than 1,500 lb/acre is achievable and well within current grazing levels, RDM below 1,500 lb/acre may require additional practices. For example, it may be necessary to confine livestock on BM patches using electric fence, or livestock may be attracted to BM patches using protein supplements and salt blocks. Dehydrated molasses supplements (Crystalyx) is a proven method of attracting livestock into an area to increase grazing and trampling (George et al. 2007). Alternatively, mowing the BM patches and adjacent areas to the desired level also could help maintain and increase the extent of BM patches but may require removal of the cut vegetation from the BM patches.

3.2.5 Stocking Rate

Determining ***stocking rate*** is a fundamental first step in grazing management planning. For the grazed portions of the GMP management unit, stocking rates must support mitigation and land management goals. For the bypass project, the primary consideration for determining stocking rate will be based on achieving the wetland and special-status species mitigation goals and performance standards. If grazing operations under this GMP prove not to be profitable for the lessees, this issue will be addressed as part of the adaptive management process. This section reviews stocking rates and confirms that they are compatible with stated NCSG and BM objectives and supported by recommended grazing management practices.

Relying on records provided by John Ford, it was determined that the stocking rate varies from about 4 AUMs/acre/year (5-month grazing season) to 6.5 AUMs/acre/year (7-month grazing season) for most of the wet meadows. As a frame of reference, good Sacramento Valley irrigated pasture supports about 10 to 12 AUMs/acre/year, and Sierra foothill oak woodlands support about 0.6 to 0.8 AUM/acre/year. Pastures that are harvested for hay usually provide 2 to 4 AUMs

after removing 2 tons of hay per acre. The RDM level for all of the offsite mitigation parcels, prior to grazing under the State MMP, presently exceeds 1,500 lb/acre.

Historically, the NMU has been grazed year-round with 35 to 40 mature cows and their calves (approximately 40 animal units). This equates to a stocking rate of about 3.3 AUMs/acre/year. Additionally about 60 to 80 tons of hay per year have been harvested from the eastern parcel that will not be grazed under the mitigation plan. Thus, the actual off-take for the Watson parcels is about 4.3 AUMs/acre/year, which is within the range reported for the Ford Ranch. It was also determined from Ford and Goss ranch records that hay production in the valley wet meadows they manage is about 1.5 to 2 tons/acre/year which is equivalent to about 3.75 to 5 AUMs/acre/year. All of these parcels are leaving at least 1,000 lb/acre of RDM on their upland soils (rangeland) and 1,500 lb/acre on the wet meadows. Based on production estimates and current stocking rates, it can be concluded that stocking rates of 4 to 6.5 AUMs can be supported by the wet meadow parcels and would not be expected to negatively affect the baseline conditions of wetlands and special-status plant species populations.

Performance monitoring of the condition and extent of wetland and special-status plant species will be used to determine whether the stocking rates should be adjusted to benefit the target mitigation resources. The performance standards and monitoring methods for wetland and special-status plant mitigation are presented in Chapters 9 and 10, respectively, of the 2012 State MMP.

The stocking rate on the Taylor Ranch is about 65 cows/980 acre or about 0.065 AUMs per acre (15 acres per AUM). While the Oak Woodland Management Unit (OWMU) produced more than 3,000 lb/acre of forage in 2010–2011, about half of the area is dense tree and shrub canopy cover and produces little forage. The Taylor Ranch is leaving RDM greater than 1,500 lb/acre. Based on the rangeland production, data it can be concluded that the OWMU can be stocked at a rate of 15 to 20 acres per AUM.

3.3 Kind and Class of Animal

3.3.1 Beef Cattle

The preferred kind and class of animal for grazing the mitigation parcels is all age classes of beef cattle (i.e., cows, heifers, calves, stockers, and bulls). Historically, Little Lake Valley has been grazed by cattle, and native habitats on the parcels have been able to persist over many decades of grazing. Currently, all classes of beef cattle graze on the mitigation parcels. Because grazing typically is deferred until May, grass in the parcels can be quite tall and will have begun to

flower by the time grazing begins. As bulk feeders (i.e., not very selective), beef cattle can process and survive on this large amount of grass better than sheep or goats.

3.3.2 Sheep and Goats

There are a few sheep flocks and goat herds in Little Lake Valley. Sheep are intermediate feeders that can process grass but prefer forbs. Goats are browsers and could adversely affect desired woody vegetation. Sheep and goats with their more precise prehensile organs (lips) are more adept at selecting (nibbling) a high-quality diet from the forage available. While goats and sheep are less effective at processing the tall forage that can accumulate on the wet meadows, sheep could be an acceptable alternative as long as they were managed to meet RDM targets. Goats can be difficult to contain with standard fences. When targeting certain weeds or woody vegetation for control, sheep and goats may be the preferred grazer. Over the past decade many sheep and goat operations have been formed to manage vegetation for a fee.

3.4 Targeted Grazing

Targeted grazing is a recent term that defines the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation or landscape goals. This term often is used for weed control or vegetation management using grazing or browsing animals. This concept has been around for decades and has taken many names, including prescribed grazing and managed herbivory. The major difference between traditional grazing management and targeted grazing is that targeted grazing refocuses outputs of grazing from livestock production to vegetation management and landscape enhancement.

There is growing evidence that cessation of grazing may have detrimental effects on native flora and fauna. Grazing is increasingly recognized as a means of managing competition from aggressive herbaceous vegetation. Targeted grazing has proven valuable for managing vernal pools in California's valley grasslands (Marty 2005), managing vegetation for Bay checkerspot butterfly (*Euphydryas editha bayensis*) populations in serpentine grasslands (Weiss 1999), Santa Cruz tarplant (*Holocarpha macradenia*) and annual wildflower displays (Hayes 1998), and native annual forb richness and cover (Hayes and Holl 2003).

Grazing by livestock may enhance grassland species diversity through the classical mechanism of reducing biomass and slowing competitive displacement (MacNaughton 1968; Noy-Meir 1995; Collins et al. 1998) or by increasing vegetation patchiness (Briske et al. 2011). Grazing also is used by conservation-oriented grassland managers to suppress exotic species and enhance native species (e.g., Menke 1989; Thomsen et al. 1993). In general, grazing is expected to have

stronger positive effects on diversity in systems with higher productivity (e.g., Grime 1979; Milchunas et al. 1988; Proulx and Mazumder 1998).

Targeted grazing also has been shown to benefit wildlife habitat. The U.S. Fish and Wildlife Service (USFWS) (2004, 2005) recognized that grazing adjacent to stock ponds and maintenance of stock ponds can provide suitable breeding and summer estivation habitat for California red-legged frog (*Rana draytonii*) and California tiger salamander (*Ambystoma californiense*). Germano and coauthors (2001) found that the cover of nonnative grasses and forbs often creates an impenetrable thicket for small, ground-dwelling vertebrates. An ongoing long-term study in Kern County has found that several animal populations are often greater on grazed plots than in ungrazed plots, including short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*), giant kangaroo rat (*Dipodomys ingens*), sage sparrow (*Amphispiza belli*), horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), and blunt-nosed leopard lizard (*Gambelia sila*) (Germano et al. 2006). Giant kangaroo rat and blunt-nosed leopard lizard are both federally and State-listed as endangered.

Without vegetation management, there is severe risk of excessive fine fuel buildup that could result in a wildfire. Targeted or prescribed grazing reduces fine fuel loads and can have the potential to be an ecologically and economically sustainable management tool for reduction of fuel loads. Existing data indicate that grazing reduces fine fuel loads, and it therefore can modify both fire frequency and fire intensity (Nader et al. 2007; Briske et al. 2011). This interpretation is supported by the well-documented inverse relationship between stocking rate and aboveground herbaceous standing crop (Bement 1969; Milchunas and Lauenroth 1993; Manley et al. 1997; Derner and Hart 2007). Fuel management studies have shown that spread rate and flame length decrease as dry grass fuel loads decrease (Scott and Burgan 2005). Diamond and coauthors (2009) showed that targeted grazing reduces biomass and cover of the invasive annual *Bromus tectorum*, resulting in reductions in flame length and rate of spread. Recent studies in Idaho have shown that livestock grazing is an effective means to reduce fuel loads (Weber, et al. 2011). Tsiouvaras and coauthors (1989) reported that grazing by goats effectively reduced 1- and 10-hour fuel load in coastal forest areas of California.

3.4.1 Target Grazing for Special Status Species

Experimental application of targeted grazing offers an opportunity to test different season, intensity and frequency of grazing effects on BM and NCSG to fine tune management over time. These management experiments must follow an adaptive management approach that incorporates monitoring of plant population characteristics such as density, spread, cover, and regrowth following grazing. For example the effect of no grazing, and various intensities of grazing could

be tested during the initial years of the project for the purpose of improving the application of grazing to maintain, increase and manage these species. Likewise different seasons of grazing and rest period following grazing could be tested to determine their effect on BM and NCSG. These tests could be compared in adjacent small pastures or in smaller sections of large pastures using temporary electric fencing.

3.4.1.1 TARGETED GRAZING FOR BAKER'S MEADOWFOAM

The results of vernal pool grazing experiments in Sacramento County and observations on the mitigation parcels of improved BM cover and density with grazing (Hulse-Stephens pers. comm.) suggest that properly timed grazing may help to maintain BM populations.

Field experiments by Jamie Marty (2005) on annual rangeland vernal pools in the Sacramento Valley have shown that when cattle are removed from grazed vernal pool grasslands, native plant diversity can decline and nonnative species abundance can increase. Marty believes that "decline in native plant cover and diversity in the ungrazed treatments was most likely caused by the significant increase in grass cover" that competes for soil moisture and light resources. Increased evapotranspiration rates due to high annual grass cover may be the cause of dramatic decrease in pool inundation periods, although Marty also theorized that decreased soil compaction in the absence of grazing could have negatively influenced pool hydroperiod. Invertebrate taxa richness also declined in pools that were ungrazed or had shorter grazing periods. This is most likely due to altered pool hydrology, especially an increase in the number of pools that dried completely during the wet season. Marty's results also show that prolonged inundation in the absence of grazing is not enough to keep exotic species out of the pools. Edge and upland zones (compared with pool bottoms) were the most negatively affected by grazing removal, with marked declines in native species richness and relative cover of natives.

While these results lend support for grazing to maintain BM populations, there is a great deal about the growth and competitive ability of BM and the effect of grazing on BM populations that is not known. Without research-based information, an adaptive management process must be followed to manage species that compete with BM. Using the knowledge and observations that are available, a targeted grazing prescription can be developed and tested following adaptive management procedures, including close monitoring.

Following is information that is pertinent to the development of targeted grazing prescriptions.

- BM is State-listed as rare and is on California Native Plant Society (CNPS) List 1B.1. This species is restricted to Mendocino County and there are 21 reported occurrences, including populations in Little Lake Valley, Laytonville, and north of Covelo (California

Natural Diversity Database 2009). BM is an annual herb that occurs in wet meadows, seeps, freshwater marshes and swamps, vernally mesic areas in grasslands (e.g., swales), and vernal pools at elevations of 574–2,985 feet above mean sea level. The reported blooming period of BM is April–May (California Native Plant Society 2012).

- Like other annual species in a Mediterranean climate, seeds of BM germinate with rains in the fall and winter. Like other annuals, BM grows slowly during the winter and more rapidly with warming spring temperatures in March, April, and May (George et al. 2001). Plants covered by too much litter produce a long, weak seedling (commonly called an *etiolated seedling* in botany and plant physiology textbooks) as the plant attempts to grow toward sunlight. These seedlings will not survive. In Little Lake Valley, BM usually flowers and sets seed in mid- to late May. BM patches that are closely grazed (lower RDM) have been observed to have higher BM densities than patches with higher RDM. Some believe that livestock trampling may ensure coverage of BM seeds with soil and enhance the next season's germination rate.
- Seeds of other annual plants that may compete with BM also germinate with the first fall rains and grow slowly during the winter and more rapidly with warming spring temperatures in March and April (George et al. 2001). Introduced perennial grasses that may compete with BM also begin growth with the first fall rains and enter a period of rapid spring growth with warming spring temperatures that can result in excessive shading of BM before the grazing season starts in May. Wet meadow vegetation will produce around 1,000 lb/acre/month or more in March and April, ensuring there will be 2,000 or more pounds per acre of standing crop, which may be 8 to 12 inches tall or more by the beginning of the grazing season in May. Flower induction and culm elongation in May and June will result in height increases to 3 to 5 feet. Therefore, to reduce shading of BM during the remainder of its growing season and during flowering and seed set in May, grazing to reduce grass height and partially suppress flowering should be applied as soon as possible in the spring.
- It has been observed that cattle do not eat BM (Hulse-Stephens pers. comm.). There is uncertainty about sheep and goat preferences for BM. If sheep and goats eat BM, their use should be deferred until after BM seed set.
- Seasonal grazing from May through October allows introduced perennials to grow unchecked during March and April. If introduced perennials are not grazed early in May, they may reach 3 feet or more in height before flowering and seed set of BM in mid to late May. Earlier grazing in April may reduce shading of BM from competing perennial grasses.

- Year-long continuous grazing allows grazing during rapid spring growth, which can suppress growth of introduced perennials. This practice can work where BM patches are adjacent to upland soils, such as those on the eastern Watson parcel.
- Grazing through the summer and early fall reduces the height of introduced perennials and reduces litter. An RDM target of 1,000 to 1,500 lb/acre will provide for this reduced height without increasing erosion risk or reducing the filtration capacity of the ground cover.
- Removal of grazing results in reduced density and area of BM.

Given what is known and the uncertainty of what is not known, BM patches should be grazed to reduce competition and to improve seed contact with the soil following the guidelines recommended in Appendix B. Application of these guidelines should be conducted using an adaptive management approach informed by monitoring so that grazing practices can be fine-tuned over time.

3.4.1.2 TARGETED GRAZING FOR NORTH COAST SEMAPHORE GRASS

As is true for BM populations, there is a great deal about the growth and competitive ability of NCSG and its response to grazing that is not known. Likewise, without research-based information, an adaptive management process must be followed to manage species that compete with NCSG.

Following is information that is pertinent to the development of targeted grazing prescriptions.

- NCSG is State-listed as threatened and is on CNPS List 1B.1. This species is known from 24 occurrences in Mendocino, Marin, and Sonoma Counties (California Natural Diversity Database 2009). In Mendocino County, there are reported occurrences near the town of Cahto, near Comptche southwest of Willits, in Mendocino Pass east of Covelo, and in areas west of the project vicinity near Boonville (Smith and Wheeler 1991; California Natural Diversity Database 2009). Additionally, nine occurrences have been documented west of Ukiah on the Orr Springs USGS 7.5-minute quadrangle in the vicinity of Low Gap.
- NCSG grows in meadows, seeps, openings, and mesic areas in broadleaved upland and North Coast coniferous forest at elevations of 33–2,201 feet above mean sea level. The reported blooming period of NCSG is April–June (California Native Plant Society 2012). This species most commonly is associated with forest and woodland edges and other partially to fully shaded mesic sites. Field surveys conducted in 2007, 2008, 2009, and

2010 located occurrences of NCSG both within the bypass project footprint and on the offsite mitigation parcels.

- Competitors to NCSG, primarily introduced pasture grasses, grow rapidly in April and May potentially beginning to shade NCSG. These introduced competitors will reach heights of 3 to 5 feet by June, shading associated NCSG plants.
- NCSG is a perennial grass that regrows each year, entering a period of rapid growth with warming spring temperatures.
- NCSG occurs in aggressive stands of introduced perennial grasses that can shade NCSG. Grazing and mowing can reduce shading of competing species.

Following an adaptive management approach, grazing and mowing should be applied following the guidelines recommended in Appendix C.

3.5 Riparian Corridors

The USACE MMP and State MMP require fencing of all riparian corridors. The USACE requires fencing of all wetland rehabilitation (i.e., ungrazed wetland rehabilitation) and establishment areas offered as USACE mitigation. Since corridor grazing is not permitted under the project's permit conditions livestock access to riparian corridors will be limited to moving livestock between pastures at designated stream crossings. In some cases it may be useful to graze riparian corridors and may be permitted by the State regulatory agencies. Appendix F presents riparian corridor grazing guidelines for the offsite mitigation parcels that could be implemented by the Land Manager during the long-term management period. At no time are riparian areas that double as USACE mitigation allowed to be grazed. This section describes the potential beneficial and adverse effects of riparian corridor grazing.

In response to the general effects of grazing on riparian vegetation, water quality, and aquatic habitat, permanent exclusion of livestock from riparian areas, especially riparian corridors and streams, has become widespread among agencies, policy makers and conservation groups. However, research in the past 15 years and natural barriers along some corridors in the mitigation parcels suggest that complete fencing of all corridors may not be necessary or desirable. The intended benefit of corridor fencing is exclusion of livestock from restoration activities and streambanks, but fenced corridors also will create a vegetation buffer that attenuates pollutants and provides wildlife habitat and movement corridors. In Little Lake Valley, existing corridors and fence lines often are invaded by Himalayan blackberry.

3.5.1 Livestock Exclusion

It is natural behavior for beef cattle and other livestock to disproportionately occupy riparian areas because of the quality forage, shade, and water found in these areas. The negative results of this behavior on riparian vegetation, streambanks, and aquatic habitat are well-documented, often resulting in exclusion of grazing from riparian and other areas by habitat managers (Larsen et al. 1998; George et al. 2011). However, studies applying livestock distribution modification techniques have shown that livestock residence time in riparian zones can be substantially reduced (Bailey 2004, 2005; George et al. 2007). Distribution of beef cows and other livestock can be altered by providing offsite water and strategically placing mineral and protein supplements and shade. Recently USDA published a national report confirming the effectiveness of these practices based on a 2-year analysis of peer-reviewed literature (George et al. 2011). The conclusion is that exclusion of livestock from riparian areas is generally unnecessary if the vegetation is established and proper grazing practices are applied.

3.5.2 Vegetation Buffers

Riparian corridor setbacks produce a riparian buffer that can attenuate pollutants (sediment, nutrients, microbial pollutants, and pesticides). Based on several review papers and 41 peer-reviewed reports of research from a wide range of grazed, agricultural, and urban systems, the overriding message is that: (1) vegetative buffers can attenuate some portion of most waterborne pollutants transported to them during overland and floodflow events; and (2) there is significant variation in buffer attenuation efficiency attributable to site-specific factors (George et al. 2011).

These site-specific factors include buffer width, slope, vegetation attributes within the buffer; pollutant type and attributes; pollutant load entering the buffer; overland or floodflow rate entering the buffer; hydrologic residence time within the buffer; riparian soil attributes within the buffer; and buffer vegetation management (George et al. 2011). During periods of inundation, nutrients, pathogens, and sediment may be flushed from the buffer regardless of its width. While site factors determine buffer efficiency, agencies and managers must decide on an acceptable level of water quality–degradation risk in determination of buffer width. As risk tolerance decreases, buffer width must increase.

There is a consistently positive correlation between vegetative ground cover, plant stem density, and buffer filtration efficiency for several pollutants, and these same plant attributes are important for determining stream channel and riparian soil stability (George et al. 2011). However, studies at the University of California Sierra Foothill Research and Extension Center (17 miles northeast of Marysville, California) have shown that harvesting buffers significantly

improved nitrogen attenuation from both surface and subsurface waters (Bedard-Haughn et al. 2004, 2005). Conversely, not harvesting the riparian buffer results in the buffer becoming a nitrogen pollution source. Buffer harvesting may be limited to periodic grazing or mowing. If buffers contain woody plants, rocks, or other obstructions, mowing may not be a choice. In narrow buffers, especially with dense woody vegetation, sheep or goats may be a better choice for grazing buffers than cattle.

Additional studies by the California Rangeland Watershed Laboratory (Appendix D) show that (1) substantial pollutant removal can occur with a grass/forb buffer of only a few meters width, (2) wetlands provide significant capacity to remove surface water pollutants, and (3) *Cryptosporidium parvum* and other pathogens do not survive spring and summer heating of pasture manure deposits and their overland transport is very small (George et al.2011).

3.5.3 Himalayan Blackberry

Studies of the effect of grazing on Himalayan blackberry in Australia (Amor 1974) indicate:

> In an ungrazed area, 96% of the plants produced daughter plants; in areas grazed lightly by horses the number dropped to 11%; in areas grazed by cattle only 1% of all plants had daughter plants; and no plants had daughter plants in areas grazed by sheep.

3.5.4 Corridor Fences

Along many riparian corridor reaches on the mitigation parcels, an existing woody plant buffer is in place on each side of the stream channel. This buffer excludes livestock from the channel along much of its length. These corridors do not require fencing along the entire corridor, but where points of penetration exist, strategically placed fencing could close these access points and allow woody vegetation to gradually fill the access point (natural restoration). To support grazing management as well as general land management activities, riparian corridors should have hardened crossings for vehicles, management staff, and livestock. The crossing should be hardened with concrete, small rock, or some other material to protect streambanks and to further minimize entrainment of sediment in the water column during crossings by animals or vehicles. Permanent stream crossing were designed by Caltrans using the USDA NRCS recommendations. The resources agencies have been given an opportunity to review and comment on the design. Caltrans incorporated their comments where possible. The crossings will be constructed as part of the mitigation program implementation.

Cattle crossing unprotected stream channels potentially contributes to the sediment load in the channel. Sediment from livestock will end once riparian corridors are fenced and hardened crossings are installed. Crossing a hardened channel only stirs sediment deposited in the crossing from upstream; it does not add sediment to the systems.

3.5.5 Riparian Pasture

The concept of a riparian pasture is not new. Enclosing riparian corridors within a pasture that can be managed separately from surrounding land can exclude grazing when streambanks are vulnerable to trampling damage and permit grazing at times when risk of stream channel impacts is minimal. Riparian pastures facilitate flash grazing to control weeds. Protection from grazing during restoration will allow woody plant growth that eventually protects the stream channel. Himalayan blackberry and other well-developed woody plants effectively will restrict livestock access to the stream channel.

3.5.6 Oak Plantings

Oak plantings can be protected by an exclosure fence or within a grazed area if they are protected with a tree shelter until the plants are 5 to 6 feet tall. Reports by McCreary (2001) and McCreary and George (2005) demonstrate that oak seedlings planted in a grazed pasture should be protected by a tree shelter supported by a fence post (metal t-post). The reports indicate only a small percentage of oak seedlings survived to Year 4 whether fenced to prevent livestock access or not fenced. With tree shelter and grazing access, 58% of the oak seedlings survived to Year 4.

3.6 Monitoring Grazing Practices

3.6.1 Purpose

Adaptive management of grazing depends on monitoring that will be used to inform lessees and Land Managers of the current vegetation conditions. Monitoring recommendations are presented in Chapter 5. Monitoring of grazing should include monitoring RDM and keeping basic pasture use records, such as in and out dates and number of head.

The purpose of monitoring is to:

- Determine the overall status and condition of the management unit.
- Identify whether grazing treatments are effective to support rehabilitation of wetlands and improve water quality.
- Identify whether grazing treatments are providing desired forage conditions.
- Identify any problems so that appropriate remedial actions can be taken.
- Document grazing management activities conducted on the offsite mitigation parcels.

3.6.2 Residual Dry Matter Monitoring

For the rangelands on the parcels, a minimum of 1,000 lb/acre of RDM should remain at the end of the grazing season (October or November). For seasonal wet meadow on the parcels, the RDM on seasonal wetland meadows should be no lower than 1,500 lb/acre at the end of the grazing season (October or November). These levels will ensure protection of soil, perennial plant growing points that support plant regrowth, and adequate carbohydrate reserves to survive the winter and the dry season. RDM should be visually estimated annually for each grazed and ungrazed management unit using photo-guides (Guenther 1998) just before the start of the rainy season. Monitoring RDM occasionally has been extended to pastures and meadows as done in this project.

Buildup of plant litter such that it forms a thatch is detrimental to vegetation growth, vigor, and competitive ability. Historically, periodic fire has prevented a buildup of thatch. With today's longer fire return intervals, grazing becomes an important means of reducing thatch and preventing its accumulation. The RDM targets recommended in this plan are a balance between preventing thatch buildup and preventing overuse of the grazed parcels. If thatch is not removed by the existing grazing practices, it may be necessary to increase stocking rate and extend the grazing period. Haying and controlled burns also may be used to reduce thatch.

RDM can be measured by clipping or by double sampling methods such as comparative yield (Bartolome et al. 2006). RDM can be estimated visually using photo-guides (Guenther 1998). Visual estimates based on photo-guides is a cost-effective means of documenting landscape conditions that requires little time but becomes a valuable record over time (McDougald et al. 2003). Digital photos of RDM levels from permanent points can supplement the visual estimates. Each year different people may do RDM monitoring on the mitigation parcels. To minimize the long-term costs of RDM monitoring and to ensure accurate assessments by different people, the

use of a standard set of photo-guides is recommended to determine whether a pasture or vegetation patch meets the recommended RDM level.

RDM targets are recommended in this plan, and photo-points have been established in each management unit. The photo-points have been geo-positioned, and the first set of photos was collected in 2011. Livestock impact and RDM are more properly assessed in the late summer or early fall before the first fall rains and after 5 to 7 months of grazing. A few livestock impact areas around water troughs and at gates and stream crossings were identified in June 2011.

3.6.3 Invasive Species Monitoring

The State MMP contains guidelines for monitoring of NCSG and BM populations and invasive plants. The State MMP provides extensive discussion of the vegetation monitoring and performance standards for invasives, BM and NCSG, and all other resources covered under the plan that will be implemented for the first 5 or 10 years of the project, depending on the resource. The mitigation monitoring results, in combination with the GMP, will be used to refine the grazing practices as needed.

Monitoring needs to be able to detect change in invasive species composition on a site-specific basis. For example, medusahead is present in the South Management Unit (SMU) and the NMU. It will be difficult to monitor these infestations as they occur as many small (a few square feet) patches are present. Photo-monitoring and global positioning of selected patches can detect reductions and increases in patch size. A landscape photo in late April or May, when medusahead is green and flowering and most other vegetation is dry, should provide an adequate indicator of pasture-level change. Yellow starthistle also occurs in patches and could be photo-monitored in May or June in much the same way as medusahead.

3.6.4 Records

Maintenance of pasture use records is part of monitoring. Records of kinds, classes, and numbers of livestock and their pasture in-dates and out-dates are basic information that should be required in all grazing lease agreements. From this information, stocking rate can be calculated. Records should include date of the first and last rains, and rainfall amounts, so that the length of the rainy season and dry season can be estimated and recorded. A manager responsible to Caltrans should maintain these records.

Performance Standards

Performance standards for resources affected by this GMP are found in the State MMP. Monitoring methods that will detect change in condition or abundance have been established for each resource and are described in the State MMP.

3.6.5 Adaptive Management

Similar to methods used by farmers and ranchers for decades, adaptive management is a form of management based on experimentation (trial and error). Guided by objectives and performance standards, adaptive management allows Land Managers to monitor and evaluate management practices through time. Documenting adaptive management processes with monitoring can help resource professionals learn from these management actions, while maintaining information feedback to the Land Manager. Adaptive management of the mitigation parcels provides the Land Manager flexibility to change the grazing prescription based on monitoring findings, as well as managing the landscape in response to drought, fire, flooding, and other disturbances. The ability to allow adaptive management often determines success in grazing management.

It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.

Following are some examples of decisions that are the responsibility of the Land Manager.

- Monitor grazing and inform lessees of needed changes.
- Control patches of invasive plant species following the guidelines in Chapter 4.
- Adjust stocking rate during drought.
- Adjust stocking rate following fire.
- Modify the RDM targets based on seasonal and annual variations in vegetation growth.
- Test different stock densities, grazing seasons, or rotations on NCSG and BM patches.
- Maintain and repair all infrastructure on grazed parcels and on ungrazed parcels if it affects the management of the leased pastures and grazing.

3.6.6 Management Responsibility

Adaptive management is active management. On the mitigation parcels the grazing lessees are currently the active managers, but they are each focused on their own livestock enterprises. The Caltrans mitigation parcels need a grazing manager to ensure that grazing is applied in accordance with the grazing plan; fences and other infrastructure are maintained and functioning; ungrazed areas are not grazed; weed populations are controlled; and monitoring of RDM, BM density, NCSG density, and weed populations is completed.

The Land Manager responsible for implementing the MMP should have practical experience managing rangeland, pasture, and grazing and have strong communications skills. This manager would be responsible for day-to-day management of the mitigation parcels, maintenance of grazing records, communication with the lessees, and monitoring. Initiation of a grazing association made up of the lessees would facilitate communication among the grazing manager, Caltrans, and the lessees.

Training and communications are crucial to successful adaptive management. Special training sessions for the Land Manager and for lessees should facilitate adaptive management and communications. An example of a possible special training scenario would be the University of California Cooperative Extension and the Mendocino County Resource Conservation District (MCRCD) organizing and conducting needed training. Likewise, if funding is available, onsite research and demonstrations could inform management how to refine grazing to meet mitigation objectives.

Chapter 4 Invasive Species Management Practices

4.1 Himalayan Blackberry

Himalayan blackberry is a perennial vine/shrub of the rose family (Rosaceae). Contrary to its name, Himalayan blackberry is native to Western Europe and probably was introduced to North America as a cultivated crop. It seeds heavily, and seeds are readily dispersed by mammals and birds. Seeds can be spread considerable distances by streams and rivers (Hoshovsky 2000). It also spreads vegetatively by rooting of cane tips. The plant first appears as individual canes that eventually can grow to 20 to 40 feet long. This plant frequently roots at the nodes or tips of the canes, spreading in an ever-larger area around the central plant. Himalayan blackberry is problematic because it displaces native riparian understory plants through formation of a large and impenetrable mound of vegetation. Himalayan blackberry occurs on several offsite mitigation parcels. It typically occurs as a riparian understory species and in some locations has begun to exclude the regeneration of riparian species. Himalayan blackberry occurs on pastures adjacent to streams and in isolated locations in wet meadow.

4.1.1 Grazing

Targeted grazing using goats, sheep, or cattle (in descending order of preference) will remove the aboveground material, but repeated close grazing will be required to kill the plant and, as in mechanical control, some resprouting will occur. If cattle are used, they may require training to eat the plant (Voth 2010). Temporary electric fencing may be required to hold the animals at the high density required to achieve control.

4.1.2 Chemical Control

The most effective control method other than grazing is repeated herbicide applications using a cut-and-paint treatment of the canes until the entire plant dies. An effective method to reduce the quantity of herbicide used is to cut and clear existing canes and apply herbicides to the cut vines or to the new vegetative growth.

Herbicides used to control wild blackberry during the growing season include glyphosate, dicamba, dicamba/2,4-D combinations, and triclopyr. Certain herbicides such as Garlon 3A

(triclopyr) and Roundup (glyphosate) have been successful at controlling blackberry after fall application on mature and new canes (Soll 2004).

Spraying the foliage tends to be more effective during the summer months (Hoshovsky 2000), and spot application on the cut canes, injection into the canes, and spraying newly emergent plants tend to be more effective in the fall (Soll 2004). The herbicide applicator should refer to herbicide labels for site-specific control information. A nonionic surfactant should be used to increase effectiveness of most herbicides.

4.1.3 Mechanical Methods

The following mechanical methods can be used to remove Himalayan blackberry.

- Excavating the root crowns and large roots.
- Repeatedly removing the aboveground vegetation with a string trimmer or mower and densely planting native vegetation that would shade the Himalayan blackberry (Soll 2004).
- In more mature infestations, removing the aboveground vegetation with tools before removing the belowground root crown and roots with shovels or a claw/Pulaski mattock (Soll 2004).

All of these methods can be effective, yet very labor-intensive and therefore expensive (Soll 2004). All three actions involve repetition. Aboveground cutting needs to be repeated several times a year for several years, and the belowground removal needs additional removal of new sprouts for several years. As a general guide, 300–1,000 hours of labor are required to remove Himalayan blackberry from 1 densely infested acre (Soll 2004).

4.1.4 Burning

Burning may be effective for removing the aboveground portions of the plant, but it will not kill the plant completely, as the plant will resprout (Tirmenstein 1989). Liability and air quality regulations limit the use of fire. Drip torches may be used to treat resprouts, but this can be labor-intensive because it requires repeated applications.

4.1.5 Proven Local Method

Experience has shown that Himalayan blackberry can be controlled by first cutting the vines with a brush hog and then grazing to eat fresh regrowth and trample the blackberry canes.

4.2 Common Teasel

Common teasel (*Dipsacus fullonum* ssp. *sylvestris*) is a monocarpic perennial (Wisconsin Department of Natural Resources 2004). It was introduced from Europe into North America in the 1700s. The plant grows as a basal rosette for a minimum of 1 year, then sends up a tall, flowering stalk and dies after flowering. The rosette stage varies according to the amount of time needed to acquire enough resources for flowering to occur. During the rosette stage, leaves change from being somewhat ovoid in the younger stage to large, oblong, and quite hairy in the older stage. Teasel develops a large taproot during the rosette phase. The taproot may be more than 2 feet long and 1 inch in diameter at the crown. Teasel grows in open, sunny habitats that range from wet to dry soil levels. Optimal conditions seem to be mesic habitats. Roadsides and heavily disturbed areas are the most common habitats of teasel.

Common teasel blooms from June through October. Flowering plants have large, oblong, opposite, sessile leaves that form cups (the cups may hold water) and are prickly, especially on the lower midrib. Stems are also prickly. Teasel's unique inflorescence makes the plant readily identifiable when flowers or seed heads are present. Flowers are small and packed in dense, oval-shaped heads. The flowers are subtended by stiff, spiny bracts that are located terminally on the flowering stems. Common teasel generally has purple flowers. Flowering stems may reach 6–7 feet in height.

Teasel is an aggressive exotic that forms extensive monocultures. Teasel produces an abundance of seeds. A single teasel plant can produce more than 2,000 seeds, and 30–80% of the seeds may germinate. Seeds may remain viable for up to 2 years. Seeds typically do not disperse far, and most seedlings will be located near the parent plant. However, highway mowing equipment and inappropriate disposal of dried teasel heads from flower arrangements can increase the spread. Seeds may also be water-dispersed, which allows dispersal over longer distances. Dead adult plants leave a relatively large area of bare ground formerly occupied by their own basal leaves, providing an optimal nursery site that new teasel plants readily occupy. Immature seed heads of cut-leaved teasel are capable of producing viable seed.

4.2.1 Grazing

There is limited information on grazing teasel because it is commonly rejected by most grazing animals. Goats have been used to manage teasel in Colorado where they have been observed to eat flowers, leaves, and stems (Lamming 2001). The objective for grazing teasel would be to prevent or suppress flowering so that the next crop is reduced. Targeted grazing may be

effective, especially if high livestock densities are employed through the use of electric fencing. Grazing animals may need to be trained to eat teasel as most find it unpalatable.

4.2.2 Chemical Control

A variety of herbicides will control this biennial plant if applied to rosettes in the spring or fall. Applying 2,4-D amine at a rate of 1 pound active ingredient per acre (ai/A) is effective. Triclopyr as Garlon 3A, applied at 1 pint per acre to actively growing plants, is also effective. The sulfonyl urea compound chlorsulfuron (0.75 ounces ai/A) may be applied to actively growing teasel in the rosette stage. While these two products give long-term broadleaf control, they may interfere with establishment of native species for several years. A nonionic surfactant should be used to increase effectiveness of most herbicides.

4.2.3 Mechanical Methods

The key to controlling teasel is to prevent seed production while exhausting the seed bank. Research suggests that teasel does not reproduce if sufficient root is removed by digging. In natural areas or lightly infested areas, flowering stems can be cut and bagged for disposal. If the stalk is cut prior to flowering, the weed will send up a new flowering stalk. If repeated removal is provided after flowering and before the seed is mature or has been released, the spread of teasel can be prevented.

Mechanical methods can be used in combination with grazing, chemical control, and burning. Mechanical control of the previous year’s vegetation and removal of tall current year growth allow easier access to apply other treatments.

4.2.4 Burning

Prescribed burns may be used to make teasel rosettes easier to find; however, fire will not carry well through dense stands of rosettes or mature plants. Drip torches may be used to treat resprouts, but this can be labor-intensive because it will require repeated applications. Burning alone will not likely eradicate populations, and liability and air quality regulations restrict its use.

4.3 Reed Canarygrass and Harding Grass

Because the control methods for the closely related reed canarygrass and Harding grass are the same, the discussion of management actions is combined in this section.

Reed canarygrass and Harding grass are both introduced perennial pasture grasses. Reed canarygrass differs from Harding grass in having more distinct rhizomes and an inflorescence that is compact at first but later becomes more open as the branches spread. Hybrids of Harding grass and reed canarygrass have been produced. There is often confusion in identification between reed canarygrass and Harding grass and orchard grass and bluejoint reedgrass (*Calamagrostis canadensis*). Orchard grass is also an introduced perennial pasture grass. Bluejoint reedgrass is a native perennial grass.

Reed canarygrass is a large, coarse grass that reaches 2 to 9 feet in height (Wisconsin Department of Natural Resources 2009). It has an erect, hairless stem with gradually tapering leaf blades 3½ to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The lead ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches long. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Reed canarygrass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800s for forage and erosion control. It has become naturalized in much of the northern half of the U.S. and still is being planted on steep slopes and banks of ponds and created wetlands. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, streambanks, and seasonally wet areas. It also grows in disturbed areas such as berms and spoil piles.

Reed canarygrass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring and then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines. Over time, it forms large, monotypic stands that harbor few other plant species. Once established, reed canarygrass dominates an area by building up a tremendous seed bank that eventually can erupt, germinate, and colonize other locations.

Native to the Mediterranean region, Harding grass has been dispersed throughout the world by agronomists and farmers for its value as forage in pastures (California Invasive Plant Council).

Its main agronomic value is its ability to tolerate conditions of low moisture, heavy grazing, and winter trampling and compaction by livestock (Langer 1990). Once planted widely for forage, it continues to colonize new areas through spread by seed. Seeds are disseminated short distances primarily by wind and by animals, while long-distance spread is through human activity.

4.3.1 Grazing

Grazing alone does not control reed canarygrass and Harding grass. Cattle prefer these species when stems and leaves are young and succulent, but do not prefer it once stems become mature and toughen. Goats and sheep will graze on young or mature reed canarygrass and Harding grass but prefer young growth. Grazing to control these grasses would require long-term, frequent, close grazing over several years. During this time other invasive species may occupy the gaps created by heavy grazing. Grazing can be combined with another treatment method and then followed by herbicide or shade cloth for good control.

4.3.2 Chemical Control

Several herbicide choices are available to control reed canarygrass and Harding grass; however, most other herbicides also will control the desirable native grasses as well. Spot application by hand using a rope wick applicator can minimize impacts on non-target species. A nonionic surfactant should be used to increase effectiveness of most herbicides. The following chemical methods can be used to control reed canarygrass and Harding grass.

- Apply 1.2–2.25 lb acid equivalent/acre glyphosate when the plants are at early heading or in fall.
- Apply 0.25–0.375 lb acid equivalent/acre fluazifop (1 to 1.5 parts product [Fusilade DX]/A) applied to actively growing plants. Not registered for wetland areas but may be okay for seasonal wetlands.
- Apply 0.5–1.0 lb acid equivalent/acre imazapyr (Habitat® is registered for aquatic sites, including wetlands). Apply in boot stage through the fall when the plant is actively growing.

Herbicidal control used in conjunction with mechanical methods also works well. The quantity of herbicides can be reduced if the mature or tall vegetative growth is cut and cleared and herbicides are applied to the new vegetative growth.

4.3.3 Mechanical Methods

Isolated plants or small patches of reed canarygrass and Harding grass can be successfully removed by digging out and removing the entire root mass. Removal is easiest when the soil is moist. All rhizomes and roots will need to be removed, as small rhizome fragments can resprout. The excavated root masses should be properly disposed of because plant material (rhizomes and stems) can develop new roots if inundated or if kept in contact with moist ground. Follow-up treatment may be required to remove any resprouted stems. Henderson (1987) found hand-pulling of reed canarygrass was effective if done over the entire population two to three times per year for 5 years. Although excavation can be effective, it is not cost-effective over a large area and may be prohibited if the populations occur in wetlands or in association with special-status plant species.

4.3.4 Mowing/Cutting

Mowing or cutting alone using a mower, brush cutter, weed eater, tractor-drawn mower, or machete will not kill reed canarygrass and Harding grass. In fact, mowing these species only once or twice per year actually stimulates additional stem production. Continued mowing (five times or more per year) for 5 to 10 years is reported successful in controlling reed canarygrass, but this has not been demonstrated on a large scale. It is not known whether this method is effective for Harding grass.

Mowing can be used effectively in combination with another control method, such as following with an herbicide application. Additionally, mowing prior to or at the onset of flowering can eliminate seed set for that year. Mowing also can facilitate the installation of shade cloth, or be used as a pretreatment for tillage, because it will remove or break up thick thatch and layers of dead litter.

4.3.5 Solarization, Shade Cloth, and Mulching

Hoffman and Kearns (1997) suggest covering reed canarygrass infestations with black plastic (solarization). They claim that for this method to be successful, light levels should be reduced to less than 40% of normal intensity and the plants should not be allowed to grow beyond the plastic (shoots emerging beyond the edges of the covering will provide food to covered rhizomes). However, this method was found to have little success by Apfelbaum and Sams (1987), who observed plants persisting even after 2 years under cover. Non-target species, including native species, also would be controlled with these methods.

4.3.6 Tillage

Tillage by itself is not recommended as it could spread these species, especially the rhizomatous reed canarygrass. Tillage for restoration plantings should be preceded by herbicide or solarization treatments that kill this species.

4.3.7 Burning

Burning generally does not kill mature reed canarygrass and Harding grass, and similar to occasional mowing, actually appears to stimulate additional stem production unless the fire burns through the entire reed canarygrass and Harding grass sod layer down to the mineral soil. Drip torches may be used to treat resprouts, but this can be labor-intensive because it will require repeated applications. Burning alone will not likely eradicate populations, and liability and air quality regulations may restrict its use.

4.4 Yellow Starthistle

Yellow starthistle is a native of Eurasia and first was recorded in California in 1869 (DiTomaso et al. 2006). Now common on roadsides, rangeland, hay fields, pastures, and waste areas, it is estimated to infest close to 8 million acres in California. The disturbance created by cultivation, poorly timed mowing, road building and maintenance, and grazing favors this rapid colonizer. Yellow starthistle forms dense infestations and may produce allelochemicals that prevent growth of competing species, allowing starthistle to take over large areas of land.

Yellow starthistle is a gray-green to blue-green annual plant with a vigorous taproot. It produces bright, dandelion-like yellow flowers with sharp spines surrounding the base. Yellow starthistle grows to varying heights from 6 inches to 3 feet. The stems of mature plants are rigid, spreading and branching from the base. Stems and leaves are covered with a loose, cottony wool that gives them a whitish appearance. Basal leaves are 2 to 3 inches long and deeply lobed. Upper leaves are short, 0.5 to 1 inch, narrow, and sharply pointed. The plant develops a deep taproot, allowing it to proliferate on dry sites or in dry years. The deep taproot extends below the zone of root competition of associated annual species and allows growth and flowering to occur well into the summer, long after other annual species have died and dried up. Yellow starthistle is able to regrow after top removal from mowing or grazing. Seed output can be as high as 29,000 seeds per square meter with about 95% of the seeds being viable. Most seeds germinate the following year, but some seeds can last 10 years or more in soil.

4.4.1 Grazing

Targeted grazing, when performed successfully, will reduce the population of yellow starthistle, minimize damage to desirable species, and support a more integrated approach to weed management. Cattle, sheep, and goats all have been successful in controlling yellow starthistle. Choosing which species to use will depend on the stage of the yellow starthistle. Intensive grazing in late May and June using high densities of cattle, sheep, or goats for a short duration can reduce plant height, canopy size, and seed production. However, overgrazing should be avoided by leaving half the grass by weight. Grazing more than this will reduce the grass recovery rate and ability to shade out yellow starthistle. Grazing can enhance other control methods for yellow starthistle such as herbicide applications.

4.4.2 Chemical Control

Quite a bit is now known about chemical control of yellow starthistle. The five most commonly used herbicides used to control yellow starthistle in Mendocino County are:

- 2,4-D (trade names include: Weedar®, Weedone®, and many others)
- Aminopyralid (Milestone®)
- Clopyralid (Transline®)
- Glyphosate (Roundup® and others)
- Triclopyr (Garlon®, Remedy®)

Of these five herbicides, 2,4-D is a restricted-use herbicide and must be applied by a licensed applicator, but it is also the least expensive option. 2,4-D and triclopyr control all broadleaf species, so native forbs may be damaged. Both herbicides are for post-emergence vegetation, with little soil residual, and perform best when yellow starthistle is between seedling and bolting stages. Clopyralid and aminopyralid are effective both pre- and post-emergence and can be applied in the fall, winter and spring. Both clopyralid and aminopyralid are slightly selective in broadleaf species but some stunting may occur on legumes. In a complete eradication program for horse pastures or horse hay fields (yellow starthistle is toxic to horses but not ruminants), using either clopyralid or aminopyralid in Year 1 and then 2,4-D in Years 2 and 3 is preferred to prevent resistance. As mentioned before, glyphosate is a non-selective, contact herbicide and should be used when annual grasses and legumes are dormant or when yellow starthistle is a pure stand. If the latter is the case, glyphosate works best on yellow starthistle from seedling to early flowering. In the former case, the yellow starthistle is usually mature and repeated treatments every 2 weeks may be necessary. With all herbicidal or mechanical methods of control, it is very

important to plant or seed the areas with desirable species that will compete with yellow starthistle for sun and nutrients.

The quantity of herbicides can be reduced if the mature or tall vegetative growth is cut and cleared and herbicides are applied to the new vegetative growth. A nonionic surfactant should be used to increase effectiveness of most herbicides.

4.4.3 Mechanical Methods

Isolated plants or small patches of yellow starthistle can be removed successfully by digging out and removing all the aboveground stem material. The best time for hand removal is after yellow starthistle has bolted but before it produces viable seed (early flowering).

Tillage using plows or discs where terrain allows is effective in controlling yellow starthistle if done in early summer prior to production of viable seeds. Desirable species also will be affected, and reseeding will need to be postponed until the fall unless there is irrigation available.

4.4.4 Mowing/Cutting

Success with mowing depends on proper timing and the growth form of yellow starthistle. Mowing is most effective at the spiny to early flower stage. In Mendocino County this usually occurs from late April to late May. Mowing too early, before the spiny season, will allow yellow starthistle to recover and suppresses competition from desirable species. Mowing works well when yellow starthistle is found in competing vegetation (grasses) as yellow starthistle's growth form is tall and less branched. In this form mowing may control up to 90% of the yellow starthistle. In pure stands of yellow starthistle, where the growth form is shorter, mowing may not be effective.

4.4.5 Burning

Two or more years of burning will control yellow starthistle but may not be practical because of liability and air quality regulations. A single burning actually may increase yellow starthistle through the suppression of competition and release of nutrients. Similar to mowing, burning should be done in early to midsummer when yellow starthistle has not set viable seed (early flowering). Burning also may be effective in combination with herbicide applications.

4.5 Medusahead

Medusahead is an aggressive winter annual that is a member of the grass family *Poaceae* (USDI Bureau of Land Management 2009). It grows to a height of 0.5 to 2 feet. The leaf blades are generally 1/8-inch wide or less and rolled. Its inflorescence is a long-awned spike nearly as wide as it is long. Mature awns or beards are twisted and are 1 to 4 inches long, stiff, and finely barbed. Sometimes medusahead is confused with foxtail or native squirrel tail; however, the spike head does not break apart as seeds mature. Individual awn-florets fall away, leaving a bristly head of awn-like glumes that persist over winter.

Medusahead is native to Eurasia and is extremely competitive, often crowding out many native and desirable plants and invading millions of acres of rangeland. It appears more commonly on high shrink-swell clay soils. Infested rangelands have suffered up to 75% reductions in grazing capacity. Left unchecked, it forms almost a monoculture and may be responsible for introducing fire into non-fire-prone ecosystems. Control of small, isolated infestations is critical to keep it from becoming widespread. As medusahead is an annual grass, like reed canarygrass and Harding grass, it will be difficult to control without damage to more desirable species.

4.5.1 Grazing

Grazing medusahead closely just before the flower emerges in the spring is a proven method to control this species. However the annual grazing window for this method is only 1–2 weeks. Therefore, this method requires some planning and monitoring of medusahead as the time window approaches. This method may not be practical over large and scattered populations because livestock may graze on other species or may not be able to graze all individual plants prior to seed set. Placement of protein supplements (e.g., Crystalyx) near medusahead patches will increase grazing and trampling in the patch.

4.5.2 Chemical Control

Herbicidal control is limited to glyphosate at the rates mentioned above for reed canarygrass and Harding grass. Herbicides should be applied in the spring (usually May) when medusahead is green and the surrounding vegetation is dry.

4.5.3 Mechanical Methods

As with grazing, mowing before flower emergence is also effective. Tillage of large infestations at this time is another option but may not be desirable because of the elimination of preferred vegetation and the potential to provide suitable seeding areas for nonnative species.

4.5.4 Burning

Prescribed burning in the spring (usually May) when medusahead is green and surrounding vegetation is dry is a proven method of reducing medusahead. However, air quality and fire hazard regulations may preclude use of this method of control.

Chapter 5 Management Unit Objectives and Grazing Practices

Caltrans has acquired more than 30 parcels for offsite mitigation of the Willits Bypass project, of which a select number of parcels or portions of parcels will be available for grazing. The remaining parcels or portions of parcels will not be grazed. For an illustration of the layout of grazed versus ungrazed land, refer to Figures 5-1 through 5-7. In order to facilitate a grazing management system that will benefit mitigation parcel natural resources, it is recommended that the parcels be combined into seven grazing management units (Figure 1-3). The management units developed for the GMP are described in this chapter and summarized in Table 5-1. Management units do not include riparian-mitigation areas that are not grazed.

The majority of land is combined into three management units: West Management Unit (WMU), Middle Management Unit (MMU), and East Management Unit (EMU). Fencing will be installed to further separate the grazed from ungrazed lands within each management unit so that accidental grazing of the ungrazed lands will be avoided. The fenced riparian corridors provide most of the east and west boundaries for the management units. The remaining parcels have been combined into the SMU, NMU, OWMU and North Coast Semaphore Grass Management Unit (NCSGMU).

The SMU is composed of the Arkelian, Goss, MGC Plasma North, and MGC Plasma Middle parcels (Table 2-1). The NMU is composed of the eastern Watson Parcel. The OWMU is composed of two Taylor parcels. The NCGSMU is located on a portion of the Huffman parcel alignment. While current lease agreements are based on the historical parcel designations, for ease of accounting and management, it is recommended that Caltrans gradually transition to lease agreements based on these proposed management unit boundaries.

5.1 West Management Unit

The WMU includes nine pastures formed from all or part of six mitigation parcels on the west side of the valley (Figure 5-1). The WMU is bounded on the east by the Outlet Creek riparian corridor and on the west by an existing segment of US 101 and the future bypass alignment. This WMU includes the riparian corridors along Old Outlet Creek, Mill Creek, Upp Creek, and Wild Oat Canyon Creek. An abandoned railroad bed transects this management unit from northwest to southeast.

Table 5-1. Individual Pasture Acreage, by Management Unit

Management Unit	Pasture Number	Pasture Acreage
West Management Unit	W-1	11.38
	W-2	11.01
	W-3	43.01
	W-4	31.55
	W-5	39.26
	W-6	28.08
	W-7	12.95
	W-8	7.81
	W-9	17.00
	Total	**202.03**
Middle Management Unit	M-1	65.81
	M-2	31.25
	M-3	24.55
	M-4	16.23
	M-5	15.99
	M-6	12.11
	M-7	14.08
	M-8	22.95
	M-9	30.21
	M-10	26.71
	M-11	14.74
	M-12	19.29
	Total	**293.93**
East Management Unit	E-1	38.30
	E-2	24.96
	E-3	64.71
	E-4	15.88
East Management Unit (Continued)	E-5	18.88
	E-6	45.12
	E-7	15.70
	E-8	22.79
	E-9	22.13
	Total	**268.48**
South Management Unit	S-1	9.90
	S-2	12.94
	S-3	9.00
	S-4	21.22
	Total	**53.06**
North Management Unit	N-1	43.42
	N-2	16.74
	Total	**53.06**
Semaphore Grass Management Unit	SG-1	3.28
	Total	**3.28**
Oak Woodland Management Unit	OW-1	149.70
	Total	**149.70**
Total Acres of Grazed Pasture		**1,030.66**

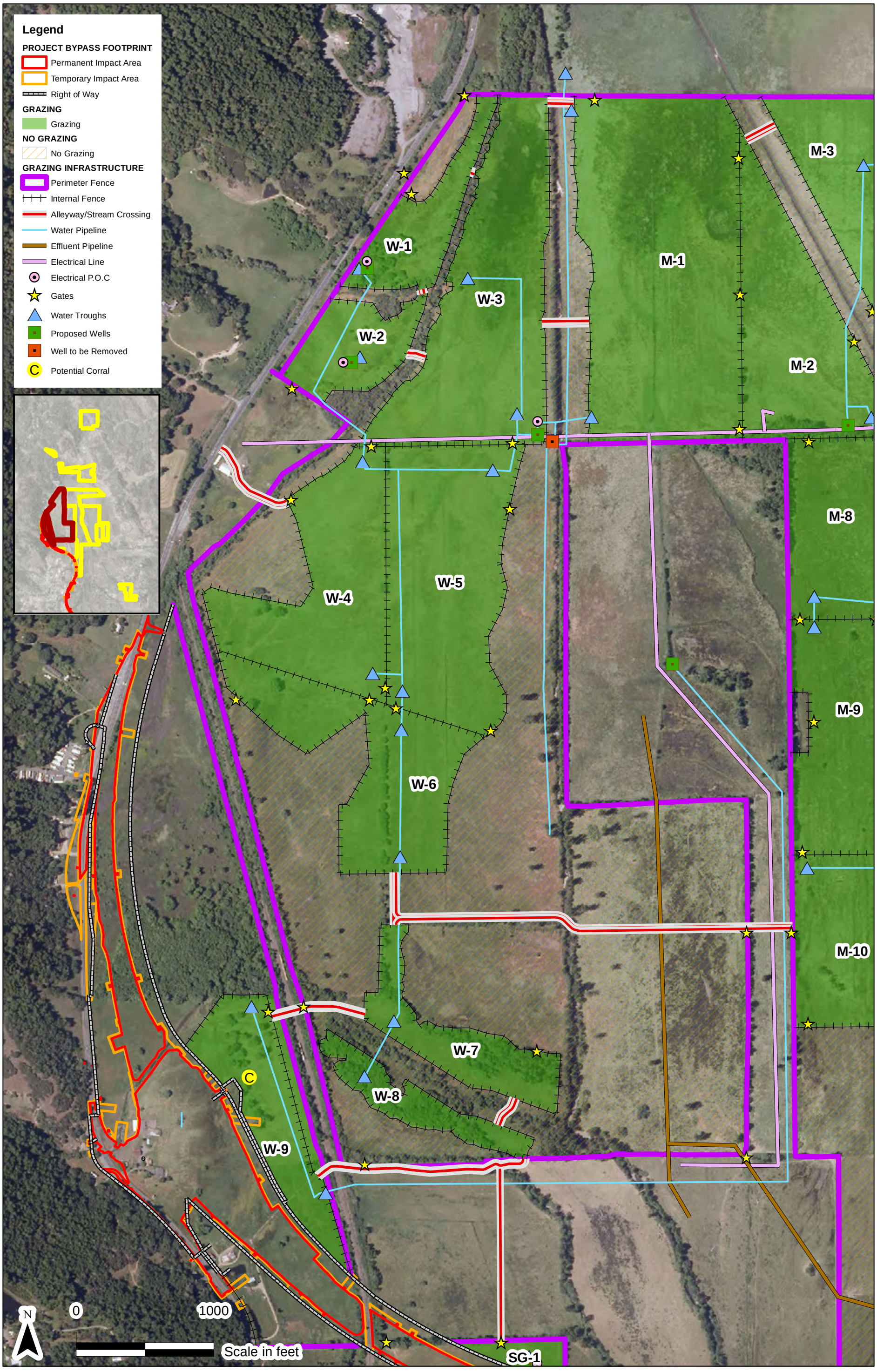

Figure 5-1
Recommended Pasture and Grazing Infrastructure Locations for the West Management Unit

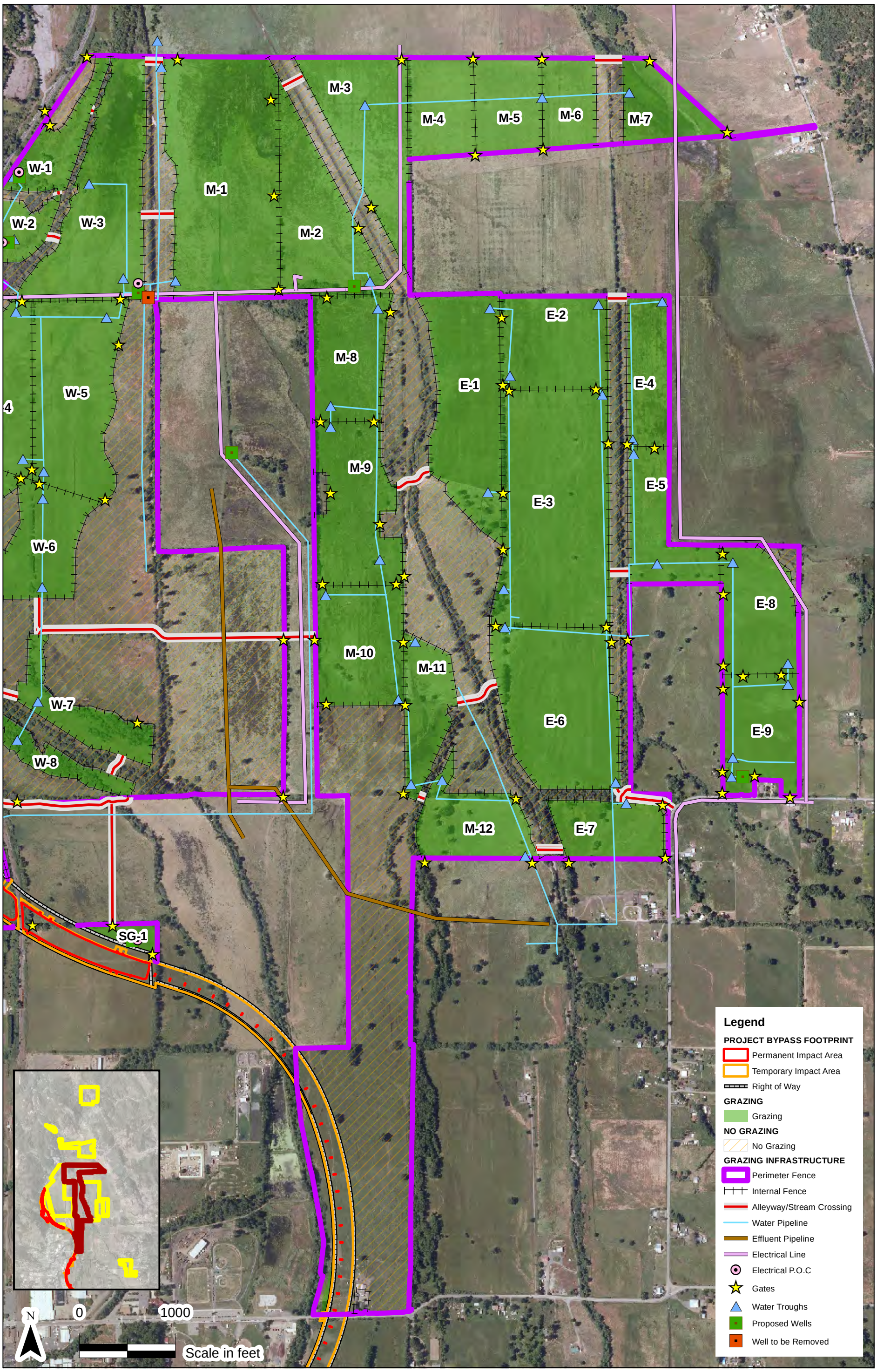

Figure 5-2
Recommended Pasture and Grazing Infrastructure Locations for the Middle Management Unit

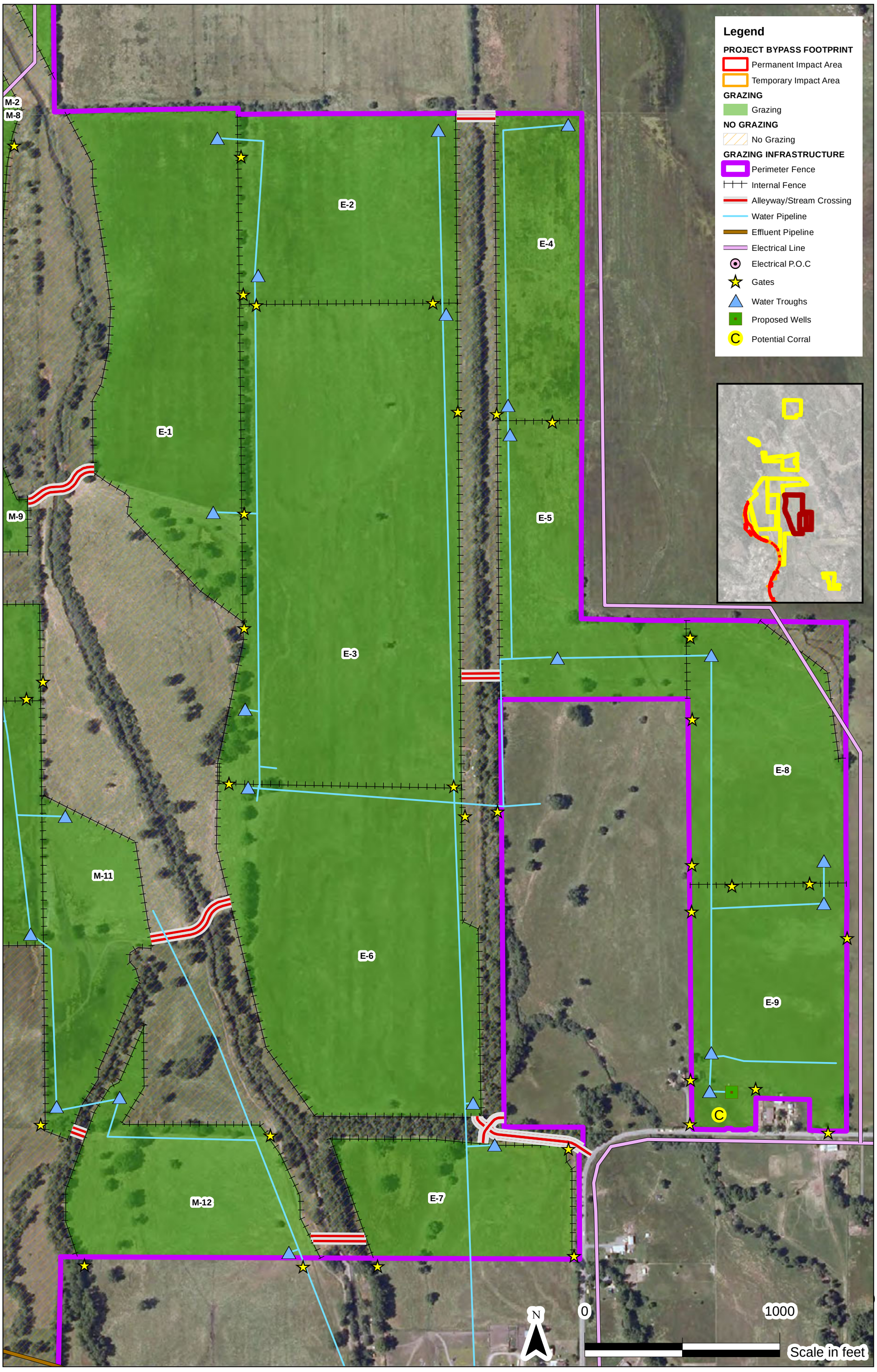

Figure 5-3
Recommended Pasture and Grazing Infrastructure Locations for the East Management Unit

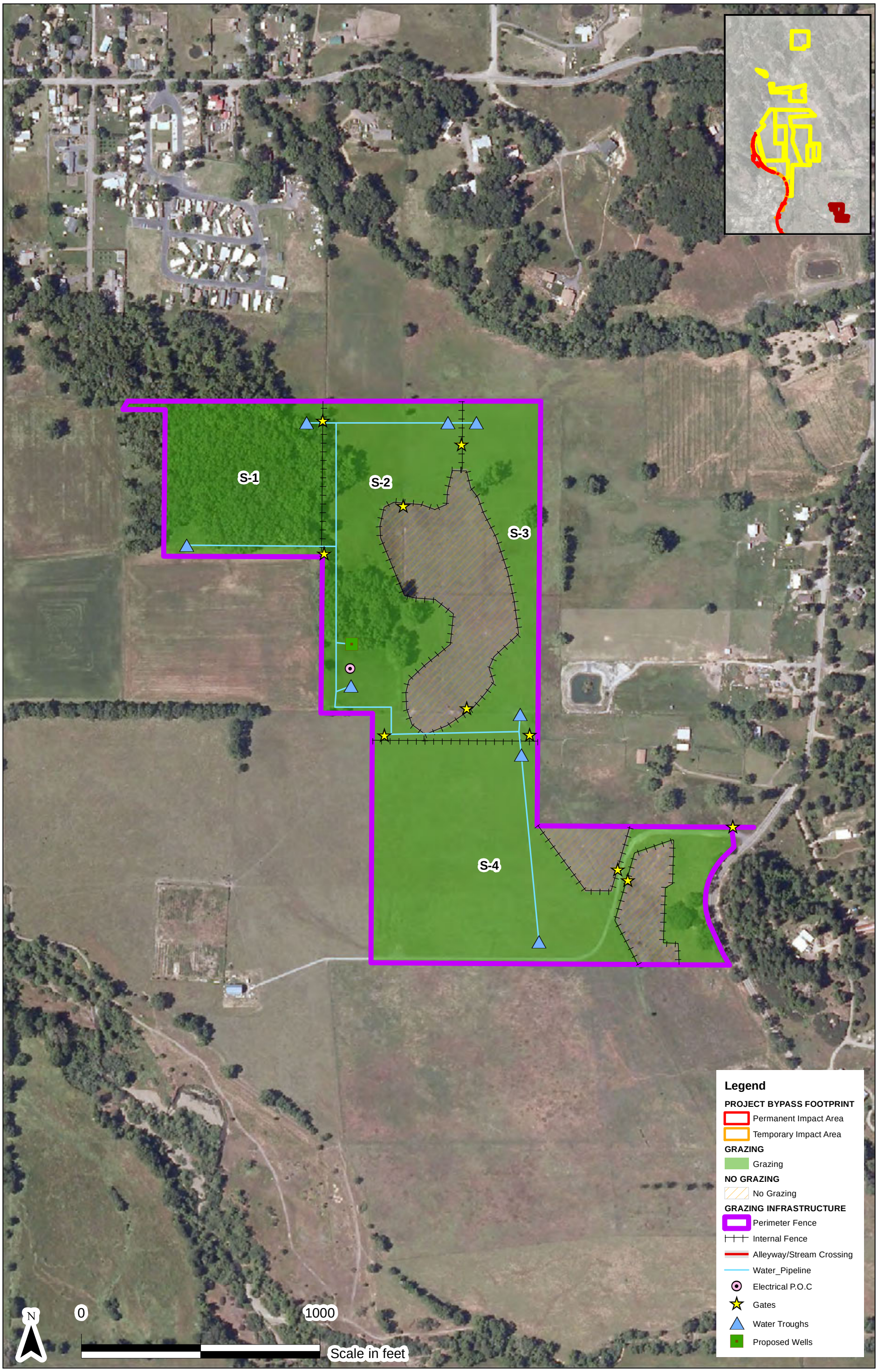

Figure 5-4
Recommended Pasture and Grazing Infrastructure Locations for the South Management Unit

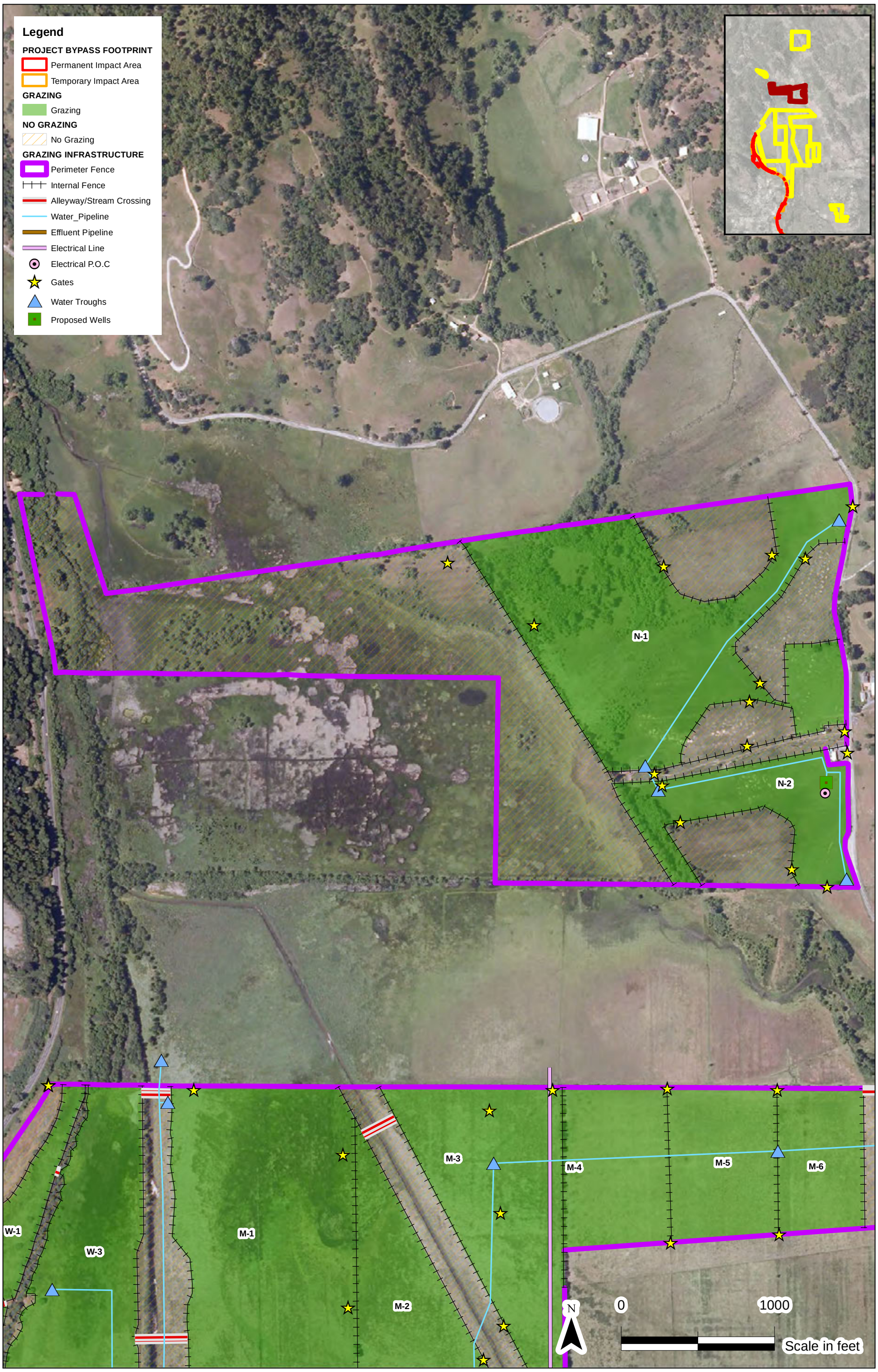

Figure 5-5
Recommended Pasture and Grazing Infrastructure Locations for the North Management Unit

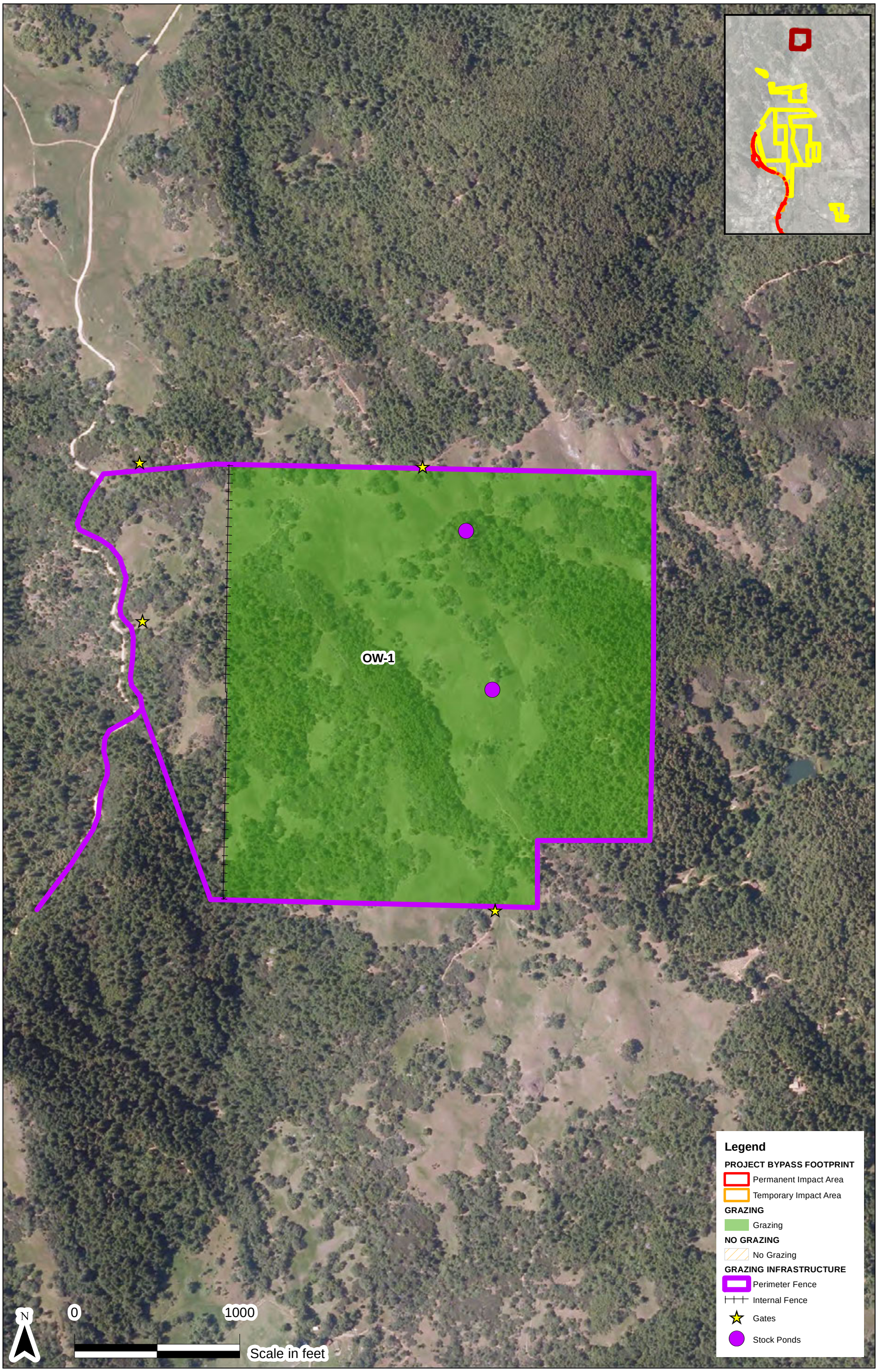

Figure 5-6
Recommended Pasture and Grazing Infrastructure Locations for the Oak Woodland Management Unit

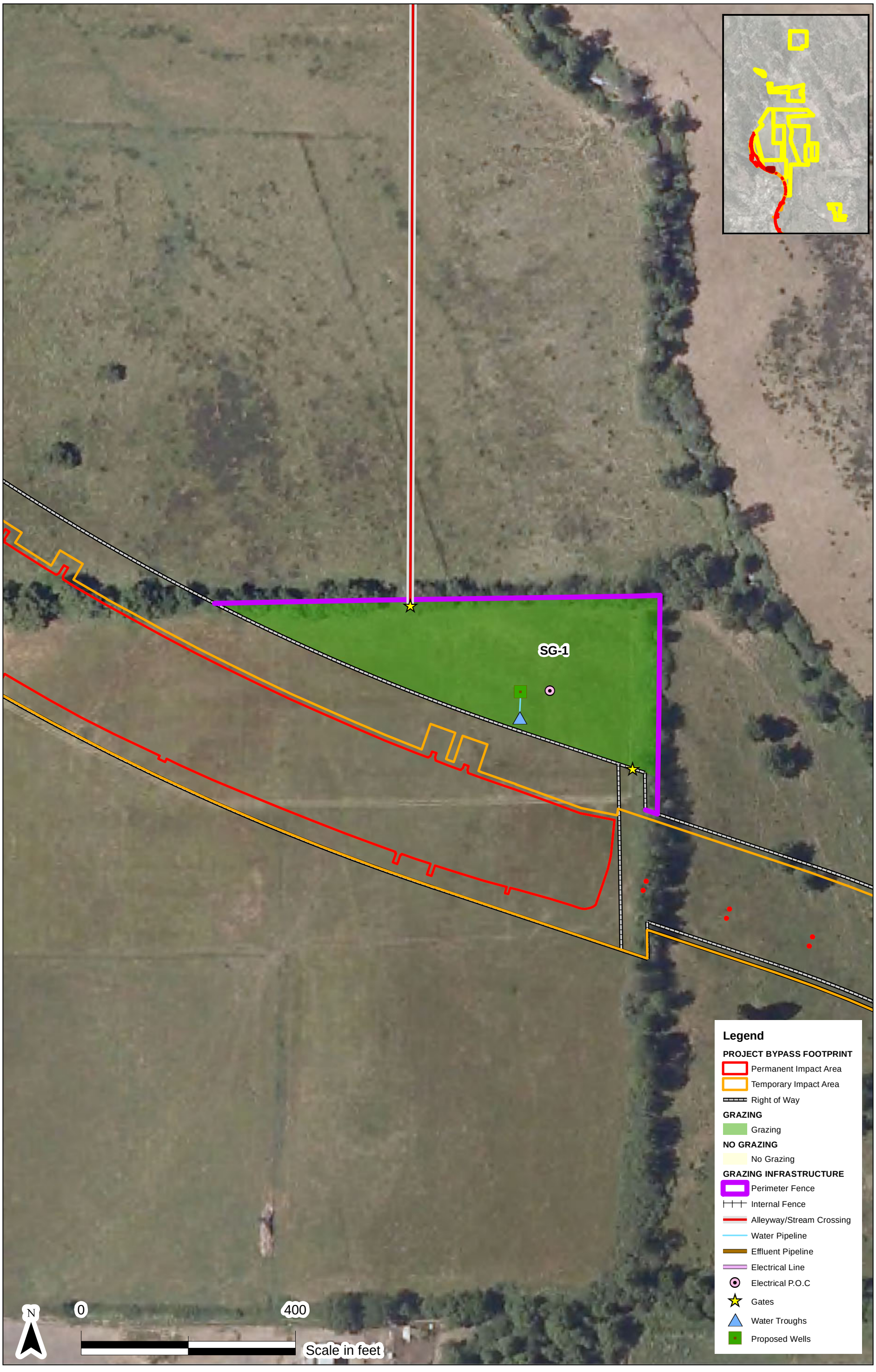

Figure 5-7
Recommended Pasture and Grazing Infrastructure Locations for the North Coast Semaphore Grass Management Unit

5.1.1 Past and Present Grazing Practices

The parcels in this unit are dominated by wet meadow vegetation. Drier upland soils supporting annual grasses and forbs occur along the west edge of this management unit (W-1 and W-2). Most of the WMU is grazed with beef cattle using seasonal rotational grazing. Grazing and hay production have been the historical use of these parcels. The Brooke parcels are not included in this management unit because grazing was removed from these parcels several years ago and, through successional development, they have become dominated by woody vegetation and, in some cases, teasel. The estimated herbaceous production for the seasonal wet meadows in June 2011 ranged from 6,500 to 8,000 lb/acre (Table 2-1). Most of these parcels are part of a rotational grazing system that has stocking rates of 4.5 to 6.5 AUMs/acre/year, depending on annual productivity.

5.1.2 Mitigation Actions

The mitigation actions in the WMU are wetland establishment, wetland rehabilitation (no grazing; planting and seeding), wetland rehabilitation (grazing only), riparian establishment (no grazing), and other waters (riparian corridor) rehabilitation (no grazing). The mitigation actions that preclude grazing have been excluded from the grazed areas in the WMU by exclusion fencing as shown in Figure 5-1.

5.1.3 Performance Standards

The mitigation performance standards, as they relate to grazing practices, are maintaining and improving wetland plant species cover and composition and maintaining and improving NCSG and BM habitat. The grazing-related performance standards associated with the mitigation actions that will occur in this management unit are identified in Chapter 9 of the State MMP.

5.1.4 Grazing Management Recommendations

5.1.4.1 GRAZING INFRASTRUCTURE

The existing grazing infrastructure is shown in Figure 2-1. The recommended grazing infrastructure is shown in Figure 5-1. The following infrastructure and management changes are recommended.

GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- The WMU contains populations of both BM and NCSG. When possible, water troughs and other infrastructure should be field located to avoid populations of these plants.

FENCES AND GATES

- Some of the fences in this management unit are relatively new and in good condition, while others are old and need to be replaced. Caltrans proposes to replace all perimeter fences and to fence all riparian corridors and areas designated for wetland establishment or rehabilitation covered by the MMPs (Figure 5-1).
- Replace perimeter fences along the highway right-of-way.
- Fence the Outlet Creek, Old Outlet Creek, and Mill Creek riparian corridors, including adjacent wetland establishment and rehabilitation areas.
- Fence the wetland establishment area in the northwest corner of pasture W-1.
- Fence the riparian corridor and all ungrazed mitigation areas along the east side of the WMU.
- Fences along the railroad right-of-way may be unnecessary because woody vegetation, including Himalayan blackberry, already acts as a barrier to livestock.
- Install cross-fences to subdivide the existing pasture on Ford 108-020-04 to create pastures W-4, W-5, and W-6 (Figure 5-1).
- Pastures W-7 and W-8 could be combined by not fencing the riparian corridor that separates W-7 from W-8. According to local information, this stream channel was human-made and rarely flows. During the May–October grazing season, it is dry and not vulnerable to streambank damage by livestock. If this corridor were left unfenced, a hardened crossing between W-7 and W-8 would be unnecessary.
- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. Fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option, as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.

- Gates should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and is typically the best person to decide the location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring.
- Install an access gate from US 101 to pasture W-1 at the gate across from the mill site.
- Gates should be installed at the locations shown in Figure 5-1. Gates should be 16-foot and made of tubular steel (e.g., Behlen® gates) to facilitate movement of livestock, people, and equipment, including hay-making equipment.

Alleyways and Stream Crossings

- Stream crossings, like gates, should be placed and built so that they facilitate herd movement.
- Install riparian corridor (stream) crossings between pastures W-1 and W-2, W-2 and W-3, and two crossings between M1 and W-3, as designated on Figure 5-1. These hardened crossings will facilitate access between pastures. Location of the crossing should be discussed with the grazing lessee.
- Install an alleyway from the Ford Ranch barns to pasture W-4. Harden the existing stream crossing.
- Install an alleyway between W-7 and W-8.
- Install an alleyway from the gate in pasture W-9 to the south end of pasture W-8. This alleyway crosses the railroad tracks. SG-1 could be accessed from this alleyway between W-8 and W-9 with a north-south alleyway if feasible.
- For the existing rotational grazing system to be effective and responsive to differences in pasture soil moisture, access is needed from pastures M10 and M11, across an ungrazed USACE 404 mitigation unit (Ford APN 108-030-05) and Cox 80, and non-Caltrans pasture leases to pasture W-4. This is crucial early in the season, when the northern pastures are too wet to access. The livestock movement will cross from pasture M-10, through the City of Willits field, into Cox 80, and then to pasture W-6. A city easement and protection of new plantings in the mitigation area may be required. This recommendation also is stated in Section 5.2.4.1.

Access and Right-of-Way

- It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the

flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.

- Right-of-way agreements should be established between Caltrans and adjacent landowners to provide alleyways (if applicable) to access the mitigation parcels in the event of an emergency and to maintain grazing infrastructure (if it occurs) on adjacent parcels.

CORRALS AND STAGING AREAS

- Identify existing corrals and staging areas on the Caltrans-owned parcels. If there are no existing corrals or staging areas, it is recommended that new areas be identified and budgeted for construction.

WATER SOURCE AND WATER TROUGHS

- Pastures W-1, W-2, and W-7 will need water troughs and additional water developments, depending on the source of water for these troughs. Figure 5-1 indicates the need for a well in W-1 and in W-2. Approximate recommended locations for the water troughs are shown in Figure 5-1.
- Install water developments, including a pipeline to provide stock water, in W-3, W-4, W-5, W-6, W-7, and W-8 (Figure 5-1).
- Add a water trough in W-9. Existing and new troughs can be serviced by extending the east-west pipeline just south of W-8 (Figure 5-1).
- Water troughs should be located away from areas of concentrated BM unless additional beneficial grazing impacts are needed to maintain or improve BM patches and patch borders.
- Some existing water lines lie within the proposed USACE 404 mitigation lands. Lessees need access and continuing permits to enter ungrazed mitigation areas to maintain infrastructure (pipelines, fences, electrical, etc.) and repair damage immediately.

SHADED AREAS

- Some of the new pasture configurations do not allow for adequate shade for cattle herds in all pastures. Until mitigation boundary fences are in place, it is unclear how much shade will be provided by existing trees. Adequate shade (30 to 40 square feet [sq. ft.] per cow) should be provided following the USDA NRCS guidelines.

5.1.4.2 GRAZING PRESCRIPTION

The grazing prescription for the WMU is summarized in Table 5-2.

Table 5-2. Grazing Prescription for the West Management Unit

Action	Description of Grazing Prescription
Location of grazing	The entire management unit will be grazed except for the riparian corridor, wetland establishment, and wetland rehabilitation where agriculture management is prohibited (e.g., ungrazed wetland rehabilitation). These areas will be fenced to exclude grazing.
Stocking rate	4.5 AUMs/acre/year to 6.5 AUMs/acre/year depending on the actual length of the grazing season.
RDM target	1,200 to 1,500 lb/acre.
Season of grazing	May 1 through October.
Frequency and duration of grazing	This management unit is cross-fenced to facilitate rotational grazing that will support NCSG and BM (Appendices B and C). The precise sequence of pasture use is determined by the grazing manager. The length of the rest period will range from 30 to 60 days depending on plant growth rates as influenced by current soil moisture and climatic conditions. Graze periods are usually a few to 10 days depending on the size of the pasture and the length of the rest period.
Hay harvest	This parcel could be harvested for hay in the spring or summer and grazed to meet the RDM target.
Kind and class of animal	Beef cows and calves are best choice for 1,200 to 1,500 lb RDM targets. Sheep are an acceptable alternative, but they must be managed closely to meet the RDM target. Sheep and goats may be used for weed control.
Grazing guidelines	Management for BM should follow the guidelines in Appendix B. Management of NCSG should follow the guidelines in Appendix C.
Drought and post-fire practices	Shorten grazing season and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow lessees to feed hay.

5.1.4.3 INVASIVE SPECIES MANAGEMENT PRACTICES

Control methods for invasive species are discussed in Chapter 4. Himalayan blackberry occurs along fence lines, and control may be required to remove and replace fences and gates. The MMP does not require blackberry control in the riparian corridors; therefore, if it is determined that fences in this management unit do not need replacement; blackberry control measures will not be implemented.

Reed canarygrass and Harding grass are present in this management unit and could be controlled using chemical spot treatments. Teasel infestations should be controlled following the methods described Chapter 4. Extensive teasel infestations have developed in the Brooke parcels where successional development has progressed for several years. Smaller teasel infestations are present in the Niesen parcel. Yellow starthistle occurs in the drier portions along the west side of this management unit (W-1 and W-2). Medusahead was not observed in this management unit. It could invade the drier western portions of this management unit in the future.

5.1.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily and to ensure that NCSG and BM areas are receiving adequate grazing to reduce competition from other plant species. Photo-guides should be used to estimate RDM. Large areas that appear to be below the target can be sampled by clipping a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season. Smaller areas of low RDM will occur around stock water, stream crossings, and favored shade trees and should not be sampled unless they are part of a larger heavily grazed area.

Density and cover of NCSG and BM populations should be monitored before and after targeted grazing to determine whether grazing practices are achieving desired results. Invasive species should be monitored to detect extent and spread over time to control effectiveness. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.1.6 Management Issues and Considerations

The following management issues and considerations were identified based on field survey observations and through coordination with current lessees.

5.1.6.1 GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.

5.1.6.2 LIVESTOCK ACCESS AND MOVEMENT

- According to local information, the riparian corridor that splits pastures W-7 from W-8 was human-made and rarely flows. The channel associated with this corridor is dry during the May–October grazing season. If this corridor were left unfenced, a hardened crossing would be unnecessary and the two pastures (W-7 and W-8) could be combined.
- There are potential access issues to pastures W-7, W-8, and W-9. Present access is from the current US 101. It appears that the new highway will not provide access to these pastures; therefore, they will need to be accessed through pasture W-6 or via an easement across property between W-8 and S-G1.

- There is a potential future issue with access between pastures W-6 and W-7. While access may not be needed currently because these two pastures have different lessees, in the future it may be necessary to move livestock from the south end of pasture W-6 across the wetland rehabilitation area into pastures W-7 and W-8. Currently, gates and an alleyway are proposed to facilitate movement from pasture WW-7 to W-8.
- Gates and stream crossings should be placed and built so that they facilitate herd movement.
- Herding of livestock across ungrazed mitigation units will be necessary to maintain the integrity of the rotational grazing system that is fundamental to achieving NCSG and BM goals for the WMU, MMU, and EMU.

5.1.6.3 ALLEYWAYS AND STREAM CROSSINGS

- If fences were installed across stream channels to create defined alleyways, it is likely the fences would fail during high flow. Therefore, permanently fenced crossings are not recommended.
- Stream crossings will be used only when livestock are moved by herders from one pasture to another or when vehicles and equipment cross. Moving in a herd and managed by a herder, cattle will not stray above or below the crossing. Gates to stream crossings will remain closed when not in use.

5.1.6.4 SPECIAL STATUS PLANT–SPECIES MANAGEMENT

- Little is known about the habitat needs of NCSG and BM. Consequently, assumptions about their potential for expansion are not substantiated by science. Likewise, the grazing prescriptions for these species are not based on a good foundation of science. The response of these species to grazing, their palatability to livestock, and other key knowledge are not available to guide management. At a minimum, the potential extent of expansion of both species should be determined by field experimentation, and response to clipping and grazing should be studied during controlled studies in the field.
- Currently the lack of fencing along riparian corridors and reduced RDM adjacent to stream channels allows unimpeded overland flow and movement of debris out of and away from the stream channels. This allows periodic sediment deposition in BM patches, which may be important to maintaining BM populations. It has been observed by valley residents that BM populations decrease after overland sediment deposition is reduced by changes in land management practices.

5.1.6.5 SHADED AREAS

- Fencing of the riparian corridor between pastures M-1 and W-3 will result in no shade for livestock in these two pastures. Shade is an animal welfare issue.

5.2 Middle Management Unit

MMU occurs on 10 mitigation parcels (Figure 5-2). The MMU is bounded on the northwest by Outlet Creek and on the west by parcels owned by the City of Willits. The MMU is bounded on the east by the Davis Creek corridor with the exception of the pastures M-3–M-7, which occur on the east side of Davis Creek. The MMU is bounded on the north by privately owned lands and on the south by privately owned land and a portion of a Benbow mitigation parcel that will not be grazed.

5.2.1 Past and Present Grazing Practices

The parcels in this unit are dominated by wet meadow vegetation. Grazing and hay production have been the historical use of these parcels. These parcels currently are grazed with beef cattle using seasonal rotational grazing. The estimated production for these parcels in June 2011 ranged from 6,900 to 8,100 lb/acre (Table 2-1). These parcels are part of a rotational grazing system that has stocking rates of 4.5 to 6.5 AUMs/acre/year, depending on annual productivity.

5.2.2 Mitigation Actions

The mitigation actions in the MMU are wetland establishment, wetland rehabilitation (no grazing; planting and seeding), wetland rehabilitation (grazing only), riparian establishment (no grazing), and other waters (riparian corridor) rehabilitation (no grazing). The mitigation actions that preclude grazing have been excluded from the grazed areas in the MMU by exclusion fencing as shown in Figure 5-2.

5.2.3 Performance Standards

The mitigation performance standards, as they relate to grazing practices, are maintaining and improving wetland plant species cover and composition and maintaining and improving BM habitat. The grazing-related performance standards associated with the mitigation actions that will occur in this management unit are identified in Chapter 9 of the State MMP.

5.2.4 Grazing Management Recommendations

5.2.4.1 GRAZING INFRASTRUCTURE

The existing grazing infrastructure in the MMU is shown in Figure 2-2. The recommended grazing infrastructure is shown in Figure 5-2. The following infrastructure and management changes are recommended.

GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- The MMU contains populations of BM. When possible, water troughs and other infrastructure should be field located to avoid populations of these plants.

FENCES AND GATES

- Existing fences and gates on this management unit are generally in good condition although some are in need of repair or replacement (Figure 2-2). Caltrans proposes to replace all perimeter fences and to fence all riparian corridors and areas designated for wetland establishment or rehabilitation covered by the MMPs (Figure 5-2).
- The fence between pastures M-3 and M-4 needs to be repaired or upgraded.
- Replace perimeter fences around the perimeter of the MMU.
- Fence the Davis Creek riparian corridor and an unnamed tributary corridor, including adjacent wetland and other waters rehabilitation areas that will not be grazed.
- Fence the wetland establishment areas.
- Fence the riparian corridor between M-2 and M-3.
- Properly align proposed fences along property lines east of M-3. There is a recorded survey of the fence line east of M-3 that shows the corners marked on the survey. The fence line along the north side of the Wildlands parcels south of Cox 80 should form a straight line. John Ford has survey records showing east-west parcel boundaries different from those in Caltrans maps.
- Install cross-fences, as needed, to form pastures M-1 through M-12 as indicated in Figure 5-2. Cross-fencing should be reviewed with the lessee and adjusted as needed. This cross-fencing arrangement will result in pastures where stock density can be manipulated more easily to manage BM populations.

- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. Fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.
- Gates should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and typically is the best person to decide the location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring.
- Gates should be installed at the locations shown in Figure 5-2. Gates should be 16-foot and made of tubular steel (e.g., Behlen® gates) to facilitate movement of livestock, people, and equipment, including hay-making equipment.

Alleyways and Stream Crossings

- Stream crossings, like gates, should be placed and built so that they facilitate herd movement.
- Install riparian corridor (stream) crossings between pastures M-2 and M-3, E-1 and M-9, E-6 and M-11, E-7 and M-11, and M11 and M-12 as designated on Figure 5-2. These hardened crossings will facilitate access between management units. Exact location of the crossing should be discussed with the grazing lessee.

Access and Right-of-Way

- It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.
- Right-of-way agreements should be established between Caltrans and adjacent landowners to provide alleyways (if applicable) to access the mitigation parcels in the event of an emergency and to maintain grazing infrastructure (if it occurs) on adjacent parcels.
- For the existing rotational grazing system to be effective and responsive to differences in pasture soil moisture, the following access points are recommended.
    - Access is needed from pastures M-10, M-11 and M-12, across ungrazed mitigation units and non-Caltrans pasture leases to pasture W-6.

  - To prevent the mixing of herds in the pastures along Davis Creek with cattle being moved between M-2, M-12 and other pastures, access is needed from M2 along the existing farm road to pastures M-11 and M12. The farm road currently exists and would be located in the proposed Davis Creek riparian and mitigation corridor.

- The three southern Benbow parcels are proposed as ungrazed mitigation units. This closes access to pasture M-10 from the Benbow corrals on Hearst Road. Lessees need to be able to herd livestock across these ungrazed mitigation units to reach pasture M-10. Some alternatives for moving cattle from Hearst Road to M-10 are (1) herd cattle across the three ungrazed mitigation parcels, (2) seek easements along City-owned parcels just west of the mitigation parcels, and (3) investigate the possibility of lease trading between the affected lessees that will preclude the need to cross the mitigation parcels.

Corrals and Staging Areas

- At least one new set of corrals is needed. The Benbow house and corrals are the only staging area for livestock grazing currently on the Caltrans-owned parcels. With this staging area effectively cut off from the rest of the grazing lands by the three ungrazed Benbow mitigation parcels, it is recommended that Caltrans identify a new site for corrals and budget their construction. E-9 is one potential location for a new set of corrals.
- Currently there are six water troughs in this management unit (Figure 2-2). Additional water troughs will be required (Figure 5-2).

Water Troughs and Water Source

- Water troughs should be located away from areas of concentrated BM unless additional beneficial grazing impacts are needed to maintain or improve BM patches and patch borders.
- With additional pipeline, the pump in the southern part of M-2 can furnish water to M-2–M-7 and M-8 M-12. Currently the water source for many of these pastures originates on the Ford Ranch.

Shaded Areas

- Some of the new pasture configurations do not provide adequate shade for cattle herds in all pastures. Until mitigation boundary fences are in place, it is unclear how much shade will be provided by existing trees. Adequate shade (30 to 40 sq. ft. per cow) should be provided following the USDA NRCS guidelines.

5.2.4.2 GRAZING PRESCRIPTION

The grazing prescription for the MMU is summarized in Table 5-3.

Table 5-3. Grazing Prescription for the Middle Management Unit

Action	Description of Grazing Prescription
Location of grazing	Grazing will be located in pastures M-1–M-12. Grazing will be excluded from the riparian corridors and adjacent mitigation action areas (Figure 5-2). The wetland establishment areas will be protected from grazing.
Stocking rate	4.5 AUMs/acre/yr to 6.5 AUMs/acre/yr depending on the actual length of the grazing season.
RDM target	1,200 to 1,500 lb/acre.
Season of grazing	May 1 through October.
Frequency and duration of grazing	This management unit is cross-fenced to facilitate rotational grazing that will support BM (Appendix B). The precise sequence of pasture use is determined by the grazing manager. The length of the rest period will range from 30 to 60 days depending on plant growth rates as influenced by soil moisture and climatic conditions. Graze periods are usually a few to 10 days depending on the size of the pasture and the length of the rest period.
Hay harvest	Portions of this management unit may be harvested for hay and grazed to meet the RDM target.
Kind and class of animal	Beef cows and calves are the best choice for the RDM target of 1,200 to 1,500 lb. Sheep are an acceptable alternative, but they must be managed closely to meet the RDM target. Sheep or goats may be used for weed control after BM seed set.
Grazing guidelines	Pastures M-1–M-6 have extensive patches of BM. Management for BM should follow the guidelines in Appendix B.
Drought and post-fire practices	Shorten grazing season and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow lessees to feed hay.

5.2.4.3 INVASIVE SPECIES MANAGEMENT

Control methods for invasive species are discussed in Chapter 4. Himalayan blackberry occurs along fence lines, and control may be required to remove and replace fences and gates. The MMP does not require blackberry control in the riparian corridors; therefore, if it is determined that fences in this management unit do not need replacement, blackberry control measures will not be implemented.

Reed canarygrass and Harding grass are present in this management unit and could be controlled using chemical spot treatments. Teasel should be controlled as it occurs. Medusahead and yellow starthistle were not observed in this management unit and would not be expected to colonize because the majority of the management unit is wet meadow.

5.2.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily and to ensure that BM areas are receiving adequate grazing to reduce competition from other plant species. Photo-guides should be used to estimate RDM. RDM can be quantified for large areas that appear to be below the target. Clipping of a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season should be adequate to quantify RDM levels. Smaller areas of low RDM will occur around stock water, stream crossings, and favored shade trees and should not be sampled unless they are part of a larger heavily grazed area.

Density and cover of BM populations should be monitored following targeted grazing to determine whether grazing practices are achieving desired results. Invasive species should be monitored to detect extent, spread over time, and effectiveness of control. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.2.6 Management Issues and Considerations

The following management issues and considerations were identified based on field survey observations and through coordination with current lessees.

5.2.6.1 General

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- The potential for debris dams and flooding should be considered and evaluated before implementation of the mitigation project. The design and location of fencing and other stream corridor infrastructure need to be fully reviewed during the design phase of the mitigation project.

5.2.6.2 Fences and Gates

- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. Fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.

- Fences across stream channels could create debris dams and fail during high flow and should not be installed. Overland flow resulting from debris dams could carry fish from the stream into adjacent fields.
- Stream crossings will be used only when livestock are moved by herders from one pasture to another or when vehicles and equipment cross. Moving in a herd and managed by a herder, cattle will not stray above or below the crossing. Gates to stream crossings will remain closed when not in use.

5.2.6.1 LIVESTOCK ACCESS AND MOVEMENT

- The majority of the Benbow properties no longer will be open to grazing. Pastures M-8–M-10 will be the only area open to the current lessee of those properties. This remaining area may not meet the needs of the current lessee who grazes the five Benbow parcels.

5.2.6.2 SPECIAL STATUS PLANT–SPECIES MANAGEMENT

- Little is known about the habitat needs of BM. Consequently, assumptions about their potential for expansion are not substantiated by science. Likewise, the grazing prescriptions for this species are not based on a good foundation of science. The response of these species to grazing, their palatability to livestock, and other key knowledge are not available to guide management. At a minimum the potential extent of expansion of both species should be determined by field experimentation, and response to clipping and grazing should be studied during controlled studies in the field.
- Currently the lack of fencing along riparian corridors and reduced RDM adjacent to stream channels allow unimpeded overland flow and movement of debris out of and away from the stream channels. This provides periodic sediment deposition in BM patches, which may be important to maintaining BM populations. It has been observed by valley residents that BM populations decrease after overland sediment deposition is reduced by changes in land management practices.

5.2.6.3 SHADED AREAS

- Fencing of the riparian corridor may result in inadequate or no shade for livestock. Shade is an animal welfare issue.

5.2.6.4 MANAGEMENT AND MAINTENANCE

- Proposed fences along riparian corridors and mitigation areas could pose maintenance problems during flood events by preventing and altering overland flow and may reduce sediment deposition in BM patches. Entrapped debris could increase flooding that damages mitigation areas and creates health and safety hazards in Little Lake Valley.

5.3 East Management Unit

The EMU includes nine pastures formed from all or portions of six mitigation parcels on the east side of the valley (Table 2-1, Figure 5-3). This unit includes all or portions of four Wildlands parcels and the Frost parcel. The EMU is bounded on the west by Davis Creek and on the north, east, and south by privately owned parcels.

5.3.1 Past and Present Grazing Practices

The EMU is dominated by wet meadows. These parcels historically have been used for cattle grazing and hay production. That use presently continues under current lease agreements. The estimated standing crop in June 2011 ranged from 6,000 to 8,900 lb/acre (Table 2-1). These parcels are currently part of a rotational grazing system that has stocking rates of 4.5 to 6.5 AUMs/ac/year depending on annual productivity.

5.3.2 Mitigation Actions

The mitigation actions in the EMU are wetland establishment, wetland rehabilitation (no grazing; planting and seeding), wetland rehabilitation (grazing only), riparian establishment (no grazing), and other waters (riparian corridor) rehabilitation (no grazing). The mitigation actions that preclude grazing have been excluded from the grazed areas in EMU by exclusion fencing as shown in Figure 5-3.

5.3.3 Performance Standards

The performance standards for the mitigation, as they relate to grazing practices, are maintaining and improving wetland plant species cover and composition and maintaining and improving NCSG and BM habitat. The grazing-related performance standards associated with the mitigation actions that will occur in this management unit are identified in Chapter 9 of the State MMP.

5.3.4 Grazing Management Recommendations

5.3.4.1 GRAZING INFRASTRUCTURE

The existing grazing infrastructure is shown in Figure 2-3. The recommended grazing infrastructure is shown in Figure 5-3. The following infrastructure and management changes are recommended.

GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- The EMU contains populations of BM and NCSG. When possible, water troughs and other infrastructure should be field located to avoid populations of these plants.

FENCES AND GATES

- The current perimeter fence, cross-fences, and gates for the EMU are in good condition (Figure 2-3). Caltrans proposes to replace all perimeter fences and to fence all riparian corridors and areas designated for wetland establishment or rehabilitation covered by the MMPs (Figure 5-3).
- Fence the management unit perimeter and riparian corridors.
- Fence the east side of the Davis Creek riparian corridor. This corridor also serves as the west boundary of the EMU.
- Install cross-fences to form pastures E1–E-9. This cross-fencing plan should be reviewed with the lessee and adjusted as needed. This cross-fencing arrangement will result in three pastures (E2–E-4) where stock density can be manipulated more easily to manage BM populations. Installation of these cross-fences will form a fenced riparian corridor along Berry Creek. Existing cross-fences that are in good working conditions do not need to be replaced.
- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. Fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.
- Gates should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and is typically the best person to decide the location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring.
- Gates should be installed at the locations shown in Figure 5-3. Gates should be 16-foot and made of tubular steel (e.g., Behlen® gates) to facilitate movement of livestock, people, and equipment, including hay-making equipment.

Alleyways and Stream Crossings

- Stream crossings, like gates, should be placed and built so that they facilitate herd movement
- Install riparian corridor (stream) crossings between E-2 and E-4 at the north end, E-3 and E-5, E-6 and the adjacent non-Caltrans parcel to the east, E-6 and E-7, E-6 and M-11, E-7 and M-12, and E-1 and M-9 as designated on Figure 5-3. The location of the crossings should be discussed with the grazing lessee and adjusted as needed.
- To facilitate rotational grazing onto non-Caltrans parcels, install an alleyway from southwest corner of E-4 to the east into the non-Caltrans parcel between E-4 and E-8 and E-9.
- Install an alleyway from the curve in Hearst Road to pasture E-4.

Access and Right-of-Way

- It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.
- Right-of-way agreements should be established between Caltrans and adjacent landowners to provide alleyways (if applicable) to access the mitigation parcels in the event of an emergency and to maintain grazing infrastructure (if it occurs) on adjacent parcels.

Corrals and Staging Areas

- Identify existing corrals and staging areas on the Caltrans-owned parcels. If there are no existing corrals or staging areas, it is recommended that new areas be identified and budgeted for construction.
- Pasture E-9 is one potential location for a new set of corrals.

Water Troughs and Water Source

- Install new troughs in pastures E1–E5, E-8, and E-9. Some water sources for these troughs originate on land owned by the Ford Ranch.
- Install pipelines to connect existing and new troughs as shown in Figure 5-3. Install wells to service the pipelines.

- Some existing water lines lie within the proposed USACE 404 mitigation lands. Lessees need access and continuing permits so that they can enter ungrazed mitigation areas to maintain infrastructure (pipelines, fences, electrical, etc.) and repair damage immediately.

SHADED AREAS

- Some of the new pasture configurations do not provide adequate shade for cattle herds in all pastures. Until mitigation boundary fences are in place, it is unclear how much shade will be provided by existing trees. Adequate shade (30 to 40 sq. ft. per cow) should be provided following the USDA NRCS guidelines.

5.3.4.2 GRAZING PRESCRIPTION

The grazing prescription for the EMU is summarized in Table 5-4.

5.3.4.3 INVASIVE SPECIES MANAGEMENT

Control methods for invasive species are discussed in Chapter 4. Himalayan blackberry occurs along fence lines, and control may be required to remove and replace fences and gates. The MMP does not require blackberry control in the riparian corridors; therefore, if it is determined that fences in this management unit do not need replacement, blackberry control measures will not be implemented.

Teasel, Harding grass, and reed canarygrass were not observed but may be present in the future and could be controlled using chemical spot treatments. Medusahead and yellow starthistle were not observed in this parcel and would not be expected to colonize because the majority of the management unit is wet meadow.

Table 5-4. Grazing Prescription for the East Management Unit

Action	Description of Grazing Prescription
Location of grazing	The entire management unit will be grazed except for the riparian corridor and areas designated for wetland establishment and wetland and riparian rehabilitation. These areas will be fenced to exclude grazing.
Stocking rate	4.5 AUMs/acre/yr to 6.5 AUMs/acre/yr depending on the actual length of the grazing season.
RDM target	1,200 to 1,500 lb /acre.
Season of grazing	May 1 through October.
Frequency and duration of grazing	This management unit is cross-fenced to facilitate rotational grazing that will support BM and NCSG (Appendices B and C). The precise sequence of pasture use is determined by the grazing manager. The length of the rest period will range from 30 to 60 days depending on plant growth rates as influenced by soil moisture and climatic conditions. Graze periods are usually a few to 10 days depending on the size of the pasture and the length of the rest period.
Hay harvest	This parcel could be harvested for hay in the spring or summer and grazed to meet the RDM target.
Kind and class of animal	Beef cows and calves are the best choice for 1,200 to 1,500 lb/acre RDM targets. Sheep are an acceptable alternative, but they must be managed closely to meet the RDM target. Sheep and goats may be used for weed control.
Grazing guidelines	Management for BM should follow the guidelines in Appendix B and management of NCSG should follow the guidelines in Appendix C.
Drought and post-fire practices	Shorten grazing season and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow lessees to feed hay.

5.3.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily and to ensure that NCSG and BM areas are receiving adequate grazing to reduce competition. Photo-guides should be used to estimate RDM. RDM can be quantified for large areas that appear to be below the target. Clipping of a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season should be adequate to quantify RDM levels. Smaller areas of low RDM will occur around stock water, stream crossings, and favored shade trees and should not be sampled unless they are part of a larger heavily grazed area.

Density and cover of NCSG and BM populations should be monitored before and after targeted grazing to determine whether grazing practices are achieving desired results. Invasive species should be monitored to detect extent, spread over time, and effectiveness of control. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.3.6 Management Issues and Considerations

The following management issues and considerations were identified based on field survey observations and through coordination with current lessees.

5.3.6.1 GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.

5.3.6.1 LIVESTOCK ACCESS AND MOVEMENT

- Gates and stream crossings should be placed and built so that they facilitate herd movement.
- Herding of livestock across ungrazed mitigation units may be necessary to maintain the integrity of the rotational grazing system that is fundamental to achieving NCSG and BM goals for the EMU.

5.3.6.2 ALLEYWAYS AND STREAM CROSSINGS

- An alleyway may be needed between E-1 and M8.
- Fences across stream channels may fail during high flow and should not be installed. Stream crossings will be used only when livestock are moved by herders from one pasture to another or when vehicles and equipment cross. Moving in a herd and managed by a herder, cattle will not stray above or below the crossing. Gates to stream crossing will remain closed when not in use.

5.3.6.3 SPECIAL STATUS PLANT–SPECIES MANAGEMENT

- Little is known about the habitat needs of BM and NCSG. Consequently, assumptions about their potential for expansion are not substantiated by science. Likewise, the grazing prescriptions for these species are not based on a good foundation of science. The response of these species to grazing, their palatability to livestock, and other key knowledge are not available to guide management. At a minimum, the potential extent of expansion of both species should be determined by field experimentation, and response to clipping and grazing should be studied during controlled studies in the field.
- Currently the lack of fencing along riparian corridors and reduced RDM adjacent to stream channels allow unimpeded overland flow and movement of debris out of and away from the stream channels. This provides periodic sediment deposition in BM

patches, which may be important to maintaining BM populations. It has been observed by valley residents that BM populations decrease after overland sediment deposition is reduced by changes in land management practices

5.3.6.4 SHADED AREAS

- Fencing of the riparian corridor between pastures M-1 and W-3 will result in no shade for livestock in these two pastures. Shade is an animal welfare issue.

5.4 South Management Unit

The SMU includes four mitigation parcels (Table 2-1, Figure 5-4). The SMU is not contiguous with any other management unit. There are no riparian corridors associated with this management unit. The SMU is bounded by privately owned parcels with the exception of the east side of the MGC Plasma Middle parcel, which is bounded by Eastside Road.

5.4.1 Past and Present Grazing Practices

Pasture S-1 is relatively undeveloped and is nearly completely covered by a dense canopy of riparian forest (Figure 5-4). It is unclear how much it has been grazed in the past or currently. There are small areas of wet meadow, dominated by grasses and forbs, that could be grazed along the south and west edges and in the northeast corner of this parcel. The productivity of these wet meadow patches was 5,400 lb/acre as measured in June 2011 (Table 2-1).

Pasture S-2 is composed of wet meadow with riparian forest. The wet meadow portions of this parcel and portions of the riparian understory normally are cut for hay (Figure 5-4). Historically 14 to 20 tons of hay have been harvested from this pasture annually, and regrowth was grazed with cattle or sheep. Pasture S-3 also is dominated by seasonal wet meadow. The productivity of the wet meadow ranged from 4600 to 5,700 lb/acre as measured in June 2011 (Table 2-1).

Pasture S-4 is dominated by annual and perennial rangeland plant species. Small areas of wet meadow occur on the east side of this pasture. Past practices are uncertain, but fence arrangements and fence removals suggest that S4 has been grazed and harvested for hay. A gravel road crosses S-4 near the east end, crossing between two wetland patches (Figure 5-4). The productivity of this rangeland pasture was 3,649 lb/acre measured in June 2011 (Table 2-1).

5.4.2 Mitigation Actions

The mitigation actions in the SMU are wetland establishment, wetland rehabilitation (no grazing; planting and seeding), and wetland rehabilitation (grazing only). The mitigation actions that preclude grazing have been excluded from the grazed areas in SMU by exclusion fencing as shown in Figure 5-4.

5.4.3 Performance Standards

The mitigation performance standards, as they relate to grazing practices, are maintaining and improving wetland plant species cover and composition and maintaining and improving BM habitat. The grazing-related performance standards associated with the mitigation actions that will occur in this management unit are identified in Chapter 9 of the State MMP.

5.4.4 Grazing Management Recommendations

5.4.4.1 INFRASTRUCTURE

The existing grazing infrastructure is shown in Figure 2-4. The recommended grazing infrastructure is shown in Figure 5-4. The following infrastructure and management changes are recommended.

GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- The SMU contains populations of BM and NCSG. When possible, water troughs and other infrastructure should be field located to avoid populations of these plants.

FENCES AND GATES

- All fences in this parcel need to be replaced or upgraded (Figure 2-4). Caltrans proposes to replace all perimeter fences and to fence all riparian corridors and areas designated for wetland establishment and rehabilitation covered by the MMPs (Figure 5-4).
- There are broken, loose and tangled wires and temporary repairs in the fences around all of the parcels. This material should be removed before implementing the GMP.

- The wetland establishment area in S-2 and S-3 will be permanently fenced. The two wetland rehabilitation areas on either side of the gravel road in the eastern end of -S4 should be fenced separately, leaving space for livestock and vehicles to move along the gravel road between the two wetland rehabilitation patches (Figure 5-4). These also will be permanent fences.
- Gates should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and is typically the best person to decide the location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring.
- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. Fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.
- Gates should be installed at the locations shown in Figure 5-4. Gates should be 16-foot and made of tubular steel (e.g., Behlen® gates) to facilitate movement of livestock, people, and equipment, including hay-making equipment.
- Gates will be needed between all four parcels if they are to be managed or leased together.

Alleyways and Stream Crossings

There are no stream crossings in this management unit.

Access and Right-of-Way

- It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.
- Right-of-way agreements should be established between Caltrans and adjacent landowners to provide alleyways (if applicable) to access the mitigation parcels in the event of an emergency and to maintain grazing infrastructure (if it occurs) on adjacent parcels.

CORRALS AND STAGING AREAS

- At least one corral is needed. S-4 is one potential location for a new set of corrals.

WATER TROUGHS AND WATER SOURCE

- There are no water troughs in these pastures. The SMU will need water troughs installed as shown in Figure 5-4. Livestock currently get water from the shallow pond associated with the wetland patch on the south side of pasture S-4. This water source no longer will be available once the wetlands are permanently fenced.
- A well, tank, and pipeline must be developed to service the water troughs in this management unit.
- There appears to be a well casing near the southwest corner of S-2 with an old pressure tank nearby. If the well casing and pressure tank are removed should be properly capped.

SHADED AREAS

- Some of the new pasture configurations do not provide adequate shade for cattle herds in all pastures. Until mitigation boundary fences are in place, it is unclear how much shade will be provided by existing trees. Adequate shade (30 to 40 sq. ft. per cow) should be provided following the USDA NRCS guidelines.

5.4.4.2 GRAZING PRESCRIPTION

The grazing prescription for the SMU is summarized in Table 5-5.

5.4.4.3 INVASIVE SPECIES MANAGEMENT

Control methods for invasive species are discussed in Chapter 4. Himalayan blackberry is present in the understory of pasture S-1 and along the fence lines of pastures S-1–S-4. Himalayan blackberry control may be required to remove and replace fences and gates. The MMP does not require blackberry control; therefore, if it is determined fences in this management unit do not need replacement; blackberry control measures will not be implemented.

Harding grass is present in S-1 and could be controlled using chemical spot treatments. Small medusahead patches occur throughout S-4. Yellow starthistle is not prevalent but could occur in uplands near the county road.

5.4.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily. Photo-guides should be used to estimate RDM. RDM on large areas that appear to be below the target can be clipped to verify RDM quantitatively. Clipping of a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season should be adequate to quantify RDM levels. Smaller areas of low RDM will occur around stock water, stream crossings, and favored shade trees and should not be sampled unless they are part of a larger heavily grazed area.

Table 5-5. Grazing Prescription for the South Management Unit

Action	Description of Grazing Prescription
Location of grazing	Pastures S-1–S-4 can be grazed. S-1 is dominated by riparian forest and has very little grazing capacity. The wetland establishment area in pasture S-3 will be fenced to permanently exclude grazing. Likewise, the wetland rehabilitation areas in pasture S-4 will be permanently fenced to exclude grazing.
Stocking rate	The stocking rate for pastures S-2 and S-3 is 3 to 4 AUMs per acre/yr. S-1 has very little grazing capacity. It could be grazed at the same time as S-2 just by opening the gates. Livestock should be removed and the gates closed when the target RDM is reached. Pasture S-4 is drier and should be managed as rangeland, keeping stocking rates at 1.5 to 2 AUMs per acre per year. If high RDM remains on this parcel in October for 3 or more years, it may be appropriate to increase the stocking rate. High stock densities may be applied to manage medusahead during the spring just before medusahead flowers.
RDM target	1,200 to 1,500 lb/acre for the seasonal wet meadows of pasture S1-3 and 1,000 to 1,500 lb/acre for the drier S4 pasture.
Season of grazing	The season of use for pastures S- 1–S-3 is May 1 through October 31. The season of use for the drier pasture S4 can be seasonal or year around continuous as long as the RDM target is met.
Frequency and duration of grazing	Currently these parcels have two different lessees, and some of the parcels are quite small. This restricts the potential to manipulate frequency and duration of grazing via a rotational grazing system. A seasonal grazing system that follows RDM guidelines and uses pastures S-1–S-3 from May 1 through October and pasture S4 anytime during the year is recommended.
Hay harvest	Portions of SMU may be harvested for hay and grazed to meet the RDM target.
Kind and class of animal	Beef cattle or sheep could graze this management unit. Sheep and goats may be used for weed control.
Grazing guidelines	Management for NCSG is the priority for pasture S-1 and S-2. Grazing in these pastures should follow the grazing guidelines for NCSG in Appendix C. The remaining pastures should be managed for invasive species control, native vegetation increases, and thatch control.
Drought and post-fire practices	Shorten grazing season and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow grazing down to 1,000 lb/acre after rapid spring growth has passed (after July 1).

Density and cover of NCSG and BM populations should be monitored before and after targeted grazing to determine whether grazing practices are achieving desired results. Invasive species should be monitored to detect extent, spread over time, and effectiveness of control. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.4.6 Management Issues and Considerations

The following management issues and considerations were identified based on field survey observations and through coordination with current lessees.

5.4.6.1 General

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.

5.4.6.2 Special Status Plant–Species Management

- Little is known about the habitat needs of NCSG and BM. Consequently, assumptions about their potential for expansion are not substantiated by science. Likewise, the grazing prescriptions for these species are not based on a good foundation of science. The response of these species to grazing, their palatability to livestock, and other key knowledge are not available to guide management. At a minimum, the potential extent of expansion of both species should be determined by field experimentation, and response to clipping and grazing should be studied during controlled studies in the field.

5.4.6.3 Shaded Areas

- Pasture S-4 will provide little to no shade for livestock. Shade is an animal welfare issue.

5.5 North Management Unit

The NMU is north of WMU, MMU, and EMU (Figure 5-5). This unit includes the terminus of Berry Creek. This management unit is bounded on the west by US 101 and on the east by Reynolds Highway.

5.5.1 Past and Present Grazing Practices

Pastures N1 and N2 consist of wet meadow and rangeland (upland) vegetation. The eastern upland portion along Reynolds Highway is dominated by annual rangeland species. In June 2011 the rangeland on the eastside of N1 and N2 had an estimated standing crop of 3,100 lb/acre (Table 2-1). The wet meadow on the west side of N1 and N2 had an estimated standing crop of 7,000 lb/acre in June 2011. This parcel currently is grazed year-round by 50 beef cows with calves.

5.5.2 Mitigation Actions

The mitigation actions in the NMU are wetland establishment, wetland rehabilitation (no grazing; planting and seeding), wetland rehabilitation (grazing only), and oak planting. The mitigation actions that preclude grazing have been excluded from the grazed areas in the NMU by exclusion fencing as shown in Figure 5-5.

5.5.3 Performance Standards

The performance standards for the mitigation, as they relate to grazing practices, are maintaining and improving wetland plant species cover and composition and maintaining and improving BM and NCSG habitat. The grazing-related performance standards associated with the mitigation actions that will occur in this management unit are identified in Chapter 9 of the State MMP.

5.5.4 Grazing Management Recommendations

5.5.4.1 GRAZING INFRASTRUCTURE

The existing grazing infrastructure is shown in Figure 2-5. The recommended grazing infrastructure is shown in Figure 5-5. The following infrastructure and management changes are recommended.

GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- The NMU contains populations of BM. When possible, water troughs and other infrastructure should be field located to avoid populations of these plants.

FENCES AND GATES

- The fences surrounding this NMU are old but serviceable, and the gates are functional. The current lessee keeps the fences in good repair. Caltrans proposes to replace all perimeter fences and to fence all riparian corridors and areas designated for wetland establishment or rehabilitation covered by the MMPs (Figure 5-5).
- Remove and replace the management unit perimeter fences.
- Install fence to separate the grazed portions of the eastern parcel from the west end of the management unit (Figure 5-5).
- While the western Watson parcel and the southwest corner of the eastern parcel will no longer be grazed, gates should be installed to facilitate access to the western parcel.
- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. Fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.
- Gates should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and is typically the best person to decide the location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring.
- Gates should be installed at the locations shown in Figure 5-5. Gates should be 16-foot and made of tubular steel (e.g., Behlen® gates) to facilitate movement of livestock, people, and equipment, including hay-making equipment

ALLEYWAYS AND STREAM CROSSINGS

- Replace the alleyway fence to form pastures N-1 and N-2 that can be grazed continuously as is currently practiced (Figure 5-5). The density and extent of the BM populations in this parcel have been observed to be one of the best in the valley. Therefore, it is recommended that yearlong continuous grazing continue but that RDM targets identified in the following section should be followed.
- While the western Watson parcel and the southwest corner of the eastern parcel will no longer be grazed, stream crossings should be installed to facilitate access to the western parcel.

ACCESS AND RIGHT-OF-WAY

- It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.
- Right-of-way agreements should be established between Caltrans and adjacent landowners to provide alleyways (if applicable) to access the mitigation parcels in the event of an emergency and to maintain grazing infrastructure (if it occurs) on adjacent parcels.
- Water troughs, wells, pipelines, and other infrastructure are shown on Figure 5-5.

WATER TROUGHS AND WATER SOURCE

There is one water trough at the west end of the alleyway (see Figure 2-5).

- Pastures N-1 and N-2 will need additional water troughs and additional water developments depending on the source of water for these troughs.

CORRALS AND STAGING AREAS

- Access to the NMU is currently available from Reynolds Highway. A new corral and staging area may be needed.

SHADED AREAS

- Some of the new pasture configurations do not provide adequate shade for cattle herds in all pastures. Until mitigation boundaries fence are in place, it is unclear how much shade will be provided by existing trees. Adequate shade (30 to 40 sq. ft. per cow) should be provided following the USDA NRCS guidelines.

5.5.4.2 GRAZING PRESCRIPTION

The grazing prescription for the NMU is summarized in Table 5-6.

Table 5-6. Grazing Prescription for the North Management Unit

Action	Description of Grazing Prescription
Location of grazing	Pastures N-1 and N-2 will be grazed but the wetland establishment areas will be permanently fenced to prevent grazing.
Stocking rate	The stocking rates for this parcel are 4 to 5.5 AUMs/acre/year.
RDM target	1,000 to 1,500 lb/acre.
Season of grazing	Continuous yearlong grazing.
Frequency and duration of grazing	Pastures N-1 and N-2 have been grazed yearlong for many years. The density and extent of the BM populations in this parcel have been observed to be one of the best in the valley (Hulse-Stephens pers. comm.). Therefore, it is recommended that yearlong continuous grazing continue but that RDM targets are followed.
Hay harvest	This parcel could be harvested for hay and grazed to meet the RDM target.
Kind and class of animal	Beef cows and calves are best choice for 1,000 to 1,500 lb RDM targets. Sheep are an acceptable alternative, but they must be managed closely to meet the RDM target. Sheep and goats may be used for weed control after BM sets seed.
Grazing guidelines	Management for BM should follow the guidelines in Appendix B.
Drought and post-fire practices	Shorten grazing season, and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow lessees to feed hay.

5.5.4.3 INVASIVE SPECIES MANAGEMENT

Control methods for invasive species are discussed in Chapter 4. Himalayan blackberry control may be required to remove and replace fences and gates. The MMP does not require blackberry control in the riparian corridors; therefore, if it is determined that fences in this management unit do not need replacement; blackberry control measures will not be implemented.

Medusahead and yellow starthistle control may be needed in the drier portion of this parcel adjacent to Reynolds Highway.

5.5.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily. Photo-guides should be used to estimate RDM. RDM on large areas that appear to be below the target can be clipped to verify RDM quantitatively. Clipping of a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season should be adequate to quantify RDM levels. Smaller areas of low RDM will occur around stock water, stream crossings, and favored shade trees and should not be sampled unless they are part of a larger heavily grazed area.

Density and cover of BM populations should be monitored following targeted grazing to determine whether grazing practices are achieving desired results. Invasive species should be monitored to detect extent, spread over time, and effectiveness of control. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.5.6 Management Issues and Considerations

The following management issues and considerations were identified based on field survey observations and through coordination with current lessees.

5.5.6.1 General

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.

5.5.6.2 Livestock Access and Movement

- Gates should be placed and built so that they facilitate herd movement.

5.5.6.3 Special Status Plant–Species Management

- Little is known about the habitat needs of NCSG or BM. Consequently, assumptions about their potential for expansion are not substantiated by science. Likewise, the grazing prescriptions for these species are not based on a good foundation of science. The response of these species to grazing, their palatability to livestock, and other key knowledge are not available to guide management. At a minimum, the potential extent of expansion of both species should be determined by field experimentation, and response to clipping and grazing should be studied during controlled studies in the field.

5.5.6.4 Shaded Areas

- Pasture N-2 will provide little to no shade for livestock. Shade is an animal welfare issue.

5.6 Oak Woodland Management Unit

The OWMU is a mosaic of oak woodland and annual grassland patches on steep terrain. The OWMU is about 1 mile north of Reynolds Highway (Figure 5-6). There are no riparian corridors associated with this management unit.

5.6.1 Past and Present Grazing Practices

The OWMU historically has been grazed and currently is grazed as part of a larger area that supports about 65 cows. The current stocking rate of the annual rangeland portion of this parcel is about 30 acre/AUM, and grazing occurs from December through May. The estimated standing crop in May 2011 was 3,300 lb/acre, which is more than enough to support this stocking rate.

5.6.2 Mitigation Actions

Preservation is the action on this management unit. Grazing will not be excluded from any portion of this management unit.

5.6.3 Performance Standards

There are no performance standards related to this management unit; however, the unit will be managed in a manner that maintains its current condition.

5.6.4 Grazing Management Recommendations

5.6.4.1 GRAZING INFRASTRUCTURE

The existing grazing infrastructure is shown in Figure 2-6. The recommended grazing infrastructure is shown in Figure 5-6. The following infrastructure and management changes are recommended.

GENERAL

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.

FENCES AND GATES

- All of the fences in this parcel need to be replaced or upgraded (Figure 5-6); however, because of steep terrain, dense vegetation, and high erosion risk, fence construction may not follow the parcel lines.
- There are no existing fences or gates on this management unit (Figure 2-6). Caltrans should evaluate the need for perimeter and interior fences.

- Gates should be placed and built so that they facilitate herd movement. The grazing manager (often the lessee or employee) knows the travel paths of the herd and is typically the best person to decide the location of new infrastructure. Travel paths and the location of gates and stream crossings are part of herd memory that is passed down from mother to offspring.
- Gates should be installed at the locations shown in Figure 5-6. Gates should be 16-foot and made of tubular steel (e.g., Behlen® gates) to facilitate movement of livestock, people, and equipment.
- Bear, elk, and deer all reside in Little Lake Valley. These species may damage existing fences in Little Lake Valley and result in significant repair expenses. If used, fencing should be designed to accommodate the movement of these large animals (Appendix E). Electric fencing is not a viable option as these animals typically do not respect the fence and may quickly break through, sometimes taking part of the fencing with them.

Alleyways and Stream Crossings

- The OWMU occurs on steep terrain with ephemeral drainages. If interior fence is installed, crossings should be placed and built so that they facilitate herd movement.

Access and Right-of-Way

- It is recommended that livestock management flexibility be part of adaptive management. Because of health, safety, and grazing system function concerns, lessees should have the flexibility to perform infrastructure repairs as they occur if such actions must happen immediately.

Corrals and Staging Areas

- Access to the NMU is currently available from Reynolds Highway. A new corral and staging area may be needed.

Water Troughs and Water Source

- The OWMU has seasonal stockwater ponds that commonly dry out in late spring or summer (Figure 5-6). Development of water (pump, storage tanks, etc.) in the upper parts of this unit could improve grazing distribution.

Shaded Areas

- The OWMU provides sufficient shade for livestock, so additional shaded areas are not recommended for this management unit.

5.6.4.2 GRAZING PRESCRIPTION

The grazing prescription for the OWMU is summarized in Table 5-7.

5.6.4.3 INVASIVE SPECIES MANAGEMENT

Control methods for invasive species are discussed in Chapter 4. Yellow starthistle and medusahead control are needed on this management unit. Himalayan blackberry, reed canarygrass, Harding grass, and teasel are not a concern for this parcel because the steep terrain, dry soil conditions, and shading by mature trees will not support these species.

Table 5-7. Grazing Prescription for the Oak Woodland Management Unit

Action	Description of Grazing Prescription
Location of grazing	This entire management unit is open to grazing. Steep slopes and dense trees and shrubs limit livestock use of large areas of these four parcels.
Stocking rate	The stocking rate for the Taylor rangeland parcels is about 30 acres per AUM (03333 AUMs/acre). The stocking rate could be increased as long as RDM targets are not exceeded and erosion, trampling, or browsing of young tree saplings does not become a problem.
RDM target	1,000 to 1,500 lb/acre on the annual rangelands.
Season of grazing	December through May. Year around would be OK if stock water were available.
Frequency and duration of grazing	Continuous grazing during the season of use, but some areas may be underused because of lack of stock water in some seasons. Stock water (seasonal sources) limits grazing. Adding a well could improve stock water and extend the season of grazing.
Hay harvest	None
Kind and class of animal	Beef cattle currently graze the OWMU. The management unit could be grazed by sheep. Sheep and goats may be used for weed control.
Grazing guidelines	Maintain adequate RDM to minimize erosion risk, and avoid excessive trampling and browsing of tree saplings and shrubs.
Drought and post-fire practices	Shorten grazing season and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow grazing down to 1,000 lb /acre after rapid spring growth has past (after July 1).

5.6.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily. Photo-guides (Guenther 1998) should be used to estimate RDM. RDM on large areas that appear to be below the target can be clipped to verify RDM quantitatively. Clipping of a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season should be adequate to quantify RDM levels. Smaller areas of low RDM will

occur around stock water, stream crossings, and favored shade trees and should not be sampled unless they are part of a larger heavily grazed area.

Invasive species should be monitored to detect extent, spread over time, and effectiveness of control. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.6.6 Management Issues and Considerations

The following management issues and considerations were identified based on field survey observations and through coordination with current lessees.

- It is recommended that the current grazing lessees be involved in the decisions about where to place pasture infrastructure (internal fences, gates, water developments, and stream crossings) because several lessees have managed livestock grazing on these parcels and are familiar with the existing and required grazing infrastructure needs.
- Steep terrain and seasonal water limit manipulation of livestock distribution.

5.7 North Coast Semaphore Grass Management Unit

The NCSGMU consists of a 3.27-acre parcel located adjacent to the bypass alignment (Figure 5-7). The NCSGMU was previously part of a larger parcel that was purchased by Caltrans for the bypass project. The NCSGMU was purchased to preserve existing populations of NCSG.

The NCSGMU is bounded on the south by the bypass alignment and on the north and east by parcels owned by the City of Willits. There are no riparian corridors associated with this management unit.

5.7.1 Past and Present Grazing Practices

The NCSGMU (pasture SG1) is a wet meadow that could be mowed or grazed to maintain or increase NCSG (Figure 5-7). In the past, this small parcel has been harvested for hay and grazed as part of a larger 40-acre parcel.

5.7.2 Mitigation Actions

The mitigation action in the NCSGMU is NCSG establishment. Grazing or mowing will be used to manage NCSG populations.

5.7.3 Performance Standards

There are no formal performance standards for this management unit. Caltrans will monitor the NCSG study plots to obtain information on the outcome of the NCSG transplant effort. The study objective is to maintain or improve NCSG populations.

5.7.4 Grazing Management Recommendations

5.7.4.1 GRAZING INFRASTRUCTURE

The existing grazing infrastructure is shown in Figure 2-7. The recommended grazing infrastructure is shown in Figure 5-7.

The future management action for this management unit has not been determined because the unit is isolated and livestock access will require agreements with adjacent landowners. If grazing is not feasible, the management unit may be mowed or hayed. The following infrastructure and management changes are recommended but are subject to change based on the management action.

GENERAL

- The NCSGMU contains populations of BM and NCSG. Water developments must be field located to avoid populations of these plants and the NCSG transplant areas.

FENCES AND GATES

- Some of the fences surrounding the NCSGMU are in need of replacement. New gates are recommended to access the site and should be installed in the new perimeter fence on the north side and possibly the east side. The site will abut the bypass on the south and west sides; therefore, these sides will not allow for livestock access. The location of the access gates should consider and avoid NCSG transplant polygons and existing stands of NCSG.

ALLEYWAYS AND STREAM CROSSINGS

- Depending on the access to the site determined by Caltrans an alleyway providing access from the north via an easement from the WMU may be necessary. There are no stream crossings in this management unit.

ACCESS AND RIGHT-OF-WAY

- Access to the unit could be along the Caltrans ROW and under the viaduct or an access easement on the south side of US 101 or from the north as mentioned above. Right-of-way agreements could be established between Caltrans and adjacent landowners to

provide alleyways (if applicable) to access the mitigation parcels in the event of an emergency and to maintain grazing infrastructure (if it occurs) on adjacent parcels

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CORRALS AND STAGING AREAS

- At least one corral is needed. SG-4 is one potential location for a new set of corrals.

WATER TROUGHS AND WATER SOURCE

- Pasture SG-1 will need a water trough if it is grazed. An approximate location for this water trough is shown in Figure 5-7.

SHADED AREAS

- The existing trees on the north boundary could provide some shade for livestock during parts of the day and season. The available shade level should be evaluated to determine whether it provides adequate cover.

5.7.4.2 GRAZING PRESCRIPTION

The grazing prescription for the NCSGMU is summarized in Table 5-8.

Table 5-8. Grazing Prescription for the North Coast Semaphore Grass Management Unit

Action	Description of Grazing Prescription
Location of grazing	The entire management unit is to be grazed or mowed.
Stocking rate	4.5 AUMs/acre/yr to 6.5 AUMs/acre/yr depending on the actual length of the grazing season.
RDM target	1,200 to 1,500 lb /acre.
Season of grazing	May 1 through October.
Frequency and duration of grazing	If this unit is grazed, it should be grazed to maintain stubble height at 8 to 12 inches (1,200 to 1,500 lb/acre RDM) so that shading of NCSG is minimized. Because this unit is so small and access is more difficult, it may be difficult to find a lessee. It may be easier to have the unit mowed each summer. Mowed vegetation should be baled and removed. Grazing or mowing practices should follow the targeted grazing guidelines for NCSG (Appendix C.)
Hay harvest	Because of the small size and difficult access, it is recommended that this management unit be harvested for hay.
Kind and class of animal	Because of the small size of this unit, sheep grazing may be more appropriate than cattle grazing. Sheep and goats may be used for weed control.
Grazing guidelines	Management for NCSG is the priority for this parcel and should follow the grazing and monitoring guidelines in Appendix C.
Drought and post-fire practices	Shorten grazing season and reduce the stocking rate (AUMs) so that the RDM does not go below the target. Allow lessees to feed hay.

5.7.4.3 INVASIVE SPECIES MANAGEMENT PRACTICES

Control methods for invasive species are discussed in Chapter 4. Himalayan blackberry is present along the fence lines and in the riparian corridors and should be controlled. Himalayan blackberry control is not needed at this time but may be required if in the future it is determined to be negatively affecting NCSG populations.

Teasel, Harding grass, and reed canarygrass were not observed but may be present in the future and could be controlled using chemical spot treatments. Medusahead and yellow starthistle were not observed in this parcel and would not be expected to colonize because the majority of the management unit is wet meadow.

5.7.5 Monitoring Recommendations

RDM should be assessed around October 1 (before the start of the rainy season) to identify areas that have been grazed too heavily and to ensure that NCSG areas are receiving adequate grazing to reduce competition from other species. Photo-guides should be used to estimate RDM. Large areas that appear to be below the target can be sampled by clipping a few (5 to 10) quadrats (1 sq. ft. or 0.96 sq. ft.) near the end of the grazing season.

Density and cover of NCSG populations should be monitored following targeted grazing or mowing to determine whether current grazing practices are achieving desired results. Invasive species should be monitored to detect extent, spread over time, and effectiveness of control. Often annual photographs can be used for monitoring. Measures of density and cover may be useful to detect small changes in invasive weed populations.

5.7.6 Management Issues and Considerations

Access issues and the small size of the NCSGMU may prevent Caltrans from finding a lessee interested in grazing the unit.

If livestock access issues are too difficult, haying the unit may be more feasible, especially if Caltrans could interest the owner of the surrounding property in harvesting the hay. It may be necessary to give the neighbor the hay in exchange for harvesting the hay.

Little is known about the habitat needs of NCSG. Consequently, assumptions about the potential for expansion are not substantiated by science. Likewise, the grazing prescriptions are not based on a good foundation of science. The response of this species to grazing, their palatability to livestock, and other key knowledge are not available to guide management. At a minimum, the

potential extent of expansion of the species should be determined by field experimentation, and response to clipping and grazing should be studied during controlled studies in the field.

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Appendix A Glossary of Terms

Adaptive management: a form of management based on experimentation (trial and error). Guided by measurable objectives, it allows managers to monitor and evaluate management practices as they go along.

Animal unit (AU): One mature cow of approximately 1,000 pounds body weight.

Animal unit month (AUM): The amount of dry forage required by 1 animal unit for 1 month.

Browse: That part of leaf and twig growth of shrubs, woody vines, and trees available for consumption by livestock or wildlife.

Carrying capacity: The maximum stocking rate possible that is consistent with maintaining or improving vegetation or related resources. It may vary from year to year on the same area as a result of fluctuating forage production.

Class of animal: Description of age and/or sex-group for a particular kind of animal. For example, cow, calf, yearly, ewe, doe, fawn, etc.

Cool-Season Plant: a plant that generally makes the major portion of its growth during the late fall, winter, and spring.

Continuous grazing: The grazing of a specific unit by livestock throughout a year or for that part of the year during which grazing is feasible. The term is not necessarily synonymous with year-long grazing, because seasonal grazing may be involved.

Drought: A prolonged chronic shortage of water, as compared to the norm, often associated with high temperatures and winds during spring, summer, and fall. A period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water.

Duration of grazing: Length of the grazing period.

Enclosure: Area fenced to confine animals.

Flash grazing: Grazing a targeted area at a relatively high stocking density for a short period of time, typically involves not more than two to four days. This is the preferred management practice if livestock will have access to a stream and riparian area.

Forage: Browse and herbage that are available for food for grazing animals or to be harvested for feeding.

Forage production: The weight of forage that is produced within a designated period of time on a given area (e.g., pounds per acre).

Forb: Any broad-leafed herbaceous plant other than those in the grass, sedge, or rush families.

Frequency of Grazing: How often a pasture is grazed.

Grass: a plant with long, narrow leaves having parallel veins and nondescript flowers. Stems are hollow or pithy in cross section.

Graze/grazing: The consumption of standing forage by livestock or wildlife.

Grazing period: Length of time that animals are allowed to graze a specific area.

Grazing management: the manipulation of grazing and browsing animals to accomplish a desired result.

Grazing pressure: An animal-to-forage relationship measured in terms of animal units per unit weight of forage at any instant (e.g., AU/ton).

Grazing system: Grazing management that defines the periods of grazing and non-grazing.

Grazing management unit: A grazing area enclosed and separated from other areas by fencing or other barriers.

Herd memory: Landscape and vegetation knowledge passed on from mother to offspring in a herd of grazing animals.

Intensity of grazing: Intensity of grazing is the degree of use resulting from the number of animals and length of the grazing period. It may be reported as percent utilization or amount of residue or stubble height remaining at end of grazing period.

Invasive species: An alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Litter: The uppermost layer of organic debris on the soil surface; essentially the freshly fallen or standing dry vegetation.

Monitoring: The orderly collection, analysis, and interpretation of resource data to evaluate progress of management objectives.

Native species: A species that is a part of the original fauna or flora of the area in question.

Non-native: A species which is not part of the original fauna or flora of the area in question.

Prescribed grazing: Managing the controlled harvest of vegetation with grazing animals to meet management objectives (NRCS).

Overgrazing: Continued heavy grazing that exceeds the recovery capacity of the community and creates a deteriorated range.

Pasture: Land that is seeded with introduced pasture grasses and legumes, fertilized and irrigated.

Photo-points: Repeat photography of an area of interest over a period of time, with photographs taken from the same location and with the same field of view as the original photo**.**

Plant community: An assemblage of plants occurring together at any point in time, denoting no particular ecological status.

Plant vigor: plant health; relates to the relative robustness of a plant in comparison to other individuals of the same species.

Prehend: To take hold of during grazing.

Prescribed grazing: Managing the controlled harvest of vegetation with grazing animals to meet management objectives (NRCS).

Rangeland: Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs. Rangelands may include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows.

Residual dry matter (RDM): The amount of old plant material left on the ground at the beginning of a new growing season.

Rest: Leaving an area ungrazed for a specific time.

Rest period: The length of time that a management unit is not grazed.

Riparian zone: The banks and adjacent areas of water bodies, watercourses, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a moister habitat than that of contiguous floodplains and uplands.

Rotational grazing: A grazing scheme in which animals are moved from one grazing unit in the same group of grazing units to another unrelated to specific graze rest periods or levels of plant defoliation.

Season of grazing: The period(s) of the year that grazing occurs. *Season of grazing* may refer to the seasons of the year (fall, winter, spring, summer) but also can refer to other periods. For example, *season of grazing* could be defined as the dry season, wet season, or just a few weeks of grazing that fit the goals of the grazing manager.

Seasonal grazing: Grazing restricted to a specific season or time of year.

Season-long continuous grazing: Continuous grazing for a season.

Seasonal-long rotational grazing: Rotational grazing for a season.

Species composition: The proportions of various plant species in relation to the total on a given area. It may be expressed in terms of cover, density, or weight.

Stock density: the relationship between the number of animals and the area of land at any given time.

Stocking rate: The number of specific kinds and classes of animals grazing or using a unit of land for a specified period of time. May be expressed as animal unit months per acre.

Targeted grazing: Targeted grazing is the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation or landscape goals. This concept has been around for decades and has taken many names, including *prescribed grazing* and *managed herbivory* (Launchbaugh and Walker 2006).

Thatch: A term for excessive litter that has gained common usage by restoration managers in California.

Unpalatable: Not agreeable to taste, disliked; can result in animal avoidance of a particular species or plant part that could be consumed.

Use: the proportion of current year's forage production that is consumed or destroyed by grazing animals.

Utilization: see *Use*. **Weed:** A plant growing where it is unwanted. A plant having a negative value within a given management system.

Wet meadow: A meadow where the surface remains wet or moist throughout the growing season.

Year-long grazing: Not a proper grazing management term. Often means year-long grazing or year-long continuous grazing.

Yearlong grazing: Continuous grazing for a calendar year. *Note: Most of these definitions follow those published in Rangeland terminology published by the Society for Range Management (1989).*

Appendix B Recommendations for Grazing to Maintain or Increase Baker's Meadowfoam

Based on what has been observed by Geri Hulse-Stephens and others, the recommended grazing regime for maintaining and potentially increasing Baker's meadowfoam (BM) patches is to graze during seed set (mid- to late May) to trample the seeds into the soil and to reduce competing vegetation and thatch by grazing and/or mowing to a residual dry matter (RDM) weight of 1,500 pounds per acre (lb/ac) by October 31. However, within an adaptive management framework, grazing effects should be monitored to fine tune the proper timing and intensity of grazing for maintaining and increasing BM. The following practices are recommended for maintaining BM.

1. BM patches should be grazed during seed set so the seeds are trampled into the soil.
    a. One potential problem with this grazing regime is that there are not enough cattle to graze all of the BM patches during seed set. This problem offers an opportunity to compare BM patches that are grazed during seed set to those that are not. This comparison should be conducted to confirm that trampling seed into the soil actually results in increased BM density as has been observed.
    b. Seven new BM pastures (E2, E4, E5 M4, M5, M6, M7 [Figures 5-2 and 5-3 of GMP]) are proposed in the fencing recommendations. Some could be grazed during seed set and others could be left ungrazed during seed set. BM density in patches in each pasture should be determined before applying this grazing regime and compared to BM density measured during the spring after the grazing regime is applied. This test should be conducted for 3 or more years so that weather influences on treatment effects can be assessed.
    c. There are several smaller patches of BM that also could be treated following these guidelines.
2. Following are some additional practices that could be tested as part of an adaptive management program.
    a. If cattle concentration is insufficient to adequately trample BM seed, try: (1) to maximize trampling, use electric fences to confine cattle to BM patches, and/or (2) place salt and/or dehydrated molasses supplements (e.g. Crystalyx®) near BM patches to attract livestock into the BM patches.
    b. BM patches that are not trampled during seed set should be grazed at high densities after the soil dries in an attempt to improved seed contact with the soil. High animal density may be achieved by enclosing cattle with electric fence or by attracting cattle by placing salt and/or protein supplements near the BM patches. The grazing manager will need to monitor enclosed cattle or attractant areas to ensure that grazing and trampling are not too heavy. The grazing manager may have to learn by trial and error (adaptive management) when to end this grazing treatment.
    c. If shading from competing vegetation is believed to be restricting the growth and expansion of BM in March and April, it may be desirable to graze some BM patches during that period. Standing water and muddy soils could restrict application of this practice. Under close monitoring, this should be tried on a small scale so that BM impacts and trampling of muddy soils can evaluated. Pastures that are grazed in April also should be grazed at BM seed set as described above.

3. To maintain the dense stands of BM in the east end of the Watson parcel, which includes upland sites dominated by annual grasses and forbs, continuous year-around grazing should be continued but closely monitored to maintain adequate RDM of 1,000 lb/ac.
4. After seed set, maturation, and drying of BM plants, grazing can continue through the summer and early fall with the goal of reducing RDM in and near BM patches to 1,000 to 1,500 lb/ac.
5. Density of BM patches that receive these grazing treatments should be compared to those that do not. This will inform the adaptive grazing manager so that practices can be adjusted as needed.

Appendix C Recommendations for Grazing to Maintain or Increase North Coast Semaphore Grass

Following an adaptive management approach, grazing and mowing can be applied to reduce competition to North Coast semaphore grass (NCSG) using the following practices:

1. To minimize shading of NCSG by taller competing grasses, graze NCSG patches to maintain standing crop at about 8 to 12 inches in height.
    a. NCSG patches should be rested at least 30 days between grazing periods. This is best done using rotational grazing.
    b. Where rotational grazing is practiced, introduced competitors and NCSG may be reduced in height during each grazing period and then regrow during rest periods. Rest between grazing periods allows NCSG and introduced species to recover.
    c. Fall vegetation should be reduced in height so that NCSG will not be shaded during the winter and early spring growing season. An RDM of 1,200 to 1,500 lb/ac should facilitate this.
2. Following are some additional practices that could be tested as part of an adaptive management program.
    a. If shading from competing vegetation is believed to be restricting the growth and expansion of NCSG in March and April, it may be desirable to graze some NCSG patches during that period. Standing water and muddy soils could restrict application of this practice. Under close monitoring, this should be tried on a small scale so that NCSG impacts and trampling of muddy soils can evaluated.
3. Competitors to NCSG grow rapidly in April and May, potentially beginning to shade NCSG. These introduced competitors will reach heights of 3 to 5 feet by June, shading associated NCSG plants. Therefore grazing or mowing needs to be applied to prevent introduced perennial grasses from shading NCSG.
4. In most years a May through October season of use prevents grazing when soils are wet. However, it may be desirable to begin reducing the height of competing species by grazing NCSG patches earlier. The grazing manager should observe height increases of competitors starting in March and learn to gauge when grazing or mowing needs to be applied to reduce the height of introduced perennial grasses.
5. Monitor and compare NCSG populations in grazed, mowed, and untreated patches. NCSG patches should be monitored annually in the spring.
6. Ideally controlled clipping and grazing experiments should be conducted to determine the proper season, intensity and frequency of grazing or mowing that would enhance NCSG and suppress competing vegetation. As stated in Chapter 3, the effects of no grazing, following an adaptive management approach incorporating plant population characteristic monitoring, and various intensities and timings of grazing could be tested and compared in adjacent small pastures or small sections of larger pastures separated by temporary electric fencing.

Appendix D Websites That Support This Grazing Management Plan

D.1 Rangeland Management

California Rangeland Research and Information Center
http://californiarangeland.ucdavis.edu/

California Rangeland Watershed Laboratory
http://rangelandwatersheds.ucdavis.edu/

UCCE Livestock and Range Topics: Educational Information for Range Livestock Producers and Managers
http://ucanr.org/blogs/LivestockRangeTopics/

California Guidelines for Residual Dry Matter (RDM) Management on Coastal and Foothill Annual Rangelands.
http://californiarangeland.ucdavis.edu/Publications%20pdf/8092.pdf

Photo Monitoring for Better Land Use Planning and Assessment
http://anrcatalog.ucdavis.edu/pdf/8067.pdf

USDA NRCS Conservation Benefits of Rangeland Practices: Assessment, Recommendations, and Knowledge Gaps
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?&cid=stelprdb1045811

Targeted Grazing
http://www.cnr.uidaho.edu/rx-grazing/handbook.htm

D.2 Invasive Species Management

Reed Canary Grass Fact Sheet.
http://dnr.wi.gov/invasives/fact/reed_canary.htm.

Common Teasel Fact Sheet
http://dnr.wi.gov/invasives/fact/teasel_com.htm

Medusahead
http://www.blm.gov/ca/st/en/fo/alturas/altweed/plants/medusa.html.

Yellow Starthistle
http://www.cal-ipc.org/ip/management/yst.php
Creeping Bentgrass
http://www.cal-ipc.org/ip/management/plant_profiles/Agrostis_stolonifera.php

Tall Fescue
http://www.cal-ipc.org/ip/management/plant_profiles/Festuca_arundinacea.php

Velvet Grass (Yorkshire Fog)
http://www.cal-ipc.org/ip/management/plant_profiles/Holcus_lanatus.php

Harding Grass
http://www.cal-ipc.org/ip/management/plant_profiles/Phalaris_aquatica.php

Reed Canarygrass
http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua011.html

Himalayan Blackberry
http://www.cal-ipc.org/ip/management/plant_profiles/Rubus_armeniacus.php

tncweeds.ucdavis.edu/moredocs/rubarm01.pdf
http://www.coosswcd.oacd.org/him_blackberry_text.htm

Appendix E Fence Guidelines

E.1 General Guidelines and Discussion

Livestock fencing requirements vary by grazing/farming management objectives, species, age and sex of animals contained, topography, climate conditions, predator control, ecological restoration requirements, maintenance issues, aesthetic concerns, and cost. In general, livestock fencing occurs as one of three types:

- boundary or perimeter fencing—used to keep livestock on site, with predation protection, and to define a management unit that is spatially unique from other units;
- cross-fencing or paddock fencing—used to control livestock distribution and achieve grazing management objectives by controlling the space, density, and duration of grazing; and
- exclosure fencing—used to protect temporarily or permanently resources that might be damaged by grazing or for monitoring by compare-and-contrast methods.

Adequate perimeter fencing to contain livestock also is required by California law (Food and Agriculture Code 17121) as Mendocino County is not considered a *free-range* county.

Wildlife friendly fencing will be used, as stated in the MMP, which requires deviation from the traditional livestock fencing specifications. Refer to the MMP for more information on the wildlife fencing specification.

E.2 Description of Fence Material

Traditional livestock fencing materials have included barbed, woven, mesh, and electrified wire and combinations of these materials. Different types of posts include treated wood, metal, and fiberglass.

E.2.1 Barbed Wire Fence

Barbed wire is the most commonly used material for cattle, but it also can be used for sheep and goats if properly spaced and will deter some predators. For sheep and goats, the bottom spacing must be closer with the first wire no more than 6 inches off the ground and the second wire 6 inches up from that. If predators are a problem, the first barbed wire is placed practically on the ground (0 to 2 inches) to discourage coyotes and domestic dogs from burrowing under the fence. The remaining wires that follow need to be spaced 8 inches apart. Typically sheep fences are only 4 feet high, but goats will need the same height as cattle. A drawback of barbed wire for sheep and angora goats is that their fleece often gets caught on the barbs.

Barbed wire consists of two or more strands of smooth, galvanized wire twisted together with two or four sharp barbs spaced every 4 to 5 inches (Figure E-1). Standard barbed wire fences usually have three to five strands of barbed wire stretched between posts. Typical fence height is either 51 or 54 inches. Spacing between wires depends on the number of line wires and fence height (Figure E-2). Line posts are usually spaced 12 to 20 feet apart.

Figure E-1: 2 & 4 Barbed Wire

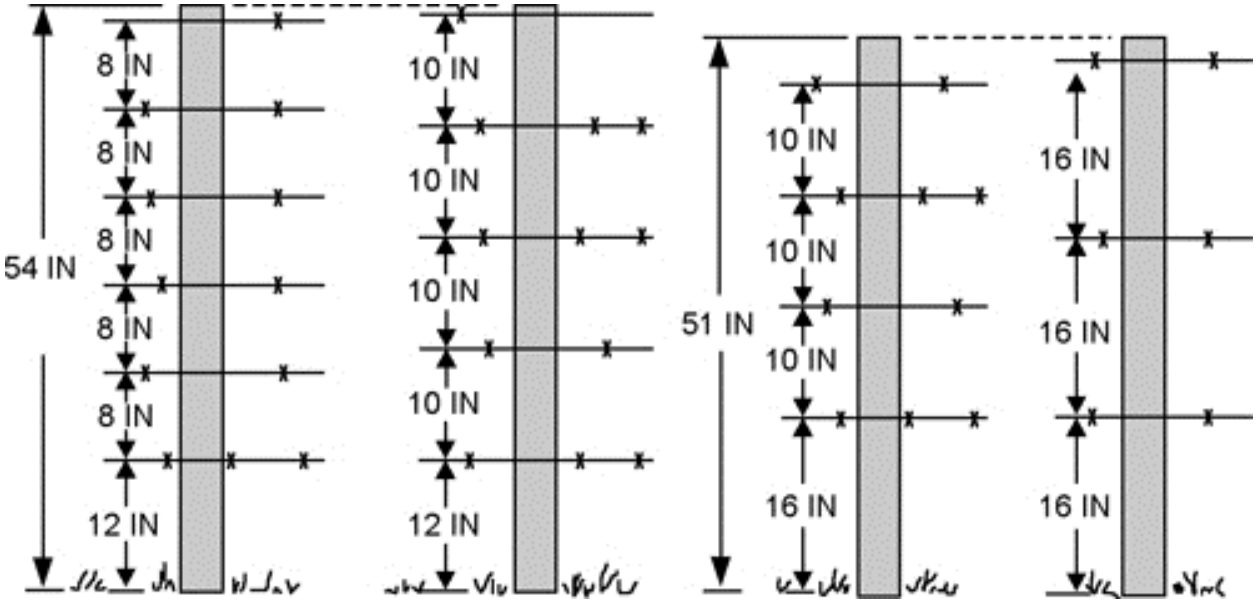

Figure E-2: Common Line Spacing for Barbed Wire Fences

E.2.2 Suspension Barbed Wire Fence

Suspension barbed wire fences consist of four to six strands of 12½-gauge barbed wire stretched taut so no more than 3 inches of sag exists between posts. The wire strands are held apart by twisted wire stays or plastic battens or droppers spaced 16 feet apart. Line posts are usually spaced 80 to 120 feet apart. Line posts should be set or driven to a minimum depth of 2½ feet and be tall enough for about 3–4 inches showing above the top wire.

E.2.3 Woven Wire Fence

Woven wire is more often used for sheep and goats as it is a tighter fence that prevents young lambs or kids from getting out. Heavy or extra heavyweight woven wire fences are excellent for non-horned sheep and goats. Fence height should be at least 48 inches to prevent animals from climbing over the fence. Woven wire fence can be used with cattle provided there are several strands of barbed top wires used to prevent the cattle from rubbing the woven wire down.

Woven wire fences consist of smooth horizontal (line) wires held apart by vertical (stay) wires. Spacing between line wires may vary from 1½ inches at the bottom for small animals to 9 inches at the top for large animals. Wire spacing generally increases with fence height.

E.2.4 Wildlife/Predator Exclusion Fence

Generally, where coyote predation is not a concern, stay wires should be spaced 6 inches apart for sheep and goats and 12 inches apart for large animals. Coyotes, however, can pass through openings as small as 4 1/2 inches, so if predation is a concern, woven wire fences with stay wires close together will prevent predators from entering fenced-in areas. Some manufacturers produce fencing with bottom openings of 6 inches by 3 inches for predator control and 3 inches by 3 inches for predator proofing. Using one strand of barbed wire at ground level with woven wire above and two to three strands of barbed wire on top is the best non-electrified fence for sheep and goats.

If wildlife-friendly fences are required, typically the topmost barbed wire is replaced with a smooth wire of similar gauge. Sometimes lower wires are also replaced with smooth wire, but it is not recommended in this area for cattle. Wildlife-friendly fences also are not recommended if predation is a problem.

Wildlife friendly fencing will be used, as stated in the MMP, which requires deviation from the traditional livestock fencing specifications. Refer to the MMP for more information on the wildlife fencing specification.

E.2.5 Exclosure Fence

For cattle the three-wire barbed fence is adequate. Typical exclosures are used for restoration and for required setbacks from riparian corridors. Unless the exclosure is extremely small, barbed wire drop gates (Figure E-3) should be installed to facilitate removal of stray animals, to allow access for maintenance, and for utility right-of-way requirements. It is not necessary to place cross-creek fences in riparian areas where livestock will cross from one pasture to the next as the animals usually are herded between the two gates, which need to be at minimum 16 feet wide. Cross-creek fences will act as debris traps and can result in excessive erosion or vegetation blow-outs during winter flows. Fences also will hinder wildlife movement in corridors. Where riparian corridors are fenced, it is often better to treat the area as a riparian pasture once woody vegetation goals are met, e.g., once tree species are above browse height (4 to 5 feet). Grazing will stimulate growth of desirable grasses and forbs and control undesirable species in riparian pastures. Timing and season of use need to be part of the adaptive management of riparian pastures.

Figure E-3: Typical Barbed Wire Drop Gate for Three Wire Fence

E.2.6 Wildlife-Friendly Fence and Wildlife Exclusion Fence

There are times when it is necessary to fence wildlife out. If wildlife must be excluded, avoid fencing a large area that includes wildlife habitats. Keep exclusion fence close to the resource you need protected, and allow wildlife to use other parts of the property or pass through.

A permanent non-electric exclusion fence for deer and elk should be 7 to 8 feet high. Different designs can be used, depending on the circumstances. Place gates at corners where an accidentally trapped animal is more likely to find an escape.

A properly maintained fence will give long and trouble-free service. The following items should be a part of a regular maintenance program.

- Repair or replace anchor post assemblies when they show signs of weakness.
- Refasten loose wires to posts and splice broken wires as necessary.
- Keep the fence properly stretched.
- Keep the fence line clear of weeds and brush.

- Monitor fences during high-water events or seasonal flooding.
- Plan and follow a regular inspection routine to identify any needed maintenance.

E.3 Management Unit Considerations

Caltrans has acquired more than 30 parcels for mitigation impacts of the Willits Bypass Project with the intention of leasing the grazing rights on those parcels where grazing is the preferred tool for their management objectives. Presently most of these parcels are not managed individually because of prior ownerships and current grazing leases. Usually a conservation, ranch, or grazing management plan addresses the management of multiple pastures, paddocks or grazing units on a ranch or in a grazing lease, including parcels that are not grazed, that are spatially contiguous.

As part of the offsite mitigation program for the bypass project, Caltrans will replace most perimeter fences and internal fences. Perimeter fences will be installed on the outer boundary of the mitigation parcels. Caltrans will layout and design internal fences to create the individual grazing units (pastures), as identified in the GMP.

As described in the GMP, the mitigation parcels will be divided and grouped into seven management units:

- West Management Unit (WMU)
- Middle Management Unit (MMU)
- East Management Unit (EMU)
- South Management Unit (SMU)
- North Management Unit (NMU)
- Oak Woodland Management Unit (OWMU)
- North Coast Semaphore Grass Management Unit (NCSGMU)

While current lease agreements are based on the parcel designations, it is recommend that Caltrans transition to lease agreements for these management units.

Fencing within the Little Lake Valley management units presents some unique challenges because of high water flows in the winter and wildlife migration patterns. Electric fences will not work in any of the management units as elk and bear will walk through and destroy them.

It is recommended that east – west (running direction) fences not be constructed of woven wire or barbed, with very close spacing, as the high water flows will trap debris and eventually damage or result in the loss of fence segments. This could create a maintenance problem almost every year. East – west fences should use the minimum number of barbed wires to contain livestock. For cattle this is three strands. For sheep or goats four or five strands would suffice, however, this could preempt using them as a grazing tool.

North – south (running direction) fences and most of the perimeter fence can be either a combination of woven wire and barbed wire or more closely spaced barbed wire as in Figure E-2. Five strands of barbed wire alone will work

for cattle and is recommended. Cross and exclosure fences are adequate with 2-barbed wire. If added security is needed 4-barbed wire may be used for perimeter fences and might be justified for use along public roadways.

End posts with H-braces made of 2-inch steel set in concrete will be stronger and last longer than wooden posts. Steel T-posts should be used for all line posts. Gates should be 16 feet wide and made of 2-inch tubular steel (Figure E-4). There are numerous retail suppliers of fence material, gates, and other field equipment and materials hay, or gravel trucks and livestock. For sheep or goats the gates should have welded mesh wire welded to the tubular steel. This size will allow adequate access for fire suppression equipment.

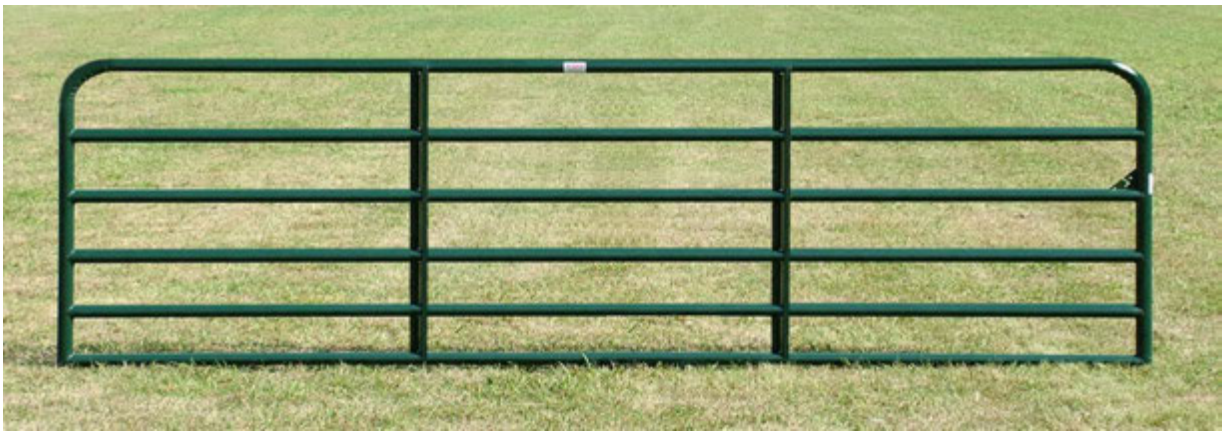

Figure E-4: 16-Foot 2-Inch Tubular Steel Powder Coated Gate by Behlen®

Cattle movements within and between the WMU, MMU, and EMU may be challenging because of wet meadow and riparian corridor mitigation requirements. In some instances, stream crossing will be required to move livestock between pastures. Temporarily fenced alleyways across riparian corridors and creeks are not recommended as it is much easier to use low-stress cattle movement with dogs and horses to cross between gates than to create small impassible spaces that crowd cattle and risk major trampling, injuries, and fence blow-outs. One example of where low-stress movement is preferred over a fenced alleyway is between pasture M-10 to pastures W-4 and W-5. Pastures W-1, W-2, W-3, W-5, and W-6 have similar requirements.

Use of barbed wire drop gates in both riparian corridors and exclosures will facilitate removing strays and allow access for maintenance of fence and water lines, mitigation planting, and monitoring and for utility right-of-way requirements. Cross-fencing on either side of a creek crossing is typically not recommended as it will prevent wildlife and fish passage, increase debris accumulation and erosion, and is not needed when used in conjunction with low-stress movement. For the bypass project, riparian corridor fencing is required as a mitigation measure.

While not strictly a fencing issue, the new management units may, in the future, require separate gathering, sorting, and loading corrals if or when current lessees change.

E.3.1 Riparian Corridor Grazing

Riparian corridor grazing is often conducted at a high stock density for a short period of time, typically two to four days. This short duration, high intensity grazing is often called “flash grazing.” If “flash grazing” is practiced within the riparian corridor or on BM patches temporary electric fencing may be used. Riparian corridor grazing guidelines are presented in Appendix F of the GMP.

Appendix F Riparian Corridor Grazing Guidelines

Riparian mitigation under the State MMP consists of riparian habitat establishment and rehabilitation and other waters rehabilitation (California Department of Transportation 2013). Riparian corridors on the offsite mitigation parcels will be fenced to prevent routine livestock access to valley streams. Preventing livestock access to these corridors will reduce streambank erosion and sediment delivery to the stream channel, attenuate surface water pollutants, and remove any grazing pressure by livestock under existing conditions. Riparian corridors mitigation will result in an increase in riparian vegetation cover and native riparian plant species composition and diversity, improve or maintain the quantity and quality of wildlife forage, provide cover for terrestrial wildlife, and provide overhead shade and instream woody material for streams.

Mitigation actions include planting of native woody plants along riparian corridors. As mitigation plantings mature, woody plant density (i.e., trees, shrubs, and vines) may suppress vegetation that would be considered fine fuels (e.g., grasses and forbs) and preclude the need for grazing at some point following restoration. Grazing may be a beneficial means of weed control during the long-term management period (i.e., following completion and approval of the monitoring program by the resource agencies). However, grazing cannot interfere with restoration activities or affect the project mitigation program from attaining the required performance standards and maintaining the mitigation objective of establishing and rehabilitating riparian habitat.

At some point in the future grazing in the riparian corridor may be needed to control weeds, manipulate plant species composition and reduce fine fuels. Riparian corridor grazing is often conducted at a high stock density for a short period of time, typically two to four days. This short duration, high intensity grazing is often called “flash grazing.” Flash grazing of a riparian corridor segment can be a normal part of a grazing rotation in a well-managed rotational grazing system.

Flash grazing can be a beneficial practice when applied within an adaptive management process. The decision to implement a flash grazing program in the project’s riparian corridors must be made in associate with the resources agencies, as described in the following sections. The NRWQCB specifically expects the Land Manager to provide the NRWQB with a proposal for their review and approval prior to flash grazing.

F.1 Grazing Guidelines

F.1.1 Riparian Corridors

Riparian corridor grazing will be confined to the areas between the exclusion fence on the interface of riparian corridor and the wetland rehabilitation and establishment areas. Riparian corridors on the mitigation parcels are designated as Category I, II, or III corridors. The riparian corridors are further defined in the State MMP. The riparian corridor boundaries are shown in Appendices C and E of the State MMP.

F.1.2 Responsible Party

The Mendocino County Resource Conservation District (MCRCD/Land Manager) will be responsible for the decision to graze a riparian corridor. The Land Manager shall make an informed decision based on the results of annual biological and general inspections made during the long-term management period (see Chapter 11 of the State MMP).

The decision to graze a riparian corridor must only be made if the Land Manager is certain that grazing will not adversely affect the riparian corridor or the project mitigation requirements. Flash grazing can be a beneficial practice when applied within an adaptive management process. It should be noted that adaptive grazing decisions often need to be made and implemented within a day or two to be effective. It is recommended that the Land Manager develop riparian area grazing guidelines, in coordination with the appropriate regulatory agencies, in advance so, when needed, riparian area grazing can be implemented without waiting for agency review and approval of individual requests.

F.1.3 Reasons for Grazing Riparian Corridors

Riparian corridor grazing may be recommended to support one or more of the following mitigation management requirements:

- Reduce fine fuels before the late summer – fall fire season.
- Prevent the accumulation of thatch
- Weed control, as described in Chapter 4 of the GMP.
- Reduce shading of short-statured native riparian plants.
- Improve the quality of native herbaceous plants for wildlife by controlling the density and/or populations of nonnative grasses and forbs.

F.1.4 Grazing Management Actions

Riparian corridor grazing will be confined to the areas between the exclusion fence (on the interface of riparian corridor and the wetland rehabilitation and establishment areas).

At the present time it is not possible to apply standard grazing management procedures to riparian corridors because the exact location, size, and vegetative composition, condition and quantity of an area that may require grazing cannot be determined. An adaptive management decision making process will need to be developed on a site-by-site basis and will be dependent on the size of the area and the type and density of vegetation.

Because the riparian corridor grazing will be adaptively managed the GMP cannot identify access points or water sources grazing will require access points and water sources. These issue and the following basic grazing management principles should be considered when developing a grazing management strategy for each riparian corridor grazing area.

F.1.4.1 SEASON OF GRAZING

Access to most of the riparian corridors requires passage across wet meadow mitigation areas. As a result the season of grazing for riparian corridors will be dependent on the season of grazing for wet meadows.

It is recommended that riparian corridor grazing and required stream crossing occur when water levels of streams have receded or the streambeds are dry to minimize potential effects on water quality and salmonids.

F.1.5 Intensity of Grazing

Stubble height at the end of the grazing period should be at a minimum 4 to 6 inches. Shorter heights may increase bare ground, reduce filtration capacity, and provide a sediment source during periods of high water or heavy rain.

F.1.6 Duration and Frequency of Grazing

The mitigation objective for riparian corridors is to maximize riparian vegetation cover in the corridors. Riparian planting areas, as shown in Appendix C of the State MMP, range from extended segments along the streambanks to small inclusions in existing canopy. Existing and planted riparian species are expected to grow into gaps that currently do not support riparian vegetation.

The duration and frequency of grazing in a riparian corridor will be dependent on the length and width of area to be grazed and the type and density of forage. As a general condition, flash grazing should be no more than 4 consecutive days in the same segment of the corridor. If repeat treatment is needed the Land Manager should wait at least 30 days before grazing.

F.1.7 Kind and Class of Animal

Riparian corridor grazing will likely be provided by beef cattle because they are the preferred kind and class of animal for grazing the wet meadow areas on the mitigation parcels. Sheep and goats could be used for riparian corridors particularly if the riparian grazing units are narrow and small in overall area. Sheep and goats will tend to avoid low and wet areas and rarely will cause wetland or stream bank damage. However, sheep and goats may graze woody plants that are not usually grazed by cattle.

F.1.8 Stocking Rate

Determining stocking rate is a fundamental first step in grazing management planning. The stocking rate for riparian corridor grazing units will be determined on a site-by-site basis and will be dependent on the size of the area, type and density of vegetation, kind and class of animal.

F.1.9 Infrastructure

Because the riparian corridor grazing will be adaptively managed the GMP cannot identify access points or water sources grazing will require access points and water sources. Riparian corridor fences and gates, as shown in the GMP, will be permanent therefore temporary gates or access points will need to be individually located and constructed to move livestock into each riparian grazing unit. Temporary internal cross fences may be needed to subdivide the corridors for each flash grazing period. Temporary electric fences may be used. Stock water sources will be required for each riparian corridor grazing unit if livestock are to be kept in a grazing unit for an extended period (usually no longer than 4 days). Stock water sources will need to be determined on a site-by-site basis. Temporary stock water could be provided by placing portable troughs and water could be obtaining from water lines identified in the GMP, temporary water lines, or water trucks. Riparian vegetation will provide an adequate shade source.

F.1.10 Documentation of Grazing Activities

Documentation of grazing activities in riparian corridors should be included in the adaptive management grazing plan. At a minimum the following information should be recorded for each grazing unit:

- Inform the appropriate resource agencies when grazing will commence.
- Record the reason for grazing.
- Dates of grazing (date in/date out).
- Record number of head and kind and class of animal.
- Visually estimate RDM before and after grazing.
- Photograph RDM levels before and after grazing.
- Visually inspect and photograph riparian vegetation before and after grazing.

Appendix R
Property Analysis Record

Under Development

PAR Analysis for the Willits Bypass Project - Long-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity/ Action	Responsible Party	Description	Frequency [2]	Actions Required	Unit	Number of Units	Cost/ Unit [1]	Annual Cost (single occurrence cost)	Divide Years	Total Cost (annual set-aside)	Assumption #
1	**Biological Monitoring**												
2	Wetland Establishment (Groups 1 & 2)	Biological monitoring for wetland establishment sites	MCRCD	Monitor 59.4 acres	Years 15 and every 10 years thereafter	Relative cover by wetland plant species, native wetland plant species, and invasive species	Labor hours	149	$65	$9,685	10	$969	10-11
3		Performance monitoring of Wetland Establishment sites (Group 1 and 2)	MCRCD	Monitor 59.4 acres	Years 15 and every 10 years thereafter	Collect data in 16 wetlands. Determine the extent of ponding, soil saturation and depth	Labor hours	762	$65	$49,530	10	$4,953	12
4		Biological monitoring for wetland establishment sites	MCRCD	Monitor 59.4 acres	Years 15 and every 10 years thereafter	Travel time between monitoring locations (Relative cover)	Labor hours	19	$65	$1,235	10	$124	13-14
5		Biological monitoring for wetland establishment sites	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hours	14	$65	$910	10	$91	15
6	Wetland Rehabilitation (Types 1)	Performance monitoring of wetland rehabilitation sites (Type 1)	MCRCD	72.79 acres	Years 15 and every 10 years thereafter	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	23	$65	$1,495	10	$150	21-22
7		Performance monitoring of wetland rehabilitation sites (Type 1)	MCRCD	72.79 acres	Years 15 and every 10 years thereafter	Travel between monitoring locations	Labor hrs	3	$65	$195	10	$20	23
8		Performance monitoring of wetland rehabilitation sites (Type 1)	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	2	$65	$130	10	$13	24
9	Wetland Rehabilitation (Types 2)	Performance monitoring of wetland rehabilitation sites (Type 2)	MCRCD	30.02 acres	Years 15 and every 10 years thereafter	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	12	$65	$780	10	$78	25-26
10		Performance monitoring of wetland rehabilitation sites (Type 2)	MCRCD	30.02 acres	Years 15 and every 10 years thereafter	Travel between monitoring locations	Labor hrs	2	$65	$130	10	$13	27
11		Performance monitoring of wetland rehabilitation sites (Type 2)	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	1	$65	$65	10	$7	28
12	Wetland Rehabilitation (Type 3)	Performance monitoring of wetland rehabilitation sites (Type 3)	MCRCD	179.01 acres	Years 15 and every 10 years thereafter	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	56	$65	$3,640	10	$364	30-31
13		Performance monitoring of wetland rehabilitation sites (Type 3)	MCRCD	179.01 acres	Years 15 and every 10 years thereafter	Travel between monitoring locations	Labor hrs	3	$65	$195	10	$20	32
14		Performance monitoring of wetland rehabilitation sites (Type 3)	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	4	$65	$260	10	$26	33
15	Wetland Rehabilitation (Type 4)	Performance monitoring of wetland rehabilitation sites (Type 4)	MCRCD	41.71 acres	Years 15 and every 10 years thereafter	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	16	$65	$1,040	10	$104	35

PAR Analysis for the Willits Bypass Project - Long-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity/ Action	Responsible Party	Description	Frequency [2]	Actions Required	Unit	Number of Units	Cost/ Unit [1]	Annual Cost (single occurrence cost)	Divide Years	Total Cost (annual set-aside)	Assumption #
16		Performance monitoring of wetland rehabilitation sites (Type 4)	MCRCD	41.71 acres	Years 15 and every 10 years thereafter	Travel between monitoring locations	Labor hrs	1	$65	$65	10	$7	36
17		Performance monitoring of wetland rehabilitation sites (Type 4)	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	1	$65	$65	10	$7	37
18	Wetland Rehabilitation (Type 5)	Performance monitoring of wetland rehabilitation sites (Type 5)	MCRCD	21.1 acres.	Years 15 and every 10 years thereafter	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	20	$65	$1,300	10	$130	39
19		Performance monitoring of wetland rehabilitation sites (Type 5)	MCRCD	21.1 acres.	Years 15 and every 10 years thereafter	Travel between monitoring locations	Labor hrs	2	$65	$130	10	$13	40
20		Performance monitoring of wetland rehabilitation sites (Type 5)	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	2	$65	$130	10	$13	41
21	Other Waters	Performance monitoring of Other Waters	MCRCD	17.98 acres	Years 15 and every 10 years thereafter	Absolute percent cover by tree and shrub species; absolute percent cover by invasive species, general site conditions and photopoints.	Labor hours	40	$65	$2,600	10	$260	17-18
22		Performance monitoring of Other Waters	MCRCD	17.98 acres	Years 15 and every 10 years thereafter	Travel time between monitoring locations	Labor hours	5	$65	$325	10	$33	19
23		Performance monitoring of Other Waters	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hours	7	$65	$455	10	$46	20
24	Other Waters Rehabilitation / Riparian Establishment - (State MMP)	Performance monitoring of Other Waters rehabilitation sites	MCRCD	Collect data on 28.61 acres	Years 15 and every 10 years thereafter	Collect data on percent absolute cover by native tree and shrub species along transect, general site conditions and photopoints.	Labor hrs	234	$65	$15,210	10	$1,521	42
25		Performance monitoring of Other Waters rehabilitation sites	MCRCD	Collect data on 28.61 acres	Years 15 and every 10 years thereafter	Collect data on percent riparian from aerial photo	Labor hrs	1	$65	$65	10	$7	43
26		Performance monitoring of Other Waters rehabilitation sites	MCRCD	Collect data on 3500 m of transects	Years 15 and every 10 years thereafter	Travel between monitoring locations for riparian cover monitoring	Labor hrs	15	$65	$975	10	$98	44
27		Performance monitoring of Other Waters rehabilitation sites	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	1	$65	$65	10	$7	45
28	Rehabilitated Wetlands - Grazed and Ungrazed (State MMP)	Performance monitoring of grazed Rehabilitated Wetland sites	MCRCD	Collect data on the 89 CRAM AA's	Years 15 and every 10 years thereafter	Collect data on CRAM biotic attribute values	Labor hrs	594	$65	$38,610	10	$3,861	46
29		Performance monitoring of grazed Rehabilitated Wetland sites	MCRCD	Collect data on the 89 CRAM AA's	Years 15 and every 10 years thereafter	Collect data on absolute cover by invasive species by transect.	Labor hrs	447	$65	$29,055	10	$2,906	47
30		Performance monitoring of grazed Rehabilitated Wetland sites	MCRCD	Collect data on the 89 CRAM AA's	Years 15 and every 10 years thereafter	Travel between monitoring locations for invasive monitoring	Labor hrs	28	$65	$1,820	10	$182	48
31		Performance monitoring of grazed Rehabilitated Wetland sites	MCRCD	Collect data on the 89 CRAM AA's	Years 15 and every 10 years thereafter	Travel between monitoring locations for CRAM monitoring	Labor hrs	38	$65	$2,470	10	$247	49
32		Performance monitoring of grazed Rehabilitated Wetland sites	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	17	$65	$1,105	10	$111	50

PAR Analysis for the Willits Bypass Project - Long-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity/ Action	Responsible Party	Description	Frequency [2]	Actions Required	Unit	Number of Units	Cost/ Unit [1]	Annual Cost (single occurrence cost)	Divide Years	Total Cost (annual set-aside)	Assumption #
33	North Coast Semaphore Grass Establishment Areas- (State MMP)	Performance monitoring of North Coast Semaphore Grass Establishment Areas	MCRCD	Collect data on the Huffman parcel establishment areas	Years 15 and every 10 years thereafter	Collect data on invasive species and species abundance (quadrats).	Labor hrs	18	$65	$1,170	10	$117	51
34		Performance monitoring of North Coast Semaphore Grass Establishment Areas	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	3	$65	$195	10	$20	52
35	North Coast Semaphore Grass Rehabilitation Areas- (State MMP)	Performance monitoring of North Coast Semaphore Grass Rehabilitation Areas	MCRCD	Collect data on the Arkelian, Goss, Lusher East and MGC Plasma parcels rehabilitation areas	Years 15 and every 10 years thereafter	Collect data on abundance and environmental conditions such as hydrology, woody species intrusion and invasives will be recorded and mapped as necessary	Labor hrs	48	$65	$3,120	10	$312	53
36		Performance monitoring of North Coast Semaphore Grass Rehabilitation Areas	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	4	$65	$260	10	$26	54
37	Baker's Meadowfoam Rehabilitation- (State MMP)	Performance monitoring of Baker's Meadowfoam Rehabilitation	MCRCD	15 CRAM AA's with Bakers Meadowfoam	Years 15 and every 10 years thereafter	Collect data on abundance and environmental conditions such as hydrology, woody species intrusion and invasives will be recorded and mapped as necessary	Labor hrs	300	$65	$19,500	10	$1,950	55-56
38		Performance monitoring of Baker's Meadowfoam Rehabilitation	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	5	$65	$325	10	$33	57
39	Oak Woodland Establishment and Preservation Monitoring- (State MMP)	Performance monitoring of Oak Woodland Establishment	MCRCD	74 acres of oak woodland	Years 15 and every 10 years thereafter	Collect data on canopy cover using aerial photographs for established and preserved oak woodland	Labor hrs	1	$65	$65	10	$7	58-59
40		Performance monitoring of Oak Woodland Establishment	MCRCD	Data Entry	Years 15 and every 10 years thereafter	Enter data and organize for inclusion in biological monitoring reports	Labor hrs	1	$65	$65	10	$7	60
41										**Sub-Total Biological Monitoring Cost**		**$18,844**	
42	**Habitat Maintenance**												
43	General Inspections and Maintenance	General Inspections of Mitigation Lands	MCRCD	1,742 acres	Annual	Twice a year (May, November) inspect mitigation parcels for fence repair, culvert repair, trash removal, erosion problems.	Labor hours	468	$65	$30,420	1	$30,420	85-86
44		Habitat Maintenance	MCRCD	1,742 acres	Annual	Annual maintenance such as fence, debris, erosion	Days	12	$2,880	$34,560	1	$34,560	71
45		Habitat Maintenance Technical Guidance	MCRCD	1,742 acres	Annual	Oversee crew approx. 12 days per year.	Labor hours	48	$65	$3,120	1	$3,120	72
46		Fence Maintenance	MCRCD	Repair or replace fences as needed	Annual	~~Fence Repair/maintenance Repair / replace 2% of fence annually.~~ Emergency repair fund for 1/2 mile of fencing set up in short term PAR.							66-68
47		Fence Maintenance	MCRCD	Repair or replace Gates	Every 10 years	Replace gates every 10 years	Unit	107	$201	$21,480	10	$2,148	69
48		Fence Maintenance	MCRCD	Repair or replace Locks	Every 10 years	Replace locks every 10 years	Unit	38	$20	$760	10	$76	70
49		Trash Removal / Disposal	MCRCD	Debris, fence material, etc.	Annual	Take trash to dump.	Ton	3	$73	$219	1	$219	74
50		Well Maintenance and Replacement	MCRCD	Maintenance and replacement	Every 10 years	Maintain and replace wells as necessary	Units	8	$3,000	$24,000	10	$2,400	75
51		Water Trough Maintenance and Replacement	MCRCD	Replacement	Every 7 years	Maintain and replace water troughs as necessary	Units	61	$400	$24,400	7	$3,486	76
52		Ditch Maintenance	MCRCD	Maintenance	Annual	Maintain 2,500 linear feet of ditch	Unit	1	$3,000	$3,000	1	$3,000	77
53		Culvert Maintenance	MCRCD	Maintenance	Annual	Clean out culverts	Unit	1	$4,000	$4,000	1	$4,000	78

PAR Analysis for the Willits Bypass Project - Long-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity/ Action	Responsible Party	Description	Frequency [2]	Actions Required	Unit	Number of Units	Cost/ Unit [1]	Annual Cost (single occurrence cost)	Divide Years	Total Cost (annual set-aside)	Assumption #
54		Culvert Replacement	MCRCD	Replacement	Every 20 years	Replace 10 culverts (<24 inch culverts)	Unit	10	$5,000	$50,000	20	$2,500	79
55		Culvert Replacement	MCRCD	Replacement	Every 50 years	Replace 1 culverts (4 foot culvert)	Unit	1	$12,500	$12,500	50	$250	79a
56		Stream Channel Maintenance	MCRCD	Maintenance	Every 10 years	Maintain 4200 ft of stream channel	Unit	1	$438,274	$438,274	10	$43,827	80
57		Cattle Shade Structure replacement	MCRCD	Maintenance	Every 55 yrs	Shade Structure replacement	Ea	46	$500	$23,000	55	$418	73
58		Cattle Shade Structure maintenance	MCRCD	Maintenance	Every 6 yrs	Shade fabric replacement	Ea	46	$50	$2,300	6	$383	73a
59		Invasive plant Species Control	MCRCD	Conduct invasive species control	Annual	Hand labor	Day	15	$2,880	$43,200	1	$43,200	81
60		Invasive Plant Species Control	MCRCD	Conduct invasive species control	Annual	Direct work crews.	Labor hrs	150	$65	$9,750	1	$9,750	82
61		Invasive Plant Species Control	MCRCD	Conduct invasive species control	Annual	Purchase herbicide.	Units	7	$99	$693	1	$693	83
62		Invasive Plant Species Control	MCRCD	Conduct invasive species control	Annual	Application using backpack sprayer	Labor hrs	140	$65	$9,100	1	$9,100	84
63											**Sub-Total Habitat Maintenance Cost**	**$193,551**	
64	**Field Equipment**												
65	Field Equipment	Misc. Field Equipment Needs/Repair	MCRCD	Misc. field equipment repair,	Annual	As needed for land management activities	Item	1	$2,500	$2,500	1	$2,500	89
66		Camera	MCRCD	Photo monitoring	Every 5 years	Photo monitoring	Item	1	$260	$260	5	$52	90
67		Signage	MCRCD	Identify mitigation lands	Every 5 years	Identify mitigation lands.	Item	98	$15	$1,470	10	$147	91
68		GPS	MCRCD	GPS	Every 10 years	Used to locate monitoring sites.	Item	1	$11,485	$11,485	10	$1,149	93
69		UTV Rental	MCRCD	General maintenance inspection.	Annual	Site access for general maintenance inspection.	Item	2	$325	$650	1	$650	93a
70											**Sub-Total Field Equipment Cost**	**$4,498**	
71	**Reporting**												
72	Reporting	Aerial Photos	MCRCD	Ortho-rectified color photos	Every 10 years	Monitor canopy cover using aerial photos.	Item	1	$15,420	$15,420	10	$1,542	92
73		General Inspection Report	MCRCD	General Inspection Report	Annual	Report includes map of mitigation area, photo documentation, maintenance or management actions, observations from general inspection, Inspection Sheet, endowment accounting, any recommendations for altered management practices	Labor hours	80	$65	$5,200	1	$5,200	87-88
74		Biological Monitoring Report	MCRCD	Biological Monitoring Report	Years 15 and every 10 years thereafter	Prepare Draft report	Labor hours	320	$65	$20,800	10	$2,080	63
75		Biological Monitoring Report	MCRCD	Biological Monitoring Report	Years 15 and every 10 years thereafter	Prepare Final report.	Labor hours	160	$65	$10,400	10	$1,040	64
76		DFG 1600 permit filing fee	MCRCD	Fee to obtain routine maintenance agreement	Every 10 years	Obtain routine maintenance agreement from DFG	Unit	1	$2,700	$2,700	10	$270	100
77											**Sub-Total Reporting Cost**	**$10,132**	
78	**Administration**												

PAR Analysis for the Willits Bypass Project - Long-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity/ Action	Responsible Party	Description	Frequency [2]	Actions Required	Unit	Number of Units	Cost/ Unit [1]	Annual Cost (single occurrence cost)	Divide Years	Total Cost (annual set-aside)	Assumption #
79	Administration	Project Coordination and Management	MCRCD	Supervise planning/management of 1742 ac of mitigation land.	Annual	Coordinate all aspects of mitigation project management, including monitoring contracts, annual maintenance work, review biological monitoring report, review leases, coordinate with ranchers, review grazing plan	Labor hours	450	$65	$29,250	1	$29,250	94
80		Budgeting Management	MCRCD	Manage budget	Annual	Track monthly expenditures, prepare annual expense report, submit to DFG, Caltrans	Labor hours	60	$65	$3,900	1	$3,900	95
81		Audit	MCRCD	State Audit	Every 2 years	State Audit	Fee	1	$2,000	$2,000	2	$1,000	96
82		Liability Insurance	MCRCD	Mitigation Parcels	Annual	Insurance for 1742 acres	Item	1	$1,200	$1,200	1	$1,200	97
83		Misc Office	MCRCD	Misc office expenses	Annual	Supplies such as paper, pens, staples, contribute to computer, printer, software purchases, etc.	Item	1	$500	$500	1	$500	98
84		Legal Fund	MCRCD	Legal/Emergency Fund	Annual	Grow legal fund.	Lump Sum	1	$50	$50	1	$50	99
85		Adaptive Management Fund	Caltrans	Adaptive Management	Set Aside	Stand alone Adaptive Management Fund	Item	0	$0	$0	0	$0	99a
86											**Sub-Total Administration Cost**	**$35,900**	
87	**Financial Summary**												
88	Financial Summary	Ongoing Annual Costs	MCRCD			Sub-Total Biological Monitoring Cost + Sub-Total Habitat Maintenance Cost + Sub-Total Field Equipment Cost + Sub-Total Reporting Cost + Sub-Total Administration Cost						$262,924	103
89		Contingency Expense	MCRCD	10% contingency = Ongoing Annual Costs x 10%.	Ongoing Annual Cost	Fund is to cover unanticipated expenses, adaptive management.	Item	1	$26,292	$26,292	1	$26,292	104
90											**Sub-Total Ongoing Annual & Contingency Cost**	**$289,216**	
91		Ongoing Administrative Costs	MCRCD	Ongoing Administrative Costs = 33% of Sub-Total On-going Annual and Contingency Costs	Annual	Covers the off-site costs needed to manage the mitigation effort	Item	1	$95,441	$95,441	1	$95,441	101
92		CDFG Administration of conservation easement oversight.	CDFG		Annual	Covers the cost of overseeing the Conservation Easement	Labor hours	32	$85	$2,720	1	$2,720	102
93											**Total Annual Ongoing Cost**	**$384,657**	
94		Funding Endowment	MCRCD	Establish endowment based on 4.0 % return and Total Annual Ongoing cost of $384,657	Lump Sum	Receive endowment funds	Lump Sum Payment	$9,616,433				$9,616,433	105
95	**Endowment to Provide Annual Income of $413,199**											**$9,616,433**	

[1] Hourly rate for personnel as provided by Miguel Segura

PAR Assumptions for Long-Term Maintenance and Monitoring Periods (Updated 04-15-13)

Mitigation Feature/Category	Assump #	Assumptions
General Assumptions	1	All information is taken from the USACE 2012 Mitigation and Monitoring Proposal Report (January 2012) or the 2012 State MMP (June 2012) or the 2012 Grazing Management Plan.
	2	1 Field Day = 8 hrs
	3	1 staff day = 8 hrs
	4	Takes 2 people 30 minutes to monitor 1 quadrat. Includes set up, data collection, photo and move to next location on transect. Therefore 2 people can monitor 20 quadrats in 1 field day. Unless otherwise noted
	5	Takes 2 people 1 hour to monitor one line-intercept transect. Includes set up, data collection, photo, and move to next location. Therefore 2 people can monitor 10 transects in 1 field day. Unless otherwise noted
	6	8-person Landscape Crew costs $2880 a day: $45/hr x 8 people = $360 per hr x 8 hr day = $2880 per day
	7	Data entry. Assumes it takes 1 minute to enter each CRAM AA data and invasive species quadrat data. Assumes it takes 2 minutes to enter other quadrat data. Assumes it takes 1 person 1 hour to digitize 96 acres of cover. Assumes it takes 12 minutes to enter each hydroperiod data. Assumes it takes 36 seconds to enter data from each line transect. Assumes it takes 2 seconds to enter each survival and vigor data point. Assumes it takes 1 second to enter each tree density data point.
Wetland Establishment Monitoring (Group 1 and 2)	8	59.4 acres to be monitored (24.53 Group 1 and 34.87 Group 2)
	9	Collect data on relative cover by wetland plant species, relative cover by native wetland species from list of target species, absolute cover by invasive species.
	10	Group 1: Assumes 2 people can monitor 32 quadrats in an 8 hour day. Assumes 5 - 100 m transects per acre. 24.53 acres x 500m = 12,265 m / 100 m per quadrat = 123 quadrats (rounded up) / 32 quadrats per day = 3.8 days (rounded up) x 2 people x 8 hour day = **61 hrs** (rounded up)
	11	Group 2: Assumes 2 people can monitor 32 quadrats in an 8 hour day. Assumes 5 - 100m transects per acre. 34.87 acres x 500 m = 17,435 m / 100 m per quadrat = 175 quadrats (rounded up) / 32 quadrats per day = 5.5 days (rounded up) x 2 people x 8 hour day = **88 hrs**
	12	Hydroperiod Monitoring - 16 wetlands. Assume 2 people can monitor (depth gauge soil saturation and gps extent of ponding) 4.8 wetlands per day. Assumes monitoring 2 times a month x 7 months (Nov -May) = 14 events. 16 wetlands / 4.8 wetlands per day = 3.4 days (rounded up) x 2 people x 8 hr day =54.4 hrs x 14 events = **762 hrs** (rounded up)
	13	Group 1: 1 hr travel (between transects) per day of field work x 3.8 days = 3.8 hrs x 2 people = **8 hrs** (rounded up)
	14	Group 2: 1 hr travel (between transects) per day of field work x 5.5 days; 5.5 hrs x 2 people = **11 hrs**
	15	Enter data and organize for inclusion in biological monitoring report. **14 hrs** (rounded up)
Other Waters Rehabilitation (USACE)	16	17.98 acres in 3 areas to be monitored
	17	**Riparian Cover Monitoring** (Absolute cover by native tree species, absolute cover by native shrub species, general site conditions and photopoints)
	18	Assumes 600 m of transects. Assumes 2 people can survey 240 m per day. 600 m / 240 m per day = 2.5 days x 2 people x 8 hr days = **40 hrs.**
	19	1 hr travel per day of field work x 2.5 days x 2 people = **5 hrs**
	20	Enter data and organize for inclusion in biological monitoring report. **7 hrs** (rounded up)
Wetland Rehabilitation Monitoring (wet meadow) (Type 1)	21	72.79 acres (total gross acreage of Type 1 Rehabilitation)
	22	Assess relative cover by wetland plant species, relative cover by selected native plant species from the list of approved species, absolute cover by invasive species, species richness, general site condition and photopoints. Assumes 4200 m of transects with 1 quadrat per 100 m. Assumes 2 people can monitor 32 quadrats per day. 4200 m of transects /100 m = 42 quadrats / 32 quadrats per day = 1..4 (rounded up) days x 2 people x 8 hour days = **23 hrs** (rounded up)
	23	1 hr travel (between transects) per day of field work x 1.4 days = 1.4 hrs x 2 people = **3 hrs** (rounded)
	24	Enter data and organize for inclusion in biological monitoring report. **2 hrs** (rounded up)
Wetland Rehabilitation Monitoring (wet meadow) (Type 2)	25	30.02 acres (total gross acreage) to be monitored
	26	Assess relative cover by wetland plant species, relative cover by selected native plant species from the list of approved species, absolute cover by invasive species, species richness, general site condition and photopoints. Assumes 2000 m of transects with 1 quadrat for every 100 m. Assumes 2 people can monitor 32 quadrats per day. 2000 m of transects / 100 m per quadrat = 20 quadrats / 32 quadrats per day = 0.7 days (rounded up) x 2 people x 8 hr days = **12 hrs** (rounded up)
	27	1 hr travel (between transects) per day of field work x 0.7 days = 0.7 hrs x 2 people = **2 hrs** (rounded up)
	28	Enter data and organize for inclusion in biological monitoring report. **1 hrs** (rounded up)
Wetland Rehabilitation Monitoring (woody species) (Type 3)	29	179.01 acres (total gross acreage) to be monitored
	30	**Cover Monitoring** (Assess relative cover by wetland plant species, relative cover by selected native plant species from the list of approved species, absolute cover by invasive species, species richness, general site condition and photopoints.)
	31	Assumes 11,000 m of transects with 1 quadrat every 100 m . Assumes 2 people can collect data from 32 quadrats per day. 11,000 m of transects / 100m per quadrat = 110 quadrats / 32 quadrats per day = 3.5 days (rounded up) x 2 people x 8 hrs per day = **56 hrs**
	32	1 hr travel per day of field work x 2.75 days = **3 hrs**
	33	Enter data and organize for inclusion in annual monitoring report. **4 hrs** (rounded up)

PAR Assumptions for Long-Term Maintenance and Monitoring Periods (Updated 04-15-13)

Wetland Rehabilitation Monitoring (woody species) (Type 4)	34	41.71 acres (total gross acreage) to be monitored
	35	**Cover Monitoring.** Assess relative cover by wetland plant species, relative cover by selected native plant species from the list of approved species, absolute cover by invasive species, species richness, general site condition and photopoints. Assumes 3,100 m of transects with 1 quadrat every 100 m. Assumes 2 people can collect data from 32 quadrats per day. 3,100 m of transects / 100m per quadrat = 31 quadrats / 32 quadrats per day = 1 day (rounded up) x 2 people x 8 hrs per day = **16 hrs**
	36	1 hr travel per day of field work x 1 day = **1 hr**
	37	Enter data and organize for inclusion in biological monitoring report. **1 hr**
Wetland Rehabilitation Monitoring (woody species) (Type 5)	38	21.1 acres (total gross acreage) to be monitored
	39	**Cover Monitoring.** Assess relative cover by wetland plant species, relative cover by selected native plant species from the list of approved species, absolute cover by invasive species, species richness, general site condition and photopoints. Assumes 3,700 m of transects with 1 quadrat every 100 m. Assumes 2 people can collect data from 32 quadrats per day. 3,700 m of transects / 100m per quadrat = 37 quadrats / 32 quadrats per day = .1.2 days (rounded up) x 2 people x 8 hrs per day = **20 hrs**
	40	1 hr travel per day of field work x 1.2 days = **2 hr** (rounded up)
	41	Enter data and organize for inclusion in annual monitoring report. **2 hrs** (rounded up)
Other Waters Rehabilitation / Riparian Establishment- (State MMP) This data is collected on the USACE Other waters properties also.	42	**Cover Monitoring.** Assess percent relative cover by native tree and shrub species. Assumes 3500 m of transects. Assumes a 2 person crew can survey 240 m a day. 3500 m / 240 m per day = 14.6 days (rounded up) x 2 people x 8 hr days = **234 hrs** (rounded up)
	43	**Riparian Cover from Aerial.** Assess percent riparian from aerial photo, including digitizing, and field check (field check is covered in the cover monitoring above). Assumes 1 person can digitize 96 acres per hour . Assumes 28.61 acres of State Riparian Establishment. 28.61 acres / 96 acres per hour = 1 hr (rounded up) = **1 hr.**
	44	1 hr travel per day of field work x 14.6 days (cover) = **15 hrs** (rounded up)
	45	Enter data and organize for inclusion in biological monitoring report. **1 hr** (rounded up)
Rehabilitated Wetlands - Grazed and Ungrazed (State MMP)	46	Assess Level 2 data collection on 89 CRAM AA units. Assumes 2 people can monitor 2.4 AA's per 8 hour day. 89 AA's / 2.4 AA's per day = 37.1 days (rounded up) x 2 people x 8 hrs = **594 hrs** (rounded up)
	47	Assess absolute cover by invasive species. Assumes 89 CRAM AA's with 1 transect per AA. Assumes 2 people can survey 3.2 transects per day. 89 CRAM AA's x 1 Transect per AA = 89 transects / 3.2 transects per day = 27.9 days x 2 people x 8 hour days = **447 hrs** (rounded up)
	48	1 hr travel per day of field work x 27.9 days (invasive) = **28 hr** (rounded up)
	49	1 hr travel per day of field work x 37.1 days (CRAM) = **38 hr** (rounded up)
	50	Enter data and organize for inclusion in biological monitoring report. **17 hrs** (rounded up)
North Coast Semaphore Grass Establishment Areas- (State MMP)	51	Collect quadrat data on invasive species and NCSG abundance . Includes travel time between sites. Assuming 1000 m of transects and 1 quadrat for every 15 m = 67 quadrats. Assumes 2 people can monitor 60 quadrats per day. 67 quadrats / 60 quadrats per day = 1.11 days (rounded up) x 2 people x 8 hr day = **18 hrs** (rounded up)
	52	Enter data and organize for inclusion in biological monitoring report. **3 hrs** (rounded up)
North Coast Semaphore Grass Rehabilitation Areas- (State MMP)	53	Assess abundance and environmental conditions such as hydrology, woody species intrusion and invasives will be recorded and mapped as necessary. Includes travel time between sites. Assumes 1815 m of transects with 1 quadrat every 15 m for a total of 120 quadrats. Assumes 2 people can monitor 40 quadrats in an 8 hour day. 120 quadrats / 40 quadrats per day = 3 day x 2 people x 8 hrs = **48 hrs**
	54	Enter data and organize for inclusion in biological monitoring report. **4 hrs**
Baker's Meadowfoam Rehabilitation- (State MMP)	55	There are 15 CRAM AA's. Collect data on population distribution and abundance using GPS. Assess general site conditions and photo monitoring. Includes travel time between sites.
	56	Assumes 2 people can survey 0.8 AAs per 8 hour day. 15 AA's x 0.8 AA per day = 18.75 days x 2 people x 8 hrs per day = **300 hrs**
	57	Enter data and organize for inclusion in biological monitoring report. **5 hrs** (rounded up)
Oak Woodland Establishment and Preservation Monitoring- (State MMP)	58	Canopy cover will be assessed from aerial photographs for 74 acres of oak woodland . Assumes 74 acres of canopy cover to be assessed (6.72 acres, established + 49.79 acres, preserved + 16.56 acres (Brooke property) = 74 acres, rounded up). Assumes 1 person can digitize 96 acres per hour.
	59	74 acres / 96 acres per hour =**1 hr** (rounded up)
	60	Enter data and organize for inclusion in biological monitoring report. **1 hr** (rounded up)
Biological Monitoring Report	61	Includes wetland establishment, wetland rehabilitation, other waters , North Coast Semiphore Grass establishment and rehabilitation areas, Baker's Meadowfoam rehabilitation, oak woodland creation / preservation
	62	Includes graphic, summaries and photos.
	63	To prepare draft report = **320 hrs**
	64	To prepare final report = **160 hrs**
Habitat Maintenance	65	
Fence Repair/Maintenance	66	Assumes 40.87 miles of fence. All fence will be replaced in first 3 years under construction contract. $5.00 per foot includes all labor and materials to put in fencing.
	~~67~~	~~Assume 2% of fence is repaired / replaced annually.~~

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	68	One time cost to fix 1/2 mile of fence (2640 feet x $5.00 per foot = $13,200 in an emergency situation placed in the Short Term PAR. Assumes Grazing leases will make Leasee reponsible for fence repair and replacement as this is normal practice. Assumes these funds will be used in an emergency if the Leasee can't react quickly enough and will be replenished after billing Leasee.
	69	Gate replacement - $200.75 per gate every 10 years. There are 107 gates. Number of gates based on grazing management plan plus estimate of additional interior gates in areas where they are needed yet grazing management plan did not identify.
	70	Lock replacement - $20.00 per lock every 10 years. There are 38 perimeter gates. Interior gates don't need pad locks
On-going Annual Maintenance Labor (fence maintenance, trash pick up, misc.)	71	1,742 acres of total mitigation lands. Does not include invasive species work. 1 crew 1 day per month x $2880/day x 12 = **$34,560 annually.**
	72	Technical Guidance of crew: 6 days x 8 hrs/day = **48 hrs annually.**
	73	Cattle Shade Structures. West Unit 14 structures, Middle Unit 12 structures, East Unit 20 structures. Total 46 structures at $500 ea. Replace every 55 yrs.
	73a	Cattle Shade Structure Fabric replacement. Replace 46 structure fabric every 6 yrs at a cost of $50 each = $2,300
	74	Trash removal. Assumes 3 tons of debris at $73 per ton
	75	Well Maintenance and Replacement - $3000/well every 10 years. There are 8 well that will be maintained in perpetuity. This cost covers replacing motors, pressure tanks, fuses or other well maintenance needs.
	76	Water Trough Maintenance and Replacement - $400/trough every 7 years. There are 61 troughs. Number of troughs based on grazing plan, cost of trough obtained from internet cost comparison of 8ft by 2ft round galvanized or plastic tank, Pipe repair is contained in replacement. Underground piping is not expected to decay. Repair of piping will be covered in contingency if needed.
	77	Ditch Maintenance - $3,000/2,500 linear feet of ditch maintenance annually. Covers removal and disposal of sediment.
	78	Culvert Maintenance - $4,000 to maintain 30 culverts annually. Clean out and disposal of sediment.
	79	Culvert Replacement - $5,000 per culvert to replace 10 culverts (<24"culverts) every 20 years. Includes material, labor, removal and disposal of old culvert.
	79a	Culvert Replacement - $12,500 per culvert to replace 1 culvert (4 foot culvert on Boy Scout Creek) every 20 years. Includes material, labor, removal and disposal of old culvert.
	80	Maintain 4200 ft of stream channel every 10 yrs. Assumes 35 feet wide and 2 feet deep. Cost for removal of 13,611 cubic yards @ $32.20 per yard = $438,274. Total stream maintenance cost = $438, 274
On-going Annual Invasive Plant Species Control	81	1 crew x 3 days/month x 5 months/year = 15 days/year x $2880/day = **$43,200 annually**
	82	Technical Guidance of crew: 15 days x 10 hrs/day = **150 hrs annually.**
	83	Herbicide purchase No more than 2% of property will have invasives because that is a requirement. 1742 acres x 2% = 35 acres (rounded up) x 2 qt / acre (application rate, Roundup Pro)= 70 quarts / 4 qts per gal = 17.5 gal. 17.5 gal / 2.5 gal (sold in 2.5 gal jugs) = 7 units x $99.00 per unit = **$693 per year**
	84	Assumes 1 person can spray 0.5 acres per hour. 1742 acres x 2% = 35 acres (rounded up) / 0.5 acre per hour = 70 hrs x 2 applications per year **=140 hrs**
General Inspection	85	1,742 acres of total mitigation lands. Assumes 1 person can inspect 150 acres per day. 1,742 acres / 150 =11.7 days (rounded up) x 8 hr day = 93.6 hrs per inspection
	86	2 inspections / yr x 93.6 hrs = **468 hrs**
General Inspection Annual Report	87	Report includes map of mitigation area, photo documentation of select mitigation areas, description of maintenance, management actions, observations from General Inspections, observations of Security Inspections, Inspection Sheet, endowment accounting, any recommendations for altered management practices.
	88	Estimate 40 hrs to organize information and 40 hrs to prepare draft and final report. **Total 80 hrs.**
Equipment	89	$2500 in miscellaneous Field Equipment Needs/Repair - Assumes field equipment needs to purchased and replaced
	90	Camera: Average of 10 cameras
	91	Signage - assumes 4 signs per mile of exterior fence line. Approximately 24.3 miles of exterior property line x 4 signs per mile = 98 signs (rounded up to next whole number).
	92	Ortho-rectified color photos. Assumes 1:2000 color, 16 flight lines, 264 exposures = $12,000. Estimate 1 scan time is 38 hours x $90 an hour = $3,420. Total = $12,000+$3,420 = **$15,420**
	93	Purchase 1 GPS units and Warranty. GeoXt 6000 ($6495), Terrasync Software ($2995), Pathfinder software ($1995). Total cost $11,485.
	93a	Two weeks of UTV rental per year for yearly compliance monitoring. $325 per week x 2 weeks = $650
Administration	94	Project Coordination and Management - Coordinate all aspects of mitigation project management, including monitoring contracts, annual maintenance work, review biological monitoring report, review leases, coordinate with ranchers and resource agencies, review grazing plan.
	95	Budgeting Management - Track monthly expenditures, prepare annual expense report, submit to DFG, Caltrans
	96	Audit - assumes a $2000 fee every two years for audit.
	97	Liability Insurance. Estimated at $1200 per year for monitoring and maintenance - does not include any structures or equipment
	98	Misc Office
	99	Grow Legal Fund
	99a	Adaptive Management Fund. Caltrans will be keeping the responsibility for Adaptive Management and funding of those tasks.
	100	DFG 1600 permit - Obtain routine maintenance agreement. $2,700 every 10 years
Financial Summary	101	Administrative Rate: This is to provide money for off-site project management costs needed to run an effective program. Using Forced Account Method which calculates Administration at 33% of On Going Annual and Contingency Cost.

PAR Assumptions for Long-Term Maintenance and Monitoring Periods (Updated 04-15-13)

	102	DFG needs 4 days to oversee the Conservation Easement
	103	On Going Annual Cost = Sub-Total Biological Monitoring Cost + Sub-Total Habitat Maintenance Cost + Sub-Total Field Equipment Cost + Sub-Total Reporting Cost + Sub-Total Administration Cost
	104	Contingency Expense is 10% of On Going Annual Cost (Assumption 104)
	105	Funding Endowment based on a 3.5% return to generate the Total Annual On Going Cost

PAR Analysis for the Willits Bypass Project - Short-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity / Action	Description	Frequency	Actions Required	Unit	Number of Units	Cost/Unit [1]	Total Cost	Assumption #
1	**Biological Monitoring**									
2	Wetland Establishment (Group 1)	Performance monitoring of wetland establishment sites (Group 1): Vegetation Sampling	24.53 acres; assumes the total acreage of wetland establishment will be monitored	Yrs 1-5	Collect data on relative cover by wetland species, relative cover by native wetland species from the list of target species, absolute cover by invasive species (quadrat and releve), species richness (yr 1), general site conditions and photopoints	Labor hrs	312	$65	$20,280	14
3		Performance monitoring of wetland establishment sites (Group 1): Vegetation Sampling	24.53 acres; assumes the total acreage of wetland establishment will be monitored	Yrs 1-5	Travel between monitoring locations	Labor hrs	31	$65	$2,015	15
4		REFERENCE Performance monitoring of Wetland Establishment sites (Group 1)	3 locations	Yrs 1-5	Collect data on relative cover by wetland species, relative cover by native wetland species from the list of target species, absolute cover by invasive species (quadrat and releve), species richness (yr 1), general site conditions and photopoints	Labor hrs	80	$65	$5,200	16
5		REFERENCE Performance monitoring of Wetland Establishment sites (Group 1)	3 locations	Yrs 1-5	Travel between monitoring locations	Labor hrs	10	$65	$650	17
6		Hydroperiod Performance Monitoring: (Group 1)	6 locations	Yrs 1-5	Collect data on extent of ponding, soil saturation, depth	Labor hrs	1,456	$65	$94,640	18-20
7		Hydroperiod Performance Monitoring: (Group 1)	6 locations	Yrs 1-5	Travel between monitoring locations	Labor hrs	175	$65	$11,375	21
8		REFERENCE Hydroperiod Performance monitoring of Wetland Establishment sites (Group 1)	3 locations	Yrs 1-5	Collect data on extent of ponding, soil saturation, depth	Labor hrs	700	$65	$45,500	22
9		REFERENCE Hydroperiod Performance monitoring of Wetland Establishment sites (Group 1)	3 locations	Yrs 1-5	Travel between monitoring locations	Labor hrs	88	$65	$5,720	23
10		Performance Monitoring: Data Entry	24.53 acres and the reference sites	Yrs 1-5	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	39	$65	$2,535	24-27
11	Wetland Establishment (Group 2)	Performance monitoring of wetland establishment sites (Group 2): Cover Sampling	34.87 acres; assumes the total acreage of wetland establishment will be monitored	Yrs 1-10	Collect data on relative cover by wetland species, relative cover by native wetland species from the list of target species, absolute cover by invasive species (quadrat and releve), species richness (yr 1), general site conditions and photopoints	Labor hrs	880	$65	$57,200	28
12		Performance monitoring of wetland establishment sites (Group 2): Cover Sampling	34.87 acres; assumes the total acreage of wetland establishment will be monitored	Yrs 1-10	Travel between monitoring locations	Labor hrs	110	$65	$7,150	29
13		REFERENCE - cover sampling - Performance monitoring of Wetland Establishment sites (Group 2)	7 locations	Yrs 1-10	Collect data on relative cover by wetland species, relative cover by native wetland species from the list of target species, absolute cover by invasive species (quadrat and releve), species richness (yr 1), general site conditions and photopoints	Labor hrs	360	$65	$23,400	30
14		Performance monitoring of wetland establishment sites (Group 2): Reference Cover Sampling	34.87 acres; assumes the total acreage of wetland establishment will be monitored	Yrs 1-10	Travel between monitoring locations	Labor hrs	44	$65	$2,860	31
15		Performance Monitoring: Hydroperiod (Group 2)	10 locations	Yrs 1-10	Collect data on extent of ponding, soil saturation, depth	Labor hrs	4,710	$65	$306,150	34
16		Performance Monitoring: Hydroperiod (Group 2)	10 locations	Yrs 1-10	Travel between monitoring locations	Labor hrs	588	$65	$38,220	35
17		REFERENCE - hydroperiod - Performance monitoring of Wetland Establishment sites: (Group 2)	7 locations	Yrs 1-10	Collect data on extent of ponding, soil saturation, depth	Labor hrs	3,360	$65	$218,400	36
18		REFERENCE - Performance Monitoring: Hydroperiod (Group 2)	7 locations	Yrs 1-10	Travel between monitoring locations	Labor hrs	420	$65	$27,300	37
19		Performance Monitoring: Data Entry	Monitoring and Reference Sites	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	104	$65	$6,760	38-41

PAR Analysis for the Willits Bypass Project - Short-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity / Action	Description	Frequency	Actions Required	Unit	Number of Units	Cost/Unit [1]	Total Cost	Assumption #
20	Wetland Rehabilitation - Ungrazed (Types 1)	Performance monitoring of wetland rehabilitation sites (Type 1)	72.8 acres; assumes the total acreage of wetland rehabilitation will be monitored	Yrs 1-10	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	230	$65	$14,950	59
21		Performance monitoring of wetland rehabilitation sites (Type 1)	72.8 acres; assumes the total acreage of wetland rehabilitation will be monitored	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	14	$65	$910	61
22	Wetland Rehabilitation - Ungrazed (Types 2	Performance monitoring of wetland rehabilitation (Type 2)	30.02 (acres ; assumes the total acreage of wetland rehabilitation will be monitored	Yrs 1-10	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	120	$65	$7,800	62-65
23		Performance monitoring of wetland rehabilitation sites (Type 2)	30.02 (acres ; assumes the total acreage of wetland rehabilitation will be monitored	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	7	$65	$455	67
24	Wetland Rehabilitation - Ungrazed (Type 3)	Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 1-5	Collect data on plant survival and vigor (yrs 1-5).	Labor hrs	14,280	$65	$928,200	70-72
25		Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 5-10	Collect data on tree density.	Labor hrs	444	$65	$28,860	73-75
26		Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 1-10	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	560	$65	$36,400	76-78
27		Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 1-5	Travel between monitoring locations (Survival)	Labor hrs	1,785	$65	$116,025	79
28		Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 5-10	Travel between monitoring locations (tree density)	Labor hrs	28	$65	$1,820	80
29		Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 1-10	Travel between monitoring locations (cover)	Labor hrs	21	$65	$1,365	81
30		Performance monitoring of wetland rehabilitation sites (Type 3)	179.01 acres	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	836	$65	$54,340	82-84
31	Wetland Rehabilitation - Ungrazed (Type 4)	Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 1-5	Collect data on plant survival and vigor (yrs 1-5)	Labor hrs	3,892	$65	$252,980	87-89
32		Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 5-10	Collect data on tree density.	Labor hrs	126	$65	$8,190	90-92
33		Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 1-10	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	160	$65	$10,400	93-95
34		Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 1-10	Travel between monitoring locations (Survival monitoring)	Labor hrs	487	$65	$31,655	96
35		Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 1-10	Travel between monitoring locations (Tree density monitoring)	Labor hrs	8	$65	$520	97
36		Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 1-10	Travel between monitoring locations (Cover monitoring)	Labor hrs	10	$65	$650	98
37		Performance monitoring of wetland rehabilitation sites (Type 4)	41.71 acres	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	230	$65	$14,950	99-101
38	Wetland Rehabilitation - Ungrazed (Type 5)	Performance monitoring of wetland rehabilitation sites (Type 5)	21.1 acres	Yrs 1-5	Collect data on plant survival and vigor (yrs 1-5)	Labor hrs	2,245	$65	$145,925	104-106
39		Performance monitoring of wetland rehabilitation sites (Type 5)	21.1 acres	Yrs 5-10	Collect data on tree density.	Labor hrs	260	$65	$16,900	107-109

PAR Analysis for the Willits Bypass Project - Short-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity / Action	Description	Frequency	Actions Required	Unit	Number of Units	Cost/Unit [1]	Total Cost	Assumption #
40		Performance monitoring of wetland rehabilitation sites (Type 5)	21.1 acres	Yrs 1-10	Collect data on relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, species richness, absolute cover by invasive species, assess general site conditions and photo documentation	Labor hrs	200	$65	$13,000	110-112
41		Performance monitoring of wetland rehabilitation sites (Type 5)	21.1 acres	Yrs 1-5	Travel between monitoring locations (survival)	Labor hrs	281	$65	$18,265	113
42		Performance monitoring of wetland rehabilitation sites (Type 5)	21.1 acres	Yrs 5-10	Travel between monitoring locations (tree density)	Labor hrs	10	$65	$650	114
43		Performance monitoring of wetland rehabilitation sites (Type 5)	21.1 acres	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	140	$65	$9,100	115-117
44	Other Waters Rehabilitation	Performance monitoring of Other Waters (non-wetland riparian) rehabilitation sites	17.98 acres	Yrs 1-5	Collect data on plant survival, vigor, general site conditions and photopoints(yrs 1-5).	Labor hrs	2,608	$65	$169,520	44-46
45		Performance monitoring of Other Waters (non-wetland riparian) rehabilitation sites	17.98 acres	Yrs 5-10	Collect data on percent vegetation cover, general site conditions and photopoints (yrs 5-10).	Labor hrs	240	$65	$15,600	47-48
46		Performance monitoring of Other Waters (non-wetland riparian) rehabilitation sites	17.98 acres	Yrs 5-10	Collect data on tree density.	Labor hrs	20	$65	$1,300	49
47		Performance monitoring of Other Waters (non-wetland riparian) rehabilitation sites	17.98 acres	Yr 10	Collect data on percent riparian from aerial photo and field check	Labor hrs	4	$65	$260	50
48		Performance monitoring of Other Waters (non-wetland riparian) rehabilitation sites	17.98 acres	Yrs 1-10	Travel between monitoring locations	Labor hrs	611	$65	$39,715	51-53
49		Performance monitoring of Other Waters (non-wetland riparian) rehabilitation sites	17.98 acres	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	601	$65	$39,065	54-56
50	Other Waters Rehabilitation / Riparian Establishment - (State MMP)	Performance monitoring of Other Waters rehabilitation sites (State MMP)	28.61 acres	Yrs 1-5	Collect data on survival and vigor of plantings	Labor hrs	4,144	$65	$269,360	118-119
51		Performance monitoring of Other Waters rehabilitation sites (State MMP)	Collect data on 3500 m of transects	Yr 5, 6, 8, 10	Collect data on percent absolute cover by native tree and shrub species along transect	Labor hrs	936	$65	$60,840	120
52		Performance monitoring of Other Waters rehabilitation sites (State MMP)	28.61 acres	Yr 10	Collect data on percent riparian from aerial photo.	Labor hrs	1	$65	$65	121
53		Performance monitoring of Other Waters rehabilitation sites (State MMP)	Collect data in 15 CRAM AA's	Yr 3, 5, 7, 10	Collect Level 2 data (CRAM)	Labor hrs	400	$65	$26,000	122
54		Performance monitoring of Other Waters rehabilitation sites (State MMP)			Collect data on Temperature. These are covered in Water Quality Monitoring, Bioassessment Monitoring and or the Erosion Assessment Monitoring	Labor hrs				
55		Performance monitoring of Other Waters rehabilitation sites (State MMP)			Collect data on Sediment. These are covered in Water Quality Monitoring, Bioassessment Monitoring and or the Erosion Assessment Monitoring	Labor hrs				
56		REFERENCE Performance monitoring of Other Water Rehabilitation. (21 sites)	Collect data on 2100 m of transects	Yrs 5-10	Collect data on Reference Sites on percent absolute cover by native tree and shrub species along transect	Labor hrs	875	$65	$56,875	123
57		REFERENCE Performance monitoring of Other Water Rehabilitation. (21 sites)	Collect data on cover from aerial photo	Yr 10	Collect data on Reference Sites on percent riparian from aerial photo	Labor hrs	1	$65	$65	124
58		Performance monitoring of Other Waters rehabilitation sites (State MMP)	Will have collected on 19.41 acres required by USACE. Need to collect data on the remaining acreage for State MMP	Yrs 1-5	Travel between monitoring locations for survival and vigor monitoring	Labor hrs	518	$65	$33,670	125
59		Performance monitoring of Other Waters rehabilitation sites (State MMP)	Collect data on 3500 m of transects	Yr 10	Travel between monitoring locations for aerial cover monitoring	Labor hrs	15	$65	$975	126
60		Performance monitoring of Other Waters rehabilitation sites (State MMP)	Collect data in 15 CRAM AA's	Yr 3, 5, 7, 10	Travel between monitoring locations for CRAM monitoring	Labor hrs	25	$65	$1,625	127
61		REFERENCE Performance monitoring of Other Water Rehabilitation. (21 sites)	Collect data on 2100 m of transects	Yrs 5-10	Travel between monitoring locations for percent absolute cover by native tree and shrub species along transect	Labor hrs	53	$65	$3,445	128
62		Performance monitoring of Other Waters rehabilitation sites (State MMP) and Reference sites	Data entry	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	500	$65	$32,500	129-132

PAR Analysis for the Willits Bypass Project - Short-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity / Action	Description	Frequency	Actions Required	Unit	Number of Units	Cost/Unit [1]	Total Cost	Assumption #
63	Rehabilitated Wetlands - Grazed and Ungrazed (State MMP)	Performance monitoring of Rehabilitated Wetland sites	Collect data on the 89 CRAM AA's	Yrs 3,5,7,10	Collect data on CRAM biotic attribute values, assess general site conditions and photopoints.	Labor hrs	2,376	$65	$154,440	133
64		Performance monitoring of Rehabilitated Wetland sites	Collect data on the 89 CRAM AA's that have level3 data requirements	Yrs 2,4,5,7,9,10	Collect data on absolute cover by invasive species by transect.	Labor hrs	2,682	$65	$174,330	134
65		Performance monitoring of Rehabilitated Wetland sites	Collect data on the 89 CRAM AA's that have level3 data requirements	Yrs 2,4, 9	Travel between monitoring locations for invasive monitoring	Labor hrs	84	$65	$5,460	135
66		Performance monitoring of Rehabilitated Wetland sites	Collect data on the 89 CRAM AA's	Yrs 3,5,7,10	Travel between monitoring locations for CRAM monitoring	Labor hrs	149	$65	$9,685	136
67		Residual Dry Matter (RDM) data collection	Collect RDM	Yrs 1-10	Collect RDM	Labor hrs	56	$65	$3,640	137
68		Performance monitoring of Rehabilitated Wetland sites	Enter data	Yrs 2, 3, 4, 5, 7, 9, 10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	98	$65	$6,370	138-139
69	North Coast Semaphore Grass Establishment Areas- (State MMP)	Performance monitoring of North Coast Semaphore Grass Establishment Areas	Collect data on the Huffman parcel establishment areas	Yrs 1-10	Collect data on plant survival and vigor of transplants, assess general site conditions and photopoints	Labor hrs	1,088	$65	$70,720	140
70		Performance monitoring of North Coast Semaphore Grass Establishment Areas	Collect data on the Huffman parcel establishment areas	Yrs 1-10	Collect data on plant survival and vigor of container plants	Labor hrs	0	$65	$0	141
71		Performance monitoring of North Coast Semaphore Grass Establishment Areas	Collect data on the Huffman parcel establishment areas	Yrs 1-10	Collect data on invasive species (quadrats).	Labor hrs	192	$65	$12,480	142
72		Performance monitoring of North Coast Semaphore Grass Establishment Areas	Collect data on the Huffman parcel establishment areas	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	54	$65	$3,510	143-144
73		Performance monitoring of North Coast Semaphore Grass Establishment Areas	Replanting effort at yr 5	yr 5	Replant 20% of population as needed	Labor hrs	181	$65	$11,765	145
74	North Coast Semaphore Grass Rehabilitation Areas- (State MMP)	Performance monitoring of North Coast Semaphore Grass Rehabilitation Areas	Collect data on the Arkelian, Goss, Lusher East and MGC Plasma parcels rehabilitation areas	Yrs 1-10	Assess population distribution and abundance, absolute cover by woody species in the understory, absolute cover of invasive species, general site conditions and photo stations	Labor hrs	496	$65	$32,240	146
75		Performance monitoring of North Coast Semaphore Grass Rehabilitation Areas	Collect data on the Arkelian, Goss, Lusher East and MGC Plasma parcels rehabilitation areas	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	40	$65	$2,600	147
76	Baker's Meadowfoam Rehabilitation- (State MMP)	Performance monitoring of Baker's Meadowfoam Rehabilitation	15 CRAM AA's with Bakers Meadowfoam	Yrs 1-10	Collect data on population distribution and abundance. Collect data on absolute cover by native plant species. Collect data on absolute cover by invasive species. Assess general site conditions and photo monitoring	Labor hrs	3000	$65	$195,000	148-149
77		Performance monitoring of Baker's Meadowfoam Rehabilitation	15 CRAM AA's with Bakers Meadowfoam	Yrs 1-10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	50	$65	$3,250	150
78	Oak Woodland Establishment- (State MMP)	Performance monitoring of Oak Woodland Establishment (Watson and Brooke parcel)	23.28 acres of Oak Woodland creation/restoration	Yrs 1 -6, 8, 10	Collect data on plant survival and vigor .	Labor hrs	368	$65	$23,920	151-152
79		Performance monitoring of Oak Woodland Establishment (Watson and Brooke parcel)	23.28 acres of Oak Woodland creation/restoration	Yrs 1 -6, 8, 10	Travel between monitoring locations for survival and vigor monitoring	Labor hrs	46	$65	$2,990	153
80		REFERENCE SITE: Performance monitoring of Oak Woodland Establishment	23.28 acres of Oak Woodland creation/restoration	Yrs 1 -6, 8, 10	Reference site: Qualitative assessment of the condition at the reference site, assess general site conditions and photo stations	Labor hrs	128	$65	$8,320	154
81		Performance monitoring of Oak Woodland Establishment (Watson and Brooke parcel)	23.28 acres of Oak Woodland creation/restoration	Yrs 1 -6, 8, 10	Enter data and organize for inclusion in annual monitoring reports	Labor hrs	20	$65	$1,300	155
82	Water Quality Monitoring - (State MMP)	Performance monitoring to partially satisfy the California Regional Water Quality Control Board's Monitoring and Reporting Program No. R1-2010-0066	Collect data at 11 sites	Yrs 1, 5, 10	This info to be collected under separate A&E ongoing contract	Per year			$0	156-157
83	Bioassessment Monitoring- (State MMP)	Performance monitoring to partially satisfy the California Regional Water Quality Control Board's Monitoring and Reporting Program No. R1-2010-0066	Collect data at 13 sites.	Yrs 2, 5, 10	This info to be collected under separate A&E ongoing contract	Per year			$0	158
84	Canopy Cover Monitoring (Effective Shade)- (State MMP)	Performance monitoring to partially satisfy the California Regional Water Quality Control Board's Monitoring and Reporting Program No. R1-2010-0066	Collect data at 18 sites	Yrs 1, 5, 10	This info to be collected under separate A&E ongoing contract	Per year			$0	159

PAR Analysis for the Willits Bypass Project - Short-Term Mitigation Maintenance and Monitoring Phase (Updated 04-15-13)

Line #	Mitigation Feature	Activity / Action	Description	Frequency	Actions Required	Unit	Number of Units	Cost/Unit [1]	Total Cost	Assumption #
85	Erosion Assessment- (State MMP)	Water quality monitoring data to be collected for several parameters.	Collect data at 8 sites	Yrs 1, 5, 10	This info to be collected under separate A&E ongoing contract	Per year			$0	160
86	**Reporting**									
87	Monitoring and Reporting	Biological Monitoring Report	Annual biological monitoring report	Yrs 1-10	Prepare draft and final biological monitoring report	Labor hrs	4,800	$65	$312,000	176-180
88		Aerial photo	Ortho-rectified color photo	Yr 10	Used to monitor canopy cover using aerial photo.	Item	1	$15,420	$15,420	8
89		Maintenance Report	Annual Maintenance Report	Yr 1-10	Prepare draft and final annual maintenance report	Labor hrs	1,200	$65	$78,000	180a
90		**Sub-Total Biological Monitoring Labor Cost**							**$4,062,565**	
91		**Sub-Total Biological Monitoring Item Cost**							**$405,420**	
92	**Short-Term Maintenance**									
93	Short-Term Maintenance	Short-term Plant Maintenance Inspections	Land management for 353.09 acres.	Yrs 4-5	Inspection for invasive species control, assess plant protection and health.	Labor hrs	160	$65	$10,400	165
94		Short-term Plant Maintenance Labor	Land management for 353.09 acres.	Yrs 1-3	Labor for invasive species control.	Days	54	$2,880	$155,520	167a
95		Short-term Plant Maintenance Labor	Land management for 353.09 acres.	Yrs 4,5	Labor for invasive species control, assess plant protection, health and additional plantings as needed.	Days	117	$2,880	$336,960	168-171
96		Short-term Plant Maintenance Inspections	Land management for 333 acres.	Yrs 6-10	Inspection for invasive species control, assess plant protection and health.	Labor hrs	380	$65	$24,700	166
97		Short-term Plant Maintenance Labor	Land management for 333 acres.	Yrs 6-10	Labor for invasive species control, assess plant protection and health	Days	140	$2,880	$403,200	172-175
98		Short term Invasive Species control	Land management for 1388.96 acres.	Yrs 1-10	Labor for invasive species control on properties with no plant establishment	Days	174	$2,880	$501,120	175a
99	General Property Maintenance	Short term property maintenance	Land management for non impacted properties	Yrs 1-10	Annual maintenance such as fence, debris, erosion.	Days	120	$2,880	$345,600	181
100	General Site Inspection	Short term property inspections	Inspect 1,742 acres	Yrs 1-3	Inspect for invasive plants, assess plant protection and health and general site assessment monthly.	Labor hrs	1,412	$65	$91,780	182
101		Short term property inspections	Inspect 1742 acres	Yrs 4-10	Inspect for invasive plants, assess plant protection and health and general site assessment quarterly.	Labor hrs	941	$65	$61,165	183
102	Stream Channel Maintenance	Yearly channel maintenance	Stream Channel Maintenance	Yrs 1-10	Clean and stabilize 420 feet of channel as necessary	Unit	10	$14,665	$146,650	184
103	**Sub-Total Habitat Maintenance Labor Cost**								**$2,077,095**	
104	**Field Equipment**									
105		Miscellaneous field equipment Needs/Repair	Miscellaneous field equipment repair and needs	Yrs 1-10	As needed for land management activities	Item	10	$2,500	$25,000	185
106		Signage	Identify mitigation lands	Yr 1	Identify mitigation lands	Item	98	$15	$1,470	186
107		Camera	Photo monitoring	Years 1 and 5	Photo monitoring	Item	2	$260	$520	187
108		GPS Equipment	Purchase :GeoXt 6000 , 2 year hardware warranty, and software	Yr 1	Purchase 2 GPS units, hardware warranty, and software	Item	2	$9,940.00	$19,880.00	188
109		GPS Equipment Warranty	Purchase :GeoXt 6000 , hardware warranty	Yr 4, 6, 8	Purchase GPS hardware warranty for 2 units	Item	6	$450.00	$2,700.00	189
110		Cattle Shade Structures	Shade structure for cattle	Yr 1	Purchase Structures	Item	46	$500.00	$23,000.00	190
111						**Sub-Total Short-Term Labor Cost**			**$6,545,080**	
112						**Forced Account 33% markup**			**$2,159,876**	
113						**Total Short-Term Labor Cost**			**$8,704,956**	
114						**Sub-Total Short-Term Item Cost**			**$49,570**	
115						**Forced Account 15% markup on materials**			**$7,436**	
116						**Total Short-Term Item Cost**			**$57,006**	
117						**10% Contingency on labor and materials**			**$876,196**	
118						**Establish Legal defense fund[3]**			**$48,083**	
119						**First Two Monitoring Years of Long Term Monitoring Period[2]**			**$769,314**	
120						**One time cost to fix 1/2 mile of fence (2640 feet x $5.00 per foot = $13,200.**			**$13,200**	191
121						**Total Short Term Cost**			**$10,468,755**	

[1] Hourly rate for personnel as provided by Miguel Segura

[2] The first two years of long term monitoring have been included in the short-term calculations because of the way interest rates and long-term endowments are calculated and structured. ($384,657 x2 = $769,314)

[3] Legal Defense fund is based on 0.5 % of the long term endowment of $9,616,433 ($9,616,433 *.005= $48,083rounded up)

PAR Assumptions for Short-Term Maintenance and Monitoring Periods (Updated 04-15-13)

Mitigation Feature/Category	Assump #	Assumptions
General Assumptions	**1**	All information is taken from the USACE 2012 Mitigation and Monitoring Proposal Report (January 2012), State MMP data is from June 2012 draft report or the 2012 Grazing Management Plan.
	2	1 Field Day = 8 hrs
	3	1 staff day = 8 hrs
	4	2 people can monitor 40 quadrats in 1 field day unless otherwise noted. Includes set up, data collection and photo documentation.
	5	One person can inspect (plant survival and vigor) 800 plants in a 8 hr day unless otherwise noted.
	6	8-person Landscape Crew costs $2880 a day: $45/hr x 8 people = $360 per hr x 8 hr day = $2880 per day
	7	The first two years of long term monitoring have been included in the short-term calculations because of the way interest rates and long-term endowments are calculated and structured.
	8	Aerial photos: Estimate for low flight, scale 1"=167'. 1:2000 Color, 16 flight lines, 264 exposures = $12,000. Estimate 1 scan time is 38 hours x $90.00 and hour = $3,420. Total of $15,420.
	9	Data entry. Assumes it takes 1 minute to enter each CRAM AA data and invasive species quadrat data. Assumes it takes 2 minutes to enter other quadrat data. Assumes 1 person can digitize 96 acres in one hour. Assumes it takes 12 minutes to enter each hydroperiod data. Assumes it takes 36 seconds to enter data from each line transect. Assumes it takes 2 seconds to enter each survival and vigor data point. Assumes it takes 1 second to enter each tree density data point.
Wetland Establishment Monitoring (Group 1 and 2)	**10**	59.4 acres to be monitored (24.53 Group 1 and 34.87 Group 2)
	11	**Monitoring period: Group 1 = 5 years; Group 2 = 10 years**
	12	Collect data on relative cover by wetland plant species, relative cover by native wetland species from list of target species, absolute cover by invasive species (quadrat and releve sampling method), species richness (year 1 only), asses general site conditions, photo points and hydroperiod. **Group 1: 5 years, Group 2: 10 years**
	13	Reference site data collection: relative cover by wetland plant species, relative cover by native wetland species from list of target species, absolute cover by invasive species (quadrat and releve), species richness (year 1 only), assess general site conditions and photo stations. **Group 1: 5 years, Group 2: 10 years.** (Hydroperiod reference sites collection identified below)
Wetland Establishment Monitoring (Group 1)	**14**	Cover Sampling: 24.53 acres. Assumes 5 transects per acre at 100 m per transect. Assumes 1 quadrat per 100m of transect. Assumes 2 people can monitor 32 transects per day. 5 transects x 100m x 24.53 acres = 12,265 m / 100 m per quadrat = 123 quadrats / 32 quadrats per day = 3.9 days (rounded up) x 2 people x 8 hour days = 62.4 hours per year x 5 years of monitoring = **312 hours**
	15	Cover Sampling, Travel: 1 hr travel (between transects) per day of field work x 3.9 days x 2 people = 6.2 hours per year x 5 years = **31 hrs**
	16	Reference Sites, Cover Sampling: Assumes 3 sites (Ford, Niesen, Goss MGC). Watson Group 1 reference site will be the same as Watson Group 2 and is captured in the Group 2 effort as it goes on for 10 years. Assumes 1000 m transect for each of the 3 site. Assumes 1 quadrat for every 100m of transect. Assumes 2 people can survey 32 quadrats per day. 1000 m transect x 3 sites = 3000 m / 100 m per quadrat = 30 quadrats / 32 quadrats per day = 1 day (rounded up) x 2 people x 8 hours per day = 16 hrs per year x 5 years = **80 hours.**
	17	Reference Site, Travel: 1 hr travel (between transects) per day of field work x 1 day x 2 people = 2 hours per year x 5 years = **10 hrs**
	18	**Hydroperiod Monitoring** (determine extent of ponding and soil saturation, measure inundation depth in shallow ground water well)
	19	24.53 acres consisting of 6 wetlands. Assumes 2 people can monitor 4.8 wetlands a day. Assumes monitoring 2 times a month x 7 months (Nov -May) = 14 events
	20	6 wetlands / 4.8 wetlands per day = 1.3 day x 2 people x 8 hour days x 14 events = 291.2 hours per year x 5 years = **1456 hrs**
	21	Hydroperiod, Travel: 1 hr travel (between sites) per day of field work x 1.25 day per event x 14 events/yr x 2 people = 35 hrs x 5 yrs =**175 hrs**
	22	Reference Site Hydroperiod Monitoring (Group 1) years 1-5. Assumes 3 reference sites. Assumes 2 people can monitor 4.8 wetlands a day. Assumes monitoring 2 times a month x 7 months (Nov -May) = 14 events. 3 references sites / 4.8 sites per day = 0.625 days x 2 people x 8 hour days x 14 events = 140 hrs per year x 5 years = **700 hrs**
	23	Reference Site Hydroperiod, Travel: 1 hr travel (between sites) per day of field work x 0.625 days / event x 14 events/yr x 2 people = 17.5 hrs per year x 5 yrs = **88 hrs** (rounded up)
	24	Years 1-5. Enter data (cover sampling) and organize for inclusion in annual monitoring report. 4.1 hrs per year x 5 yrs = **21 hrs** (Rounded up)
	25	Years 1-5. Enter data (hydroperiod) and organize for inclusion in annual monitoring report. 1.3 hrs per year x 5 yrs = **7 hrs** (rounded up)
	26	Years 1-5. Enter data (Reference site - cover sampling) and organize for inclusion in annual monitoring report. 1.0 hrs per year x 5 yrs = **5.0 hrs**
	27	Years 1-5. Enter data (Reference - hydroperiod) and organize for inclusion in annual monitoring report. 1.2 hrs per year x 5 yrs = **6.0 hrs**
Wetland Establishment Monitoring (Group 2)	**28**	Cover Sampling, 34.87 acres. Assumes 5 transects per acre at 100 m per transect. Assumes 1 quadrat per 100m of transect. Assumes 2 people can monitor 32 transects per day. 5 transects x 100m x 34.87 acres = 17435 m / 100 m per quadrat = 175 quadrats / 32 quadrats per day = 5.5 days (rounded up) x 2 people x 8 hour days = 88 hours per year x 10 years of monitoring = **880 hrs**
	29	Cover Sampling, Travel. 1 hr travel (between transects) per day of field work x 5.5 days x 2 people x 10 yrs = **110 hrs**
	30	Reference Sites, Cover Sampling. Assumes 7 reference sites. One reference site per property where wetland establishment occurs, except where a contiguous wetland crosses multiple property boundaries. In such case only one reference site will be identified. Assumes 1000 m transect for each of the 7 sites. Assumes 1 quadrat for every 100m of transect. Assumes 2 people can survey 32 quadrats per day. 1000 m transect x 7 sites = 7,000 m / 100 m per quadrat = 70 quadrats / 32 quadrats per day = 2.2 days (rounded up) x 2 people x 8 hours per day = 36 hrs (rounded up) per year x 10 years = **360 hrs.**
	31	Reference Sites, Cover Sampling Travel. 1 hr travel (between transects) per day of field work x 2.2 days x 2 people = 4.4 hrs per year x 10 yrs = **44 hrs**

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Mitigation Feature/Category	Assump #	Assumptions
	32	**Hydroperiod Monitoring** (determine extent of ponding and soil saturation, measure inundation depth in shallow ground water well)
	33	34.87 acres consisting of 10 wetlands
	34	Hydroperiod Monitoring. Assume 2 people can monitor 4.8 wetlands in 1 day. Assumes monitoring 2 times a month x 7 months (Nov -May) = 14 events. 10 wetlands / 4.8 wetlands per day = 2.1 days (rounded up)x 2 people x 8 hr days x 14 events = 471 hrs (rounded up) per year x 10 yrs = **4710 hrs**
	35	Hydroperiod, Travel: 1 hr travel (between sites) per day of field work x 2.1 days/event x 14 events/yr x 2 people = 58.8 hrs x 10 yrs = **588 hrs**
	36	Reference Sites, Hydroperiod Monitoring. Assumes 7 wetlands. 7 wetlands / 4.8 wetlands per day = 1.5 days(rounded up) x 2 people x 8 hrs days x 14 events = 336 hrs per year x 10 years = **3360 hrs**
	37	Reference Site Hydroperiod, Travel: 1 hr travel (between sites) per day of field work x 1.5 days/event x 14 events/yr x 2 people = 42 hrs per year x 10 yrs = **420 hrs**
	38	Years 1-10. Enter data (cover sampling) and organize for inclusion in annual monitoring report. 5.78 hrs x 10 yrs = **58 hrs** (rounded up)
	39	Years 1-10. Enter data (hydroperiod) and organize for inclusion in annual monitoring report. 2 hrs x 10 yrs = **20 hrs**
	40	Years 1-10. Enter data (Reference site - cover sampling) and organize for inclusion in annual monitoring report. 1.19 hrs per year x 10 yrs = **12 hrs** (rounded up)
	41	Years 1-10. Enter data (Reference - hydroperiod) and organize for inclusion in annual monitoring report. 1.4 hrs per year x 10 yrs = **14 hrs**
Other Waters Rehabilitation (USACE Jurisdiction)	42	17.98 acres in 3 areas to be monitored
	43	10 years of annual monitoring (5 years survival counts, 5 years transects)
	44	**Plant Survival Monitoring and Vigor (Years 1-5)** Plant survival by percentage and by species; plant vigor and average vigor by species
	45	Assumes 1 person can monitor 800 plants per day. Assumes plantings are applied to 66% of the area. Plantings - Herbaceous on 5' centers, Woody trees on 10' centers, oaks 20' centers. Numbers for Riparian Establishment and Other Water Rehabilitation were combined and then broken out by percentages based on percentages from the MMP for State Riparian Establishment (61.4%) and Corp Other Waters (38.6%). Total plantings are 131,131+3,829 = 134,960. For Corp will use 134,960 x 38.6% = 52,095
	46	52,095 plants / 800 plants per day = 65.2 days (rounded up) x 1 person x 8 hr days = 521.6 hrs per yr x 5 yrs = **2608 hrs**
	47	**Riparian Cover Estimate (Line Intercept Monitoring) (Years 5-10)** (Relative cover by native tree species, relative cover by native shrub species, woody plant density)
	48	Assuming 600 m of transect. A 2 person crew can survey 240 m of transect per 8 hr day. 600 m / 240 m per day = 2.5 days x 2 people x 8 hr day = 40 hrs per year x 6 years = **240 hrs**
	49	**Tree Plant Density (Years 6-10)**. Assumes 600 m of transect with 1 survey point every 100 m (collects 4 data points at each survey point). Assumes a 2 person crew can collect 32 survey points in a 8 hr day. Uses the same transects as relative cover but collected during late summer. 600 m transect / 100 m = 6 survey points. 6 survey points / 32 survey points per day = 0.2 days (rounded up) x 2 people x 8 hr day = 3.2 hrs x 6 yrs = **20 hrs** (rounded up)
	50	**Canopy Cover from Aerial (Year 10).** Assess percent canopy cover from aerial photo, including digitizing, and field check in year 10. **4 hrs**
	51	1 hr travel (between sites) per day of field work x 65.2 days (Survival) x 2 people = 131 hrs (rounded up) x 5 yrs = **655 hrs**
	52	1 hr travel (between sites) per day of field work x 2.5 days (Riparian) x 2 people = 5 hrs x 5 yrs = **25 hrs**
	53	1 hr travel (between sites) per day of field work x 0.2 days (Tree density) x 2 people = 0.4 hrs x 6 yrs = **3 hrs** (rounded up)
	54	Enter data (survival and vigor, yrs 1-5) and organize for inclusion in annual monitoring report.29.2 hrs x 5 yrs = **146 hrs**
	55	Enter data (riparian cover, yrs 5,6,8,10) and organize for inclusion in annual monitoring report.6 hrs x 4 yrs = **24 hrs**
	56	Enter data (tree density, yrs 6-10) and organize for inclusion in annual monitoring report.0.006 hrs x 6 yrs = **1 hr** (rounded up)
Wetland Rehabilitation Monitoring (wet meadow) (Type 1)	57	72.8 acres (total gross acreage of Type 1 rehabilitation)
	58	Collect data on: relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, absolute cover by invasive species, assess general site conditions and photo stations in years 1-10
	59	Assumes 4200 m of transects with 1 quadrat per 100 m. Assumes 2 people can monitor 32 quadrats per day. 4200 m of transects /100 m = 42 quadrats / 32 quadrats per day = 1.4 days (rounded up) x 2 people x 8 hour days = 23 hours per year (rounded up) x 10 years = **230 hours**
	60	No travel time since 1 contiguous location
	61	Enter data and organize for inclusion in annual monitoring report.1.39 hrs x 10 yrs = **14 hrs** (rounded up)
Wetland Rehabilitation Monitoring (wet meadow) (Type 2)	62	30.02 acres (total gross acreage of Type 2)
	63	Collect data on: relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, absolute cover by invasive species, species richness, assess general site conditions and photo stations in years 1-10.
	64	Assumes 2000 m of transects with 1 quadrat for every 100 m. Assumes 2 people can monitor 32 quadrats per day.
	65	2000 m of transects / 100 m per quadrat = 20 quadrats / 32 quadrats per day = 0.7 days (rounded up) x 2 people x 8 hr days = 12 hours per year (rounded up)x 10 years = **120 hours**
	66	No travel time since 1 contiguous location
	67	Enter data and organize for inclusion in annual monitoring report.0.66 hrs x 10 yrs = **7 hrs** (rounded up)
Wetland Rehabilitation Monitoring (woody species planting) (Type 3)	68	179.01 acres to be monitored.
	69	Collect data on: relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, absolute cover by invasive species, species richness, assess general site conditions, photo stations in years 1-10, plant survival and vigor in years 1-5 and tree density in years 5-10)
	70	**Plant Survival and Vigor Monitoring (Years 1-5)**

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Mitigation Feature/Category	Assump #	Assumptions
	71	Assumes 1 person can monitor 800 plants per day. This category requires a 40% relative lift and the background needs to have an existing relative cover of up to 40% of the species from the target list. Therefore, the acreage which we'll be performing work on is 40% of 179.01 acres= 71.117 acres. Planting- Herbaceous Liners are applied to the total area with cluster of 2 plantings (18" apart) and each cluster spaced at 5' on center, Oak Acorns are applied to the total area with cluster of 2 plantings with 3 acorns each (5' apart) and each cluster spaced at 20' on center. Total plants = 284,810.
	72	284,810 plantings /800 plants per day = 357 days (rounded up) x 1 person x 8 hr days = 2,856 hrs per yr x 5 yrs = **14,280 hrs**
	73	**Tree Plant Density Monitoring (Years 5-10) - Transects**
	74	Assumes 11,000 m of transects with quadrat every 100 m. Assumes 2 people can collect data on 24 quadrats per day. Can not be monitored concurrent with herbaceous cover because it occurs during late summer.
	75	11,000 m of transects / 100m per quadrat = 110 quadrats / 24 quadrats per day = 4.6 days (rounded up) x 2 people x 8 hrs per day = 74 hrs/yr (rounded up) x 6 years = **444 hours**
	76	**Cover Monitoring (Years 1-10) Quadrats**
	77	Assumes 11,000 m of transects with 1 quadrat every 100 m. Assumes 2 people can collect data from 32 quadrats per day.
	78	11,000 m of transects / 100m per quadrat = 110 quadrats / 32 quadrats per day = 3.5 days x 2 people x 8 hrs per day = 56 hrs/yr x 10 years = **560 hours**
	79	1 hr travel (between sites) per day of field work x 357 days (survival) = 357 hours x 5 yrs = **1785 hrs**
	80	
	81	1 hr travel (between sites) l per day of field work x 3.5 days (cover) = 3.5 hr x 6 yrs =**21 hrs**
	82	Enter data (cover) and organize for inclusion in annual monitoring report. 3.63 hrs per yr x 10 yrs = **37 hrs** (rounded up)
	83	Enter data (survival and vigor, yrs 1-5) and organize for inclusion in annual monitoring report. 159.5 hrs per yr x 5 yrs = **798 hrs** (rounded up)
	84	Enter data (tree density, yrs 5-10) and organize for inclusion in annual monitoring report. 0.12 hrs per yr x 6 yrs = **1 hr** (rounded up)
Wetland Rehabilitation Monitoring (woody species planting) (Type 4)	85	41.71 acres to be monitored.
	86	Collect data on: relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, absolute cover by invasive species, species richness, assess general site conditions, photo stations in years 1-10, plant survival and vigor in years 1-5 and tree density in years 5-10)
	87	**Plant Survival and Vigor Monitoring (Years 1-5)**
	88	Assumes 1 person can monitor 800 plants per day. This category requires a 70% relative lift and the background needs to have an existing relative cover of up to 20% of the species from the target list. Therefore, the acreage which we'll be performing work on is between 70% (assumes 0% of existing cover) and 34% (assumes 20% existing cover plus 70% lift). For calculations, we'll use 70% x 41.71 acres= 29.278 acres. Plant mix - 60% herbaceous and 40% woody trees and shrubs, apply to totla area. Planting mix- Herbaceous - Cluster of 2 plantings (18" apart), each cluster spaced at 5' on center. Planting- Woody- Cluster of 2 plantings (2' apart), each cluster spaced at 10' on center. Planting- Oak Acorns- Cluster of 2 plantings with 3 acorns each (5' apart), each cluster spaced at 20' on center
	89	77,798 plantings / 800 plants per day = 97.3 days (rounded up) x 1 person x 8 hr day = 778.4 hrs per yr x 5 yrs = **3892 hrs**
	90	**Tree Plant Density Monitoring (Years 5-10) - Transects**
	91	Assumes 3,100 m of transects with quadrat every 100 m. Assumes 2 people can collect data on 24 quadrats per day. Can not be monitored concurrent with herbaceous cover because it occurs during late summer.
	92	3,100 m of transects / 100m per quadrat = 31 quadrats / 24 quadrats per day = 1.3 days rounded up) x 2 people x hrs per day = 21 hrs/yr (rounded up) x 6 years = **126 hours**
	93	**Cover Monitoring (Years 1-10) Quadrats**
	94	Assumes 3,100 m of transects with 1 quadrat every 100 m. Assumes 2 people can collect data from 32 quadrats per day.
	95	3,100 m of transects / 100m per quadrat = 31 quadrats / 32 quadrats per day = 1 day (rounded up) x 2 people x 8 hrs per day = 16 hrs/yr x 10 years = **160 hours**
	96	1 hr travel (between sites) per day of field work x 97.3 days (survival) = 97.3 hr x 5 yrs = **487 hrs** (rounded up)
	97	1 hr travel (between sites) per day of field work x 1.3 days (tree density) = 1.3 hr x 6 yrs = **8 hrs** (rounded up)
	98	1 hr travel (between sites) per day of field work x 1 day (cover monitoring) = 1 hr x 10 yrs = **10 hrs**
	99	Enter data (cover, yrs 1-10) and organize for inclusion in annual monitoring report. 1.02 hrs x 10 yrs = **11 hrs** (rounded up)
	100	Enter data (survival and vigor, yrs 1-5) and organize for inclusion in annual monitoring report. 43.6 hrs per yr x 5 yrs = **218 hrs**
	101	Enter data (tree density, yrs 5-10) and organize for inclusion in annual monitoring report. 0.03 hrs x 6 yrs = **1 hr** (rounded up)
Wetland Rehabilitation Monitoring (woody species planting) (Type 5)	102	21.1 acres to be monitored.
	103	Collect data on: relative cover by wetland plant species, relative cover by selected native wetland plant species from the list of approved species, absolute cover by invasive species, species richness, assess general site conditions, photo stations in years 1-10; plant survival and vigor in years 1-5 and tree density in years 5-10.
	104	**Plant Survival and Vigor Monitoring (Years 1-5)**
	105	Assumes 1 person can monitor 800 plants per day. MMP lists 21.10 acres is receiving credit for rehabilitation. Plans measure 20.7 acres. This category requires a 70% relative lift and the background needs to have an existing relative cover of up to 20% of the species from the target list. Therefore, the acreage which we'll be performing work on is between 70% (assumes 0% of existing cover) and 34% (assumes 20% existing cover plus 70% lift). For calculations, we'll use 70% x 20.7 acres= 14.493 acres
	106	44,826 plantings / 800 plants per day = 56.1 days (rounded up) x 1 person x 8 hr days = 449 hrs per yr (rounded up) x 5 yrs = **2245 hrs**

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Mitigation Feature/Category	Assump #	Assumptions
	107	**Tree Plant Density Monitoring (Years 5-10) - Transects**
	108	Assumes 3,700 m of transects with quadrat every 100 m. Assumes 2 people can collect data on 24 quadrats per day. Can not be monitored concurrent with herbaceous cover because it occurs during late summer.
	109	3,700 m of transects / 100m per quadrat = 37 quadrats / 24 quadrats per day = 1.6 days (rounded up) x 2 people x 8 hrs per day = 26 hrs/yr (rounded up)x 10 years = **260 hours**
	110	**Cover Monitoring (Years 1-10) Quadrats**
	111	Assumes 3,700 m of transects with 1 quadrat every 100 m. Assumes 2 people can collect data from 32 quadrats per day.
	112	3,700 m of transects / 100m per quadrat = 37 quadrats / 32 quadrats per day = 1.2 days (rounded up) x 2 people x 8 hrs per day = 20 hrs/yr (rounded up) x 10 years = **200 hours**
	113	1 hr travel (between sites) per day of field work x 56.1 days (survival) = 56.1 hr x 5 yrs = **281 hrs** (rounded up)
	114	1 hr travel (between sites) per day of field work x 1.6 days (tree density) = 1.6 hr x 6 yrs = **10 hrs** (rounded up)
	115	Enter data (cover, yrs 1-10) and organize for inclusion in annual monitoring report. 1.22 hrs x 10 yrs = **13 hrs** (rounded up)
	116	Enter data (survival and vigor, yrs 1-5) and organize for inclusion in annual monitoring report. 25.1 hrs x 5 yrs = **126 hrs** (rounded up)
	117	Enter data (tree density, yrs 5-10) and organize for inclusion in annual monitoring report. 0.04 hrs x 6 yrs = **1 hr** (rounded up)
Other Waters Rehabilitation / Riparian Establishment- (State Jurisdiction) This is in addition to the USACE Other waters.	118	**Plant Survival and Vigor Monitoring (Years 1-5)**. Assess survival and vigor of plantings. Assumes 1 person can survey 800 plants per day. MMP lists 28.61 acres is receiving credit for establishment. Assumes plantings are applied to 66% of the area. Plantings - Herbaceous on 5' centers, Woody trees on 10' centers, oaks 20' centers. Numbers for Riparian Establishment and Other Water Rehabilitation were combined and then broken out by percentages based on percentages from the MMP for State Riparian Establishment (61.4%) and Corp Other Waters (38.6%). Total plantings are 131,131+3,829 = 134,960. For Other Waters Rehab (State) will use 134,960 x 61.4% = 82,865
	119	82,865 plantings / 800 plants per day = 103.6 days (rounded up) x 1 person x 8 hr days = 828.8 hrs per yr x 5 yrs = **4,144 hrs**
	120	**Riparian Cover Monitoring (Years 5,6,8,10).** Assess percent relative cover by native tree and shrub species. Assumes 3500 m of transects. Assumes a 2 person crew can survey 240 m a day. 3500 m / 240 m per day = 14.6 days (rounded up) x 2 people x 8 hr days = 234 hrs(rounded up) x 4 yrs = **936 hours**
	121	**Riparian Cover from Aerial (Year 10).** Assess canopy cover from aerial photo (digitizing) and field check (field check is covered in cover monitoring above) in year 10. Assumes 1 person can digitize 96 acres per hour. Assumes 28.61 acres of State Riparian Establishment. 28.61 acres / 96 acres per hour = 1 hr (rounded up) x 1 year = **1 hrs.**
	122	**CRAM Level 2 data (Years 3, 5, 7, 10).** Assess CRAM biotic values. Assumes 15 CRAM AA's. Assumes a 2 person crew can survey 2.4 AA's in 1 day. 15 AA's / 2.4 AA' per day =6.25 days x 2 people x 8 hrs = 100 hrs x 4 yrs = **400 hours**
	123	**Reference Sites: Riparian Cover Monitoring (Years 5-10)**. Assess percent absolute cover by native tree and shrub species. Assumes 2100 m of transects. Assumes a 2 person crew can survey 240 m a day. 2100 m / 240 m per day = 8.75 days x 2 people x 8 hr days = 175 hrs x 5 yrs =**875 hours**
	124	**Reference Sites: Canopy Cover from Aerial (Year 10).** Assess percent riparian from aerial photo (digitizing) in year 10. Assumes 1 person can digitize 96 acres per hour. Assumes less than 96 acres will be digitized. so 1 hr for digitizing. **1 hr** (digitize) **= 1 hrs**
	125	1 hr travel (between sites) per day of field work x 103.6 days (survival) = 103.6 hr x 5 yrs = **518 hrs**
	126	1 hr travel (between sites) per day of field work x 14.6 days (riparian cover) = 14.6 hr x 1 yrs = **15 hrs** (rounded up)
	127	1 hr travel (between sites) per day of field work x 6.25 days (CRAM) = 6.25 hr x 4 yrs = **25 hrs**
	128	References Site: 1 hr travel per day of field work x 8.75 days (riparian cover) = 8.75 hr x 6 yrs = **53 hrs**
	129	Enter data (survival and vigor, yrs 1-5) and organize for inclusion in annual monitoring report. 46.4 hrs x 5 yrs = **232 hrs**
	130	Enter data (riparian cover, yrs 5, 6, 8, 10) and organize for inclusion in annual monitoring report. 35 hrs x 4 yrs = **140 hrs** (rounded up)
	131	Enter data (CRAM, yrs 3, 5, 7, 10) and organize for inclusion in annual monitoring report. 0.26 hrs x 4 yrs = **2 hrs** (rounded up)
	132	Enter data (Reference- riparian cover, yrs 5-10) and organize for inclusion in annual monitoring report. 21 hrs x 6 yrs = **126 hrs** (rounded up)
Rehabilitated Wetlands - Grazed and Ungrazed (State MMP)	133	**CRAM Level 2 data (Years 3, 5, 7, 10).** Assess Level 2 data collection on 89 CRAM AA's. Assumes 2 people can monitor 2.4 AA's per day. 89 AA's / 2.4 AA's per day = 37.1 days (rounded up) x 2 people x 8 hr days = 594 hrs / yr (rounded up) x 4 years = **2376 hours**
	134	**Invasive Species (Years 2, 4, 5, 7, 9, 10).** Assess absolute cover by invasive species. Assumes 89 CRAM AA's with 1 transect per AA. Assumes 2 people can monitor 3.2 transects per 8 hour day. 89 CRAM AA's x 1 Transect per AA = 89 transects / 3.2 transects per day = 27.9 days (rounded up) x 2 people x hour days = 447 hrs per year (rounded up) x 6 yrs = **2682 hours**
	135	1 hr travel (between sites) per day of field work x 27.9 days (invasive) = 27.9 hrs x 3 yrs (yrs 2, 4, 9) = **84 hrs** (rounded up)
	136	1 hr travel (between sites) per day of field work x 37.1 days (CRAM) = 37.1 hrs x 4 yrs (yrs 3, 5, 7, 10) = **149 hrs** (rounded up)
	137	Residual Dry Matter. Should take **56 hours per year**. Based on surveys that were completed to develop baseline conditions.
	138	Enter data (CRAM, Yrs 3, 5, 7, 10) and organize for inclusion in annual monitoring report.1.51 hrs x 4 yrs = **7 hrs** (rounded up)
	139	Enter data (absolute cover for invasives - Yrs 2, 4, 5, 7, 9, 10) and organize for inclusion in annual monitoring report.15.1 hrs x 6 yrs = **91 hrs** (rounded up)
North Coast Semaphore Grass Establishment Areas- (State MMP)	140	**Plant Survival and Vigor Monitoring for transplants (Years 1-10) .** Asses plant survival and vigor for transplants, assess general site conditions, collect photo points. Assumes 400 plants per day can be monitored by 1 person. Includes travel between sites. 5404 plantings / 400 plants per day per person = 13.6 day (rounded up) x 1 person x 8 hr day = 108.8 hrs / yr x 10 years = **1088 hours**
	141	**Plant Survival and Vigor Monitoring for container plants (Years 1-10) .** Contianer plants will be planted at year 5 to bring the total back up to 5404 plants. Assuming a 20% die off, will need 1081 container plants. Since these are replacements doesn't add additional time for surveying

PAR Assumptions for Short-Term Maintenance and Monitoring Periods (Updated 04-15-13)

Mitigation Feature/Category	Assump #	Assumptions
	142	**Invasive Species (Years 1-10).** Collect quadrat data on invasive species. Includes travel between sites. Assuming 1000 m of transects and 1 quadrat for every 15 m = 67 quadrats. Assumes 2 people can monitor 60 quadrats per day. 67 quadrats / 60 quadrats per day = 1.2 days (rounded up) x 2 people x 8 hr day = 19.2 hrs per year x 10 years = **192 hours**
	143	Enter data (survival and vigor, Yrs 1-10) and organize for inclusion in annual monitoring report. 3.1 hrs (rounded up) x 10 yrs = **31 hrs**
	144	Enter data (invasive species, Yrs 1-10) and organize for inclusion in annual monitoring report. 2.21 hrs x 10 yrs = **23 hrs** (rounded up)
	145	Assumes a 20% die off of NCSG by year 5 = 1081 plants. Assumes 1 person can plant 6 plants in an hour. 1081 plants / 6 plants per hr = **181 hrs** (rounded up)
North Coast Semaphore Grass Rehabilitation Areas- (State MMP)	146	Assess population distribution and abundance, absolute cover by woody species in the understory, absolute cover of invasive species, general site conditions and photo stations. Includes travel. Assumes 1815 m of transects with 1 quadrat every 15 m for a total of 121 quadrats. Assumes 40 quadrats can be monitored by 2 people in 1 day. 121 quadrats / 40 quadrats per day = 3.1 (rounded up) day x 2 people x 8 hr days = 49.6 hrs per year x 10 years = **496 hours**
	147	Enter data (wetland and invasive species Yrs 1-10) and organize for inclusion in annual monitoring report. 3.99 hrs x 10 yrs = **40 hrs** (rounded up)
Baker's Meadowfoam Rehabilitation- (State MMP)	148	There are 15 CRAM AA's in Baker's Meadowfoam habitat. Collect data on Baker's Meadowfoam population distribution of occupied habitat using GPS, absolute cover in random quadrats within representative polygons. Collect data on absolute cover by native plant species in BM absolute cover random quadrats. Collect data on absolute cover by invasive species visually in the CRAM AA and estimate absolute cover in BM absolute cover random quadrats. Assess general site conditions and photo monitoring. Includes travel time. (Years 1-10)
	149	Assumes 2 people can survey 0.8 AA per day. 15 AA's x 0.8 AA per day = 18.75 days x 2 people x 8 hrs per day = 300 hrs per year x 10 years = **3000 hrs**
	150	Enter data (abundance, invasive and native cover, Yrs 1-10) and organize for inclusion in annual monitoring report. 4.95 hrs x 10 yrs = **50 hrs** (rounded up)
Oak Woodland Creation/Restoration Monitoring- (State MMP)	151	23.28 acres to be created. Collect data on Plant survival and vigor (Years 1-6, 8, 10). Assumes can monitor 800 plantings per person per day. Watson Property (6.72 acres). Planting, apply to total area - Woody shrubs - on 20' centers; Oak Acorns- cluster of 3 plantings with 3 acorns each with each cluster spaced at 20' on center; Woody shrubs (different palette)- on 10' centers for a total of 2,443 individual plants. Brooke Property (16.56 acres) - already extensive oak and ash woodland present. using 30% of total acres for planting area. Plantings - Herbaceous - on 20' centers; Oak Acorns- cluster of 3 plantings with 3 acorns each with each cluster spaced at 20' on center; Woody shrubs - on 10' centers for a total of 2,090 individual plants. Total Plantings 2,443 + 2,090 = 4,533
	152	4,533 plantings / 800 plantings per day = 5.7 days (rounded up) x 1 person x 8 hr day = 46 hrs per yr (rounded up) x 8 yrs = **368 hrs**
	153	Travel assumes 1 hr per day. 5.7 days x 1 hr = 5.7 hrs x 8 yrs = **46 hrs** (rounded up)
	154	REFERENCE SITE monitoring : Assumes 2 reference sites, 1 for Watson and 1 for Brooke. Qualitative assessment of the condition at the reference site, assess general site conditions and photo stations. Years 1-6, 8, 10. Assumes each reference site can be monitored by 2 people in 0.5 days. 2 sites x 2 people x 0.5 days x 8 hour days = 16 hours per year x 8 years = **128 hours**
	155	Enter data (survival, vigor and Reference qualitative, Yrs 1-6, 8, 10) and organize for inclusion in annual monitoring report. 2.5 hrs x 8 yrs = **20 hrs**
Water Quality Monitoring- (State MMP)	156	~~For years 1, 5 and 10: The following is identified in the Monitoring and Reporting Program No. R1-2010-0066 (August 6, 2010). Assumes the 11 monitoring sites identified on page 22 of MRP. Assumes continuous collection of: Stream flow, pH, Temperature (air, water), total dissolved solids, turbidity, specific conductance. Monthly collection and after first 8 storms of the following: Total settleable solids, total and dissolved metals (CAM 17), total nitrogen, ammonia, nitrate and nitrite, total kjeldahl nitrogen, biochemical oxygen demand, total and dissolved phosphorus, hardness, fecal coliform, enterococcus and total organic carbon. Assumes analysis, reporting and travel between sites is covered in costs. This permit is in the process of being modified as of 7/25/12.~~THIS DATA TO BE COLLECTED
	157	~~$40,000 per month. $40,000 per month x 12 months = $480,000 per year x 3 years = $1,440,000.~~ THIS DATA TO BE COLLECTED UNDER A SEPERATE ONGOING A&E CONTRACT.
Bioassessment Monitoring- (State MMP)	158	~~Data collection, analysis, travel between sites and reporting costs for 13 sites is $250,000. Anticipated collection years are 1,5,10 years after mitigation completion. Assumes Caltrans will transfer the sonde units used during baseline data collection. Consumables (probes, batteries, calibration fluids), lab analysis, quality assurance and reporting are included in costs.~~ THIS DATA TO BE COLLECTED UNDER A SEPERATE ONGOING A&E CONTRACT.
Canopy Cover Monitoring (Effective Shade)- (State MMP)	159	~~Data collection, analysis, travel between sites and reporting costs for 18 sites is $60,000. Anticipated collection years are 1,5,10 years after mitigation completion.~~THIS DATA TO BE COLLECTED UNDER A SEPERATE ONGOING A&E CONTRACT.
Erosion Assessment- (State MMP)	160	~~Data collection, analysis, travel between sites and reporting costs for 5 sites (1 site has 3 separate locations for a total of 8 locations) is $175,000. Anticipated collection years are 1,5,10 years after mitigation completion.~~ THIS DATA TO BE COLLECTED UNDER A SEPERATE ONGOING A&E CONTRACT.
Short Term Maintenance Period	161	**Years 1-3. Plant Establishment**
	162	Maintenance costs for Years 1-3 are not included. It is assumed that this is the responsibility of the planting contractor hired by Caltrans and cost will be included in the mitigation construction cost estimates. Includes watering, weeding, replacement planting, noxious species control, assess plant protection and health, general site maintenance (fence repair, debris removal).
	163	**Short Term Maintenance Period Inspections**
	164	Inspect established wetlands, rehabilitated wetlands and rehabilitated other waters for remaining performance monitoring period. Inspections for garbage, weeds, invasive species infestations, fencing, erosion and plant protection and health.
	165	**Years 4 -5.** Inspect 353.09 (Type 3-5 {includes Brooke}, 258 acres + State/USACE Other waters, 45.51 acres + Group 1, 20.09 acres + Group 2 wetlands, 29.49 acres = 353.09) acres of land. Assume 2 people can inspect 72 acres per day. 353.09 acres / 72 acres per day = 5 days (rounded up) x 2 people x 8 hr days =80 hrs x 2 yrs = **160 hrs**
	166	**Years 6-10.** Inspect 333 (Type 3-5 {includes Brooke}, 258 acres + State/USACE Other waters, 45.51 acres + Group 2 wetlands, 29.49 acres = 333) acres of land. Assume 2 people can inspect 72 acres per day. 333 acres / 72 acres per day = 4.7 days x 2 people x 8 hr days =76 hrs (rounded up) x 5 yrs = **380 hrs**
	167	**Short Term Maintenance Labor**

PAR Assumptions for Short-Term Maintenance and Monitoring Periods (Updated 04-15-13)

Mitigation Feature/Category	Assump #	Assumptions
	167a	**Years 1-3.** Invasive species erradication down to 2% of cover on 353.09 acres of Plant Establishment Properties. Plant Establishment Contractor will not control entire site, just those areas around the plants. Assumes 10% noxious weeds to be controlled. 353.09 acres x 10%= 35.4 (rounded up) acres. Assumes 1 person can remove noxious weeds on 0.25 acres per 8 hr day = 2 acres per day per 8 person crew. 35.4 acres / 2 acres per day = 18 days (rounded up) x 3 yrs = **54 days**
	168	**Years 4-5.** Maintain 353.09 acres. Less intense than Years 1-3, includes weeding, replacement planting, noxious species control, assess plant protection and health, general site maintenance (fence repair, debris removal). no watering anticipated. Assumes an 8 person crew can maintain 40 acres per day.
	169	353.09 acres / 40 acres per day = 8.9 (rounded up) days x 5 months x 2 yrs = 89 days x $2,880 (8 person crew, assumption 6) = $256,320
	170	14 additional days for remainder of the year x 2 yrs = 28 days x $2,800 (8 person crew, assumption 6) = $78,400
	171	Total $256,320 (89 days) + $78,400 (28 days) = **$334,720**
	172	**Years 6 - 10.** Maintain 333 acres (Type 3-5, 258 acres + State Other Waters , 45.51 acres + Group 2, 29.49 acres = 333 acres). Includes weeding, noxious species control, assess plant protection and health, general site maintenance (fence repair, debris removal). No watering anticipated. Since plants are more mature and past initial die off stage it is assumed an 8 person crew can maintain 80 acres per day.
	173	333 acres / 80 acres per day = 4.2 days (rounded up) x 5 months = 21 days per year x 5 yrs = 105 days x $2,880 (8 person crew, assumption 7) = $302,400
	174	7 additional days (1 day per month for remaining months) x 5 yrs = 35 days x $2,880 (8 person crew, assumption 6) = $100,800
	175	Total $302,400 (105 days) + $100,800 (35 days)= **$403,200**
	175a	Labor for invasive speceis control (control to baseline) on 1388.96 acres (1742 total acres - 353.09 contractor responsible = 1388.91 acres) for years 1-10. Assumes an 8 person crew can control invasives on 80 acres per day. 1388.96 / 80=17.4 days (rounded up) x 10 years = 174 days x $2880 (8 person crew, assumption 6) =**$501,120**
Annual Biological Monitoring Report	**176**	Years 1-10. Includes wetland establishment, all wetland rehabilitation, other waters (riparian establishment), hydro-monitoring data, North Coast Semaphore grass establishment and rehabilitation, Oak woodland creation/preservation, water quality monitoring, Bioassessment monitoring, Effective shade monitoring and Erosion Assessment.
	177	Includes graphics, summaries and photos.
	178	Draft 320 hrs x 10 yrs = **3200 hrs**
	179	Final 160 hrs x 10 yrs = **1600 hrs**
	180	3200 (draft) hrs + 1600 (final)hrs=**4800 hrs**
	180a	Complile annual maintenance report for the 353.09 acreas of created/modified habitats (see assumption 165 for break down of properties). Incorporate the as planted drawings in year 1 and the as maintained drawings in yr 2-10. Draft 80 hrs x 10 yrs = 800 hrs, Final 40 hrs x 10 yrs = 400 hrs. 800 hrs (draft) + 400 hrs (final) = **1200 hrs**
On-going Annual Maintenance for 1742 acres (fence maintenance, trash pick up, misc.)	**181**	Total mitigation lands owned by Caltrans = 1,742 acres. Does not include invasive species work. 1 crew x 1 day per month x $2880/day x 12 months= $34,560 annually x 10 yrs = **$345,600 total**
General Site Inspection	**182**	Inspect for invasive plants, weeds, assess plant protection and health, visual inspection of seed germination and general site assessment. For years 1-3. Assumes 1742 acres. Assumes 1 person can inspect 360 acres per 8 hr day. Assumes there are 12 inspections per year. 1742 / 360 acres per day = 4.9 days (rounded up) x 8 hr day **=** 39.2 hrs per inspection x 12 inspections per year x 3 yrs = **1412 hrs** (rounded up)
	183	Inspect for invasive plants, assess plant protection and health and general site assessment. For years 4-10. Assumes 1,742 acres. Assumes 1 person can inspect 360 acres per 8 hr day. Assumes there are 4 inspections per year. 1,742 acres / 360 acres per day = 4.9 days (rounded up) x 8 hr day = 39.2 hrs per inspection x 4 inspections per yr x 6 yrs = **941 hrs** (rounded up)
Stream Channel Maintenance	**184**	Clean and stabilize channels as necessary. Maintain 4200 ft of stream channel every 10 yrs. Assumes 35 feet wide and 2 feet deep. Cost for removal of 13,611 cubic yards @ $32.20 per yard = $438,274. Sell 648 truck and transfer @ $450 per load = $291,600. Total stream maintenance cost = $438, 274-$291,600=$146,647 / 10 yrs = $14,665 per year
Field Equipment	**185**	Misc. Field Equipment Needs/Repair - Assumes field equipment needs to purchased and replaced (ex. Tape measures, quadrats,)
	186	Signage - assumes 4 signs per mile of exterior fence line. Approximately 24.3 miles of exterior property line x 4 signs per mile = 98 signs (rounded up to next whole number) x $15 per sign = $1470
	187	Camera: Average of 10 cameras
	188	GeoXt 6000 = $6495, Terrasyn and Pathfinder License = $2,995. 2 year hardware warranty extension=$450. Total cost is $9940.
	189	Purchase 2 GPS unit warranties at years 4, 6, 8. 2 units x $450 x 3 years = $2700
	190	Cattle shade structures. Assumes West Unit 14 structures, Middle Unit 12 structures, East Unit 20 structures. Total 46 structures at $500 ea = $23,000
	191	One time cost to fix 1/2 mile of fence (2640 feet x $5.00 per foot = $13,200. Assumes Grazing leases will make Leasee reponsible for fence repair and replacement as this is normal practice. Assumes these funds will be used in an emergency if the Leasee can't react quickly enough and will be replenished after billing Leasee. Funds will need to rolled into the Long Term PAR when established.