Wiyot Tribe
Natural Resources Department

Clean Water Act §319 Nonpoint Source Pollution Control Program

NONPOINT SOURCE ASSESSMENT

Wiyot Tribe - Table Bluff Reservation

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Overview

This assessment narrative is intended to document nonpoint source (NPS) pollution for waters affecting the Table Bluff Reservation (TBR) of the Wiyot Tribe (hereafter "Tribe") and provide background information to update the Tribe's NPS management plan. Documentation of NPS pollution provides the Tribe with an important tool for evaluating cumulative impacts of NPS pollution and in maintaining sound NPS management policies and control programs.

TBR covers 88.5 acres in coastal Northern California, and contains both groundwater and wetland water resources (Figure 1). Section 319 of the federal Clean Water Act (CWA§319) provides authority to Tribes to address problems associated with nonpoint sources of pollution of Tribal water resources; the Tribe has received CWA§319 monies from the United States Environmental Protection Agency (USEPA) for the purpose of addressing NPS issues on TBR. To continue receiving CWA§319 grant funding, the Tribe updates its NPS assessment report and NPS management plan.

While water quality at TBR is good and is meeting all applicable standards, there are several NPS threats to water quality. Among these are pollution originating as a result of: storm-water runoff from roads and residential areas, agricultural operations, wastewater operation, and solid/hazardous waste. Because water quality is satisfactory, the Tribe's efforts will be placed in prevention of degradation of waters from nonpoint sources of pollution. Potential and recommended actions will be outlined in this assessment, and expanded in greater detail in the Tribe's NPS management plan.

Introduction

Wiyot people have always lived along the Pacific Ocean and around Humboldt Bay. Before the 1850's and the times of the Gold Rush, the Wiyot people covered 40 miles of coast line, going inland about 10 miles. The Tribe's ancestral territory includes Little River to the north, Bear River Ridge to the south, and from the Pacific Coast out to as far as Berry Summit in the northeast and Chalk Mountain in the southeast. Currently the Tribe controls 0.02% of this land. Main waterways include Humboldt Bay, Little River, Mad River, Jacoby Creek, Freshwater Creek, Elk River, Eel River, Van Duzen River, and Bear River. The majority of villages were concentrated around Humboldt Bay and along the coast; other villages were located inland, generally near rivers.

Figure 1. Table Bluff Reservation. This photograph was taken looking due west towards the reservation; the Pacific Ocean can be seen in the background.

After the atrocities in 1860, nearly all Wiyot people were removed from this area, but some returned. In the early 1900's, a church group purchased the original 20 acres of the "old reservation," in the Eel River estuary, for homeless Wiyot people. The Federal Government later transferred this land into trust status in 1908. In 1958, the Federal Government passed the California Rancheria Act (amended in 1964) that terminated the Tribe in 1961. In 1975, the Tribe filed suit against the Federal Government for unlawful termination. In 1981, in Table Bluff Band of Indians v. Lujan (United States), it was determined that the Tribe's termination was unlawful and trust status was reinstated. In 1991, because of drinking water contamination and other sanitation issues, the court mandated new land be purchased and the Tribe moved to another location. This resulted in the Tribe's acquisition of 88.5 acres of land approximately 1 mile away from the original Rancheria (Figure 2). The original 20 acres were put into fee simple under the individual families, but deemed to be under the Tribe's jurisdiction as long as held in Indian hands. In 1998, the Table Bluff Rancheria of Wiyot Indians was changed to Table Bluff Reservation - Wiyot Tribe. In 2005, the name was changed again, this time truncated to the Wiyot Tribe. To date, there are approximately 650 tribal citizens enrolled and 120 TBR residents.

In the late 1990's, the Tribe established an Environmental Department (changed to "Natural Resources Department" in 2013) to guide and inform natural resource management decisions. A water pollution control program, funded by the USEPA under authority of section 106 of the Clean Water Act (CWA§106), was established by the Tribe in 2004; a NPS water pollution control program, funded by USEPA under authority of CWA§319 of the Clean Water Act, was established in 2005. These programs are intended to protect the Tribe's water resources from pollution and to guide management of tribal water resources.

This NPS assessment is an update of the 2010 edition and has been prepared by the Wiyot Tribe's Natural Resources Department with the intent to assess NPS pollution threats to water quality at the TBR. The goal of this NPS assessment is to create a general reference which the Tribe can use to coordinate and maximize the effectiveness of its efforts to prevent, reduce, and mitigate NPS pollution of the waters within and entering the Table Bluff Reservation. The objectives of the assessment are:

- to provide a description of the present status of reservation waters,
- to describe some of the processes that have the potential to have a deleterious impact on those waters, and
- to outline a range of options that can address current and foreseeable negative impacts from NPS water pollution

The Tribe's water resources, including groundwater and a half-acre freshwater wetland on the reservation, are presently of good quality but are threatened by NPS pollution such as residential accumulation of non-operating vehicles, polluted runoff associated with roads and buildings, improper grazing practices and pesticide applications on and off the reservation, invasive wetland botanical species, spills as a result of leachfield/septic tank failure, and solid/hazardous waste as a result of illegal dumping or unintentional spills. Several NPS

pollution problems on the reservation, including erosion and other issues associated with poorly managed cattle grazing, have already been addressed via implementation of control efforts over the past 5 years since the Tribe's NPS pollution control program was established. The primary aim of the program now lies in maintaining the quality of water resources on the reservation by prevention of NPS pollution.

In addition to TBR, the Tribe also owns three fee-simple status properties within its ancestral territory: a one-acre lot on the Old Wiyot Reservation, situated at the northern edge of the Eel River estuary and a mile away from the current reservation; approximately 45.5 acres on Humboldt Bay's Indian Island, and is currently in the process of obtaining another 270 acres which the City of Eureka is transferring to the Tribe. and approximately 104 acres on Cock Robin Island, in the Eel River Estuary. Because the CWA§319 program does not fund activities on non-trust lands, this assessment does not include these additional fee-simple properties – it pertains solely to TBR.

A public comment period for the Wiyot Tribe's Nonpoint Source Assessment and Management Plan for TBR took place between the dates of September 9, 2020 and October 9, 2020, concurrent with the USEPA review period for the documents. Public notice was posted at the Wiyot Tribal office, on the Tribe's website at www.wiyot.us, and distributed to the Wiyot Tribal citizenship.

Figure 2. Regional Map with location of Table Bluff Reservation

Methodology

The primary data source for NPS water pollution assessment on the reservation is the Wiyot Tribe's water quality monitoring program, established in 2004 under authority of CWA§106.

In September 2004, USEPA approved a Quality Assurance Program Plan (QAPP) for Water Quality Assessment and Monitoring for the Tribe. The QAPP ensures that the quality assurance (QA) and quality control (QC) procedures used to document technical data generated during projects is accurate, precise, complete, and representative of actual field conditions. QA is defined as an integrated program designed to assure reliability and repeatability of monitoring and measurement data. QC is defined as the routine application of procedures to obtain prescribed standards of performance in the monitoring and measurement process. The QAPP is consistent with guidelines set forth in the USEPA's *Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5* (USEPA, 1998) and *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (USEPA, 1998).

In establishing a monitoring design, Non-Random Data Collection Methodology was used to determine sites for monitoring and sampling based on proximity to potential contamination and where water quality impairment has been deemed most likely to occur. The Tribe has established two sample stations at the reservation's seasonal wetland to monitor for site-specific potential contamination: starting in December 2003, surface water samples were collected during the wet season, when there was adequate surface water for sample collection; in 2005 two shallow wetland wells were developed to monitor the groundwater/surface water interface year-round. The surrounding land uses most likely to result in contamination of the wetland include agricultural production of beef cattle and hay, and the adjacent management of the reservation's community wastewater leach field. The most likely contaminants to be detected in the wetland would include nitrates and phosphates, as well as fecal coliform.

The Tribe samples for a suite of water quality indicators at these monitoring sites:

- Temperature
- pH
- Dissolved oxygen (DO)
- Turbidity
- Phosphorus (total phosphate)
- Total nitrogen (total Kjeldahl, ammonia, nitrate-nitrite)
- Total/fecal coliform

The Tribe also monitors these parameters at all sites:

- Specific conductivity
- Salinity
- Depth

The Tribe monitors for the additional WQIs and constituents:

- Total petroleum hydrocarbons (TPH)
- Priority metals
- Total suspended solids (TSS)

Temperature, pH, DO, and turbidity monitoring is performed *in situ* with Yellow Springs Instruments Exo 2 sondes; phosphorus, nitrogen, and bacteria monitoring are performed using various collection methods described in the Tribe's QAPP. All collected samples are analyzed by North Coast Laboratories in Arcata, California. Presently, the Tribe monitors for pH, DO, turbidity, specific conductivity, and salinity on a bi-weekly schedule, and monitors for the other parameters every autumn after "first flush" rains have washed potential pollutants into the wetland.

All data collected for sonde parameters (temperature, DO, turbidity, specific conductivity, pH, salinity) have been generated in electronic format and managed using Microsoft Excel. Data generated from laboratory-analyzed samples have been converted from paper to electronic format using Microsoft Excel. Metadata generated from field notes and sample collection log sheets generated in the field are also converted to Microsoft Excel. Additionally, the Tribe formats all data to be compatible with USEPA's Storage and Retrieval (STORET) database; data are regularly uploaded to the database via the Water Quality Exchange (WQX) Web online interface. To facilitate public availability of collected information, data from the Tribe's sampling of physical parameters of water quality are posted and available for download on the Tribe's website (http://www.wiyot.us/biological-water-quality-monitoring-data). The Tribe oversees all aspects of data recording, validation, transformation, transmittal, reduction, analysis, and tracking as prescribed in the Tribe's USEPA-approved QAPP.

Besides the Tribe's water quality monitoring program, other sources of data include:

- Geological and Geophysical Survey for Well Water Location for the Table Bluff Reservation, GeoConsultants, 2006.
- Water Quality Test Results for Drinking Water Well on Table Bluff Reservation, North Coast Laboratories, 2009 & 2011.
- Water Quality Control Plan for the North Coast Region, North Coast Regional Water Quality Control Board, adopted by the State Water Resources Control Board on March 21, 1994 (updated March 2011).

Since the Tribe has not established water quality standards of its own, the Tribe compares collected water quality data to applicable water quality standards and criteria set forth by USEPA and the State of California, including the North Coast Regional Water Quality Control Board Basin Plan and Amendments, the National Recommended (Ambient) Water Quality Criteria, California Toxics Rule, and National Primary Drinking Water Standards. These comparisons indicate whether water quality is meeting established water quality criteria, and the Tribe's water quality assessments are based on the results of these comparisons.

Land Use Summary

Setting – Table Bluff Reservation

TBR is located on the bluffs above the south end of Humboldt Bay (150 feet from the reservation boundary) and the Pacific Ocean (1.1 miles from the reservation boundary) (Figures 3 & 4); the Eel River estuary lies 0.63 miles to the south. Within the reservation boundaries, there are 36 residences and one community center, supporting a population of approximately 120 people. There are over 650 citizens enrolled with the Tribe.

Figure 3 & 4. From south Humboldt Bay (left) and on TBR (right), showing the proximity to coastal resources and habitats commonly found on and surrounding the reservation

There are no major industrial operations on the reservation. Cattle grazing and other agriculture dominate surrounding land uses. Historic land use within the area of the current reservation consisted of dairy ranching and potato farming.

Hydrologic Resources

The reservation rises above and sits at the boundary of two watersheds – the Lower Eel Watershed (Hydrologic Unit Code [HUC] 18010105) and Mad-Redwood Watershed (HUC 18010102); technically, the reservation lies within the Mad-Redwood Watershed, although waters from that watershed do not flow onto the reservation. The nearest river, the Eel River, is 3.7 miles from the reservation; the nearest creek is 1 mile from the reservation. A half-acre of seasonal freshwater wetland exists within reservation boundaries. The water sources for the reservation community drinking water system are two groundwater wells located near the western and southeastern boundaries of the reservation (Figure 5). Location of TBR in relation to watersheds can be found in Figure 6.

Figure 5. Map of Table Bluff Reservation Water Resources

Figure 6. Location of Table Bluff Reservation and Bordering Hydrologic Units

Identification of NPS Threats

Currently on TBR, the known NPS pollution threats have been identified and ranked according to current, potential, unknown, or no known NPS pollution impairment (Table 1).

Table 1. Categories and subcategories of NPS pollution threats with level of impairment for Table Bluff Reservation.

Category	Subcategory	Impairment level*
Agriculture	Pasture land	2
Hydrologic/Habitat Modification	Draining/Filling of wetlands	1
Construction	Roads, highways, bridges	2
	Land develop or redevelopment	3
Turf Management	Yard maintenance	3
Urban Areas	Surface runoff	2
Land Disposal, Storage, and Treatment	Hazardous waste	4
	Inappropriate waste disposal	3
	Wastewater	3

*Scale of impairments:
Level 1. Confirmed impairment currently exists.
Level 2. Possible impairment: not yet confirmed by monitoring data.
Level 3. NPS pollution occurring with no current impairment to waterbodies.
Level 4. No known NPS pollution occurring or impairment to waterbodies at this time.

Geology

The reservation soils have been analyzed and determined to be of the Rohnerville series, consisting of moderately well drained soils developed from softly consolidated sedimentary alluvium originating in the Hookton and Rohnerville geologic formations. Geologic materials underlying the reservation consist of deposits of gravels, sands, silts, and clays of the upper Pleistocene Hookton Formation. Underlying the Hookton Formation are conglomerate, sandstone, and claystone of the Carlotta Formation of lower Pleistocene age. Subsurface folding and faulting may control ground water movement and flow, and the subsurface may be separated in to separate compartments.

Climate

Due to its location near the coast, the reservation has a climate with a strong maritime influence. Rainfall averages between 30 and 55 inches per year. Average annual temperature ranges between 55- and 60-degrees Fahrenheit. The average wind speed in the area is 10 knots. Fog is a frequent meteorological occurrence in the area, and high winds and flooding are occasionally observed.

Social Setting

The Wiyot Tribe was unlawfully terminated under the California Rancheria Act of August 18, 1958, amended 1964. The Tribe sued the Federal Government for re-recognition and regained its status in 1981.

Since the Tribe's incorporation under the Indian Self-Determination Act in 1991, the Tribe has worked to establish essential Tribal programs. The Tribe is governed by a seven-member elected Tribal Council. The Tribal staff is organized into six departments, namely Administration, Cultural, Natural Resources, Fiscal, Maintenance, and Social Services.

While the Tribe has a current citizenship around 650, approximately 120 people live within the area studied in this assessment. Economic conditions on the reservation are not completely uniform, but poverty is extensive – some 85% of reservation residents subsist below the national poverty level.

Water and Culture for the Wiyot Tribe

The Wiyot people have always lived around Humboldt Bay and the lower Eel and Mad Rivers, and have used the waters of the bay, rivers, and coast for many purposes. Fishing, hunting, and gathering food and culturally significant materials are particularly important to tribal citizens who have long depended on fish and wildlife for subsistence. Before the damming of wetlands by European settlers, there were over 100 miles of travelable waterway up into sloughs and creeks that empty into Humboldt Bay. Using redwood canoes, these routes were means of reaching important locations, such as ceremonial grounds and fishing sites. Food resources such as shellfish, crabs, seals, otter, fish, and eels were often harvested from the rivers, bay, and mudflats in canoes. Basket and textile materials such as tule and willow root were, and still are, collected from wetland and riparian habitats. Water continues to be essential in use of medicines, soaking basket materials, leaching foods such as acorns, and bathing the sick when in ceremonies, or when used while fasting during ceremonies.

Domestic Water

All households on TBR rely on two groundwater sources for their domestic water supply (Figure 7). The Tribe operates a community drinking water system serving 120 residents through 37 connections. One 600'-deep well supplying the water system is located near the western boundary of the reservation; the well was installed in 2008 and connected to the water system in 2010. Another 500'-deep well is located near the southeastern boundary of the reservation; the well was installed in January 2011 and was online July 2011. More information on the drinking water sources can be found in subsequent sections.

Figure 7. Water Treatment Building. The Table Bluff Reservation community drinking water system includes this treatment building and tank that stores 100,500 gallons of treated groundwater.

Surface and Ground Water Quality Summary

Surface Water Inventory

There are no permanent, visible surface waters on the reservation. Technically, the majority of the reservation lies within the Mad-Redwood Watershed (HUC 18010102), although surface waters from that watershed do not flow onto the reservation. The nearest river, the Eel River, is 3.7 miles from the reservation; the nearest creek is 1 mile from the reservation. Humboldt Bay lies 110' to the north of the reservation boundary.

In 2005, the Tribe implemented erosion control measures to improve the north edge of the bluff, the stability of which had been compromised by grazing cattle. Measures included the installation of jute, straw, and native grass seed, as well as the installation of an exclusionary fence to keep cattle away from the edge of the bluff. These efforts stabilized the bluff and prevented further sediment loading of Humboldt Bay from reservation sources.

Wetlands

There are approximately 0.5 acres of seasonal freshwater wetland located at the northeast section of the reservation (Figure 8). The wetland soils are saturated to ground surface level, typically with standing water over the ground surface, during the wet months of November through June; the soils remain moist the remainder of the year. The wetland is bisected by the exterior boundaries of the reservation and continues down-slope onto neighboring property; the total wetland area is estimated to be 1.5 acres. Because the entirety of the wetland is not under tribal jurisdiction, the Tribe encourages cooperative participation with the neighboring landowner in regard to information sharing, planning, and activities related to wetland protection and restoration.

Figure 8. Reservation Wetland. The half-acre seasonal freshwater wetland on the reservation is threatened by pollution from multiple NPS threats.

Because the Tribe has categorized the land use zone for the wetland area as "cultural preservation" and "wildlife habitat preservation," the wetland is subject to little direct human impact. However, surrounding land uses of cattle grazing have historically impacted the wetland, and a poor-functioning and substantially sized community wastewater drainfield has historically had the potential to impact the wetland. In 2005, using CWA§319 monies, the Tribe installed exclusionary fencing around the wetland to keep cattle from denuding wetland vegetation and trampling sensitive wetland soils, and to provide a buffer from over-grazing-

Figure 9. Wetland Fence. Fence was constructed in 2005 to keep cattle out of the reservation wetland and provide a buffer area to protect the wetland from nutrient-contaminated runoff.

caused erosion and nutrient loads from cattle excrement (Figure 9). In 2006, the Tribe implemented a reservation grazing management plan to eliminate over-grazing; this has resulted in a significant recovery of the grasslands surrounding the wetland.

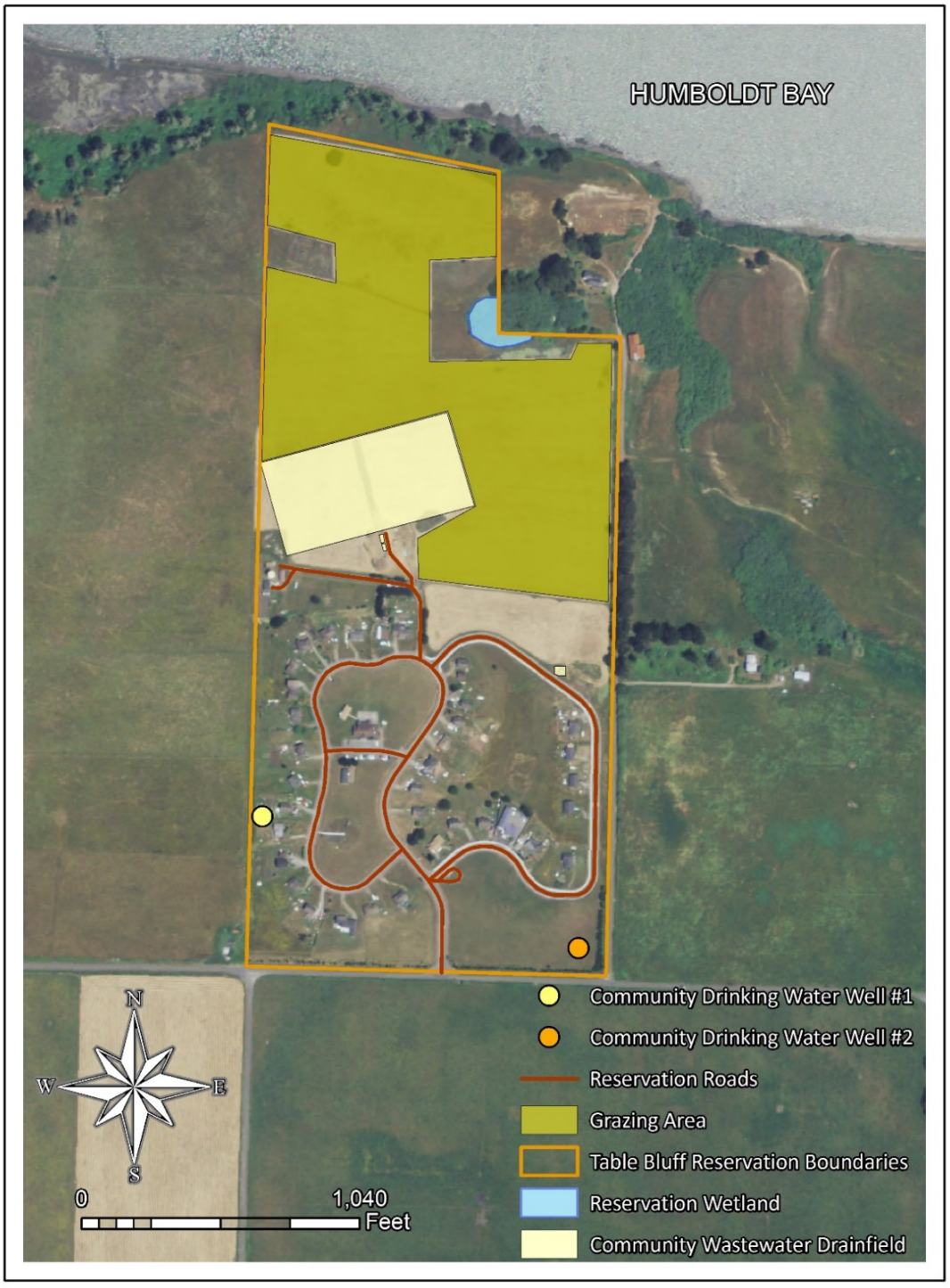
Another threat to the Tribe's wetland is the community wastewater leachfield In 2009, the Tribe used USEPA Drinking Water Tribal Set Aside monies to upgrade the community drainfield to remedy inadequate wastewater treatment and make sewage overflows less likely. In 2014, the Tribe installed two risers (1 in each 10,000 gallon septic storage tank) to allow better access for pumping/cleaning to avoid overflows caused by the accumulation of solids/debris that clog the tank filter.

Another threat to wetland water quality is sedimentation from construction site runoff. Several large construction projects including two wastewater system improvement projects, two drinking water system improvement projects, and a substantial road extension project, have taken place on TBR since 2007. In order to adequately control and manage construction site erosion and stormwater runoff, in 2011 the Tribe created both a Grading, Sediment, and Erosion Control ordinance and a Wetland Zone Protection ordinance. The Grading, Sediment, and Erosion Control ordinance is a regulatory Best Management Practice (BMP) that will reduce or eliminate stormwater runoff associated with construction sites. The Wetland Zone Protection ordinance is a regulatory BMP that restricts development, agricultural practices, and dumping in the Tribe's established wetland boundaries. In addition to the restricted practices, any construction activities within 100' of the wetland zone boundary will require the installation and management of proper BMPs in order to avoid potential NPS contamination from entering the wetland habitat. In 2013, the Tribe implemented a Low Impact Development (LID) Policy which will ensure the protection of cultural and/or environmental resources as a result of stormwater pollution originating from any construction/demolition activities. The main goals of the LID Policy are:

- To prevent the contamination of the Tribe's groundwater and drinking water resources by point and/or NPS pollution generated as a result of stormwater runoff
- To protect environmental sensitive habitats (i.e. wetlands) from degradation as a result of development/redevelopment activities
- To maintain and/or improve upon the aesthetic beauty of TBR
- To prevent the degradation of both the Tribe's cultural and biological resources (i.e. botanical and wildlife resources)
- Provide outreach and education opportunities for Tribal citizens, especially youth, in regards to LID and pollution related topics

The Tribe has been monitoring ambient water quality at the wetland since 2003. The parameters of highest priority are nitrates, phosphates, and fecal coliform (Figure 10). While the wetland habitat has improved dramatically, water quality monitoring has not resulted in observations of improvement due to management. This is in part because water quality prior to implementation of wetland protective measures was not particularly poor. The protective measure implementation is still viewed as a success because it protects good water quality in the wetland, rather than improving poor water quality.

Figure 10. Map of Table Bluff Reservation NPS Pollution Threats



Groundwater Resources

TBR utilizes local groundwater sources for its community drinking water system. The Tribe operates two wells located on the western and southeastern boundaries of TBR. The 600'-deep well (well #1) was installed in 2008 and connected to the water system in 2010 (Figure 11). Water is pumped from a depth of 260 feet, static water depth is 74 feet, dynamic water depth is 150 feet, and yield is 15-20 gallons per minute (gpm). The 500'-deep well (well #2) was installed in January 2011 and connected to the water system in July 2011 (Figure 12). Water is pumped from a depth of 180 feet, static water level is 72 feet, and yield is 30-35 gpm. The Tribe pumps around 1.8 million gallons (5.5 acre-feet) per year to fulfill reservation community water demand.

Electrotelluric soundings performed in 2006 to research potential well-drilling sites showed that subsurface strata saturated with water lies in two intervals under the reservation (Appendix A). The first runs between the depths of around 200 and 290 feet, and second runs between the depths of around 480 to 690 feet, although there is significant variation on these depths at different points on the reservation. The water-saturated strata appear to run under the entire area of the reservation, 88.5 acres. Water quality for the wells installed in 2008 and 2011 have been studied extensively and compared to USEPA primary drinking water standards for evaluation. A broad suite of tests were performed, including measurement of physical, bacteriological, and chemical parameters (Appendices B & C). Groundwater drawn from both saturated intervals shows very high quality, and no parameters exceed any primary drinking water criteria. Upon installation of both wells, one parameter, pH, exceeds the national secondary drinking water regulation of 6.5 to 8.5, with a pH close to 9.0. This poses no health risk to consumers, nor does it negatively influence aesthetic perception of water quality. However, as water has been drawn from both wells for the community, the pH has decreased to within acceptable levels (~8.0).

Figures 11 & 12. Drilling Water Wells. In 2008 and 2011, the Tribe installed two drinking water wells on TBR, giving the community access to the higher quality groundwater beneath their feet.

Groundwater recharge is primarily from precipitation and surface runoff infiltration. Infiltration of surface runoff has the potential to carry contaminants into the groundwater. The most likely on-reservation sources of groundwater contamination are storm-water runoff as a result of paved reservation roads (Figure 13), increased development, and accumulation of non-operational vehicles, as well as agricultural operations, especially cattle grazing. Land use surrounding the reservation is dominated by more cattle grazing. The most likely contaminants resulting from the above sources include nitrates and nitrites, phosphates, fecal coliform, and petroleum hydrocarbons. There are no known underground storage tanks on the reservation or tribal properties.

Figure 13. TBR community center parking lot. Impermeable surfaces such as paved roads and parking lots on the reservation collect automobile-related pollutants which are "flushed" during rainfall events.

In 2007, in an effort to improve treatment of storm-water runoff from paved reservation roads, the Tribe constructed a retention basin to capture some of the runoff and slow its infiltration into the groundwater. The basin is designed to hold the runoff long enough that micro-flora and micro-fauna associated with native plants installed in the basin have an opportunity to break down pollutants that may be present in the runoff. While it is expected that this passive bio-remediation utilization is having a protective effect of water quality, there are no data to confirm this: no groundwater quality data were available prior to the project, and post-project groundwater quality data do not show impacts from run-off related pollutants.

Results

Reservation Wetlands

Water Quality Assessment (Appendix D)
Monitoring at the two shallow wetland wells on the reservation has not shown any exceedances of water quality criteria. Sampling for **nitrite** has shown no detections since sampling began in 2005. For this monitoring period, the greatest concentration of **nitrate** was detected in well #2 at 1.2 mg/L (previous recorded high level was 6.1 mg/L in January 2015 at well #2), under even the National Recommended Ambient Water Quality Criterion of 10.0 mg/L for sources of drinking water (which the wetland is not). In October of 2008, sampling showed the highest concentrations of **ammonia nitrogen** in the two wetland wells of 0.62 and 0.11 mg/L, far below the USEPA Recommended Water Quality Criteria for Freshwater Aquatic Life after taking into account temperature and pH of the sample. For this monitoring period, ammonia nitrogen was not detected in well #1 or well #2.

Bacteriological results have been more variable. While most sampling events have shown **total coliform** concentrations of less than 30 MPN/100 ml, eleven events at well #1 have yielded high results. In contrast, well #2 has only had six samples that have shown a total coliform concentration exceeding 30 MPN/100 ml. Previous to 2010, **fecal coliform** had not been detected in the wetland during any of the sampling events. Since then four sampling events at well #1 and three at well #2 have resulted in detected levels of fecal coliforms present. To date, all QA/QC samples (rinsate samples) performed in the field and processed by NCL have been "non-detect" results for total and fecal coliforms suggesting the result values are uncompromised (e.g., sampler error, improper cleaning of equipment). All samples detecting total coliform levels above 30 MPN/100 ml and/or fecal coliform levels above 0 MPN/100 ml have been listed in Table 2 below.

Table 2. Total/Fecal coliform results for water quality monitoring sites at TBR wetland.

Sampling Site	Sampling Date	Total Coliform Results (MPN/100 ml)	Fecal Coliform Results (MPN/100 ml)
Well #1	May 2005	240	<2
	March 2006	>1600	<2
	November 2006	>1600	<2
	February 2009	>1600	<2
	October 2010[1]	-	8
	November 2010	>240	<2
	October 2011	>1600	79
	October 2012	>1600	22
	November 2014	540	11
	March 2016	350	<2
	January 2017	240	<2
	December 2017	240	4.5
	June 2019	35	4.5
Well #2	October 2010[1]	-	80
	November 2010	190	28
	October 2011	>1600	170
	October 2012	>1600	<2
	January 2015	240	<2
	January 2016	350	<2
	March 2018	350	1.8
	June 2019	49	4.8

[1]Results processed by NCL did not include total coliform values, only fecal coliform values.

The coliform results seem to be consistent with levels that would be naturally occurring in a wetland environment. When first detected in 2010, it was discussed that the presence of fecal coliforms could possibly be originating from the Tribe's leach field, located approximately 150 yards uphill and south of wetland well #1, or a failed septic system from a nearby neighboring bed and breakfast, but the low detection of nitrate and total phosphate phosphorus suggests otherwise (Dr. Matthew Hurst personal communication). The Tribe will continue to track this recent occurrence of fecal coliform and consult Indian Health Service (IHS) and/or HSU's Dr. Hurst for information and guidance on potential mitigation and remediation. While there is no criterion for fecal coliform concentrations that applies directly to shallow wetland groundwater, the NCRWQCB's objective for inland surface waters is a 30-day median of 50 MPN/100 ml with a minimum of not less than 5 samples, and that not more than ten percent of total samples during any 30 period exceed 400/100 ml. During the period from December 28, 2016 through January 27, 2017 the Tribe sampled both wetland well #1 and wetland well #2 five times each with both wells meeting the NCRWQB's 30-day median objective. No 30-day median sampling occurred during FY 2018.

In 2011, testing for **total suspended solids** was conducted and the results showed a concentration of 3 mg/L in wetland well #1 and 34 mg/L in wetland well #2. Monitoring for physical parameters from October 2011 to September 2012 showed a turbidity average of 3.9 Nephelometric Turbidity Units (NTU) in well #1 and 2.3 NTU's in well #2. The presence of elevated TSS concentrations in well #2 may suggest that sediment is more easily transported into the well casing at this site in comparison to well #1. Sediment is a suitable media for bacterial growth so higher turbidity readings may explain why coliform levels in wetland well #2 were elevated when compared to well #1. Sampling for TSS was not conducted from the period of October 2017 – September 2018 but turbidity data from *in situ* sampling showed averages of 3.57 NTU for well #1 and 20.82 NTU for well #2. This is in contrast to last year's monitoring which showed 7.02 NTUs for well #1 and 12.1 NTUs for well #2.

Total phosphate phosphorus concentrations have been variable, with samples yielding results ranging from non-detections to a maximum of 0.93 mg/L. Monitoring during the period of October 2018 through September 2019 yielded a maximum result of 0.066 mg/L in well #1. There is no criterion for phosphate that applies directly to shallow wetland groundwater; however, the National Recommended Ambient Water Quality Criterion for streams is .05 mg/L. It is unsurprising that the phosphate levels in the wetland occasionally exceed the stream-related criterion – wetlands often act as a sink for nutrients.

The Tribe began sampling for **priority metals** in fiscal year (FY) 2013 and continued the sampling into this monitoring period. For chromium, sampling for this monitoring period resulted in 5.2 ug/L in well #1 and was not detected in well #2. These limited amount found in well #1 is to be expected as chromium naturally occurs in soil. Similarly **copper** was absent this monitoring period but was present in FY14 (4.4 ug/L) and in FY13 (1.4 ug/L). Zinc was present this monitoring period in well #1 at 15 ug/L and was not detected in well #2. Both zinc and copper are present in low concentrations and are normal for a wetland environment (Dr. Matthew Hurst personal communication). **Nickel** was present this monitoring period at 9.3 ug/L in well #1 and was not detected in well #2. This presence on nickel is well under even the National Recommended Ambient Water Quality Criterion of 640 ug/L for sources of human consumption (i.e., drinking water).
Similar to priority metals, the Tribe also began sampling for **total petroleum hydrocarbons** in FY13 and continued the sampling into this monitoring period. Prior to monitoring conducted in FY16, there had been no detections of TPH at either sampling locations in the Tribe's wetland. A sample taken at well #1 in FTY16 resulted in concentrations of diesel oil at 61 ug/L but laboratory notes indicated that the sample contained material in the diesel range of molecular weights, but the material did not exhibit the peak pattern typical of diesel oil. Due to a potential discrepancy noted by NCL, it is believed that this sample contained contaminants that caused interference during sample processing and that a definitive presence of TPH in the wetland well cannot be recorded. Further analysis of TPH in the wells is needed to determine if contamination is currently occurring. There were no detections of TPH in either well this sampling period.

Discussion

Water quality on TBR is very good. Results from long-term water quality monitoring at the reservation wetland indicate that water resource is in good condition. This condition has been protected by measures implemented by the Tribe, including improvements in grazing management and community wastewater drainfield function. Groundwater quality on the reservation, only recently assessed for use for the reservation community drinking water system, is very good. While the groundwater has not yet been thoroughly assessed in regards to all potential NPS pollutants, so far there are no indications of contamination.

However, maintenance of the high quality of Tribal water resources is not forever assured. Several potential sources of NPS pollution exist on the reservation, and threaten to degrade water quality. Among these are agricultural runoff, degradation of sensitive environments such as wetlands, runoff from reservation roads and housing lots, contamination via the Tribe's wastewater system, and/or improper disposal of solid/hazardous waste. Listed below are the NPS pollution threats to TBR listed according to category and subcategory along with ranking priorities according to quantifiable impairment. Ranking criteria includes:

Severe: Waterbodies impacted by multiple sources of NPS pollution threats causing knowing impairments via existing monitoring data
High: Waterbodies impacted by multiple sources of NPS pollution threats that may be causing impairments but is not known either due to little or unknown monitoring data
Moderate: Waterbodies may be impacted by potential sources of NPS pollution threats but no impairments have been detected
Low: Waterbodies are not impacted by potential sources of NPS pollution threats or threats are nonexistent

NPS Pollution Threat Category: Agriculture (Rank category: High)
Subcategory: Pasture land

- Soil disturbance in and around wetland and bluff edge in grazing areas (sediment)
- Loss of riparian vegetation from cattle grazing in and out of wetland (sediment and increased temperatures)
- Contaminated runoff and direct deposition of manure and urine to wetland (nutrients, pathogens)
- Application of fertilizers and pesticides for crop management and disturbance of soil as a result of grazing crop practices either on reservation or on neighboring lands leading to runoff of pollutants to nearby tribal water sources (nutrients, sediment, PCB/SVOCs, metals)
- Potential contamination from farming equipment used during seasonal removal of pasture land grasses for hay on reservation or on neighboring lands (hydrocarbons, PCB/SVOCs, metals)

NPS Pollution Threat Category: Hydrologic/Habitat Modification (Rank category: Severe)
Subcategory: Draining/Filling of Wetlands

- Deterioration of wetland habitat quality and lowered biological diversity as a result of non-native, invasive botanical species (e.g., Himalayan blackberry [*Rubus armeniacus*]) which can dominate wetland vegetation, eliminate native plant species, and drain wetlands of groundwater via intense transpiration (lowered biodiversity, wetland drainage)
- Continued development leading to the conversion of wetlands to uplands for the purposes of housing, infrastructure, etc. (sediment, habitat destruction)
- Deterioration of wetland habitat quality by the historic deposition of construction soils directly adjacent to the wetland. Seeds from non-native, invasive species (e.g., bull thistle [*Circium vulgare*], milk thistle [*Silybum marianum*], wild radish [*Raphanus raphanistrum*], and poison hemlock [*Conium maculatum*]) have propagated in the wetland as a result of soils being dumped during the construction of houses on TBR in the early 1990's. These species can dominate wetland vegetation, eliminate native plant species, and encourage the growth of non-native, invasive species (lowered biodiversity, wetland drainage)

NPS Pollution Threat Category: Construction (Rank category: High)
Subcategory: Roads, highways, bridges

- Inadequately managed soil disturbance in and around construction site (sediment)
- Inadequate construction design of tribal roads (sediment, increased storm-water loading)

Subcategory: Land development or redevelopment

- Continued development leading to increase of impervious surfaces on the reservation, contributing to increased storm-water runoff and poor drainage (hydrocarbons, metals)
- Inadequate construction design of tribal buildings (sediment, increased storm-water loading, metals, PCB/SVOCs)
- Inadequately managed soil disturbance in and around construction site (sediment)

NPS Pollution Threat Category: Turf Management (Rank category: Moderate)
Subcategory: Yard Maintenance

- Improper application of pesticides and fertilizers around tribal homes and buildings (PCB/SVOCs, nutrients)
- Improper care for ground cover/vegetation around tribal homes leading to increased soil disturbance (sediment)
- Improper disposal of pet wastes (pathogens)
- Improper disposal of green waste (e.g., leaves and yard trimmings) as a result of yard maintenance activities (nutrients, increased solid waste in landfills)

NPS Pollution Threat Category: Urban areas (Rank category: High)
Subcategory: Surface Runoff

- Contaminated runoff from reservation roads into wetland or infiltration into groundwater (hydrocarbons, metals)
- Contaminated runoff from residential accumulation of non-operational vehicles into wetland or infiltration into groundwater (hydrocarbons, metals)
- Contaminated runoff from pollutant sources originating from and/or around residential dwellings that have the potential to contaminate tribal water resources and nearby waterways (metals, nutrients, sediment, pathogens, PCB/SVOCs)
- Impervious surfaces on the reservation, contributing to increased storm-water runoff and poor drainage (erosion, habitat destruction, increased storm-water loading)

NPS Pollution Threat Category: Land Disposal/Storage/Treatment (Rank category: Moderate)
Subcategory: Hazardous Waste

- Contamination of water resources by the storage and/or transportation of the Tribe's oil and antifreeze housed at the Tribe's collection facility on TBR (hydrocarbons, PCB/SVOCs)
- Improper storage and disposal of household chemicals, including automobile fluids, pesticides, paints, solvents, etc. (hydrocarbons, nutrients, PCB/SVOCs)

Subcategory: Inappropriate Waste Disposal

- Inadvertent or deliberate illegal disposal of solid/hazardous waste on TBR, potentially leading to contamination of both tribal and nearby water sources (e.g., Humboldt Bay) (pathogens, PCB/SVOCs)

Subcategory: Wastewater

- Inadequately treated wastewater runoff into wetland from either the Tribe's wastewater leachfield and/or septic tank and small leachfield located on neighboring property (nutrients, pathogens)
- Contamination of water resources by infiltration of inadequately treated wastewater originating from the Tribe's leachfield (nutrients, pathogens)
- Contamination of water resources by infiltration of untreated sewage through undetected leak(s) from underground wastewater line(s) (nutrients, pathogens)

Selection of Best Management Practices

The Tribe seeks to utilize regionally accepted BMPs whenever feasible. The Tribe considers BMPs to be those practices determined to be practicable, acceptable to the public, and cost-effective in preventing water pollution or reducing the amount of pollution generated by nonpoint sources, including information and education programs, technical and financial assistance, technology transfer, demonstration projects, monitoring/evaluation systems, and regulation and enforcement. Examples of selected BMPs from the Natural Resources Conservation Service can be found in the appendices (Appendix E).

Core Participants/Public Participation/Governmental Coordination

The Tribe's Natural Resources Department develops and presents BMPs to the Tribal Council for approval as needs arise. The Tribe has legislative procedures in place that set forth a comprehensive and systematic process for the Tribal Council to establish, amend, or modify policies, ordinances and acts, or to take other major governmental actions on behalf of the Tribe for the improvement of water quality. The process to identify and select BMPs is conducted on a project-by-project basis according to the relative significance of the sources of NPS pollution to each project's goals and objectives. In each instance, the most appropriate BMPs are incorporated into project design or management planning, and public input is solicited when required by Tribal policy. The Tribal Constitution of the Wiyot Tribe, adopted 1986, revised April 3, 1999, defines the process for calling Special General Council Meetings, which notifies the entire Tribal Citizenship of said meetings and incorporates public comment into the Tribe's planning process.

The model for the Tribal decision making process regarding choosing BMPs for addressing NPS pollution is as follows:

1. Identify all BMPs that are appropriate for the NPS pollution through research and/or consultation
2. Determine which of the identified BMPs are suitable for the purpose in terms of scale, environment, and existing infrastructure
3. Rank BMPs based upon likely performance; if necessary, determine likely efficacy of BMPs through research, modeling, and/or consultation
4. If necessary, consult with other relevant agencies and jurisdictions to determine which BMPs may best be used in coordination with their efforts. Develop formal cooperative agreement(s) when necessary. Identify multiple funding options where possible
5. Determine which BMPs will have the most favorable results per unit cost
6. Present options to public meeting of tribal council to allow tribal leadership, tribal citizens and nontribal public an opportunity to consider options, provide comment, and shape the implementation of the proposal
7. Implement BMP with adequate resources to perform necessary maintenance and monitor performance
8. Provide regular updates on BMP status and effectiveness for Tribal Council and other relevant agencies

Outside agencies and entities with whom the Natural Resources Department may work with to identify and select BMPs may include, but not limited to, the following:

- Bureau of Indian Affairs (BIA)
- California Department of Fish and Wildlife (CDFW)
- Californians for Alternatives to Toxics
- Eel River Resource Recovery
- GHD Engineers

- Greenway Partners
- Humboldt County – University of California Cooperative Extension (UCCE), Department of Environmental Health, & Sheriff's Office
- Humboldt State University (HSU)
- Humboldt Waste Management Authority (HWMA)
- Indian Health Service (IHS)
- U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS), Rural & Community Development
- Neighboring landowners
- Neighboring Tribes (e.g., Trinidad Rancheria, Blue Lake Rancheria, Bear River Rancheria)
- Rural Community Action Agency (RCAA)
- Rural Community Assistance Corporation (RCAC)
- Samara Restoration
- SHN Engineers
- State Water Resources Control Board
- U.S. Environmental Protection Agency (USEPA)
- U.S. Fish and Wildlife Service (USFWS)

Implementation of BMPs will be accomplished through a number of NPS pollution control programs, funding mechanisms, and educational programs conducted by the Tribe in conjunction with federal agencies. Local, state, and federal agencies can offer numerous forms of support of BMP implementation, including technical assistance, education, demonstration projects, and financial assistance. Some of the local, state, and federal government agencies that can contribute to a NPS pollution control program include:

- Bureau of Indian Affairs (BIA)
- Bureau of Reclamation (BOR)
- California Environmental Protection Agency (CalEPA)
- Humboldt County – UCCE, Department of Environmental Health, & Sheriff's Office (ordinance/policy enforcement)
- Indian Health Service (IHS)
- U.S. Department of Agriculture (USDA)
- U.S. Environmental Protection Agency (USEPA)
- U.S. Fish and Wildlife Service (USFWS)

Existing BMPs on Table Bluff Reservation

Below is a list of existing and/or planned BMPs on TBR. A more detailed narrative on past BMP projects can be found below under the section titled "NPS Control Programs."

Table 3a: Existing BMPs by NPS Category - Agriculture

NPS Category	Nonpoint Source	BMP(s)	(Potential) Partners	(Potential) Funding
Agriculture	1) Erosion 2) Habitat destruction 3) Hydrocarbons 4) Increased temperatures 5) Metals 6) Nutrients 7) Pathogens 8) PCB/SVOCs (pesticides & fertilizers) 9) Sediment	Community Education/Awareness Program	USEPA, HSU, UCCE, USDA	CWA§319
		Enforcement of Range Management Plan	USEPA, Humboldt County Sheriff's Department	CWA§319
		Enforcement of Wetland Zone Protection Ordinance	USEPA, Humboldt County Sheriff's Department	CWA§319
		NRCS-340 Cover Crop	UCCE, Samara Restoration	USDA
		NRCS-342 Critical Area Planting	USEPA, Samara Restoration	CWA§319
		NRCS-353 Monitoring Well	USEPA	CWA§106
		NRCS-382 Fence	USEPA, USDA	CWA§319, USDA
		NRCS-390 Riparian Herbaceous Cover	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-528 Prescribed Grazing	USDA, UCCE	USDA
		NRCS-590 Nutrient Management	USDA	USEPA, USDA
		NRCS-595 Integrated Pest Management	USEPA, USDA, UCCE	CWA§319, USDA
		NRCS-612 Tree/Shrub Establishment	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-643 Restoration and Management of Rare and Declining Habitats	USEPA, USDA	CWA§319, USDA
		NRCS-644 Wetland Wildlife Habitat Management	USEPA, USFWS, USDA	USEPA, USDA, USFWS
		NRCS-657 Wetland Restoration	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS 659-Wetland Enhancement	USEPA, Samara Restoration, USDA	CWA§319, USDA

Table 3b. Existing BMPs by NPS Category - Hydrologic/Habitat Modification

NPS Category	Nonpoint Source	BMP(s)	(Potential) Partners	(Potential) Funding
Hydrologic / Habitat Modification	1) Habitat Destruction 2) Invasive species 3) Lowered biodiversity 4) Sediment 5) Wetland Drainage	Community Education/Awareness Program	USEPA, HSU, USFWS, USDA	CWA§319
		Enforcement of Wetland Zone Protection Ordinance	USEPA, Humboldt County Sheriff's Department	CWA§319
		NRCS-315 Herbaceous Weed Control	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-353 Monitoring Well	USEPA	CWA§106
		NRCS-390 Riparian Herbaceous Cover	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-391 Riparian Forest Buffer	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-612 Tree/Shrub Establishment	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-643 Restoration and Management of Rare and Declining Habitats	USEPA, USDA	CWA§319, USDA
		NRCS-644 Wetland Wildlife Habitat Management	USEPA, USFWS, USDA	USEPA, USDA, USFWS
		NRCS-647 Early Successional Habitat Development/Management	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS-657 Wetland Restoration	USEPA, Samara Restoration, USDA	CWA§319, USDA
		NRCS 659-Wetland Enhancement	USEPA, Samara Restoration, USDA	CWA§319, USDA

Table 3c. Existing BMPs by NPS Category - Construction

NPS Category	Nonpoint Source	BMP(s)	(Potential) Partners	(Potential) Funding
Construction	1) Erosion 2) Increased storm-water loading 3) Habitat destruction 4) Hydrocarbons 5) Metals 6) PCB/SVOCs (building materials) 7) Sediment	Community Education/Awareness Program	USEPA, HSU, Greenway Partners, GHD Engineers	CWA§319
		Enforcement of Grading, Sediment, and Erosion Control Ordinance	USEPA, Humboldt County Sheriff's Office	CWA§319
		Enforcement of Wetland Zone Protection Ordinance	USEPA, Humboldt County Sheriff's Office	CWA§319
		Enforcement of Low Impact Development Policy	USEPA, Humboldt County Sheriff's Office	CWA§319
		NRCS-350 Sediment Control Basin	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319, USDA
		NRCS-393 Filter Strip	USEPA, USDA	CWA§319, USDA
		NRCS-472 Access Control	USEPA, USDA	CWA§319 USDA
		NRCS-484 Mulching	UCCE, USDA	CWA§319 USDA
		NRCS-558 Roof Runoff Structure	USEPA, RCAA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-570 Stormwater Runoff Control	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-607 Surface Drain, Field Ditch	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-638 Water & Sediment Control Basin	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319

Table 3d. Existing BMPs by NPS Category - Turf Management

NPS Category	Nonpoint Source	BMP(s)	(Potential) Partners	(Potential) Funding
Turf Management	1) Erosion 2) Increased solid waste in landfills 3) Nutrients 4) Pathogens 5) PCB/SVOCs (pesticides & fertilizers) 6) Sediment	Alternative to Toxins Policy	USEPA, RCAA, Californians for Alternatives to Toxics, Humboldt County Department of Environmental Health	CWA§319
		Community Education/Awareness Program	USEPA, HSU, Humboldt County Department of Environmental Health, UCCE	CWA§319
		NRCS-327 Conservation Cover	UCCE, Samara Restoration, USDA	CWA§319, USDA
		NRCS-484 Mulching	UCCE, USDA	CWA§319 USDA
		NRCS-590 Nutrient Management	USDA	CWA§319 USDA
		NRCS-595 Integrated Pest Management	USEPA, USDA, UCCE	CWA§319, USDA, CalEPA
		NRCS-612 Tree/Shrub Establishment	USEPA, Samara Restoration, USDA	CWA§319, USDA

Table 3e. Existing BMPs by NPS Category - Urban Areas

NPS Category	Nonpoint Source	BMP(s)	(Potential) Partners	(Potential) Funding
Urban Areas	1) Erosion 2) Habitat destruction 3) Hydrocarbons 4) Increased storm-water loading 5) Metals 6) Nutrients 7) Pathogens 8) PCB/SVOCs (pesticides & fertilizers) 9) Sediment	Community Education/Awareness Program	USEPA, HSU, Greenway Partners, Samara Restoration	CWA§319
		Enforcement of Non-Operational Vehicle Ordinance	USEPA, Humboldt County Sheriff's Office	CWA§319
		Enforcement of Low Impact Development Policy	USEPA, Humboldt County Sheriff's Office	CWA§319
		NRCS-350 Sediment Basin	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319, USDA
		NRCS-558 Roof Runoff Structure	USEPA, RCAA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-570 Stormwater Runoff Control	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-607 Surface Drain, Field Ditch	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-612 Tree/Shrub Establishment	USEPA Samara Restoration, USDA	CWA§319, USDA
		NRCS-638 Water & Sediment Control Basin	USEPA, USDA, Greenway Partners, SHN Engineers	CWA§319
		NRCS-656 Wetland Construction	USEPA, USDA, Greenway Partners, SHN Engineers, Samara Restoration	CWA§319, USDA

Table 3f. Existing BMPs by NPS Category - Land Disposal, Storage, Treatment

NPS Category	Nonpoint Source	BMP(s)	(Potential) Partners	(Potential) Funding
Land Disposal, Storage, Treatment	1) Hydrocarbons 2) Nutrients 3) Pathogens 4) PCB/SVOCs (pesticides, fertilizers, household chemical, building products)	Community Education/Awareness Program	USEPA, HSU, IHS, HWMA, Eel River Disposal & Resource Recovery	CWA§319
		Enforcement of Wetland Zone Protection Ordinance	USEPA, Humboldt County Sheriff's Office	CWA§319
		Improved Wastewater System Management	IHS	N/A
		NRCS-317 Composting Facility	USEPA, UCCE, USDA	CWA§319, USDA
		NRCS-353 Monitoring Well	USEPA	CWA§106
		NRCS-382 Fence	USEPA, IHS	USEPA
		Remedy Wastewater System Design Flaws	USEPA, IHS	IHS, USEPA
		Secondary Containment Facility	USEPA, Humboldt County Dept. of Environmental Services, Asbury Environmental Services	CalEPA, USEPA
		Solid/Hazardous/E-Waste Amnesty Days	HWMA, Eel River Disposal & Resource Recovery	N/A

Pollution Reduction

As described above, water quality on the reservation is good. Therefore, general selection of BMPs is more focused on prevention of NPS pollution rather than remediation. In circumstances where pollutants are detected, the first step to resolve the issue is identifying the source of the pollutants. When a nonpoint source has been identified, BMPs will be evaluated for their ability to resolve the pollution issue, both in the short and long term. Short-term goals could include elimination or reduction of the pollutant; long-term goals could include public outreach and education, continued water quality monitoring, prevention of recurrence of the issue, and sustained land stewardship.

Conclusions

As described in this assessment, Tribal water resources of TBR are in good condition and water quality is so far unimpaired by NPS pollution. Despite this, NPS pollution threats do exist on the reservation, and their management is a priority for the Tribe in its efforts to maintain good water quality. The NPS threats (listed by category) to water quality on TBR include, but may not be limited to:

Agriculture
Biological/Chemical Impairments
- hydrocarbons, nutrients, pathogens, PCB/SVOCs (pesticides/fertilizers), sediment

Environmental/Ecosystem Impairments
- erosion, habitat destruction, increased water temperatures

Hydrology/Habitat Modification
Biological/Chemical Impairments
- invasive species, sediment

Environmental/Ecosystem Impairments
- habitat destruction, lowered biodiversity, wetland drainage

Construction
Biological/Chemical Impairments
- hydrocarbons, metals, sediment

Environmental/Ecosystem Impairments
- erosion, habitat destruction, increased storm-water loading

Turf Management
Biological/Chemical Impairments
- nutrients, pathogens, PCB/SVOCs (pesticides/fertilizers), sediment

Environmental/Ecosystem Impairments
- erosion, increased solid waste in landfills

Urban Areas
Biological/Chemical Impairments
- hydrocarbons, metals, nutrients, pathogens, PCB/SVOCs (pesticides/fertilizers), sediment

Environmental/Ecosystem Impairments
- erosion, habitat destruction, increased storm-water loading

Land Disposal, Storage, and Treatment
Biological/Chemical Impairments
- hydrocarbons, nutrients, pathogens, PCB/SVOCs (pesticides/fertilizers)

The Tribe has already implemented many programs, projects, and BMPs to protect water quality on the reservation, including education programs, erosion-control efforts, establishment of a grazing management plan, infrastructure improvements for the community wastewater system and road runoff treatment, and policies and ordinances (e.g., Wetland Zone Protection ordinance, Grading, Sediment, and Erosion control ordinance, Non-operational Vehicle ordinance, and a Low-Impact Development policy) to protect water quality on TBR. It is important that the Tribe continues its current programs to maintain water quality.

As the Tribe moves forward, each NPS issue will be addressed in the long term using existing regulatory and management programs, the CWA§319 NPS Water Pollution Control Program, and on-the-ground projects funded by various sources including, but not limited to, CWA§319 funding. Below, the Tribe has prioritized NPS issues that will be addressed through the NPSMP:

1. Hydrologic/habitat modification of Tribe's wetland
2. Plan, implement, and construct a LID demonstrative/outreach project at the Tribe's administrative buildings
3. Geospatial analysis of Tribe's existing and newly discovered NPS pollution threats
4. Continue to monitor the Tribe's water resources for potential NPS pollution threats by continuing the Tribe's Water Quality and Biological Monitoring Plans
5. Continue to ensure compliance of Council approved policies and ordinances
6. Continue to update and expand NPS pollution environmental education program

Working to identify new problems not identified in this assessment and solutions to them and the issues herein, management changes will be incorporated into day to day operations to minimize and mitigate NPS pollution. Implementation of a CWA§319 NPS Management Plan will provide the framework for selection and implementation of BMPs and NPS prevention strategies.

Public Comment

A public comment period for the Wiyot Tribe's Nonpoint Source Assessment and Management Plan for TBR took place between the dates of September 9, 2020 and October 9, 2020 concurrent with the USEPA review period for the documents. Public notice was posted at the Wiyot Tribal office, on the Tribe's website at www.wiyot.us, and distributed to the Wiyot Tribal citizenship (Appendix F).

Nonpoint Source Assessment Report – Tribal Approvals

Organization: Wiyot Tribe

APPROVALS:

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Theodore Hernandez, Tribal Chairman – Wiyot Tribe
October 12, 2020

_____

Eddie Koch, Natural Resources Director – Wiyot Tribe
October 12, 2020

References/Sources of Information

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Wiyot Tribe – Eddie Koch, Natural Resources Department. 2019. *Water Quality Assessment Report*. Wiyot Tribe, Loleta, CA.

List of Acronyms

AA	assessment area
BIA	Bureau of Indian Affairs
BMP	best management practice
BOR	Bureau of Reclamation
CalEPA	California Environmental Protection Agency
CDFW	California Department of Fish and Wildlife
cm	centimeter
CRAM	California Rapid Assessment Method
CWA	Clean Water Act
DO	dissolved oxygen
FAC	facultative (referring to Wetland Indicator Status)
FACW	facultative wetland (referring to Wetland Indicator Status)
FY	fiscal year
gpm	gallons per minute
HBNWR	Humboldt Bay National Wildlife Refuge
HSU	Humboldt State University
HUC	hydrologic unit code
HWMA	Humboldt Waste Management Authority
IHS	Indian Health Service
LID	low impact development
m	meter
mg/L	milligrams per liter
MPN/ml	Most Probable Number/milliliters
NPS	nonpoint source
PCB	polychlorinated biphenyl
ppb	parts per billion
ppm	parts per million
OBL	obligate (referring to Wetland Indicator Status)
QA	quality assurance
QAPP	Quality Assurance Program Plan
QC	quality control
NCRWQCB	North Coast Regional Water Quality Control Board
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
RCAA	Redwood Community Action Agency
RCAC	Rural Community Assistance Corporation
STORET	STOrage and RETrieval (USEPA's water quality database)
SVOC	semi-volatile organic compound
TBR	Table Bluff Reservation
TPH	total petroleum hydrocarbon
TSS	total suspended solid
ug/L	micrograms per liter

UCCE	University of California Cooperative Extension
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WPDG	Wetland Program Development Grant
WPP	Wetland Program Plan
WQX	Water Quality Exchange (USEPA's Import Tool)

Appendices

A. *Geological and Geophysical Survey for Well Water Location for the Table Bluff Reservation*. GeoConsultants, Inc. 2006.

B. *2008 Well Drinking Water Quality Results (Drinking Water Well #1)*. North Coast Laboratories, 2009.

C. *2011 Well Drinking Water Quality Results (Drinking Water Well #2)*. North Coast Laboratories, 2011.

D. *Water Quality Assessment Report*. Wiyot Tribe – Eddie Koch, Natural Resources Department. 2019.

E. *National Conservation Practice Standards*. Natural Resources Conservation Service
NRCS-315 Herbaceous Weed Control Practice Standard
NRCS-317 Composting Facility Practice Standard
NRCS-327 Conservation Cover Practice Standard
NRCS-340 Cover Crop Practice Standard
NRCS-342 Critical Area Planting Practice Standard
NRCS-350 Sediment Basin Practice Standard
NRCS-353 Monitoring Well Practice Standard
NRCS-382 Fence Practice Standard
NRCS-390 Riparian Herbaceous Cover Practice Standard
NRCS-391 Riparian Forest Buffer Practice Standard
NRCS-393 Filter Strip Practice Standard
NRCS-472 Access Control Practice Standard
NRCS-484 Mulching Practice Standard
NRCS-528 Prescribed Grazing Practice Standard
NRCS-558 Roof Runoff Structure Practice Standard
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NRCS-638 Water and Sediment Control Basin Practice Standard
NRCS-643 Restoration and Management of Rare and Declining Habitats Practice Standard
NRCS-644 Wetland Wildlife Habitat Management Practice Standard
NRCS-647 Early Successional Habitat Development/Management Practice Standard
NRCS-656 Wetland Construction Practice Standard
NRCS-657 Wetland Restoration Practice Standard
NRCS-659 Wetland Enhancement Practice Standard

F. Nonpoint Source Assessment Report Public Comment Documentation

Appendix A
Geophysical Survey TBR 2006

GEOLOGICAL AND GEOPHYSICAL SURVEY
FOR WATER WELL LOCATION
WIYOT TRIBE, TABLE BLUFF RESERVATION
HUMBOLDT COUNTY, CALIFORNIA

For:

Wiyot Tribe

June 2006

GEOCONSULTANTS, INC.
Hydrogeology ▪ Ground-Water Exploration & Development ▪ Ground-Water Resources Management ▪
1450 Koll Circle, Suite 114, San Jose, California 95112-4612
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www.geo-consultants.com

June 21, 2006
Project G1481-01

Mr. Barry D. Jarvis, P.E.
Civil Engineer
Indian Health Service
Arcata Field Office
1125 16th Street, Suite 100
Arcata, CA 95521

RE: GEOLOGICAL AND GEOPHYSICAL SURVEY FOR WATER WELL LOCATION WIYOT TRIBE PORTIONS OF TABLE BLUFF RESERVATION LOLETA, HUMBOLDT COUNTY, CALIFORNIA

Attention: Mr. Dylan Gray, Environmental Specialist I

Dear Mr. Jarvis,

In accordance with our Proposal P-4593 of April 24, 2006 and the Agreement CA-05-066 No. 1 with the Wiyot Tribe, which commenced on May 5, 2006, we have completed our geological and geophysical survey for a water well location over portions of the Table Bluff Reservation. Tasks performed as part of this project included hydrogeologic research and field reconnaissance, geophysical surveys, and the evaluation of the resulting data. The following report contains the basic hydrogeologic data generated by our study as well as our conclusions and recommendations.

Mr. Barry D. Jarvis, P.E.
June 21, 2006

It has been a pleasure working with you on this project. If you have any questions, please contact us at your convenience.

Sincerely,

GEOCONSULTANTS, INC.

Keil A. Albert
Geologist, PG-7273

Jeremy C. Wire
Hydrogeologist, HG-93

Copies: Addressee (5)

TABLE OF CONTENTS

GEOLOGICAL AND GEOPHYSICAL SURVEY
FOR WATER WELL LOCATION
WIYOT TRIBE
TABLE BLUFF RESERVATION
HUMBOLDT COUNTY, CALIFORNIA

INTRODUCTION

In accordance with our proposal letter P-4593 of April 24, 2006 and our Agreement CA 05-066 No. 1 with the Wiyot Tribe, this report presents the results of our geological and geophysical survey on portions of the Table Bluff Reservation property in Humboldt County, California. The survey area is located on a bluff northwest of the town of Loleta, and is bounded on the south by Table Bluff Road, and on the east by Phelan Road (Figure 1). The existing well that serves the Reservation is located roughly one mile away to the southwest on the old Reservation. This well is roughly 135 feet in depth, and the water quality is generally poor, with respect to salinity and iron and manganese. As part of planned water system improvements, the Tribe wishes to develop a domestic community supply well having a capacity of 35 gallons per minute (gpm) of good quality water, and have the new well be located on the existing Reservation property. The purpose of the survey was to determine where a sufficient thickness of water-bearing materials might exist in the subsurface at selected locations so that construction of an additional well having an adequate yield and good quality water would be feasible.

In the following report, we present the results of our geological and geophysical evaluation of potential water well sites to evaluate their relative water-yielding potential. Further evaluation by test drilling can then be concentrated on the

most favorable site so that the chances of obtaining a satisfactory yield from a completed production well are greatly improved.

HYDROGEOLOGIC SETTING

Geologic materials underlying the survey area consist of deposits of gravels, sands, silts and clays of the upper Pleistocene Hookton Formation. The fine black sand intervals of this unit are particularly productive. Underlying the Hookton Formation are conglomerate, sandstone, and claystone of the Carlotta Formation of lower Pleistocene age (Ogle, 1953). Subsurface folding and faulting may control ground water movement and flow, and the subsurface may be separated into separate compartments.

The sands and gravels store and transmit varying quantities of ground water where penetrated by wells. The more permeable sand and gravel units that connect with better recharge sources will produce a greater quantity of water. In this hydrogeologic setting, significant quantities of ground water in storage and available for transmission to a well will only be found in the more permeable and continuous sand and gravel units. Another factor influencing the feasibility of water well development in this setting is the amount of average annual recharge that will replenish the ground-water reservoir. Permeable layers or having a greater regional extent will usually connect into better recharge sources. Accordingly, our geological and geophysical survey was directed toward finding a location where such a favorable environment might exist in the subsurface at selected sites.

FIELD SURVEY

General

Our fieldwork was completed on May 23, 2006 and consisted of a site geologic reconnaissance followed by the completion of two geophysical traverses and a total of thirteen electrotelluric soundings (ETS). One of the soundings was taken at the existing well on the old Reservation, and another was taken near the location of a deep oil and gas test hole from the early 1950's located roughly at the intersection of Table Bluff Road and Phelan Road for calibration and correlation purposes. The oil and gas well (Texaco "Quinn") has an electric log (E-log) available, which indicates potentially productive sand intervals in the deeper subsurface in the vicinity of the Reservation. The existing Reservation well, which produces relatively poor quality water, was used as a model to indicate potential salinity problems in the deeper subsurface. All sounding locations were staked and flagged in the field and their latitude and longitude position noted by a Garmin GPS unit. The locations of the geophysical traverses as well as the soundings are plotted on the Site Plan, Figure 1.

Geophysical Traverses

Geophysical traverses T-1 and T-2 as identified on the Site Plan, Figure 1, consisted of an electromagnetic survey using a Geonics EM-16 VLF/electromagnetic unit combined with a Geometrics proton precession ground magnetometer to locate any channels in the alluvium or potential faulting that could serve to compartmentalize the underlying aquifer materials. Commonly, such features may be indicated by a "crossover" in the electromagnetic readings or an anomalous "low"

in the total magnetic intensity count when encountered along a traverse line. Graphic plots of the traverse data are presented on Figures 2 through 5.

Geophysical traverse T-1 was made in a south to north direction along the western boundary of the Reservation. The VLF/EM data (Figure 3) are somewhat scattered along this line up until roughly the area of the water storage tank. It could be that the data was somewhat affected by the underground piping in this area. The magnetometer data (Figure 2) seems to be less affected by this. Both instruments indicated an anomalous area at about 520 feet from the south end of the line. This feature may relate to faulting or a subsurface channel in this area. Subsurface conditions at this anomaly were further explored by ETS-6, as described below. A large magnetometer low occurs at roughly 1300 feet from the south end of the line, and there is a weak VLF/EM anomaly in this general area also. Again, this feature probably indicates subsurface faulting or channeling. Subsurface conditions at this anomaly were further explored by ETS-7. The northern portion of the line from the water tank area to the north indicates no significant anomalous areas. ETS-9 was completed at the north end of the traverse line at a minor magnetometer low. On geophysical traverse T-2, which was completed in a south to north orientation along the eastern boundary of the Reservation, a magnetometer anomaly was noted at roughly 720 feet from the south end of the traverse line (Figure 4). The VLF/EM data show no corresponding anomalous conditions in this area (Figure 5). Subsurface conditions in this area were further explored by ETS-2, which was completed just north of this anomalous area to determine if subsurface faulting was affecting aquifer properties at depth. ETS-1 and ETS-3 were completed near the north and south ends of this traverse line to explore minor anomalies in these areas. The ETS-3

location is the closest to the Texaco "Quinn" well, which indicated a large section of sand within the general depth interval of 600 and 730 feet on the E-log of this well.

Electrotelluric Soundings

The electrotelluric survey measures, on the Earth's surface, the electrical fields generated by telluric currents flowing in the subsurface formations of differing lithology. The ionosphere induces these currents as pulses, with the pulse duration depending on the depth of penetration. A highly portable surface receiver transforms the electrotelluric radiation into an audible signal. There is a very specific relationship between depth of origin of an electromagnetic wave front and frequency. Accordingly, the relative electrical conductivity resulting from the electrotelluric response over the depth interval investigated at each survey station is determined.

At the surface, a receiver is set to investigate a specific depth range of frequencies that represents a specific depth interval. As the vertical interval is evaluated, a change in conductivity will cause a change in amplitude of the audible signal. This change is graphed on a relative scale from very low to very high. The vertical scale is set to match the amount of detail necessary for a specific investigation, and also set to correlate with the level of detail from available exploratory boring or well logs. Except at the most sensitive settings, the readings from the receiver are insensitive to nearby power lines and other cultural electrical noise.

Ground water will usually cause a distinct and recognizable distortion in the audible signal. Where fluids are present, a qualitative evaluation is made based on the recognition of characteristic distortion effects. The result is a relative conductivity

graph of the formations investigated along with a relative delineation of formation/porosity contacts and a qualitative evaluation of the fluids contained within the porosity or fracture zones. The following Table A presents a summary of the sounding information.

TABLE A
ELECTROTELLURIC SOUNDING DATA

Sounding No.	GPS Coordinates	Depth Interval Evaluated (Feet)	Zones of Potential Saturation (Feet)	Total Production Zones (Feet)
ETS-1	N 40 41.571 W 124 15.019	50 – 800	198 – 229 553 – 669	147
ETS-2	N 40 41.379 W 124 15.019	50 – 800	210 – 238 492 – 689	225
ETS-3	N 40 41.229 W 124 15.011	50 – 800	226 – 269 459 – 730	314
ETS-4	N 40 41.228 W 124 15.140	50 – 800	211 – 237 262 – 284 459 – 679	268
ETS-5	N 40 41.228 W 124 15.281	50 – 800	259 – 288 478 – 684	237
ETS-6	N 40 41.298 W 124 15.281	50 – 800	269 – 288 381 – 411 473 – 686	262
ETS-7	N 40 41.450 W 124 15.261	50 – 800	258 – 276 603 – 698	113
ETS-8	N 40 41.453 W 124 15.198	50 – 800	220 – 243 262 – 276 598 – 688	127
ETS-9	N 40 41.654 W 124 15.271	50 – 800	181 – 208 223 – 247 579 – 667	139
Well #2 Old Reservation	N 40 40.962 W 124 15.856	0 – 150	47 – 83 95 – 118	59
Texaco "Quinn"	N 40 41.216 W 124 15.005	600 – 950	600 – 732	132

Included in the Appendix are copies of the electrotelluric logs for all of the soundings that were processed. Telluric Consulting Services of Garland, Texas performed the data processing and preparation of the electrotelluric logs contained

in this report. The Lithology Signature column shows the presence of potentially favorable reservoir units, such as porous sand and gravel, for ground water. The more porous and permeable units will generally exhibit a low to very low lithology response (a deflection to the left). Porosity zones with higher actual fluid (water) saturation are shown by hachured areas in the Content Signature column of the individual logs. The darker the hachured area, the stronger the fluid response is for those depth intervals. The Signature Depth column shows the approximate vertical limits of the individual porosity intervals.

A lower lithologic signature generally indicates a greater potential for ground-water production. For this reason, the lithologic signature is weighted more heavily than the fluid signature. Thus, although some soundings may exhibit a weak or no fluid signature, they may actually have production potential if there is a favorable lithologic signature. In general, the relative water quality with respect to overall salinity can often be determined when analyzing the distortion effects of the fluids contained within the porosity zones. Based on the results of the calibration sounding at the existing offsite well and the Texaco "Quinn" well, for this study we chose to only include intervals that exhibited a fluid signature in the Total Potential Saturated Interval column.

DISCUSSION

Table A shows that of the soundings evaluated for a new well location, ETS-3 exhibits the thickest section of potential saturated materials of 314 feet, followed by ETS-4 and ETS-6 with a total potential saturated sections of 268 and 262 feet, respectively. The ETS-6 location has stronger fluid signatures than the ETS-4

location, and is therefore the more favorable of the two. The ETS-6 location is adjacent to the current water line that delivers water from the existing well on the old Reservation. From a logistic standpoint, this location would be favorable with respect to hooking the new well up to the current distribution system. There is a large water-bearing section of sand at this location from roughly 473 to 686 feet in depth, and the interval between roughly 567 and 600 feet in depth exhibits a moderate fluid response, which indicates greater production potential. The ETS-3 location in the southeast corner of the Reservation near the site of the Texaco "Quinn" well shows a large water-bearing sand section between roughly 459 and 730 feet in depth. There is also an interval of moderate fluid strength between roughly 567 and 583 feet in depth, which is slightly thinner than the corresponding interval at the ETS-6 location. The ETS-6 and the ETS-3 locations are the most favorable locations for maximum production from a completed well. All of the sounding locations show some potential for well development, and the required amount of 35 gallons per minute (gpm) should not be a problem.

In general, the soundings completed in the southern portions of the Reservation property exhibit thicker sections of water-bearing materials in the subsurface when compared to soundings in the northern portions of the Reservation. If the traversing data did indicate any type of faulting that serves to compartmentalize the ground-water conditions beneath the Reservation, it seems likely that the boundary of this faulting is located in the southern portions of the Reservation. In general, the conditions seem more favorable with respect to ground-water production south of the ETS-2 and ETS-7 locations.

With respect to water quality, a general determination of water quality with respect to relative salinity was made based on the aforementioned distortion effects in the fluid zones. The existing production well on the old Reservation had fairly high relative salinity values. The shallow depth of this well and its proximity to the slough has allowed poor quality water to migrate into this well. In contrast, in all of the sounding locations on the new Reservation, no significant salinity values were noted in any of the fluid zones at the individual locations. This indicates that water in the deeper subsurface below the Reservation is likely to be of good to excellent quality, at least with respect to salinity.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our survey, we conclude that there is the potential to develop a supply well on the Reservation having the desired yield and quality, and further evaluation by test drilling is warranted. Based on the preceding discussion, we conclude that the ETS-6 location is the most favorable for further evaluation. The proximity to the current distribution system and the thicker zone of moderate fluid response within the large sand section makes this location the most favorable. The ETS-3 location has a thicker section of sand, but this location would require that new piping be installed to deliver the water from this location to the current distribution system. The area around this location should be dedicated a potential future well site, in the event that the Tribe would like to drill another well in the future.

To evaluate either of these locations, a test hole should be drilled using the mud-rotary drilling method to a target depth of 750 feet to adequately evaluate the water-yielding potential. When the mud rotary method is used, following completion,

a down-hole electrical log (E-log) and natural gamma log should be performed in the test hole in order to evaluate the water-yielding potential of the formations.

During test drilling, samples of the drill cuttings should be collected at 10-foot intervals for further evaluation as necessary. Sieve analyses should be performed on the formation samples from the potential production zones so that the proper gravel pack and screen slot size can be determined so the new well does not produce sand when pumped at high volumes. If the production potential is satisfactory, then the test hole can be reamed to a larger diameter and completed with appropriate casing, screens, gravel pack, and sanitary seal. The well can then be pumped for evaluation of sustained yield and samples taken for water quality analysis.

Proper evaluation of test drilling and appropriate construction and well development are critical for the successful completion of water wells. As part of a separate contract, Geoconsultants, Inc. can evaluate the drill cuttings and observe the drilling activities at critical times, to assure that the ground-water production potential of the location is fully evaluated.

LIMITATIONS

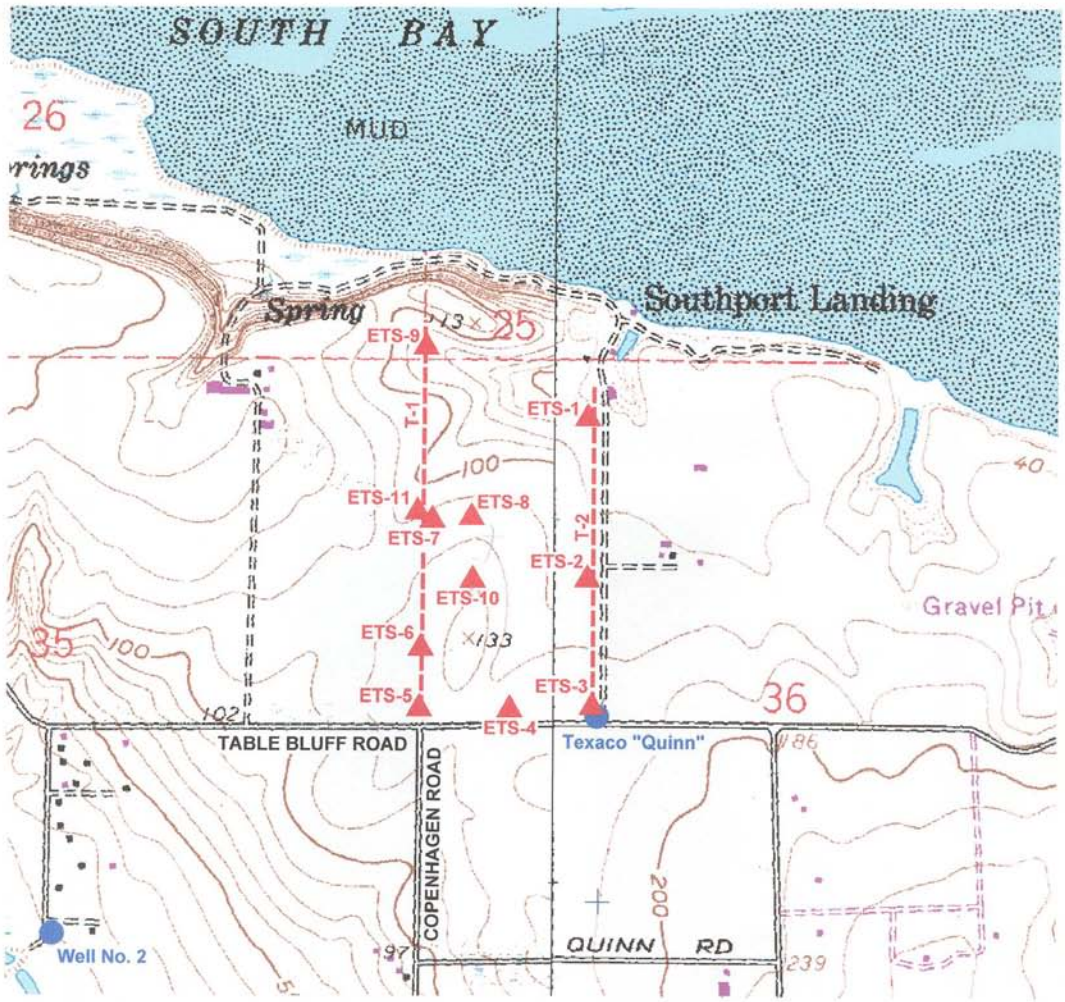
Geoconsultants, Inc. has provided its findings, recommendations, specifications, and professional advice after preparing such information in a manner consistent with that level of care and skill ordinarily exercised by the members of the profession currently practicing under similar conditions in the field of hydrogeology. This acknowledgment is in lieu of all warranties either express or implied.

Geoconsultants, Inc. makes no guarantee of the granting of well approval, well use, and/or pumping permits by city, county, state, or other governmental

authorities. No guarantee is made that water will be found in any specific quantity or mineral quality at the proposed test well location or within specific depth intervals stated. Environmental changes, either naturally occurring our artificially induced, may cause the quantity and/or quality of water produced to change with time. Therefore, we do not guarantee continued production or consistent mineral quality of ground water from any well in the future.

SELECTED REFERENCE

Ogle, Burdett A., 1953, Geology of Eel River Valley Area, Humboldt County, California; California Division of Mines and Geology Bulletin 164, 128p.



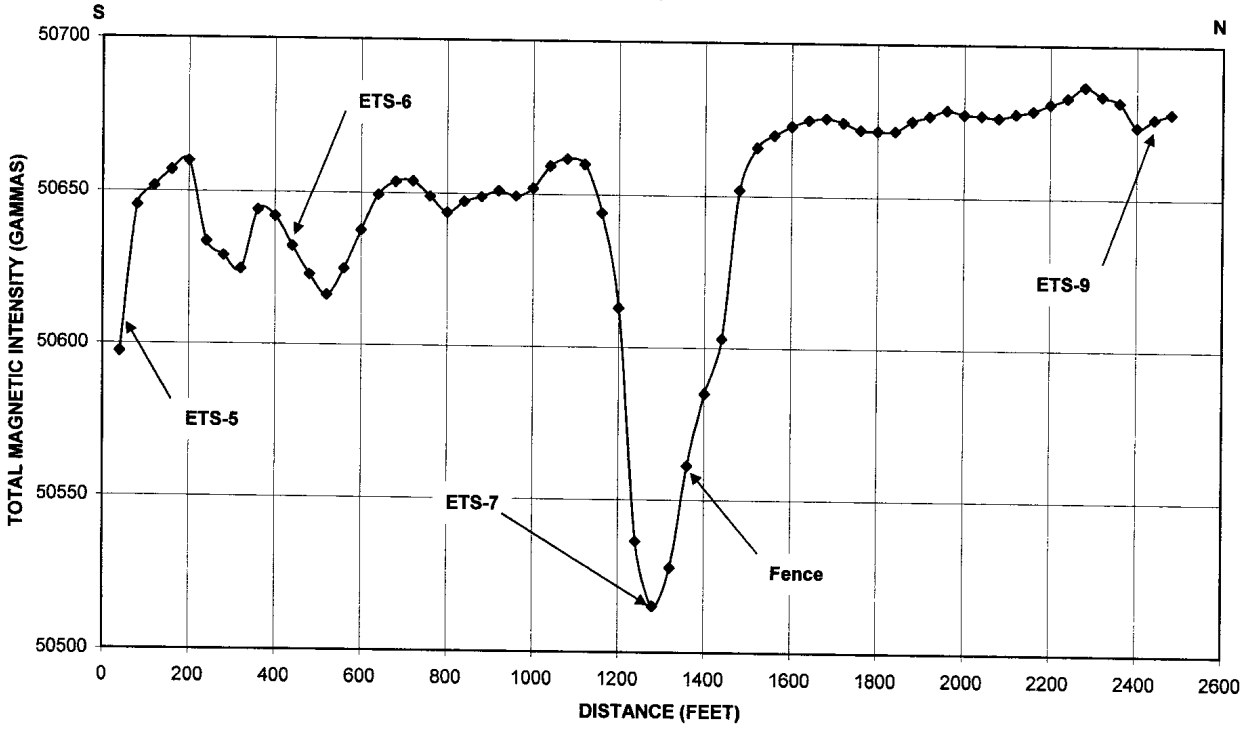
SITE PLAN

GEOCONSULTANTS, INC.
Hydrogeology • Ground-Water Exploration & Development • Ground-Water Resources Management •
1450 Koll Circle, Suite 114
San Jose, California 95112
Phone: (408) 453-2541 Fax: (408) 453-2543

G1481-01 06/06

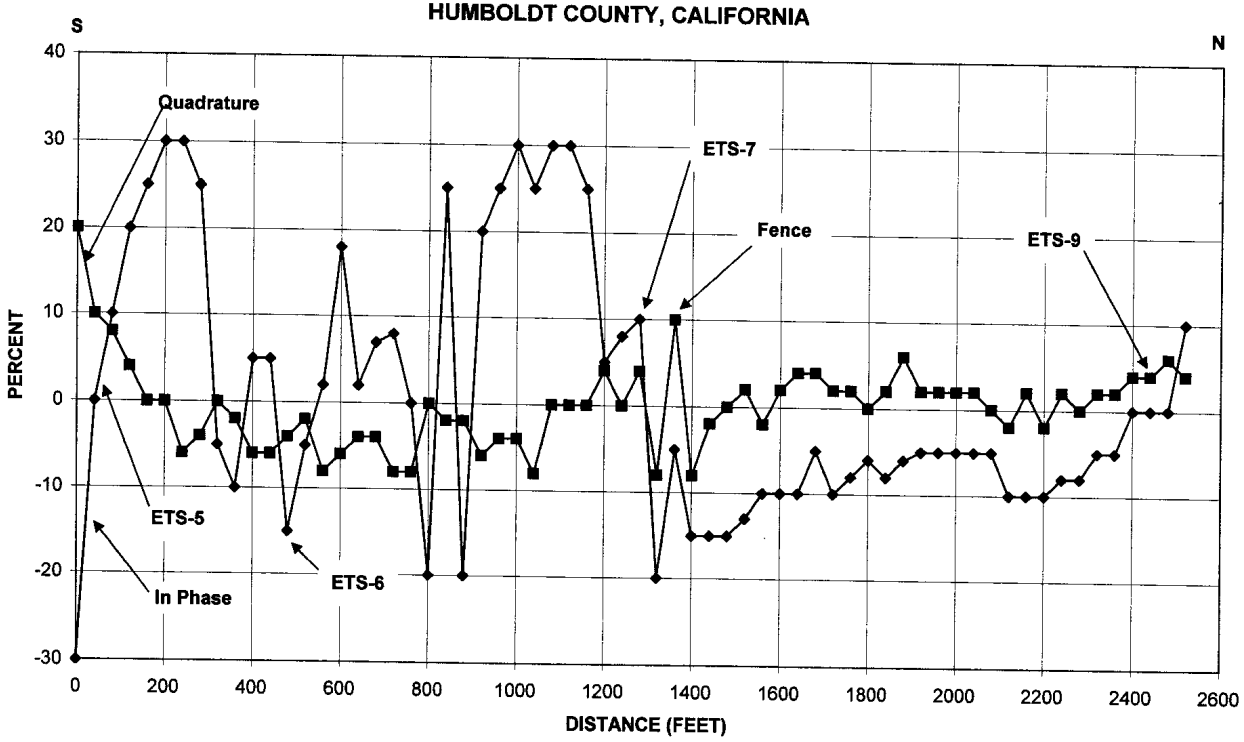
FIGURE 1

GEOPHYSICAL TRAVERSE T-1
MAGNETOMETER SURVEY
TABLE BLUFF RESERVATION
HUMBOLDT COUNTY, CALIFORNIA



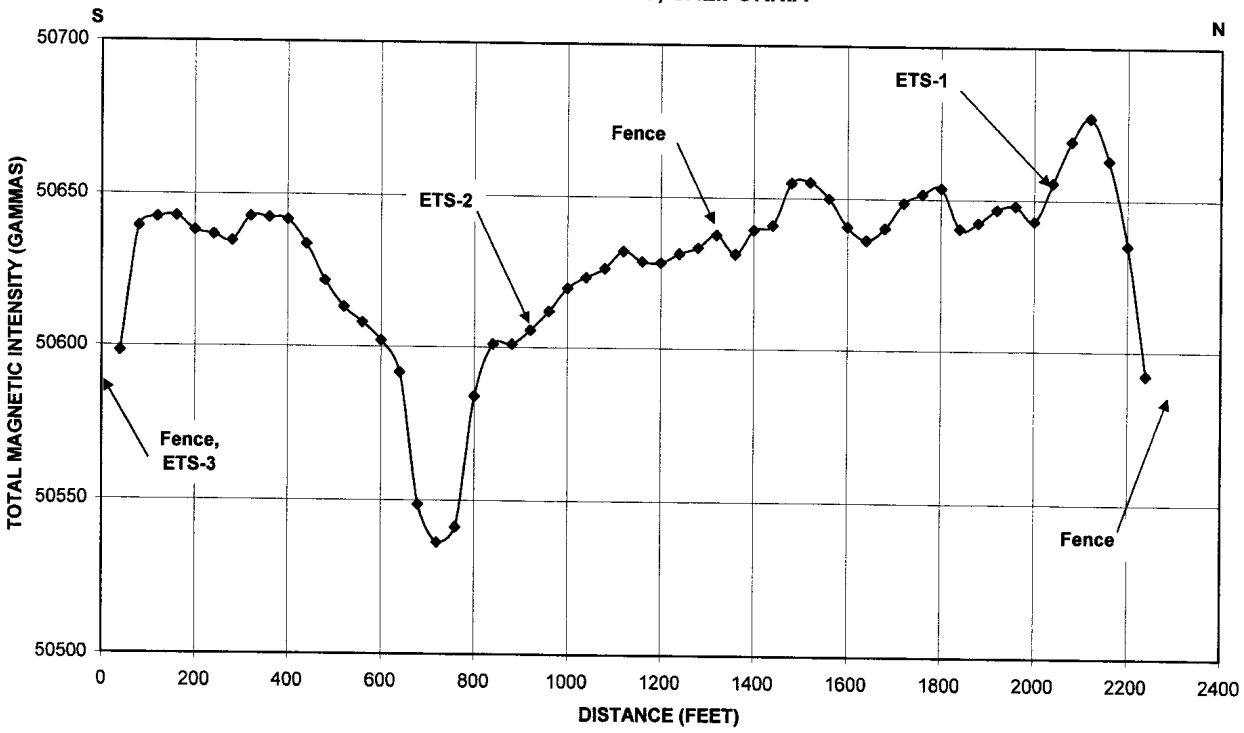
GEOCONSULTANTS, INC.
G1481-01 06/06
FIGURE 2

GEOPHYSICAL TRAVERSE T-1
VLF/ELECTROMAGNETIC SURVEY
TABLE BLUFF RESERVATION
HUMBOLDT COUNTY, CALIFORNIA



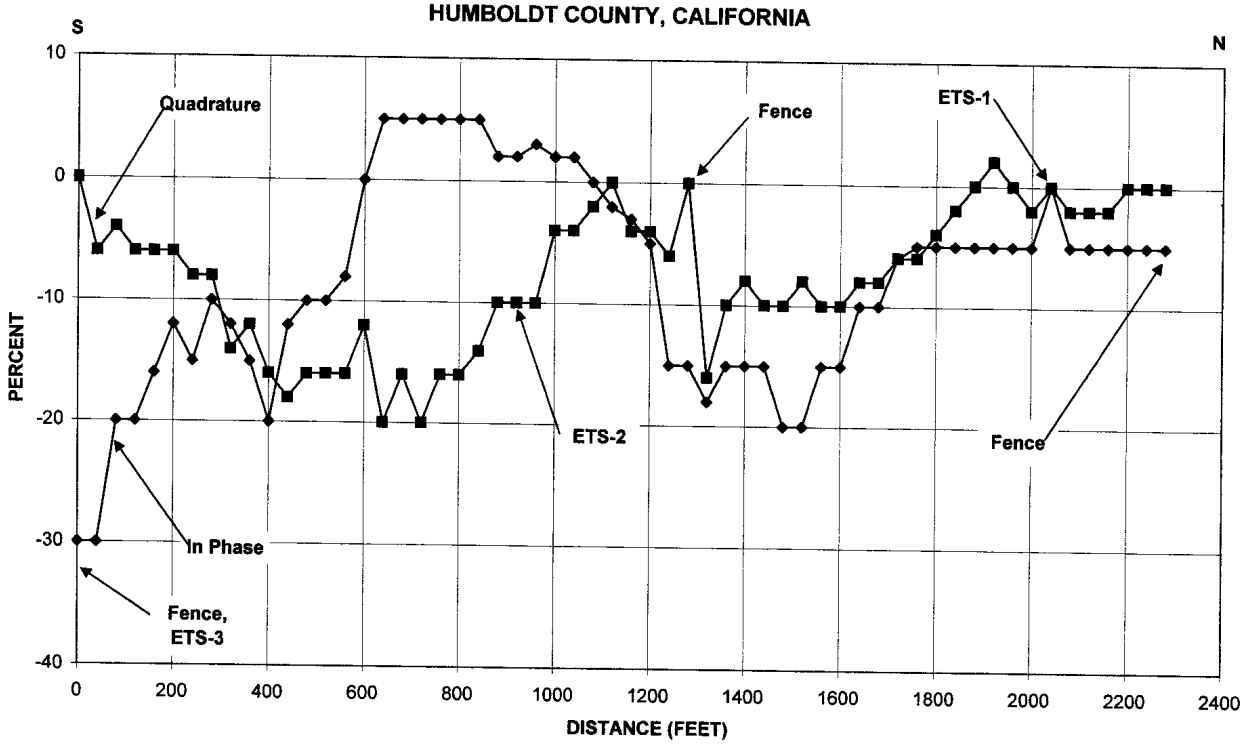
GEOCONSULTANTS, INC.
G1481-01 06/06
FIGURE 3

GEOPHYSICAL TRAVERSE T-2
MAGNETOMETER SURVEY
TABLE BLUFF RESERVATION
HUMBOLDT COUNTY, CALIFORNIA



GEOCONSULTANTS, INC.
G1481-01 06/06
FIGURE 4

GEOPHYSICAL TRAVERSE T-2
VLF/ELECTROMAGNETIC SURVEY
TABLE BLUFF RESERVATION
HUMBOLDT COUNTY, CALIFORNIA



GEOCONSULTANTS, INC.
G1481-01 06/06
FIGURE 5

APPENDIX

TELLURIC CONSULTING SERVICES
P.O. Box 740728
Dallas, TX 75374
972-494-1910

ELECTROTELLURIC LOG

COMPANY: Geoconsultants, Inc.
STATION: ETS-1
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 1:45
Tape/Record No: M1-3

Elevation: 59
Resolution: 10-Ft. Unit

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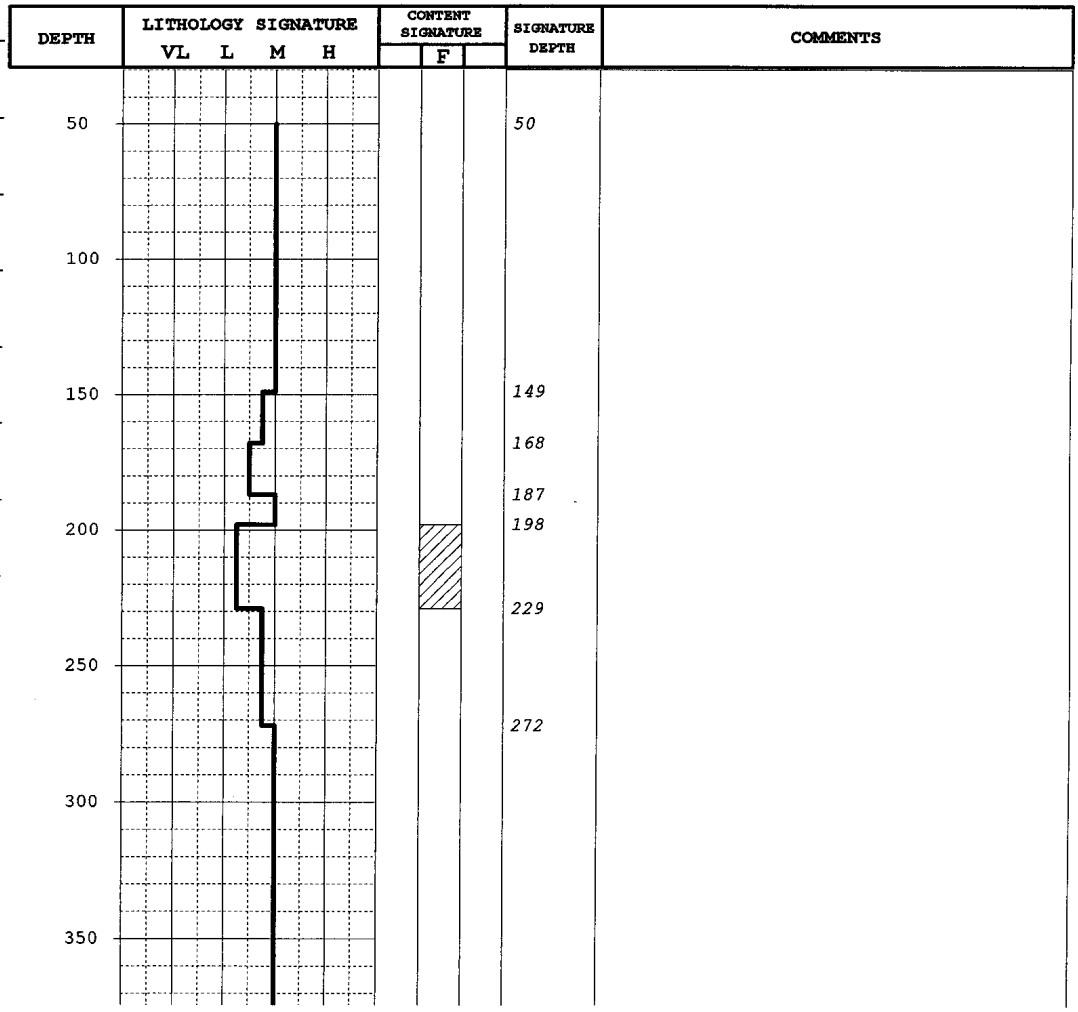

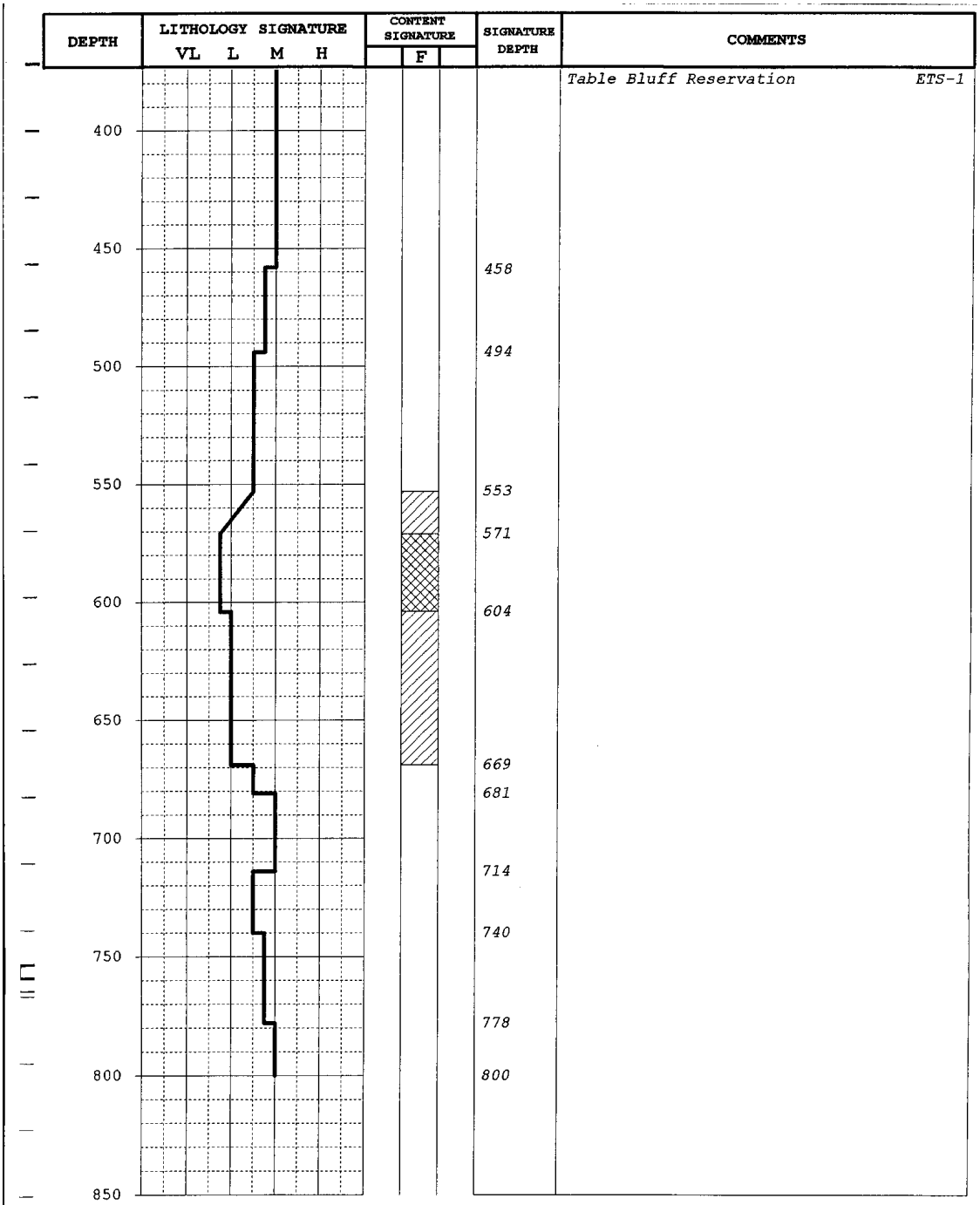
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TELLURIC CONSULTING SERVICES
P.O. Box 740726
Dallas, TX 75374
972-494-1910

ELECTROTELLURIC LOG

COMPANY: Geoconsultants, Inc.
STATION: ETS-2
PROJECT: Table Bluff Reservation
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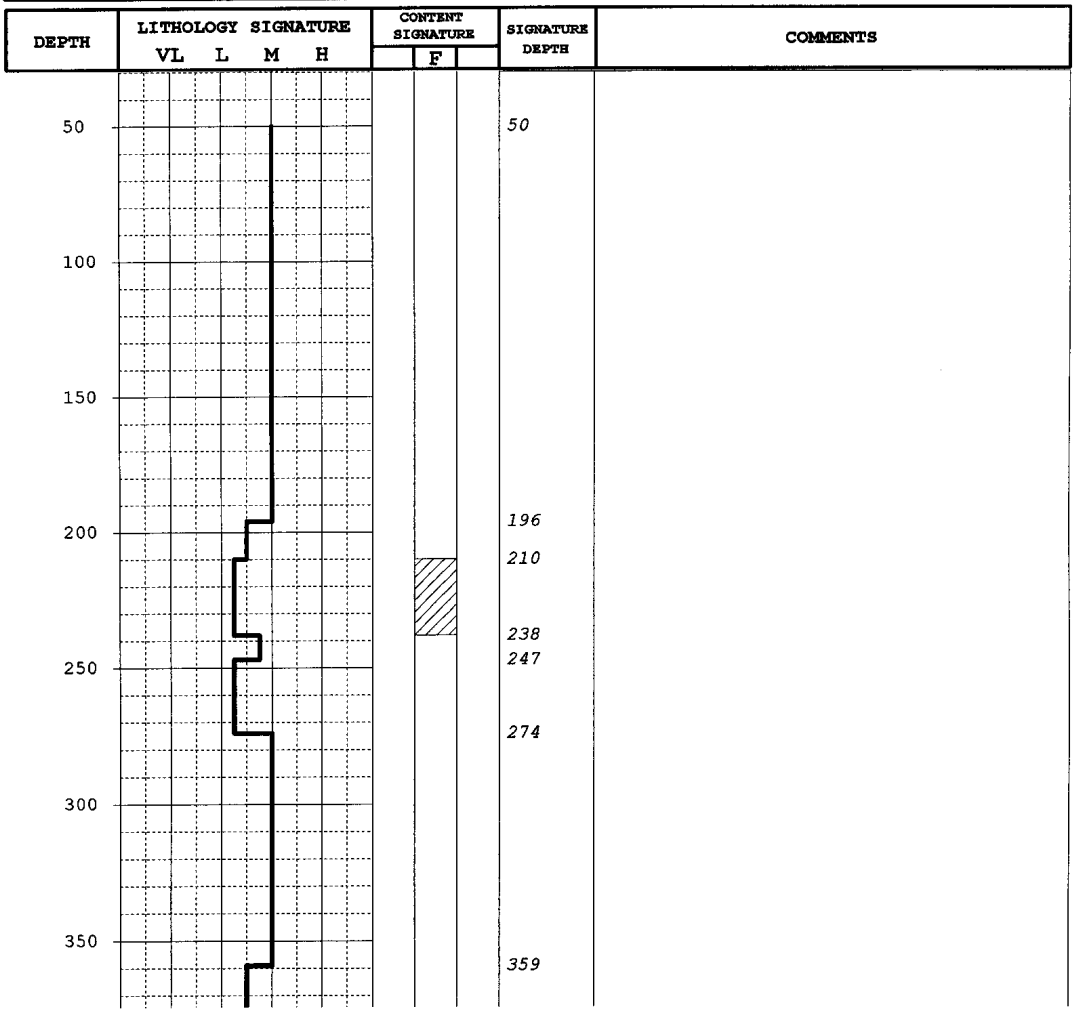

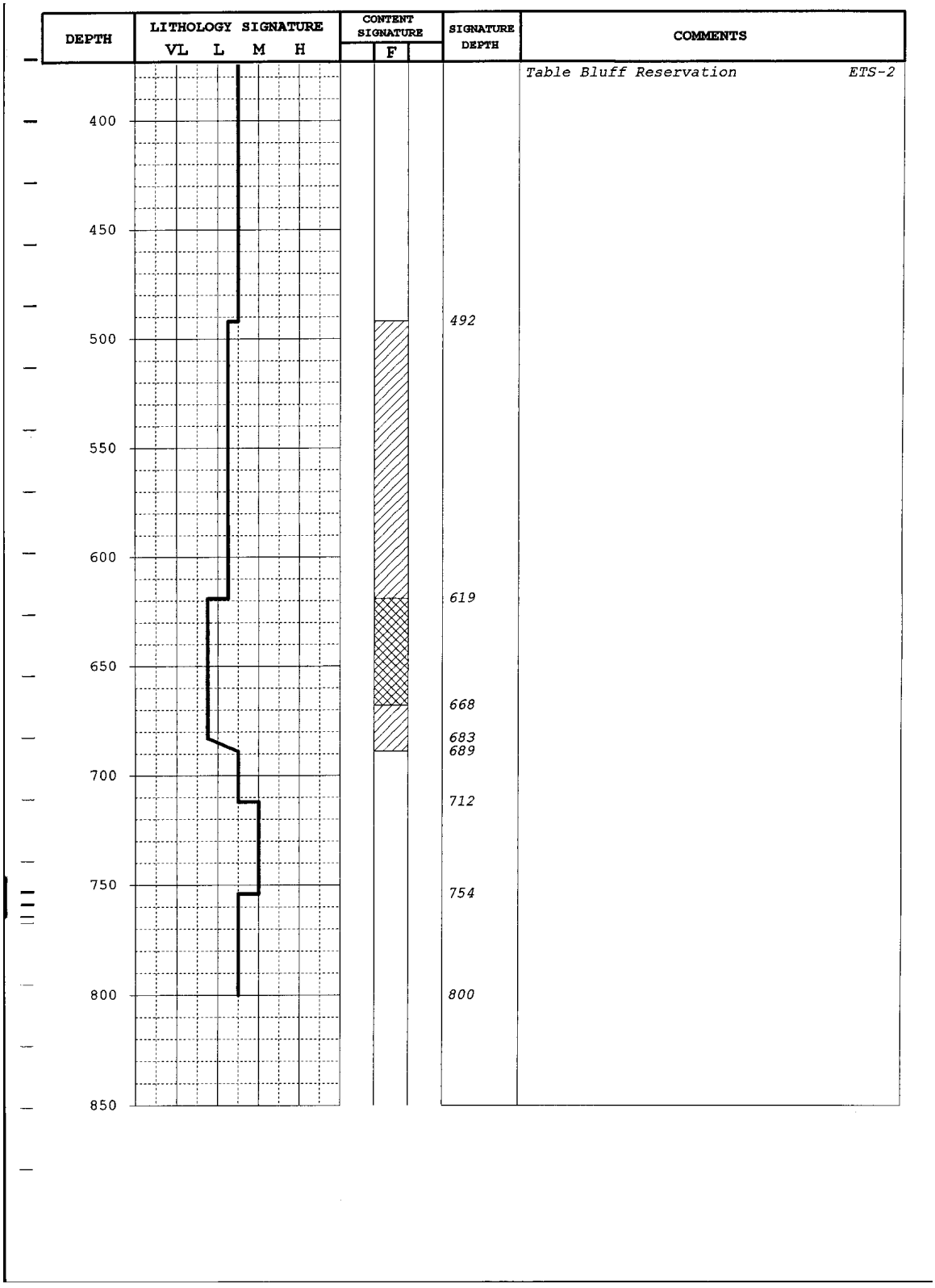
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ELECTROTELLURIC LOG

TELLURIC CONSULTING SERVICES
P.O. Box 740728
Dallas, TX 75374
972-494-1910

COMPANY: Geoconsultants, Inc.
STATION: ETS-3
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 2:23
Tape/Record No: M1-5

Elevation: 136
Resolution: 10-Ft. Unit

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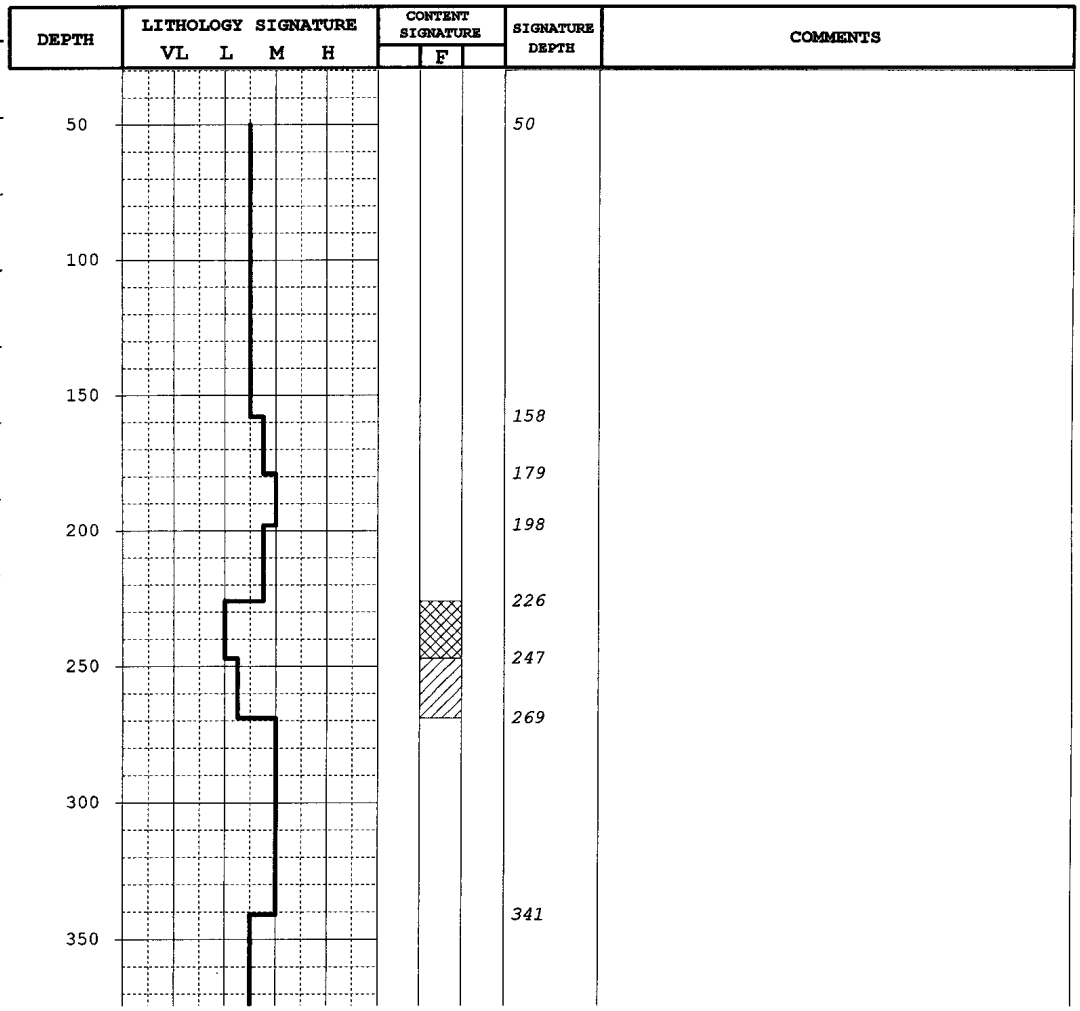

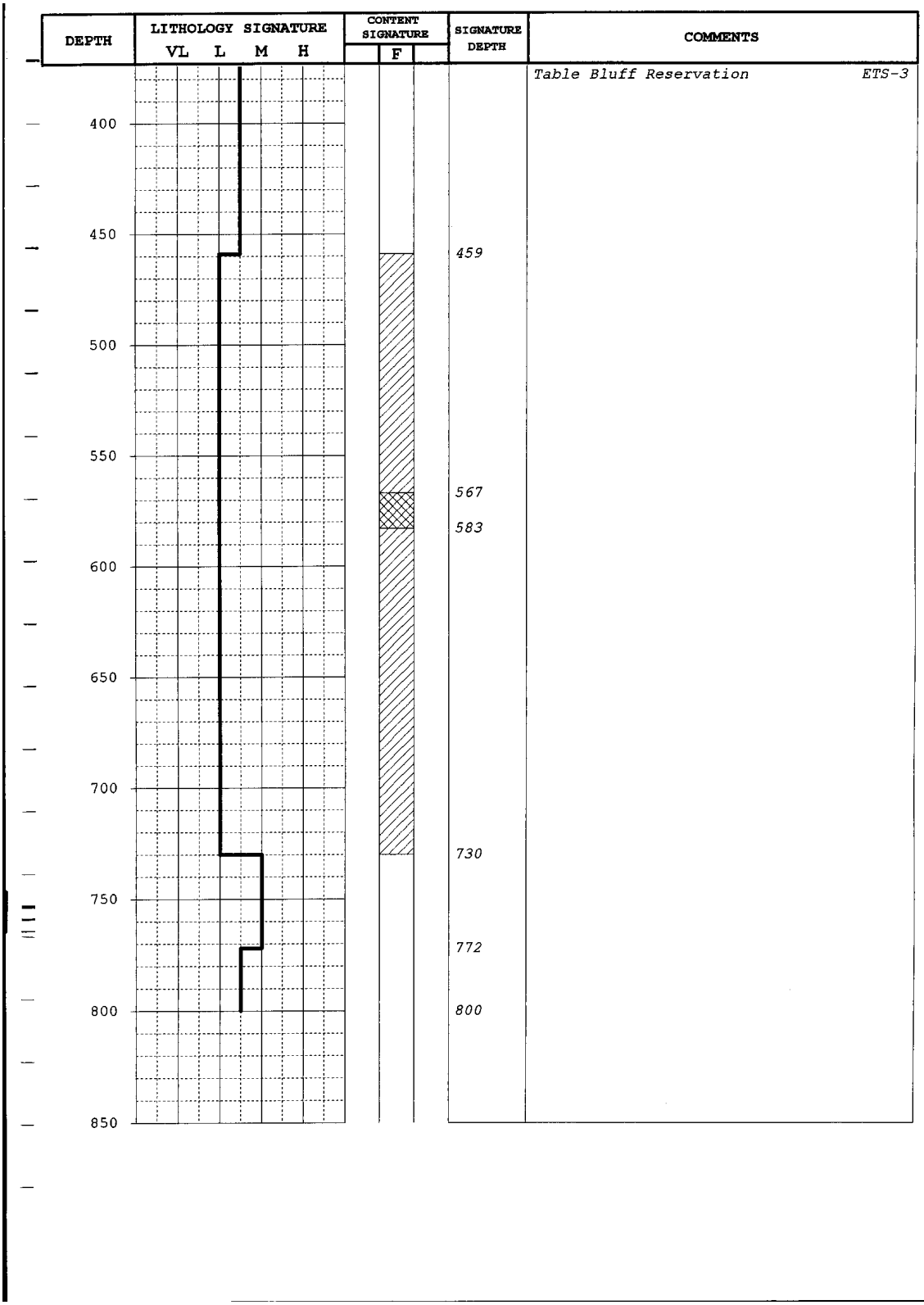
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TELLURIC CONSULTING SERVICES
P.O. Box 740728
Dallas, TX 75374
972-494-1910

ELECTROTELLURIC LOG

COMPANY: Geoconsultants, Inc.
STATION: ETS-4
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

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Tape/Record No: M1-6

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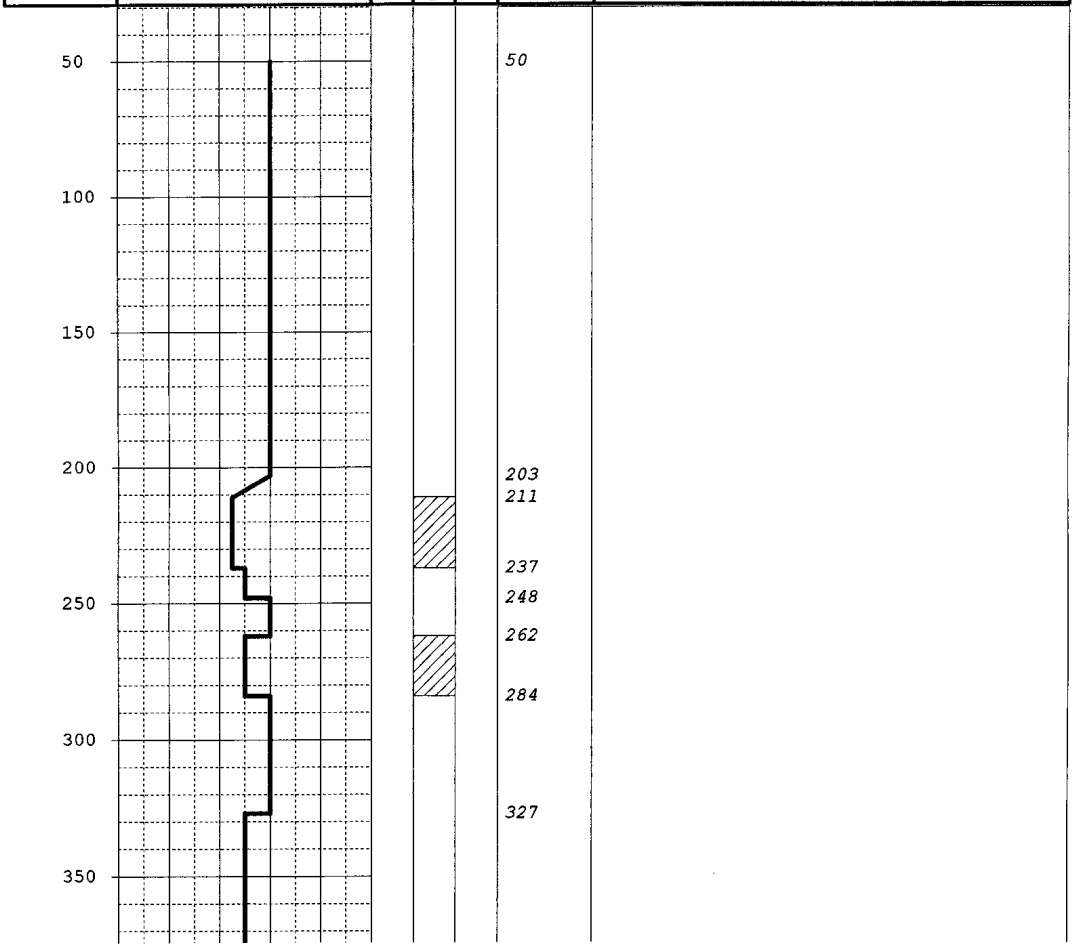

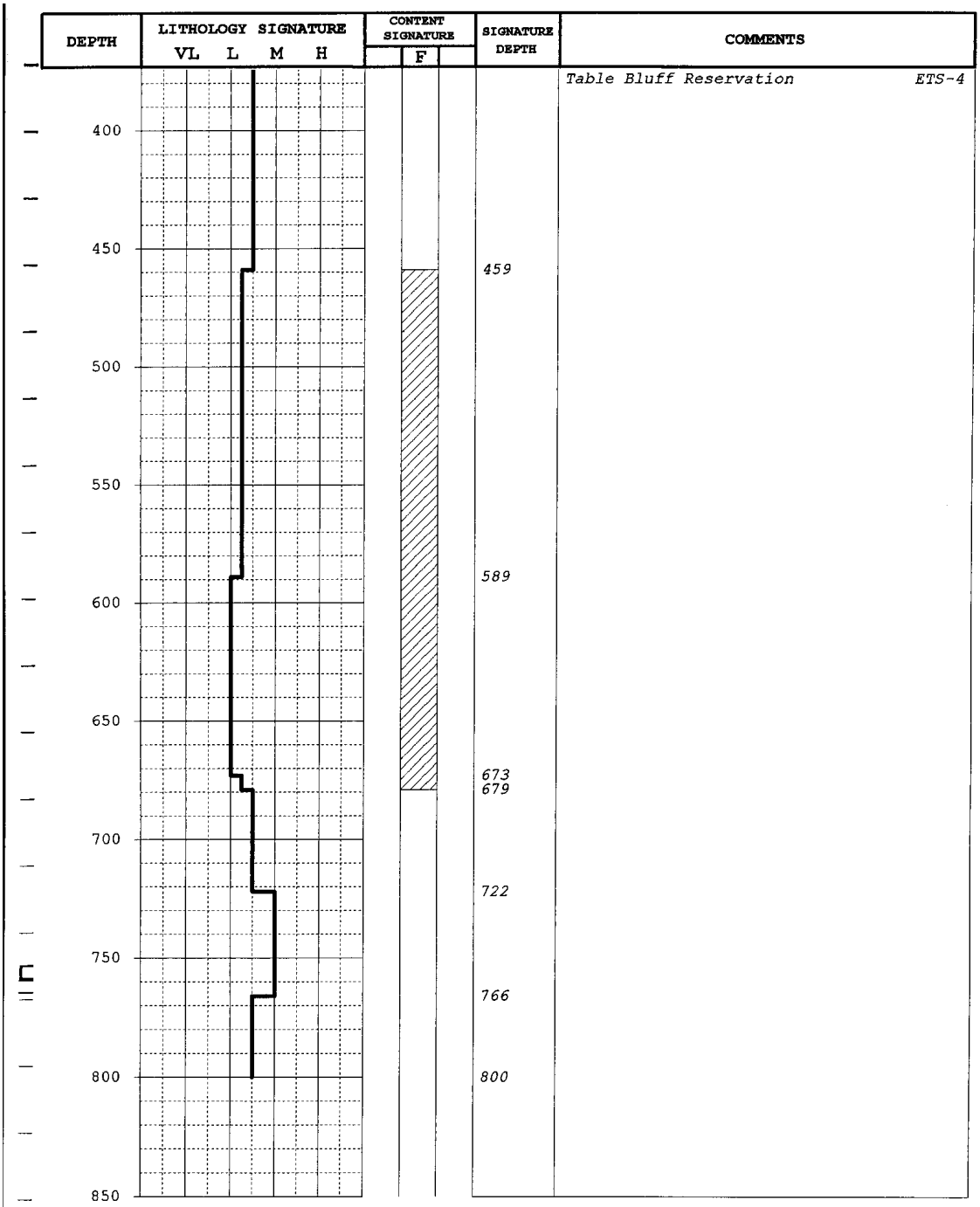
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Dallas, TX 75374
972-494-1910

ELECTROTELLURIC LOG

COMPANY: Geoconsultants, Inc.
STATION: ETS-5
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

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Tape/Record No: M1-7

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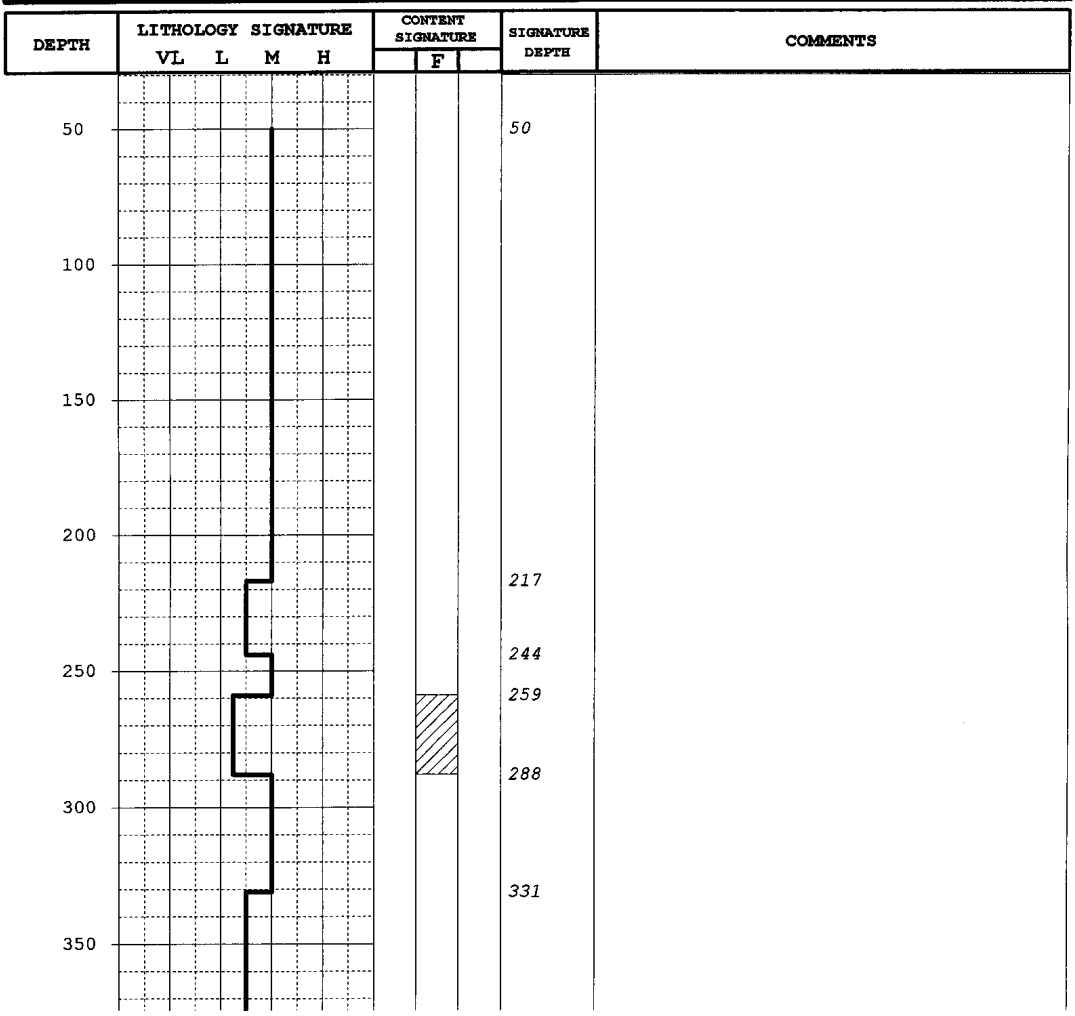

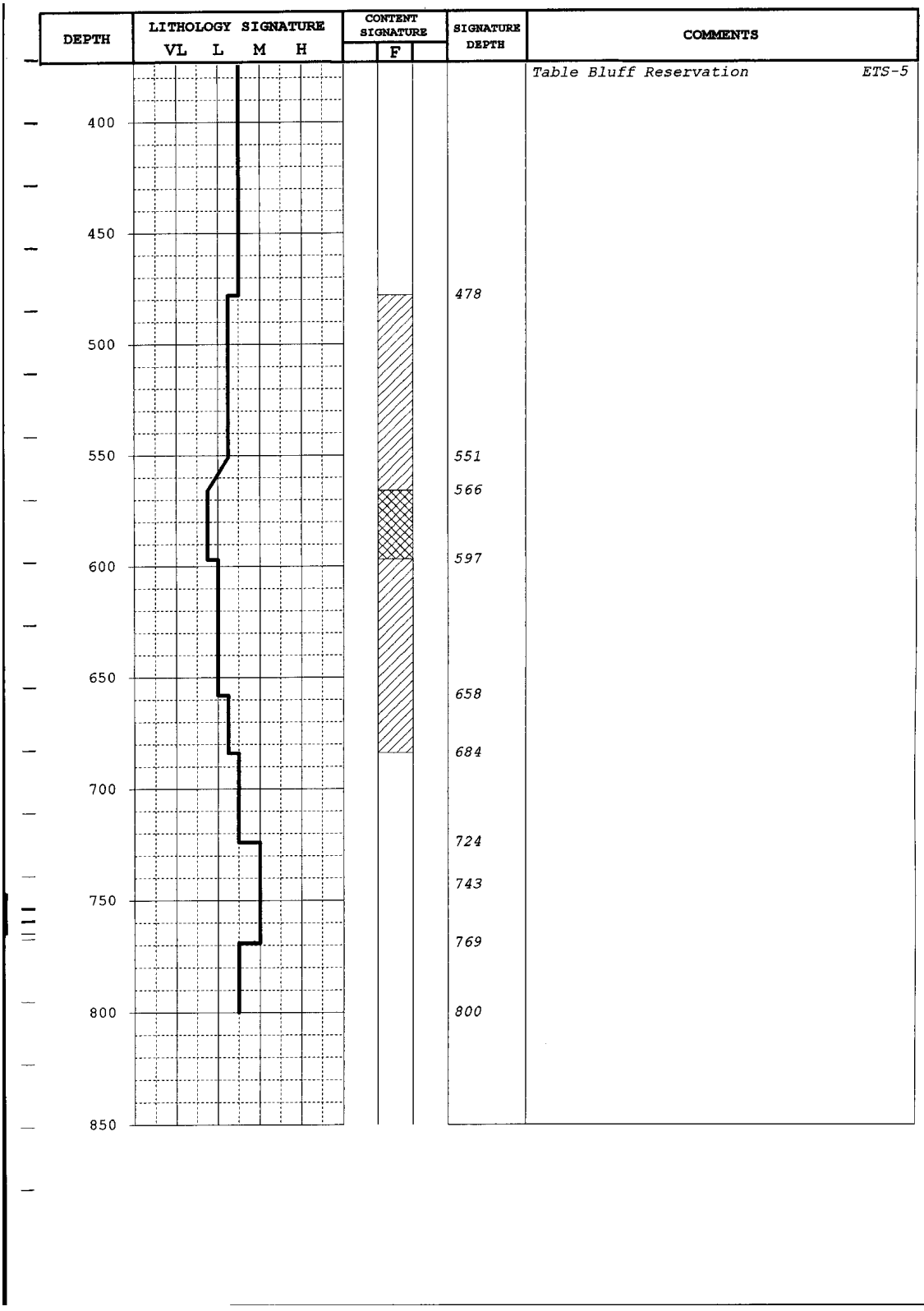
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566
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658
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724
743
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800

ELECTROTELLURIC LOG

TELLURIC CONSULTING SERVICES
P.O. Box 740728
Dallas, TX 75374
972-494-1910

COMPANY: Geoconsultants, Inc.
STATION: ETS-6
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

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Tape/Record No: M1-8

Elevation: 128
Resolution: 10-Ft. Unit

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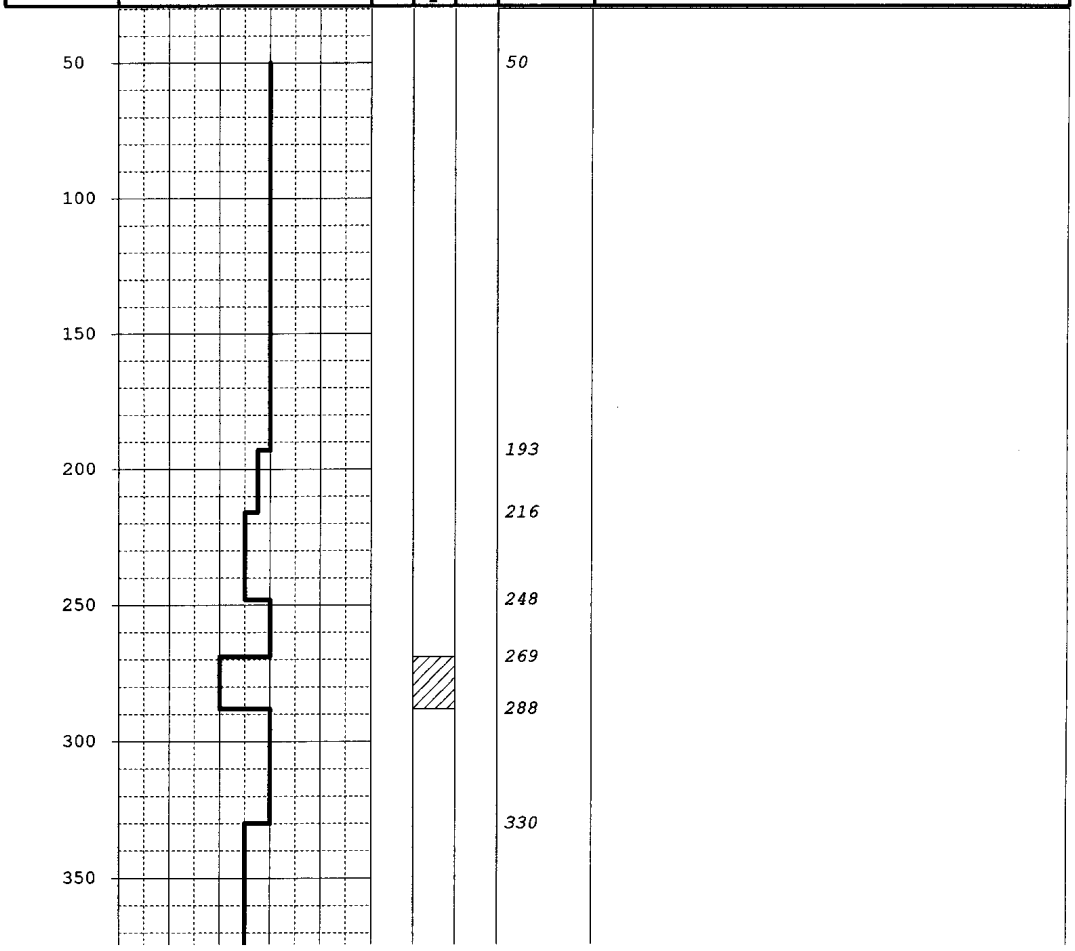

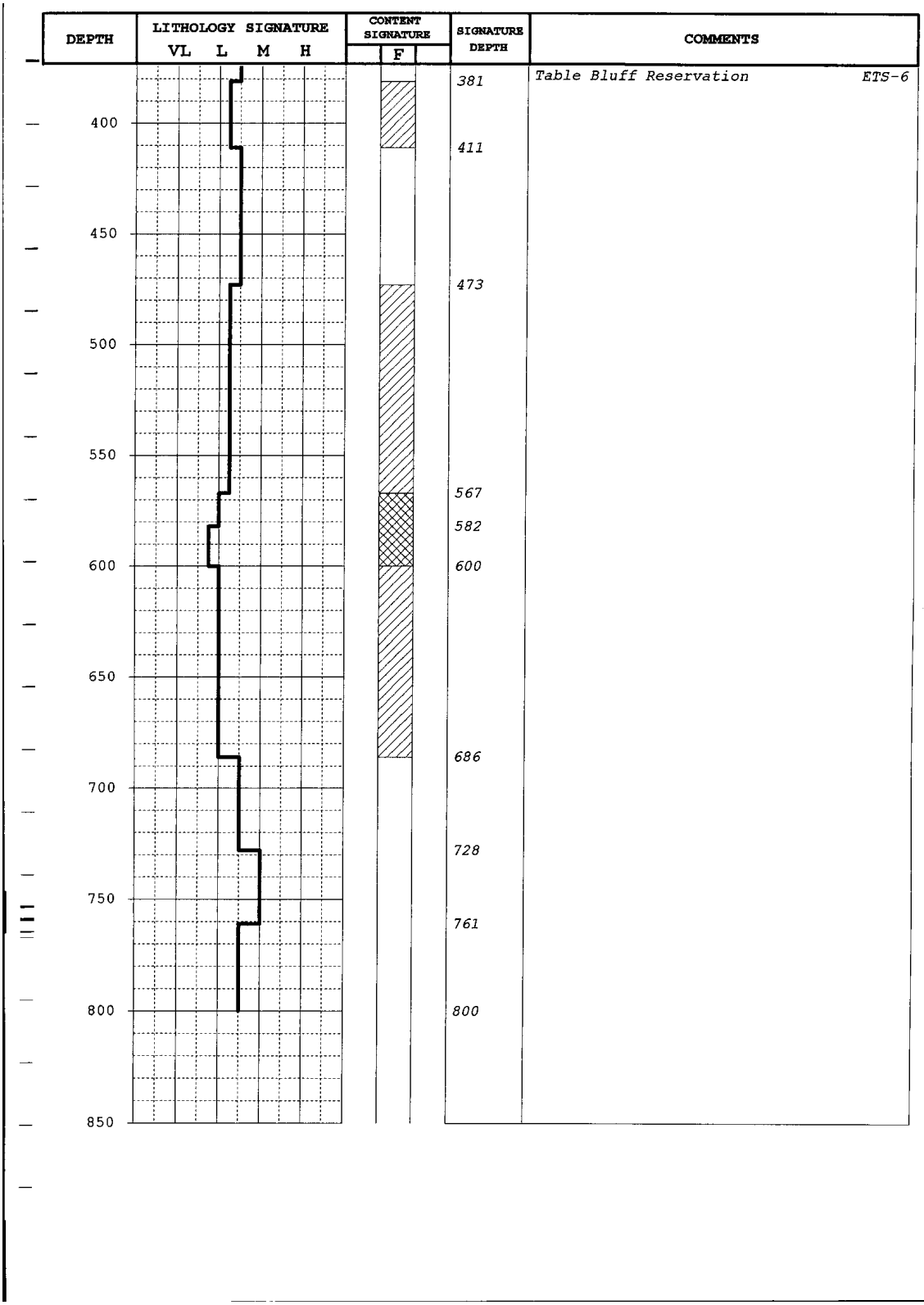
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VL
L
M
H
CONTENT SIGNATURE
F
SIGNATURE DEPTH
COMMENTS
Table Bluff Reservation
ETS-6
400
450
500
550
600
650
700
750
800
850
381
411
473
567
582
600
686
728
761
800

TELLURIC CONSULTING SERVICES
P.O. Box 740728
Dallas, TX 75374
972-494-1910

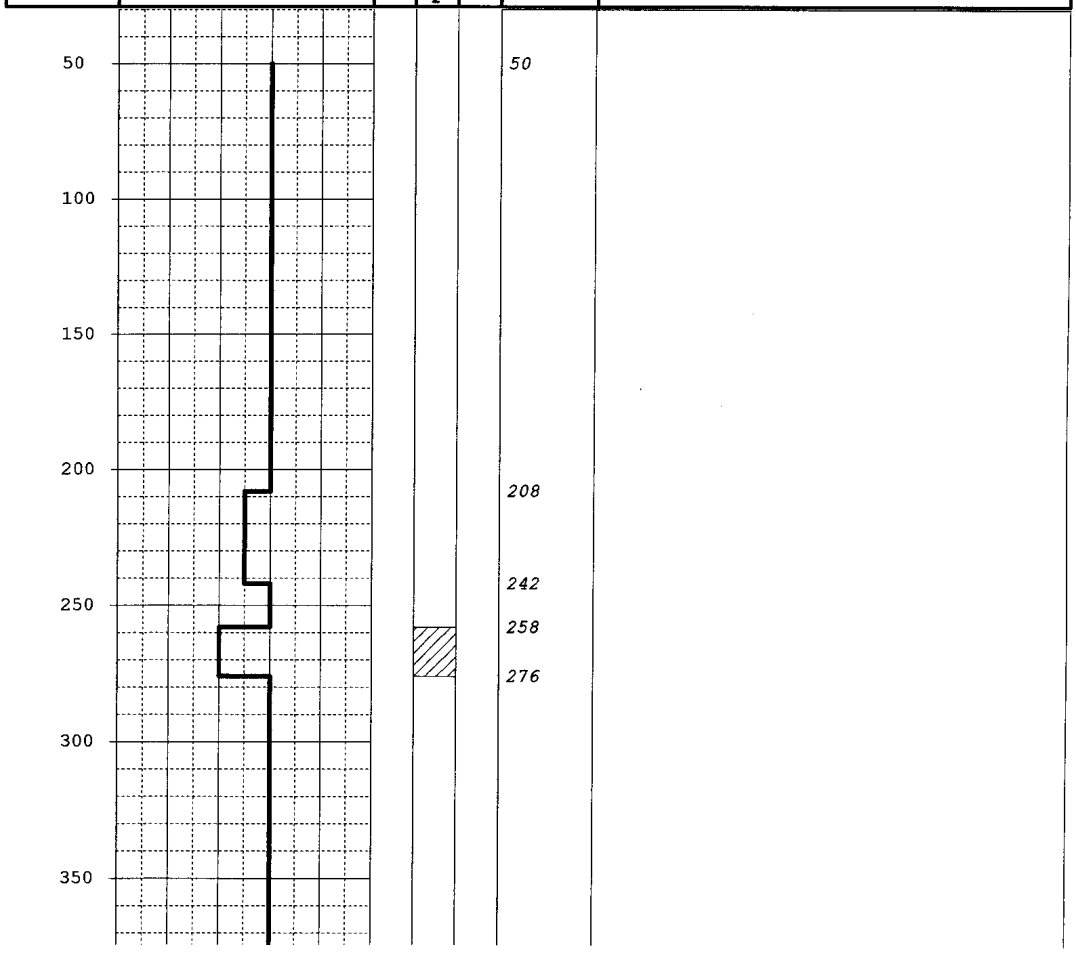
ELECTROTELLURIC LOG

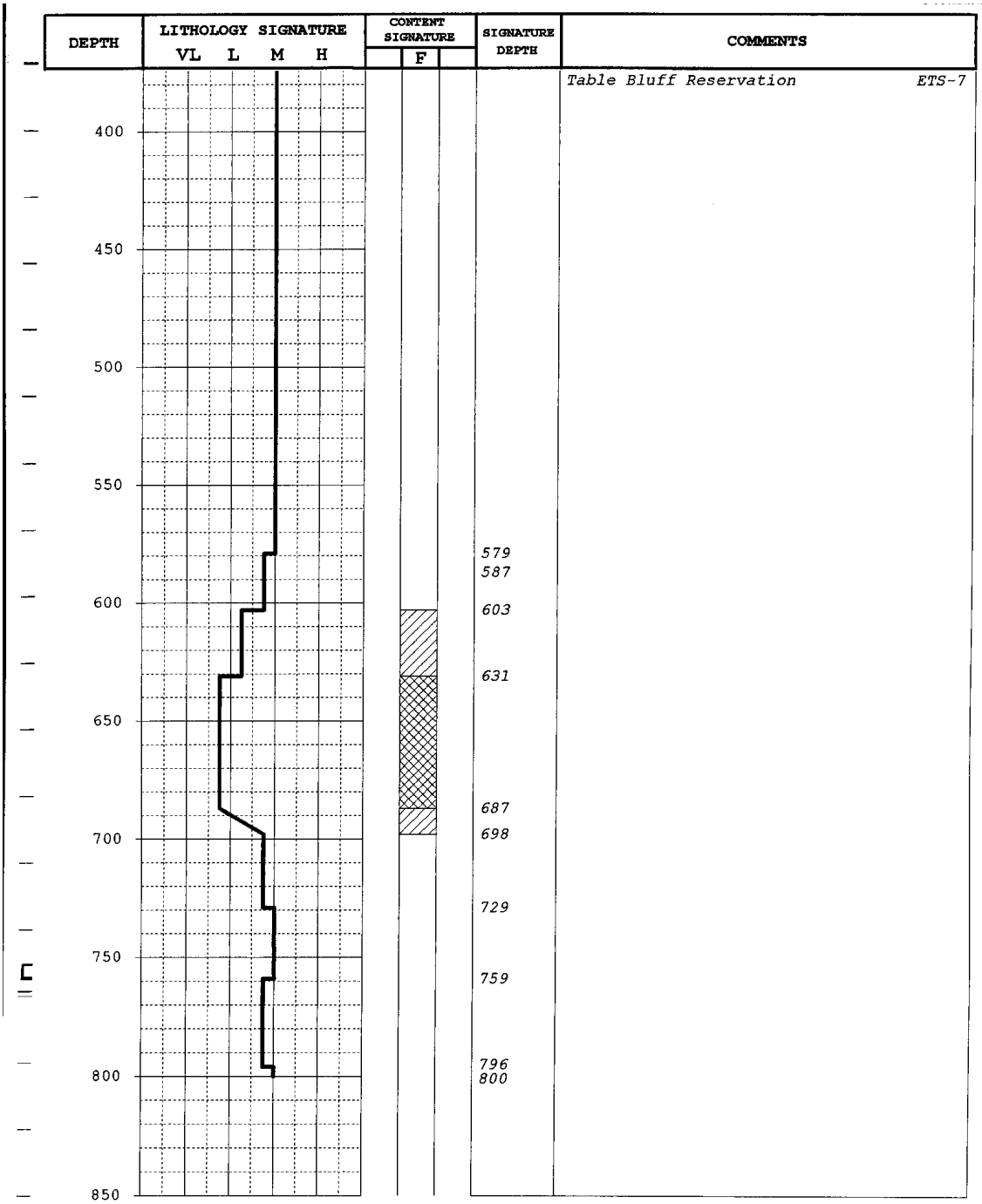
COMPANY: Geoconsultants, Inc.
STATION: ETS-7
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 3:26
Tape/Record No: M1-9

Elevation: 117
Resolution: 10-Ft. Unit

TCS provides its best judgment in data interpretation. We do not guarantee the accuracy and we accept no responsibility. The Content Signature is a qualitative analysis indicating potential resources. Formation descriptions are not derived directly from instrumentation, but rather from geologic interpretation.




DEPTH
LITHOLOGY SIGNATURE
VL
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CONTENT SIGNATURE
F
SIGNATURE DEPTH
COMMENTS
Table Bluff Reservation
ETS-7
400
450
500
550
579
587
600
603
631
650
687
698
700
729
750
759
796
800
800
850

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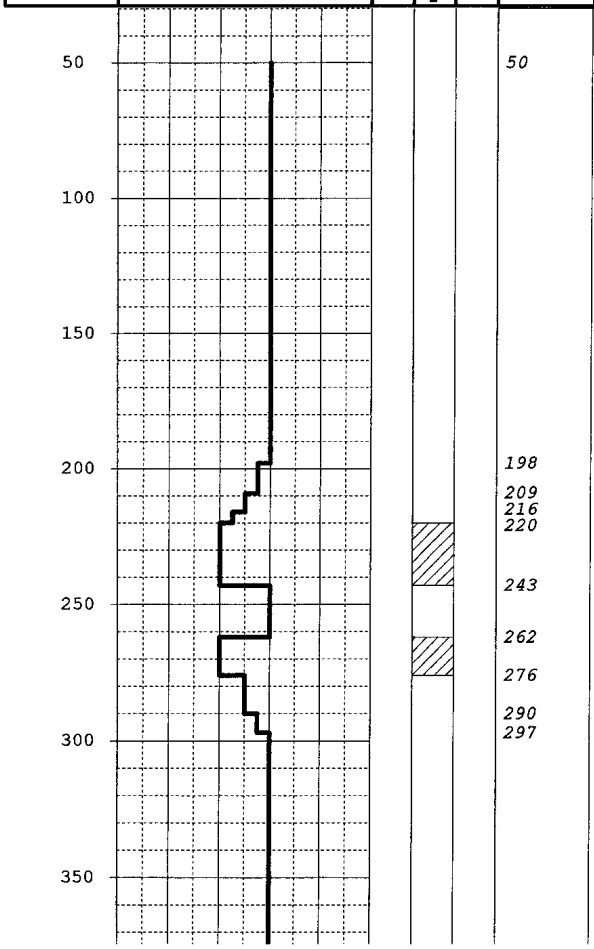
Dallas, TX 75374
972-494-1910

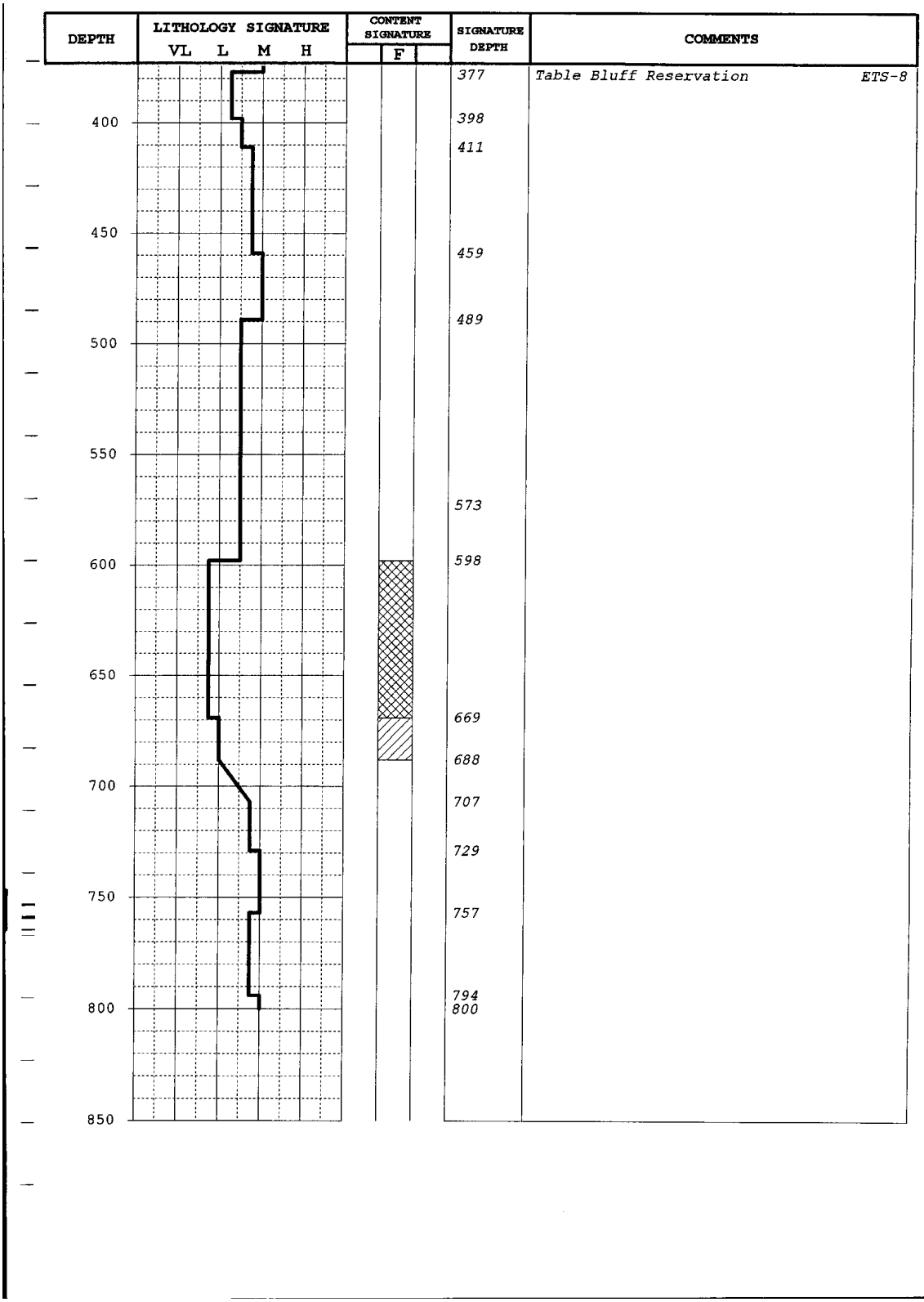
ELECTROTELLURIC LOG

COMPANY: Geoconsultants, Inc.
STATION: ETS-8
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 3:39
Tape/Record No: M1-10

Elevation: 116
Resolution: 10-Ft. Unit




DEPTH
LITHOLOGY SIGNATURE
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CONTENT SIGNATURE
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SIGNATURE DEPTH
COMMENTS
377
Table Bluff Reservation
ETS-8
398
411
459
489
573
598
669
688
707
729
757
794
800
400
450
500
550
600
650
700
750
800
850

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ELECTROTELLURIC LOG

COMPANY: Geoconsultants, Inc.
STATION: ETS-9
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 3:56
Tape/Record No: M1-11

Elevation: 84
Resolution: 10-Ft. Unit

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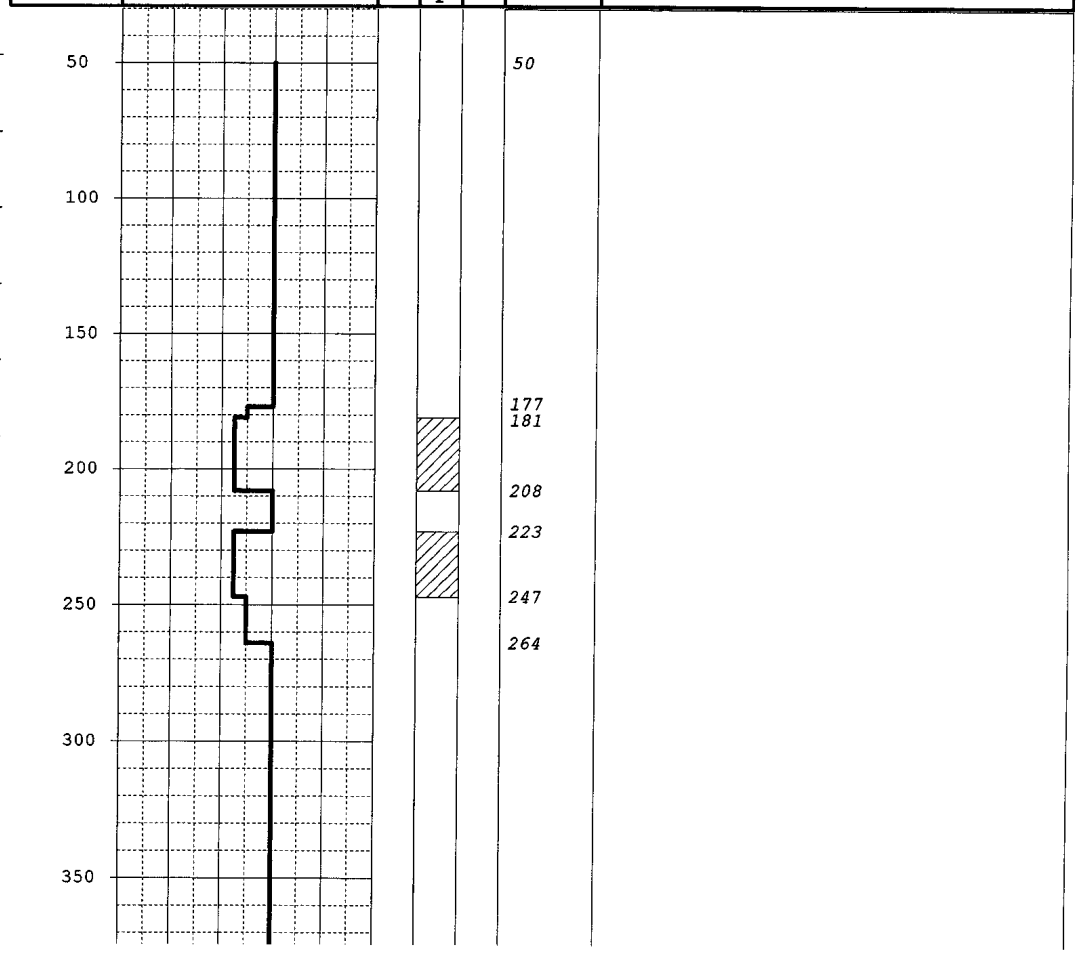

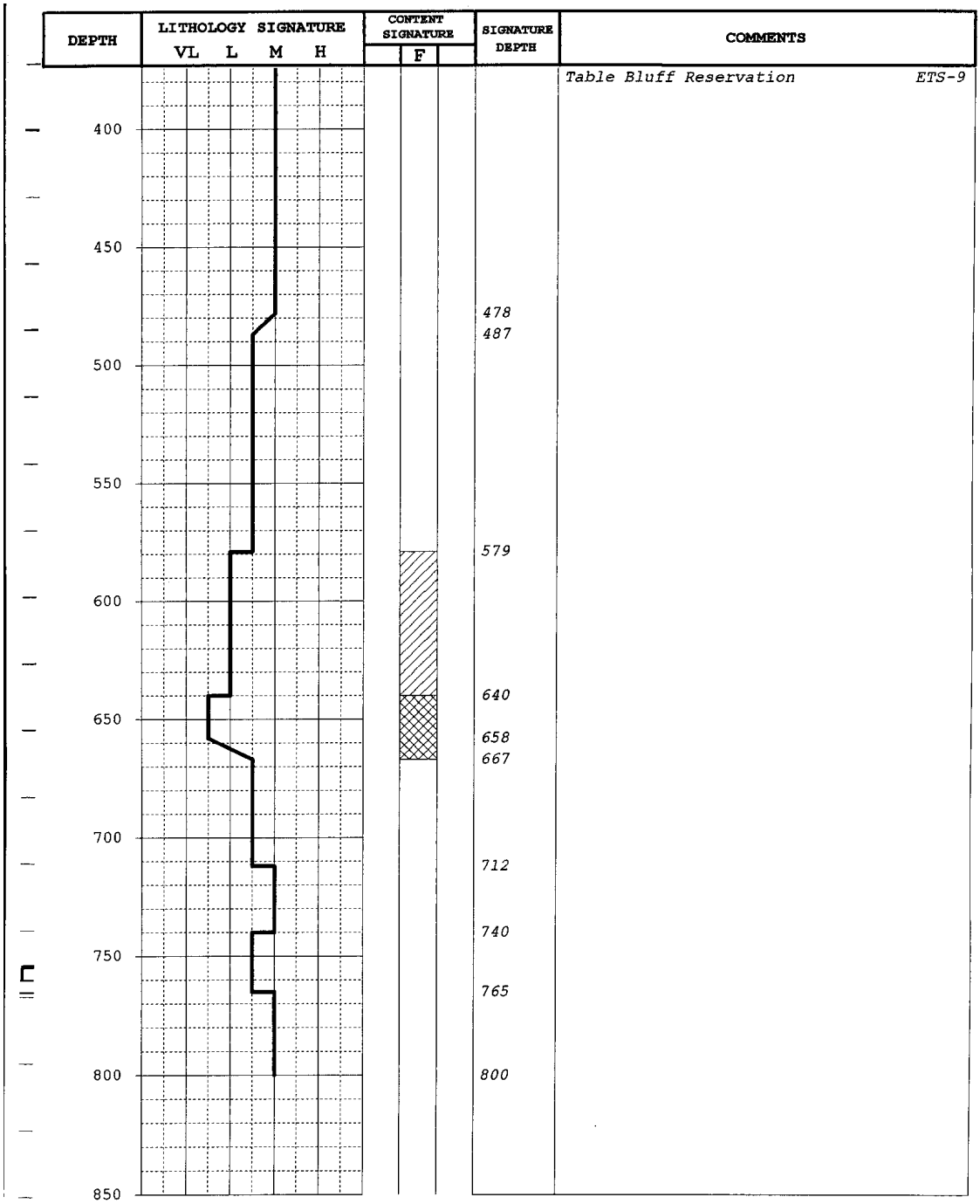
DEPTH
LITHOLOGY SIGNATURE
VL
L
M
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CONTENT SIGNATURE
F
SIGNATURE DEPTH
COMMENTS
Table Bluff Reservation
ETS-9
400
450
500
550
600
650
700
750
800
850
478
487
579
640
658
667
712
740
765
800

ELECTROTELLURIC LOG

TELLURIC CONSULTING SERVICES
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Dallas, TX 75374
972-494-1910

COMPANY: Geoconsultants, Inc.
STATION: Well No. 2
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 1:01
Tape/Record No: M1-1

Elevation: 10
Resolution: 10-Ft. Unit

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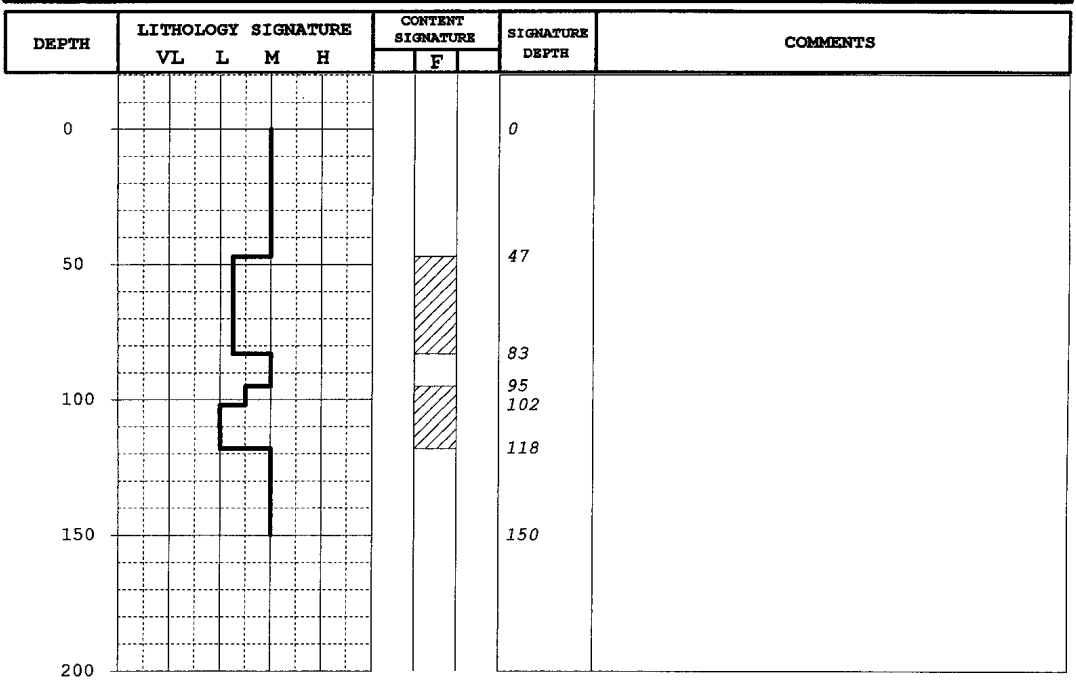

ELECTROTELLURIC LOG

TELLURIC CONSULTING SERVICES
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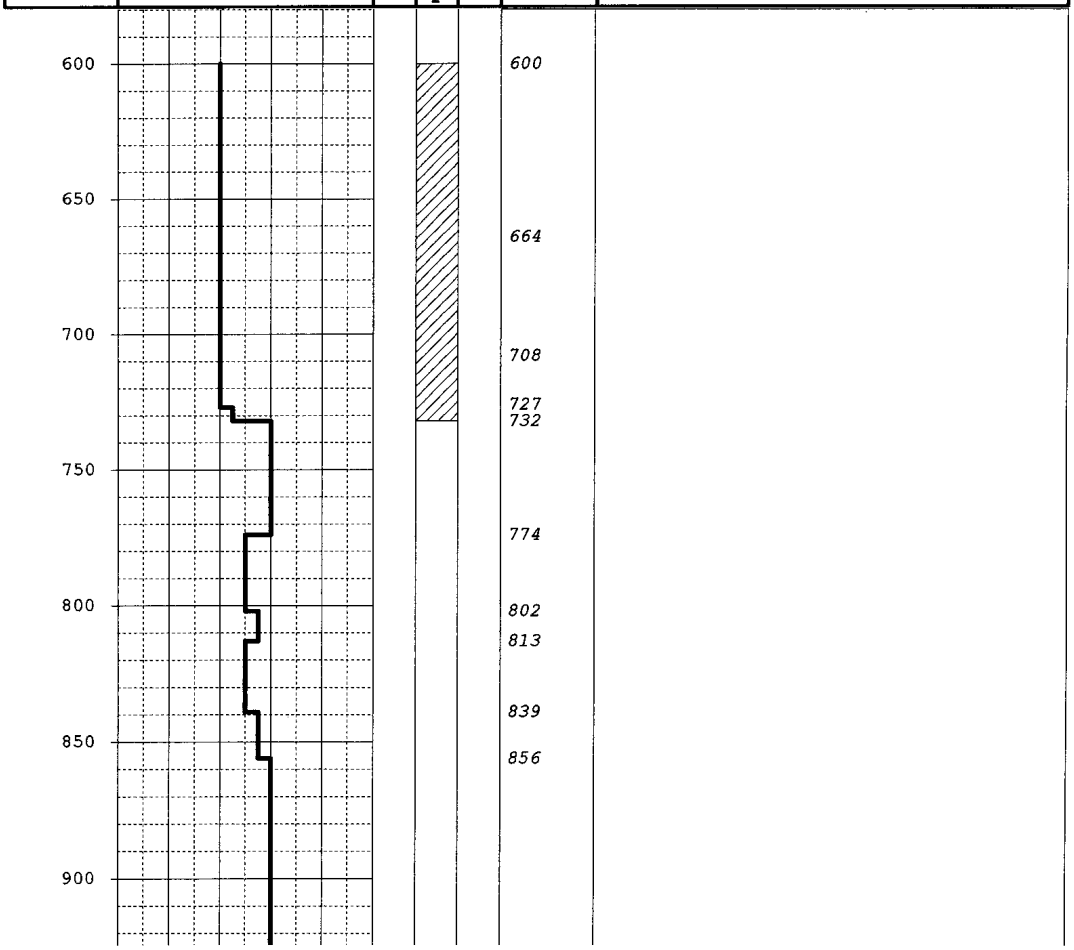
Dallas, TX 75374
972-494-1910

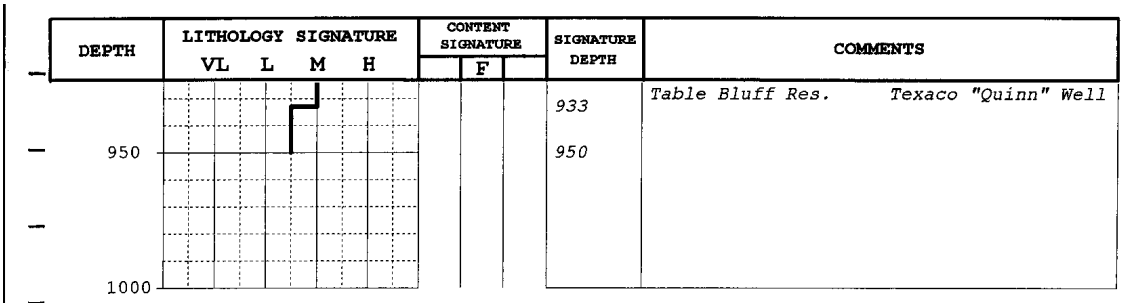
COMPANY: Geoconsultants, Inc.
STATION: Texaco "Quinn" Well
PROJECT: Table Bluff Reservation
LOCATION: Humboldt Co., California

Record Date: 5-23-06
Record Time: 1:23
Tape/Record No: M1-2

Elevation: 140
Resolution: 10-Ft. Unit

TCS provides its best judgment in data interpretation. We do not guarantee the accuracy and we accept no responsibility. The Content Signature is a qualitative analysis indicating potential resources. Formation descriptions are not derived directly from instrumentation, but rather from geologic interpretation.




DEPTH
LITHOLOGY SIGNATURE
VL
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H
CONTENT SIGNATURE
F
SIGNATURE DEPTH
COMMENTS
950
1000
933
950
Table Bluff Res.
Texaco "Quinn" Well

Appendix B
2008 Well Drinking Water Quality Results

January 13, 2009

Maggiora Bros. Drilling Inc.
595 Airport Blvd.
Watsonville, CA 95076

Lab ID : STK0851623-001
Customer ID : 3-8986

Sampled On : November 13, 2008-10:00
Sampled By : Liam Bocardo
Received On : November 13, 2008-15:30
Matrix : Ground Water

Description : Well
Project : Table Bluff Reservation

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'4]								
Total Hardness	57.1	2.5	mg/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Calcium	13	1	mg/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Magnesium	6	1	mg/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Potassium	8	1	mg/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Sodium	30	1	mg/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Total Cations	2.7	0.1	meq/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Boron	ND	0.1	mg/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Copper	40	10	ug/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Iron	1070	50	ug/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Manganese	20	10	ug/L		200.7	11/15/08:211722	200.7	11/17/08:214148
Zinc	50	20	ug/L		200.7	11/15/08:211722	200.7	11/17/08:214148
SAR	1.7	0.1	--		200.7	11/15/08:211722	200.7	11/17/08:214148
Total Alkalinity (as CaCO3)	80	10	mg/L		2320B	11/17/08:211753	2320B	11/18/08:214173
Hydroxide	ND	10	mg/L		2320B	11/17/08:211753	2320B	11/18/08:214173
Carbonate	ND	10	mg/L		2320B	11/17/08:211753	2320B	11/18/08:214173
Bicarbonate	100	10	mg/L		2320B	11/17/08:211753	2320B	11/18/08:214173
Sulfate	9	2	mg/L		300.0	11/14/08:211770	300.0	11/15/08:214165
Chloride	24	1	mg/L		300.0	11/14/08:211770	300.0	11/15/08:214165
Nitrate	ND	0.4	mg/L		300.0	11/14/08:211770	300.0	11/15/08:214165
Nitrite as N	ND	0.1	mg/L		4500NO2B	11/14/08:211712	4500NO2B	11/14/08:214061
Fluoride	ND	0.1	mg/L		300.0	11/14/08:211770	300.0	11/15/08:214165
Total Anions	2.5	0.1	meq/L		2320B	11/17/08:211753	2320B	11/18/08:214173
pH	8.8	--	units		4500-H B	11/13/08:301185	4500HB	11/13/08:301463
Specific Conductance	252	1	umhos/cm		2510B	11/18/08:211782	2510B	11/18/08:214146
Total Dissolved Solids	140	20	mg/L		2540 C	11/17/08:211772	2540C	11/18/08:214142
MBAS (foaming agents)	ND	0.1	mg/L		5540C	11/14/08:211717	5540C	11/14/08:214072
Aggressiveness Index	12.2	1	--		4500-H B	11/13/08:301185	4500HB	11/13/08:301463
Langlier Index (20°C)	0.4	1	--		4500-H B	11/13/08:301185	4500HB	11/13/08:301463
Metals, Total[P:1'5]								
Aluminum	850	20	ug/L		200.8	11/19/08:211835	200.8	11/19/08:214272
Antimony	ND	1	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Arsenic	ND	2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Barium	30.0	0.2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Beryllium	ND	0.2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Cadmium	ND	0.2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127

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FAX: 805/525-4172
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Stockton, CA 95215
TEL: 209/942-0182
FAX: 209/942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: 530/343-5818
FAX: 530/343-3807
CA ELAP Certification No. 2670

Field Office
Visalia, California
TEL: 559/734-9473
Mobile: 559/737-2399
FAX: 559/734-8435

January 13, 2009
Description : Well

Lab ID : STK0851623-001
Customer ID : 3-8986

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Metals, Total[P:1'5]								
Chromium	4	1	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Lead	3.0	0.2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Mercury	ND	0.02	ug/L		7470	11/18/08:211820	245.1	11/18/08:214243
Nickel	7	1	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Selenium	ND	2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Silver	ND	1	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Thallium	ND	0.2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Vanadium	2	2	ug/L		200.8	11/17/08:211730	200.8	11/17/08:214127
Wet Chemistry[P:1'10]								
Color	10	5	units		2120B	11/14/08:211747	2120B	11/14/08:214100
Cyanide, Total	ND	0.004	mg/L		9010B	11/19/08:211841	4500CNCE	11/24/08:214455
Odor	2	1	TON		2150B	11/14/08:211748	2150B	11/14/08:214101
Turbidity	8.4	0.2	NTU		2130B	11/14/08:211749	2130B	11/14/08:214102

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (AGT) Amber Glass TFE-Cap, (AST) Amber Silanized-TFE, (P) Plastic, (VOA) VOA
Preservatives: Monochloracetic Buffer, NH4Cl, H2SO4 pH < 2, NaOH, HNO3 pH < 2, HNO3 pH < 2, HCl pH < 2

January 13, 2009

Maggiora Bros. Drilling Inc.
595 Airport Blvd.
Watsonville, CA 95076

Lab ID : STK0851623-001
Customer ID : 3-8986

Sampled On : November 13, 2008-10:00
Sampled By : Liam Bocardo
Received On : November 13, 2008-15:30
Matrix : Ground Water

Description : Well
Project : Table Bluff Reservation

Sample Result - Organic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
EPA 504.1[VOA:1]								
1,3-Dibromopropane	94.1	70-130	%		504	11/18/08:211803	504.1	11/19/08:214211
DBCP	ND	0.01	ug/L		504	11/18/08:211803	504.1	11/19/08:214211
EDB	ND	0.02	ug/L		504	11/18/08:211803	504.1	11/19/08:214211
EPA 505[VOA:1]								
Alachlor	ND	0.2	ug/L		505	11/21/08:211968	505	11/21/08:214361
Aldrin	ND	0.01	ug/L		505	11/21/08:211968	505	11/21/08:214361
Chlordane	ND	0.1	ug/L		505	11/21/08:211968	505	11/21/08:214361
Dieldrin	ND	0.01	ug/L		505	11/21/08:211968	505	11/21/08:214361
Endrin	ND	0.01	ug/L		505	11/21/08:211968	505	11/21/08:214361
Heptachlor	ND	0.01	ug/L		505	11/21/08:211968	505	11/21/08:214361
Heptachlor Epoxide	ND	0.01	ug/L		505	11/21/08:211968	505	11/21/08:214361
Hexachlorobenzene	ND	0.01	ug/L		505	11/21/08:211968	505	11/21/08:214361
Hexachlorocyclopentadiene	ND	0.1	ug/L		505	11/21/08:211968	505	11/21/08:214361
Lindane	ND	0.05	ug/L		505	11/21/08:211968	505	11/21/08:214361
Methoxychlor	ND	0.1	ug/L		505	11/21/08:211968	505	11/21/08:214361
Toxaphene	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1016	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1221	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1232	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1242	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1248	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1254	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
PCB 1260	ND	0.5	ug/L		505	11/21/08:211968	505	11/21/08:214361
EPA 507[AGT:1]								
Triphenylphosphate	91.5	70-130	%		507	11/18/08:211785	507	11/22/08:214367
Alachlor	ND	1	ug/L		507	11/18/08:211785	507	11/22/08:214367
Atrazine	ND	0.5	ug/L		507	11/18/08:211785	507	11/22/08:214367
Bromacil	ND	2	ug/L		507	11/18/08:211785	507	11/22/08:214367
Butachlor	ND	1	ug/L		507	11/18/08:211785	507	11/22/08:214367
Diazinon	ND	2	ug/L		507	11/18/08:211785	507	11/22/08:214367
Dimethoate	ND	2	ug/L		507	11/18/08:211785	507	11/22/08:214367
Metolachlor	ND	1	ug/L		507	11/18/08:211785	507	11/22/08:214367
Metribuzin	ND	0.5	ug/L		507	11/18/08:211785	507	11/22/08:214367
Molinate	ND	2	ug/L		507	11/18/08:211785	507	11/22/08:214367
Prometryne	ND	2	ug/L		507	11/18/08:211785	507	11/22/08:214367

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FAX: 209/942-0423
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Chico, CA 95926
TEL: 530/343-5818
FAX: 530/343-3807
CA ELAP Certification No. 2670

Field Office
Visalia, California
TEL: 559/734-9473
Mobile: 559/737-2399
FAX: 559/734-8435

January 13, 2009 Lab ID : STK0851623-001
Description : Well Customer ID : 3-8986

Sample Result - Organic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
EPA 507[AGT:1]								
Propachlor	ND	1	ug/L		507	11/18/08:211785	507	11/22/08:214367
Simazine	ND	1	ug/L		507	11/18/08:211785	507	11/22/08:214367
Thiobencarb	ND	1	ug/L		507	11/18/08:211785	507	11/22/08:214367
Cyanazine	ND	0.5	ug/L		507	11/18/08:211785	507	11/22/08:214367
EPA 515[AGT:1]								
2,4-DCAA	110	70-130	%		515.3	11/25/08:212082	515.3	12/02/08:214697
Bentazon	ND	2	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
2,4-D	ND	2	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
Dalapon	ND	10	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
Dicamba	ND	1	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
Dinoseb	ND	1	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
Pentachlorophenol	ND	0.2	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
Picloram	ND	1	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
2,4,5-TP (Silvex)	ND	1	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
2,4,5-T	ND	1	ug/L		515.3	11/25/08:212082	515.3	12/02/08:214697
EPA 524.2[VOA:1'3]								
4-Bromofluorobenzene	111	70-130	%		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2-Dichlorobenzene-d4	104	70-130	%		524.2	11/20/08:211945	524.2	11/20/08:214338
Benzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Bromobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Bromochloromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Bromodichloromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Bromoform	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Bromomethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
n-Butylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
sec-Butylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
tert-Butylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Carbon Tetrachloride	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
tert-Butanol	ND	2	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Chlorobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Chloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Chloroform	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Chloromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
2-Chlorotoluene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
4-Chlorotoluene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Dibromochloromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Dibromomethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2-Dichlorobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338

January 13, 2009
Description : Well

Lab ID : STK0851623-001
Customer ID : 3-8986

Sample Result - Organic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
EPA 524.2[VOA:1'3]								
1,3-Dichlorobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,4-Dichlorobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Dichlorodifluoromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1-Dichloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2-Dichloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1-Dichloroethylene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
cis-1,2-Dichloroethylene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
trans-1,2-Dichloroethylene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2-Dichloropropane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,3-Dichloropropane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Dichloromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
2,2-Dichloropropane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1-Dichloropropene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
cis-1,3-Dichloropropene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
trans-1,3-Dichloropropene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
cis-1,3-Dichloropropene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
trans-1,3-Dichloropropene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Di-isopropyl ether (DIPE)	ND	3	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Ethyl Benzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Ethyl tert-Butyl Ether (ETBE)	ND	3	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Hexachlorobutadiene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Isopropylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
p-Isopropyltoluene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Methyl tert-Butyl Ether (MTBE)	ND	1	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Naphthalene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
n-Propylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Styrene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Tert-amyl-methyl Ether (TAME)	ND	3	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Tetrachloroethylene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Toluene	3.0	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2,3-Trichlorobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2,4-Trichlorobenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1,1-Trichloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1,2-Trichloroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Trichloroethylene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Trichlorofluoromethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338

January 13, 2009
Description : Well

Lab ID : STK0851623-001
Customer ID : 3-8986

Sample Result - Organic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
EPA 524.2[VOA:1'3]								
1,2,3-Trichloropropane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,1,2-Trichlorotrifluoroethane	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,2,4-Trimethylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
1,3,5-Trimethylbenzene	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Vinyl Chloride	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Xylenes m,p	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Xylenes o	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Xylenes (Total)	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Xylenes m,p	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
Xylenes o	ND	0.5	ug/L		524.2	11/20/08:211945	524.2	11/20/08:214338
EPA 525.2[AGT:1]								
Perylene-d12	96.4	70-130	%		525.2	11/23/08:212046	525.2	12/09/08:215293
Benzo(a)pyrene	ND	0.1	ug/L		525.2	11/23/08:212046	525.2	12/09/08:215293
bis(2-Ethylhexyl)adipate	ND	1	ug/L		525.2	11/23/08:212046	525.2	12/09/08:215293
bis(2-Ethylhexyl)phthalate	ND	3	ug/L		525.2	11/23/08:212046	525.2	12/09/08:215293
EPA 531.1[AGT:1'8]								
Aldicarb	ND	3	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
Aldicarb Sulfone	ND	2	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
Aldicarb Sulfoxide	ND	3	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
Carbaryl	ND	5	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
Carbofuran	ND	5	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
3-Hydroxycarbofuran	ND	10	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
Methomyl	ND	5	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
Oxamyl	ND	5	ug/L		531.1	12/03/08:212322	531.1	12/03/08:214842
EPA 547[AGT:1]								
Glyphosate	ND	20	ug/L		547	11/17/08:211775	547	11/17/08:214130
EPA 548.1[AGT:1]								
Endothall	ND	40	ug/L		548.1	11/20/08:211920	548.1	11/25/08:214471
EPA 549[AST:1]								
Diquat	ND	2	ug/L		549	11/20/08:211921	549.2	12/01/08:214661
EPA 552.2[AGT:1'12]								
2,3-Dibromopropionic Acid	127	70-130	%		552	11/19/08:211837	552.2	11/20/08:214215
Bromoacetic Acid	ND	1	ug/L		552	11/19/08:211837	552.2	11/20/08:214215
Chloroacetic Acid	ND	2	ug/L		552	11/19/08:211837	552.2	11/20/08:214215
Dibromoacetic Acid	ND	1	ug/L		552	11/19/08:211837	552.2	11/20/08:214215
Dichloroacetic Acid	ND	1	ug/L		552	11/19/08:211837	552.2	11/20/08:214215
Trichloroacetic Acid	ND	1	ug/L		552	11/19/08:211837	552.2	11/20/08:214215
Haloacetic acids (five)	ND	2	ug/L		552	11/19/08:211837	552.2	11/20/08:214215

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (AGT) Amber Glass TFE-Cap, (AST) Amber Silanized-TFE, (P) Plastic, (VOA) VOA
Preservatives: Monochloracetic Buffer, NH4Cl, H2SO4 pH < 2, NaOH, HNO3 pH < 2, HNO3 pH < 2, HCl pH < 2

January 13, 2009

Maggiora Bros. Drilling Inc.
595 Airport Blvd.
Watsonville, CA 95076

Lab ID : STK0851623-001
Customer ID : 3-8986

Sampled On : November 13, 2008-10:00
Sampled By : Liam Bocardo
Received On : November 13, 2008-15:30
Matrix : Ground Water

Description : Well
Project : Table Bluff Reservation

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Radio Chemistry[P:1'5]								
Gross Alpha	0.731 ± 0.715	0.933	pCi/L	15/5	900.0	12/30/08:213213	900.0	01/09/09:200404
Gross Beta	3.98 ± 1.10	1.15	pCi/L	50	900.0	12/30/08:213213	900.0	01/09/09:200404
Total Alpha Radium (226)	0.089 ± 0.123	0.373	pCi/L	3	903.0	11/20/08:211912	903.0	11/25/08:214539
Uranium	0.366 ± 0.475	0.278	pCi/L	20	908.0	12/29/08:213165	908.0	01/07/09:200269
Ra 228	0.000 ± 1.56	0.258	pCi/L	2	Ra - 05	12/02/08:212217	Ra - 05	12/08/08:215096

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (AGT) Amber Glass TFE-Cap, (AST) Amber Silanized-TFE, (P) Plastic, (VOA) VOA
Preservatives: Monochloracetic Buffer, NH4Cl, H2SO4 pH < 2, NaOH, HNO3 pH < 2, HNO3 pH < 2, HCl pH < 2

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = (Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following
If Gross Alpha's (AV) exceeds 5 pCi/L run Uranium. If Gross Alpha's (AV) minus Uranium exceeds 5 pCi/L run Radium 226.

Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: 805/392-2000
FAX: 805/525-4172
CA NELAP Certification No. 01110CA

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: 209/942-0182
FAX: 209/942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: 530/343-5818
FAX: 530/343-3807
CA ELAP Certification No. 2670

Field Office
Visalia, California
TEL: 559/734-9473
Mobile: 559/737-2399
FAX: 559/734-8435

Date: 26-Aug-2009
WorkOrder: 0908409

ANALYTICAL REPORT

Client Sample ID: #1 **Received:** 8/18/2009 **Collected:** 8/17/2009 20:00
Lab ID: 0908409-01A

Test Name: pH **Reference:** Std. Meth. 20th Ed. 4500-H B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
pH	8.6	N/A	pH Units	1.0		8/18/2009

Test Name: Turbidity **Reference:** EPA 180.1

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Turbidity	0.27	0.050	NTU	1.0		8/19/2009

Client Sample ID: #1 **Received:** 8/18/2009 **Collected:** 8/17/2009 20:00
Lab ID: 0908409-01B

Test Name: ICAP Metals **Reference:** EPA 200.7 Rev. 4.4 (1994)

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Aluminum	ND	50	µg/L	1.0	8/25/2009	8/25/2009
Iron	ND	15	µg/L	1.0	8/25/2009	8/25/2009
Manganese	2.8	1.0	µg/L	1.0	8/25/2009	8/25/2009

Client Sample ID: #1(DISSOLVED) **Received:** 8/18/2009 **Collected:** 8/17/2009 20:00
Lab ID: 0908409-01C

Test Name: ICAP Metals **Reference:** EPA 200.7 Rev. 4.4 (1994)

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Aluminum	ND	50	µg/L	1.0	8/18/2009	8/19/2009

Client Sample ID: #2 **Received:** 8/18/2009 **Collected:** 8/18/2009 04:00
Lab ID: 0908409-02A

Test Name: pH **Reference:** Std. Meth. 20th Ed. 4500-H B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
pH	8.6	N/A	pH Units	1.0		8/18/2009

Test Name: Turbidity **Reference:** EPA 180.1

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Turbidity	0.67	0.050	NTU	1.0		8/19/2009

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5680 West End Road • Arcata, California 95521-9202 • 707-822-4649 • FAX 707-822-6831

Date: 26-Aug-2009
WorkOrder: 0908409

ANALYTICAL REPORT

Client Sample ID: #2 **Received:** 8/18/2009 **Collected:** 8/18/2009 04:00
Lab ID: 0908409-02B

Test Name: ICAP Metals **Reference:** EPA 200.7 Rev. 4.4 (1994)

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Aluminum	ND	50	µg/L	1.0	8/25/2009	8/25/2009
Iron	18	15	µg/L	1.0	8/25/2009	8/25/2009
Manganese	3.0	1.0	µg/L	1.0	8/25/2009	8/25/2009

Client Sample ID: #2(DISSOLVED) **Received:** 8/18/2009 **Collected:** 8/18/2009 04:00
Lab ID: 0908409-02C

Test Name: ICAP Metals **Reference:** EPA 200.7 Rev. 4.4 (1994)

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Aluminum	ND	50	µg/L	1.0	8/18/2009	8/19/2009

Client Sample ID: #3 **Received:** 8/18/2009 **Collected:** 8/18/2009 12:00
Lab ID: 0908409-03A

Test Name: pH **Reference:** Std. Meth. 20th Ed. 4500-H B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
pH	8.6	N/A	pH Units	1.0		8/18/2009

Test Name: Turbidity **Reference:** EPA 180.1

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Turbidity	0.26	0.050	NTU	1.0		8/19/2009

Client Sample ID: #3 **Received:** 8/18/2009 **Collected:** 8/18/2009 12:00
Lab ID: 0908409-03B

Test Name: ICAP Metals **Reference:** EPA 200.7 Rev. 4.4 (1994)

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Aluminum	ND	50	µg/L	1.0	8/25/2009	8/25/2009
Iron	ND	15	µg/L	1.0	8/25/2009	8/25/2009
Manganese	2.5	1.0	µg/L	1.0	8/25/2009	8/25/2009

Client Sample ID: #3(DISSOLVED) **Received:** 8/18/2009 **Collected:** 8/18/2009 12:00
Lab ID: 0908409-03C

Test Name: ICAP Metals **Reference:** EPA 200.7 Rev. 4.4 (1994)

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Aluminum	ND	50	µg/L	1.0	8/18/2009	8/19/2009

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Appendix C
2011 Well Drinking Water Quality Results

NORTH COAST LABORATORIES LTD.

February 16, 2011

Whitson Inc.
P.O. Box 240
Willow Creek, CA 95573-0240

Attn:

RE: 1023 Table Bluff Reservation Well

Order No.: 1101440
Invoice No.: 94853
PO No.:
ELAP No.1247-Expires July 2012

SAMPLE IDENTIFICATION

Fraction	Client Sample Description
01A	Table Bluff Well (Subcontracted)
01B	Table Bluff Well (Subcontracted)
01C	Table Bluff Well (Subcontracted)
01D	Table Bluff Well (Subcontracted)
01E	Table Bluff Well (Subcontracted)
01F	Table Bluff Well (Subcontracted)
01G	Table Bluff Well (Subcontracted)
01H	Table Bluff Well (Subcontracted)
01I	Table Bluff Well
01J	Table Bluff Well
01K	Table Bluff Well
01L	Table Bluff Well
01N	Table Bluff Well
01O	Table Bluff Well
01P	Table Bluff Well
01Q	Table Bluff Well
01R	Table Bluff Well
01S	Table Bluff Well
01T	Table Bluff Well
01U	Table Bluff Well
01V	Table Bluff Well

ND = Not Detected at the Reporting Limit

Limit = Reporting Limit

Flag = Explanation in Case Narrative

All solid results are expressed on a wet-weight basis unless otherwise noted.

REPORT CERTIFIED BY

Laboratory Supervisor(s)

QA Unit

Jesse G. Chaney, Jr.
Laboratory Director

North Coast Laboratories, Ltd. **Date:** 17-Feb-2011

CLIENT: Whitson Inc.
Project: 1023 Table Bluff Reservation Well
Lab Order: 1101440

CASE NARRATIVE

Samples for pH, residual chlorine and dissolved oxygen analysis must be analyzed within 15 minutes of collection. Therefore, any samples requiring these analyses were analyzed past the official holding time.

EPA 506:
The recovery of di-ethylhexylphthalate was below the lower control limit in the laboratory control sample/laboratory control sample duplicate. It was justified to report the sample result as not-detected based on the response of a low level standard analyzed at or below the method reporting limit.

EPA 507:
The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery was above the upper acceptance limit for bromacil. The elevated recovery equates to a high bias. There were no detectable levels of the analyte in the sample; therefore, the data were accepted.

EPA 508:
The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery was below the lower acceptance limit for Aroclor 1260 . The response of the reporting limit standard was such that the analyte would have been detected even with the low recovery; therefore, the data were accepted.

EPA 524:
The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery was above the upper acceptance limit for hexachlorobutadiene. The elevated recovery equates to a high bias. There were no detectable levels of the analyte in the sample; therefore, the data were accepted.

EPA 549.2:
Diquat strongly adsorbs to soil particles that are suspended in water. The strong chemical bonds make the herbicide chemically inactive. When bound with soil particles, the extraction procedure for method EPA 549.2 is ineffective at isolating the bound diquat. Any reported diquat represents the dissolved analyte in the water that has not been bound to the soil particles.

Aluminum:
Due to trace contamination of the method blank the reporting limit was raised.

Calcium/Magnesium/Sodium:
The matrix spike recoveries were not quantifiable due to the large amount of analyte in the sample which was spiked.

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Date: 16-Feb-2011
WorkOrder: 1101440

ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01I

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Apparent Color
Reference: Std. Meth. 20th Ed. 2120 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Apparent Color	10		3.0	C.U.	1.0		1/27/2011

Test Name: Odor
Reference: Std. Meth. 20th Ed. 2150 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Odor	1.0		1.0	TON	1.0		1/27/2011

Test Name: Turbidity
Reference: EPA 180.1

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Turbidity	12		0.050	NTU	1.0		1/27/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01J

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Hardness
Reference: Std. Meth. 20th Ed. 2340 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Hardness	58		1.0	mg/L CaCO3	1.0	2/1/2011	2/4/2011

Test Name: ICAP Metals
Reference: EPA 200.7 Rev 4.4 (1994)

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Calcium	14,000		50	µg/L	1.0	2/1/2011	2/3/2011
Iron	500		15	µg/L	1.0	2/1/2011	2/3/2011
Magnesium	5,800		50	µg/L	1.0	2/1/2011	2/3/2011
Potassium	2,800		2,000	µg/L	1.0	2/1/2011	2/3/2011
Sodium	32,000		100	µg/L	1.0	2/1/2011	2/3/2011

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Date: 16-Feb-2011
WorkOrder: 1101440

ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01J

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: ICP-MS Metals

Reference: EPA 200.8 Rev 5.4 (1998)

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Aluminum	290		10	µg/L	1.0	2/1/2011	2/2/2011
Antimony	ND		1.0	µg/L	1.0	2/1/2011	2/2/2011
Arsenic	ND		2.0	µg/L	1.0	2/1/2011	2/2/2011
Barium	120		1.0	µg/L	1.0	2/1/2011	2/2/2011
Beryllium	ND		1.0	µg/L	1.0	2/1/2011	2/2/2011
Cadmium	ND		1.0	µg/L	1.0	2/1/2011	2/2/2011
Chromium	1.8		1.0	µg/L	1.0	2/1/2011	2/2/2011
Copper	2.6		1.0	µg/L	1.0	2/1/2011	2/2/2011
Lead	1.0		1.0	µg/L	1.0	2/1/2011	2/2/2011
Manganese	11		1.0	µg/L	1.0	2/1/2011	2/2/2011
Nickel	5.0		1.0	µg/L	1.0	2/1/2011	2/2/2011
Selenium	ND		5.0	µg/L	1.0	2/1/2011	2/2/2011
Silver	ND		2.0	µg/L	1.0	2/1/2011	2/2/2011
Thallium	ND		1.0	µg/L	1.0	2/1/2011	2/2/2011
Zinc	8.3		5.0	µg/L	1.0	2/1/2011	2/2/2011

Test Name: Mercury

Reference: EPA 245.1 Rev 3.0 (1994)

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Mercury	ND		1.0	µg/L	1.0	1/31/2011	2/1/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01K

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Alkalinity

Reference: Std. Meth. 20th Ed. 2320 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Alkalinity	92		1.0	mg/L CaCO3	1.0		1/27/2011

Test Name: Anions by Ion Chromatography

Reference: EPA 300.0 Rev 2.1 (1993)

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Chloride	19		0.10	mg/L	1.0		1/28/2011
Fluoride	ND		0.10	mg/L	1.0		1/28/2011
Sulfate	13		0.50	mg/L	1.0		1/28/2011

Test Name: Anions by Ion Chromatography

Reference: EPA 300.0 Rev 2.1 (1993)

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Nitrate (as Nitrogen)	ND		0.10	mg/L	1.0		1/28/2011
Nitrite (as Nitrogen)	ND		0.10	mg/L	1.0		1/28/2011

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Date: 16-Feb-2011
WorkOrder: 1101440

ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01K

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Conductivity — **Reference:** Std. Meth. 20th Ed. 2510 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Conductivity	260		1.0	µmhos/cm	1.0		1/31/2011

Test Name: Corrosivity Calculation (@20°C) — **Reference:** Std. Meth. 20th Ed. 2330 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Corrosivity	+0.16		N/A	Langlier	1.0		2/4/2011

Test Name: Forms of Alkalinity — **Reference:** Std. Meth. 20th Ed. 2320 B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Bicarbonate	89		1.0	mg/L CaCO3	1.0		2/4/2011
Carbonate	2.4		1.0	mg/L CaCO3	1.0		2/4/2011
Hydroxide	ND		1.0	mg/L CaCO3	1.0		2/4/2011

Test Name: pH — **Reference:** Std. Meth. 20th Ed. 4500-H B

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
pH	8.4		N/A	pH Units	1.0		1/27/2011

Test Name: Total Dissolved Solids — **Reference:** Std. Meth. 20th Ed. 2540 C

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Total Dissolved Solids	160		10	mg/L	1.0		1/28/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01L

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: EDB and DBCP — **Reference:** EPA 504.1

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
EDB	ND		0.020	µg/L	1.0	2/4/2011	2/4/2011
DBCP	ND		0.010	µg/L	1.0	2/4/2011	2/4/2011

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ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01N

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Organohalide Pesticides **Reference:** EPA 505

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
HCCPD	ND		0.050	µg/L	1.0	2/2/2011	2/3/2011
HCB	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Lindane	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Heptachlor	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Alachlor	ND		0.20	µg/L	1.0	2/2/2011	2/3/2011
Aldrin	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Heptachlor epoxide	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Dieldrin	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Endrin	ND		0.010	µg/L	1.0	2/2/2011	2/3/2011
Methoxychlor	ND		0.10	µg/L	1.0	2/2/2011	2/3/2011
Chlordane	ND		0.10	µg/L	1.0	2/2/2011	2/3/2011
Toxaphene	ND		0.50	µg/L	1.0	2/2/2011	2/3/2011

Test Name: PCB and Chlorothalonil By EPA 508 **Reference:** EPA 508

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
PCB Aroclor 1016	ND		0.26	µg/L	1.0	2/8/2011	2/7/2011
PCB Aroclor 1221	ND		0.19	µg/L	1.0	2/8/2011	2/7/2011
PCB Aroclor 1232	ND		0.23	µg/L	1.0	2/8/2011	2/7/2011
PCB Aroclor 1242	ND		0.26	µg/L	1.0	2/8/2011	2/7/2011
PCB Aroclor 1248	ND		0.30	µg/L	1.0	2/8/2011	2/7/2011
PCB Aroclor 1254	ND		0.33	µg/L	1.0	2/8/2011	2/7/2011
PCB Aroclor 1260	ND		0.36	µg/L	1.0	2/8/2011	2/7/2011
Surrogate: PCNB	81.1		70-130	% Rec	1.0	2/8/2011	2/7/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01O

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Glyphosate **Reference:** EPA 547

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Glyphosate	ND		5.0	µg/L	1.0		2/10/2011

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ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01P

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Chlorinated Acids (herbicides) **Reference:** EPA 515.3

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Dalapon	ND		10	µg/L	1.0	1/28/2011	2/2/2011
Dicamba	ND		1.5	µg/L	1.0	1/28/2011	2/2/2011
2,4-D	ND		10	µg/L	1.0	1/28/2011	2/2/2011
Pentachlorophenol	ND		0.20	µg/L	1.0	1/28/2011	2/2/2011
Silvex	ND		1.0	µg/L	1.0	1/28/2011	2/2/2011
2,4,5-T	ND		2.0	µg/L	1.0	1/28/2011	2/2/2011
2,4-DB	ND		10	µg/L	1.0	1/28/2011	2/2/2011
Dinoseb	ND		2.0	µg/L	1.0	1/28/2011	2/2/2011
Bentazon	ND		2.0	µg/L	1.0	1/28/2011	2/2/2011
Picloram	ND		1.0	µg/L	1.0	1/28/2011	2/2/2011
Surrogate: 2,4-Dichloroacetic acid	99.4		70-130	% Rec	1.0	1/28/2011	2/2/2011

Test Name: Endothall **Reference:** EPA 548.1

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Endothall	ND		45	µg/L	1.0	1/28/2011	1/31/2011
Surrogate: 2,3-D	91.2		63.8-117	% Rec	1.0	1/28/2011	1/31/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01Q

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: EPA 506 **Reference:** EPA 506

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Di-N-butyl phthalate	ND		3.0	µg/L	1.0	1/31/2011	2/4/2011
Diethylhexyladipate	ND		5.0	µg/L	1.0	1/31/2011	2/4/2011
Diethylhexylphthalate	ND		3.0	µg/L	1.0	1/31/2011	2/4/2011

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ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01R

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: Nitrogen-Phosphorous Containing Pesticides **Reference:** EPA 507

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Molinate	ND		0.25	µg/L	1.0	1/28/2011	2/2/2011
Propachlor	ND		0.25	µg/L	1.0	1/28/2011	2/2/2011
Dimethoate	ND		0.050	µg/L	1.0	1/28/2011	2/2/2011
Simazine	ND		0.50	µg/L	1.0	1/28/2011	2/2/2011
Atrazine	ND		0.10	µg/L	1.0	1/28/2011	2/2/2011
Diazinon	ND		0.025	µg/L	1.0	1/28/2011	2/2/2011
Metribuzin	ND		0.25	µg/L	1.0	1/28/2011	2/2/2011
Alachlor	ND		1.0	µg/L	1.0	1/28/2011	2/2/2011
Prometryn	ND		0.13	µg/L	1.0	1/28/2011	2/2/2011
Bromacil	ND		0.50	µg/L	1.0	1/28/2011	2/2/2011
Thiobencarb	ND		0.25	µg/L	1.0	1/28/2011	2/2/2011
Metolachlor	ND		0.50	µg/L	1.0	1/28/2011	2/2/2011
Butachlor	ND		0.38	µg/L	1.0	1/28/2011	2/2/2011
Surrogate: 1,3-Dimethyl-2-nitrobenzene	95.2		70-130	% Rec	1.0	1/28/2011	2/2/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01S

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: EPA 549.2 **Reference:** EPA 549.2

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Diquat (dissolved)	ND		0.40	µg/L	1.0	1/28/2011	1/28/2011

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01T

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: N-methyl-carbamoyloximes and carbamates **Reference:** EPA 531.1

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Aldicarb Sulfoxide	ND		3.0	µg/L	1.0		2/3/2011
Aldicarb Sulfone	ND		4.0	µg/L	1.0		2/3/2011
Oxamyl	ND		5.0	µg/L	1.0		2/3/2011
Methomyl	ND		2.0	µg/L	1.0		2/3/2011
3-OH-Carbofuran	ND		3.0	µg/L	1.0		2/3/2011
Aldicarb	ND		3.0	µg/L	1.0		2/3/2011
Propoxur	ND		5.0	µg/L	1.0		2/3/2011
Carbofuran	ND		5.0	µg/L	1.0		2/3/2011
Carbaryl	ND		5.0	µg/L	1.0		2/3/2011
Methiocarb	ND		5.0	µg/L	1.0		2/3/2011
Surrogate: BDMC	103		80-120	% Rec	1.0		2/3/2011

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Date: 16-Feb-2011
WorkOrder: 1101440

ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01U

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: EPA 550.1 **Reference:** EPA 550.1

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Naphthalene	ND		0.50	µg/L	1.0	1/28/2011	2/2/2011
Acenaphthylene	ND		1.0	µg/L	1.0	1/28/2011	2/2/2011
Acenaphthene	ND		1.0	µg/L	1.0	1/28/2011	2/2/2011
Fluorene	ND		0.10	µg/L	1.0	1/28/2011	2/2/2011
Phenanthrene	ND		0.040	µg/L	1.0	1/28/2011	2/2/2011
Anthracene	ND		0.020	µg/L	1.0	1/28/2011	2/2/2011
Fluoranthene	ND		0.050	µg/L	1.0	1/28/2011	2/2/2011
Pyrene	ND		0.10	µg/L	1.0	1/28/2011	2/2/2011
Benzo(a)anthracene	ND		0.050	µg/L	1.0	1/28/2011	2/2/2011
Chrysene	ND		0.050	µg/L	1.0	1/28/2011	2/2/2011
Benzo(b)fluoranthene	ND		0.020	µg/L	1.0	1/28/2011	2/2/2011
Benzo(k)fluoranthene	ND		0.020	µg/L	1.0	1/28/2011	2/2/2011
Benzo(a)pyrene	ND		0.050	µg/L	1.0	1/28/2011	2/2/2011
Dibenzo(ah)anthracene	ND		0.20	µg/L	1.0	1/28/2011	2/2/2011
Benzo(ghi)perylene	ND		0.080	µg/L	1.0	1/28/2011	2/2/2011
Indeno(1 2 3-Cd)pyrene	ND		0.050	µg/L	1.0	1/28/2011	2/2/2011
Surrogate: Terphenyl	83.2		43.9-123	% Rec	1.0	1/28/2011	2/2/2011

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Date: 16-Feb-2011
WorkOrder: 1101440

ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01V

Received: 1/27/2011
Collected: 1/27/2011 10:30

Test Name: EPA 524.2

Reference: EPA 524.2

Parameter	Result	Flag	Limit	Units	DF	Extracted	Analyzed
Dichlorodifluoromethane	ND		0.50	µg/L	1.0		1/31/2011
Chloromethane	ND		0.50	µg/L	1.0		1/31/2011
Vinyl Chloride	ND		0.50	µg/L	1.0		1/31/2011
Bromomethane	ND		0.50	µg/L	1.0		1/31/2011
Chloroethane	ND		0.50	µg/L	1.0		1/31/2011
Trichlorofluoromethane	ND		0.50	µg/L	1.0		1/31/2011
1,1-Dichloroethene	ND		0.50	µg/L	1.0		1/31/2011
1,1,2-Trichlorotrifluoroethane	ND		0.50	µg/L	1.0		1/31/2011
Methylene Chloride	ND		0.50	µg/L	1.0		1/31/2011
trans-1,2-Dichloroethene	ND		0.50	µg/L	1.0		1/31/2011
Methyl tert-butyl ether (MTBE)	ND		3.0	µg/L	1.0		1/31/2011
Tert-butyl alcohol (TBA)	ND		15	µg/L	1.0		1/31/2011
Di-isopropyl ether (DIPE)	ND		3.0	µg/L	1.0		1/31/2011
1,1-Dichloroethane	ND		0.50	µg/L	1.0		1/31/2011
Ethyl tert-butyl ether (ETBE)	ND		3.0	µg/L	1.0		1/31/2011
cis-1,2-Dichloroethene	ND		0.50	µg/L	1.0		1/31/2011
2,2-Dichloropropane	ND		0.50	µg/L	1.0		1/31/2011
Bromochloromethane	ND		0.50	µg/L	1.0		1/31/2011
Chloroform	ND		0.50	µg/L	1.0		1/31/2011
Carbon tetrachloride	ND		0.50	µg/L	1.0		1/31/2011
1,1,1-Trichloroethane	ND		0.50	µg/L	1.0		1/31/2011
1,1-Dichloropropene	ND		0.50	µg/L	1.0		1/31/2011
Benzene	ND		0.50	µg/L	1.0		1/31/2011
1,2-Dichloroethane	ND		0.50	µg/L	1.0		1/31/2011
Tert-amyl methyl ether (TAME)	ND		3.0	µg/L	1.0		1/31/2011
Trichloroethene	ND		0.50	µg/L	1.0		1/31/2011
Dibromomethane	ND		0.50	µg/L	1.0		1/31/2011
1,2-Dichloropropane	ND		0.50	µg/L	1.0		1/31/2011
Bromodichloromethane	ND		0.50	µg/L	1.0		1/31/2011
cis-1,3-Dichloropropene	ND		0.50	µg/L	1.0		1/31/2011
Toluene	***0.56***		0.50	µg/L	1.0		1/31/2011
Tetrachloroethene	ND		0.50	µg/L	1.0		1/31/2011
trans-1,3-Dichloropropene	ND		0.50	µg/L	1.0		1/31/2011
1,1,2-Trichloroethane	ND		0.50	µg/L	1.0		1/31/2011
Dibromochloromethane	ND		0.50	µg/L	1.0		1/31/2011
1,3-Dichloropropane	ND		0.50	µg/L	1.0		1/31/2011
1,2-Dibromoethane (EDB)	ND		0.50	µg/L	1.0		1/31/2011
Chlorobenzene	ND		0.50	µg/L	1.0		1/31/2011
Ethylbenzene	ND		0.50	µg/L	1.0		1/31/2011
1,1,1,2-Tetrachloroethane	ND		0.50	µg/L	1.0		1/31/2011

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Date: 16-Feb-2011
WorkOrder: 1101440

ANALYTICAL REPORT

Client Sample ID: Table Bluff Well
Lab ID: 1101440-01V

Received: 1/27/2011
Collected: 1/27/2011 10:30

m,p-Xylene	ND	0.50	µg/L	1.0	1/31/2011
o-Xylene	ND	0.50	µg/L	1.0	1/31/2011
Bromoform	ND	0.50	µg/L	1.0	1/31/2011
Styrene	ND	0.50	µg/L	1.0	1/31/2011
Isopropylbenzene	ND	0.50	µg/L	1.0	1/31/2011
Bromobenzene	ND	0.50	µg/L	1.0	1/31/2011
n-Propylbenzene	ND	0.50	µg/L	1.0	1/31/2011
1,1,2,2-Tetrachloroethane	ND	0.50	µg/L	1.0	1/31/2011
2-Chlorotoluene	ND	0.50	µg/L	1.0	1/31/2011
1,2,3-Trichloropropane	ND	0.50	µg/L	1.0	1/31/2011
1,3,5-Trimethylbenzene	ND	0.50	µg/L	1.0	1/31/2011
4-Chlorotoluene	ND	0.50	µg/L	1.0	1/31/2011
tert-Butylbenzene	ND	0.50	µg/L	1.0	1/31/2011
1,2,4-Trimethylbenzene	ND	0.50	µg/L	1.0	1/31/2011
sec-Butylbenzene	ND	0.50	µg/L	1.0	1/31/2011
p-Isopropyltoluene	ND	0.50	µg/L	1.0	1/31/2011
1,3-Dichlorobenzene	ND	0.50	µg/L	1.0	1/31/2011
1,4-Dichlorobenzene	ND	0.50	µg/L	1.0	1/31/2011
n-Butylbenzene	ND	0.50	µg/L	1.0	1/31/2011
1,2-Dichlorobenzene	ND	0.50	µg/L	1.0	1/31/2011
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	µg/L	1.0	1/31/2011
Hexachlorobutadiene	ND	0.50	µg/L	1.0	1/31/2011
1,2,4-Trichlorobenzene	ND	0.50	µg/L	1.0	1/31/2011
Naphthalene	ND	0.50	µg/L	1.0	1/31/2011
1,2,3-Trichlorobenzene	ND	0.50	µg/L	1.0	1/31/2011
Surrogate: 1,2-Dichlorobenzene-d4	98.7	70-130	% Rec	1.0	1/31/2011
Surrogate: Dibromofluoromethane	106	70-130	% Rec	1.0	1/31/2011

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Certificate of Analysis

Laura Miller
North Coast Laboratories
5680 West End Rd.
Arcata, CA 95521

Report Issue Date: 02/03/2011 16:42
Received Date: 01/28/2011
Received Time: 11:09

Lab Sample ID: A1A1890-01
Sample Date: 01/27/2011 10:30
Sample Type: Grab

Client Project: 1101440
Sampled by: Client
Matrix: Waste Water

Sample Description: 1101440-01B // Table Bluff Well

General Chemistry

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Cyanide (total)	SM 4500-CN E	ND	0.0050	mg/L	1	A101301	02/03/11	02/03/11	

1414 Stanislaus Street Fresno, CA 93706 (559) 497-2888 FAX (559) 485-6935 www.bsklabs.com

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Project: 1101440 / Table Bluff well

EMSL Order: 091100865
Customer ID: NORT99
Customer PO: 1101440
EMSL Project ID:
Received: 1/28/2011
Analyzed: 2/09/2011

Test Report: Determination of Asbestos Structures >10µm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

Sample ID Client / EMSL	Sample Filtration Date/Time	Original Sample Vol. Filtered (ml)	Effective Filter Area (mm^2)	Area Analyzed (mm^2)	ASBESTOS Asbestos Types	Fibers Detected	Analytical Sensitivity	Concentration	Confidence Limits
							MFL (million fibers per liter)		
1101440-01A Table Bluff 091100865-0001	1/28/2011 12:00 AM	50	1288	0.1300	None Detected	ND	0.20	<0.20	0.00 - 0.73

Sample has asbestos fibers present that were less than 10 microns in length. EPA 100.2 only reports asbestos fibers greater than or equal to 10 microns in length.

Initial report from: 02/09/2011 19:06:50

Analyst(s)
Jason Mcgriff (1)

Baojia Ke, Laboratory Manager
or other Approved Signatory

Any questions please contact Baojia Ke.

North Coast Laboratories LTD

Client Sample ID: TABLE BLUFF WELL (1101440-01D)

Trace Level Organic Compounds

Lot-Sample #...: G1B010490-001 Work Order #...: MDX341AA Matrix.....: WATER
Date Sampled...: 01/27/11 Date Received..: 02/01/11
Prep Date.....: 02/02/11 Analysis Date..: 02/07/11
Prep Batch #...: 1033191
Dilution Factor: 1

PARAMETER	RESULT	DETECTION LIMIT	UNITS	METHOD
2,3,7,8-TCDD	ND	5.0	pg/L	EPA-5 1613B-Tetra

INTERNAL STANDARDS	PERCENT RECOVERY	RECOVERY LIMITS
13C-2,3,7,8-TCDD	56	(31 - 137)

February 16, 2011

Lab ID : SP 1101099-001
Customer ID : 2-14882

North Coast Laboratories, Ltd.
Attn:Trudie Haughy
5680 West End Road
Arcata, CA 95521

Sampled On : January 27, 2011-10:30
Sampled By : Not Available
Received On : February 2, 2011-10:30
Matrix : Ground Water

Description : Table Bluff Well
Project : 1101440-01E

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
Radio Chemistry[P:1]								
Gross Alpha	0.945 ± 1.19	1.45	pCi/L	15	900.0	02/06/11:201403	900.0	02/08/11:202067
Ra 228	0.000 ± 0.733	0.347	pCi/L	2	Ra - 05	02/11/11:201542	Ra - 05	02/13/11:202340

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 * PQL adjusted for dilution.

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = (Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following
If Gross Alpha's (AV) exceeds 5 pCi/L run Uranium. If Gross Alpha's (AV) minus Uranium exceeds 5 pCi/L run Radium 226.

Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: 805/392-2000
FAX: 805/525-4172
CA NELAP Certification No. 01110CA

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: 209/942-0182
FAX: 209/942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: 530/343-5818
FAX: 530/343-3807
CA ELAP Certification No. 2670

Field Office
Visalia, California
TEL: 559/734-9473
Mobile: 559/737-2399
FAX: 559/734-8435

February 16, 2011

North Coast Laboratories, Ltd.
Attn:Trudie Haughy
5680 West End Road
Arcata, CA 95521

Description : Table Bluff Well
Project : 1101440-01F

Lab ID : SP 1101099-002
Customer ID : 2-14882

Sampled On : January 27, 2011-10:30
Sampled By : Not Available
Received On : February 2, 2011-10:30
Matrix : Ground Water

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
Radio Chemistry[P:1'5] Total Alpha Radium (226)	0.000 ± 0.129	0.412	pCi/L	3	903.0	02/08/11:201446	903.0	02/09/11:202205

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 * PQL adjusted for dilution.

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = (Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following
If Gross Alpha's (AV) exceeds 5 pCi/L run Uranium. If Gross Alpha's (AV) minus Uranium exceeds 5 pCi/L run Radium 226.

Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

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Field Office
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FAX: 559/734-8435

February 16, 2011

Lab ID : SP 1101099-003
Customer ID : 2-14882

North Coast Laboratories, Ltd.
Attn:Trudie Haughy
5680 West End Road
Arcata, CA 95521

Sampled On : January 27, 2011-10:30
Sampled By : Not Available
Received On : February 2, 2011-10:30
Matrix : Ground Water

Description : Table Bluff Well
Project : 1101440-01G

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
Radio Chemistry P:T5 Uranium	0.000 ± 1.50	0.595	pCi/L	20	908.0	02/03/11:201289	908.0	02/04/11:201880

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 * PQL adjusted for dilution.

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = (Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following
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Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

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Mobile: 559/737-2399
FAX: 559/734-8435

February 16, 2011

North Coast Laboratories, Ltd.
Attn:Trudie Haughy
5680 West End Road
Arcata, CA 95521

Description : Table Bluff Well
Project : 1101440-01H

Lab ID : SP 1101099-004
Customer ID : 2-14882

Sampled On : January 27, 2011-10:30
Sampled By : Not Available
Received On : February 2, 2011-10:30
Matrix : Ground Water

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
Radio Chemistry P:1'5								
Gross Beta	1.56 ± 0.977	1.25	pCi/L	50	900.0	02/06/11:201403	900.0	02/08/11:202069

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 * PQL adjusted for dilution.

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = (Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following
If Gross Alpha's (AV) exceeds 5 pCi/L run Uranium. If Gross Alpha's (AV) minus Uranium exceeds 5 pCi/L run Radium 226.

Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

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CA ELAP Certification No. 2670

Field Office
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TEL: 559/734-9473
Mobile: 559/737-2399
FAX: 559/734-8435

Certificate of Analysis

Report Date: Thursday, February 10, 2011
Received Date: Tuesday, February 1, 2011
Received Time: 9:15 am
Turnaround Time: Normal

Client: North Coast Laboratories, Inc.
5680 West End Road
Arcata, CA 95521-9202

Phones: (707) 822-4649
Fax: (707) 822-4649

Attn: Laura Miller
Project:

P.O. #:

Lab Sample ID: 1B01020-01 **Sample ID: 1101440-01C Table Bluff Well** **Matrix:** Water
Sampled by: Client **Sampled: 01/27/11 10:30** **Sample Note: Groundwater**

Analyte	Result	MDL	MRL	Units	Dil	Method	Prepared	Analyzed	Batch	Qualifier
Epichlorohydrin	ND		20	ug/l	1x1	EPA 524.2	2/9/11	2/9/11 21:32	W1B0405	
Surrogate: 1,2-Dichlorobenzene-d4	*112 %*		*70-130*	%		Concentration: *11.2*				
Surrogate: 4-Bromofluorobenzene	*105 %*		*70-130*	%		Concentration: *10.5*				

Weck Laboratories, Inc 14859 East Clark Avenue, City of Industry, California 91745-1396 (626) 336-2139 FAX (626) 336-2634
www.wecklabs.com

Appendix D
Water Quality Assessment Report

Wiyot Tribe
Natural Resources Department

Clean Water Act §106 Water Pollution Control Program

WATER QUALITY ASSESSMENT REPORT (WQAR)

Project Period: October 2018 – September 2019

Prepared By:
Eddie Koch
Natural Resources Director
December 2019

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LIST OF FIGURES

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List of Acronyms

BIA – Bureau of Indian Affairs
BMP – Best Management Practices
CDFW – California Department of Fish and Wildlife
CeNCOOS – Central and Northern California Ocean Observing Systems
CP – Conservation Plan
CRAM – California Rapid Assessment Method
CWA – Clean Water Act
DO – Dissolved Oxygen
FY – Fiscal Year
HBHRCD – Humboldt Bay Harbor, Recreation, and Conservation District
HBNWR – Humboldt Bay National Wildlife Refuge
HSU – Humboldt State University
IHS – Indian Health Service
LID – Low Impact Development
mg/L – milligram/liter
MPA – Marine Protected Area
NCL – North Coast Laboratories
NCRWQCB – North Coast Regional Water Quality Control Board
NOAA – National Oceanic and Atmospheric Administration
NPS – Nonpoint Source
NRCS – Natural Resources Conservation Service
NTU – Nephelometric Turbidity Unit
OSPR – Office of Spill Prevention and Response
PCB – Polychlorinated biphenyl
QA – Quality Assurance
QAPP – Quality Assurance Program Plan
QC – Quality Control
STORET – USEPA's Store and Retrieve Database
SVOC – semi-volatile organic compound
TBR – Table Bluff Reservation
TPH – Total Petroleum Hydrocarbons
TSS – Total Suspended Solids
ug/L – microgram/liter
USDA – United States Department of Agriculture

USEPA – United States Environmental Protection Agency
USFWS – United States Fish & Wildlife Service
VOC – volatile organic compound
WNRD – Wiyot Tribe's Natural Resources Department
WPDG – Wetlands Program Development Grant
WPP – Wetlands Program Plan
WQAR – Water Quality Assessment Report
WQI – Water Quality Indicator
WQX – Water Quality Exchange
WRE – Wetland Reserve Easement

1.0 Background

Wiyot people have always lived along the Pacific Ocean and around Humboldt Bay. Before the 1850s and the times of the Gold Rush, the Wiyot people covered 40 miles of coastline, going inland about 10 miles. The Wiyot Tribe's (hereafter "Tribe) ancestral territory includes Little River to the north, Bear River Ridge to the south, and from the Pacific Coast out to as far as Berry Summit in the northeast and Chalk Mountain in the southeast. Currently the Tribe controls 0.02% of this land. Main waterways include Humboldt Bay, Little River, Mad River, Jacoby Creek, Freshwater Creek, Elk River, Eel River, Van Duzen River, and Bear River. The majority of villages were concentrated around Humboldt Bay and along the coast; other villages were located inland, generally near rivers (Figure 1).

Due to water contamination issues at the "old Reservation," a court mandate resulted in the Tribe's acquisition of 88.5 acres of land approximately 1 mile away from the original Rancheria. In 1998, the Table Bluff Rancheria of Wiyot Indians was changed to Table Bluff Reservation (TBR) - Wiyot Tribe. In 2005, the name was changed again, this time truncated to the Wiyot Tribe. To date, there are approximately 650 enrolled Tribal members.

TBR has 37 homes with approximately 150 residents and 5 administrative buildings with approximately 20 employees in the Tribal administration (e.g., Administration, Natural Resources, Cultural, Social Services, and Public Works Departments). TBR public drinking water infrastructure consists of 2 drinking water wells (500' and 600' deep) and a treatment plant. Wastewater infrastructure consists of wastewater lines both gravities fed and pumped (at pump station) into two 10,000 gallon tanks that is disbursed via siphon into 37 pairs of lateral lines within the Tribe's leachfield.

The habitats associated with TBR include:

- Rangeland, which comprises approximately 36% of the total area of TBR, was used to raise cattle prior to 2005. Current operations within the rangeland portion of TBR include seasonal removal of grass for hay.
- Urban/Developed Area which is approximately 49% of the total area of TBR and is comprised of paved roads (10%), residential development (32.5%), wastewater infrastructure such as the community leachfield (6%), and maintenance operations (0.5%).
- Seasonal intermittent wetland which comprises approximately 0.5% of the total area of TBR and is present from days to weeks following heavy rain events.
- Depressional wetland habitat which is approximately 3% of the total area of TBR and is comprised of a transitional upland-wetland zone (2.5%) and a depressional wetland (0.5%) containing two shallow water quality monitoring wells and a wide variety of culturally important plant and animal species.

In addition to the present reservation lands of the Wiyot people, the Tribe also has interest in protecting water resources present on the Tribe's other landholdings including:

Old Reservation: located at the south edge of Table Bluff and adjacent to McNulty Slough of the Eel River estuary. After the atrocities in 1860, nearly all Wiyot people were removed from this area, but some returned. In the early 1900s, a church group purchased the original 20 acres of the "old reservation," in the Eel River estuary, for homeless Wiyot people. The Federal Government later transferred this land into trust status in 1908. In 1958, the Federal Government passed the California Rancheria Act (amended in 1964) that terminated the Tribe in 1961. In 1975, the Tribe filed suit against the Federal Government for unlawful termination. In 1981, in Table Bluff Band of Indians v. Lujan (United States), it was determined the Tribe's termination was unlawful and trust status was reinstated. In 1991, because of drinking water contamination and other sanitation issues, the court mandated new land be purchased and the Tribe moved to another location. The original 20 acres were put into fee simple under the individual families, but deemed to be under the Tribe's jurisdiction as long as held in Indian hands. This portion of land includes habitats such as:

- Salt marsh bordering a state owned reserve which is heavily invaded by the non-native, invasive dense-flowered cordgrass (*Spartina densiflora*) and has been anthropogenically altered to create wildlife habitat (e.g., ponds/islands) and levees.
- Mudflat which houses the largest discovered population of non-native, invasive dwarf eelgrass (*Zostera japonica*) in the local region.
- McNulty Slough, Hawk Slough, and Mainstem Eel River (near mouth) which is heavily used by hunters and anglers as an access point to reaches in the lower watershed. Past water quality assessments have shown high levels of coliforms (specifically fecal coliforms) and elevated phosphorus and nitrate levels suggesting that water quality at this site is drastically impaired from either cattle fecal deposition upstream or failed septic systems in nearby lots.

Due to jurisdictional issues related to the old Reservation, the Wiyot Tribe's Natural Resources Department (WNRD) is unable to perform any regular monitoring of these waters in order to prevent continued degradation, to supply educational information (e.g., signage), or to aid in eradication efforts. The recent discovery of dwarf eelgrass has led researchers to believe that the unregulated boat ramp located at the terminus point at the old Reservation may be aiding in the disbursement of invasives in the local region. It has been stressed by local California Department of Fish and Wildlife (CDFW) representatives and local biologists that there is a lack of signage depicting the discovery and prevention of this and other locally occurring invasive species. Additionally, failing levees and upstream discharge of fecal coliforms is contributing to water quality degradation. It is the hope that future jurisdictional issues will be resolved by the Tribe so that water quality/biological monitoring and restoration efforts may continue in order to improve the overall water quality of associated waterways.

Indian Island: located in Humboldt Bay; In March of 2000, the Tribe purchased a 1.5-acre parcel on Indian Island, the location of the Wiyot village, ***Tuluwat***. The parcel was the site of a tragic massacre of many Wiyot people in 1860 as well as a sacred dance site for the Tribe. The ground beneath *Tuluwat* is an enormous clamshell mound (or midden) which measures over six acres in size, estimated to be over 1,000 years old, and is an irreplaceable physical history of the Wiyot way of life. Contained within it are remnants of meals, tools, and ceremonies, as well as many burial sites.

The Eureka City Council made history May 18, 2004 as they unanimously approved a resolution to return approximately 45 acres, comprising the northeastern tip, of Indian Island to the Wiyot Tribe. Indian Island will be protected from inappropriate development because all zoning and land use restrictions will be in place. This portion of land includes habitats such as:

- Salt marsh with sensitive plant species such as Humboldt Bay owl's clover (*Castilleja ambigua ssp. humboldtiensis*) and Point Reyes bird's beak (*Cordylanthus maritimus ssp. palustris*) and heavily invaded by the non-native, invasive dense-flowered cordgrass.
- Mudflats containing vital species such as Pacific eelgrass (*Zostera marina*) that aid in the sheltering of juvenile salmon and crab species (e.g., Dungeness crab [*Metacarcinus magister*]), eggs of Pacific herring (*Clupea pallasii*), and is the main staple of the diet of black brant (*Branta bernicla nigricans*). Invasive dwarf eelgrass was discovered on the mudflats just west of the Tribe's property.
- Levees/dikes and channels created to hydrologically alter the salt marsh habitat to drain the land in order to raise more cattle.
- Humboldt Bay that houses large stocks of commercially important fisheries species and aids as a vital stopover for migratory bird species traveling along the Pacific Flyway.

A recently completed USEPA Brownsfield cleanup on *Tuluwat* removed solid waste and hazardous material including soil contaminated with dioxin, pentachlorophenol (PCP), and heavy metals. The site was secondarily treated with an *in situ* application of CoolOx®, a neutralizing agent that binds to compounds such as dioxin to aid in the remediation of contaminated soil. Following this treatment, a tertiary treatment was administered by covering the entire "developed" portion of the shellmound with a geotextile fabric cloth, covering with 1' of soil, sand, rock, and crushed oyster shells, and hydroseeding with a native grass seed mixture. After project completion, the Tribe completed the interrupted World Renewal Ceremony from 1860, 154 years later.

Phase IV of the Indian Island Cultural and Environmental Restoration Project (IICERP) called for the restoration of the surrounding salt marsh habitat. As stated above, the habitat is heavily impacted by hydrologic modifications and dense-flowered cordgrass. A current project is addressing the cordgrass by physical removal via weed whacking the plant's roots. Future projects will be aimed at additional treatments of the cordgrass, possibly planting native plants (e.g., pickleweed [*Salicornia virginica*]), and addressing the artificial channels and levees by possible physical removal and filing with spoils from dredging at the mouth of Humboldt Bay.

Cock Robin Island: located in the Eel River estuary, the Tribe acquired approximately 104 acres on the eastern portion of Cock Robin Island in 2006. The acreage of Tribally owned property on Cock Robin Island includes habitats such as:

- Riparian woodland consisting of older cottonwood stands listed as G1 S1.1 according to the California Natural Diversity Database (CNDDB). With typically 5 or fewer known occurrences, the CNDDB defines the habitat ranking as critically imperiled due to extreme rarity or increased vulnerability to extinction or extirpation.
- Gravel bar which is tidally influenced and experiences moderate to severe flooding depending on tides, river discharge, or a combination of both.
- Vegetated gravel bar which is located on the gravel bar but is situated at a slightly higher elevation where stands of willows and alders, along with non-native, invasive species such as pampus grass (*Cortaderia selloana*), have become established.
- Slough, named East Lake Slough, which may become disconnected (on the surface) from the mainstem Eel River during warmer summer months. Remnants of a relict slough through middle portions of Cock Robin Island have been noted and were associated with East Lake Slough.
- Eel River which is state listed for impairments to sediment and temperature is the main river to the third largest watershed in California. The Eel River houses cultural and environmentally vital, Tribal trust species such as Pacific lamprey, ***gou'daw*** (*Entosphenus tridentatus*), green sturgeon, ***ba'm*** (*Acipenser medirostris*), and salmonids (e.g., salmon, ***valhuk*** and steelhead, ***tswal***).

The Wiyot Tribe shares its name with its ancestral river, ***Wiya't***, which translates as "abundance." A significant aspect of that abundance was the Pacific lamprey, commonly called "eels," which inspired the river's English name, the Eel River. The Eel River has always been extremely important to the Tribe as most of the Tribe's ancestral territory encompassed much of the lower reaches of the Eel River and was 30% of current day Humboldt County. The Eel River, once California's largest salmon-producing system, has since become an extremely periled river. Also, most traditional gathering that took place within the rivers active area is no longer permitted by the State of California. The Tribe is committed to using its resources to work toward restoration of this important watershed.

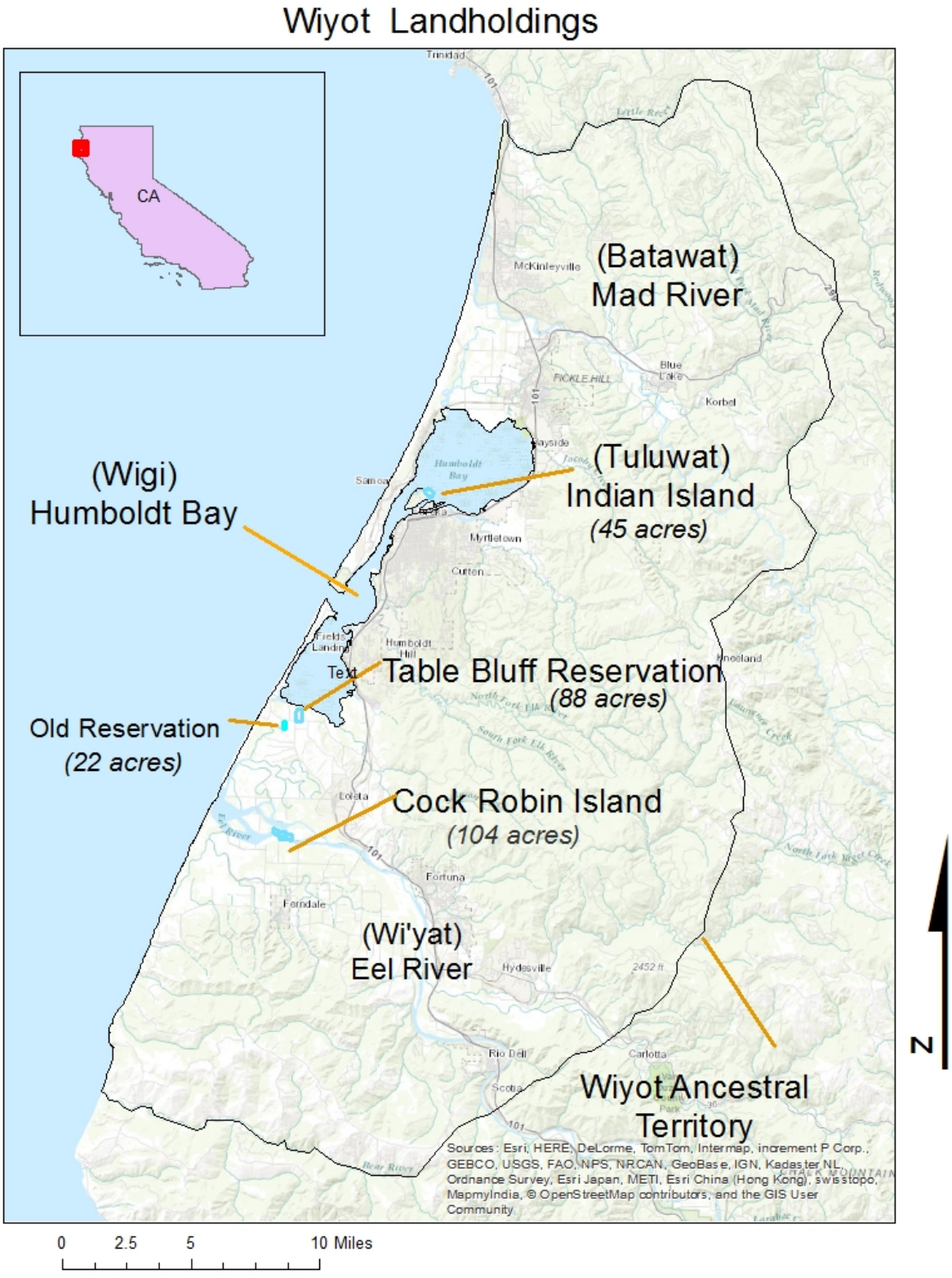

Figure 1. Wiyot Tribal landholdings, Ancestral Territory, and valuable water resourc

2.0 Description of Tribal Water Quality Monitoring Programs

Undoubtedly, the Tribe has many reasons to protect the water that supports the diverse ceremonial, medicinal, practical, and subsistence resources that the people depend on. Fresh water, besides domestic uses, is important for ceremonies and food resources. Water is essential in use of medicines, soaking basket materials, leaching foods, such as acorns, and bathing the sick when in ceremonies, or when used while fasting during ceremonies. The Wiyot people have always lived around Humboldt Bay and the lower Eel and Mad Rivers, and have used the waters of the bay, rivers, and coast for many purposes. Fishing, hunting, and gathering food and culturally significant materials are particularly important to Tribal members who have long depended on fish and wildlife for subsistence. Before the damming of wetlands and salt marshes by European settlers, there were over 100 miles of travelable waterways up into sloughs and creeks that empty into Humboldt Bay. Using redwood canoes, these routes were means of reaching important locations, such as ceremonial grounds and fishing sites. Food resources such as shellfish, crabs, seals, otter, fish, and lamprey (commonly referred to as "eels") were often harvested from the rivers, bay, and mudflats in canoes and continue to be, in the present era, a main staple of the Wiyot diet. Basket and textile materials such as tule and willow root were, and still are, collected from wetland and riparian habitats. Today, there are many threats to the Tribe's various water resources, including illegal dumping, inadequate septic systems, erosion, agricultural runoff, and automobile-related pollution, among others. Clean, clear, and appropriately cool waters are vitally important to the continuing viability of the Wiyot people.

The Tribe's concern with protecting its water resources has required the establishment of several environmental programs, including a Clean Water Act (CWA) §106 Water Pollution Control Program (established October 2002) and a CWA §319 Nonpoint Source (NPS) Water Pollution Control Program (established 2003) through the United States Environmental Protection Agency (USEPA). The overarching aims of the programs are to:

- Assess and better understand the Tribe's surface water, ground water, and wetland resources,
- Identify on-site and off-site threats and negative stressors to water quality, and
- Protect the Tribe's water resources and their uses.

One tool in meeting these goals is the Tribe's Water Quality Monitoring Program (established 2004); the basic elements of which are outlined in the Tribe's Quality Assurance Program Plan (QAPP) (approved by USEPA in 2004, updated in 2015/2016). The hypothesis formulated for this program is that the waters of the Tribe are threatened or impaired by land uses within their

respective watersheds. The monitoring program is an investigation to determine the extent and nature of contaminants in the groundwater and wetlands affecting the Tribe through traditional analytical techniques. The monitoring objectives are three fold:

- To characterize the extent to which offsite and on-site land uses affect the waters of the Tribe,
- To identify exceedances of water-quality guidelines, and
- To generate data as a basis for future water quality standards, guidelines, and regulatory decisions.

3.0 Monitoring Design

Non-Random Data Collection Methodology was used to determine sites for monitoring and sampling based on proximity to potential contamination and where water quality impairment has been deemed most likely to occur.

The Tribe has established the following sample stations to monitor for site-specific potential contamination:

- **TBR Wetland**: Two shallow wetland wells have been developed to monitor the groundwater/surface water interface year round (Figure 2). Surrounding land uses that could potentially result in contamination of the wetland include agricultural production of beef cattle and hay, continued development of the Tribal community in close proximity to the wetland, and the adjacent management of the reservation's community septic leach field as well as the septic system associated with a nearby property. The potential contaminants to be detected in the wetland would include fecal coliforms, nitrates, phosphates, sediment, total petroleum hydrocarbons (TPH), and metals.

Figure 2. TBR depressional wetland

- **TBR Stormwater Retention Basin**: A catch basin that was designed to capture, bioremediate, and slowly disperse stormwater runoff originating from Wiyot Drive (Figure 3). Prior to development, stormwater runoff was dispersing into a lower field that sloped down towards Phelan Rd. and eventually into Humboldt Bay. By installing this Best Management Practice (BMP), the Tribe was able to contain stormwater runoff that was posing a risk to nearby waterways. Potential contaminants at this site include fecal coliforms, TPH, and metals.

Figure 3. Stormwater retention basin.

The Tribe desires to incorporate additional water quality monitoring locations to their existing program but this is dependent upon land acquisition/jurisdictional issues (Figure 4). Sites that the Tribe would like to eventually establish include:

- **McNulty Slough, adjacent to the "old reservation"**: The water quality at this site is threatened by historical solid waste/hazardous waste accumulation and burn/ash pits, surrounding agricultural land use for dairy and beef cattle, illicit methamphetamine production, failing residential septic systems, non-operational vehicle storage and/or abandonment, improperly abandoned residential wells, failing levees, and invasive species such as dense-flowered cordgrass and dwarf eelgrass. Prior to abandoning the well that supplied the Tribe's drinking water up until April 2010, it was possible that pollutants carried into McNulty Slough could have impacted the water quality. Potential

contaminants at this site include fecal coliform, nitrates, phosphates, semi-volatile and/or volatile organic compounds (SVOC/VOC), metals, and TPH.

- **Mouth of Humboldt Bay**: The bay is on the North Coast Regional Water Quality Control Board's (NCRWQCB) "watch list" for impairment due to sediments; longshore currents bring sediment from the Eel River watershed into Humboldt Bay; additionally, several of the bay's tributary streams are 303(d) listed for sediment impairment; lastly, the sewage treatment plant that serves the greater Eureka area discharges into Elk River Slough just upstream from Humboldt Bay. Ongoing monitoring by Humboldt Baykeeper, California Department of Public Health, and oyster growers in Humboldt Bay are determining the impact, if any, of potential coliform/viral outbreaks from improper sewage treatment. Potential contaminants include total suspended solids (TSS) and fecal coliform.

- **Adjacent to the Tribe's Indian Island property in Humboldt Bay, just offshore in the middle channel**: The Tribe's land on Indian Island was the historic site of an old dry-dock facility and foundry; The WNRD recently completed a USEPA Brownfields cleanup project for metals and dioxin contamination on the Tribe's 1.5-acre shellmound at the *Tuluwat* village. Prior to the installation of a retaining wall on Indian Island, contamination was able to leach into the surrounding mudflats. As a result, the potential contaminants that may be present include metals, dioxin, polychlorinated biphenyls (PCB), and TSS.

- **Mouth of the Mad River Slough, in northern Humboldt Bay**: This site is near a recently closed (2015) lumber mill with known historic dioxin and PCB contamination (Humboldt Bay is presently 303(d) listed for impairment due to dioxin and PCB contamination) and dairy cattle ranching; additionally, this site is surrounded by large acreage of land used for cattle/dairy operations. Potential contaminants include fecal coliform, nitrates, phosphates, dioxin, and PCBs.

- **Cock Robin Island, in the Eel River estuary**: The Eel River lower main stem and delta is 303(d) listed for sediment impairment and water temperature. Tribally owned lands are surrounded by landowners utilizing their lands for timber production and dairy cattle ranching. Other threats to water quality include, but are not limited to, failing legacy logging roads, exposed hillsides from timber mismanagement and failing rail lines and supporting infrastructure (e.g., bridges, culverts), illegal diversions, nutrient overloads from large, illegal marijuana grows, NPS runoff from surrounding urban areas, and a geologically unstable river canyon. In the lower Eel River estuary, potential contaminants include fecal coliform, nitrates and phosphates, and suspended solids.

- **Hookton Slough, in southern Humboldt Bay**: This site is near the Humboldt Bay National Wildlife Refuge (HBNWR) and is a main waterway for migrating salmonid species that utilize the newly restored Salmon Creek. Surrounding land uses are

dominated by dairy cattle ranching but other threats include NPS runoff from surrounding urban areas. Potential contaminants include fecal coliform, nitrates, phosphate, and suspended solids.

Figure 4. Current and desired water quality monitoring sites.

The Tribe's landholdings have increased since the water quality monitoring program began in 2003. As a result, the lands that are not currently held in trust (e.g., Indian Island and Cock Robin Island) were rarely, if ever, formally surveyed (Table 1). Due to this pressing need to assess the Tribal resources of these coastal wetlands, the Tribe applied for, and received, a Wetlands Program Development Grant (WPDG). Through the WPDG, the Tribe was able to carry forth the following tasks:

- Increase Tribal capacity by attending trainings necessary to conduct biological surveys (e.g., California Rapid Assessment Method [CRAM], wetland delineation training)
- Monitor and assess wetlands present on all the Tribe's landholdings including biological and water quality monitoring as well as wetland delineation
- Develop a Wetlands Program Plan (WPP) based on monitoring and assessment results to bolster a wetlands program by performing reoccurring or additional monitoring and/or guiding restoration efforts
- Perform outreach and education to both Tribal citizens, especially youth, and the general public

Information pertaining to monitoring results, the Tribes WPP, and educational handouts are available on the Tribe's website.

Table 1. Atlas of Tribal Waters and Assessment.*

Water Body Type and Measurement	Total Distance or Area	Monitored
On-Reservation		
Total number of freshwater wetland acres	0.5	0.5
Off-Reservation (optional)		
Total number of saltwater wetland acres	45	45
Total number of estuary acres	104	104

*This atlas is distinct from the Atlas of Tribal Waters in the USEPA 2016 WQAR Template; this atlas includes landholdings, not just reservation lands.

4.0 Core Water Quality Indicators

The Tribe samples for a suite of Water Quality Indicators (WQI) at all of the present monitoring sites, as well as specific additional WQIs unique to each site based on suspected contamination threats. The WQIs common to all sites are:

- Temperature
- pH
- Dissolved oxygen (DO)
- Turbidity
- Phosphorus (total phosphate)
- Total nitrogen (total Kjeldahl, ammonia, nitrate-nitrite)
- Total/fecal coliform

The Tribe also monitors these parameters at all sites:

- Specific conductivity
- Salinity
- Depth

The Tribe monitors for the additional WQIs and constituents:

- Total petroleum hydrocarbons
- Priority metals
- Total suspended solids

Temperature, pH, DO, turbidity, specific conductivity, salinity, and depth monitoring is performed *in situ* with a Yellow Springs Instruments EXO 2 sonde; phosphorus, nitrogen, bacteria, TPH, priority metals, and TSS monitoring are performed using various collection methods described in the Tribe's QAPP. All collected samples are analyzed by North Coast Laboratories (NCL) in Arcata, California.

Presently, the Tribe is discrete monitoring for temperature, pH, DO, turbidity, specific conductivity, and salinity on a bi-weekly schedule. Discrete sampling consists of deploying a sonde for 12 minutes (4 minute equilibration, 8 minute sampling period). The Tribe is monitoring for all other WQIs annuall

5.0 Quality Assurance

In September 2004, USEPA approved a QAPP for Water Quality Assessment and Monitoring for the Tribe and, as required by USEPA, the Department recently updated the QAPP to include additional monitoring and assessment activities. The QAPP ensures that the quality assurance (QA) and quality control (QC) procedures used to document technical data generated during projects is accurate, precise, complete, and representative of actual field conditions. QA is defined as an integrated program designed to assure reliability and repeatability of monitoring and measurement data. QC is defined as the routine application of procedures to obtain prescribed standards of performance in the monitoring and measurement process. The QAPP is consistent with guidelines set forth in the USEPA's *Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5* (USEPA 1998) and *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (USEPA 1998).

6.0 Data Management

Historically, all data collected for sonde parameters (temperature, DO, turbidity, specific conductivity, pH, salinity) have been generated in electronic format and managed using Microsoft Excel. Data generated from laboratory-analyzed samples have been converted from paper to electronic format using Microsoft Excel. Metadata generated from field notes and sample collection log sheets generated in the field are also converted to Microsoft Excel.

Additionally, the Tribe formats all data to be compatible with USEPA's Store & Retrieve (STORET) Database. Historically, data has been uploaded using USEPA's WebSIM import tool, but more recently the Tribe began using USEPA's new import tool, Water Quality Exchange (WQX) Web. To facilitate public availability of collected information, data from the Tribe's sampling of physical, chemical, and biological parameters of water quality as well as additional data from avian and botanical surveys are posted and available for review on the Tribe's website (http://www.wiyot.us/biological-water-quality-monitoring-data).

The Tribe oversees all aspects of data recording, validation, transformation, transmittal, reduction, analysis, and tracking as prescribed in the Tribe's USEPA-approved QAPP.

7.0 Data Analysis and Assessment

TBR has not yet developed or implemented Tribal water quality standards. Interim standards to be implemented while Tribal standards are under development generally duplicate federal and state of California standards. Jurisdiction and enforcement of these standards is the responsibility of the Wiyot Tribal Council.

The Tribe compares collected data to applicable water quality standards and criteria set forth by USEPA and state of California, including the NCRWQCB Basin Plan and Amendments, the National Recommended (Ambient) Water Quality Criteria, the California Ocean Plan, California Toxics Rule, and National Primary Drinking Water Standards. These comparisons indicate whether water quality is meeting established water quality criteria, and the Tribe's water quality assessments are based on the results of these comparisons. Whether or not designated uses of Tribal waters are being supported is a dominant consideration in the assessment process. Table 2 below lists the designated uses in the TBR wetlands and the specific parameters measured to determine if such uses are being met.

Table 2. Designated Uses for Water Bodies & Making Assessment Decisions

Water Body	Designated Uses	Parameter(s) Measured to Determine Support of Use of Goal
Reservation Wetland	• Aquatic life and wildlife • Cultural/Traditional • Secondary contact	• *E. coli* or Enterococci • DO, temperature, pH, turbidity nitrogen, phosphorus • Basic habitat

8.0 Assessment Narrative

The following assessments are based on data collected since the Tribe's water quality monitoring program began in 2003 through September 2019, with specific comparisons between data collected prior to October 2018 and data collected from October 2018 through September 2019. It is concluded that the wetland is serving all of its designated uses, including wildlife habitat and cultural uses (Table 3).

Table 3. Use Support in Tribal Freshwater Wetlands

Designated Use of Tribal Goal	Number of Acres Monitored/ Assessed	Number of Acres Fully Supporting Use of Goal	Number of Acres Supporting Use but Threatened	Number of Acres Not Supporting Use or Goal
Aquatic life and wildlife	0.5	0.5	0	0
Cultural/Traditional	0.5	0.5	0	0
Secondary Contact	0.5	0.5	0	0

Besides the slightly elevated levels of fecal coliform, water quality during the period of October 2018 through September 2019 was consistent with water quality prior to October 2018; therefore water quality appears maintained at the site.

8.1 Reservation Wetland

8.1.1 Water Quality Assessment

8.2.1.1 Results

Monitoring at the two shallow wetland wells on the reservation has not shown any exceedances of water quality criteria. Sampling for **nitrite** has shown no detections since sampling began in 2005. For this monitoring period, the greatest concentration of **nitrate** was detected in well #2 at 1.2 mg/L (previous recorded high level was 6.1 mg/L in January 2015 at well #2), under even the National Recommended Ambient Water Quality Criterion of 10.0 mg/L for sources of drinking water (which the wetland is not). In October of 2008, sampling showed the highest concentrations of **ammonia nitrogen** in the two wetland wells of 0.62 and 0.11 mg/L, far below the USEPA Recommended Water Quality Criteria for Freshwater Aquatic Life after taking into account temperature and pH of the sample. For this monitoring period, ammonia nitrogen was not detected in well #1 or well #2.

Bacteriological results have been more variable. While most sampling events have shown **total coliform** concentrations of less than 30 MPN/100 ml, eleven events at well #1 have yielded high results. In contrast, well #2 has only had six samples that have shown a total coliform concentration exceeding 30 MPN/100 ml. Previous to 2010, **fecal coliform** had not been detected in the wetland during any of the sampling events. Since then four sampling events at well #1 and three at well #2 have resulted in detected levels of fecal coliforms present. To date, all QA/QC samples (rinsate samples) performed in the field and processed by NCL have been "non-detect" results for total and fecal coliforms suggesting the result values are uncompromised (e.g., sampler error, improper cleaning of equipment). All samples detecting total coliform levels above 30 MPN/100 ml and/or fecal coliform levels above 0 MPN/100 ml have been listed in Table 4 below.

Table 4. Total/Fecal coliform results for water quality monitoring sites at TBR wetland.

Sampling Site	Sampling Date	Total Coliform Results (MPN/100 ml)	Fecal Coliform Results (MPN/100 ml)
Well #1	May 2005	240	<2
	March 2006	>1600	<2
	November 2006	>1600	<2
	February 2009	>1600	<2
	October 2010[1]	-	8
	November 2010	>240	<2
	October 2011	>1600	79
	October 2012	>1600	22
	November 2014	540	11
	March 2016	350	<2
	January 2017	240	<2
	December 2017	240	4.5
	June 2019	35	4.5
Well #2	October 2010[1]	-	80
	November 2010	190	28
	October 2011	>1600	170
	October 2012	>1600	<2
	January 2015	240	<2
	January 2016	350	<2
	March 2018	350	1.8
	June 2019	49	4.8

[1]Results processed by NCL did not include total coliform values, only fecal coliform values.

The coliform results seem to be consistent with levels that would be naturally occurring in a wetland environment. When first detected in 2010, it was discussed that the presence of fecal coliforms could possibly be originating from the Tribe's leach field, located approximately 150 yards uphill and south of wetland well #1, or a failed septic system from a nearby neighboring

bed and breakfast, but the low detection of nitrate and total phosphate phosphorus suggests otherwise (Dr. Matthew Hurst personal communication). The Tribe will continue to track this recent occurrence of fecal coliform and consult Indian Health Service (IHS) and/or HSU's Dr. Hurst for information and guidance on potential mitigation and remediation. While there is no criterion for fecal coliform concentrations that applies directly to shallow wetland groundwater, the NCRWQCB's objective for inland surface waters is a 30-day median of 50 MPN/100 ml with a minimum of not less than 5 samples, and that not more than ten percent of total samples during any 30 period exceed 400/100 ml. During the period from December 28, 2016 through January 27, 2017 the Tribe sampled both wetland well #1 and wetland well #2 five times each with both wells meeting the NCRWQB's 30-day median objective. No 30-day median sampling occurred during FY 2018.

In 2011, testing for **total suspended solids** was conducted and the results showed a concentration of 3 mg/L in wetland well #1 and 34 mg/L in wetland well #2. Monitoring for physical parameters from October 2011 to September 2012 showed a turbidity average of 3.9 Nephelometric Turbidity Units (NTU) in well #1 and 2.3 NTU's in well #2. The presence of elevated TSS concentrations in well #2 may suggest that sediment is more easily transported into the well casing at this site in comparison to well #1. Sediment is a suitable media for bacterial growth so higher turbidity readings may explain why coliform levels in wetland well #2 were elevated when compared to well #1. Sampling for TSS was not conducted from the period of October 2017 – September 2018 but turbidity data from *in situ* sampling showed averages of 3.57 NTU for well #1 and 20.82 NTU for well #2. This is in contrast to last year's monitoring which showed 7.02 NTUs for well #1 and 12.1 NTUs for well #2.

Total phosphate phosphorus concentrations have been variable, with samples yielding results ranging from non-detections to a maximum of 0.93 mg/L. Monitoring during the period of October 2018 through September 2019 yielded a maximum result of 0.066 mg/L in well #1. There is no criterion for phosphate that applies directly to shallow wetland groundwater; however, the National Recommended Ambient Water Quality Criterion for streams is .05 mg/L. It is unsurprising that the phosphate levels in the wetland occasionally exceed the stream-related criterion – wetlands often act as a sink for nutrients.

The Tribe began sampling for **priority metals** in fiscal year (FY) 2013 and continued the sampling into this monitoring period. For chromium, sampling for this monitoring period resulted in 5.2 ug/L in well #1 and was not detected in well #2. These limited amount found in well #1 is to be expected as chromium naturally occurs in soil. Similarly **copper** was absent this monitoring period but was present in FY14 (4.4 ug/L) and in FY13 (1.4 ug/L). Zinc was present this monitoring period in well #1 at 15 ug/L and was not detected in well #2. Both zinc and copper are present in low concentrations and are normal for a wetland environment (Dr. Matthew Hurst personal communication). **Nickel** was present this monitoring period at 9.3 ug/L in well #1 and was not detected in well #2. This presence on nickel is well under even the

National Recommended Ambient Water Quality Criterion of 640 ug/L for sources of human consumption (i.e., drinking water).
Similar to priority metals, the Tribe also began sampling for **total petroleum hydrocarbons** in FY13 and continued the sampling into this monitoring period. Prior to monitoring conducted in FY16, there had been no detections of TPH at either sampling locations in the Tribe's wetland. A sample taken at well #1 in FTY16 resulted in concentrations of diesel oil at 61 ug/L but laboratory notes indicated that the sample contained material in the diesel range of molecular weights, but the material did not exhibit the peak pattern typical of diesel oil. Due to a potential discrepancy noted by NCL, it is believed that this sample contained contaminants that caused interference during sample processing and that a definitive presence of TPH in the wetland well cannot be recorded. Further analysis of TPH in the wells is needed to determine if contamination is currently occurring. There were no detections of TPH in either well this sampling period.

8.2.1.2 Discussion

From 1990 until 2005, the uplands surrounding the wetland were used as grazing land for beef cattle production. With too many head of cattle for the available area, the land was significantly over-grazed; additionally, the cattle had unfettered access to the wetland itself. Evidence of their impact included denuding of wetland vegetation, deep tracks through the wet areas, complete destruction of low terrestrial and semi-aquatic vegetation, and fecal deposition.

Figure 5. Exclusionary fencing with TBR wetland in background

The list below highlights BMPs put into place by the Tribe in order to protect the wetlands located on TBR:

- In 2005, the Tribe installed exclusionary fencing around the wetland and a surrounding buffer area (Figure 5).
- In 2006, the Tribe implemented a Range Management Plan to improve the environmental conditions of the upland and wetland.
- In 2011, the Tribe implemented a Wetland Zone Protection ordinance which will restrict development, agricultural practices, and dumping in the Tribe's established wetland boundaries. In addition to the restricted practices, any construction activities within 100' of the wetland zone boundary will require the installation and management of proper BMPs in order to avoid potential NPS contamination from entering the wetland habitat.
- In 2013, the Tribe implemented a Low Impact Development Policy (LID) which will ensure the protection of cultural and/or environmental resources as a result of stormwater pollution originating from any construction/demolition activities. The main goals of the Policy are:
    - ✓ To prevent the contamination of the Tribe's groundwater and drinking water resources by point and/or NPS pollution generated as a result of stormwater runoff
    - ✓ To protect environmental sensitive habitats (i.e. wetlands) from degradation as a result of development/redevelopment activities
    - ✓ To maintain and/or improve upon the aesthetic beauty of TBR
    - ✓ To prevent the degradation of both the Tribe's cultural and biological resources (i.e. botanical and wildlife resources)
    - ✓ Provide outreach and education opportunities for Tribal citizens, especially youth, in regards to LID and pollution related topics

In FY15, the Department completed and submitted a NPS Assessment & Management Plan per CWA §319 requirements for approval by both Tribal Council and USEPA detailing additional projects to ensure protection of water resources and associated habitats. These projects include:

- Habitat restoration at Reservation wetland and stormwater retention basin via removal of invasive botanical species (e.g., Himalayan blackberry [*Rubus armeniacus*], poison hemlock [*Conium maculatum*], and wild radish [*Raphanus raphanistrum*]) and reintroduction of native plant species (e.g., rush [*Juncus* sp.], Hooker's willow, sedge [*Carex* sp.]). Similarly, the WNRD will attempt to leverage additional funds from the BIA and/or NRCS for the creation of an ecotone between the upland and wetland boundary for the potential reintroduction of the culturally important, rare, and endangered Western lily (*Lilium occidentale*).
- Demonstration project at the TBR Community Center showing valuable LID techniques for reducing pollution associated with stormwater runoff by capturing, holding, and slowing spreading the water source.

- Continue to educate the Wiyot community (especially youth) about the threats to the Tribe's water resources and ways they can safeguard and conserve their resources for future generations.

In FY17 the department began phase 1 of a multi-year CWA §319 Wetland Restoration Project aimed at restoring habitats associated with Tribal water resources to prevent, maintain, or improve water quality through the treatment of non-native, invasive botanical species. This past year the department conducted the following tasks associated with this project;

- Pilot project involving planting native shrubs to test the effectiveness of shading out non-native, invasive species. Pre-treatment data was collected before planting took place in order to make post-planting treatment comparisons.
- Implementation of invasive species control techniques such as mowing and weed wacking.
- Vegetation surveys which included vegetation classification mapping.
- Continued monitoring of treatment area removing invasive plants as necessary.

In FY18 the department began phase 2 of the CWA §319 Wetland Restoration Project. This past year the department conducted the following tasks associated with this project.

- Planting over 150 Pacific reed grass plugs.
- Continued treatment of newly emerged invasive plants.
- Treated the restoration area with sheet mulching to help prevent the spread of noxious weeds and to ensure the best success of planted natives.
- Continued to mow the restoration site and adjacent areas occupied with non-native invasive poison hemlock and wild radish. This combined with sheet mulching and native plant installation has resulted in a significant reduction of invasive cover.

While the wetland habitat has improved dramatically, water quality monitoring has not resulted in observations of improvement due to management. This is in part because water quality prior to implementation of wetland protective measures was not particularly poor. However, the protective measure implementation is still viewed as a success because it protects good water quality in the wetland, rather than improving poor water quality.

8.2.2 Biological Assessment

In addition to water quality in the TBR wetland, the Tribe's Biological Monitoring Program includes annual botanical transect surveys, monthly avian surveys, and rapid assessments utilizing techniques according to CRAM to track long-term changes in the biological resources present.

Further assessments that the Tribe would like to conduct to improve upon their existing Biological Monitoring Program include macroinvertebrate, small mammal, and reptile and amphibian ("herps") surveys. Macroinvertebrate surveys will be dependent upon the quantity and temporal duration of surface water present in the seasonal depressional wetland. The use

of macroinvertebrate data to determine wetland health is viewed as more critical than either plant or other wildlife surveys as macroinvertebrates lack the ability to migrate or select preferable habitats. As a consequence, they are more susceptible to changes in habitat and water quality and the presence and/or absence of specific macroinvertebrate genera or species can be indicators to wetland health. Similarly, small mammal and "herp" surveys are beneficial as they provide insight into the lower trophic levels present and, along with macroinvertebrate surveys, aid in the assessment of habitat quality in regards to primary/secondary consumers.

Along with biological resources, and as a result of securing CWA §104 (b)(3) funding, the Tribe assessed abiotic features (e.g., soils) to assist with the task of delineating the TBR wetland. Also, in conjunction with the Tribe's CWA §319 NPS pollution control program related to stormwater/urban runoff, the Tribe desires to assess the amount of sediment accumulation in both the wetland and stormwater retention basin by possibly installing long-term sediment depth markers in appropriate locations (e.g., sediment forebay in retention basin).

9.0 References

Hurst, Dr. Matthew. Personal communication. Associate Professor of Chemistry. Humboldt State University, Arcata, CA.

United States Environmental Protection Agency (USEPA). 1998. *Guidance for Quality Assurance Project Plans, EPA QA/G-5*. Office of Environmental Information, Washington D.C.

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Appendix E
NRCS Conservation Practices

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

HERBACEOUS WEED CONTROL

(Ac.)

CODE 315

DEFINITION

The removal or control of herbaceous weeds including invasive, noxious and prohibited plants.

PURPOSE

- Enhance accessibility, quantity, and quality of forage and/or browse.
- Restore or release native or create desired plant communities and wildlife habitats consistent with the ecological site.
- Protect soils and control erosion
- Reduce fine-fuels fire hazard and improve air quality

CONDITIONS WHERE PRACTICE APPLIES

On all lands except active cropland where removal reduction, or manipulation of herbaceous vegetation is desired.

This practice does not apply to removal of herbaceous vegetation by prescribed fire (use Prescribed Burning - 338) or removal of herbaceous vegetation to facilitate a land use change (use Land Clearing - 460).

CRITERIA

General Criteria Applicable to All Purposes

Herbaceous weed control will be applied in a manner to achieve the desired control of the target species and protection of desired species. This will be accomplished by mechanical, chemical, burning or biological methods either alone or in combination. When burning is used as a method, the Prescribed Burning standard (338) will also be applied.

NRCS will not develop biological or chemical treatment recommendations except for biological control utilizing grazing animals. Prescribed Grazing (528) is used to ensure desired results are achieved and maintained.

NRCS may provide clients with acceptable biological and/or chemical control references.

NRCS may provide clients with current acceptable references to achieve desired management objectives.

When herbicides are used, environmental hazards and site-specific application criteria listed on pesticide labels and contained in extension service and other approved pest management references must be followed.

Herbaceous weed control will include post treatment measures as needed to achieve resource management objectives.

Livestock and people access will be controlled based on management methods applied and restrictions as listed on the chemical labels.

Manage and/or dispose of treated weed species in a manner that will prevent the spread of herbaceous weeds to new sites.

Additional Criteria to Enhance Accessibility, Quantity, and Quality of Forage and/or Browse

Herbaceous weed control will be applied in a manner to minimize negative impact to forage and/or other non targeted plants. Timing and sequence of control shall be planned in coordination with specifications developed for Prescribed Grazing (528) or Forage Harvest Management (512).

Additional Criteria to Restore or Release Native or Create Desired Plant Communities and Wildlife Habitats Consistent with the Ecological Site

Apply herbaceous weed control in a manner to protect the health and vigor of native or desired plant species.

Use applicable Ecological Site Description (ESD) State and Transition models, to develop specifications that are ecologically sound and defensible. Treatments must be congruent with dynamics of the ecological site(s) and keyed to states and plant community phases that have the potential and capability to support the desired plant community. If an ESD is not available, base specifications on the best approximation of the desired plant community composition, structure, and function.

Treatments will be conducted during periods of the year when weed species are most vulnerable and will promote restoration of the native or desired plant communities.

Apply herbaceous weed control in a manner that maintain or enhance important wildlife habitat requirements.

Treatments will be conducted during periods of the year that accommodate reproduction and other life-cycle requirements of target wildlife and pollinator species.

Apply treatments that maintain or enhance plant community composition and structure to meet the requirements of target wildlife species.

Additional Criteria to Protect Soils and Control Erosion

Apply herbaceous weed control to minimize soil disturbance and soil erosion.

Additional treatment will be applied to protect soils and prevent erosion.

Additional Criteria to Reduce Fine-Fuels Fire Hazard and Improve Air Quality

Treat weed species in a manner that creates a native or desired plant community which reduces the potential for accumulating excessive fuel loads and increased wildfire hazards.

Apply treatment methods in a manner that minimize the potential for unintended impacts to air resources, e.g., smoke, chemical drift etc.

CONSIDERATIONS

Consider using Integrated Pest Management (595) in support of herbaceous weed control. Consider soil erosion potential and difficulty of vegetation establishment when choosing a method of control that causes soil disturbance.

Consider the appropriate time period for treatment. Some herbaceous weed control activities can be effective when applied within a single year; others may require multiple years of treatment(s) to achieve desired objectives.

Consider impacts to wildlife species, in general, treatments that create a mosaic pattern may be the most desirable.

Consider impacts to wildlife food supplies, space, and cover availability when planning the method and amount of herbaceous weed control.

State issued licenses may be required when using chemical pesticide treatments.

For air quality purposes, consider using chemical methods of herbaceous weed control that minimize chemical drift and excessive chemical usage and consider mechanical methods of herbaceous weed control that minimize the entrainment of particulate matter.

Adjacent land uses must be considered before chemicals are used.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or treatment unit according to the criteria included in this standard. At a minimum, a herbaceous weed control practice plan shall include:

1. Goals and objectives statement.
2. Plan map and soil map for the site.
3. Pre-treatment cover or density of the target plant(s) and the planned post-treatment cover or density and desired efficacy.
4. Maps, drawings, and/or narratives detailing or identifying areas to be treated, pattern of treatment (if applicable), and areas that will not be disturbed.

5. A monitoring plan that identifies what shall be measured (including timing and frequency) and the changes in the plant community (compare with objectives) that will be achieved.

For Mechanical Treatment Methods. Plans and specifications will include items 1 through 5 above, plus the following:

- Type of equipment to use for management
- Dates of treatment for effective management.
- Operating instructions (if applicable)
- Techniques and procedures to be followed.

For Chemical Treatment Methods. Plans and specifications will include items 1 through 5, above, plus the following:

- Acceptable chemical treatment references for containment and management of target species
- Document techniques to be used, planned dates and rates of application
- Evaluation and interpretation of herbicide risks associated with the selected treatment(s) using WIN-PST or other approved tools.
- Any special mitigation, timing considerations or other factors (such as soil texture and organic matter content) that must be considered to ensure the safest, most effective application of the herbicide
- Reference to product label instructions

For Biological Treatment Methods. Plans and specifications will include items 1 through 5, above, plus the following:

- Acceptable biological treatment references for the selected biological agent used to contain and manage the target species
- Document release date, kind, and number of agents
- Timing, frequency, duration and intensity of grazing or browsing
- Desired degree of grazing or browsing use for effective management of target species
- Maximum allowable degree of use on desirable non-target species
- Special mitigation, precautions, or requirements associated with the selected treatment(s)

OPERATION AND MAINTENANCE

Operation. Herbaceous weed control practices shall be applied using approved materials and procedures. Operations will comply with all local, state, and federal laws and ordinances.

Success of the practice shall be determined by evaluating regrowth or reoccurrence of target species after sufficient time has passed to monitor the situation and gather reliable data. Length of evaluation periods will depend on the herbaceous weeds species being monitored, proximity of propagules (seeds, plant materials and roots) to the site, transport mode of seeds (wind or animals) and methods and materials used.

The operator will develop a safety plan for individuals exposed to chemicals, including telephone numbers and addresses of emergency treatment centers and the telephone number for the nearest poison control center. The National Pesticide Information Center (NPIC) telephone number in Corvallis, Oregon, may also be given for non-emergency information: **1-800-858-7384**

Monday to Friday

6:30 a.m. to 4:30 p.m. Pacific Time

The national Chemical Transportation Emergency Center (CHEMTRAC) telephone number is: 1-800-424-9300

- Follow label requirements for mixing/loading setbacks from wells, intermittent streams and rivers, natural or impounded ponds and lakes, and reservoirs.
- Post signs, according to label directions and/or federal, state, tribal, and local laws, around fields that have been treated. Follow restricted entry intervals.
- Dispose of herbicide and herbicide containers in accordance with label directions and adhere to federal, state, tribal, and local regulations.

- Read and follow label directions and maintain appropriate Material Safety Data Sheets (MSDS). MSDS and herbicide labels may be accessed on the Internet at: http://www.greenbook.net/
- Calibrate application equipment according to recommendations before each seasonal use and with each major chemical and site change.
- Replace worn nozzle tips, cracked hoses, and faulty gauges on spray equipment.
- Maintain records of plant management for at least two years. herbicide application records shall be in accordance with USDA Agricultural Marketing Service's Pesticide Recordkeeping Program and state-specific requirements.

Maintenance. Following initial application, some regrowth, resprouting, or reoccurrence of herbaceous weeds may be expected. Spot treatment of individual plants or areas needing re-treatment should be completed as needed when weed vegetation is most vulnerable to desired treatment procedures.

Review and update the plan periodically in order to incorporate new IPM technology; response to grazing management and complex weed population changes; and avoid the development of weed resistance to herbicide chemicals.

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(No.)

CODE 317

DEFINITION

A structure or device to contain and facilitate the controlled aerobic decomposition of manure or other organic material by micro-organisms into a biologically stable organic material that is suitable for use as a soil amendment.

PURPOSE

To reduce the pollution potential and improve the handling characteristics of organic waste solids; and produce a soil amendment that adds organic matter and beneficial organisms, provides slow-release plant-available nutrients, and improves soil condition.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Organic waste material is generated by agricultural production or processing.
- The facility is a component of a planned waste management system;
- The facility can be constructed, operated and maintained without polluting air and/or water resources; and,
- The compost can be applied to the land or marketed to the public.

CRITERIA

General Criteria Applicable to All Purposes

Laws and Regulations. Install and operate the facility in compliance with all federal, state and local laws, rules and regulations.

Safety. Incorporate safety and personal protection features and practices into the facility and its operation as appropriate to minimize the occurrence of equipment and biosecurity hazards during the composting process.

Facility Siting. Locate on a base of low permeability soils, concrete, or other liner material that will not allow contamination of ground water. The floor of the composting facility shall be at least two feet above the seasonal high water table.

Locate outside of floodplains when practical; otherwise protect the facility from inundation or damage from a 25-year flood event.

Locate so that prevailing winds and landscape elements minimize odors and protect visual resources.

Direct surface runoff away from the compost facility. Direct contaminated runoff from the composting operation to an appropriate storage or treatment facility for further management.

Locate so that water is available to the facility during dry periods to ensure proper moisture and acceptable curing times to meet the management goals.

Facility Type. Select the type of composting facility or method based on the type and availability of raw material, the

desired quality of finished compost, equipment, labor, time and land available.

Meet the structural requirements of conservation practice standard 313, Waste Storage Facility when designing slabs, walls, and support structures. Meet the requirements of conservation practice standard 367, Roofs and Covers when designing roofs.

Facility Size. Size the composting facilities to accommodate the amount of raw material planned for active composting, with a capacity consistent with the composting processes that will be used to produce the desired compost product, and with sufficient finishing time as required to achieve the desired characteristics. Space for compost storage may be included in the finishing space or in a separate facility. Select dimensions to accommodate handling and processing.

A facility for manure and other agricultural organic waste that is to be used on the farm shall have the capacity to produce compost that can be safely stored without undesirable odors. This requires the temperature of the compost to be maintained above 104^{o}F for five days with at least four hours above 130^{o}F during that time period.

A facility to produce compost for use off the farm or for sale shall have the capacity to significantly reduce pathogens. For a static pile or within vessel facility this requires the temperature of the compost to be maintained above 130^{o}F for three days. The total compost period shall include time for the initial primary stage of composting and time for secondary stage composting. For a windrow system this requires the temperature of the compost to be above 130^{o}F for 15 days with a minimum of five turnings of the compost.

If the facility is to be used to compost animal carcasses it shall have the capacity to maintain the compost temperature greater than 130° F for at least 5 days as an average throughout the compost mass followed by a compatible time for secondary composting. For a windrow system the temperature of the compost shall be above 130^{o}F for 15 days with a minimum of five turnings of the compost. Size animal mortality composting facilities according to the methods provided in the National Engineering Handbook Part 637, Chapter 2 – Composting (NEH 637.0213, Dead Animal Composting), National Engineering Handbook Part 651, Agricultural Waste Management Field Handbook, Chapter 10 Mortality Management (NEH 651.1007), NRCS or comparable extension publication. Base the size of dead animal composting facilities on normal mortality loss records for the operation. If these data are not available use locally established mortality rates for the type of operation. Ensure that the final product of the composting process has no visible pieces of soft tissue remaining.

Use of Finished Compost. Land application of finished compost shall be in accordance with conservation practice standard 590, Nutrient Management; or conservation practice standard 633, Waste Utilization.

CONSIDERATIONS

To reduce offensive odors increase the carbon nitrogen ratio. A carbon nitrogen ration of 30:1 in the initial mix should have minimal odors.

Minimize odors and nitrogen loss by selecting carbonaceous material that, when blended with the nitrogenous material, provides a balance of nutrients and porous texture for aeration.

A chemical neutralizing or other additive agent should be used if structural components do not provide adequate odor reduction.

Maximize solar warming by aligning piles north to south configured with moderate side slopes.

Orient windrows to prevent ponding of surface runoff.

Protect compost facilities from the wind in cold or dry climates. Wind protection may help prevent excess drying of the compost.

Minimize blown in rain by providing roof overhang.

For facilities that are organic producers or that sell compost to organic producers, ensure that the treated lumber used in the stacking facility meets the requirements for organic production. It may be best to have

the producer consult with the organic certifier as to the use and acceptability of treated lumber for litter and compost storage.

PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard and describe the requirements for applying the practice to achieve its intended use, including:

- Layout and location of livestock facilities, waste collection points, and/or waste transfer
- Size, type and number of animals or other sources of organic feedstock
- Grading plan showing excavation, fill, and drainage, as appropriate
- Size and capacity needed
- Design requirements
- Safety requirement for operation

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of this practice and the life of the composting facility. Recipe ingredients and the sequence that they are to be layered and mixed shall be given in the plan.

Compost Mix. Develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

Carbon-Nitrogen Ratio. The initial compost mix shall result in a carbon to nitrogen (C:N) ratio between 25:1 and 40:1. Compost with a lesser carbon to nitrogen ratio can be used if nitrogen mobilization is not a concern.

Carbon Source. Store a dependable source of carbonaceous material with a high C:N ratio to mix with nitrogen rich waste materials.

Bulking Materials. Add bulking materials to the mix as necessary to enhance aeration. The bulking material may be the carbonaceous material used in the mix or a non-biodegradable material that is salvaged at the end of the compost period. Make provision for the salvage of any non-biodegradable material used in the composting process.

Moisture Level. Maintain adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis). Prevent excess moisture from accumulating in the compost in high precipitation climatic regions. This may require the facility to be covered.

Temperature of Compost Mix. Manage the compost to attain and then maintain the internal temperature for the duration required to meet management goals. It may be necessary for the compost to reach 145^{o}F to adequately destroy weed seeds. Closely monitor temperatures above 165^{o}F. Take action immediately to cool piles that have reached temperatures above 185^{o}F.

Turning/Aeration. The frequency of turning/aeration shall be appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

Monitoring: The operation and maintenance plan shall state that composting is a biological process that needs monitoring and management throughout the composting period to insure proper composting processes. The operation may need to undergo some trial and error in the start-up of a new composting facility. Manage the compost piles for temperature, odors, moisture, and oxygen, as appropriate. Test the finished compost as appropriate to assure that the required decomposition has been reached.

REFERENCES

USDA, NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting. Washington, D.C.

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

CONSERVATION COVER

(Ac.)

CODE 327

DEFINITION

Establishing and maintaining permanent vegetative cover

PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce sheet, rill, and wind erosion and sedimentation.
- Reduce ground and surface water quality degradation by nutrients and surface water quality degradation by sediment.
- Reduce emissions of particulate matter (PM), PM precursors, and greenhouse gases.)
- Enhance wildlife, pollinator and beneficial organism habitat.
- Improve soil health.

CONDITION WHERE PRACTICE APPLIES

This practice applies on all lands needing permanent herbaceous vegetative cover. This practice does not apply to plantings for forage production or to critical area plantings. This practice can be applied on a portion of the field.

CRITERA

General Criteria Applicable to All Purposes

Select species that are adapted to the soil, ecological sites, and climatic conditions that are suitable for the planned purpose and site conditions. Periodic removal of some products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the conservation purpose is not compromised by the loss of vegetation or harvesting disturbance.

Inoculate legumes at planting time.

Choose seeding rates and planting methods that will be adequate to accomplish the planned purpose.

Planting dates, planting methods and care in handling and planting of the seed or planting stock shall ensure that planted materials have an acceptable rate of survival.

Prepare the site by establishing a consistent seeding depth. Eliminate weeds that would impede the establishment and growth of selected species.

Base the timing and equipment selection on the site and soil conditions.

Apply nutrients as needed to ensure crop establishment and planned growth.

Additional Criteria to Reduce Sheet, Rill, and Wind Erosion and Sedimentation

Determine and maintain the amount of plant biomass and cover needed to reduce wind and water erosion to the planned soil loss objective by using the current approved wind and/or water erosion prediction technology.

Additional Criteria to Reduce Emissions of Particulate Matter (PM), PM Precursors, and greenhouse gases

In perennial crop systems such as orchards, vineyards, berries and nursery stock, establish vegetation to provide full ground coverage in the alleyway during mowing and harvest operations to minimize generation of particulate matter.

Additional Criteria to Enhance Wildlife, Pollinator and Beneficial Organism Habitat

Plant a diverse mixture grasses and forbs

species to promote bio-diversity and meet the needs of the targeted species using approved habitat appraisal guides, evaluation tools, and appraisal worksheets for the respective state.

Locate habitat plantings to reduce pesticide exposures that could harm wildlife, pollinators, and other beneficial organisms.

Additional Criteria to Improve Soil Health

To maintain or improve soil organic matter, select plants that will produce high volumes of organic material. The amount of biomass needed will be determined using the current soil conditioning index procedure.

CONSIDERATIONS

This practice may be used to promote the conservation of wildlife species in general, including threatened and endangered species.

Certified seed and planting stock that is adapted to the site should be used when it is available.

Mowing may be needed during the establishment period to reduce competition from weeds.

On sites where annual grasses are an expected weed problem it may be necessary to postpone nitrogen fertilizer application until the planted species are well established.

Where applicable this practice may be used to conserve and stabilize archeological and historic sites.

Consider rotating management and maintenance activities (e.g. mow only one-fourth or one-third of the area each year) throughout the managed area to maximize spatial and temporal diversity.

Where wildlife management is an objective, the food and cover value of the planting can be enhanced by using a habitat evaluation procedure to aid in selecting plant species and by providing or managing for other habitat requirements necessary to achieve the objective. Encouraging plant species diversity and establishing plantings that result in multiple structural levels of vegetation within the conservation cover will maximize wildlife use.

Where pollinator and wildlife habitat are primary purposes consider less dense seeding rates as long as soil loss is within tolerable soil loss limits.

To provide habitat for natural enemies of crop pests, select a mix of plant species that provide year round habitat and food (accessible pollen or nectar) for the desired beneficial species. Consider habitat requirements of predatory and parasitic insects, spiders, insectivorous birds and bats, raptors, and terrestrial rodent predators. Consult Land Grant University Integrated Pest Management recommendations for beneficial habitat plantings to manage the target pest species.

Use a diverse mix of cover plant species that come into bloom at different times and provide a sequence of bloom throughout the year (e.g., plant at least three flowering species from each of the three bloom periods (spring, summer, and fall).

Where practical, use native species that are appropriate for the identified resource concern and management objective. Consider trying to re-establish the native plant community for the site.

If a native cover (other than what was planted) establishes, and this cover meets the intended purpose and the landowner's objectives, the cover should be considered adequate.

During vegetation establishment, natural mulches, such as wood products or hay, can be used to conserve soil moisture, support beneficial soil life, and suppress competing vegetation.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for the site to include, but are not limited to:

- recommended species,
- seeding rates and dates,
- establishment procedures,
- management actions needed to insure and adequate stand

Specifications and operation and maintenance shall be recorded using approved Implementation Requirement document.

OPERATION AND MAINTENANCE

Mowing and harvest operations in a perennial crop system such as orchards, vineyards, berries, and nursery stock shall be done in a manner which minimizes the generation of particulate matter.

If wildlife habitat enhancement is a purpose, maintenance practices and activities shall not disturb cover during the reproductive period for the desired species. Exceptions should be considered for periodic burning or mowing when necessary to maintain the health of the plant community.

Control noxious weeds and other invasive species.

Mowing may be needed during the establishment period to reduce competition from weeds.

To benefit insect food sources for grassland nesting birds, spraying or other control of noxious weeds shall be done on a "spot" basis to protect forbs and legumes that benefit native pollinators and other wildlife.

Re-vegetate bare spots.

REFERENCES

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Revised Universal Soil Loss Equation Version 2 (RUSLE2) website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/

Wind Erosion Prediction System (WEPS) website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/

Preventing or mitigating potential negative impacts of pesticides on pollinators using IPM and other conservation practices. Nat. Agron. Tech Note 9. Washington, DC. http://directives.sc.egov.usda.gov/

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

COVER CROP

(Ac.)

CODE 340

DEFINITION

Grasses, legumes, and forbs planted for seasonal vegetative cover.

PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce erosion from wind and water.
- Maintain or increase soil health and organic matter content.
- Reduce water quality degradation by utilizing excessive soil nutrients.
- Suppress excessive weed pressures and break pest cycles.
- Improve soil moisture use efficiency.
- Minimize soil compaction.

CONDITIONS WHERE PRACTICE APPLIES

All lands requiring seasonal vegetative cover for natural resource protection or improvement.

CRITERIA

General Criteria Applicable to All Purposes

Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with applicable local criteria and soil/site conditions.

Select species that are compatible with other components of the cropping system.

Ensure herbicides used with crops are compatible with cover crop selections and purpose(s).

Cover crops may be established between successive production crops, or companion-planted or relay-planted into production crops. Select species and planting dates that will not compete with the production crop yield or harvest.

Do not burn cover crop residue.

Determine the method and timing of termination to meet the grower's objective and the current NRCS Cover Crop Termination Guidelines.

When a cover crop will be grazed or hayed ensure the planned management will not compromise the selected conservation purpose(s).

Do not harvest cover crops for seed.

If the specific rhizobium bacteria for the selected legume are not present in the soil, treat the seed with the appropriate inoculum at the time of planting.

Additional Criteria to Reduce Erosion from Wind and Water

Time the cover crop establishment in conjunction with other practices to adequately protect the soil during the critical erosion period(s).

Select cover crops that will have the physical characteristics necessary to provide adequate erosion protection.

Use the current erosion prediction technology to determine the amount of surface and/or canopy cover needed from the cover crop to achieve the erosion objective.

Additional Criteria to Maintain or Increase Soil Health and Organic Matter Content

Cover crop species will be selected on the basis of producing higher volumes of organic material and root mass to maintain or increase soil

organic matter.

The planned crop rotation including the cover crop and associated management activities will score a Soil Conditioning Index (SCI) value > 0, as determined using the current approved NRCS Soil Conditioning Index (SCI) procedure, with appropriate adjustments for additions to and or subtractions from plant biomass.

The cover crop shall be planted as early as possible and be terminated as late as practical for the producer's cropping system to maximize plant biomass production, considering crop insurance criteria, the time needed to prepare the field for planting the next crop, and soil moisture depletion.

Additional Criteria Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

Establish cover crops as soon as practical prior to or after harvest of the production crop. (i.e. before or after harvest)

Select cover crop species for their ability to effectively utilize nutrients.

Terminate the cover crop as late as practical to maximize plant biomass production and nutrient uptake. Practical considerations for termination date may include crop insurance criteria, the amount of time needed to prepare the field for planting the next crop, weather conditions, and cover crop effects on soil moisture and nutrient availability to the following crop.

If the cover crop will be harvested for feed (hay/balage/etc.), choose species that are suitable for the planned livestock, and capable of removing the excess nutrients present.

Additional Criteria to Suppress Excessive Weed Pressures and Break Pest Cycles

Select cover crop species for their life cycles, growth habits, and other biological, chemical and or physical characteristics to provide one or more of the following:

- To suppress weeds, or compete with weeds.
- Break pest life cycles or suppress of plant pests or pathogens.
- Provide food or habitat for natural enemies of pests.
- Release compounds such as glucosinolates that suppress soil borne pathogens or pests.

Select cover crop species that do not harbor pests or diseases of subsequent crops in the rotation.

Additional Criteria to Improve Soil Moisture Use Efficiency

In areas of limited soil moisture, terminate growth of the cover crop sufficiently early to conserve soil moisture for the subsequent crop. Cover crops established for moisture conservation shall be left on the soil surface.

In areas of potential excess soil moisture, allow the cover crop to grow as long as possible to maximize soil moisture removal.

Additional Criteria to Minimize Soil Compaction

Select cover crop species that have the ability to root deeply and the capacity to penetrate or prevent compacted layers.

CONSIDERATIONS

Plant cover crops in a timely matter and when there is adequate moisture to establish a good stand.

When applicable, ensure cover crops are managed and are compatible with the client's crop insurance criteria.

Maintain an actively growing cover crop as late as feasible to maximize plant growth, allowing time to prepare the field for the next crop and to optimize soil moisture.

Select cover crops that are compatible with the production system, well adapted to the region's

climate and soils, and resistant to prevalent pests, weeds, and diseases. Avoid cover crop species that harbor or carry over potentially damaging diseases or insects.

Cover crops may be used to improve site conditions for establishment of perennial species.

When cover crops are used for grazing, select species that will have desired forage traits, be palatable to livestock, and not interfere with the production of the subsequent crop.

Use plant species that enhance forage opportunities for pollinators by using diverse legumes and other forbs.

Cover crops may be selected to provide food or habitat for natural enemies of production crop pests.

Cover crops residues should be left on the soil surface to maximize allelopathic (chemical) and mulching (physical) effects.

Seed a higher density cover crop stand to promote rapid canopy closure and greater weed suppression. Increased seeding rates (1.5 to 2 times normal) can improve weed-competitiveness.

Cover crops may be selected that release biofumigation compounds that inhibit soil-borne plant pests and pathogens.

Species can be selected to serve as trap crops to divert pests from production crops.

Select a mixture of two or more cover crop species from different plant families to achieve one or more of the following: (1) species mix with different maturity dates, (2) attract beneficial insects, (3) attract pollinators, (4) increase soil biological diversity, (5) serve as a trap crop for insect pests, or (6) provide food and cover for wildlife habitat management.

Plant legumes or mixtures of legumes with grasses, crucifers, and/or other forbs to achieve biological nitrogen fixation. Select cover crop species or mixture, and timing and method of termination that will maximize efficiency of nitrogen utilization by the following crop, considering soil type and conditions, season and weather conditions, cropping system, C:N ratio of the cover crop at termination, and anticipated nitrogen needs of the subsequent crop. Use LGU- recommended nitrogen credits from the legume and reduce nitrogen applications to the subsequent crop accordingly. “If the specific rhizobium bacteria for the selected legume are not present in the soil, treat the seed with the appropriate inoculum at the time of planting.

Time the termination of cover crops to meet nutrient release goals. Termination at early vegetative stages may cause a more rapid release compared to termination at a more mature stage.

Both residue decomposition rates and soil fertility can affect nutrient availability following termination of cover crops

Allelopathic effects to the subsequent crop should be evaluated when selecting the appropriate cover crop.

Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom.

Additional Considerations to Reduce Erosion by Wind or Water

To reduce erosion, best results are achieved when the combined canopy and surface residue cover attains 90 percent or greater during the period of potentially erosive wind or rainfall.

Additional Considerations to Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

Use deep-rooted species to maximize nutrient recovery.

When appropriate for the crop production system, mowing certain grass cover crops (e.g., sorghum-sudangrass, pearl millet) prior to heading and allowing the cover crop to regrow can enhance rooting depth and density, thereby increasing their subsoiling and nutrient-recycling efficacy.

Additional Considerations to Increase Soil Health and Organic Matter Content

Increase the diversity of cover crops (e.g., mixtures of several plant species) to promote a wider diversity of soil organisms, and thereby promote increased soil organic matter.

Plant legumes or mixtures of legumes with grasses, crucifers, and/or other forbs to provide nitrogen through biological nitrogen fixation.

Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or treatment unit according to the planning criteria and operation and maintenance requirements of this standard. Specifications shall describe the requirements to apply the practice to achieve the intended purpose for the practice site. Plans for the establishment of cover crops shall, as a minimum, include the following specification components in an approved Cover Crop, 340, Implementation Requirements document:

- Field number and acres
- Species of plant(s) to be established.
- Seeding rates.
- Seeding dates.
- Establishment procedure.
- Rates, timing, and forms of nutrient application (if needed).
- Dates and method to terminate the cover crop.
- Other information pertinent to establishing and managing the cover crop e.g., if haying or grazing is planned specify the planned management for haying or grazing.

OPERATION AND MAINTENANCE

Evaluate the cover crop to determine if the cover crop is meeting the planned purpose(s). If the cover crop is not meeting the purpose(s) adjust the management, change the species of cover crop, or choose a different technology.

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Wind Erosion Prediction System (WEPS) website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/tools/weps/

USDA, Natural Resources Conservation Service, National Agronomy Manual, 4th Edition, Feb. 2011. Website: http://directives.sc.egov.usda.gov/ Under Manuals and Title 190.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

CRITICAL AREA PLANTING

(Ac.)

CODE 342

DEFINITION

Establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical or biological conditions that prevent the establishment of vegetation with normal practices.

PURPOSE

This practice supports one or more of the following purposes:

- Stabilize stream and channel banks, pond and other shorelines – Resource concern (SOIL EROSION– Excessive bank erosion from streams shorelines or water conveyance channels).
- Stabilize areas with existing or expected high rates of soil erosion by wind or water – Resource concern (SOIL EROSION – Concentrated flow erosion and/or SOIL EROSION - Sheet, rill, & wind erosion and/or SOIL QUALITY DEGRADATION – Concentration of salts or other chemicals).
- Stabilize areas, such as sand dunes and riparian areas – Resource concern (SOIL EROSION – Concentrated flow erosion and/or SOIL EROSION - Sheet, rill, & wind erosion).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to highly disturbed areas such as:

- active or abandoned mined lands;
- urban restoration sites;
- construction areas;
- conservation practice construction sites;
- areas needing stabilization before or after natural disasters such as floods, hurricanes, tornados and wildfires;
- eroded banks of natural channels, banks of newly constructed channels, and lake shorelines;
- other areas degraded by human activities or natural events.

CRITERIA

General Criteria Applicable to All Purposes

Site Preparation. A site investigation shall be conducted to identify any physical, chemical, or biological conditions that could affect the successful establishment of vegetation.

Areas to be planted will be cleared of unwanted materials and smoothed or shaped, if needed, to meet planting and landscaping purposes.

A suitable seedbed shall be prepared for all seeded species. Compacted layers will be ripped and the soil re-firmed prior to seedbed preparation.

As site conditions dictate, when grading slopes, stockpile topsoil to be redistributed over area to be planted

Species Selection. Species selected for seeding or planting shall be suited to local site conditions and intended uses, and be common to the site or location.

Selected species will have the capacity to achieve adequate density and vigor to stabilize the site within an appropriate period.

Establishment of Vegetation. Seeds will be planted using the method or methods best

suited to site and soil conditions.

Sod placement shall be limited to areas that can naturally supply needed moisture or sites that can be irrigated during the establishment period.

Sod will be placed and anchored using techniques to ensure that it remains in place until established.

Species, rates of seeding or planting, minimum quality of planting stock (e.g. pure live seed (PLS) or stem caliper), method of seedbed preparation, and method of establishment shall be specified before application. Only viable, high quality seed or planting stock will be used.

Seeding or planting shall be done at a time and in a manner that best ensures establishment and growth of the selected species

Planting shall be done during approved times for the species to be used.

Apply soil amendments (e.g. lime, fertilizer, compost) according to the requirements in the local Field Office Technical Guide.

Plantings shall be mulched as necessary to ensure establishment. Other disturbed areas shall be mulched as necessary to prevent erosion.

Additional Criteria to Stabilize Stream and Channel Banks, Pond and other Shorelines

Bank and Channel Slopes. Channel side slopes shall be shaped so that they are stable and allow establishment and maintenance of desired vegetation.

A combination of vegetative and structural measures may be necessary on slopes steeper than 2:1 to ensure adequate stability.

Species Selection. Plant material used for this purpose shall:

- be adapted to the hydrologic zone (see Fig. 1) into which they will be planted.
- be adapted and proven in the regions in which they will be used.
- be compatible with existing vegetation in the area
- protect the channel banks but not restrict channel capacity.

Establishment of Vegetation. The species used, planting rates, spacing, and methods and dates of planting shall be based on local planting guides or technical notes.

Identify and protect desirable existing vegetation during practice installation.

A combination of vegetative and structural practices using living and inert material shall be used when flow velocities, soils, and bank stability preclude stabilization by vegetative establishment alone.

If the existing vegetation on a site will compete with species to be established vegetatively (e.g. bare-root, containerized, ball-and-burlap, potted), it will be controlled in a manner that ensures the successful establishment of the planted species.

Streambank stabilization plantings shall be in accordance with the NRCS Engineering Field Handbook Part 650, Chapter 16 (Streambank and Shoreline Protection) and Chapter 18 (Soil Bioengineering for Upland Slope Protection & Erosion Reduction).

Site Protection and Access Control. Restrict access to planted areas until fully established.

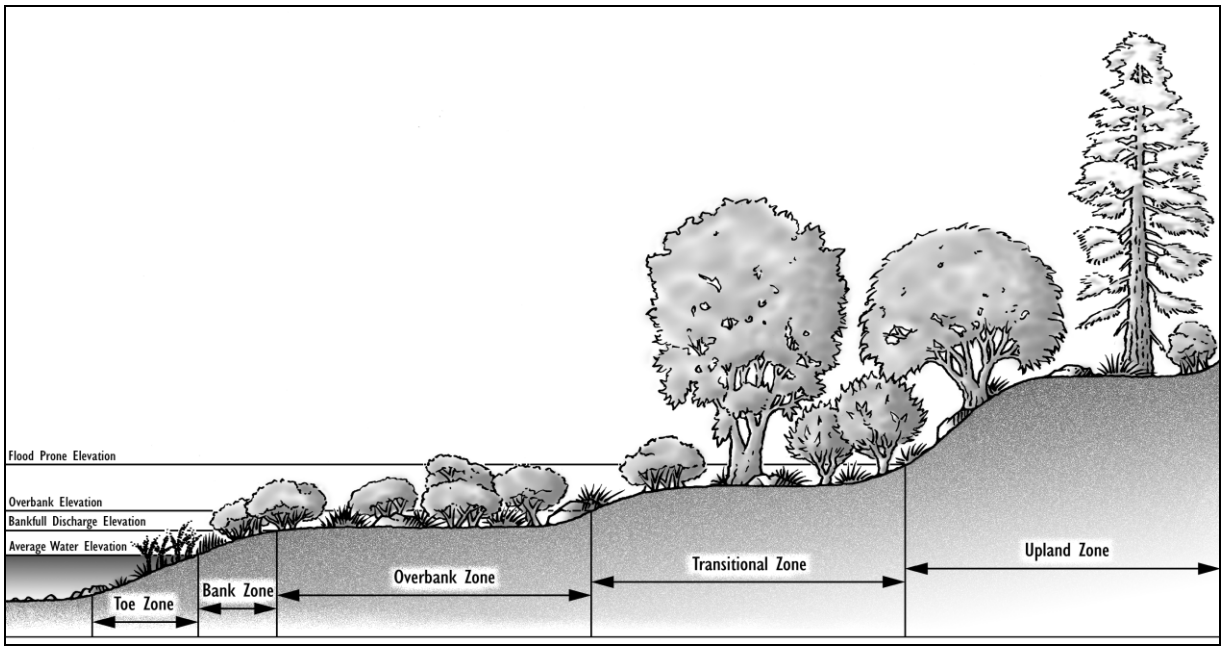

Figure 1. Location of hydrologic zones along a channel or shoreline.

Definitions and descriptions of hydrologic zones used for channels and shorelines:

Bankfull Discharge Elevation - In natural streams, it is the elevation at which water fills the channel without overflowing onto the flood plain.

Bank Zone - The area above the Toe Zone located between the average water level and the bankfull discharge elevation. Vegetation may be herbaceous or woody, and is characterized by flexible stems and rhizomatous root systems.

Overbank Zone - The area located above the bankfull discharge elevation continuing upslope to an elevation equal to two thirds of the flood prone depth. Vegetation is generally small to medium shrub species.

Toe Zone - The portion of the bank that is between the average water level and the bottom of the channel, at the toe of the bank. Vegetation is generally herbaceous emergent aquatic species, tolerant of long periods of inundation.

Transitional Zone - The area located between the overbank zone, and the flood prone width elevation. Vegetation is usually larger shrub and tree species.

Upland Zone – The area above the Transitional Zone; this area is seldom if ever saturated.

Note: some channels or shorelines have fewer than four hydrologic zones because of differences in soils, topography, entrenchment and/or moisture regime.

Additional Criteria to Restore Coastal Areas, such as Sand Dunes and Riparian Areas

Plants for sand dunes and coastal sites must be able to survive being buried by blowing sand, sand blasting, salt spray, salt water flooding, drought, heat, and low nutrient supply.

Sand trapping devices such as sand fences or brush matting shall be included in the re-vegetation/stabilization plans where applicable.

CONSIDERATIONS

Species or mixes that are adapted to the site and have multiple benefits should be considered. Native species may be used when appropriate for the site.

To benefit pollinators and other wildlife, flowering shrubs and wildflowers with resilient root systems and good soil holding capacity also should be considered for incorporation as a small percentage of a larger grass-dominated planting. Where appropriate consider a diverse mixture of forbs to support pollinator habitat.

NRCS, NHCP

December 2013

Avoid species that may harbor pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

Planning and installation of other conservation practices such as Diversion (code 362), Obstruction Removal (code 500), Subsurface Drain (code 606), or Underground Outlet (code 620) may be necessary to prepare the area or ensure vegetative establishment.

Areas of vegetation established with this practice can create habitat for various type of wildlife. Maintenance activities, such as mowing or spraying, can have detrimental effects on certain species. Perform management activities at the times and in a manner that causes the least disruption to wildlife.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or management unit according to the criteria and operation and maintenance sections of this standard. Record practice specifications using approved Implementation Requirement document.

The following elements shall be addressed in the plan, as applicable, to meet the intended purpose.

- Site preparation
- Topsoil requirements
- Fertilizer application
- Seedbed/planting area preparation
- Methods of seeding/planting
- Time of seeding/planting
- Selection of species
- Seed/plant source
- Seed analysis
- Seeding rate/plant spacing
- Mulching
- Supplemental water needed for establishment
- Protection of plantings
- Describe successful establishment (e.g. minimum percent ground/canopy cover, percent survival, stand density.

OPERATION AND MAINTENANCE

Use of the area shall be managed as long as necessary to ensure the site remains stable.

Plantings shall be protected from pests (e.g. weeds, insects, diseases, livestock, or wildlife) as necessary to ensure long-term survival.

Inspections, reseeding or replanting, and fertilization may be needed to ensure that this practice functions as intended throughout its expected life. Observation of establishment progress and success should be performed at regular intervals until the practice has met the criteria for successful establishment and implementation.

All areas to be grazed will follow a grazing plan that meets the criteria in the local Field Office Technical Guide.

Grazing will be permanently excluded on high hazard sites, such as cut banks, areas of seepage, or other potential unstable areas.

REFERENCES

Federal Interagency Stream Restoration Working Group. 1998. Stream corridor restoration: principles, processes, and practices. National Engineering Handbook, Part 653.

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SEDIMENT BASIN

(No.)

CODE 350

DEFINITION

A basin constructed with an engineered outlet, formed by an embankment or excavation or a combination of the two.

PURPOSE

To capture and detain sediment laden runoff, or other debris for a sufficient length of time to allow it to settle out in the basin.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to urban land, construction sites, agricultural land, and other disturbed lands:

- Where physical conditions or land ownership preclude treatment of a sediment source by the installation of erosion-control measures.
- Where a sediment basin offers the most practical solution.
- Where failure of the basin will not result in loss of life, damage to homes, commercial or industrial buildings, main highways or railroads; or in the use of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway.
- The effective height of the dam is 35 feet or less. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam.
- The Hazard Class of the dam is Low.

CRITERIA

Sediment basin design and construction must comply with all applicable federal, state and local laws and regulations.

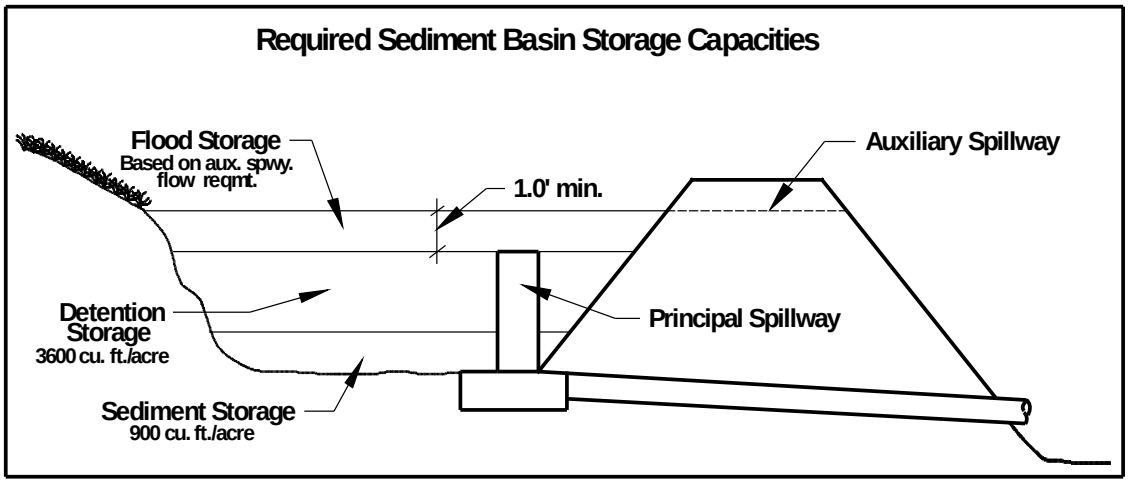
Location. Sediment basins are the last line of defense for capturing sediment when erosion has already occurred. When possible construct basins prior to soil disturbance in the watershed. Choose the location of the sediment basin so that it intercepts as much of the runoff as possible from the disturbed area of the watershed. Choose a location that minimizes the number of entry points for runoff into the basin and interference with construction or farming activities. Do not locate sediment basins in perennial streams.

Basin Capacity. The sediment basin must have sediment storage capacity, detention storage and temporary flood storage capacities. For maximum sediment retention, design the basin so that the detention storage remains full of water between storm events. However, if site conditions, safety concerns, or local laws preclude a permanent pool of water, design all or a portion of the detention and sediment storages to be dewatered between storm events.

Design the sediment storage for a minimum of 900 ft^3/acre of disturbed area. The sediment storage volume is calculated from the bottom of the basin. Design the detention storage for a minimum of 3600 ft^3/acre of drainage area. The detention volume is calculated from the top of the sediment storage to the crest of the principal spillway.

NRCS, NHCP

January 2010



Flood storage is based on the required design storm for the auxiliary spillways. Flood storage is calculated between the crest of the principal spillway and the crest of the auxiliary spillway. A minimum of 1 foot in elevation is required between the principal and auxiliary spillways.

Principal and Auxiliary Spillway Design

Design the principal spillway to carry long-duration, continuous, or frequent flows without discharge through the auxiliary spillway. The diameter of the principal spillway pipe must be 6 inches or greater.

The principal spillway can be designed to remove only water from the temporary flood storage or it can be designed to dewater all or part of the detention storage. Design the principal spillway to drawdown the temporary flood storage within 24 hours. Drawdown times for the detention storage can be longer to improve sediment trapping.

Design the auxiliary spillway to pass large storms without damage to the basin. Refer to NRCS Conservation Practice Standard 378, Ponds for the required design storm and design criteria for the auxiliary spillways.

The outlet of the principal spillway must be stable for anticipated design flow conditions.

Basin Shape. Design basins with a length to width ratio of 2 to 1 or greater. Baffles to divert the flow in the basin can be used to lengthen the flow path of incoming water to achieve the required length to width ratio.

Embankment and Side Slopes. If the sediment basin includes an embankment, it must be constructed of well compacted soil with stable side slopes. Refer to NRCS Conservation Practice Standard 378, Pond for design requirements for the embankment.

Above the permanent water line, the side slopes of the pool area must be 3 horizontal to 1 vertical or flatter. Side slopes below the permanent water line can be as steep as 2 horizontal to 1 vertical.

Vegetation. Establish vegetation on the embankment and side slopes of the basin and pool area immediately after construction. Refer to NRCS Conservation Practice Standard 342, Critical Area Planting for criteria for the establishment of vegetation. If construction takes place during a time period that is not conducive to establishing vegetation, protect the embankment by mulching or other methods. Refer to NRCS Conservation Practice Standard 484, Mulching for mulching criteria.

If arid climatic conditions do not allow for the establishment of vegetation other means of reducing erosion may be used.

Safety. Sediment basins are often installed in developing areas and can be an attractive nuisance and safety hazard to the public. Design with the safety of the public in mind. Where appropriate, include safety features

such as fencing to limit access to the pool area and embankment, signs to warn of danger and a safety ledge below the water level 6 feet wide and 4 horizontal to 1 vertical (4:1) or flatter around the edge of the permanent pool.

CONSIDERATIONS

A large sediment basin may have an effect on the peak discharge rate from a watershed. Planners should consider this, and take steps to mitigate any potential negative effects this may have on riparian habitat downstream from the structure.

In many cases the use of a sediment basin alone may not provide sufficient protection for offsite sedimentation problems. To work most effectively, the sediment basin should be the last practice in a series of erosion control and sediment capturing practices installed in the disturbed area. This incremental approach will reduce the load on the basin and improve effectiveness of the overall effort to prevent offsite sedimentation problems.

The efficiency of sediment removal in a basin is affected by the detention time of runoff, the type of dewatering device, the presence of a permanent pool in the basin, a decrease in turbulence in the basin and soil particle size. The uses of the following techniques are particularly effective if there is a need to remove clay and other fine grained particles.

- Detention time can be increased by increasing the storage volume in the basin. Increased storage along with a properly designed dewatering device can significantly improve the efficiency of sediment capture.
- Dewatering should be done in a manner which removes the cleaner water above the sediment storage, without removing the sediment laden water found deeper in the basin. One dewatering device that has been very successful is a skimming devices that floats on the surface of the water and rises and falls with the water level in the basin. Use of this type of dewatering device should improve the quality of the water leaving the basin. Details for this type of dewatering device can be found in the North Carolina Erosion and Sediment Control Planning and Design Manual.
- Maintaining a permanent pool also improves sediment trapping by reducing the re-suspension of sediment in the basin. This can be accomplished by only dewatering the temporary flood storage or only a portion of the detention storage. Removal of sediment from the basin before it reaches the sediment storage elevation will maintain the pool volume and improve trapping efficiency.
- Turbulence in the basin can be reduced by constructing porous baffles that extend across the entire basin. The baffles slow down flows and force water to spread across the entire width of the basin. A thorough discussion and design criteria for porous baffles can be found in the North Carolina Erosion and Sediment Control Planning and Design Manual.
- For very fine grained sediments, flocculants can be added to the runoff before it enters the basin. One commonly used flocculant is anionic polyacrylamide (PAM). Do not use cationic polyacrylamide because it can be toxic to aquatic life.

Since the sediment basin must be designed to handle all of the contributing drainage whether it is from disturbed areas or not, diverting runoff from undisturbed areas away from the basin will improve the function of the basin. The design storm for diversion measures should be equal to the design storm for the auxiliary spillway of the basin.

The use of forebays that are separate from the main basin, and easily accessible for cleanout will reduce turbulence and will allow larger particles to settle out of the runoff before it enters the main basin.

Because the sediment storage capacity of a basin is finite, choose a location that will allow access for sediment removal when the storage capacity is full.

Visual aesthetics may be a concern, especially in urban or suburban areas. To address these concerns, design the basin to blend with the surrounding topography, or use plantings to screen the view from surrounding homes or buildings.

In some situations, after they have served the sediment capture function, sediment basins may remain in place to function as stormwater detention or wildlife ponds. This will require appropriate planning during the design phase to ensure that the basin can function for a different use. In addition, significant modifications to outlet structures may need to be made as well as removal of accumulated sediment to convert it to a new use.

If the basin will be used by wildlife, the use of native species is recommended to provide food and habitat diversity. Also, consider wildlife use of the basin when scheduling maintenance activities that may disrupt wildlife life cycles or negatively impact pollinators.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for sediment basins that describe the requirements for applying the practice according to this standard. Include as a minimum, the following in the plans and specifications:

1. A plan view of the layout of the sediment basin.
2. Typical cross sections of the basin.
3. Details of the outlet system
4. Seeding requirements if needed.
5. Construction specifications that describe in writing site specific installation requirements of the sediment basin.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in the operation and maintenance plan are:

1. Periodic inspections and maintenance of the embankment, principal and auxiliary spillways and dewatering device especially following significant runoff events.
2. Prompt repair or replacement of damaged components.
3. Prompt removal of sediment when it reaches pre-determined storage elevations.
4. Periodic mowing of vegetation to control of trees, brush and invasive species.
5. Periodic inspection of safety components and immediate repair if necessary.

REFERENCES

California Stormwater Quality Association. 2003. California Stormwater BMP Handbook, Construction. Menlo Park, CA.

Center for Watershed Protection. 2000. Improving the Trapping Efficiency of Sediment Basins, Article 58, The Practice of Watershed Protection: Techniques for Protecting and Restoring Urban Watersheds. Ellicott City, MD.

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North Carolina Department of Environmental and Natural Resources, Division of Land Resources. 2006. North Carolina Erosion and Sediment Control Planning and Design Manual. Raleigh, NC.

Tennessee Erosion and Sediment Control Handbook . 2002. Tennessee Department of Environment and Conservation. Nashville, TN

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USDA Natural Resources Conservation Service. 1983. National Engineering Handbook, Section 3 – Sedimentation. Washington, DC

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

MONITORING WELL

(No.)

CODE 353

DEFINITION

A well, or wells, designed and installed to obtain representative groundwater samples and hydrogeologic information.

PURPOSE

To provide controlled access for sampling groundwater near an agricultural waste storage facility, waste treatment facility or other area of concern to detect the occurrence of seepage and to monitor groundwater quality through time.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to the design, installation, and development of monitoring wells near components of an agricultural waste management system.

This practice does not apply to:

- Methods for developing a groundwater monitoring plan
- Methods for collection of groundwater samples
- Analysis or interpretation of laboratory test results
- Monitoring of subsurface waters in the vadose (unsaturated) zone
- Installation of wells for any other purpose
- Temporary exploratory drill holes.

CRITERIA

General Criteria Applicable to All Purposes

Permits. The landowner is responsible for obtaining all necessary permits for the work prior to construction. The contractor is responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Hydrogeologic Site Characterization. Use guidance provided in ASTM D5092, "Standard Practice for Design and Installation of Groundwater Monitoring Wells," to conduct surface and subsurface investigations within the area of concern prior to the design of a monitoring well. Use this information to develop a conceptual hydrogeologic model of the site, identify probable groundwater flow paths, and determine the target monitoring zone(s).

Use National Engineering Handbook 631 (NEH-631), Geology, for methodologies for identification, field-testing, and interpretation of geologic material and mass factors that affect movement and flow direction of groundwater within the area of concern.

Planning. Locate and describe any tile lines, subsurface drains, surface drains, irrigation ditches, irrigation wells, water supply wells, septic drain fields, infiltration strips, quarries, mines, and other water control/management features that influence the flow of local subsurface and surface water.

Identify and describe other relevant features that influence subsurface water flow such as hard pans, sand boils, animal burrows, seasonal desiccation, high shrink/swell soils, dense till, depth of frost line, or permafrost.

Estimate the vertical and lateral seasonal variability in the water table using guidance provided in NEH 651, Agricultural Waste Management Field Handbook, Chapter 7.

Write a report of the hydrogeologic investigation and include a geologic evaluation map or sketches of all identified features and interpretations.

Layout. Use the hydrogeologic investigation report to determine the optimum location(s) of monitoring wells, both up-gradient and down-gradient of the waste storage facility or in the area of concern.

In highly fractured-rock and in karst aquifers, locate the monitoring wells in the zones of highest permeability, even if locations are offsite.

Design. The design of all components of the monitoring well must conform to criteria provided in ASTM D5092.

Materials. Materials used for the construction of monitoring wells must not chemically react with the groundwater and must not leach substances into the groundwater. Avoid quick-setting cements containing additives that may leach from the cement and influence the chemistry of water samples collected from the monitoring well.

For conventionally screened and filter-packed groundwater monitoring wells located in sand and gravel aquifers and other granular materials, ensure the grain size distribution contains less than 50% finer than the 200 sieve and less than 20% clay sized material.

Ensure all materials used in construction, development, and sealing are free of contaminants prior to installation.

Use only commercial well screens or slotted pipe.

Use only threaded jointed pipe or casing. Do not use glued or solvent-welded joints.

Use only materials of adequate strength to withstand the forces of installation and well development.

Installation. Select the design protocol and installation method according to site-specific conditions identified during the hydrogeologic investigation.

Use only drilling or digging equipment capable of creating a stable, open, vertical hole for proper installation of the monitoring well.

Installation methods must conform to ASTM D5092, and ASTM D5787, "Standard Practice for Monitoring Well Protection."

Direct push methods for installation are allowable provided they are consistent with guidance provided in ASTM D6724, "Guide for Installation of Direct Push Groundwater Monitoring Wells," and ASTM D6725, "Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers."

Well Protection. Protect the monitoring well from damage from hazards such as frost action, surface drainage, animal or equipment traffic, and lack of visibility.

Establish positive surface drainage away from the wellhead.

Establish a buffer zone with a minimum radius of 30 feet around the wellhead of the monitoring well. Use fencing or other types of protection that excludes motorized vehicle access and livestock.

Ensure that no storage, handling, mixing, or application of fertilizers, pesticides or other agricultural chemicals or cleaning of equipment used in the handling or application of such items occurs within the buffer zone at any time.

Development. Well development procedures must target the most productive hydrogeologic zones penetrated by the monitoring well. Seal the annular spaces adjacent to non-productive zones to prevent cross contamination and comingling of chemically or biologically different zones of underground or surface waters. Refer to ASTM D5521, "Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers" for a description of the various development methods. Conduct the development process only after completion of well installation, fill and sealing operations, and wellhead protection measures.

Recordkeeping. When writing records to describe a groundwater site, refer to guidance provided in ASTM D5408 "Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part One – Additional Identification Descriptors," and ASTM D5409 "Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part Two – Physical Descriptors."

CONSIDERATIONS

In developing the conceptual hydrogeologic model, consider effects of geomorphic processes, geologic structures, regional stratigraphy, and soil and rock properties on subsurface flow patterns, location of groundwater recharge, and pollution potential. Consider the physical properties and methods of movement in the environment of solutes and pollutants of interest and potential impact of relevant soil properties (clay content, organic matter) when designing and locating the physical position and depth of a monitoring well. Also, consider inherent physical and conductive properties of relevant soil horizons (particle size, structure, kSAT).

Consider using geophysical tools in conjunction with penetrative exploratory techniques to improve and refine the mapping of the location, shape, orientation, and extent of subsurface hydrogeologic units.

Consider installing additional monitoring wells at other locations and at appropriate depths to ensure identification of the location and direction of movement of any potential contaminant plume.

Consider alternative drilling or digging methods for installing monitoring wells as provided in ASTM D6286 “Standard Guide for Selection of Drilling Methods for Environmental Site Characterization.”

Where frost heave is a concern, consider design alternatives that reduce the potential for frost heave damage of the monitoring well(s).

PLANS AND SPECIFICATIONS

Prepare plans and specifications for constructing, installing, completing, and developing monitoring wells that describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Operation and maintenance requirements must comply with the purpose of this standard.

Maintenance and rehabilitation procedures must comply with criteria in ASTM D5978 to ensure acquisition of groundwater samples free of artificial turbidity, eliminate siltation of wells between sampling events, and permit acquisition of accurate groundwater levels and hydraulic conductivity test data from the zone screened by the well.

When no longer needed, close the well according to NRCS Conservation Practice Standard *Well Decommissioning (Code 351)*.

REFERENCES

American Society for Testing and Materials:

ASTM D5092 “Standard Practice for Design and Installation of Groundwater Monitoring Wells”

ASTM D5408, “Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part One – Additional Identification Descriptors”

ASTM D5409, “Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part Two – Physical Descriptors”

ASTM D5521, “Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers”

ASTM D5787, “Standard Practice for Monitoring Well Protection”

ASTM D5978, “Guide for Maintenance and Rehabilitation of Groundwater Monitoring Wells

ASTM D6286, “Standard Guide for Selection of Drilling Methods for Environmental Site Characterization”

ASTM D6724, “Guide for Installation of Direct Push Groundwater Monitoring Wells”

ASTM D6725, “Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers”

USDA, NRCS, 2012. National Engineering Handbook Part 631, Geology.

USDA, NRCS, 2010. NEH 651, AGRICULTURAL WASTE MANAGEMENT FIELD HANDBOOK, CHAPTER 7, GEOLOGY AND GROUNDWATER CONSIDERATIONS.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FENCE

(Ft.)

CODE 382

DEFINITION

A constructed barrier to animals or people.

PURPOSE

This practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on any area where management of animal or human movement is needed.

CRITERIA

General Criteria Applicable to All Purposes

Fencing materials, type and design of fence installed shall be of a high quality and durability. The type and design of fence installed will meet the management objectives and site challenges. Based on need, fences may be permanent, portable, or temporary.

Fences shall be positioned to facilitate management requirements. Ingress/egress features such as gates and cattle guards shall be planned. The fence design and installation should have the life expectancy appropriate for management objectives and shall follow all federal, state and local laws and regulations.

Height, size, spacing and type of materials used will provide the desired control, life expectancy, and management of animals and people of concern.

CONSIDERATIONS

The fence design and location should consider: topography, soil properties, livestock management and safety, livestock trailing, wildlife class and movement, location and adequacy of water facilities, development of potential grazing systems, human access and safety, landscape aesthetics, erosion problems, moisture conditions, flooding potential, stream crossings, and durability of materials. When appropriate, natural barriers should be utilized instead of fencing.

Where applicable, cleared rights-of-way may be established which would facilitate fence construction and maintenance. Avoid clearing of vegetation during the nesting season for migratory birds.

Fences across gullies, canyons or streams may require special bracing, designs or approaches.

Fence design and location should consider ease of access for construction, repair and maintenance.

Fence construction requiring the removal of existing unusable fence should provide for the proper disposal of scrap materials to prevent harm to animals, people and equipment.

PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for all fence types, installations and specific sites. Requirements for applying the practice to achieve all of its intended purposes shall be described.

OPERATION AND MAINTENANCE

Regular inspection of fences should be part of an ongoing maintenance program. Inspection of fences after storms and other disturbance events is necessary to insure the continued proper function of the fence. Maintenance and repairs will be performed in a timely manner as needed, including tree/limb removal and water gap replacement.

Remove and properly discard all broken fencing material and hardware. All necessary precautions should be taken to ensure the safety of construction and maintenance crews.

REFERENCES

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Heady, H.F. and R.D. Child. 1994. Rangeland ecology and management. Western Press.

Holechek, J.L., R.D. Pieper, and C.H. Herbel. 2001. Range management: principles and practices. Prentice Hall.

Stoddard, L.A., A.D. Smith, and T.W. Box. 1975. Range management. McGraw-Hill Book Company.

United States Department of Interior, Bureau of Land Management and United States Department of Agriculture, Forest Service. 1988. Fences. Missoula Technology and Development Center.

United States Department of Agriculture, Natural Resources Conservation Service. 2005. Electric fencing for serious graziers. Columbia, Mo.

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Vallentine, J.F. 1971. Range development and improvement. Brigham Young University Press.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

RIPARIAN HERBACEOUS COVER

(Ac.)

CODE 390

DEFINITION

Grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils, established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats.

PURPOSE

This practice may be applied as part of a conservation management system to accomplish one or more of the following purposes

- Provide or improve food and cover for fish, wildlife and livestock,
- Improve and maintain water quality.
- Establish and maintain habitat corridors.
- Increase water storage on floodplains.
- Reduce erosion and improve stability to stream banks and shorelines.
- Increase net carbon storage in the biomass and soil.
- Enhance pollen, nectar, and nesting habitat for pollinators.
- Restore, improve or maintain the desired plant communities.
- Dissipate stream energy and trap sediment.
- Enhance stream bank protection as part of stream bank soil bioengineering practices.

CONDITIONS WHERE PRACTICE APPLIES

- Areas adjacent to perennial and intermittent watercourses or water bodies where the natural plant community is dominated by herbaceous vegetation that is tolerant of periodic flooding or saturated soils. For seasonal or ephemeral watercourses and water bodies, this zone extends to the center of the channel or basin.
- Where channel and stream bank stability is adequate to support this practice.
- Where the riparian area has been altered and the potential natural plant community has changed.

CRITERIA

General Criteria Applicable to All Purposes

Where available, use Ecological Site Description to guide restoration to appropriate vegetative community phase and include appropriate vegetative functional groups.

Select perennial plants that are adapted to site and hydrologic conditions and provide the structural and functional diversity preferred by fish and wildlife likely to benefit from the installation of the practice.

In areas where native seeds and propagules are present, natural regeneration can be used in lieu of planting. Planting is required if no native seed bank is present.

Protect riparian vegetation and water quality by reducing or excluding haying and grazing until the desired plant community is well established.

Stream type and site hydrology must be considered. Selected plant species must be adapted to the projected duration of saturation and inundation of the site.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

Pest management will be conducted in a manner that mitigates impacts to pollinators.

Management systems applied will be designed to maintain or improve the vigor and reproduction of the desired plant community.

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species. Only viable, high quality and site-adapted planting stock will be used.

Determine the width of the riparian herbaceous cover planting based on the geomorphic potential of the site and project purposes, including the life history requirements of local fish and wildlife species, including pollinators.

Existing underground functional drains that pass through these areas shall be replaced with rigid, non perforated pipe through the buffer or equipped with a management regulating structure to allow control of overflow.

Domestic grazing should be deferred for a minimum of two years or until such time as the desired plant community is established.

Additional Criteria to Maintain or Improve Water Quality and Quantity

Minimum width shall be increased to 2.5 times the stream width (based on the horizontal distance between bank-full elevations) or 35 feet for water bodies. Concentrated flow erosion or mass soil movement shall be controlled in the up gradient area prior to establishment of the riparian herbaceous cover.

Species selected shall have stiff stems and high stem density near the ground surface to reduce water velocities and facilitate infiltration into the floodplain.

Additional Criteria to Stabilize Streambanks and Shorelines

Select native or accepted, introduced species that provide a deep, binding root mass to strengthen streambanks and improve soil health.

Additional Criteria for Increasing Net Carbon Storage in Biomass and Soils

Maximize width and length of the herbaceous riparian cover to fit the site.

Plant species used will have the highest rates of biomass production for the soil and other site conditions, consistent with meeting fish and wildlife habitat requirements.

Additional Criteria for Pollinator Habitat

Include forbs and legumes that provide pollen and nectar for native bees. Utilize a diverse mix of plant species that bloom at different times throughout the year.

Additional Criteria for Terrestrial Wildlife

Select native species adapted to the site.

Density of the vegetative stand established for this purpose shall be managed for targeted wildlife habitat requirements and shall encourage plant diversity.

If mowing is necessary to maintain herbaceous cover it will occur outside the nesting and fawning season and allow for adequate re-growth for winter cover. To protect pollinators and maintain habitat with a diversity of plant structure, a third or less of the site should be disturbed (mowed, grazed, burned, etc.) each year, allowing for recolonization of pollinators from surrounding habitat.

The management plan shall consider habitat and wildlife objectives such as habitat diversity, habitat linkages, daily and seasonal habitat ranges, limiting factors and native plant communities.

Additional Criteria for Restoring Desired Plant Community

Use Ecological Site Description (ESD) State and Transition models, where available, to determine if proposed actions are ecologically sound and defensible. Treatments need to be congruent with dynamics of the ecological site(s) and keyed to states and plant community phases that have the potential and capability to support the desired plant community. If an ESD is not available, base design criteria on best approximation of the desired plant community composition, structure, and function.

CONSIDERATIONS

Selection of native plant species is preferred. All selected species should have multiple values such as those suited for biomass, wintering and nesting cover, aesthetics, forage value for aquatic invertebrates, and tolerance to locally used herbicides.

Other conservation practices that may facilitate the establishment of Riparian Herbaceous Cover or enhance its performance include:

- Stream Habitat Improvement and Management (395)
- Streambank and Shoreline Protection – (580)
- Fence – (382)
- Pasture and Hayland Planting – (512)
- Range Planting – (550)
- Filter Strip – (393)
- Access Control – (472)
- Prescribed Grazing – (528A)
- Brush/Shrub Management – (314)
- Stream Herbaceous Weed Control Management – (315)
- Heavy Use Area Protection (561)
- Critical Area Planting (342)
- Riparian Forest Buffer (391)
- Early Successional Habitat Improvement Development and Management (395-(643)
- Conservation Cover - (327)
- Restoration and Management of Rare and Declining Habitat - (647)
- Stream Crossing (578)
- Watering Facility (614)

Considerations should be given to how this practice will complement the functions of adjacent riparian, terrestrial and aquatic habitats.

Consider the effects of upstream and downstream conditions, structures, facilities, and constraints on the planned activities.

Control of invasive trees and shrubs may be required to prevent dominance of the riparian zone by woody plants and maintain openness in riparian system.

Establish alternative water sources or controlled access stream crossings to manage livestock access to the stream and riparian area.

Selection of native plant species is recommended. Introduced species may be used. All selected species should have multiple values such as those suited for biomass, wintering and nesting cover, aesthetics, forage value for aquatic invertebrates, and tolerance to locally used herbicides.

Herbaceous riparian areas can function to link pollinators with adjacent fragmented habitat, and can serve as a conduit to move pollinators into areas requiring insect pollination. Different flower sizes and shapes appeal to different categories of pollinators. To support many species, consider establishing the greatest diversity possible. Consider incorporating nesting habitat, including patches of unshaded bare soil for ground nesting bees or where bumble bee conservation is a priority, clump forming warm-season native grasses.

Avoid plant species which may be alternate hosts to pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

The location, layout and vegetative structure and composition of the buffer should complement natural features.

Corridor configuration, establishment procedures and management should enhance habitats for threatened, endangered and other plant or animal species of concern, where applicable.

Use plant species that provide full ground coverage to reduce particulate matter generation during establishment and maintenance operations.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specification shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The purpose of operation, maintenance and management is to insure that the practice functions as intended over time.

The riparian area will be inspected periodically in order to detect adverse impacts and make adjustments in management to maintain the intended purpose.

Control of concentrated flow erosion or mass soil movement shall be continued in the up-gradient area to maintain riparian function.

Any use of fertilizers, pesticides and other chemicals to assure riparian area function shall not compromise the intended purpose.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

Pest management will be conducted in a manner that mitigates impacts to pollinators.

Avoid haying or grazing when streambanks and riparian areas are vulnerable to livestock or mechanical damage.

Manage grazing to sustain riparian functions and values.

Management systems will be designed and applied to maintain or improve the vigor and reproduction of the desired plant community, e.g., the riparian functions and values.

Where the primary purpose of the practice is to provide terrestrial wildlife habitat, the density of the vegetative stand shall be managed for targeted wildlife habitat requirements and shall encourage plant diversity. If mowing is necessary to maintain herbaceous cover, it will occur outside the nesting and fawning season and allow for adequate re-growth for winter cover.

REFERENCES

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United States Department of Agriculture, Natural Resources Conservation Service. 2003. National Range and Pasture Handbook. Washington, DC.

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http://www.unl.edu/nac/agroforestrynotes.htm

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

(Ac.)

CODE 391

DEFINITION

An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSE

- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms.
- Create or improve riparian habitat and provide a source of detritus and large woody debris.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Reduce pesticide drift entering the water body.
- Restore riparian plant communities.
- Increase carbon storage in plant biomass and soils.

CONDITIONS WHERE PRACTICE APPLIES

Riparian forest buffers are applied on areas adjacent to permanent or intermittent streams, lakes, ponds, and wetlands. They are not applied to stabilize stream banks or shorelines.

CRITERIA

General Criteria Applicable to All Purposes

The riparian forest buffer shall be positioned appropriately and designed to achieve sufficient width, length, vertical structure/density and connectivity to accomplish the intended purpose(s).

Dominant vegetation will consist of existing, naturally regenerated, or seeded/planted trees and shrubs suited to the soil and hydrology of the site and the intended purpose(s).

The vegetation will extend a minimum width to achieve the purpose(s). Measurement shall begin at and perpendicular to the normal water line, bank-full elevation, or the top of the bank as determined locally.

Overland flow through the riparian area will be maintained as sheet flow.

For sites to be regenerated or planted, excessive sheet-rill and concentrated-flow erosion will be controlled.

Excessive sheet-rill and concentrated-flow erosion will be controlled in the areas immediately adjacent and up-gradient of the buffer site.

Use tree and shrub species that are native and non-invasive. Substitution with improved and locally accepted cultivars or purpose-specific species is allowed. For plantings and seeding, only viable, high-quality and adapted plant materials will be used.

Favor tree and shrub species that have multiple values such as those suited for timber, nuts, fruit, florals, browse, nesting, and aesthetics.

Periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Necessary site preparation and planting shall be done at a time and manner to insure

survival and growth of selected species for achieving the intended purpose(s).

Livestock shall be controlled or excluded as necessary to achieve the intended purpose. Refer to the standards Prescribed Grazing, 528, and/or Access Control, 472, as applicable.

Harmful plant and animal pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose. If pesticides are used, refer to the standard Pest Management, 595.

Additional Criteria to Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or the top of the bank as determined locally.

The width will be extended in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is needed.

Existing, functional underground drains through the riparian area will pass pollutants directly to the outlet. To filter such pollutants, drains can be plugged, removed or replaced with perforated pipe/end plugs or water control structures (see Structure for Water Control - 587) to allow passage and filtration of drain water through the riparian forest root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

Additional Criteria to Create or Improve Riparian Habitat and Provide a Source of Detritus and Large Woody Debris.

The width will be extended to meet the minimum habitat requirements of the wildlife or aquatic species of concern.

Establish plant communities that address the target aquatic and terrestrial wildlife and pollinator needs and have multiple values such as habitat, nutrient uptake and shading. The establishment of diverse native woody and herbaceous species will enhance wildlife and pollinator values.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

Maximize width and length of the riparian forest buffer.

Select plants that have higher rates of carbon sequestration in soils and plant biomass and are adapted to the site to assure strong health and vigor. Plant the appropriate stocking rate for the site.

CONSIDERATIONS

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Using seed and/or seedlings collected or propagated from multiple sources can increase genetic diversity.

Consider selecting species with tolerance to herbicide leakage from adjoining fields.

Allelopathic impacts of plants should be considered.

The location, layout and density of the buffer should complement natural features, and mimic natural riparian forests.

For sites where continued function of drains is desired, woody root penetration may eventually plug the underground structure. In these cases, a setback of woody vegetation planted over the drain maintained in herbaceous cover or using rigid, non-perforated pipe will minimize woody root penetration.

Maximize widths, lengths, and connectivity of riparian forest buffers.

The species and plant communities that attain biomass more quickly will sequester carbon/ faster. The rate of carbon sequestration is enhanced as riparian plants mature and soil organic matter increases.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, concentrated flows, pesticides, livestock or wildlife damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

Any manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation shall sustain the intended purpose(s). Refer to the standard Forest Stand Improvement, 666.

Control or exclusion of livestock and harmful wildlife shall continue. Refer to the standards Prescribed Grazing, 528, and/or Access Control, 472, as applicable.

Fertilizers, pesticides and other chemicals used to maintain buffer function shall not impact water quality.

REFERENCES

Bentrup, Gary 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FILTER STRIP

(Ac.)

CODE 393

DEFINITION

A strip or area of herbaceous vegetation that removes contaminants from overland flow.

PURPOSE

- Reduce suspended solids and associated contaminants in runoff.
- Reduce dissolved contaminant loadings in runoff.
- Reduce suspended solids and associated contaminants in irrigation tailwater.

CONDITIONS WHERE PRACTICE APPLIES

Filter strips are established where environmentally-sensitive areas need to be protected from sediment, other suspended solids and dissolved contaminants in runoff.

CRITERIA

General Criteria Applicable to All Purposes

Overland flow entering the filter strip shall be uniform sheet flow.

Concentrated flow shall be dispersed before it enters the filter strip.

The maximum gradient along the leading edge of the filter strip shall not exceed one-half of the up-and-down hill slope percent, immediately upslope from the filter strip, up to a maximum of 5%.

State-listed noxious plants will not be established in the filter strip. Filter strips shall not be used as a travel lane for equipment or livestock.

Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Runoff

The filter strip will be designed to have a 10-year life span, following the procedure in the Agronomy Technical Note No. 2 (Using RUSLE2 for the Design and Predicted Effectiveness of Vegetative Filter Strips (VFS) for Sediment), based on the sediment delivery in RUSLE2 to the upper edge of the filter strip and ratio of the filter strip flow length to the length of the flow path from the contributing area. The minimum flow length through the filter strip shall be 20 feet.

The filter strip shall be located immediately downslope from the source area of contaminants.

The drainage area above the filter strip shall have a slope of 1% or greater.

Vegetation. The filter strip shall be established to permanent herbaceous vegetation

Species selected shall be:

- able to withstand partial burial from sediment deposition and
- tolerant of herbicides used on the area that contributes runoff to the filter strip.

Species selected shall have stiff stems and a high stem density near the ground surface.

Species selected for seeding or planting shall be suited to current site conditions and intended uses. Selected species will have the capacity to achieve adequate density and vigor within an appropriate period to stabilize the site sufficiently to permit suited uses with ordinary management activities.

Species, rates of seeding or planting, minimum quality of planting stock, such as PLS or stem caliper, and method of establishment shall be specified before application. Only viable, high quality seed or planting stock will be used.

Site preparation and seeding or planting shall be done at a time and in a manner that best ensures survival and growth of the selected species. What constitutes successful establishment, e.g. minimum percent ground/canopy cover, percent survival, stand density, etc. shall be specified before application.

Planting dates shall be scheduled during periods when soil moisture is adequate for germination and/or establishment.

The minimum seeding and stem density shall be equivalent to a high quality grass hay seeding rate for the climate area or the density of vegetation selected in RUSLE2 to determine trapping efficiency, whichever is the higher seeding rate.

Additional Criteria to Reduce Dissolved Contaminants in Runoff

The criteria given in **"Additional criteria to reduce suspended solids and associated contaminants in runoff"** for location, drainage area and vegetation characteristics also apply to this purpose.

The minimum flow length for this purpose shall be 30 feet.

Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Irrigation Tailwater

Filter strip vegetation shall be a small grain or other suitable annual plant

The seeding rate shall be sufficient to ensure that the plant spacing does not exceed 4 inches.

Filter strips shall be established early enough prior to the irrigation season so that the vegetation is mature enough to filter sediment from the first irrigation.

The minimum flow length for this purpose shall be 20 feet.

CONSIDERATIONS

General. Filter strip width (flow length) can be increased as necessary to accommodate harvest and maintenance equipment.

Filters strips with the leading edge on the contour will function better than those with a gradient along the leading edge.

Seeding rates that establish a higher stem density than the normal density for a high quality grass hay crop will be more effective in trapping and treating contaminants.

Reducing Suspended Solids and Associated Contaminants in Runoff. Increasing the width of the filter strip beyond the minimum required will increase the potential for capturing contaminants in runoff.

Creating, Restoring or Enhancing Herbaceous Habitat for Wildlife and Beneficial Insects. Filter strips are often the only break in the monotony of intensively-cropped areas. The wildlife benefits of this herbaceous cover can be enhanced by:

- Increasing the width beyond the minimum required, and planting this additional area to species that can provide food and cover for wildlife. This additional width should be added on the downslope side of the filter strip.
- Adding herbaceous plant species to the filter strip seeding mix that are beneficial to wildlife and compatible for one of the listed purposes. Changing the seeding mix should not detract from the purpose for which the filter strip was established.

Maintain or Enhance Watershed Functions and Values. Filter strips can:

- enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed.
- enhance the aesthetics of a watershed.
- be strategically located to reduce runoff, and increase infiltration and ground water recharge throughout the watershed.

Air Quality. Increasing the width of a filter strip beyond the minimum required will increase the potential for carbon sequestration.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for each field site where a filter strip will be installed. A plan includes information about the location, construction sequence, vegetation establishment, and management and maintenance requirements.

As a minimum, the plans shall include:

a) Length, width (flow path), and slope of the filter strip to accomplish the planned purpose (width refers to flow length through the filter strip).

b) Species selection and seeding or sprigging rates to accomplish the planned purpose

c) Planting dates, care and handling of the seed to ensure that planted materials have an acceptable rate of survival

d) A statement that only viable, high quality and regionally adapted seed will be used

e) Site preparation sufficient to establish and grow selected species

OPERATION AND MAINTENANCE

For the purposes of filtering contaminants, permanent filter strip vegetative plantings shall be harvested as appropriate to encourage dense growth, maintain an upright growth habit and remove nutrients and other contaminants that are contained in the plant tissue.

Control undesired weed species, especially state-listed noxious weeds.

If prescribed burning is used to manage and maintain the filter strip, an approved burn plan must be developed.

Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas and take other measures to prevent concentrated flow through the filter strip.

Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.

Periodically re-grade and re-establish the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function. Reestablish the filter strip vegetation in these regraded areas, if needed.

If grazing is used to harvest vegetation from the filter strip, the grazing plan must insure that the integrity and function of the filter strip is not adversely affected.

REFERENCES

Dillaha, T.A., J.H. Sherrard, and D. Lee. 1986. Long-Term Effectiveness and Maintenance of Vegetative Filter Strips. VPI-VWRRC Bulletin 153.

Dillaha, T.A., and J.C. Hayes. 1991. A Procedure for the Design of Vegetative Filter Strips: Final Report Prepared for U.S. Soil Conservation Service.

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Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture. Agriculture Handbook 703.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

ACCESS CONTROL

(Ac.)

CODE 472

DEFINITION

The temporary or permanent exclusion of animals, people, vehicles, and/or equipment from an area.

PURPOSE

Achieve and maintain desired resource conditions by monitoring and managing the intensity of use by animals, people, vehicles, and/or equipment in coordination with the application schedule of practices, measures and activities specified in the conservation plan.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all land uses.

CRITERIA

Use-regulating activities (e.g., posting of signs, patrolling, gates, fences and other barriers, permits) shall achieve the intended purpose and include mitigating associated resource concerns to acceptable levels during their installation, operation, and maintenance. Activities will complement the application schedule and life span of other practices specified in the conservation plan.

Each activity or measure will identify the entity to be monitored and regulated (animals, people, vehicles and/or equipment) and specify the intent, intensity, amounts, and timing of exclusion by that entity. Activities may involve temporary to permanent exclusion of one to all entities.

Placement, location, dimensions and materials (e.g., signs, gates), and frequency of use (e.g., continuous, specific season, or specific dates) shall be described for each activity including monitoring frequency.

CONSIDERATIONS

Even though usage of the area is monitored and controlled, the land manager and/or tenant should be advised about emergency preparedness agencies and related information, e.g., the local fire/wildfire control agency and pumper truck water sources on or near the area. Information should be designated initially and re-designated annually.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each area and recorded using approved specification sheets, job sheets, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Monitoring of the effectiveness of use-regulating activities will be performed routinely and at least annually with changes made to specifications and operation and maintenance requirements as necessary.

Modifications to activities and use of measures are allowed temporarily to accommodate emergency-level contingencies such as wildfire, hurricane, drought, or flood as long as resource conditions are maintained.

REFERENCES

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U.S. Department of Transportation, Federal Highway Administration. 2003. Manual on Uniform Traffic Control Devices for Streets and Highways - Part 5, Traffic Control Devices for Low-Volume Roads. Washington, DC. http://mutcd.fhwa.dot.gov/pdfs/2003r1r2/pdf_index.htm

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

MULCHING

(Ac.)

CODE 484

DEFINITION

Applying plant residues or other suitable materials produced off site, to the land surface.

PURPOSE

- Conserve soil moisture
- Moderate soil temperature
- Provide erosion control
- Suppress weed growth
- Facilitate the establishment of vegetative cover
- Improve soil condition
- Reduce airborne particulates

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where mulches are needed. This practice may be used alone or in combination with other practices.

CRITERIA

General Criteria Applicable to All Purposes

The selection of mulching materials will depend primarily on site conditions and the material's availability. Mulch materials shall consist of natural and/or artificial materials that are environmentally safe such as plant residue, wood bark or chips, gravel, plastic, fabric, rice hulls, or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended purpose for the required time period.

Prior to mulching, the soil surface shall be prepared in order to achieve the desired purpose.

The mulch material shall be evenly applied and, if necessary, anchored to the soil. Tackifiers, emulsions, pinning, netting, crimping or other acceptable methods of anchoring will be used if needed to hold the mulch in place for specified periods.

As a minimum, manufactured mulches shall be applied according to the manufacturer's specifications.

Mulching operations shall comply with federal, state and/or local laws and regulations during the installation, operation and maintenance of this practice.

Mulch material shall be relatively free of disease, pesticides, chemicals, noxious weed seeds, and other pests and pathogens.

Additional Criteria to Conserve Soil Moisture

Mulch materials applied to the soil surface shall provide at least 60 percent surface cover to reduce potential evaporation.

Additional Criteria to Moderate Soil Temperature

Mulch materials shall be selected and applied to obtain 100 percent coverage over the area treated. The material shall be of a significant thickness to persist for the period required for the temperature modification.

Additional Criteria to Provide Erosion Control

When mulching with cereal grain straw or grass hay, apply at a rate to achieve a minimum 70 percent ground cover. Mulch rate shall be determined using current erosion prediction technology to reach the soil erosion objective.

When mulching with wood products such as wood chips, bark, or shavings or other wood materials, apply a minimum 2-inch thickness.

When mulching with gravel or other inorganic material apply a minimum 2 inch thickness and shall consist of pieces 0.75 to 2 inches in diameter.

Additional Criteria to Suppress Weed Growth

The thickness of mulch will be determined by the size of the plant being mulched. Mulches shall be kept clear of the stems of plants where disease is likely to occur. Mulches applied around growing plants or prior to weed seedling development shall have 100 percent ground cover. Thickness of the mulch shall be adequate to prevent emergence of targeted weeds. Plastic mulches may be used.

Additional Criteria to Establish Vegetative Cover

Mulch shall be applied at a rate that achieves a minimum of 70 percent ground cover to provide protection from erosion and runoff and yet allow adequate light and air penetration to the seedbed to ensure proper germination and emergence.

Additional Criteria to Improve Soil Condition

Apply mulch materials with a carbon to nitrogen ratio (C:N) less than 30 to 1 so that soil nitrogen is not immobilized by soil biota. Do not apply mulch with C:N less than 20:1 to an area of designed flow in watercourses.

Use the Soil Conditioning Index to assess soil quality impacts and to determine the type and rate of the mulching material.

Additional Criteria to Reduce Airborne Particulate Matter from Wind Erosion

Mulch rate shall be determined using current wind erosion prediction technology to reach the soil erosion (movement of particulates offsite) objective.

CONSIDERATIONS

Evaluate the effects of mulching on evaporation, infiltration and runoff. Mulch material may affect microbial activity in the soil surface, increase infiltration, and decrease runoff, erosion and evaporation. The temperature of the surface runoff may also be lowered.

Mulch material used to conserve soil moisture should be applied prior to moisture loss. Prior to mulching, ensure soil under shallow rooted crops is moist, as these crops require a constant supply of moisture.

Mulch materials with a high water holding capacity and/or high impermeability to water droplets may adversely affect the water needs of plants.

Fine textured mulches (e.g. rice hulls) which allow less oxygen penetration than coarser materials should be no thicker than 1 or 2 inches.

Organic materials with C:N ratios of less than 20:1 will release nitrate-nitrogen which could cause water quality impairments.

Mulching may also provide habitat for beneficial insect and provide pest suppression.

Clear and infra-red transmissible (IRT) plastics have the greatest warming potential. They are transparent to incoming radiation and trap the longer wavelengths radiating from the soil. Black mulches are limited to warming soils by conduction only and are less effective.

Clear mulches allow profuse weed growth and may negate the benefits of soil warming. Black mulches provide effective weed control. Wavelength selective (IRT) plastic provides the soil warming characteristics of clear mulch with the weed control ability of black mulch.

Low permeability mulches (e.g. Plastic) may increase concentrated flow and erosion on un-mulched areas.

Consider potential toxic alleleopathic effects that mulch material may have on other organisms. Animal and plant pest species may be incompatible with the site.

Consider the potential for increased pathogenic activity within the applied mulch material.

Keep mulch 3 to 6 inches away from plant stems and crowns to prevent disease and pest problems. Additional weed control may be needed around the plant base area.

Deep mulch provides nesting habitat for ground-burrowing rodents that can chew extensively on

tree trunks and/or tree roots. Light mulch applied after the first cold weather may prevent rodents from nesting.

Some mulch material may adversely affect aquatic environments through changes in water chemistry or as waterborne debris. Consider placing mulch in locations that minimizes these risks.

PLANS AND SPECIFICATIONS

Specifications shall be prepared for each site and purpose and recorded using approved specification sheets, job sheets, technical notes, narrative statements in the conservation plan, or other acceptable documentation.

Documentation shall include:

- Purpose of the Mulch
- Type of mulch material used
- The percent cover and/or thickness of mulch material
- Timing of application
- Site preparation
- Listing of netting, tackifiers, or method of anchoring, and
- Operation and maintenance.

OPERATION AND MAINTENANCE

Mulched areas will be periodically inspected, and mulch shall be reinstalled or repaired as needed to accomplish the intended purpose.

Removal or incorporation of mulch materials shall be consistent with the intended purpose and site conditions.

Operation of equipment near and on the site shall not compromise the intended purpose of the mulch.

Prevent or repair any fire damage to the mulch material.

Properly collect and dispose of artificial mulch material after intended use.

Monitor and control undesirable weeds in mulched areas.

REFERENCES

Agriculture and Agri-Food Canada. 2000. Plastic mulches for commercial vegetable production. Canada-Saskatchewan Irrigation Diversification Centre. Outlook, Saskatchewan.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, Coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703.

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USDA, NRCS. 2002. National Agronomy Manual. 190-V. Washington, D.C.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

PRESCRIBED GRAZING

(Ac.)

CODE 528

DEFINITION

Managing the harvest of vegetation with grazing and/or browsing animals.

PURPOSE

This practice may be applied as a part of conservation management system to achieve one or more of the following:

- Improve or maintain desired species composition and vigor of plant communities.
- Improve or maintain quantity and quality of forage for grazing and browsing animals' health and productivity.
- Improve or maintain surface and/or subsurface water quality and quantity.
- Improve or maintain riparian and watershed function.
- Reduce accelerated soil erosion, and maintain or improve soil condition.
- Improve or maintain the quantity and quality of food and/or cover available for wildlife.
- Manage fine fuel loads to achieve desired conditions.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where grazing and/or browsing animals are managed.

CRITERIA

General Criteria Applicable to All Purposes

Removal of herbage will be in accordance with site production limitations, rate of plant growth the physiological needs of forage plants and the nutritional needs of the animals.

Adequate quantity and quality drinking water will be supplied at all times during period of occupancy.

Adjust intensity, frequency, timing and duration of grazing and/or browsing to meet the desired objectives for the plant communities and the associated resources, including the grazing and/or browsing animal.

Manage kind of animal, animal number, grazing distribution, length of grazing and/or browsing periods and timing of use to provide grazed plants sufficient recovery time to meet planned objectives. The recovery period of non-grazing can be provided for the entire year or during the growing season of key plants. Deferment (non-grazing period less than one year) and/or rest (non-grazing period equal or greater than one year) will be planned for critical periods of plant needs.

Provide deferment or rest from grazing or browsing to ensure the success of prescribed fire, brush management, seeding or other conservation practices that cause stress or damage to key plants.

Manage grazing and/or browsing animals to maintain adequate vegetative cover on sensitive areas (i.e. riparian, wetland, habitats of concern, karst areas).

Manage livestock movements based on rate of plant growth, available forage, and allowable utilization target.

Develop contingency plans to deal with expected episodic disturbance events e.g.

insect infestation, drought, wildfire, etc.

Additional Criteria to Improve or Maintain the Health and Vigor of Plant Communities.

Duration and intensity of grazing and/or browsing will be based on desired plant health and expected productivity of key forage species to meet management objectives.

Plan periodic deferment from grazing and/or browsing to maintain or restore the desired plant community following episodic events, such as wildfire or severe drought.

Where appropriate, soil test periodically for nutrient status and soil reaction and apply fertilizer and/or soil amendments according to soil test to improve or maintain plant vigor.

Additional Criteria to Improve or Maintain Quantity and Quality of Forage for Animal Health and Productivity

Plan grazing and/or browsing to match forage quantity and quality goals of the producer within the capability of the resource to respond to management.

Enhance diversity of rangeland and pasture plants to optimize delivery of nutrients to the animals by planning intensity, frequency, timing and duration of grazing and/or browsing.

Plan intensity, frequency, timing and duration of grazing and/or browsing reduce animal stress and mortality from toxic and poisonous plants.

Supplemental feed and/or minerals will be balanced with the forage consumption to meet the desired nutritional level for the kind and class of grazing and/or browsing livestock.

Dietary needs of livestock will be based on the National Research Council's Nutrient Requirements of Domestic Animals or similar scientific sources with appropriate adjustments made for increased energy demand required by browsing or grazing animals foraging for food including travel to and from pasture site.

Biosecurity safeguards will be in place to prevent the spread of disease between on-farm or ranch classes of livestock and between livestock farm or ranch units.

Shelter in the form of windbreaks, sheds, shade structures, and other protective features will be used where conditions warrant to protect livestock from severe weather, intense heat/humidity, and predators.

Additional Criteria to Improve or Maintain Surface and/or Subsurface Water Quality and Quantity.

Minimize concentrated livestock areas to enhance nutrient distribution and improve or maintain ground cover.

Plan intensity, frequency, timing and duration of grazing and/or browsing to:

Minimize deposition or flow of animal wastes into water bodies,

Minimize animal impacts on stream bank or shoreline stability.

Provide adequate ground cover and plant density to maintain or improve infiltration capacity and reduce runoff.

Provide adequate ground cover and plant density to maintain or improve filtering capacity of the vegetation.

Additional Criteria to Improve or Maintain Riparian and Watershed Function.

Minimize concentrated livestock areas to enhance nutrient distribution and improve or maintain ground cover and riparian/floodplain plant community structure and functions.

Plan intensity, frequency, timing and duration of grazing and/or browsing to:

Provide adequate ground cover and plant density to maintain or improve infiltration capacity and reduce runoff.

Provide adequate ground cover and plant density to maintain or improve filtering capacity of the vegetation.

Maintain adequate riparian community structure and function to sustain associated riparian, wetland, floodplain and stream species.

Additional Criteria to Reduce Soil Erosion and Maintain Soil Condition

Minimize concentrated livestock areas, trailing, and trampling to reduce soil compaction, excess runoff and erosion.

Plan intensity, frequency, timing and duration of grazing and/or browsing to provide adequate ground cover, litter and canopy to maintain or improve infiltration and soil condition.

Additional Criteria to Improve or Maintain Food and/or Cover for Fish and Wildlife Species of Concern

Identify species of concern in the objectives of the prescribed grazing plan.

Plan intensity, frequency, timing and duration of grazing and/or browsing to provide for the development and maintenance of the plant structure, density and diversity needed for the desired fish and wildlife species of concern.

Additional Criteria for Management of Fine Fuel Load

Plan intensity, frequency, timing and duration of grazing and/or browsing to reduce hazardous fuel loads.

Plan intensity, frequency, timing and duration of grazing and/or browsing to manage fuel continuity, load and other conditions to facilitate prescribed burns.

CONSIDERATIONS

Protect soil, water, air, plant and animal resources when locating livestock feeding, supplementing, handling and watering facilities.

Livestock feeding, handling, and watering facilities will be designed and installed in a manner to improve and/or maintain animal distribution. These facilities will also be designed and installed to minimize stress, the spread of disease, parasites, contact with harmful organisms and toxic plants.

Utilization or stubble height target levels are tools that can be used in conjunction with monitoring to help ensure that resource conservation and producer objectives are met.

Where practical and beneficial, start the grazing sequence in a different management unit each growing season.

When weeds are a significant problem prescribed grazing and/or browsing should be implemented in conjunction with other pest management practices to promote plant community resistance to invasive species and protect desired plant communities.

Prescribed grazing should consider the needs of other enterprises utilizing the same land, such as wildlife and recreational uses.

Consider improving carbon sequestration in biomass and soils through management of grazing and/or browsing to produce the desired results.

If nutrients are being applied, Nutrient Management (590) will be applied.

PLANS AND SPECIFICATIONS

The prescribed grazing plan shall conform to all applicable federal, state and local laws. Seek measures to avoid adverse affects to endangered, threatened, and candidate species and their habitats.

Prepare a prescribed grazing plan for all planned management units where grazing and/or browsing will occur according to state standards and specifications.

Prescribed Grazing Plan will include:

- Goals and Objectives clearly stated.
- Resource Inventory that identifies:
    - existing resource conditions and concerns
    - ecological site or forage suitability group
    - identifies opportunities to enhance resource conditions
    - location and condition of structural improvements such as fences, water developments, etc, including seasonal availability and quality of watering sites.
- Forage Inventory of the expected forage quality, quantity and species in each management unit(s).

- Forage-Animal Balance developed for the grazing plan, which ensures forage produced or available meets forage demand of livestock and/or wildlife.
- Grazing Plan developed for livestock that identifies periods of grazing and/or browsing, deferment, rest, and other treatment activities for each management unit.
- Contingency plan developed that details potential problems (i.e., severe drought, flooding, insects) and serves as a guide for adjusting the grazing prescription to ensure resource management and economic feasibility without resource degradation.
- Monitoring plan developed with appropriate records to assess in determining whether the grazing strategy is resulting in a positive or upward trend and is meeting objectives. Identify the key areas and key plants that the manager should evaluate in making grazing management decisions.

OPERATION AND MAINTENANCE

Operation. Prescribed Grazing will be applied on a continuing basis throughout the occupation period of all planned grazing units.

Adjustments will be made as needed to ensure that the goals and objectives of the prescribed grazing strategy are met.

Maintenance. Monitoring data and grazing records will be used on a regular basis within the prescribed grazing plan to insure that objectives are being met, or to make necessary changes in the prescribed grazing plan to meet objectives.

All facilitating and accelerating practices (e.g. Fence (382), Pest Management (595), Brush Management (314), Pasture Planting (512) (etc.) that are needed to effect adequate grazing and/or browsing distribution as planned by this practice standard will be maintained in good working order and are being operated as intended.

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NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

ROOF RUNOFF STRUCTURE

(No.)

CODE 558

DEFINITION

A structure that will collect, control and convey precipitation runoff from a roof.

PURPOSE

This practice is applied to achieve one or more of the following purposes:

- Protect surface water quality by excluding roof runoff from contaminated areas
- Protect a structure foundation from water damage or soil erosion from excess water runoff
- Increase infiltration of runoff water
- Capture water for other uses

CONDITIONS WHERE PRACTICE APPLIES

Where roof runoff from precipitation needs to be:

- diverted away from a contaminated area or the foundation of a structure;
- collected and conveyed to a stable outlet or infiltration area; or
- collected and captured for other uses such as evaporative cooling systems, livestock water and irrigation.

CRITERIA

General Criteria Applicable to All Purposes

Evaluate the condition of the existing roof structure prior to installation of a gutter. Install new fascia boards as needed to support gutters and downspouts for the practice life span. Mount gutters on plumb fascia boards.

Ensure that the gutter support system will withstand the anticipated loading, including loads from snow and ice, as applicable. If structural support is missing or insufficient, design the required support for the selected gutter. As an alternative to increasing the structural supports, use a ground gutter design to convey the roof runoff.

Where snow and ice damage will occur, install the roof gutter below the projection of the roof line.

Use a pipe guard or pipe casing where necessary to protect the downspout, lateral or cross-pipe pipelines of the roof runoff structure from damage by livestock or equipment.

Gutter Design Capacity. When a roof runoff structure is used to protect roof runoff from contamination by manure, design the roof runoff structure to convey the flow rate generated from a 25-year, 5-minute rainfall event. (Refer to Agricultural Waste Management Field Handbook, NEH Part 651 Chapter 10 Appendix 10B).

For other applications, design the roof runoff structure to convey the flow rate generated from a 10-year, 5-minute rainfall event.

Downspout. Use downspouts, collector pipes, lateral downspouts or cross-pipes with a capacity equal or exceeding the roof gutter flow rate.

When a downspout outlets at the ground level, place an elbow and energy dissipation device at the outlet to provide erosion protection and direct water away from the foundation of the structure.

Ground Gutter. Where runoff from the roof eave drops onto the ground surface, provide a ground gutter with adequate provision to convey runoff away from the foundation of the structure.

Ground gutter designs can use a rock pad, a rock filled trench with a subsurface drain, a concrete channel, or a pre-cast channel to convey the roof runoff water to a stable discharge location or infiltration area.

Outlet. Roof runoff can empty into a subsurface drain, underground outlet, a ground gutter, a storage tank or onto stabilized soil.

Size the outlet to ensure adequate design capacity. Provide for a clean-out of the outlet as appropriate.

Use NRCS Conservation Practice Standard *Subsurface Drain (Code 606)* to design a subsurface drain used to dewater a ground gutter or infiltration ditch.

Use NRCS Conservation Practice Standard *Underground Outlet (Code 620)* to design an underground outlet used to convey roof runoff to a stable outlet.

Materials. Roof gutters and downspouts may be made of aluminum, galvanized steel, wood, or plastic. Aluminum gutters and downspouts require a minimum nominal thickness of 0.027 inches and 0.020 inches, respectively. Galvanized steel gutters and downspouts require a minimum 28 gauge. Wood may be redwood, cedar, cypress, or other species that has the desired longevity and will be free of knots. Plastics must contain ultraviolet stabilizers.

To prevent corrosion, avoid contact between components of dissimilar metals.

To enable infiltration with rock-filled trenches and rock pads use 'poorly graded rock' (rock fragments approximately all the same size) that is free of appreciable amounts of sand or soil particles. Do not use crushed limestone for backfill material unless it has been washed.

Use NRCS National Engineering Manual, Part 536.20, Design Criteria for Reinforced Concrete, for design and installation of reinforced concrete channels, pads or slabs.

For non-reinforced concrete channels or pads use the NRCS National Engineering Handbook, Part 642, Construction Specification 32, Structural Concrete.

Additional Criteria to Increase Infiltration

Increase runoff infiltration by directing flow to existing landscapes (e.g., lawns, mass planting areas, infiltration trenches, rain gardens or natural areas). Ensure these areas have the capacity to infiltrate the runoff without adversely affecting the desired plant species and without creating a soil erosion problem.

Additional Criteria to Protect the Foundation of a Structure

For a design which outlets the roof runoff on the ground, slope the runoff discharge area away from the structure foundation. Use a minimum downspout extension of five (5) feet to discharge runoff away from the foundation of a structure built on expansive soils or a building foundation placed on bedrock.

Additional Criteria to Capture Water for Other Uses

Design a water storage tank of adequate size, strength and durability to hold water for the intended purpose. Install the tank on a firm, unyielding foundation. Anchor above-ground water storage tanks to prevent damage from wind loads.

Prohibit access to water storage tanks by children and animals to prevent drowning. Protect the area around the tank from erosion caused by overflow from the tank.

Construct or select water storage tanks of materials and in a manner that will not degrade the quality of the stored water. Design water supply attachments to meet system needs. Include a first flush diverter as necessary to reduce sediment, pathogens, and chemical pollutants in the collected water.

The water quality must be suitable for the intended use. The landowner is responsible for any water quality testing and treatment.

CONSIDERATIONS

Consider the use of multiple downspouts to reduce gutter size.

Discharge of outlets near wells and sinkholes or directly into drainage ditches, streams or ponds can cause point source pollution.

Consider installation of rain gardens at the outlets to clean, transpire and infiltrate runoff water.

When underground outlets are used, consider either a strainer at the head of the downspout, or a clean-out port on the riser pipe.

Consider the use of wrap-around straps in lieu of rigid supports on steep roofs where the outer edge of the gutter cannot be placed below the projected roof line.

On roofs subject to snow and ice slides, consider additional supports even if the gutter is installed below the projected roof line.

For cold climates, ensure the underground outlet is deep enough to avoid freezing or include a method to bypass the outlet without damage to the downspout.

PLANS AND SPECIFICATIONS

Provide plans and specifications for installing a roof runoff structure that describe the requirements for applying this practice to achieve its intended purpose. At a minimum, include the location, size and any specific installation instructions of all gutters and spacing of downspouts, type of ground gutters, outlets and the types and quality of material to be used.

Include plans and specifications for other practices essential for the proper functioning of the roof runoff structure.

Instruct landowner and contractor of responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, site conditions and safety requirements. The plan will contain, but not be limited to, the following provisions:

- Keep roof runoff structures clean and free of obstructions that reduce flow.
- Make regular inspections and perform cleaning and maintenance as needed.

REFERENCES

NRCS, 2009, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Agricultural Waste Management System Component Design

NRCS, National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 2, Estimating Runoff

NRCS National Engineering Manual, Part 536.20, Design Criteria for Reinforced Concrete

NRCS National Engineering Handbook, Part 642, Construction Specification 32, Structural Concrete

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

STORMWATER RUNOFF CONTROL

(No. and Ac.)

CODE 570

DEFINITION

Controlling the quantity and quality of stormwater runoff.

PURPOSE

To control stormwater runoff to achieve one or more of the following:

- Minimize erosion and sedimentation during and following construction activities.
- Reduce the quantity of stormwater leaving developing or developed sites.
- Improve the quality of stormwater leaving developing or developed sites.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to sites where stormwater runoff causes or may cause undesirable downstream flooding, sedimentation or channel degradation and/or degradation of surface or ground water quality if left untreated. This practice may apply both to sites undergoing development as well as remedial work on already developed sites.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design and construct stormwater runoff controls to comply with applicable federal, state, and local laws and regulations.

Develop a plan to reduce the impacts of stormwater runoff from the site based on an assessment of the downstream area. As applicable include in the plan practices or management activities that will:

- Reduce onsite erosion.
- Reduce offsite impacts from sedimentation.
- Reduce the quantity of stormwater leaving the site to levels that will not adversely affect downstream receiving channels.
- Improve the quality of runoff leaving the site.
- Leave the site in a stable condition after construction.

Vegetative Measures. Where appropriate, stabilize all areas disturbed by construction with vegetation as soon as possible after construction. Refer to Conservation Practice Standard, (342) Critical Area Planting for the establishment of vegetation. If vegetation is not appropriate for the site, use other measures to stabilize the area.

Safety. Detention ponds and other areas where water is detained or flows swiftly, can present hazards to the public. Where necessary, include appropriate safety features to warn of potential dangers or deter entry to hazardous areas such as fences, gates and warning signs.

Additional Criteria for the Reduction of Water Quantity. Design stormwater control systems to control flow from the area of concern to rates and volumes that will not cause degradation of downstream areas due to erosion or sedimentation. Acceptable peak rates are dependent upon the capacity and stability of the receiving channel. Local regulations may specify acceptable discharge rates for different storm frequencies.

Runoff is controlled by slowing the release of runoff from the site. This can be accomplished by onsite storage, increasing infiltration onsite, lengthening the flow path of runoff or a

combination of these methods.

All runoff control methods must include provisions to safely bypass runoff in excess of the design storm.

Additional Criteria for the Improvement of Water Quality. Runoff from developing areas can be contaminated with a variety of substances including sediment, oils, chemicals and trash. Runoff control systems must include provisions to reduce contaminates in the runoff leaving the site. This can include vegetated filtration areas and other biofilters, trash guards and settling areas that are readily accessible for cleanout. For runoff that is known to be contaminated with substances that may be particularly harmful to the water supply or fish and wildlife, additional measures may be necessary.

Additional Criteria for Erosion and Sediment Control. Control erosion on the site by limiting the amount and length of time that bare soil is exposed to precipitation. This can be accomplished by staging construction and only removing vegetation from a portion of the site at a time, revegetating areas incrementally during construction or using temporary seeding and mulching to stabilize areas until permanent vegetation can be established. Structural erosion control practices can also be installed to reduce the flow length and velocity of runoff to limit erosion.

When erosion cannot be stopped at the source, sediment laden runoff must be filtered or detained to allow sediment particles to settle out to acceptable levels before runoff is released from the site. This can be accomplished by sediment traps, sediment basins and other structures designed to detain or filter runoff. Refer to Conservation Practice Standard, (350) Sediment Basin for design requirements for sediment basins.

CONSIDERATIONS

Research has shown that the first runoff from a site is often the most contaminated. After this initial flush, less pollutants are available for removal and dilution lessens the impact. Consequently treatment of this “first flush” of runoff is often sufficient to address the water quality concern. The exact amount of runoff to treat varies depending upon the surface and level of contamination. Determine the amount of runoff to treat based on appropriate research or experience.

Stormwater control practices can affect downstream hydrology. While this is the point of most stormwater control systems the effect of changing the peak rate and volume of runoff should be considered on downstream areas. The effect of a single project should also be considered in context with other projects in the watershed to determine the cumulative effect. Generally peak rates of runoff should be kept at or below pre-development rates of runoff from the site for the 2 year 24 hour storm. For already developed areas consider reducing the peak flow from the current developed condition.

Design stormwater control practices to fit into the visual landscape as well as to function for runoff control. Since stormwater control practices are generally installed in public spaces, consider how the space will be used and the visual impact the practices will have.

If properly designed, stormwater control practices can be beneficial to wildlife. When possible use native vegetation to provide food and habitat for wildlife and pollinators. Since most stormwater control practices are in aquatic environments, they can inhibit the movements of aquatic organisms. When designing these structures include provisions for the safe passage of aquatic organisms that may inhabit the site.

To be most effective, stormwater control should include a system of practices working together. This might include detention along with infiltration areas and the maintenance of natural, undisturbed areas. However, it could also include managing the development of the site to limit the disturbed area, ensuring that revegation occurs in a timely manner and controlling where heavy equipment is allowed to travel on a site.

Large storms can quickly fill stormwater runoff practices with sediment that must be removed in order for the practices to function correctly. Consequently these practices should be designed for easy access and maintenance.

Since stormwater control practices are often installed in urban and public spaces, vandalism may be a problem. Consider using practices that cannot be easily vandalized such as grouting rock in place and installing barriers and locks where appropriate.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for stormwater runoff control systems that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include:

1. A plan view showing the extent of the practice.
2. Where appropriate, cross-sections and/or profiles showing elevations and distances.
3. Where appropriate, plans for structural details.
4. Where appropriate, seeding requirements.
5. Construction specifications that describe in writing site specific installation requirements for the stormwater runoff control systems.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in the operation and maintenance plan are:

1. Periodic inspections, especially immediately following significant rainfall events.
2. Prompt repair or replacement of damaged components especially surfaces that are subjected to wear or erosion.
3. Regular inspection of settling basins, trash guards and other practices to collect and remove accumulated sediment and debris.
4. Where vegetation is specified, periodic mowing, fertilization and control of vegetation.

REFERENCES

Bannerman, Roger, and E. Considine, 2003. Rain Gardens: A How-to Manual for Homeowners. University of Wisconsin Extension Publication GWQ037 or Wisconsin Department of Natural Resources Publication PUB-WT-776 2003. Madison, WI

U. S. Environmental Protection Agency. 2007. Developing Your Stormwater Pollution Prevention Plan. Washington, DC

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.

PURPOSE

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To protect air quality by reducing nitrogen emissions (ammonia and NO_x compounds) and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests.

For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing movement of nutrients and other potential contaminants to surface and/or ground waters.

Areas contained within established minimum application setbacks (e.g., sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas) shall not receive direct application of nutrients.

The amount of nutrients lost to erosion, runoff, irrigation and drainage, shall be addressed, as needed.

Soil and Tissue Sampling and Laboratory Analyses (Testing). Nutrient planning shall be based on current soil and tissue (where used as a supplement) test results developed in accordance with Land Grant University guidance, or industry practice if recognized by the Land Grant University. Current soil tests are those that are no older than five years.

Soil and tissue samples shall be collected and prepared according to the Land Grant University guidance or standard industry practice. Soil and tissue test analyses shall be performed by laboratories that are accepted in one or more of the following:

- Laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program (NAPT) under the auspices of the Soil Science Society of America, or

- State recognized program that considers laboratory performance and proficiency to assure accuracy of soil test results.

Soil and tissue testing shall include analyses for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, nitrogen, phosphorus and potassium.

Nutrient Application Rates. Soil amendments shall be applied, as needed, to adjust soil pH to an adequate level for crop nutrient availability and utilization.

Recommended nutrient application rates shall be based on Land Grant University recommendations (and/or industry practice when recognized by the university) that consider current soil test results, realistic yield goals and management capabilities. If the Land Grant University does not provide specific recommendations, application shall be based on realistic yield goals and associated plant nutrient uptake rates.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- Nitrogen Application **-** Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are a source of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.

- Phosphorus Application **-** Planned phosphorus application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are sources of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.

- Potassium Application - Potassium shall not be applied in situations in which excess (greater than soil test potassium recommendation) causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines.

- Other Plant Nutrients - The planned rates of application of other nutrients shall be consistent with Land Grant University guidance or industry practice if recognized by the Land Grant University in the state.

- Starter Fertilizers - When starter fertilizers are used, they shall be included in the overall nutrient budget, and applied in accordance with Land Grant University recommendations, or industry practice if recognized by the Land Grant University within the state.

Nutrient Application Timing. Timing and method of nutrient application (particularly nitrogen) shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, risk assessment tools (e.g., leaching index, P index) and field accessibility.

Nutrient Application Methods. Application methods to reduce the risk of nutrient transport to surface and ground water, or into the atmosphere shall be employed.

To minimize nutrient losses:

- Apply nutrient materials uniformly to application area(s).

- Nutrients shall not be applied to frozen, snow-covered or saturated soil if the potential risk for runoff exists.

- Nutrients shall be applied considering the plant growth habits, irrigation practices, and other conditions so as to maximize availability to the plant and minimize the risk of runoff, leaching, and volatilization losses.

- Nutrient applications associated with irrigation systems shall be applied in a

manner that prevents or minimizes resource impairment.

Conservation Management Unit (CMU) Risk Assessment. In areas with identified or designated nutrient related water quality impairment, a CMU specific risk assessment of the potential for nutrient transport from the area shall be completed.

States that utilize a threshold prescreening procedure to trigger CMU risk assessment shall follow approved procedures as recommended by the respective state or Land Grant University.

Use an appropriate nutrient risk assessment tool for the nutrient in question (e.g., leaching index, phosphorus index) or other state recognized assessment tool.

Additional Criteria Applicable to Manure and Organic By-Products or Biosolids Applied as a Plant Nutrient Source

When animal manures or organic by-products are applied, a risk assessment of the potential for nutrient transport from the CMU shall be completed to adjust the amount, placement, form and timing of application of nutrient sources, as recommended by the respective state or Land Grant University.

Nutrient values of manure and organic by-products (excluding sewage sludge or biosolids) shall be determined prior to land application. Samples will be taken and analyzed with each hauling/emptying cycle for a storage/treatment facility. Manure sampling frequency may vary based on the operation's manure handling strategy and spreading schedule. If there is no prior sampling history, the manure shall be analyzed at least annually for a minimum of three consecutive years. A cumulative record shall be developed and maintained until a consistent (maintaining a certain nutrient concentration with minimal variation) level of nutrient values is realized. The average of results contained in the operation's cumulative manure analyses history shall be used as a basis for nutrient allocation to fields. Samples shall be collected and prepared according to Land Grant University guidance or industry practice.

In planning for new operations, acceptable "book values" recognized by the NRCS and/or the Land Grant University may be used if they accurately estimate nutrient output from the proposed operation (e.g., NRCS Agricultural Waste Management Field Handbook).

Biosolids (sewage sludge) shall be applied in accordance with USEPA regulations. (40 CFR Parts 403 (Pretreatment) and 503 (Biosolids) and other state and/or local regulations regarding the use of biosolids as a nutrient source.

Manure and Organic By-Product Nutrient Application Rates. Manure and organic by-product nutrient application rates shall be based on nutrient analyses procedures recommended by the respective state or Land Grant University. As indicated above, "book values" may be used in planning for new operations. At a minimum, manure analyses shall identify nutrient and specific ion concentrations, percent moisture, and percent organic matter. Salt concentration shall be monitored so that manure applications do not cause plant damage or negatively impact soil quality.

The application rate (in/hr) of liquid materials applied shall not exceed the soil intake/infiltration rate and shall be adjusted to minimize ponding and to avoid runoff. The total application shall not exceed the field capacity of the soil and shall be adjusted, as needed, to minimize loss to subsurface tile drains.

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

Nitrogen Application Rates

- When manure or organic by-products are used, the nitrogen availability of the planned application rates shall match plant uptake characteristics as closely as possible, taking into consideration the timing of nutrient application(s) in order to minimize leaching and atmospheric losses.
- Management activities and technologies shall be used that effectively utilize mineralized nitrogen and that minimize nitrogen losses

through denitrification and ammonia volatilization.

- Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.
- When the nutrient management plan component is being implemented on a phosphorus basis, manure or organic by-products shall be applied at rates consistent with a phosphorus limited application rate. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply, but not exceed, the recommended amounts of nitrogen in any given year.

Phosphorus Application Rates

- When manure or organic by-products are used, the planned rates of phosphorus application shall be consistent with any one of the following options:
  - ◊ Phosphorus Index (PI) Rating. Nitrogen-based manure application on Low or Medium Risk Sites; phosphorus-based or no manure application on High and Very High Risk Sites.**
  - ◊ Soil Phosphorus Threshold Values. Nitrogen-based manure application on sites on which the soil test phosphorus levels are below the threshold values; Phosphorus-based or no manure application on sites on which soil phosphorus levels equal or exceed threshold values.**
  - ◊ Soil Test. Nitrogen-based manure application on sites for which the soil test recommendation calls for phosphorus application; phosphorus-based or no manure application on sites for which the soil test recommendation calls for no phosphorus application. ‡

    ** Acceptable phosphorus-based manure application rates shall be determined as a function of soil test recommendation or estimated phosphorus removal in harvested plant biomass. Guidance for developing these acceptable rates is found in the NRCS General Manual, Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy), and the National Agronomy Manual, Section 503 (to be developed).
- The application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. When such applications are made, the application rate shall:
  - ◊ Not exceed the recommended nitrogen application rate during the year of application, or
  - ◊ Not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
  - ◊ Not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices or management activities are used to reduce the vulnerability.

Heavy Metal Monitoring. When sewage sludge (biosolids) is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

Additional Criteria to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere

In areas with an identified or designated nutrient management related air quality concern, any component(s) of nutrient

management (i.e., amount, source, placement, form, timing of application) identified by risk assessment tools as a potential source of atmospheric pollutants shall be adjusted, as necessary, to minimize the loss(es).

When tillage can be performed, surface applications of manure and fertilizer nitrogen formulations that are subject to volatilization on the soil surface (e.g., urea) shall be incorporated into the soil within 24 hours after application.

When manure or organic by-products are applied to grassland, hayland, pasture or minimum-till areas the rate, form and timing of application(s) shall be managed to minimize volatilization losses.

When liquid forms of manure are applied with irrigation equipment, operators will select weather conditions during application that will minimize volatilization losses.

Operators will handle and apply poultry litter or other dry types of animal manures when the potential for wind-driven loss is low and there is less potential for transport of particulates into the atmosphere.

Weather and climatic conditions during manure or organic by-product application(s) shall be recorded and maintained in accordance with the operation and maintenance section of this standard.

Additional Criteria to Improve the Physical, Chemical and Biological Condition of the Soil

Nutrients shall be applied and managed in a manner that maintains or improves the physical, chemical and biological condition of the soil.

Minimize the use of nutrient sources with high salt content unless provisions are made to leach salts below the crop root zone.

To the extent practicable nutrients shall not be applied when the potential for soil compaction and rutting is high.

CONSIDERATIONS

The use of management activities and technologies listed in this section may improve both the production and environmental performance of nutrient management systems.

The addition of these management activities, when applicable, increases the management intensity of the system and is recommended in a nutrient management system.

Action should be taken to protect National Register listed and other eligible cultural resources.

The nutrient budget should be reviewed annually to determine if any changes are needed for the next planned crop.

For sites on which there are special environmental concerns, other sampling techniques may be appropriate. These include soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.

Additional practices to enhance the producer's ability to manage manure effectively include modification of the animal's diet to reduce the manure nutrient content, or utilizing manure amendments that stabilize or tie-up nutrients.

Soil test information should be no older than one year when developing new plans, particularly if animal manures are to be used as a nutrient source.

Excessive levels of some nutrients can cause induced deficiencies of other nutrients.

If increases in soil phosphorus levels are expected, consider a more frequent (annual) soil testing interval.

To manage the conversion of nitrogen in manure or fertilizer, use products or materials (e.g. nitrification inhibitors, urease inhibitors and slow or controlled release fertilizers) that more closely match nutrient release and availability for plant uptake. These materials may improve the nitrogen use efficiency (NUE) of the nutrient management system by reducing losses of nitrogen into water and/or air.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Ground Water.

Erosion control and runoff reduction practices can improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and protect or improve water and air quality (Consider installation of one or more NRCS FOTG, Section IV – Conservation Practice Standards).

Cover crops can effectively utilize and/or recycle residual nitrogen.

Apply nutrient materials uniformly to the application area. Application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere include:

- Split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- Use stalk-test to minimize risk of over applying nitrogen in excess of crop needs.
- Avoid winter nutrient application for spring seeded crops,
- Band applications of phosphorus near the seed row,
- Incorporate surface applied manures or organic by-products as soon as possible after application to minimize nutrient losses,
- Delay field application of animal manures or organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.

Odors associated with the land application of manures and organic by-products can be offensive to the occupants of nearby homes. Avoid applying these materials upwind of occupied structures when residents are likely to be home (evenings, weekends and holidays).

When applying manure with irrigation equipment, modifying the equipment can reduce the potential for volatilization of nitrogen from the time the manure leaves the application equipment until it reaches the surface of the soil (e.g., reduced pressure, drop down tubes for center pivots). N volatilization from manure in a surface irrigation system will be reduced when applied under a crop canopy.

When planning nutrient applications and tillage operations, encourage soil carbon buildup while discouraging greenhouse gas emissions (e.g., nitrous oxide N_2O, carbon dioxide CO_2).

Nutrient applications associated with irrigation systems should be applied in accordance with the requirements of Irrigation Water Management (Code 449).

CAFO operations seeking permits under USEPA regulations (40 CFR Parts 122 and 412) should consult with their respective state permitting authority for additional criteria.

PLANS AND SPECIFICATIONS

Plans and specifications for nutrient management shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize resource impairment.

Nutrient management plans shall include a statement that the plan was developed based on requirements of the current standard and any applicable Federal, state, or local regulations, policies, or programs, which may include the implementation of other practices and/or management activities. Changes in any of these requirements may necessitate a revision of the plan.

The following components shall be included in the nutrient management plan:

- aerial site photograph(s) or site map(s), and a soil survey map of the site,
- location of designated sensitive areas or resources and the associated, nutrient management restriction,
- current and/or planned plant production sequence or crop rotation,
- results of soil, water, manure and/or organic by-product sample analyses,
- results of plant tissue analyses, when used for nutrient management,

- realistic yield goals for the crops,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the crop rotation or sequence,
- listing and quantification of all nutrient sources,
- CMU specific recommended nutrient application rates, timing, form, and method of application and incorporation, and
- guidance for implementation, operation, maintenance, and recordkeeping.

If increases in soil phosphorus levels are expected, the nutrient management plan shall document:

- the soil phosphorus levels at which it may be desirable to convert to phosphorus based planning,
- results of appropriate risk assessment tools to document the relationship between soil phosphorus levels and potential for phosphorus transport from the field,
- the potential for soil phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus loss.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
- significant changes in animal numbers and/or feed management will necessitate additional manure sampling and analyses to establish a revised average nutrient content.
- protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- calibration of application equipment to ensure uniform distribution of material at planned rates.
- documentation of the actual rate at which nutrients were applied. When the actual rates used differ from the recommended and planned rates, records will indicate the reasons for the differences.
- Maintaining records to document plan implementation. As applicable, records include:
    - Soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application,
    - quantities, analyses and sources of nutrients applied,
    - dates and method(s) of nutrient applications,
    - weather conditions and soil moisture at the time of application; lapsed time to manure incorporation, rainfall or irrigation event.
    - crops planted, planting and harvest dates, yields, and crop residues removed,
    - dates of plan review, name of reviewer, and recommended changes resulting from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling ammoniacal nutrient sources, or when dealing with organic wastes stored in unventilated enclosures.

Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.

Nutrient containers should be recycled in compliance with state and local guidelines or regulations.

REFERENCES

Follett, R.F. 2001. Nitrogen Transformation and Transport Processes. pp. 17-44, In R.F. Follett and J. Hatfield. (eds.). 2001. Nitrogen in the Environment; Sources, Problems, and Solutions. Elsevier Science Publishers. The Netherlands. 520 pp.

Sims, J.T. (ed.) 2005. Phosphorus: Agriculture and the Environment. Agron. Monogr. 46. ASA, CSSA, and SSSA, Madison, WI.

Stevenson, F.J. (ed.) 1982. Nitrogen in Agricultural Soils. Agron. Series 22. ASA, CSSA, and SSSA, Madison, WI.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

INTEGRATED PEST MANAGEMENT (IPM)

(Ac.)

CODE 595

DEFINITION

A site-specific combination of pest prevention, pest avoidance, pest monitoring, and pest suppression strategies.

PURPOSE

1. Prevent or mitigate off-site pesticide risks to water quality from leaching, solution runoff and adsorbed runoff losses.
2. Prevent or mitigate off-site pesticide risks to soil, water, air, plants, animals and humans from drift and volatilization losses.
3. Prevent or mitigate on-site pesticide risks to pollinators and other beneficial species through direct contact.
4. Prevent or mitigate cultural, mechanical and biological pest suppression risks to soil, water, air, plants, animals and humans.

CONDITIONS WHERE PRACTICE APPLIES

On all lands where pests will be managed.

CRITERIA

General Criteria Applicable to All Purposes

IPM strategies (Prevention, Avoidance, Monitoring and Suppression or "PAMS") shall be employed to prevent or mitigate pest management risks for identified natural resource concerns.

A comprehensive IPM plan utilizing PAM's strategies will be developed in accordance with this standard to document how specific pest management risks will be prevented or mitigated. The IPM plan must be crop and/or land use specific and adhere to applicable elements and guidelines accepted by the local Land Grant University or Extension.

If a comprehensive IPM system is not feasible, utilize appropriate IPM techniques to adequately prevent or mitigate pest management risks for identified natural resource concerns.

Additional Criteria to Prevent or Mitigate Off-site Pesticide Risks to Water Quality from Leaching, Solution Runoff and Adsorbed Runoff Losses

For identified water quality concerns related to pesticide leaching, solution runoff and adsorbed runoff, the current version of the USDA-NRCS WIN-PST program will be used to evaluate potential risks to humans and/or fish, as appropriate, for each pesticide to be used.

The minimum level of mitigation required for each resource concern is based on the final risk ratings in the "WIN-PST Soil/Pesticide Interaction Hazard Ratings" Table below:

WIN-PST Identified Hazard Rating	Minimum Mitigation Index Score Level Needed
Low or Very Low	None Needed
Intermediate	20
High	40
Extra High	60

Use Agronomy Technical Note 4, Pest Management in the Conservation Planning Process - Table II to determine if planned conservation practices provide adequate mitigation. If they do not, use Agronomy Technical Note 4 - Table I to apply appropriate IPM techniques with this practice.

Additional Criteria to Prevent or Mitigate Off-site Pesticide Risks to Soil, Water, Air, Plants, Animals and Humans from Drift and Volatilization Losses

For identified natural resource concerns related to pesticide drift, use Agronomy Technical Note 4, Pest Management in the Conservation Planning Process – Table II to determine if planned conservation practices provide adequate mitigation. If they do not, use Agronomy Technical Note 4 - Table I to apply appropriate IPM techniques with this practice. The minimum level of mitigation required for drift is an index score of 20.

For Volatile Organic Compound (VOC) emission concerns, apply at least one IPM mitigation technique from the Pesticide Volatilization section of Agronomy Technical Note 4 - Pest Management in the Conservation Planning Process.

Additional Criteria to Prevent or Mitigate On-site Pesticide Risks to Pollinators and Other Beneficial Species through Direct Contact

For direct contact pesticide risks to pollinators and other beneficial species in the application area, apply at least two IPM mitigation techniques from the Pesticide Direct Contact section of Agronomy Technical Note 4 - Pest Management in the Conservation Planning Process.

Additional Criteria to Prevent or Mitigate Cultural, Mechanical and Biological Pest Suppression Risks to Soil, Water, Air, Plants and Animals

For identified natural resource concerns related to cultural, mechanical and biological pest suppression, (e.g. air quality concerns with burning for weed control or soil erosion concerns with tillage for weed control), natural resource concerns shall be addressed to FOTG quality criteria levels.

CONSIDERATIONS

IPM strategies that keep pest populations below economically damaging levels and minimize pest resistance should be utilized because they also help prevent unnecessary pest management risks to natural resources and humans.

For noxious weed and invasive species control, the minimum level of pest suppression necessary to meet natural resource objectives should be used, however, for the eradication of invasive species, the acceptable pest threshold may be zero.

IPM Prevention, Avoidance, Monitoring, and Suppression (PAMS) techniques include:

- Prevention – Activities such as cleaning equipment and gear when leaving an infested area, using pest-free seeds and transplants, and irrigation scheduling to limit situations that are conducive to disease development.
- Avoidance – Activities such as maintaining healthy and diverse plant communities, using pest resistant varieties, crop rotation, and refuge management.
- Monitoring – Activities such as pest scouting, degree-day modeling, and weather forecasting to help target suppression strategies and avoid routine preventative treatments.
- Suppression – Activities such as the judicious use of cultural, mechanical, biological and chemical control methods that reduce or eliminate a pest population or its impacts while minimizing risks to non-target organisms.

IPM guidelines from the local Land Grant University or Extension may be supplemented with information from appropriately certified professionals.

When providing technical assistance to organic producers, the IPM approach to managing pests should be consistent with the USDA-Agricultural Marketing Service National Organic Program standard which includes:

- A diverse crop rotation that reduces habitat for major pests and increases habitat for natural enemies
- Use of “farmscaping” principles to create borders of beneficial species habitat
- Farming techniques to improve soil quality
- Planting of locally adapted, pest resistant crop cultivars.

Adequate plant nutrients and soil moisture, including favorable pH and soil quality, can reduce plant stress, improve plant vigor and

increase the plant's overall ability to tolerate pests.

On irrigated land, irrigation water management should be designed to avoid conditions conducive to disease development and minimize offsite contaminant movement.

Producers should be reminded that they are responsible for following all pesticide label instructions and complying with all applicable Federal, state and local regulations, including those that protect Threatened and Endangered Species.

Enhancement Considerations

1. A more intensive level of IPM focused primarily on prevention and avoidance strategies can further minimize pest management risks to natural resources and humans.
2. Precision pesticide application techniques in an IPM system can further minimize pesticide risks to natural resources and humans.

PLANS AND SPECIFICATIONS

The IPM plan shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

The IPM plan shall include at a minimum:

1. Plan map and soil map of site/affected area, if applicable (use conservation plan maps if available).
2. Location of sensitive resources and setbacks, if applicable (use conservation plan maps if available).
3. Interpretation of the environmental risk analysis. Note: all pesticide label requirements and federal, state, and local regulations must be followed for all pesticide applications.
4. Identification of appropriate mitigation techniques. See Agronomy Technical Note 4 - Table I for pesticide risk mitigation management techniques.
5. A list of pest prevention and avoidance strategies that will be implemented, if applicable.
6. A scouting plan and threshold levels for each pest, if applicable.
7. Other monitoring plans, if applicable, such as weather monitoring to indicate when pesticide application for prevention is warranted.
8. A list of accepted pest thresholds or methods to determine thresholds that warrant treatment, if applicable.

Note: Items 5, 6, 7 and 8 are required to document a comprehensive IPM system, but they may not be applicable when only a limited number of mitigation techniques are sufficient to address identified natural resource concerns.

Record Keeping. The following records, where applicable, shall be maintained by the producer:

1. Monitoring or scouting results including the date, pest population/degree of infestation, and the crop or plant community condition.
2. When and where each pest suppression technique was implemented.
3. When and where special IPM techniques were implemented to mitigate site-specific risks (e.g. soil incorporation of a pesticide to reduce its surface runoff to a nearby stream).

Note: Applicability will depend on the level of IPM adoption and mitigation requirements.

OPERATION AND MAINTENANCE

The IPM plan shall include appropriate operation and maintenance items for the client. These may include:

- Review and update the plan periodically in order to incorporate new IPM strategies, respond to cropping system and pest complex changes, and avoid the development of pest resistance.
- Maintain mitigation techniques identified in the plan in order to ensure continued effectiveness.
- Calibrate application equipment according to Extension and/or manufacturer recommendations before each season of use and with each major chemical change.
- Maintain records of pest management for at least two years. Pesticide application records shall be in accordance with USDA

Agricultural Marketing Service's Pesticide Recording Keeping Program and site specific requirements.

REFERENCES

National Information System for the Regional IPM Centers – IPM Elements and Guidelines:

http://www.ipmcenters.org/ipmelements/index.cfm

USDA-AMS National Organic Program, National List of Allowed and Prohibited Substances.

http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateN&navID=NationalListLinkNOPNationalOrganicProgramHome&rightNav1=NationalListLinkNOPNationalOrganicProgramHome&topNav=&leftNav=NationalOrganicProgram&page=NOPNationalList&resultType=&acct=nopgeninfo

USDA-NRCS GM-190-404 Pest Management Policy:

http://directives.sc.egov.usda.gov/RollupViewer.aspx?hid=17015

Using Farming Bill Programs for Pollinator Conservation:

http://plants.usda.gov/pollinators/Using_Farm_Bill_Programs_for_Pollinator_Conservation.pdf

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SURFACE DRAIN, FIELD DITCH

(Ft.)

CODE 607

DEFINITION

A graded ditch for collecting excess water in a field.

PURPOSE

This practice may be applied as part of a resource conservation system to achieve one or more of the following:

- Interception of excess subsurface water and conveyance to an outlet.
- Collection or interception of excess surface water, such as sheet flow from natural and graded land surfaces or channel flow from furrows, and conveyance to an outlet.
- Drainage of surface depressions.

CONDITIONS WHERE PRACTICE APPLIES

The practice is applicable to sites that:

- Have soils that are slowly permeable (low permeability) or are shallow over barriers such as rock or clay, which hold or prevent ready percolation of water to a deep stratum.
- Have surface depressions or barriers that trap rainfall.
- Have insufficient land slope for ready movement of runoff across the surface.
- Receive excess runoff or seepage from uplands.
- Require the removal of excess irrigation water.
- Require control of the water table.

CRITERIA

General Criteria Applicable to All purposes

Field ditches shall be planned as integral parts of a drainage system for the field served and shall collect and intercept water and carry it to an outlet with continuity and without ponding.

Investigations. An investigation shall be made to assure adequate outlets are available for discharge of drainage water by gravity flow or pumping.

Location. On extensive areas of uniform topography, collection or interception ditches shall be installed as required for effective drainage.

Size. The size of field ditch shall be computed by applying Manning's formula.

Velocity. The design velocity shall not exceed the maximum velocity contained in Table 14.3 of NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage).

Criteria Applicable to Interception of Excess Subsurface Water

Capacity. One or more of the following shall determine the required capacity:

- Application of locally tried and proven drainage coefficients to the acreage drained, including added capacity required to dispose of surface water entering through inlets.
- Yield of ground water based on the expected deep percolation of irrigation water from the overlying fields, including the leaching requirement.

- Comparison of the site with other similar sites where subsurface drain yields have been measured.
- Measurement of the rate of subsurface flow at the site during a period of adverse precipitation and ground water conditions.
- Application of Darcy's law to lateral or artesian subsurface flow.
- Estimates of lateral or artesian subsurface flow.

Depth, Spacing, and Location. The depth, spacing, and location of field ditches shall be based on site conditions, including soils, topography, ground water conditions, crops, land use, outlets, and saline or sodic conditions.

Criteria Applicable to Collection or Interception of Excess Surface Water

The capacity, size, depth, side slopes, and cross sectional area shall be based on the State Drainage Guide recommendations, if available. If local information is not available, use the information contained in NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage).

CONSIDERATIONS

When planning this practice, the following items should be considered as applicable:

- Ditches shall be established, insofar as topography and property boundaries permit, in straight or nearly straight courses. Random alignment may be used to follow depressions and isolated wet areas of irregular or undulating topography. Excessive cuts and the creation of small irregular fields shall be avoided.
- Permit free entry of water from adjacent land surfaces without causing excessive erosion.
- Permit crossing by field equipment if feasible.
- Provide effective removal or reuse of excess irrigation water.
- Potential impacts on downstream flows or aquifers that would affect other water uses or users.
- Potential water quality impacts for soluble pollutants, sediments and sediment-attached pollutants.
- Potential for uncovering or redistributing toxic materials.
- Impacts on cultural resources.
- Effects on wetlands or water-related wildlife habitats.
- Potential benefits of Drainage Water Management, including reduction of nutrient concentrations, improved plant productivity, and providing seasonal wildlife habitat.
- Potential effects of Drainage Water Management on downstream water temperatures or salinity of soils.
- The need for riparian buffers, filter strips and fencing.
- Effects on water budget components, especially the relationships between runoff and infiltration.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing drainage field ditches shall be in keeping with this standard and shall describe the requirements for properly installing the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

A site-specific operation and maintenance plan shall be provided to and reviewed with the landowner(s) before the practice is installed.

The plan shall adequately guide the landowner(s) in the routine maintenance and operational needs of the ditch(es). The plan shall also include guidance on periodic inspections and post-storm inspections to detect and minimize damage to the ditches.

REFERENCES

National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage).

NRCS, NHCP

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

TREE/SHRUB ESTABLISHMENT

(Ac.)

CODE 612

DEFINITION

Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.

PURPOSE

Establish woody plants for:

- forest products such as timber, pulpwood, and energy biomass
- wildlife habitat
- long-term erosion control and improvement of water quality
- treating waste
- storing carbon in biomass
- energy conservation
- improving or restoring natural diversity
- enhancing aesthetics.

CONDITIONS WHERE PRACTICE APPLIES

Tree/shrub establishment can be applied on any appropriately prepared site where woody plants can be grown.

Utilize other practice standards for specialized tree/shrub establishment situations, e.g., Riparian Forest Buffer, 391; Alley Cropping, 311; Windbreak/Shelterbelt Establishment, 380; Critical Area Planting, 342; Hedgerow Planting, 422.

CRITERIA

General Criteria Applicable to All Purposes

Composition of species will be adapted to site conditions and suitable for the planned purpose(s).

Species considered locally invasive or noxious shall not be used.

Planting or seeding rates will be adequate to accomplish the planned purpose for the site.

Planting dates, and care in handling and planting of the seed, cuttings or seedlings will ensure that planted materials have an acceptable rate of survival.

Only viable, high-quality and adapted planting stock or seed will be used.

A precondition for tree/shrub establishment is appropriately prepared sites. Refer to practice standard Tree/Shrub Site Preparation, 490.

Adequate seed sources or advanced reproduction needs to be present or provided for when using natural regeneration to establish a stand.

Selection of planting technique and timing will be appropriate for the site and soil conditions.

The acceptability and timing of coppice regeneration shall be based on species, age and diameter.

The planting will be protected from plant and animal pests and fire. If pesticides are used, refer to standard Pest Management, 595, as appropriate.

Each site will be evaluated to determine if mulching, supplemental water or other cultural treatments (e.g., tree protection devices,

shade cards, brush mats) will be needed to assure adequate survival and growth.

Additional Criteria for Treating Waste

Species used to treat waste shall have fast growth characteristics, extensive root systems, high nutrient uptake capacity and tolerance of the planned effluent.

Additional Criteria for Improving or Restoring Natural Diversity

Composition of species selected for planting or those favored for natural regeneration will be native to the site and create a successional stage or state that can progress to the potential natural plant community.

Additional Criteria for Storing Carbon in Biomass

The species and plant communities that attain biomass more quickly will sequester carbon faster. The rate of carbon sequestration is enhanced as trees and/or shrubs mature and soil organic matter increases. Select plants that have higher rates of growth and potential for carbon sequestration in biomass and are adapted to the site. Plant species at the appropriate stocking rate for the site.

CONSIDERATIONS

Priority should be given to plant materials that have been selected and tested in tree/shrub improvement programs. All plant materials should comply with minimum standards such as those as established by the American Nursery and Landscape Association, Forest Service, or state-approved nursery.

Plans for landscape and beautification plantings should consider foliage color, season and color of flowering, and mature plant height.

Consider using species which best meet local wildlife needs.

Tree/shrub arrangement and spacing should allow for and anticipate the need for future access lanes for purposes of stand management.

Residual chemical carryover should be evaluated prior to planting and alter species selection and/or timing of planting/seeding.

When underplanting, trees should be planted sufficiently in advance of overstory removal to ensure full establishment.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Access by vehicles or equipment during or after tree/shrub establishment shall be controlled to protect new plants and minimize erosion, compaction and other site impacts. Refer to the standard Use Exclusion, 472.

The trees and shrubs will be inspected periodically and protected from adverse impacts including insects, diseases or competing vegetation, fire and damage from livestock or wildlife.

If needed, competing vegetation will be controlled until the woody plants are established. Noxious weeds will be controlled. If pesticides are used, refer to standard Pest Management, 595.

Replanting will be required when survival is inadequate.

Supplemental water will be provided as needed.

Periodic applications of nutrients may be needed to maintain plant vigor.

After trees and/or shrubs are established, refer to the standards Forest Stand Improvement, 666, and Tree/Shrub Pruning, 660, for subsequent management.

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WATER AND SEDIMENT CONTROL BASIN

(No.)

CODE 638

DEFINITION

An earth embankment or a combination ridge and channel constructed across the slope of minor watercourses to form a sediment trap and water detention basin with a stable outlet.

PURPOSE

This practice may be applied as part of a resource management system for one or more of the following purposes:

- To reduce watercourse and gully erosion
- To trap sediment
- To reduce and manage onsite and downstream runoff

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to sites where:

1. The topography is generally irregular.
2. Watercourse or gully erosion is a problem.
3. Sheet and rill erosion is controlled by other conservation practices.
4. Runoff and sediment damages land and works of improvements.
5. Adequate outlets can be provided.

Do not use this standard in place of terraces. Where the ridge and/or channel extends beyond the detention basin or level embankment, use Conservation Practice Standard (600), Terrace or (362) Diversion as appropriate.

CRITERIA

General Criteria Applicable to All Purposes

Install Water and Sediment Control Basins as part of a conservation system that adequately addresses resource concerns both above and below the basin. Where land ownership or physical conditions preclude treatment of the upper portion of a slope, a Water and Sediment Control Basin may be used to separate this area from, and permit treatment of the lower slope.

Location. Locate Water and Sediment Control Basins to control erosion in drainage ways. Basins may be installed singly or in series as part of system. Adjust the location to fit the topography, maximize storage and accommodate farm equipment and farming operations.

Earth embankment. Minimum top widths are given in Table 1. Construct embankments at least 5% greater than design height to allow for settlement. Measured from natural ground at the centerline of the embankment, the maximum settled height of the embankment must be 15 feet or less.

Table 1. Minimum Top Width of Embankments

Fill Height (feet)	Top Width (feet)
0 – 5	3
5 - 10	6
10 –15	8

Design embankment slopes no steeper than 2 horizontal to 1 vertical. The sum of the horizontal components of the upstream and downstream slopes of the embankment must

be 5 or greater. Design all slopes to be farmed no steeper than those on which farm equipment can be operated safely.

Foundation cutoff and seepage control. Portions of basin ridges designed to impound more than a 3-foot depth of water must include foundation cutoff and if conditions warrant, seepage control. Refer to Conservation Practice Standard (378), Pond for criteria for foundation cutoff and seepage control.

Capacity. As a minimum, design Water and Sediment Control Basins with sufficient capacity to control the runoff from a 10-year frequency, 24-hour duration storm using a combination of flood storage and discharge through the outlet. Where basins are used for flood control or to protect other works of improvement, if warranted, use larger design storms appropriate to the risk.

In addition to the above storage, Water and Sediment Control Basins must have the capacity to store at least the anticipated 10-year sediment accumulation, or periodic sediment removal is required in the Operation and Maintenance Plan to maintain the required capacity.

Outlets. A Water and Sediment Control Basin must have an adequate outlet. The outlet must convey runoff water to a point where it will not cause damage. Outlets can be underground outlets, pipe drop structures, soil infiltration, stabilized channels or a combination of outlet types.

If the basin is cropped, design the outlet so that the flow release time does not exceed the inundation tolerance of the planned crops. If sediment retention is a primary design goal, adjust the release rate according to sediment particle size so that sediment is retained in the basin. Refer to Conservation Practice Standard (620), Underground Outlet for design criteria for underground outlets.

Outlets can include auxiliary spillways above the primary storage to handle large storm flows. If an auxiliary spillway is used, add freeboard to the design height of the embankment to provide for the safe operation of the spillway. The freeboard shall be at least 0.5 ft. above the design flow depth through the auxiliary spillway. Auxiliary spillways must not contribute runoff to lower Water and Sediment Control Basins unless they are designed to handle the runoff. Refer to Conservation Practice Standard (378), Pond for criteria to design auxiliary spillways.

Topsoil. Where necessary to restore or maintain productivity, spread topsoil over areas disturbed by construction. Topsoil can be salvaged and stockpiled from the site of the Water and Sediment Control Basin prior to construction.

Vegetation. After construction of the Water and Sediment Control Basin, revegetate disturbed areas that will not be cropped as soon as possible. In non-cropland settings other erosion protection such as gravel or organic mulches can also be used.

Refer to Conservation Practice Standard (342), Critical Area Planting for criteria on seed selection, seedbed preparation, fertilizing and seeding.

CONSIDERATIONS

Water and Sediment Control Basins can be spaced at intervals down a slope, similar to terraces, in order to control erosion. Refer to Conservation Practice Standard (600), Terraces for methods to determine spacing. Additional conservation measures may be needed in the water course between basins to prevent erosion.

When choosing the location of a Water and Sediment Control Basin be sure to consider the extent of ponding that will occur from the basin. If the basin will cause water to pond near or across property lines both land owners should agree in writing on the elevation and expected duration of ponding.

The soil survey can be a valuable resource when planning and designing water and sediment control basins. The soil survey can identify potential problems such as the presence of limiting layers to plant growth in the soil profile. Field investigations can then identify problem areas to avoid such as shallow bedrock or dense, acid or saline layers that will adversely affect plant growth if construction brings them into the root zone.

Sediment retention within the basin can be enhanced by using flow deflectors, inlet and outlet selection, and by increasing the length to width ratio of the basin.

For cropped fields, embankment orientation and crop row direction should be approximately perpendicular to the land slope to support contour farming. The design should support farmability by limiting short point rows or sharp curves. Field boundaries and row lengths should also be considered in planning basin location and row direction.

Underground outlets from Water and Sediment Control Basins can provide a direct conduit to receiving waters for contaminated runoff from crop land. To reduce the impact of this runoff, Water and Sediment Control Basins should be installed as part of a conservation system that includes such practices as grassed waterways, contouring, a conservation cropping system, conservation tillage, nutrient and pest management, crop residue management and filter areas to reduce or mitigate contaminated runoff.

Seasonal water sources can be very important for migratory waterfowl and other wildlife. Partially blocking the outlet of a basin during non-cropping times of the year will allow water to pond in the basin to provide water for wildlife. Refer to Conservation Practice Standard (646) Shallow Water Development and Management for information on managing seasonal water sources for wildlife.

The construction of a Water and Sediment Control Basin can disturb large areas and potentially affect cultural resources. Be sure to follow state cultural resource protection policies before construction begins.

The construction of Water and Sediment Control Basins can introduce steep and potentially dangerous slopes into crop fields. When designing Water and Sediment Control Basins that will be farmed, choose flat slopes that will be safe for operating farm equipment. Where steep slopes are unavoidable, make sure that the farmer is aware of the location of the basin and the potential danger.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for Water and Sediment Control Basins that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include:

1. A plan view of the layout of the Water and Sediment Control Basin system.
2. Typical cross sections of the basin(s).
3. Profile(s) of the basin(s).
4. Details of the outlet system.
5. For underground outlets, details of the inlet and profile(s) of the underground outlet.
6. Seeding requirements if needed.
7. Construction specifications that describe in writing site specific installation requirements of the Water and Sediment Control Basin system.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in the operation and maintenance plan are:

1. Periodic inspections, especially immediately following significant runoff events.
2. Prompt repair or replacement of damaged components.
3. Maintenance of basin ridge height and outlet elevations.
4. Removal of sediment that has accumulated in the basin to maintain capacity and grade.
5. Regular cleaning of inlets for underground outlets. Repair or replacement of inlets damaged by farm equipment. Removal of sediment around inlets to ensure that the inlet remains the lowest spot in the basin.
6. Where vegetation is specified, regular mowing and control of trees and brush. Vegetative disturbance should be scheduled to avoid the peak nesting season.

7. Notification of hazards about steep slopes on the basin.

REFERENCES

USDA, NRCS. National Engineering Handbook, Part 650 Engineering Field Handbook, Chapters 6, 8, 14.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

RESTORATION AND MANAGEMENT OF RARE OR DECLINING HABITATS

(Ac.)

CODE 643

DEFINITION

Restoring, conserving, and managing unique or diminishing native terrestrial and aquatic ecosystems.

PURPOSE

To return aquatic or terrestrial ecosystems to their original or usable and functioning condition and to improve biodiversity by providing and maintaining habitat for fish and wildlife species associated with the ecosystem.

CONDITIONS WHERE PRACTICE APPLIES

Sites or areas that once supported or currently support a unique, dwindling, or imperiled native plant and animal community.

CRITERIA

All necessary local, state, and federal permits shall be obtained by the landowner (or designee) prior to the restoration.

Methods used shall be designed to protect the soil resource from erosion and compaction.

Invasive plant and animal species and noxious weeds shall be controlled. When possible, control will be limited to that necessary to control undesirable species while still protecting habitat that benefit native pollinators and other fish and wildlife species that depend on the site for food, cover, and water.

Undisturbed areas shall be conserved on a sufficient extent of the area to sustain disturbance-intolerant species.

Plant species and seeding rate specifications will be prepared to achieve desired habitat condition.

Only high quality and ecologically adapted plant materials will be used. When feasible, only local ecotypes will be used.

Site preparation, planting dates and methods, and plant material care and handling shall optimize vegetation survival and growth.

A pretreatment assessment of the targeted habitat will be documented to provide a baseline for comparison with post-treatment habitat conditions. Goals or success criteria will be established using reference sites for guidance and comparison. Where no such reference site exists, use ecological site description or historic data to establish restoration goals.

Use of fertilizers, pesticides and other chemicals shall not compromise the intended purpose of this practice

CONSIDERATIONS

Confer with other agencies and organizations to develop guidelines and specifications to conserve declining habitats.

Vegetative manipulations to restore plant and/or animal diversity can be accomplished by prescribed burning or mechanical, biological or chemical methods, or a combination of the four. Where prescribed burning is conducted it shall follow all guidelines delineated in the Prescribed Burning (Code 338) practice standard.

Consider how land use and habitat in the associated landscape may influence the ability

to achieve restoration and management objectives.

Consider the likelihood of being able to maintain or establish important ecological disturbances such as burning, flooding or grazing.

Consider how the short and long term effects of climate change may influence the ability to achieve restoration and management objectives.

Generally, the size of the restored or managed habitat should be large enough to support populations of all species associated with the targeted habitat.

Other conservation practices that will facilitate the restoration and management of rare and declining habitats include:

Fence – Code 382

Access Control – Code 472

Range Planting – Code 550

Brush Management – Code 314

Tree and Shrub Establishment – Code 612

Prescribed Burning – Code 338

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared. Specifications shall be recorded using approved specifications sheets and job sheets. Narrative statements in the conservation plan or other acceptable documentation may provide supplemental information to the specifications and job sheets.

OPERATION AND MAINTENANCE

Haying, grazing, prescribed burning, forest stand improvement, and other management activities will be planned and managed (including access control) as necessary to achieve and maintain the intended purpose.

Vegetation management and maintenance activities shall not be conducted during critical life stages of fish and wildlife except when necessary to achieve the desired habitat condition.

Habitat conditions should be evaluated and compared to reference conditions on a regular basis to adapt the conservation plan and schedule maintenance to ensure the desired habitat condition.

Management and maintenance activities should be rotated to mimic natural disturbance regimes.

REFERENCES

Barbour, M.G., and W. D. Billings (eds.). 2000. North American Terrestrial Vegetation. Cambridge University Press, New York, Second Edition.

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND WILDLIFE HABITAT MANAGEMENT

(Ac.)

CODE 644

DEFINITION

Retaining, developing or managing wetland habitat for wetland wildlife.

PURPOSE

To maintain, develop, or improve wetland habitat for waterfowl, shorebirds, fur-bearers, or other wetland dependent or associated flora and fauna.

CONDITIONS WHERE PRACTICE APPLIES

On or adjacent to wetlands, rivers, lakes and other water bodies where wetland associated wildlife habitat can be managed. This practice applies to natural wetlands and/or water bodies as well as wetlands that may have been previously restored (657), enhanced (659), and created (658).

CRITERIA

A habitat evaluation or appraisal, approved by the NRCS state office, shall be used to identify habitat-limiting factors in the planning area.

Application of this practice shall remove or reduce limiting factor(s) in their order of significance, as indicated by results of the habitat evaluation.

Application of this practice alone, or in combination with other supporting and facilitating practices, shall result in a conservation system that will enable the planning area to meet or exceed the minimum quality criteria for wildlife habitat established in Section III of the FOTG.

Identify wildlife species management goals and objectives. For the desired species, identify the types, amount and distribution of habitat elements and the management actions necessary to achieve the management objectives.

Native plants will be used wherever possible.

Sites containing hazardous waste will be cleaned prior to the installation of this practice.

Invasive plant species and federally/state listed noxious and nuisance species shall be controlled on the site.

CONSIDERATIONS

Consider effects management will have on disease vectors such as mosquitoes.

Consider effects on downstream flows or aquifers that would affect other water uses or users.

Consider effects on fish and wildlife habitats that would be associated with the practice.

Establishing vegetative buffers on surrounding uplands can reduce the delivery of sediment and soluble and sediment-attached contaminants carried by runoff and/or wind.

The nutrient and pesticide tolerance of the species planned should be considered where known nutrient and pesticide contamination exists.

Consider effects on temperature of water resources to prevent undesired effects on aquatic and wildlife communities.

Soil disturbance associated with the installation of this practice may increase the potential of invasion by unwanted species.

Adding dead snags, tree trunks or logs can provide structure and cover for wildlife and serve as a carbon source for food chain support.

For discharge wetlands, consider underground upslope water and/or groundwater source availability.

When determining which species to plant, consider microtopography and different hydrology levels.

Consider effects of management actions on compliance with state and federal hunting regulation (e.g., baiting).

Water level draw-downs may increase the potential for turtle mortality (4).

Consider effects of livestock grazing on runoff, infiltration, wetland vegetation and nesting success.

Adding artificial nesting structures that are appropriate for the region can increase utilization of these areas.

Locating this practice adjacent to existing wetlands and other water bodies will provide connectivity to these cover types.

The improved habitat that results from the installation of this practice may lead to increased crop depredation by wildlife on adjacent cropland.

Consider adjacent wetlands or water bodies that contribute to wetland system complexity and diversity, decrease habitat fragmentation, and maximize use of the site by wetland-associated wildlife.

PLANS AND SPECIFICATIONS

Document how habitat needs will be provided for the desired kinds of wildlife:

- required depth of water during the different seasons;
- types and sizes of structures required;
- desired native plant species and the means of establishing and maintaining them.

Specific information may be provided using appropriate job sheets or written documentation in the conservation plan.

OPERATION AND MAINTENANCE

A plan for operation and maintenance at a minimum should include monitoring and management of structural and vegetative measures.

Haying and livestock grazing plans, if haying or livestock grazing is used as a needed wildlife management tool, will be developed to allow the establishment, development and management of wetland and associated upland vegetation for the intended wetland and/or wildlife purpose.

Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible.

Added water depth and duration may be utilized as a method to control unwanted vegetation (e.g., reed canary grass).

REFERENCES

Hall, C.D. and F.J. Cuthbert. 2000. Impact of a controlled wetland drawdown on Blanding's Turtles in Minnesota. Chelonian Conservation Biology. Vol. 3, No. 4, pp. 643-649.

Helmers, D.L. 1992. Shorebird management manual. Western Hemisphere Shorebird Reserve Network, Manomet, MA 58 pp.

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Smith, Loren M. and Roger L. Pederson. 1989. Habitat management for migrating and wintering waterfowl in North America. Texas Tech University Press, 574 pp.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

EARLY SUCCESSIONAL HABITAT DEVELOPMENT/MANAGEMENT

(Ac.)

CODE 647

DEFINITION

Manage plant succession to develop and maintain early successional habitat to benefit desired wildlife and/or natural communities.

PURPOSE

To provide habitat for species requiring early successional habitat for all or part of their life cycle.

CONDITIONS WHERE PRACTICE APPLIES

On all lands that are suitable for the kinds of desired wildlife and plant species.

CRITERIA

Management will be designed to achieve the desired plant community structure (e.g., density, vertical and horizontal cover) and plant species diversity.

Where planting is needed, regionally adapted plant materials will be used.

Site preparation, planting dates, and planting methods shall optimize survival.

Planting of noxious weeds and invasive species is prohibited.

Measures must be provided to control noxious weeds and invasive species.

If using chemical methods of control, Pesticide Screening Tool (WinPST) shall be used to assess risks, and appropriate mitigation to reduce known risks shall be employed.

To benefit insect food sources for grassland nesting birds, spraying or other control of noxious weeds will be in a targeted manner through the use of spot spraying, mechanical or hand wick applicators, or other approved methods to protect grasses, forbs and legumes that benefit native pollinators and other wildlife.

Management will be timed to minimize negative impacts to wildlife. Disturbance to habitat shall be restricted during critical periods (e.g., wildlife nesting, brood rearing, fawning or calving seasons).

Minimize soil disturbance in natural communities where soil integrity is essential, on steep slopes, on highly erodible soil, and where establishment of invasive species is likely.

When grazing is used as a management tool, a prescribed grazing plan developed to specifically meet the intent and objective(s) of this practice standard is required.

CONSIDERATIONS

Vegetative manipulation to maximize plant and animal diversity can be accomplished by disturbance practices that include, but are not limited to: selected herbicide techniques, brush management prescribed burning, light disking, mowing, prescribed grazing, or a combination of these.

This practice should be applied periodically to maintain the desired early successional plant community and rotated throughout the managed area.

Wildlife habitat purposes often require lighter seeding rates than specified to prevent soil erosion.

Design and install the treatment layout to facilitate:

- operation of machinery

- use of natural firebreaks or development and maintenance of bare soil firebreaks when prescribed burning.

When prescribed grazing, consider setting aside a paddock near the center of the pasture and defer grazing until after the critical nest and brood rearing period. Many grassland birds require more than 40 days to fledge their young.

When selecting plants and designing management for this practice, consider the needs of pollinators and incorporate to the maximum extent practicable.

PLANS AND SPECIFICATIONS

Written specifications, application schedules and maps shall be prepared for each site. Specifications shall identify the amounts and kinds of habitat elements, locations and management actions necessary to achieve management objectives.

Specifications shall be transmitted to clients using approved specification sheets, job sheets, and customized practice narratives or by other written documentation approved by NRCS.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

Occasional disturbance may be incorporated into the management plan to ensure the intended purpose of this practice.

Any use of fertilizers, pesticides and other chemicals shall not compromise the intended purpose.

REFERENCES

Best, L. B., K. E. Freemark, J.J.Dinsmore and M. Camp. 1995. A review and synthesis of bird habitat use in agricultural landscapes of Iowa. Am. Midl.Nat. 134:1-29.

Burger, L.W. 2002. Quail management: Issues, concerns, and solutions for public and private lands-a southeastern perspective. Proceedings of the National Quail Symposium 5.

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Shepherd, M. D., S. L. Buchmann, M. Vaughan, S. H. Black. 2003. *Pollinator Conservation Handbook: A Guide to Understanding, Protecting, and Providing Habitat for Native Pollinator Insects*, 145 pp. Portland: The Xerces Society.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

CONSTRUCTED WETLAND

(Ac.)

CODE 656

DEFINITION

An artificial ecosystem with hydrophytic vegetation for water treatment.

PURPOSE

For treatment of wastewater and contaminated runoff from agricultural processing, livestock, and aquaculture facilities, or

For improving the quality of storm water runoff or other water flows lacking specific water quality discharge criteria.

CONDITIONS WHERE PRACTICE APPLIES

- Constructed wetlands for the purpose of wastewater treatment apply where a constructed wetland is a component of an agricultural wastewater management system.
- Constructed wetlands for the purpose of water quality improvement apply where wetland effluent is not required to meet specific water quality discharge criteria.

This standard should not be used in lieu of NRCS Conservation Practice Standards, Wetland Restoration (657), Wetland Creation 658, or Wetland Enhancement (659), when the main purpose is to restore, create, or enhance, wetland functions other than wastewater treatment or water quality improvement.

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

Locate the wetland to minimize the potential for contamination of ground water resources, and to protect aesthetic values.

Provide appropriate inlet control structures to prevent debris from entering the wetland, to control the rate of inflow during normal operations, and to control inflow as necessary for operation and maintenance.

Provide an outlet control structure capable of maintaining appropriate water depths to achieve the desired water treatment, and to meet the requirements of the hydrophytic vegetation.

The minimum height of interior embankments shall contain the design water depth and a sufficient depth for the accretion of settlable solids, decayed plant litter and microbial biomass. In the absence of an accretion rate analysis the minimum depth for accretion shall be 1 inch per year for either the design life of the practice or between scheduled debris and sediment removal maintenance operations.

Provide an auxiliary spillway or inlet bypass with sufficient capacity to pass the peak flow of the 25-year frequency, 24-hour duration storm and provide erosion protection for the perimeter embankment.

Unless otherwise specified, the spillway requirements, embankment configurations, excavated side slopes, protective cover on disturbed soils and disposal of excavated material shall comply with the general criteria, criteria for embankment ponds, and criteria for excavated ponds as appropriate as contained in NRCS Conservation Practice Standard, Pond (378).

Soils used in constructing the embankment shall be suitable for that purpose according to the Unified Soil Classification System.

Use a planting medium that has a cation exchange capacity, pH, electrical conductivity,

organic matter, and textural class that is conducive to wetland plant growth and retention of contaminants.

Select wetland plants that are suitable for local climatic conditions and tolerant of the concentrations of nutrients, pesticides, salts and other contaminants flowing into the wetland. Do not use invasive or non-native species that could be a problem in native habitats.

Provide supplemental water as necessary to establish and maintain plants in a condition suitable for the water treatment purpose.

CRITERIA APPLICABLE TO WASTEWATER TREATMENT

Locate outside the boundary area of natural wetlands of any classification.

When located in a floodplain, provide protection from inundation or damage from a 25-year frequency flood event.

Pretreat water flowing to the wetland to reduce the concentrations of solids, organics, and nutrients to levels that will be tolerated by the wetland system and to prevent excessive accumulation of solids within the wetland.

Provide sufficient storage upstream of the wetland to contain the wastewater and runoff from a 25-year frequency, 24-hour duration storm. The outlet of this storage shall deliver the water to the wetland at a rate consistent with the treatment objectives of the wetland.

Design the wetland system with a minimum of two rows of functionally parallel cells.

Determine the surface area using design procedures in NRCS National Engineering Handbook, Part 637, Chapter 3, Constructed Wetlands, or alternative design procedures that are recognized by the regulatory and academic conservation partners in the state.

Construct wetland cells with a sufficient length-to-width ratio to assure uniform and predictable hydraulic retention times.

Control seepage as necessary for similar wastewater management facilities.

Exclude livestock from the wetland.

CRITERIA APPLICABLE TO WATER QUALITY IMPROVEMENT

When located in a floodplain or watercourse provide protection from damage from a 10-year frequency flood event.

When used to improve the water quality of surface water runoff, design the wetland so that it will return to design operating levels within 72 hours after a 10-year frequency, 24-hour duration storm event.

When used in populated areas install safety fences and warning signs forbidding access by unauthorized persons.

Provide an adequate access for cleanout and maintenance.

CONSIDERATIONS

Consider the impact a constructed wetland could have on existing wetlands or other significant features in the landscape ecosystem.

Consider bat boxes, mosquito fish, and other measures to control vectors and nuisance insects when locating the wetland near residences, commercial buildings, and public use areas.

Consider seasonal storage of contaminated water upstream of the wetland during cold, dry, or excessively wet climatic conditions when the function of the wetland may be compromised.

Effluent from the wetlands may be stored for land application, recycled through the wastewater management system, or otherwise used in the agricultural operation.

Measures for controlling seepage may be designed according to the procedures in NRCS National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Appendix 10d, “Geotechnical Design and Construction Guidelines.”

Where wetland performance may be compromised by large, infrequent storm events, consider providing an inlet that captures the first flush of storm water runoff and allows excess flow to bypass the wetland.

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Consider a sedimentation basin, and reaches of shallow and deep water within the wetland.

Provide inflow and outflow structures and cell geometries that promote cross-sectional mixing of water flowing through the wetland cell.

Consider the potential of pollutants entering the wetland that may cause environmental problems due to accumulation, biological uptake, or release during maintenance operations.

When selecting vegetative species, give priority to native wetland plants collected or grown from material within the Major Land Resource Area (MLRA) of the Constructed Wetland location, and consider the potential to transport chemical contamination from the wetland plant site to the constructed wetland.

Fences or other measures may be needed to exclude or minimize access of humans or animals that could be adversely affected by the constructed wetland or that would inhibit its function.

Consider access for animals that might be attracted to the wetland, and egress for fish that could be entrained and trapped. Flatter side slopes generally provide better habitat for wildlife. If there is a desire to use the constructed wetland for wildlife habitat, consult NRCS Conservation Practice Standards, Wetland Restoration (657), Wetland Enhancement (659), Wetland Creation (658), Wetland Wildlife Habitat Management (644), and Shallow Water Development and Management (646).

Consider providing embankment protection against burrowing animals.

Consider vegetative buffers (herbaceous and woody) around the perimeter of constructed wetland for additional filtering of pollutants entering and leaving wetland areas during precipitation events.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each specific field site where a constructed wetland will be installed. Define the purpose, goals, and objectives of the practice and the soils, hydrology and vegetation criteria. Include information about the location, construction sequence, and vegetation establishment.

Specifications shall include:

- Dimensions of the constructed wetland
- Species selection
- Seeding rates, sprigging rates or planting density of containerized plants.
- Planting dates, care and handling of the seed to ensure that planted materials have an acceptable rate of survival.
- Site preparation such as stabilizing crop, mulching, or mechanical means of stabilizing, fertilizer, and pH adjustment sufficient to establish and grow selected species.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes and intended life of the practice. Include the requirements for safety, water management, cleanout of sediment, maintenance of structures, embankments, and vegetation, control measures for vectors and pests, and containment of potential pollutants during maintenance operations.

Operational requirements include:

- Maintenance of water level in wetland cells appropriate for vegetation
- Control flow to wetland according to water budget
- Monitoring of wetland performance
- Sampling effluent for nutrients prior to utilization
- Surveillance of inlet and outlet

Maintenance requirements should include:

- Repair of embankments
- Control density of desirable vegetation.
- Removal of invasive and/or non-native species that could be a problem in native habitats
- Repair of fences or other ancillary features
- Replacement of wetland plants

- Repair of pipelines and spillways
- Control of unwanted animals (varmints) or vectors (mosquitoes)

REFERENCES

USDA, NRCS. National Engineering Handbook, Part 637, Chapter 3. Constructed Wetlands.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND RESTORATION

(Ac.)

CODE 657

DEFINITION

The rehabilitation of a degraded wetland or the reestablishment of a wetland so that soils, hydrology, vegetative community, and habitat are a close approximation of the original natural condition that existed prior to modification to the extent practicable.

PURPOSE

To restore wetland function, value, habitat, diversity, and capacity to a close approximation of the pre-disturbance by:

- Restoring hydric soil
- Restoring hydrology (depth duration and season of inundation, and/or duration and season of soil saturation).
- Restoring native vegetation (including the removal of undesired species, and/or seeding or planting of desired species).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies only to natural wetland sites with hydric soils, or problem soils that are hydric, which have been subject to hydrologic or vegetative degradation, or to sites where hydric soils are covered by fill, sediment, or other deposits.

This practice is applicable only where the natural hydrologic conditions, including the hydroperiods, can be approximated by modifying drainage and/or by artificial flooding of a duration and frequency similar to the original, natural conditions.

This practice does not apply:

- to treat point and non-point sources of water pollution (Constructed Wetland - 656);
- to modify an existing wetland where specific attributes are heightened by management objectives, and/or returning a degraded wetland back to a wetland but to a different type than what previously existed on the site (Wetland Enhancement - 659);
- to creating a wetland on a site location which historically was not a wetland (Wetland Creation - 658).

CRITERIA

General Criteria Applicable to All Purposes

The purpose, goals and objectives of the restoration shall be clearly outlined, including soils, hydrology and vegetation criteria that are to be met and are appropriate for the site and the project purposes.

The soil, hydrology and vegetative characteristics existing on the site and the contributing watershed shall be documented before restoration of the site begins.

The nutrient and pesticide tolerance of the species planned shall be considered where known nutrient and pesticide contamination exists.

Upon completion of the restoration, the site shall meet soil, hydrology, vegetation and habitat conditions of the wetland that previously existed on the site to the extent practicable.

Where offsite drainage or the presence of invasive species impact the site, the design shall compensate for these landscape changes (e.g., increased water depth, berms or microtopography).

Sites suspected of containing hazardous waste shall be tested to identify appropriate remedial measures. Sites containing hazardous material shall be cleaned prior to the installation of this practice.

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) shall be controlled on the site. This includes the manipulation of water levels to control unwanted vegetation. The establishment and/or use of non-native plant species shall be discouraged where possible.

Criteria for Hydric Soil Restoration

Restoration sites will be located on hydric soils, or on problem soil areas that are hydric.

If the hydric soil is covered by fill, sediment, spoil, or other depositional material, the material covering the hydric soil shall, to the extent technically feasible, be removed.

Criteria for Hydrology Restoration

The hydrology (including the timing of inflow and outflow, duration, and frequency) and hydroperiod of the restored site shall approximate the conditions that existed before alteration. This includes affects to hydrology restoration caused by roads, ditches, drains, terraces, etc. within the watershed.

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

A natural water supply should be used to reestablish the site's hydrology that approximates the needs of the wetland type. If this is not possible, an artificial water supply can be used; however, these sources shall not be diverted from other wetland resources (e.g. prairie pothole wetland complexes or springs).

To the extent technically feasible reestablish topographic relief and/or microtopography.

Use reference sites within the area to determine desired topographic relief.

Excavations from within the wetland shall remove sediment to approximate the original topography and/or microtopography or establish a water level that will compensate for the sediment that remains.

Existing drainage systems will be utilized, removed or modified as needed to achieve the intended purpose.

Criteria for Vegetative Restoration

Hydrophytic vegetation restoration shall be of species typical for the wetland type(s) being established. Preference shall be given to native wetland plants with localized genetic material.

Where natural colonization of pre-identified, selected species will realistically dominate within 5 years, sites may be left to revegetate naturally. If a site has not become dominated by the targeted species within 5 years, active forms of revegetation may be required.

Adequate substrate material and site preparation necessary for proper establishment of the selected plant species shall be included in the design.

Where planting and/or seeding is necessary, the minimum number of native species to be established shall be based upon the type of vegetative communities present and the vegetation type planned:

- Where the dominant vegetation will be herbaceous community types, a subset of the original vegetative community shall be established within 5 years; or, a suitable precursor to the original community will be established within 5 years that creates conditions suitable for the establishment of the native community. Species richness shall be addressed in the planning of herbaceous communities.

Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a minimum of six species. Seeding rates shall be based upon percentage of pure live seed that shall be tested within 6 months of planting.

CONSIDERATIONS

It is expected that for wildlife purposes, planting density and stocking rates will generally be lower than for production purposes, and that the selection of species will generally be different than those used for production purposes.

On sites where woody vegetation will dominate, consider adding 1 to 2 dead snags, tree stumps or logs per acre to provide structure and cover for wildlife and a carbon source for food chain support.

Consider impact that water surface draw-downs will have on concentrating aquatic species such as turtles into diminished pool area resulting in increased mortality.

Consider existing wetland functions and/or values that may be adversely impacted.

Consider the effect restoration will have on disease vectors such as mosquitoes.

Consider effect of volumes and rates of runoff, infiltration, evaporation and transpiration on the water budget.

Consider effects on downstream flows or aquifers that would affect other water uses or users.

Consider the effect of water control structures on the ability of fish or other aquatic species to move in and out of the wetland.

Consider establishing herbaceous vegetation by a variety of methods over the entire site, or a portion of the site, and at densities and depths appropriate.

Consider effects on wetlands and water-related resources, including fish and wildlife habitats, which would be associated with the practice.

Consider linking wetlands by corridors wherever appropriate to enhance the wetland's use and colonization by the native flora and fauna.

Consider establishing vegetative buffers on surrounding uplands to reduce sediment and soluble and sediment-attached substance carried by runoff and/or wind.

Consider effects on temperature of water resources to prevent undesired effects on aquatic and wildlife communities.

Consider the effects of soil disturbance and probability of invasion by unwanted species.

For discharge wetlands, consider underground upslope water and/or groundwater source availability.

Consider microtopography and hydroperiod when determining which species to plant.

Consider controlling water levels to prevent oxidation of organic soils and inundated organic matter and materials.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other documentation. Requirements for the operation and maintenance of the practice shall be incorporated into site specifications. Plans and specifications should be reviewed by staff with appropriate training in design and implementation of wetland restoration.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance):

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals shall assure that the intended purpose of the wetland restoration shall not be compromised;

Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible;

Establish an inspection schedule for embankments and structures for damage assessment;

The depth of accumulated sediment should be measured and the accumulations removed when the planned project objectives are jeopardized.

Management actions shall maintain vegetation, and control undesirable vegetation.

For wildlife habitat purposes, haying and grazing, if justified as a necessary wildlife/wetland management tool, can be used for management of vegetation. Disturbance to ground nesting species shall be minimized.

The control of water depth and duration may be utilized to control unwanted vegetation.

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NRCS, NHCP

August 2005

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND ENHANCEMENT

(Ac.)

CODE 659

DEFINITION

The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site; sometimes at the expense of other functions.

PURPOSE

To increase the capacity of specific wetland functions (such as habitat for targeted species, and recreational and educational opportunities) by enhancing:

- Hydric soil functions (changing soil hydrodynamic and/or bio-geochemical properties).
- Hydrology (dominant water source, hydroperiod, and hydrodynamics).
- Vegetation (including the removal of undesired species, and/or seeding or planting of desired species).
- Enhancing plant and animal habitats.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any degraded or non-degraded wetland sites with hydric soils, where the objective is to enhance selected wetland functions to conditions different than those that originally existed on the site.

This practice does not apply to:

- The treatment of point and non-point sources of water pollution (Constructed Wetland – Code 656);
- The rehabilitation of a degraded wetland or the reestablishment of a former wetland so that soils, hydrology, vegetative community, and habitat are a close approximation of the original natural condition and boundary that existed prior to the modification (Wetland Restoration – Code 657).
- The creation of a wetland on a site location that was historically non-wetland. (Wetland Creation – Code 658).
- The management of fish and wildlife habitat on wetlands enhanced under this standard.

CRITERIA

General Criteria Applicable to All Purposes

The purpose, goals, and objectives of the enhancement shall be clearly defined in the enhancement plan, including soils, hydrology, vegetation, and fish and wildlife habitat criteria that are to be met and are appropriate for the site and the project objectives.

The planning process will evaluate the impact of this practice on existing non-degraded wetland functions and/or values. The relative increase or decrease in functions will be assessed with the use of a functional assessment procedure or state approved equivalent. The functions to be increased or decreased on wetlands found to be currently functioning at or near a “reference” condition will be documented.

The soils, hydrology, and vegetative conditions existing on the site, the adjacent landscape, and the contributing watershed shall be documented in the planning process.

The nutrient and pesticide tolerance of the plant and animal species likely to occur shall be evaluated where known nutrient and pesticide contamination exists. Sites suspected of containing hazardous material shall be tested to identify appropriate remedial measures. If remedial measures are not possible or practicable, the practice shall not

be planned.

The availability of sufficient water rights should be reviewed prior to enhancement.

Upon completion, the site shall meet the appropriate wetland criteria and provide wetland functions as defined in the project's objectives.

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) shall be controlled on the site as necessary to enhance wetland functions. The establishment and/or use of non-native plant species shall be discouraged.

Criteria for Hydric Soil Enhancement

Enhancement sites will be located on soils that are hydric.

Changes to soil hydrodynamic and bio-geochemical properties such as permeability, porosity, pH, or soil organic carbon levels shall be made as needed to meet the planned objectives.

Criteria for Hydrology Enhancement

The hydroperiod, hydrodynamics, and dominant water source of the enhanced site shall meet the project objectives. The enhancement plan shall document the adequacy of available water sources based on groundwater investigation, stream gage data, water budgeting, or other appropriate means.

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

Timing and level setting of water control structures required for the establishment and maintenance of vegetation, soil, and wildlife and fish habitat functions shall be determined.

Other structural practices, macrotopography and/or microtopography may be used to meet the planned objectives.

Macrotopographic features, including ditch plugs installed in lieu of re-filling surface drainage ditches, shall meet the requirements of other practice standards to which they may apply due to purpose, size, water storage capacity, hazard class, or other parameters. If no other practice standard applies, they shall meet the requirements for Dike – Code 356 unless there is no potential for damage to the feature or other areas on or off site due to erosion, breaching, or overtopping.

Water control structures that may impede the movement of target aquatic species or species of concern shall meet the criteria in Fish Passage – Code 396.

Criteria for Vegetative Enhancement

Hydrophytic vegetation restoration shall be of species typical for the wetland type(s) being established and the varying hydrologic regimes and soil types within the wetland. Preference shall be given to native wetland plants with localized genetic material.

Where natural colonization of acceptable species can realistically be expected to occur within 5 years, sites may be left to re-vegetate naturally. If not, the appropriate species will be established by seeding or planting.

Adequate substrate material and site preparation necessary for proper establishment of the selected plant species shall be included in the plan.

Where planting and/or seeding is necessary, the minimum number of native species to be established shall be based on a reference wetland unless the objectives require a different plant community.

- If the targeted hydrophytic vegetation is predominantly herbaceous, species diversity will be maximized as appropriate to meet the targeted functions. Seeding rates shall be based upon the percentage of pure live seed and labeled with a current seed tag from a registered seed laboratory identifying the germination rate, purity analysis, and other seed statistics.
- Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a mix of woody species (trees and/or shrubs) adequate to establish the reference wetland community.

CONSIDERATIONS

Soil Considerations

Consider making changes to physical soil properties, including:

- Increasing or decreasing saturated hydraulic conductivity by mechanical compaction or tillage, as appropriate
- Incorporating soil amendments.
- The effect of construction equipment on soil density, infiltration, and structure.

Consider changes in soil bio-geochemical properties, including:

- Increasing soil organic carbon by incorporating compost.
- Increasing or decreasing soil pH with lime, gypsum, or other compounds.

Hydrology Considerations

Consider the general hydrologic effects of the enhancement, including:

- Impacts on downstream stream hydrographs, volumes of surface runoff, and groundwater resources due to changes of water use and movement created by the enhancement.

Consider the impacts of water level management, including:

- Increased predation due to concentrating aquatic organisms, including herptivores, in small pool areas during draw downs.
- Increased predation of amphibians due to high water levels that can sustain predator fish.
- Decreased ability of aquatic organisms to move within the wetland and from the wetland area to adjacent habitats, including fish and amphibians, as water levels are decreased.
- Increases in water temperature on-site, and in off-site receiving waters.
- Changes in the quantity and direction of movement of subsurface flows due to increases or decreases in water depth.
- The effect changes in anaerobic conditions have on soil bio-geochemical properties; including oxidation/reduction, and maintenance of organic soils.
- The potential for water control structures, dikes, and macrotopographic features to negatively impact the movement of non-target aquatic organisms.

Vegetation Considerations

Consider:

- The relative effects of planting density on fish and wildlife habitat versus production rates in woody plantings.
- The potential for vegetative buffers to increase function by trapping sediment, cycling nutrients, and removing pesticides.
- The selection of vegetation for the protection of structural measures that is appropriate for wetland function.
- The potential for invasive or noxious plant species to establish on bare soils after construction and before the planned plant community is established.
- The use of prescribed burning to maintain wetland and adjacent upland plant communities.

Fish and Wildlife Habitat Considerations

Consider:

- The addition of coarse woody debris to provide an initial carbon source and fish and wildlife cover.
- The potential to restore habitat capable of supporting fish and wildlife with the ability to control disease vectors such as mosquitoes.
- The potential to establish fish and wildlife corridors linking the site to adjacent landscapes, streams, and water bodies and to increase the sites colonization by native flora.
- The need to provide barriers to passage for unwanted or predatory fish and wildlife species.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared for each site. Plans and specifications shall be recorded using approved specifications sheets, job sheets, or other documentation. The plans and specifications for structural features will include, at a minimum, a plan view, quantities, and sufficient profiles and cross-sections to

define the location, line, and grade for stakeout and checkout. Plans and specifications shall be reviewed and approved by staff with appropriate job approval authority.

OPERATION AND MAINTENANCE

A separate Operation and Maintenance Plan will be prepared for sites that have structural features. The plan will include specific actions for the normal and repetitive operation of installed structural items, especially water control structures, if included in the project. The plan will also include the actions necessary to assure that constructed items are maintained for the life of the project. It will include the inspection schedule, a list of items to inspect, a checklist of potential damages to look for, recommended repairs, and procedures for documentation.

Management and monitoring activities needed to ensure the continued success of the wetland enhancement objectives may be included in the above plan, or in a separate Management and Monitoring Plan. In addition to the monitoring schedule, this plan may include the following:

- The timing and methods for the use of fertilizers, pesticides, prescribed burning, or mechanical treatments.
- Circumstances when the use of biological control of undesirable plant species and pests (e.g. using predator or parasitic species) is appropriate, and the approved methods.
- Actions which specifically address any expected problems from invasive or noxious species
- The circumstances which require the removal of accumulated sediment.
- Conditions which indicate the need to use haying or grazing as a management tool, including timing and methods.

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Appendix F
Public Comment Document

PUBLIC NOTICE

Update of Tribal NPS Assessment and Management Plan Documents

The Wiyot Tribe's Natural Resources Department is currently updating the nonpoint source pollution assessment and management plan for the Table Bluff Reservation. The assessment summarizes nonpoint pollution sources and threats on the reservation and the management plan describes the Tribe's approach over the next five (5) years to preventing pollution from sources identified in the assessment.

The documents are updated every five years. Draft versions of the current update are open to public comment from 9/11/20 to 10/12/20. The final versions of the documents will be available for public review in November 2020. If you would like to review the documents, please visit the Tribe's website at www.wiyot.us and follow the links to "NPS Assessment" and "NPS Management Plan." Please provide comments to Eddie Koch via email (eddie@wiyot.us) or in writing to:

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