Twin Tunnels Environmental Assessment Study
Area Wetland Delineation Report

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1.0 Introduction

1.1 Purpose of this Report

The purpose of this report is to document the wetlands and other waters of the U.S. present in the Twin Tunnels Environmental Assessment Study Area. The wetland delineation was completed for the proposed Colorado Department of Transportation (CDOT) roadway improvements for the eastbound lanes of I-70 between Milepost (MP) 241 and MP 244 located in Clear Creek County, Colorado. This report can also be used as support for US Army Corps of Engineers (USACE) Section 404 permitting.

1.2 Study Area Description

The study area is I-70 between MP 241 and MP 244. The study area is found on the Squaw Pass US Geological Survey 7.5-minute quadrangle and has the following coordinates (datum is NAD 83):

- Township 35, Range 72W, Section 32
- Latitude, Longitude: 39 44 37.24 N, 105 28 24.27 W

The study area is located along Clear Creek which is a large tributary of the South Platte River. The elevation of the study area is approximately 7,400 feet above mean sea level. All of the study area wetlands are located in the Clear Creek floodplain riparian vegetation community.

2.0 Wetland Delineation Methods

Robert Belford and Francesca Tordonato surveyed the entire study area on October 13th and 20th, 2011 to identify wetlands and other waters of the U.S. Wetlands were delineated using the procedures outlined in the *1987 Corps of Engineers Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (USACE 20ll). The detailed wetland delineation included collection of vegetation, soil, and hydrology data. All the data was recorded on USACE Western Mountain, Valleys, and Coast Region Data Forms.

The Region 8/Intermountain National List of Plant Species that Occurs in Wetlands (Reed 1988) was used to determine the wetland indicator status for each dominant plant species in the wetlands. If at least 50 percent of the plant species had an indicator status of facultative, facultative wet, or obligate the potential wetland area meets the USACE criteria for wetland vegetation.

Soils were examined at each sampling point to identify the presence of hydric soil indicators. At each soil data point, a soil probe was inserted to a depth of 12-14 inches to observe the soil profile.

In addition to recording plant species and identifying soil characteristics, wetland sites were assessed for sources of hydrology. The study area wetland sites all had saturated soils primarily from seasonal inundation.

All wetland boundaries were mapped using a Trimble GeoXH hand-held Global Position System that records positions to sub-meter accuracy.

3.0 Wetlands

The study area contains seven wetland areas that encompass a total of approximately 0.88 acre. All of these wetlands are associated with Clear Creek and were located on the banks of the stream. Using the standard wetland classification system (Cowardin et al. 1979) all seven wetland areas are classified as palustrine emergent and palustrine scrub/shrub combination (PEM/PSS). These wetland areas are primarily composed of equal parts PEM and PSS. Figure 1 and 2 shows the location of the seven wetland areas. Wetland data sheets are located in Appendix A. Representative wetland photographs are located in Appendix B.

Study Area Wetlands

Wetland Area 1

Wetland area 1 is located along the north bank of Clear Creek. This wetland area is 0.02 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Coyote willow (*Salix exigua*) – OBL
Thin-leaf alder (*Alnus incana tenuifolia*) – FACW
Mountain rush (*Juncus balticus*) – OBL
Redtop (*Agrostis alba*) – FACW
Sedge species unidentified (*Carex* sp.) - OBL

Soils:

Generally consists of silty sandy soils with a depleted matrix.

Hydrology:

Hydrology is provided from Clear Creek. Soils were saturated at the surface and water table was present at six inches.

Wetland Area 2a

Wetland area 2a is a streamside bench along Clear Creek. This wetland area is 0.03 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Thin-leaf alder – FACW
Coyote willow– OBL
Willow species unidentified (*Salix* sp.) - OBL
Redtop- FACW
Bluejoint (*Calamagrostis Canadensis*) - FACW

Wetlands

Figure 1
Wetland Locations

N
W E
S

1:6,000

0 187.5 375 750 Feet

Wetlands

Figure 2
Wetland Locations

N
W E
S

1:6,000

0 187.5 375 750 Feet

Soils:

Generally consist of fine sand with distinct redox features.

Hydrology:

Soils are likely saturated during higher flow events on Clear Creek. Drift lines and sediment deposits were observed from higher flows during the spring high water period.

Wetland Area 2b

Wetland area 2b is a streamside bench along Clear Creek. This wetland area is .29 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Coyote willow – OBL
Thin-leaf alder- FACW
Willow species unidentified – No determination
Redtop – FACW
Bluejoint – FACW

Soils:

Soils consist of fine sand with distinct redox features.

Hydrology:

Soils are likely saturated during higher flow events on Clear Creek. Drift lines and sediment deposits were observed from higher flows during the spring high water period.

Wetland Area 3

Wetland area 3 is a streamside bench along Clear Creek. The wetland area is 0.30 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Coyote willow – OBL
Thin-leaf willow- FACW
Willow species unidentified – No determination
Mountain rush – OBL
Redtop – FACW
Bluejoint – FACW
Sedge species unidentified- OBL

Soils:

Soils consist of a fine silty loam with a depleted matrix.

Hydrology:

Soils are saturated at the surface from direct connection to Clear Creek. Water marks and sediment deposits were also observed in the wetland area.

Wetland Area 4a

Wetland area 4a is a streamside bench along Clear Creek. The wetland area is 0.14 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Thin-leaf willow – FACW
Coyote willow – OBL
Mountain rush – OBL
Redtop - FACW
Reed canary grass (*Phalaris arundinacea*) – OBL

Soils:

Soils consist of a fine silty loam with a depleted matrix.

Hydrology:

Soils are saturated at the surface from connectivity to Clear Creek. Other primary hydrology indicators observed in the field survey included sediment deposits and drift deposits.

Wetland 4b

Wetland area 4b is a streamside bench along Clear Creek. The wetland area is 0.03 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Coyote willow – OBL
Mountain rush – OBL
Sedge unidentified species – OBL
Redtop – FACW

Soils:

Soils consist of a silt loam with a depleted matrix.

Hydrology:

Soils are saturated at the surface from connectivity to Clear Creek. Drift deposits were observed within the wetland during the field survey.

Wetland 5

Wetland area 5 is a streamside bench along Clear Creek. The wetland area is 0.07 acre. Dominant vegetation and hydric soil characteristics are provided below.

Dominant Vegetation:

Redtop – FACW
Mountain rush – OBL

Soils:

Soils consist of a silty loam with a depleted matrix.

Hydrology:

Soils are saturated at the surface from connectivity to Clear Creek. Other primary hydrology indicators observed within the wetland were sediment deposits and drift deposits.

3.1 Functional Assessment of Colorado Wetlands (FACWet) Method

FACWet is a rapid assessment methodology that rates wetland conditions through evaluation of ecological stressors that drive wetland functions. Each state variable is rated on a scale of 0.0 to 1.0 (non-functioning to reference standard or essentially pristine, respectively). The FACWet method was used to evaluate the general condition of the delineated wetlands that occur along the north bank of Clear Creek within the study area. Based on this methodology, the study area wetlands were rated at the higher end of the functioning category. Table 1 shows the study area wetland scoring for the seven FACWet criteria.

Table 1 FACWet Score Card

Functional Capacity Indices (FCI)	Wetland Variable Score
Support of Characteristic Wildlife Habitat	.75
Support of Characteristic Fish/Aquatic Habitat	.81
Flood Attenuation	.80
Short-and-Long-term Water Storage	.79
Nutrient/Toxicant Removal	.70
Sediment Retention/Shoreline Stabilization	.75
Production Export/Food Chain Support	.80
Composite FCI Score (out of 100)	**77**

The study area wetlands are supported by a reliable hydrology source and a diverse mix of both emergent wetland plant species with a significant shrub component that result in functional wetlands. The channelization and slope armoring along I-70 on the north side of Clear Creek has resulted in the elimination of wetlands/riparian habitat in the study area. The study area wetlands are rated as functioning, but are fragmented because of historic wetland loss along the Clear Creek corridor and lack of habitat connectivity.

4.0 Other Waters of the U.S.

Clear Creek represents the only other waters of the U.S. present within the study area. The Clear Creek ordinary high water mark was mapped using the current edge-of-water survey and adding the two-year flood event. This methodology was approved by the USACE. The Clear Creek edge-of-water survey was completed in October and November 2011.

5.0 References

Cowardin, Lewis M. , Virginia Carter, Frances C. Golet, and Edward T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service, FWS/OBS- 79/31.

Reed, P.B. Jr. 1988. *National List of Plant Species that Occur in Wetlands: Intermountain Region (Region 8)*. Prepared for National Wetland Inventory, U.S. Fish and Wildlife Service.

US Army Corps of Engineers. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountain, Valleys, and Coast Region*. May 2010.

Appendix A – USACE Data Sheets

Wetland 1

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels - EA City/County: Clear Creek Sampling Date: 10.20.11
Applicant/Owner: CDOT Region 1 State: CO Sampling Point: Wet-1
Investigator(s): R. Belford & F. Tordonato Section, Township, Range: T3S R72W Section 32
Landform (hillslope, terrace, etc.): Streamside Local relief (concave, convex, none): _____ Slope (%): —
Subregion (LRR): LRR-E Lat: 39°44'37.24"N Long: 105°28'24.27"W Datum: NAD 83
Soil Map Unit Name: N/A NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. Salix exigua	10	NO	OBL
2. Alnus inlana ssp. tenuifolia	10	NO	FACW
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Juncus balticus	40	Yes	OBL
2. Agrostis alba	40	Yes	FACW
3. Carex sp.	20	Yes	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: Wet 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10 YR 3/2	70						Silty Sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Cobble

Depth (inches): 7

Hydric Soil Present? Yes ✓ No ___

Remarks:

Soil was saturated - water table present at 6 inches.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ✓ No ___ Depth (inches): 6

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): Surface

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Small wetland fringe that borders riparian habitat. Hydrology from Clear Creek

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels - EA City/County: Clear Creek Sampling Date: 10.13.2011
Applicant/Owner: CDOT Region 1 State: CO Sampling Point: Wet-2
Investigator(s): R. Belford & F. Tordonato Section, Township, Range: T35 R72W Section 32
Landform (hillslope, terrace, etc.): Streamside Local relief (concave, convex, none): None Slope (%): —
Subregion (LRR): LRR-E Lat: 39°44'46.25"N Long: 105°28'23.05"W Datum: NAD 83
Soil Map Unit Name: N/A NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____	
Wetland Hydrology Present?	Yes ✓ No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. Alnus incana ssp. tenuifolia	30	yes	FACW
2. Salix exigua	25	yes	OBL
3. Salix sp.	10	No	OBL
4.			
5.			
	65 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Agrostis alba	30	Yes	FACW
2. Calamagrostis canadensis	25	yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	55 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
__ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:
Streamside bench adjacent to Clear Creek Wetland/Riparian Complex

SOIL

Sampling Point: W-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 4/2	60	10yr 5/6	40				Fine Sand.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks: Fine Sand w/ distinct redox features throughout soil profile

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): _____

Water Table Present? Yes ___ No ___ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Wetland likely saturated during higher-flow events - wetland located directly adjacent to Clear Creek.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels - EA City/County: Clear Creek Sampling Date: 10.20.2011
Applicant/Owner: CDOT Region 1 State: CO Sampling Point: W2-OUT
Investigator(s): R. Belfield & F. Tordenato Section, Township, Range: T3S R72W Section 32
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): — Slope (%): 3-4%
Subregion (LRR): LRR-E Lat: 39°44'46.25"N Long: 105°28'23.05"W Datum: NAD83
Soil Map Unit Name: N/A NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Higher quality riparian w/ understory of upland species.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pseudotsuga menziesii	30	Yes	NI
2. Populus angustifolia	20	Yes	FAC
3. Pinus ponderosa	10	NO	FACU
4.			
	60	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. Alnus incana ssp. tenuifolia	20	Yes	FACW
2. Salix sp.	10	NO	OBL
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: ____)			
1. Bromus inermis	50	Yes	NI
2. Aster sp.	15	NO	
3. Cirsium arvense	10	NO	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	75	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

% Bare Ground in Herb Stratum 10%

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
__ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

SOIL

Sampling Point: W2-Out

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10yr 4/4	100%	—				Gravelly loam w/ large pebbles	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Rock

Depth (inches): 7

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Water drains down from Twin Tunnels - soils don't stay saturated long enough to support wetland vegetation but higher quality riparian habitat is present.

wetland 5

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels EA City/County: Clear Creek Sampling Date: 10·20·2011
Applicant/Owner: CDOT Region 1 State: CO Sampling Point: W-3 UP
Investigator(s): R. Belford & F. Tarolonato Section, Township, Range: T3S R72W Section 33
Landform (hillslope, terrace, etc.): Streamside Local relief (concave, convex, none): — Slope (%): —
Subregion (LRR): LRR-E Lat: 39°44'34.20"N Long: 105°27'11.23"W Datum: NAD 83
Soil Map Unit Name: N/A NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____	
Wetland Hydrology Present?	Yes ✓ No ____	

Remarks: Streamside bench

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. Salix exigua	30	yes	OBL
2. Salix sp.	20	yes	OBL
3. Alnus incana ssp tenuifolia	20	yes	FACW
4.			
5.			
	70 = Total Cover		
Herb Stratum (Plot size: ____)			
1 Juncus balticus	40	yes	OBL
2 Carex sp.	20	yes	OBL
3. Agrostis alba	10	no	FACW
4. Oldmagnostis canadensis	10	no	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
__ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

SOIL

Sampling Point: W-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10yr 3/2	80	10yr 5/6	20	RM	M		Fine Silty loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Cobble

Depth (inches): 7

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ✓ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

High quality riparian / wetland complex adjacent to Clear Creek

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels EA City/County: Clear Creek Sampling Date: 10.20.2011
Applicant/Owner: CDOT Region 1 State: CO Sampling Point: W-4a
Investigator(s): R. Belford & F. Tordonato Section, Township, Range: T3S R72W Section 33
Landform (hillslope, terrace, etc.): Streamside Local relief (concave, convex, none): _____ Slope (%): —
Subregion (LRR): LRR-E Lat: 39°44'35.16"N Long: 105°26'40.36"W Datum: NAD83
Soil Map Unit Name: N/A NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: Streamside bench

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. Alnus incana ssp. tenuifolia	40	yes	FACW
2. Salix exigua	20	yes	OBL
3. Salix sp.	10	no	—
4.			
5.			
	70 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Juncus balticus	30	yes	OBL
2. Agrostis alba	20	yes	FACW
3. Phalaris arundinacea	20	yes	OBL
4. Carex sp.	10	no	OBL
5. Heracleum lanatum	5	no	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
__ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: W-4a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10yr 3/2	100	—					Silty loam
6-12	10 yr 4/4	70	10yr 5/6	30	RM	M	" "	Silty loam,

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): _____

Water Table Present? Yes ___ No ___ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland 7b

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels - EA City/County: Clear Creek Sampling Date: 10.20.2011

Applicant/Owner: CDOT Region 1 State: CO Sampling Point: Wet 4b

Investigator(s): L. Belford & F. Tordonato Section, Township, Range: T3S R72W Section 33

Landform (hillslope, terrace, etc.): Streamside bench Local relief (concave, convex, none): none Slope (%): —

Subregion (LRR): LRR-E Lat: 39°44'35.22"N Long: 105°26'37.03"W Datum: NAD83

Soil Map Unit Name: N/A NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. Salix exigua	30	yes	OBL
2.			
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Juncus balticus	40	yes	OBL
2. Carex sp.	30	yes	OBL
3. Agrostis alba	20	yes	FACW
4. Calamagrostis canadensis	10	no	FAC/OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ 5 - Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: W-4b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10yr 3/2	100%						Silty loam
7-9	10yr 3/3	70%	10yr 5/6	30	RM	M	" "	Silty loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Cobble

Depth (inches): 10

Hydric Soil Present? Yes ✓ No ___

Remarks: Soil is very saturated

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Streamside bench adjacent to Clear Creek

Wetland 5

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Twin Tunnels EA City/County: Clear Creek Sampling Date: 10.20.2011
Applicant/Owner: CDOT Region 1 State: CO Sampling Point: W-5 UP
Investigator(s): R. Belford + F. Tordonato Section, Township, Range: T3S R72W Section 33
Landform (hillslope, terrace, etc.): Streamside Local relief (concave, convex, none): _____ Slope (%): —
Subregion (LRR): LRR-E Lat: 39°44'35.70"N Long: 105°26'34.30"W Datum: NAD83
Soil Map Unit Name: N/A NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: Streamside bench adjacent to Clear Creek

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. Salix exigua	<10	No	OBL
2.			
3.			
4.			
5.			
	<10% = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis alba	50	yes	FACW
2. Juncus balticus	40	yes	OBL
3. Carex sp.	<10	No	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: W-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10 yr 3/2	100	—					silty loam
4-12	10 yr 4/3	70	10 yr 5/6	30	RM	M	" "	silty loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (Includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Streamside bench adjacent to Clear Creek

Appendix B – Photographs

PHOTO DOCUMENTATION

Twin Tunnels Environmental Assessment Study Area (Photos taken Francesca Tordonato, Jacobs)

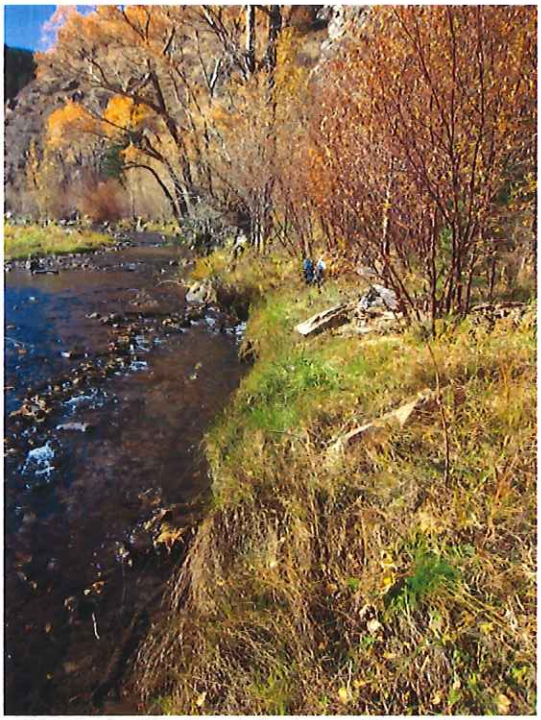

Photo 1: Wetland 1 along Clear Creek.

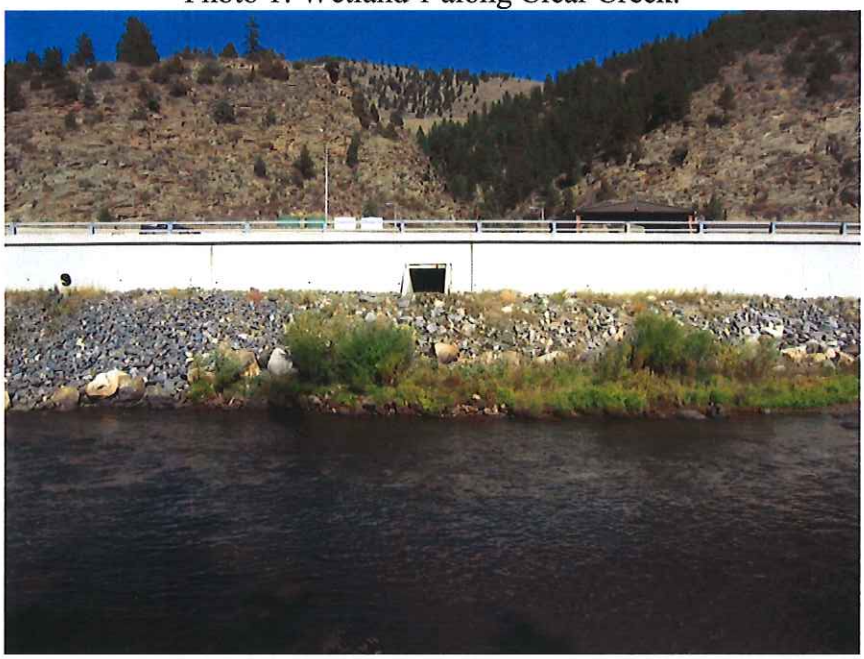

Photo 2: Wetland 2a along Clear Creek.

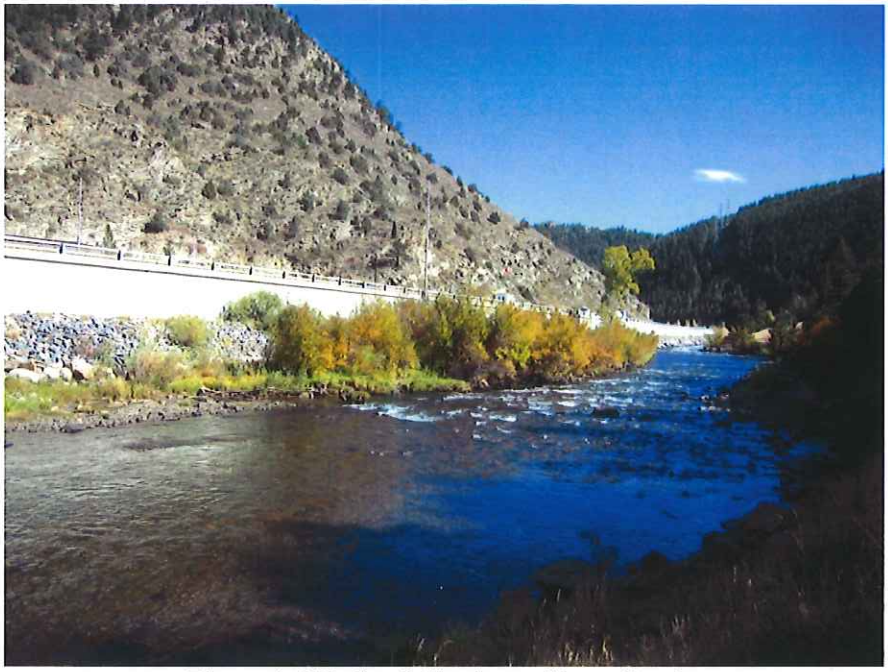

Photo 3: Wetland 2b along Clear Creek.

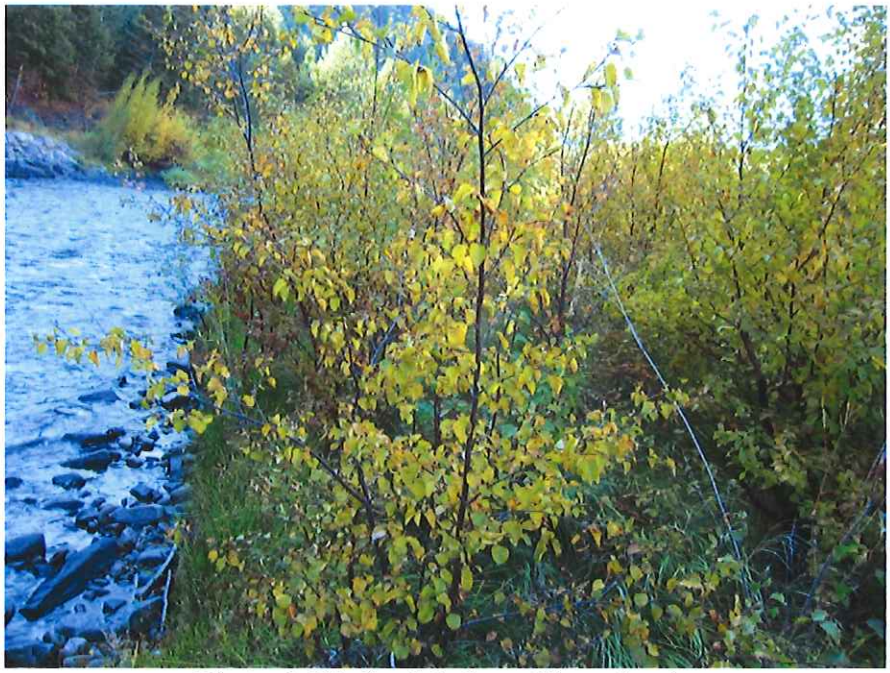

Photo 4: Wetland 3 along Clear Creek.

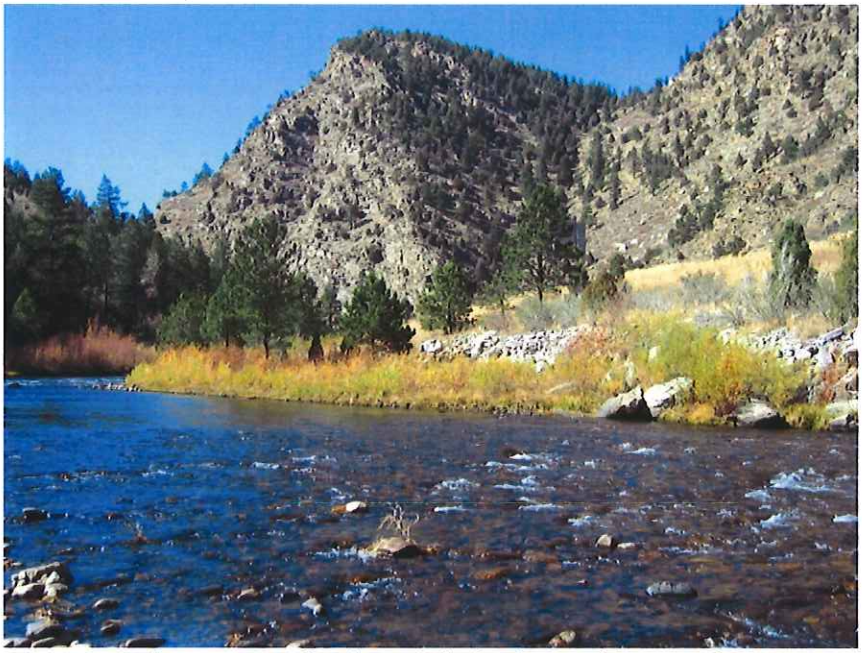

Photo 5: Wetland 4a and 4b along Clear Creek

Photo 6: Wetland 5 along Clear Creek

Appendix C – FACWet Data Sheets

ADMINISTRATIVE CHARACTERIZATION

General Information			
Site Name or ID:	Frontage Road + Twin Tunnel Project	Date of Evaluation:	11/9/12
404 or Other Permit Application #:		Project Name:	Twin Tunnels Environmental Assessment
Evaluator Name(s):	Robert Belford	Applicant Name:	CDOT
		Evaluator's professional position and organization:	Senior Biologist Wilson + Company

Location Information:			
Site Location (Lat./Long. or UTM):		Geographic Datum Used (NAD 83	
USGS Quadrangle Map:		Map Scale: (Circle one)	1:24,000 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	10190004	Wetland Ownership:	Private

Project Information:

This evaluation is being performed at: (Check applicable box)
- [X] *Project Wetland(s)*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- [X] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* ☐ Restortation ☐ Enhancement ☐ Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	.96 ac.	[X] Measured - GPS - Includes 12 wetland Polygons along Clear Creek [ ] Estimated					
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	3.3 miles of CC banks. ac.	[X] Measured [ ] Estimated	ac. ac.	ac. ac.	ac. ac.	ac. ac.
Characteristics or Method used for AA boundary determination:	The AA includes all of the Clear Creek banks within the Frontage Road + Twin Tunnels Project Areas. The large AA was used because all of the wetlands are of the same HGM Class.						

Notes:

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- ☐ Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- ☐ Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- ☐ Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- ☐ The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- ☐ Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.

_____

_____

- ☐ Federally threatened or endangered species are **SUSPECTED** to occur in the AA?

_____

_____

_____

- ☐ Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- ☐ The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- ☐ Other special concerns (please describe)

_____

HYDROGEOMORPHIC SETTING

- ☒ AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- ☐ AA wetland has been subject to change in HGM classes as a result of anthropogenic modification
  If the above is checked, please describe the original wetland type if discernable using the table below.
- ☐ AA wetland was created from an upland setting.

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting	Water source	(Surface flow)	Groundwater	Precipitation	Unknown	
	Hydrodynamics	(Unidirectional)	Vertical	Bi-directional		
	Wetland Gradient	(0 - 2%)	2-4%	4-10%	>10%	
	# Surface Inlets	(Over-bank)	0	1	2	3	>3
	# Surface Outlets		0	1	2	3	>3
	Geomorphic Setting (Narrative Description. Include approx. stream order for riverine)	The wetlands occur in a riverine setting. Clear Creek is a first-order stream. All the wetlands are present along the banks of Clear Creek.				
	HGM class	(Riverine)	Slope	Depressional	Lacustrine	

Historical Conditions

Previous wetland typology	Water source	Surface flow	Groundwater	Precipitation	Unknown
	Hydrodynamics	Unidirectional	Vertical		
	Geomorphic Setting (Narrative Description)				
	Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Notes (include information on the AA's HGM subclass and regional subclass):

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

US FWS habitat classification according as reported in Cowardin et al. (1979).

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Riverine	Palustrine	EM/SS	Cobble-Gravel	E	✓	✓

Lacustrine	Littoral; Limnoral	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Semi-Perm. flooded(F); Intermittently exposed(G); Artificially flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	
Palustrine	Palustrine					
Riverine	Lower perennial; Upper perennial; Intermittent					

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features. – See attached aerial photography.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI and hydric soils maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo, create a 500 meter perimeter around the AA.

2. The area within this perimeter is the **Habitat Connectivity Envelope (HCE)**

3. Within the HCE, outline the current extent of naturally occurring wetland and riparian habitat. Do not include habitats such as excavated ponds or reservoir induced fringe wetlands.

4. Outline the historical extent of wetland and riparian habitats (i.e., existing natural wetlands plus those that have been destroyed).

- Use your knowledge of the history of the area and evident land use change to identify where habitat losses have occurred. Additional research could be utilized to increase the accuracy of this estimate including consideration of floodplain maps, historical aerial photographs, etc.

5. Calculate the area of existing and historical wetlands. Divide the area values to determine the percentage of naturally occurring wetland habitat that remains in the HCE, and determine the variable score using the guidelines below.

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats
<0.9 - 0.8	*Highly Functioning*	More than 80% of historical wetland habitat area within the HCE is still present (less than 20% of habitat area lost).
<0.8 - 0.7	*Functioning*	80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% of habitat area lost).
<0.7 - 0.6	*Functioning Impaired*	Less than 60 to 25% of historical wetland habitat area within the HCE is still present (more than 40 to 75% of habitat area lost).
<0.6	*Non-functioning*	Less than 25% of the historical wetland habitat area within the HCE still in existence (more than 70% of habitat lost).

Variable 1 Score .65

Notes:

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas within the HCE. This includes naturally occurring habitats as well as those purposefully created or induced by land use change.

2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers

✓	Stressors	Comments/description
✓	Major Highway	I-70 - Bank Impacts and Channelization.
	Secondary Highway	
✓	Tertiary Roadway	Frontage Road - Bank Impacts, Encroachment on riparian corridor
	Railroad	
✓	Bike Path	Encroachment on riparian corridor.
	Urban Development	
	Agricultural Development	
	Artificial Water Body	
	Fence	
	Ditch or Aqueduct	
	Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in the HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding wetland/riparian habitat highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding wetland/riparian habitat.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of wetland/riparian habitat. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding wetland/riparian habitat.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding wetland/riparian habitat. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding wetland/riparian habitat could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding wetland/riparian habitat by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and wetland/riparian habitat in the HCE.

Variable 2 Score .65

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, delimit the buffer area (BA) as the zone within 250 meters of the outer boundary of the AA.

2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering all of the identified stressors, their composite severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes	✓	Stressors	Comments/description
		Industrial/commercial	
		Urban	
		Residential	
		Rural	
		Dryland Farming	
		Intensive Agriculture	
		Orchards or Nurseries	
		Livestock Grazing	
	✓	Transportation Corridor	Impermeable surface, roadway run-off
		Urban Parklands	
		Dams/impoundments	
		Artificial Water body	
		Physical Resource Extraction	
		Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or low intensity silviculture, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use changes within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score .69

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain. This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 8.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✓	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
	Dams	
	Diversions	
	Groundwater pumping	
	Draw-downs	
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
	Transbasin Diversion	
	Actively Managed Hydrology	

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial increase of peak flows or capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or capacity of water to perform work. Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or capacity of water to perform work. Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.
<0.6	*Non-functioning*	Water source diminished enough to threaten or extinguish wetland hydrology in the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score .90

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity ***within*** *the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally* ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In most cases, the Water Source variable score will determine the maximum achievable score for Water Distribution, since the condition of the water source exerts a primary control on the wetland's capacity to distribute water in a characteristic fashion and exhibit a natural hydrograph.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. In most cases, the Water Source variable score will set the upper limit for the Water Distribution score.

✓	Stressors	Comments/description
	Alteration of Water Source	
	Ditches	
	Ponding/Impoundment	
	Culverts	
✓	Road Grades	Encroachment on flood plain.
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
✓	Artificial Banks/Shoreline	Roadway alteration of banks.
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland. AA maintains a natural hydrologic regime.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system, generally exhibited as a conversion to upland or deep water habitat.	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score .72

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on the AA's ability to export water, energy and associated materials to habitats down-gradient of the AA. In most cases, the Water Source variable score will determine the maximum achievable score for Water Outflow, since the condition of the water source exerts a primary control over the wetland's capacity to export water and associated materials.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials. In most cases the Water Source variable will set the upper limit for the Water Outflow score.

✓	Stressors	Comments/description
	Alteration of Water Source	
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") levels flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately to highly impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics severely disrupted.
<0.6	*Non-functioning*	The natural outflow regime is profoundly impaired. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score .90

Variable 7: Geomorphology

*This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include the resultant effects of geomorphic change; rather focus on the physical impacts **within the footprint** of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to geomorphology should be evaluated including small-scale impacts such as pugging, hoof sheer, and sedimentation which constitute important, but not immediately apparent, impacts.*

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✓		Stressors	Comments
	General	Dredging/Excavation/Mining	
		Fill, including dikes, road grades, etc.	
		Grading	
		Compaction	
		Plowing/Disking	
		Excessive Sedimentation	
		Dumping	
		Hoof Shear/Pugging	
		Aggregate or Mineral Mining	
		Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
		Excessive Bank Erosion	
✓		Channelization	I-70 encroachment on Clear Creek
		Reconfigured Stream Channels	
✓		Artificial Banks/Shoreline	I-70 encroachment on Clear Creek
		Beaver Dam Removal	
		Substrate Embeddedness	
		Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions in some or all of the AA; or more severe impacts exist but affect less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild to moderate in severity. May include patches of more significant habitat alteration; or more severe alterations affect up to 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been strongly impacted throughout most or all of the AA; or more severe alterations affect up to 50% of the AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Pervasive geomorphic alterations have caused a fundamental change in site character and functioning, commonly resulting in a conversion to upland or deepwater habitat.

Variable 7 Score .65

Variable 8: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
   -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✓	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			.77
	Agricultural Runoff			
	Septic/Sewage	✓		
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			.78
	Excessive Deposition			
	Fine Sediment Plumes	✓		
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			.60
	Nearby Industrial Sites			
	Road Drainage/Runoff	✓		
	Livestock			
	Agricultural Runoff			
	Storm Water Runoff			
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
	Metal staining on rocks and veg.			
Temperature	Excessive Temperature Regime			.78
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation			.72
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 8: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA.
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
.77	+	.78	+	.60	+	.78	+	.72	=	3.64

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 8 Score .72

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required In cases where a stratum has been thinned or removed, enter the expected coverage of that layer **not** the current percent coverage.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labeled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*		✓	✓		
Stressor	Tree	Shrub	Herb	Aquatic	**Comments**
Noxious Weeds					
Exotic/Invasive spp.					
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

Percent Cover of Layer		+	60	+	40	+	= 100 percent
	X		X		X		X
Veg. Layer Sub-variable Score			.90		.90		÷
	=		=		=		=
Weighted Sub-variable Score		+	54	+	36	+	= 90

See sub-variable scoring guidelines on following page

Variable 9 Score 0.9

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	Variable 1:	Habitat Connectivity - Neighboring Wetland Habitat Loss	.65
	Variable 2:	Habitat Connectivity - Migration/Dispersal Barriers	.65
	Variable 3:	Buffer Capacity	.69
Hydrology	Variable 4:	Water Source	.90
	Variable 5:	Water Distribution	.72
	Variable 6:	Water Outflow	.90
Abiotic and Biotic Habitat	Variable 7:	Geomorphology	.65
	Variable 8:	Chemical Environment	.72
	Variable 9:	Vegetation Structure and Complexity	.90

Functional Capacity Indices

Function 1 -- Support of Characteristic Wildlife Habitat

$V1_{wetloss}$	+ $V2_{barriers}$	+ $V3_{buffer}$	+ (2 x $V9_{veg}$)			= Total Functional Points	÷ 5 = Functional Capacity Index
.65	+ .65	+ .69	+ 1.8	+	+	= 3.79	÷ 5 = 0.75

Function 2 -- Support of Characteristic Fish/aquatic Habitat

(3 x $V4_{source}$)	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$	+ $V8_{chem}$	+ $V7_{geom}$		=	÷ 9 =
2.7	+ 1.44	+ 1.8	+ .72	+ .65	+	= 7.3	÷ 9 = .81

Function 3 -- Flood Attenuation

$V3_{buffer}$	+ 2 x $V4_{source}$	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$	+ $V7_{geom}$	+ $V9_{veg}$	=	÷ 9 =
.69	+ 1.8	+ 1.44	+ 1.8	+ .65	+ .90	= 7.28	÷ 9 = .80

Function 4 -- Short- and Long-term Water Storage

$V4_{source}$	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$)	$V7_{geom}$			=	÷ 6 =
.90	+ 1.44	+ 1.8	+ .65	+	+	= 4.79	÷ 6 = .79

Function 5 -- Nutrient/Toxicant Removal

(2 x $V5_{dist}$)	+ $V8_{chem}$	+ $V7_{geom}$				=	÷ 4 =
1.44	+ .72	+ .65	+	+	+	= 2.81	÷ 4 = .70

Function 6 -- Sediment Retention/Shoreline Stabilization

$V3_{buffer}$	+ (2 x $V7_{geo}$)	+ (2 x $V9_{veg}$)				=	÷ 5 =
.69	+ 1.3	+ 1.8	+	+	+	= 3.79	÷ 5 = .75

Function 7 -- Production Export/Food Chain Support

$V1_{wetloss}$	+ 2 x $V6_{outflow}$	+ $V8_{chem}$	+ $V7_{geo}$	+ (2 x $V9_{veg}$)		=	÷ 7 =
.65	+ 1.8	+ .72	+ .65	+ 1.8	+	= 5.62	÷ 7 = .80

Sum of Individual FCI Scores 5.4

Divide by the Number of Functions Scored ÷ 7

Composite FCI Score .77