

**Practice: 657 - Wetland Restoration**

**Scenario: #1 - Mineral Flat**

**Scenario Description:**

A Mineral Flat wetland is to be restored. The tract size is 160 Acres consists of surface saturated soils interspersed with shallow depressions that are not depressional class HGM wetlands. The wetland size is also 160 acres. Resource Concerns are: 4-SOIL QUALITY DEGRADATION - Organic matter depletion, 11- WATER QUALITY DEGRADATION - Excess nutrients in surface and ground waters, 12 - WATER QUALITY DEGRADATION - Pesticides transported to surface and ground waters, 16 - WATER QUALITY DEGRADATION - Excessive sediment in surface waters, 18 - DEGRADED PLANT CONDITION - Undesirable plant productivity and health, 19 - DEGRADED PLANT CONDITION, Inadequate structure and composition, 22- INADEQUATE HABITAT FOR FISH AND WILDLIFE - Habitat degradation.

**Before Situation:**

The site has been drained with a tile drain system. A suitable seed bank exists for natural regeneration to re-establish hydrophytic vegetation. The site is in agricultural production.

**After Situation:**

The drain tiles have been rendered non-functional by excavating 50 foot lengths of tile mains and laterals in 24 separate locations, and backfilling with excavated earth, which is compacted with the excavator bucket. There are no facilitating practices. Restoration of hydrology and plant community functions will improve the WATER QUALITY and DEGRADED PLANT CONDITION concerns listed above. The hydrologic and vegetative practices will address the SOIL QUALITY DEGRADATION and INADEQUATE HABITAT FOR FISH AND WILDLIFE concerns.

**Scenario Feature Measure:** Acres of Tract

**Scenario Unit:** Acre

**Scenario Typical Size:** 160

**Scenario Cost:** \$2,103.30

**Scenario Cost/Unit:** \$13.15

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Hydraulic Excavator, .5 CY	930	Track mounted hydraulic excavator with bucket capacity range of 0.3 to 0.8 CY. Equipment and power unit costs. Labor not included.	Hour	\$56.49	24	\$1,355.76
<b>Labor</b>						
Equipment Operators, Light	232	Includes: Skid Steer Loaders, Hydraulic Excavators <50 HP, Trenchers <12", Ag Equipment <150 HP, Pickup Trucks, Forklifts, Mulchers	Hour	\$20.40	24	\$489.60
<b>Mobilization</b>						
Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$257.94	1	\$257.94

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**Scenario: #2 - Riverine Levee Removal and Floodplain Features**

**Scenario Description:**

A Riverine HGM tract on a large floodplain is to be restored. It has been converted to agricultural production by surface ditching and clearing of woody vegetation. The size of the tract is 100 acres. The wetland extent is 60 acres, and 40 acres are adjacent non-wetland. Resource Concerns are: 4-SOIL QUALITY DEGRADATION - Organic matter depletion, 11- WATER QUALITY DEGRADATION - Excess nutrients in surface and ground waters, 12 - WATER QUALITY DEGRADATION - Pesticides transported to surface and ground waters, 16 - WATER QUALITY DEGRADATION - Excessive sediment in surface waters, 18 - DEGRADED PLANT CONDITION - Undesirable plant productivity and health, 19 - DEGRADED PLANT CONDITION, Inadequate structure and composition, 22- INADEQUATE HABITAT FOR FISH AND WILDLIFE - Habitat degradation.

**Before Situation:**

A levee prevents floodwater from entering the tract. The original cover was forest. The site is drained by surface ditches which collect surface water and direct it to the river through a flap gate structure. The site has been completely cleared, and no suitable adjacent seedwall exists for natural regeneration of forest species. The lateral connectivity between the channel and floodplain has been altered by construction of levees along the reach.

**After Situation:**

The hydrology of the site is restored with the installation of ditch plugs, and the excavation of macrotopographic features with an average depth of 6" over 30% of the wetland area. Excavated spoil is placed adjacent to the features on the wetland and adjacent non-wetland area with a maximum depth of 24 inches. The levee has been breached at the upstream and downstream ends of the tract reach, restoring dynamic stream flooding. The breach length is 150 feet long at both locations. Both the wetland and non-wetland areas are planted with a Bottomland Hardwood species mix. The levee breaches are armored with rock riprap. Facilitating practices include Grade Stabilization Structure and Tree and Shrub Planting. Restoration of hydrology and plant community functions will improve the WATER QUALITY and DEGRADED PLANT CONDITION concerns listed above. The hydrologic and vegetative practices will address the SOIL QUALITY DEGRADATION and INADEQUATE HABITAT FOR FISH AND WILDLIFE concerns.

**Scenario Feature Measure:** Cubic yds of earth excavation/moving

**Scenario Unit:** Cubic Yard

**Scenario Typical Size:** 16,520

**Scenario Cost:** \$36,576.14

**Scenario Cost/Unit:** \$2.21

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic yard	\$1.99	16520	\$32,874.80
Dozer, 140 HP	927	Track mounted Dozer with horsepower range of 125 to 160. Equipment and power unit costs. Labor not included.	Hour	\$125.42	15	\$1,881.30
<b>Labor</b>						
Equipment Operators, Heavy	233	Includes: Cranes, Hydraulic Excavators >=50 HP, Dozers, Paving Machines, Rock Trenchers, Trenchers >=12", Dump Trucks, Ag Equipment >=150 HP, Scrapers, Water Wagons.	Hour	\$22.84	15	\$342.60
<b>Mobilization</b>						
Mobilization, large equipment	1140	Equipment >150HP or typical weights greater than 30,000 pounds or loads requiring over width or over length permits.	Each	\$492.48	3	\$1,477.44

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**Scenario: #3 - Depression Sediment Removal and Ditch Plug**

**Scenario Description:**

A Depressional HGM class wetland is to be restored. The tract size is 15 acres, and the actual wetland size is 10 acres. The site is a recharge depression, fed only from surface runoff. Resource Concerns are: 4-SOIL QUALITY DEGRADATION - Organic matter depletion, 11- WATER QUALITY DEGRADATION - Excess nutrients in surface and ground waters, 12 - WATER QUALITY DEGRADATION - Pesticides transported to surface and ground waters, 16 - WATER QUALITY DEGRADATION - Excessive sediment in surface waters, 18 - DEGRADED PLANT CONDITION - Undesirable plant productivity and health, 19 - DEGRADED PLANT CONDITION, Inadequate structure and composition, 22- INADEQUATE HABITAT FOR FISH AND WILDLIFE - Habitat degradation.

**Before Situation:**

The wetland has been converted to agricultural production, and the tract drained with a surface ditch. The ditch is 4' average depth, and 12 feet average width. The wetland receives surface runoff from an adjacent upland watershed, and ponds water on a shallow perched layer. The watershed has been converted from native to agricultural landuse, and the resultant soil erosion has deposited 6" of sediment in the bottom of the depression.

**After Situation:**

The ditch has been plugged by the installation of a 50' long section of compacted clay fill, and the deposition has been removed down to the original topsoil layer. A herbaceous plant community has been seeded. Facilitative practices include Conservation Cover. Restoration of hydrology and plant community functions will improve the WATER QUALITY and DEGRADED PLANT CONDITION concerns listed above. The hydrologic and vegetative practices will address the SOIL QUALITY DEGRADATION and INADEQUATE HABITAT FOR FISH AND WILDLIFE concerns.

**Scenario Feature Measure:** Acres of Tract

**Scenario Unit:** Acre

**Scenario Typical Size:** 15

**Scenario Cost:** \$17,366.70

**Scenario Cost/Unit:** \$1,157.78

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic yard	\$1.99	8067	\$16,053.33
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic yard	\$3.69	89	\$328.41
<b>Mobilization</b>						
Mobilization, large equipment	1140	Equipment >150HP or typical weights greater than 30,000 pounds or loads requiring over width or over length permits.	Each	\$492.48	2	\$984.96

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**Scenario: #5 - Riverine Channel and Floodplain Restoration**

**Scenario Description:**

A Riverine HGM landscape on a small stream on a low stream order riparian landscape has been converted to agricultural production. The stream channel has degraded. The reach is 1500 feet in length, and the tract size is 15 acres. The wetland area is 10 acres. Resource Concerns are: 4-SOIL QUALITY DEGRADATION - Organic matter depletion, 11- WATER QUALITY DEGRADATION - Excess nutrients in surface and ground waters, 12 - WATER QUALITY DEGRADATION - Pesticides transported to surface and ground waters, 16 - WATER QUALITY DEGRADATION - Excessive sediment in surface waters, 18 - DEGRADED PLANT CONDITION - Undesirable plant productivity and health, 19 - DEGRADED PLANT CONDITION, Inadequate structure and composition, 22- INADEQUATE HABITAT FOR FISH AND WILDLIFE - Habitat degradation.

**Before Situation:**

Channel incision has broken the lateral connectivity between the stream and floodplain. The conversion to cropland was accompanied by filling and leveling of backswamp, side channel, and oxbow features which formerly ponded water or exposed the floodplain groundwater table. The site no longer has access to floodwater or water surface profile supported groundwater. No suitable seed bank exists for natural regeneration of the original hydrophytic plant community, either in the channel, or on the floodplain.

**After Situation:**

The hydrology of the site is restored by the installation of a series of rock check structures to raise the stream water surface profile. Floodplain macrotopographic features replicating the original side channels, oxbows, and backswamps are constructed by excavation. Spoil is placed adjacent to the excavations to replicate natural depositional features. The average depth of the excavated features is 2 feet, and the surface area of the excavations is 25% of the tract size. The eroding stream bank is stabilized with soil bio-engineering features, and fish habitat improvement measures are installed in the channel. The tract is seeded to appropriate hydrophytic and upland vegetation, both woody and herbaceous. Facilitating practices are Streambank and Shoreline protection, Structure for Water Control, Conservation Cover, Tree/Shrub Establishment, and Stream Habitat Improvement and Management. Restoration of hydrology and plant community functions will improve the WATER QUALITY and DEGRADED PLANT CONDITION concerns listed above. The hydrologic and vegetative practices will address the SOIL QUALITY DEGRADATION and INADEQUATE HABITAT FOR FISH AND WILDLIFE concerns.

**Scenario Feature Measure:** Acres of Tract

**Scenario Unit:** Acre

**Scenario Typical Size:** 15

**Scenario Cost:** \$7,004.71

**Scenario Cost/Unit:** \$466.98

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic yard	\$1.99	3025	\$6,019.75
<b>Mobilization</b>						
Mobilization, large equipment	1140	Equipment >150HP or typical weights greater than 30,000 pounds or loads requiring over width or over length permits.	Each	\$492.48	2	\$984.96

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**Scenario: #6 - Crush Tile/Fill Ditch**

**Scenario Description:**

This scenario involves crushing tile and/or plugging an open ditch to restore hydrology to a wetland. Exploratory ditches or holes are placed to determine locations. A paralell ditch is dug along side of unknown tile to detrmine depth, size, etc. Tile(s) are removed, crushed or otherwise disabled. Soil material is compacted in the areas of excavation. Vegetation is then established. Associated practices expected to be included are Conservation Cover (327), Mulching (484) and or other vegetative establishment. Typical size is 20 acres.

**Before Situation:**

An existing crop field was drained in the past either by an open ditch or tile drains or a combination of the two. This practice plugs existing ditch(es) and crushes drain tile so as to restore wetland conditions and restore hydrologic conditons.

**After Situation:**

Tile drains are strategically crushed and/or ditches are plugged with fill from on-site sources. A herbaceous plant community will be be seeded. Facilitative practices include Conservation Cover. Restoration of hydrology and plant community functions will improve the WATER QUALITY and DEGRADED PLANT CONDITION concerns listed above. The hydrologic and vegetative practices will address the SOIL QUALITY DEGRADATION and INADEQUATE HABITAT FOR FISH AND WILDLIFE concerns.

**Scenario Feature Measure:** CY of material excavated

**Scenario Unit:** Cubic Yard

**Scenario Typical Size:** 165

**Scenario Cost:** \$769.64

**Scenario Cost/Unit:** \$4.66

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, common earth, side cast, large equipment	1227	Bulk excavation and side casting of common earth with hydraulic excavator with less greater than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$1.82	180	\$327.60
<b>Labor</b>						
General Labor	231	Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc.	Hour	\$18.41	10	\$184.10
<b>Mobilization</b>						
Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$257.94	1	\$257.94

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**Scenario: #7 - Dike Breach, ditch fill and creation of surface macrofeatures**

**Scenario Description:**

To restore 80 acre area back to a wetland requires three 50' long breaches within an existing 4' H, 8' top width, 1,100' L dike. In addition, 12 ditches are filled (40' L x 4' Wide x 1.25' Deep on average) at the discharge end of existing swales and compacted; Also install macrofeatures on 20 surface acres (0.5 deep) creating interconnected drainage ditches. This work allows for frequent inundation and restores the normal hydraulic regime. Resource Concerns are water quality from excess nutrients in surface and ground waters and pesticides transported to surface and ground waters as well as excessive sediment in surface waters and degraded habitat for waterfowl, fish and wildlife.

**Before Situation:**

The 80 acre farmed wetland has an existing 1,100'- 4' H, 8' top width dike which prevents frequent inundation of cropland and there are regularly spaced (100') shallow (1.5' Deep) surface drainage ditches. The lateral connectivity between the channel and floodplain has been altered by construction of levees along the reach. and the ditches assure surface runoff and drainage of the area to provide for cropping of the area. Resource Concerns are water quality from excess nutrients in surface and ground waters and pesticides transported to surface and ground waters as well as excessive sediment in surface waters and degraded habitat for waterfowl, fish and wildlife.

**After Situation:**

Restoration of hydrology and plant community functions are improved for the water quality, soil condition improvement, and habitat for fish and wildlife. The hydrology of the site is restored with the levee breach and ditch plugs and the excavation of macrotopographic features on 20 acres. Excavated spoil is placed adjacent to the features on the wetland and adjacent non-wetland area with a maximum depth of 24 inches. The dike has been breached at the upstream, center and downstream ends, restoring natural stream flooding to the area. The breach length averages 50 feet long per location with three completed. The disturbed areas are planted with hydrophilic vegetation using CAP (342). The levee breaches are protected by bioengineered methods using live stakes, fascines and bare root stock plantings using Streambank and Shoreline Protection (580). Facilitating practices include CAP (342), Streambank and Shoreline Protection (580), Structure for Water Control (587), Channel Bed Stabilization (584), Conservation Cover (327), Tree/Shrub Establishment (612), Wetland Enhancement (659) and Riparian Forest Cover (391) or Riparian Herbaceous Cover (390).

**Scenario Feature Measure:** CY of material excavated

**Scenario Unit:** Cubic Yard

**Scenario Typical Size:** 16,666

**Scenario Cost:** \$34,840.33

**Scenario Cost/Unit:** \$2.09

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic yard	\$1.99	16666	\$33,165.34
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic yard	\$3.69	187	\$690.03
<b>Mobilization</b>						
Mobilization, large equipment	1140	Equipment >150HP or typical weights greater than 30,000 pounds or loads requiring over width or over length permits.	Each	\$492.48	2	\$984.96

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**Scenario: #8 - CY Macro-Features**

**Scenario Description:**

Restore the topographic and/or hydrologic features in the area back to a wetland by re-creating the natural macrofeatures ( 0.5' over 20 acres) typical of the wetland type, creating shallow pools of water and restoring the natural hydraulic functions. Resource Concerns are water quality from excess nutrients in surface and ground waters and pesticides transported to surface and ground waters, associated with farming of the area, as well as excessive sediment in surface waters and degraded habitat for waterfowl, fish and wildlife.

**Before Situation:**

The area had been farmed in the past by shaping and grading and removing natural wetland shallow pools. Resource Concerns are water quality from excess nutrients in surface and ground waters and pesticides transported to surface and ground waters as well as excessive sediment in surface waters and degraded habitat for waterfowl, fish and wildlife.

**After Situation:**

Restoration of hydrology and plant community functions are improved for the water quality, soil condition improvement, and habitat for fish and wildlife. The 0.5' D -20 acre wetland area is re-created. Excavated spoil is placed on non-wetland area with a maximum depth of 24 inches. Facilitating practices include CAP (342), Streambank and Shoreline Protection (580), Structure for Water Control (587), Channel Bed Stabilization (584), Conservation Cover (327), Tree/Shrub Establishment (612), Wetland Enhancement (659) and Riparian Forest Cover (391) or Riparian Herbaceous Cover (390).

**Scenario Feature Measure:** CY of excavated material

**Scenario Unit:** Cubic Yard

**Scenario Typical Size:** 16,133

**Scenario Cost:** \$32,597.15

**Scenario Cost/Unit:** \$2.02

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic yard	\$1.99	16133	\$32,104.67
<b>Mobilization</b>						
Mobilization, large equipment	1140	Equipment >150HP or typical weights greater than 30,000 pounds or loads requiring over width or over length permits.	Each	\$492.48	1	\$492.48

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**Scenario: #9 - Fill shallow drainage ditches, no macro features**

**Scenario Description:**

Restore the area back to a wetland by filling the downstream end and midway section of the 18 shallow ditches that have 4' Width, 2:1S. Fill material for ditch is created from existing 0.5' macrofeature (1.1 surface area). This creates shallow pools of water where the ditch is left in tack thus removing the surface drainage and restoring hydraulic functions. Resource Concerns are water quality from excess nutrients in surface and ground waters and pesticides transported to surface and ground waters, associated with farming of the area, as well as excessive sediment in surface waters and degraded habitat for waterfowl, fish and wildlife.

**Before Situation:**

The 40 acre farmed wetland has 18 shallow drainage ditches (4' bottom and 1.75' deep) which removes surface water and wetland hydrology allowing the area to be cropped at times. Resource Concerns are water quality from excess nutrients in surface and ground waters and pesticides transported to surface and ground waters as well as excessive sediment in surface waters and degraded habitat for waterfowl, fish and wildlife.

**After Situation:**

Restoration of hydrology and plant community functions are improved for the water quality, soil condition improvement, and habitat for fish and wildlife. The farmed wetland has filled 16 surface drainage ditches with 32-40' Long (center and end) of the shallow drainage ditches (16 SF/FT) of ditch section in addition a 1.1 surface area of macrofeatures and swales to connect upslope ditches is created. Some of the property has hydrophilic vegetation and by filling in the ditches, the wetland hydrology of the area will be completely restored. The disturbed areas are planted with hydrophilic vegetation using CAP (342) as needed. The levee breaches are protected by bioengineered methods using live stakes, fascines and bare root stock plantings using Streambank and Shoreline Protection (580). Facilitating practices include CAP (342), Streambank and Shoreline Protection (580), Structure for Water Control (587), Channel Bed Stabilization (584), Conservation Cover (327), Tree/Shrub Establishment (612), Wetland Enhancement (659) and Riparian Forest Cover (391) or Riparian Herbaceous Cover (390).

**Scenario Feature Measure:** CY Macro Feature Creation

**Scenario Unit:** Cubic Yard

**Scenario Typical Size:** 887

**Scenario Cost:** \$5,054.63

**Scenario Cost/Unit:** \$5.70

**Cost Details (by category):**

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<b>Equipment/Installation</b>						
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic yard	\$1.99	887	\$1,765.13
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic yard	\$3.69	758	\$2,797.02
<b>Mobilization</b>						
Mobilization, large equipment	1140	Equipment >150HP or typical weights greater than 30,000 pounds or loads requiring over width or over length permits.	Each	\$492.48	1	\$492.48