A Landscape Level Approach to Wetland Functional Assessment

Wetland Mapping & Functional Assessment
Canadian River Watershed
New Mexico

December 10, 2013
### EPA 3 Level Technical Approach

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<tr>
<th>Level 1 - Landscape Assessment:</th>
<th>Products/Applications</th>
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| Use GIS and remote sensing to gain a landscape view of watershed and wetland condition. Typical assessment indicators include wetland coverage (NWI), land use and land cover | • Targeting restoration and monitoring  
• Landscape condition assessment  
• Status and trends  
• Integrated reporting CWA 305(b)/303(d) |

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<th>Level 2 – Rapid Wetland Assessment:</th>
<th>Products/Applications</th>
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| Evaluate the general condition of individual wetlands using relatively simple field indicators. Assessment is often based on the characterization of stressors know to limit wetland functions e.g., road crossings, tile drainage, ditching. | • 401/404 permit decisions  
• Integrated reporting  
• Watershed planning  
• Implementation monitoring of restoration projects, including nonpoint source BMPs, and Farm Bill programs |

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<th>Level 3 – Intensive Site Assessment</th>
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| Produce quantitative data with known certainty of wetland condition within an assessment area, used to refine rapid wetland assessment methods and diagnose the causes of wetland degradation. Assessment is typically accomplished using indices of biological integrity or hydrogeomorphic function. | • WQS development, including use designation  
• Integrated reporting  
• Compensatory mitigation performance standards  
• Verify levels 1 and 2 methods |
Level 1 - Landscape Level Wetland Mapping & Assessment

Project Objectives:

Use remote sensing, image interpretation techniques, collateral GIS data, and best professional judgment to:

- Map or update the wetland landscape profile of a project study area (soil, hydrology, vegetation)
- Extend traditional wetland mapping to include “interpretable” hydrogeomorphic metrics
- Correlate wetland types and characteristics to wetland function on the landscape
- Map and document additional wetland characteristics to provide continuity between Level 1 and Level 2
Northeastern New Mexico Study Area Description

• **Watersheds (HUC 8):** Upper Canadian, Upper Rio Grande, Upper Pecos Rivers

• **Total Area:** 9100 sq. miles or 5.7 M acres

• **Counties:** Colfax, Mora, San Miguel, Taos, Rio Arriba and Santa Fe

• **Previous Wetland Mapping:** None, limited site specific NWI

• **Major Ecoregions:** Montane forests, foothill shrub lands, tableland shrub and grasslands, high plains
Major Steps of Project

- Map and classify present-day wetlands:
  - NWI Cowardin classification
  - FGDC National Wetland Mapping Std
  - Map and classify adjacent riparian areas
  - project imagery 2009 NAIP
  - numerous collateral data layers

- Add hydrogeomorphic characteristics to wetlands:
  - LLWW interpretation and classification

- Develop functional correlation table:
  - utilize local wetland professionals – “bpj”
  - establish wetland functions to be assessed
  - correlate wetland descriptors to functions

- Link to Rapid Assessment Methods
  - collect additional data, tie to HGM
Mapping and Classification Systems

- National Wetland Inventory (NWI)
  Cowardin (1976)

- System for Mapping Western Riparian Areas
  Dick/USFWS (2009)

- Landscape Position, Landform, Waterbody Type, Water Flow Path (LLWW)
  Tiner (2011)

- Crosswalk to Hydrogeomorphic Classification for Wetlands (HGM)
  Brinson (1993)
National Wetland Inventory

- Based on Cowardin (1976) and endorsed by FGDC Federal Wetland Mapping Standard
  - Dominant Life Forms (e.g. forested, emergent)
  - Subclasses (e.g. Persistent, Non-persistent)
  - Water Regimes (generally, e.g. Wet Soil Palustrine)
  - Special Modifiers (certain, e.g. farmed, beaver, excavated etc.)
NWI Classification

Systems: Riverine (R), Lacustrine (L), Palustrine (P)

Subsystems: Lower Perennial (2), Upper Perennial (3) and Limnetic (1), Littoral (3)

Classes: Unconsolidated Bottom (UB), Aquatic Bed (AB), Emergent (EM), Scrub/Shrub (SS), Forested (FO)

Subclasses: Persistent (1), Non-Persistent (2), Broad-leaved Deciduous (1), Needle-leaved Evergreen (3),

Water Regimes: Temporarily Flooded (A), Saturated (B), Seasonally Flooded (C), Semi-permanently Flooded (F), Intermittently Exposed (G), Permanently Flooded (H), Intermittently Flooded (J)

Special Modifiers: Beaver (b), Partly Drained (d), Impounded (h), Excavated (x), Farmed (f)

Water Chemistry and Soil: Acid (a), Alkaline (i), Organic (g), Mineral (n)

Typical Code: PEM1C - Palustrine, Emergent, Persistent, Seasonally Flooded
NWI Water Regimes

Open Water (Aquatic Rod)

Deep Marsh (Emergent wetland)

Shallow Marsh (Emergent wetland)

Wet Meadow

Scrub/Shrub Wetland

Forest Wetland

Upland Buffer

NWI – A

NWI – B

NWI – C

NWI – F

NWI – G, H
Riparian Classification

- **System** is a single unit category - riparian vegetation (Rp).

- **Subsystem** defines two categories reflecting the water source for the riparian area - lotic (1) and lentic (2).

- **Class** describes the dominant life form of riparian vegetation. Classes are: forested (FO), scrub/shrub (SS), and emergent (EM).

- **Subclass** further describes the Class as either dead (5), deciduous (6), evergreen (7), or mixed deciduous/evergreen (8).

- **Dominance Type** refers to vegetative species within the mapping unit, e.g. cottonwood (CW).

- **Rp1FO6CW** is interpreted as:

  - **System:** Rp - Riparian
  - **Subsystem:** 1 - Lotic
  - **Class:** FO - Forested
  - **Subclass:** 6 - Deciduous
  - **Dominance:** CW - Cottonwood
NM Project Imagery and Collateral Data

Interpretation Challenges

• Limited resources for image acquisition
• Chose to move forward with existing NAIP imagery
• True color, mid summer, leaf on, drought conditions. Not an ideal image source for wetland interpretation
• Ideally would have been spring, leaf off, normal precipitation color infra-red
• Forced reliance on collateral data
Maxwell Wildlife Refuge
2005 – 2009 Imagery
NM Collateral Data Sources

- USGS 1:24,000 DRG
- USGS NHD streams and waterbodies
- NRCS SURRGO Soils Data
- Google Earth imagery time slider tool
- SWQB Stream Data (cold water, warm water, fish species)
- USGS 30m and 10m National Elevation Dataset
- USFS Springs and Seeps database
NM Pre and Post Mapping Field Validation

Validation of image signatures

Confirmation of landscape position and other hydrogeomorphic metrics
Based on Tiner (2011)

*similar to older hydrogeomorphic classification (Brinson 1993)

**Landscape Position** - relationship between a wetland and an adjacent waterbody or not

**Landform** - shape or physical form (island, basin, floodplain, etc.)

**Water Flow Path** - directional flow of water (outflow, inflow, isolated, etc.)

**Water Body Type** – lake, pond, river, stream
Landscape Position
LLWW continued

**Lotic** – in or along rivers and streams and in floodplains

**Lentic** – in or along lakes

**Terrene** – completely surrounded by upland or nearly so; not flooded by river or streams
Lentic
LLWW continued
Lotic

LLWW continued
Terrene
LLWW continued
Landforms
LLWW continued

• Slope
• Island
• Fringe
• Floodplain (basin, flat)
• Interfluve (basin, flat)
• Basin
• Flat
Basin (BA)Landform
Flats (FL) Landform
Slope (SL) Landform
Floodplain (FL) Landform
Water Flow Paths
LLWW continued

• Bidirectional (BI)
• Inflow (IN)
• Isolated (IS)
• Throughflow (TH)
• Outflow (OU)
Bidirectional (BI) Waterflow Path
Inflow (IN)
Waterflow Path
Isolated (IS)
Waterflow Path
Outflow (OU)
Waterflow Path
Throughflow (TH)
Waterflow Path
Waterbody Types

River (RV)
- low, middle, high gradient
- dammed

Stream (ST)
- low, middle, high gradient
- artificial

Lake (RV)
- natural
- dammed

Pond (PD)
- natural, dammed, excavated, beaver, other artificial
Waterbody Types
LLWW continued

• River and Stream Gradients (low)
• Lakes (natural, reservoir)
• Ponds (e.g. natural, beaver, farm, residential)
LLWW Interpretation and Coding

During NWI mapping also consider and add LLWW codes:

Example (next slides, highlighted polygon):

**NWI:** PSS5C
*Paulustrine, scrub shrub - dead, seasonally flooded*

**LLWW:** LS1BATHhw
*Lotic Stream low gradient, Basin, Through-flow, headwaters*
Functional Correlations

How well do they perform each function?

- Each polygon is ranked high or moderate based on the characteristics identified in NWI+

- Use existing correlation tables developed by Best Professional Judgment (BPJ) and modify for the Arid West

  Fizzell (2011), Miller et al. (2012), Richtman (2012)
LLWW Codes to Wetland Functions

Functions for New Mexico Assessment:

- 1. Surface Water Detention;
- 2. Streamflow Maintenance;
- 3. Groundwater Recharge;
- 4. Carbon Sequestration;
- 5. Nutrient Transformation;
- 6. Carbon Sequestration;
- 7. Bank and Shoreline Stabilization;
- 8. Fish Habitat;
- 9. Aquatic Invertebrate Habitat;
- 10. Waterfowl and Water Bird Habitat;
- 11. Other Wildlife Habitat; and,
- 12. Unique, Uncommon, or Highly Diverse Wetland Plant Communities
Functions and Values Schema

- Requires wetlands classified in Cowardin (NWI) System
- NWI Water Regimes correlate to LLWW Landforms
- NWI System and Classes correlate to Waterbody Type
- Requires accurate spatial wetland data
Surface Water Detention or Stream-flow Maintenance

Highly Functional
- Vegetated wetlands along streams, rivers, lakes, and islands
- Isolated wetlands with inlet and outlet

Moderately Functional
- Isolated or outflow vegetated wetlands
- Wetlands adjacent to lakes not already included in High
Carbon Sequestration

Highly Functional
- Dominated by floating aquatics (e.g. lillies)
- Non-persistent emergents (e.g. wild rice)
- Wetlands with organic soils (P____g)
  (Teleconference with Ralph Tiner)

Moderately Functional
- Saturated, Temporarily Flooded or Seasonally Flooded Wetlands with mineral soils
Fish Habitat

Highly Functional
• Wetlands with throughflow lakes, rivers, and streams

Moderately Functional
• Throughflow ponds
• Scrub/shrub and forested wetland along trout streams
Waterfowl Habitat

Highly Functional
• Vegetated shallow lakes and ponds
• Wooded wetland along rivers and streams

Moderately Functional
• Natural ponds and excavated open water in wetland
• Emergent wetlands adjacent to open water
Other Wildlife Habitat

Highly Functional
• Wetland complexes larger than 20 acres
• Wetlands 10 to 20 acres with two or more plant communities

Moderately Functional
• All vegetated wetland
Wetland and Deepwater Habitats

Map Information:
- Projection: UTM NAD83 Zone 13N
- Datum: NAD 1983
- Production Date: September 2013

Disclaimer: This map is intended as visual aid and is not intended for regulatory use.
Hydrogeomorphic Classification of Wetland Subclasses

• Based on recent document by U.S. Army Corps of Engineers *A Hydrogeomorphic Classification of New Mexico Wetlands* Wilder, et al. (2012)

• Developed a model based on vegetation communities by subclass

• First run of model excluded some wetland types

• Continuing to refine model
Hydrogeomorphic Classifications for future Rapid Assessment Development

• NM Wetlands Program currently has a NM RAM for Mid-Montane Riverine Wetlands
• Lowland Riverine Wetland subclass RAM in development
• Beginning development of RAM for Playa wetlands
• Future planned development of RAM for Springs and Seeps
• Additional wetland subclasses: Headwater/subalpine/alpine riverine subclass; Slope wetlands; Flats; additional subclasses identified from mapping