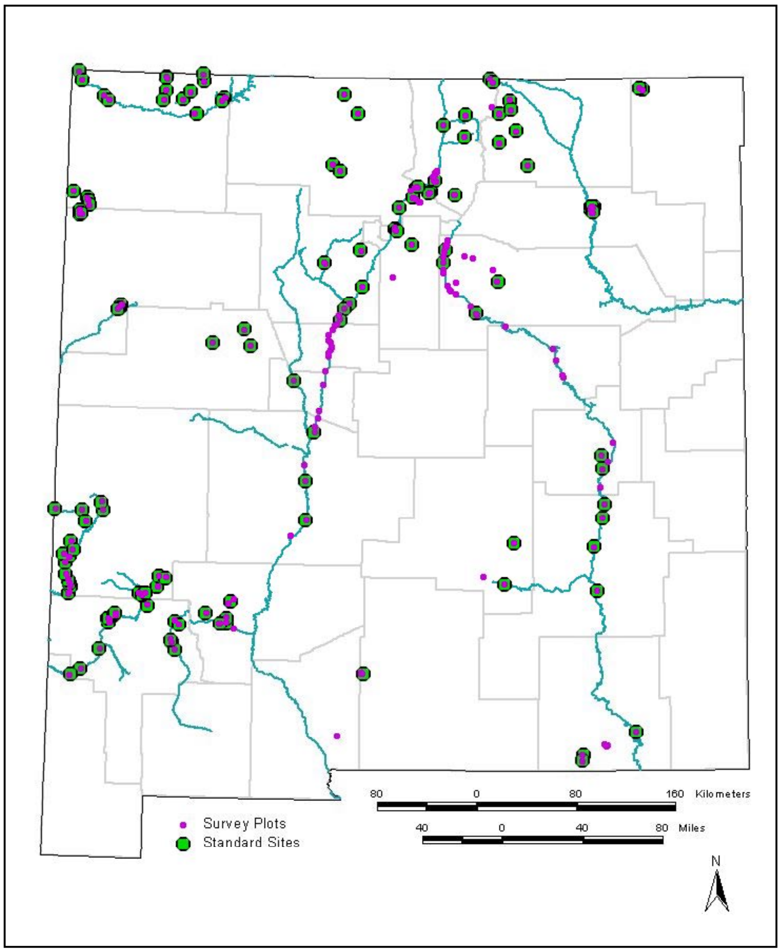
A Wetlands/Riparian Assessment Database and GIS For New Mexico

Final Report



New Mexico Environment Department

New Mexico Natural Heritage Program

A Wetlands/Riparian Assessment Database and GIS for New Mexico

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Introduction

The Environmental Protection Agency's current goal, reflecting administrative policy, is for no net loss of wetlands with a long-term goal of increasing both quantity and quality of wetlands in the United States. In addition, the Clean Water Act aims to restore the biological, as well as the chemical and physical, integrity of our waters, including wetlands (Environmental Protection Agency 1997). Recently, the EPA has encouraged research and monitoring that will lead to restoration of biological integrity of wetlands through workshops, and the development of approaches and guidance (Environmental Protection Agency 1997, Brinson 1993). In this context, we report here our efforts to build on our capacity to assess the status of wetlands (including riparian areas) in New Mexico with an eye towards the goal of achieving no net loss of wetlands or their function. Accordingly, we evaluated current wetland assessment techniques used around the state and then designed and built a prototype wetlands/riparian assessment database and associated geographic information system (GIS) as a tool to track assessments and the status of New Mexico's wetlands.

We used a field workshop of professionals knowledgeable in the arena of wetlands assessment as a mechanism for evaluation current assessment techniques. The workshop focused on four techniques: Proper Functioning Condition (Prichard et al. 1993, 1994 & 1998); the Hydrogeomorphic Approach or HGM (Brinson 1993; Brinson et al 1998; Ainslie et al. 1998), Greenline Survey and associated riparian monitoring techniques (Winward 2000), and the New Mexico Natural Heritage Program's Wetland/Riparian Site Biodiversity Ranking protocol (Bradley et al 1998 and Muldavin et al. 2000). Over the course of two days a variety of wetlands were visited and the application of the various methods discussed among the participants. The results are summarized below and include a workshop overview, list of participants, verbatim transcription of selected discussions, and a list of pertinent wetland assessment literature.

The input from workshop participants was used in the design of the Wetlands GIS and associated databases to support wetland assessment throughout New Mexico. In the past,

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wetlands data sets have been entered into a variety of non-spatial databases or simply compiled into reports. This significantly limits spatial analysis as well as information availability for wetlands assessment, and ultimately, conservation. In this context, a GIS spatial approach seemed most appropriate, and with the advent of relatively inexpensive and user-friendly software, useable by many people among a variety of agencies and organizations. To develop the prototype, we used data collected by the New Mexico Natural Heritage Program (NMNHP) in previous wetlands conservation program work (Bradley et al. 1998 and Muldavin et al. 2000) to provide the initial structure to the database and the necessary mapping information for development of GIS layers. The details of the GIS structure and content are provided below, and the GIS itself with its preliminary set of 127 wetland sites is available on CD to interested parties. The overall goals of Wetlands/Riparian GIS are to provide a platform to archive a variety of wetlands assessment information (including the target techniques), and to track the status of wetland/riparian sites around the state.

Target Assessment Methods

Although there are several wetland/riparian and aquatic assessment techniques in use in the western U.S., we focused on the four methods that have, or potentially have, broad applications in New Mexico's wetland/riparian areas: 1) the interagency Proper Functioning Condition (PFC) tool for riparian area management; 2) Hydrogeomorphic Approach (HGM) developed by the Army Corps of Engineers Waterways Experiment Station; 3) Greenline surveys and related vegetation monitoring tools developed by the US Forest Service for riparian areas; and 4) the Wetland/Riparian Site Biodiversity Ranking protocols of the New Mexico Natural Heritage Program (see Appendix A for a list of references on wetland/riparian assessment techniques).

The four techniques have much in common with respect to parameters considered, but they differ with respect to their levels of precision and goals. For example, the Heritage Site Biodiversity Ranking and the HGM methodologies refer directly to detailed quantitative reference data sets for a given ecosystem type. Greenline surveys also refer to the reference conditions (Potential Natural Communities), but are less intensive with respect to data acquisition. PFC is primarily qualitative in application with optional quantitative methodologies (in fact, Greenline surveys are suggested by Winward (2000) as a quantitative follow-up to PFC assessment).

While each method assesses condition and functionality, they define them differently in the context of their objectives. In PFC, riparian-wetland functionality means channel stability, less erosion, good water quality, good water availability, forage, and fish and wildlife habitat. Accordingly, PFC measures focus on how vegetation, landform and woody debris dissipate stream energy, filter sediment, aid groundwater recharge and floodplain development, stabilize streambanks, and maintain channel characteristics (Prichard et al. 1998). There are 17 measures for lotic systems and 20 for lentic that result in categorizing wetland/riparian areas as either *functional* (needing minimal management intervention), *functional—at risk* (restorable, but needing immediate management intervention), or *nonfunctional* (not restorable without major intervention). The method relies on expert opinion and a multidisciplinary team approach to efficiently address these selected sets of functional characteristics with a minimum reliance on acquisition of new quantitative data. The priority is to identify wetland/riparian sites at risk that are restorable with a modicum of management intervention before they become completely nonfunctional.

HGM views functionality in a similar way but with a somewhat broader scope. It is based on a set of models that evaluate how wetlands: 1) temporarily store surface water; 2) store and convey subsurface water; 3) cycle nutrients; 4) remove and sequester elements and compounds; 5) retain particulates; 6) export organic carbon; 7) provide environments for native plant communities; and 8) provide wildlife habitat[4]. The models use a large suite of variables and data from reference sites to derive Functional Capacity Indices (FCIs) corresponding to each wetland function. "FCIs are scaled from 0.0 to 1.0, so a given disturbed wetland might be found to function at the 0.5 level, or at 50% of potential, for a particular function." The emphasis on functionality in relation to water quality reflects HGM's roots in the Clean Water Act Section 404 Regulatory Program, but over time it has grown in scope beyond impact assessment and mitigation to be used as general wetland/riparian management tool (Anslie 1998).

In contrast, Greenline surveys and the Heritage ranking system view functionality more in terms of the maintenance of vegetation communities. Vegetation pattern and composition are seen as integrators of processes and physical attributes, and are a reflection of overall condition of a wetland/riparian site. With Greenline surveys and associated monitoring methods, condition is framed in terms of either successional status or departure from desired condition based on expected natural community expression in a wetland/riparian complex. In addition, the Greenline transects are intended to evaluate bank stability. Using step transect data, status and stability ratings are computed that are then evaluated against standards set for the general area being studied, and, as necessary, management is adjusted to meet these standards (Winward 2000). Greenline sampling is fundamentally intended to be an efficient and cost effective monitoring methodology to track change in wetland/riparian complexes.

The goals of the Heritage ranking system are somewhat different: conservation and enhancement of wetland/riparian biodiversity. Hence, measures focus on evaluating the composition and status of biodiversity at a site in local, landscape, and global contexts. The objective is to determine a wetland/riparian site's biodiversity conservation value and long-term sustainability. The methodology has three main sets of factors: condition, landscape, and size. Condition factors look at immediate physical and biological attributes of wetland/riparian community (e.g., species composition, structure, fuel loads, streambank stability, etc.) using known, high quality reference sites as benchmarks. Landscape factors put a community in a broader context of landscape mosaic and watershed conditions by looking at both composition and functional attributes (e.g., community diversity in a wetland/riparian complex, fragmentation of natural communities, fire regime status, and hydrological modifications, etc.). Size, although it has implications for condition and landscape factors, has direct connotations for sustainability: the larger the occurrence of a community, the more resilient it is likely to be in the face of impacts and the therefore more sustainable. Also imbedded in the Heritage ranking process is the concept of ecosystem rarity, i.e., the more threatened an ecosystem is on a global scale, or

[4]New Mexico Assessment Field Review, 10-99: Overview of HGM and related approaches by Charles Klimas. See attachments.

any given species elements with it, the greater its conservation value. When condition, landscape, size and rarity are taken together the result is a Biodiversity Significance Rank (B-Rank) that is a generalized measure used to set conservation goals. This ranking system reflects the long evolution of assessment techniques within the national Natural Heritage network to aid conservation planning, but the tools have also come to have broader applications in wetland/riparian restoration and stewardship.

Figure 1. Participants in the Wetlands/Riparian Field Workshop gather along the Jemez River in the Santa Fe National Forest to talk about methods in wetland/riparian condition assessment.

Wetland/Riparian Assessment Field Workshop

Goals

Many federal, state, and local agencies, private organizations and landowners are charged with stewardship of the state's wetland/riparian areas. As the objectives of these organizations are diverse, so also are the methodologies used to collect information and manage these sensitive areas. What methods work best and under what conditions? Is a single, standardized method desirable or even possible? How can all this information by tracked and accessed by interested parties?

To address these and other questions, we conducted a two-day field review focusing on the four target methodologies described above for assessing the condition of wetlands and riparian areas. The primary objective of the workshop was to assemble information available about riparian assessment and to generate discussion of riparian condition evaluation. The workshop, sponsored by the New Mexico Natural Heritage Program (NMNHP) and the Surface Water Quality Bureau of New Mexico Environment Department generated input leading to the development of a statewide Wetlands/Riparian GIS database for tracking the status of wetland/riparian sites throughout the state. In addition, NMNHP hosted this workshop to further goals developed in 1998 by the New Mexico Riparian Council to increase communication among people working in riparian assessment.

The workshop brought together both assessment experts and riparian resource managers representing the variety of agencies and organizations currently interested in riparian assessment. The two-day workshop provided an opportunity to briefly present overviews of various assessment approaches, and foster discussions to identify critical parameters common to the majority of these methods. Another objective for the workshop included fostering a better understanding among all participants of the variety of approaches to riparian assessment. In addition, the hope was expressed that this group would be able to identify any areas and/or issues that needed further development of tools for appropriate evaluation.

Participation

Participation was solicited from a variety of agencies including: the New Mexico Environment Department, the New Mexico Department of Game and Fish, the New Mexico Natural Resource and Conservation Division, the USDA Forest Service (at regional, forest, and district levels), the U.S. Bureau of Land Management, the U.S. Army Corps of Engineers, The Nature Conservancy, and private consultants with expertise in riparian assessment. In addition to identifying participants for this workshop, this process also identified a wider group of people with an interest in riparian assessment in New Mexico.

The following lists probably represents just the tip of the iceberg of the population of people who are interested in riparian assessment in New Mexico. The following groupings indicate each person's connection with our effort to assess current methodology. A list with our available contact information is included in Appendix B (and as a Microsoft Excel file).

Riparian Assessment Workshop Attendees

Dan	Cramsey	retired forester
Melanie	Deason	New Mexico Environment Department
Charles	Klimas	Charles Klimas & Associates
Chris	Massingill	Mainstream Consulting
Maryann	McGraw	NMED - Surface Water Quality Bureau
Steve	McWilliams	USDA Santa Fe National Forest
Patricia	Mehlhop	NM Natural Heritage Program
McKinley-Ben	Miller	Bureau of Land Management
Travis	Moseley	Jemez Ranger District, USFS
Esteban	Muldavin	NM Natural Heritage Program
Natalie	Runyan	NM State Land Office
Mary	Stuever	Seldom Seen Expeditions, Inc.
Paul	Tashjian	USFW&S, Water Resources
Sarah	Wood	NM Natural Heritage Program

People Who Had Wished to Attend Workshop, but Had Conflicts

Jon	Ambrose	NM State Land Office
Cliff	Crawford	UNM Dept. of Biology
Livia	Crowley	USDA Lincoln National Forest
Bill	Fleming	NM Watershed Watch
Patrick	McCarthy	The Nature Conservancy
Dave	Pawlik	USDA Cibola National Forest
Dan	Smith	Waterways Experiment Station
Rita	Suminski	Mt. Taylor Ranger District, USFS
Willie	Ticaro	Ghost Ranch Conference Center

People Who Asked to Be Kept Informed of Workshop Results

Drew	Baird	Bureau of Reclamation
Todd	Caplan	Pueblo of Santa Ana, Dept. of Nat. Resources
David	Dall	U.S. Fish & Wildlife Service
William	Deragon	U.S. Army Corps of Engineers
Greg	Fitch	NM Forestry & Resource Conservation Division, EMNRD
Reggie	Fletcher	USDA Forest Service
Mark	Harbery	US Army Corps of Engineers
Kris	Havstad	Jornada LTER, NMSU
Jeff	Herrick	Jornada LTER, NMSU
Nic	Medley	NM Dept. of Game & Fish
John	Peterson	USDA Jemez Ranger District
Wayne	Robbie	SW Reg. Office, USDA Forest Service
Buck	Sanchez	USDA Jemez Ranger District
Luke	Shelby	NM Dept. of Game & Fish
Chic	Spann	USDA Forest Service
Nancy	Umbreit	Bureau of Reclamation
Jeff	Whitney	U.S. Fish and Wildlife Service
Charlie	Wicklund	NM State Forestry
Jim	Wilbur	Bureau of Reclamation

Other People With an Interest in Riparian Assessment in NM

Cynthia	Abeyta	U.S. Fish & Wildlife Service
Stacey	Carr	Pueblo of Laguna
Kathryne	Clark	USDA, F.S., Southwestern Region
Gina	Dello Russo	Bosque del Apache NWR
Andy	Dimas	State Office, Bureau of Land Management
David	Duffy	Pueblo Jemez, Dept. of Resource Protection
Jim	Enote	Zuni Conservation Project
Sid	Goodloe	Carrizozo Ranch
Sterling	Grogan	Middle Rio Grande Conservancy District
Ondrea	Hummel	Albuquerque Open Space Division
Beth	Janello	Sandia Environment Department
Gwen	Kittel	Colorado Natural Heritage Program
Leslie	McWhirter	ENTRANCO Inc.
Rand	Morgan	NM State Highway & Transportation Department
Jim	O'Brien	FLO Engineering
Thora	Padilla	Div. of Res. Mng. & Prot., Mescalero Apache Tribe
Patty	Phillips	Parson Engineering and Science
Andy	Rosenau	US Army Corps of Engineers
Rich	Schrader	NM Watershed Watch
Jim	Tolisano	College of Santa Fe
Dave	Witkins	NM State Highway & Transportation Department
Jim	Zokan	Pueblo of Santa Ana, DNR

Logistics

The workshop was organized and facilitated by Mary Stuever, a consulting forest ecologist with Seldom Seen Expeditions, Inc. The purpose of the two-day field trip was to compare assessment strategies to gain a clear understanding of the objectives, similarities, and differences in these strategies. One objective of this workshop was to help the staff at the New Mexico Natural Heritage Program identify reasonable parameters to include in the development of a statewide GIS database for tracking wetland/riparian health. The workshop also addressed an objective to increase communication among professionals doing riparian assessment, which was identified by the New Mexico Riparian Council in the fall of 1998.

Participants met in Bernalillo on October 27, 1999 and traveled to a site along the Jemez River near Cañon, New Mexico. Other stops that day included sites near La Cueva, San Antonio Campground, and San Ysidro. At each site, participants shared information about the riparian assessment methods that they use. Discussions were held on the strengths and weaknesses of these methods. The next day, a similar agenda was followed but included stops along Las Huertas Creek in Placitas and the Rio Grande bosque near Alameda in Albuquerque.

Participants received a field guide handout that included examples of the major assessment techniques that are currently available (one has been provided as an attachment to this report). It includes excerpts from: 1) NMNHP's *Handbook of Wetland Vegetation Communities of New Mexico,* and NMNHP's *Vegetation Survey and Assessment Handbook*; 2)

Riparian Area Survey and Evaluation System (RASES); 3) Proper Functioning Condition and other Technical References developed jointly by the USDA Forest Service and USDI Bureau of Land Management; 4) title pages to the USDI Fish and Wildlife Service's *A System for Mapping Riparian Areas in the Western United States* (1997); 5) New Mexico Watershed Watch rapid bioassessment developed by Bill Fleming; and 6) the Bosque Ecosystem Monitoring Program protocols sponsored by UNM Dept. of Biology and Bosque School. Additional handouts were provided by course participants and included: an overview of the Hydrogeomorphic Approach to Assessment of Wetland Functions by Chuck Klimas; examples of standard checklists for lentic and lotic PFC assessments; Greenline assessment; and a data form for T-Walk assessment provided by McKinley-Ben Miller.

Two micro-cassette recorders were used to document the two-day conversation and are provide as an attachment. The most pertinent discussions were transcribed by retired forester Dan Cramsey and are provided in Appendix B.

Summary of Discussions

The following discussion summarizes the content of these presentations and conversations, includes some background information from the literature and conversations with people not at the workshop, and highlights some comments related to the objectives stated above.

On the first day, the majority of the time was devoted to examining various wetland/riparian assessment methodologies. After a brief presentation, discussion regarding the methods ensued. The primary methods discussed this day included the *New Mexico Wetland Vegetation Classification Handbook* (Muldavin et al. 2000) recently developed by the New Mexico Natural Heritage Program, the hydrogeomorphic method (HGM), and Proper Functioning Condition used by the BLM and USFS.

In general, most workshop participants welcomed the upcoming publication of the *New Mexico Wetland Vegetation Classification Handbook.* This two-volume set represents a compilation of many years of fieldwork in the state's major drainages, as well as closed basins and playas. Volume 1 presents a vegetation community classification system based on this data. In Volume 2, which has been in print since 1998, reference sites are characterized. These 38 sites, which represent the top 10% of the sites in the NMNHP database, can be used as benchmarks for anticipating the desired conditions for similar community types. Workshop participants attested to the value of this second volume identifying reference sites. Professionals using assessment and monitoring techniques such as the Greenline method will immediately be able to find a use for Volume 1, which describes the community types.

In Appendix B, Dan Cramsey's notes document the discussion on the evaluation criteria and site ranking system used by the New Mexico Natural Heritage Program. One weakness of the new handbook is that the classification system is based on a limited number of plots (approximately 400) and many of the community types are provisional because of limited sampling. High elevation community types may also be underrepresented since the majority of the data was gathered on state and private land, and the majority of these sites occur on national forests. In general, the members of the group were anxious to receive the new set of handbooks.

In many states, the Corps of Engineers and a few other federal agencies lean on the Hydrogeomorphic (HGM) assessment of wetland functions as the main riparian assessment tool. In New Mexico it is not currently used, although Chuck Klimas is exploring the potential of introducing this method here. HGM organizes wetlands to reflect their functions rather than dominant vegetation. The HGM approach consists of three parts: hydrogeomorphic classification, model development and classification, and model application. The process includes assembling data, building functional assessment models, and applying them. Teams of various natural resource experts develop the models, and high priority systems can be targeted for initial model development.

One of the most widely used riparian assessment tools by land management agencies is Proper Functioning Condition, or PFC. A PFC assessment is done by a team of at least three, but preferably five trained natural resource professionals. The team looks at the entire riparian system before assessing the various stretches. Then the team fills out a checklist that asks several questions grouped by three major categories—hydrology, vegetation, and erosion/deposition. The answers are ranked, and the site is identified into one of three categories: 1) proper functioning condition, 2) functioning at risk, and 3) non-functioning. The management implication is that the sites designated in the middle category, functioning at risk, are the places where riparian restoration efforts will be most successful. The general philosophy is that non-functioning sites are not worth the effort to restore.

There are several concerns about the PFC assessment as it has been applied in New Mexico. At the core of the assessment is the expertise and dedication of the team making the assessment. Many PFC assessments are done with only one or two people actually making the field visits. Since the system is designed for interaction and discussion in the field among team members, this practice severely negates the process. As one leader in riparian assessment put it, "PFC is only as good at the group doing it." Several of the cadre of PFC trainers admit that there is a need for professionals to take the assessment more seriously and to "follow the real rules."

Another challenge in applying PFC in New Mexico is that many drier riparian areas do not fit the PFC definition of "riparian " as having 30 consecutive days of flow. In order for the system to really be effective in this state, it may need to be modified to include ephemeral situations as well. Upper watershed practices can alter stream flow, and need to be considered in determining the potential for consecutive days of flow.

PFC is a tool designed to identify one category of streams for restoration efforts. Although the system identifies the serious problems in a watershed, it does not quantify less serious problems. For example, in a relatively healthy riparian ecosystem, all stretches may receive a "functional" rating, yet have serious ecological problems, such as exotic species invasion. Such issues can be commented upon at the discretion of the team, but there is no explicit guidelines for their inclusion in the process. It is also important to recognize that PFC is not intended as a comprehensive, detailed evaluation and monitoring methodology, but rather, it is triage approach for recognizing at-risk sites based on a special set of functional criteria, and then targeting them for immediate management intervention.

TWALK (Tarzwell Watershed Area Link) is a follow-up quantitative assessment of stream health in risk areas identified with PFC. TWALK addresses regulatory questions through a quantitative analysis of riparian conditions. Another related riparian assessment tool is Riparian Area Survey and Evaluation System (RACES) that has an emphasis on aquatic conditions with linkages to the Terrestrial Ecosystem Survey of the USFS. However, no one present at the workshop was familiar details of this method.

None of the systems discussed addressed spring assessment, although the group felt this was a very important and overlooked issue in wetland/riparian assessment. The feeling was that many seeps and springs are drying up, and existing ones are often capped, with water being exported off site thus destroying the surrounding riparian area.

Highly regulated large river systems, such as the middle Rio Grande, present special challenges to evaluating condition. Although processes are often highly altered, riparian areas that line these rivers still sustain a wealth of natural biodiversity and are extremely important for water quality and quantity. Assessment strategies need to accommodate the larger operating scale of these ecosystems and allow for hierarchical analysis of what constitutes functionality, good condition, and long-term viability.

The premise that land management objectives should address areas where there is the greatest hope for greatest recovery has forced most assessment methods to identify the worst cases first, at the expense of not recognizing management and protection issues for those sites in good condition. Under this scenario, good sites with a downward trend must slip to an "at risk" category to attract attention. At this point intervention may be more expensive than addressing the original minor concerns.

What emerged from the workshop is that the various assessment methods have overlapping and complementary aspects, and each has its drawbacks and strengths. Yet, the general sense from the workshop is that a satisfactory approach that successfully synthesizes all the techniques is not likely, nor necessarily desirable. Each agency or organization has specific goals and timeframes that are likely to be best served by a variety of methods, rather than just one. There were two unifying themes. Assessment techniques must take a multi/inter-disciplinary approach that includes hydrology, vegetation, soils, and landscape analyses in an understandable, yet not necessarily simplistic framework. They must also be accountable and effectively address the conservation and restoration issues in wetland/riparian ecosystems of the state.

Wetland/Riparian Assessment Database and GIS

A view that emerged from the workshop and review of information from around the state is that the tracking of wetland/riparian condition has been *ad hoc*, and that the overall status of the states wetland/riparian resources is only partially understood, even within a given agency or organization. To help address this information quandary, NMNHP has developed an assessment database and associated geographic information system (GIS) that can accommodate assessment and monitoring information from various agencies and groups. The intent was to build a user-friendly system that makes information readily available to interested parties, and that ultimately will provide a broad picture of the work being done on behalf of New Mexico's wetlands.

The structure of the database and GIS was derived from database methodologies developed over the past several decades by the national network of Natural Heritage Programs (now known as the Conservation Data Network). The Heritage methodology focuses on places or sites, and not only tracks location and descriptive information, but also conservation status and ongoing or proposed management actions. Accordingly, we have provided tools for delineating "wetland/riparian sites" around the state and for tracking PFC determinations, Greenline ratings, and Heritage Biodiversity ranks. (HGM and other assessment techniques have not been be added to the database system at this time because they are not yet widely implemented in New Mexico.)

To maintain flexibility and comprehensiveness, "wetland/riparian sites" are operationally defined based on the assessment or monitoring method used, type of wetland, and scale. At its simplest, a site might be represented by single stand of vegetation along a river or a particular playa lake. Alternatively, a site might be defined by: a vegetation community complex along a stream reach of uniform gradient and channel geomorphology; a series of a playa lakes in a region; or a riparian restoration project site. Hence, the delineation of sites can be hierarchically structured to address questions at multiple scales.

Because of their wide availability and relatively low cost, the assessment database and GIS were designed using Microsoft Access 97and ArcView (Ver. 3.2), respectively. The relationship between the two is complementary and dynamic. The Access database is a multi-table relational database that efficiently stores information on a wide variety of wetland/riparian site attributes. It provides a capacity to manipulate data for quantitative analysis within Access or to export data to the GIS or statistical analysis packages. The ArcView GIS component provides the most efficient and useful way to store spatial information about a wetland/riparian site. It consists of several spatial data layers with associated data tables that store spatial information and the results from spatial analysis. This information in turn can be passed back to the Access database creating a dynamic framework for the database and GIS.

Database Structure, Definition, and Content

The Wetlands/Riparian Assessment Database is a multi-table relational database that, despite the appearance of complex structure, allows for relatively easy and efficient entry and manipulation of data on wetland riparian sites (Figure 2). It is composed of two underlying sets of data tables: those that are native to the Assessment database, and those that are drawn from the NMNHP Ecology Plot Database. Those that are native include the main Site Basic Record (SBR) table and associated tables that have Site in the name. These contain most of the site level location, descriptive, and status information. The Plot and Communities tables are drawn from Ecology Plot Database and provide detailed location, physical and biological information from plots in wetland/riparian areas around the state. All tables and associated variables and definitions are given in Appendix C. In addition, there is a data entry form to help standardize and reduce errors in the data input process, and queries and associated reports that display and/or print the information on individual sites in the database.

In summary, there are four main categories of information:

1) **Identification, location, and other spatial data attributes**. This includes the key field SiteCode that links all the tables to one another. Associated with SiteCode are various descriptors (SiteName, SiteType, SiteClass, and SiteLevel). Site Type refers to whether a site is a basic "standard site" with no embedded sites, a "macro-site" with two or more embedded standard sites, or a "mega-site" with two or more embedded macro-sites. This allows for spatial hierarchical structuring of sites. There are also detailed mapping and location fields plus a field that provides on-the-ground directions to a site. Of particular importance is the boundary justification (Boundjust) field that specifies how the site was defined, i.e., how the boundary was determined in terms of physical, biological, and/or administrative constraints, and so on.

2) **Descriptive physical and biological attribute fields**. These are fields such as Site Description and Key Environmental Factors that summarize the physical and biological characteristics of a site. Land use history, climate, and cultural features are also provided for in the SBR. Additional detailed information on plant communities, soil types, ground cover, and hydrology can be drawn directly from data in the Ecology Plot Database, based on information developed by Bradley et al. 1998 and Muldavin et al. 2000.

3) **Condition and management status.** These fields form the heart of the assessment database and include summary attributes for Proper Functioning Condition (PFC_*) determinations, Greenline ratings (GSR_*), and Heritage Biodiversity ranks (Biodivsig), most of which are found in the Site Basic Record (SBR) table. There are also several fields that focus on management issues (management needs, exotic species, natural hazards, and so on). The Ecology Plot Database provides additional detailed ranking and condition information from plots taken in individual wetland/riparian stands.

4) **Monitoring and quantitative data.** The SBRmonitoring table was created to track revisits to a wetland/riparian site. It allows for additional information on condition to be added through time and identifies monitoring data sets. Although not implemented at this time, this table will link to the detailed assessment and monitoring data such as PFC checkoff lists, Greenline rating tables, Heritage ranking tables, and associated quantitative datasets.

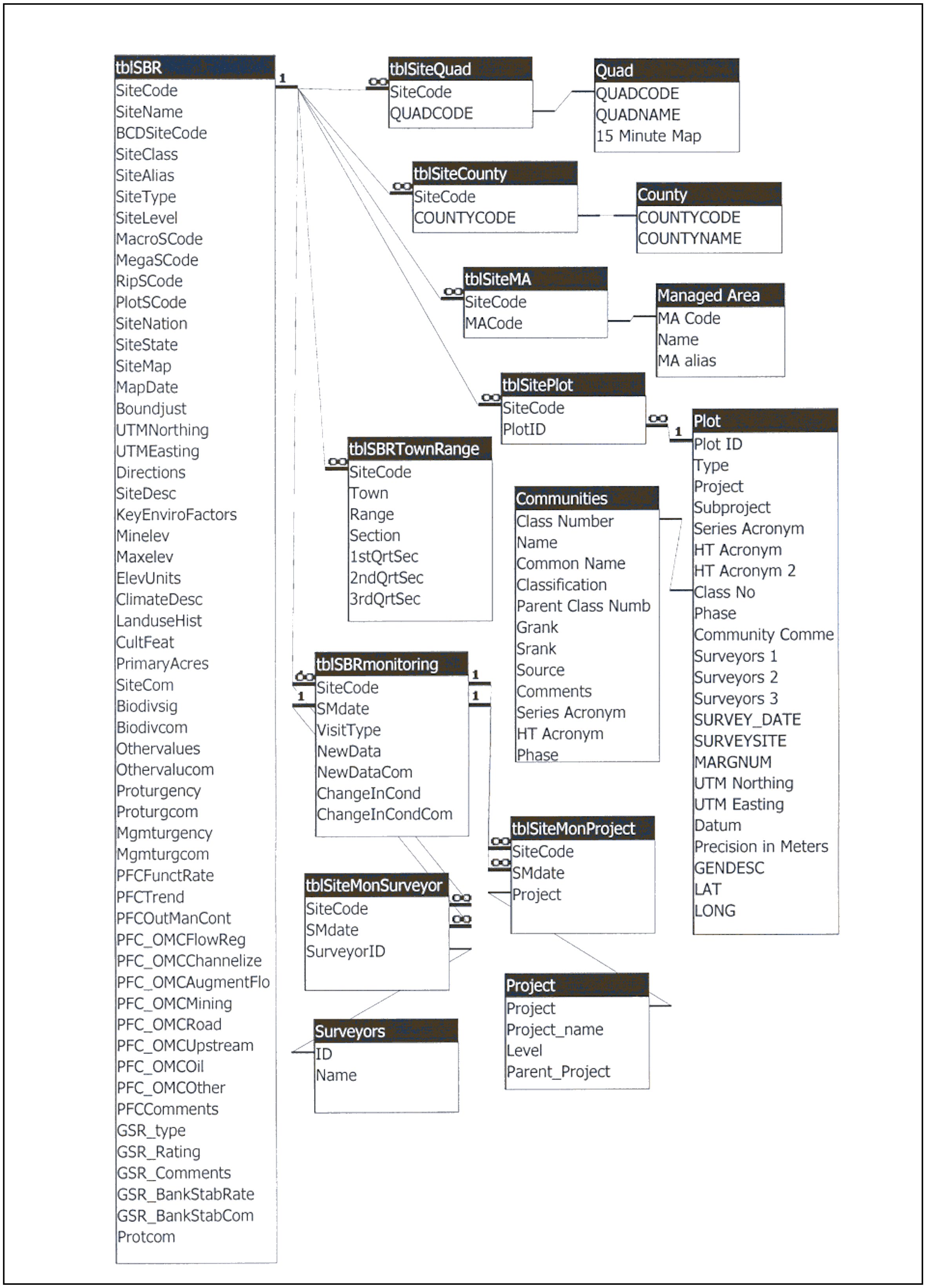

Figure 2. Wetlands/Riparian Assessment Database table structure with partial lists of attributes. See Appendix C for definitions of variables.

Over the past decade the NMNHPs identified 302 wetland/riparain sites through aerial reconnaissance and field studies. Most of these were in the major river basins of New Mexico, including the Pecos, upper and middle Rio Grande, Gila, San Francisco, Mimbres, San Juan, Little Colorado, and Canadian Rivers (see Bradley et al. 1998 and Muldavin et al. 2000 for details on these studies). In addition, there are sites identified from playa surveys in northeastern New Mexico (Wood and Muldavin 2000), and ongoing spring surveys, river monitoring and restoration studies of the NMNHP.

Of the 302 sites, 127 were entered into the Assessment Database and GIS (Figure 3). These include the 38 "reference" sites defined by Bradley et al (1998) as representative of the major wetland/riparian vegetation community types in New Mexico. Each site has supporting quantitative data on vegetation, soils and hydrological transect data (there are 400 plots in the database system from around the state—see Figure 3). There are 41 additional sites with quantitative data that are currently under boundary review and will be added to the database. The remaining 134 sites have only qualitative data from aerial or on-foot reconnaissance and were of lower priority. These have yet to be reviewed in depth, and may require more data before they can be entered into the database (many of these sites are "negeatives" with severe impacts with little potential for restoration).

GIS Structure, Definition, and Content

An ArcView 3.2 GIS was constructed to complement the Access97 Wetlands/Riparian Assessment Database described above. It is composed of several spatial layers that include vector and raster formats that are overlain in various combinations to aid wetland/riparian site boundary delineation and description (Figure 4). The centerpiece is a vector layer of wetland/riparian standard sites with an associated data table. This is an ArcView shape file that contains all the polygons that define the boundaries of standard sites (basic sites with no imbedded sites). Each polygon is tracked by the site number assigned to it in the Access database, and, hence, spatial analysis results on size, distribution, and environments among sites can be passed back to the database. Similarly, there will be separate macro- and mega-site layers implemented that are tied by site number in a parent-child relationship to the standard sites, and also tracked in the assessment database.

The system was designed to incorporate site information from any source, and hence, the delineation of boundaries is dependent on the spatial data available about a site. With the numerous types of assessment techniques available, which range from predominantly qualitative such as PFC to quantitative such as HGM or jurisdictional wetland delineations, standardized boundary rules are not realistic, nor necessarily desirable. What is important is documentation. The criteria used to determine boundaries, the degree of confidence in those boundaries, and changes to the them are tracked in the database Boundary Justification field.

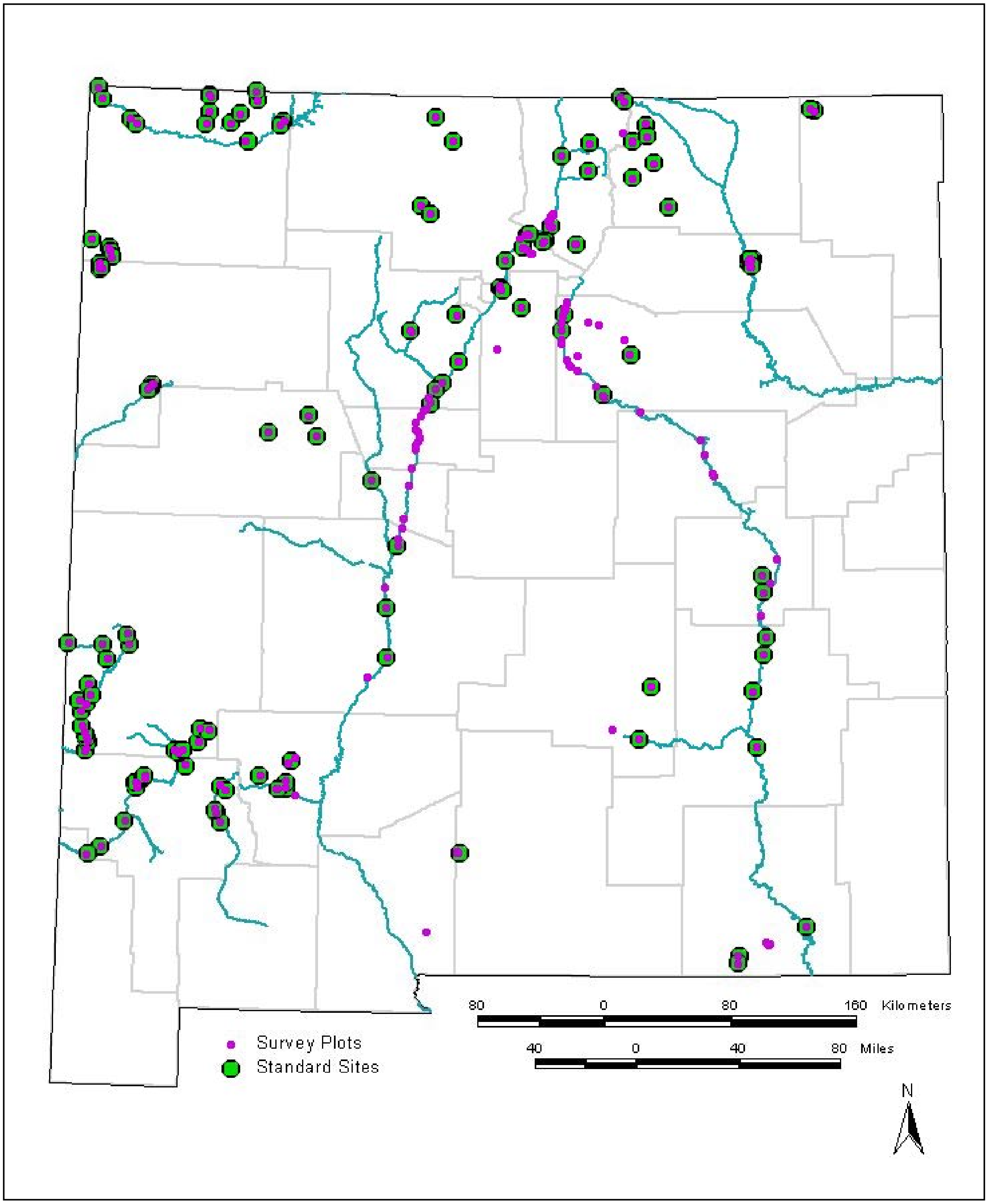

Figure 3. Distribution of the 127 Standard Sites (green circles) in the Wetlands/Riparian Assessment GIS. Purple dots represent vegetation plots and hydrological cross-sections from the NMNHP Ecology Database. Those without circles are potential wetland/riparian standard sites under review

Currently, 127 standard sites have been delineated based on detailed survey information collected by NMNHP during its wetland/riparian work (Bradley et al. 1998 and Muldavin et al. 2000). These sites have detailed information on location, biological content, condition status, and conservation value. Generally, preliminary site boundaries were drawn in the field on USGS 7.5-minute topographic quadrangle maps. There were also sketch maps, photos, and detailed site description reports along with quantitative vegetation plot data, soils information, and hydrological cross-sections and stream flow analyses. Much of this information was directly available in the NMNHP Ecology Database. There are 175 additional sites that need further confirmation and evaluation of their boundaries before being entered into the GIS. These include 41 sites with quantitative supporting data plus 134 that primarily have qualitative assessments.

To support boundary delineation of these sites, several ancillary spatial layers were used (see Appendix C complete list spatial layers). To provide context, digital raster graphic files of USGS 7.5-minute topographic quadrangles were brought into the system as necessary. A point layer of all vegetation plots was compiled with associated information on community type. In addition, a Landsat Thematic Mapper satellite image of the state developed by the New Mexico Geological Society along with stream networks, and county boundaries from the Earth Data Analysis Center for New Mexico Resource Geographic Information Systems (RGIS) were used to help interpret boundary locations. Site boundaries were screen digitized at the 1:6,000 scale, but targeted for use at the 1:24,000 to match the general level of precision of the primary data. To allow easy viewing of site locations at the state level, a separate site point layer was also developed using the centerpoints of the site polygons (Figure 3).

Given the nature of NMNHP data, the delineated standard sites generally conformed to stream segments of uniform gradient and channel morphology, or individual lakes or springs. They also tended to be defined by the extent and pattern of natural or semi-natural vegetation communities. Riparian vegetation communities tend to occur in long, narrow strips, with successional stands radiating out from the current water source, potentially creating complex mosaics within a site. These communities are tracked, when available, by plot data from the NMNHP Ecology Database (for example, the plot IDs shown in Figure 4). The satellite imagery was of particular use in excluding extensive agriculture and urban areas.

The relationship between the ArcView GIS and Access database is meant to be dynamic to optimally aid analysis. The ArcView site and plot layers were created in part from data originally in the Access assessment database, while analytical data from the GIS was subsequently used to update and fill specific fields in the database. Attributes such as total area of sites, center points of the sites, and other location information is most easily gathered in the GIS and then imported into Access to update the database. Corrections to plot location information is also more efficiently done in ArcView and then brought back to the database. The GIS forms the foundation for analyses of wetland/riparian community distribution and status, particularly in terms of area. Furthermore, gaps in information, plus research and survey needs are most easily pinpointed using the GIS.

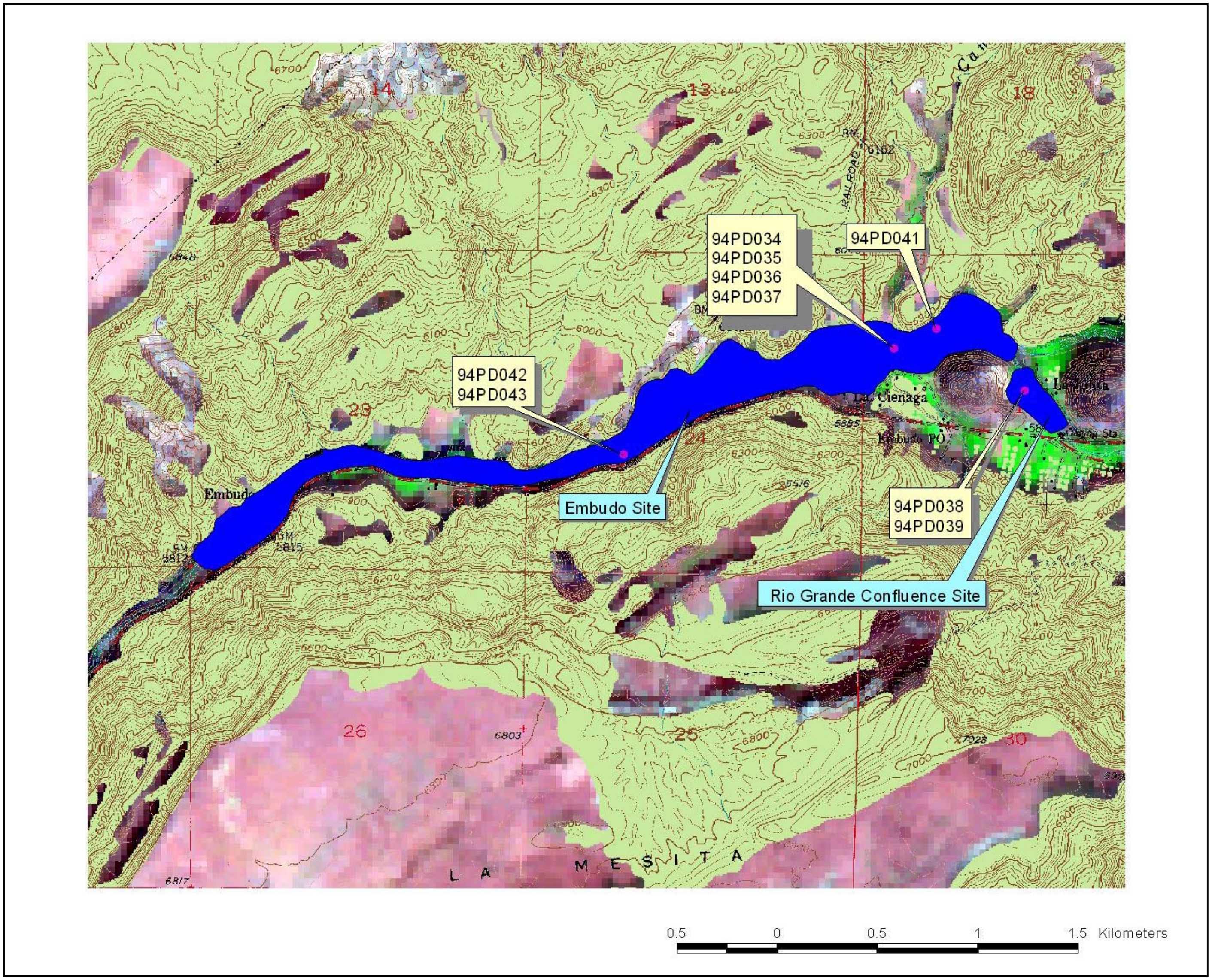

Figure 4. An example of wetland/riparian standard site delineations (Embudo and Rio Grande Confluence Site in blue) overlain on a digital raster graphic of a USGS 7.5-minute topographic quadrangle map, along with plot locations from the plot point layer, and an under-layer of Landsat Thematic Mapper satellite imagery

Current Status of the Database and GIS

Version 1.0 of the Wetland/Riparian Assessment Database and GIS is provided on an accompanying CD. It can be used directly from the CD with ArcView 3.2 and Access97, or it can be copied to a computer hard drive (see readme file on the CD). All spatial layers were developed using the NAD 27 datum. The CD also contains a copy of this document.

Version 1.0 contains only the 127 sites with sufficient quantitative and spatial data based on the NMNHP surveys and studies (Figure 3). These sites have a definite bias towards lowland riverine systems, which were the focus of NMNHP's work in support of the New Mexico Wetlands Conservation Plan (see Muldavin et al. 2000). However, the database and GIS were designed to incorporate information on wetland/riparian sites from any source with the intent of fulfilling the goal of a more comprehensive evaluation of the status of New Mexico's wetland/riparian resources. Accordingly, we strongly encourage the various land management agencies and other organizations to help in this effort by providing information on other wetland/riparian resources around the state that can be entered into the system. The NMNHP will add sites over time and periodically update the database and GIS and distribute them to interested parties (with a proposed serving on the web).

Information, inquiries, and comments are welcome and can be sent to:

Wetlands/Riparian Assessment Database Manager
New Mexico Natural Heritage Program
UNM Biology Department
Castetter Hall 167
Albuquerque, NM 87131

or by email at: nmnhp@unm.edu

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Appendix A

A Literature List for Wetland/Riparian Assessment and Monitoring and Related Management.

The following is a list of references cited in this report plus additional literature relevant to wetland/riparian assessment in New Mexico. This is provisional list and intended as a foundation for the development of a more formal bibliography.

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Appendix B

Tape Transcription for October 27, 1999 Wetlands/Riparian Field Workshop

Transcribed by Dan Cramsey

This session was an informal outdoor discussion among natural resource professionals with expertise in assessing the quality and health of riparian areas. The objective was to evaluate and compare assessment strategies in an attempt to develop a statewide inventory of riparian health.

Workshop attendees on Wednesday included Mary Stuever, Forest Ecologist and consultant with Seldom Seen Expeditions, Inc., Esteban Muldavin, Forest Ecologist, Sarah Wood, and Pat Mehlhop, New Mexico Natural Heritage Program (NMNHP), Charles (Chuck) Klimas, Hydrogeomorphic (HGM) consultant, Paul Tashjian, Hydrologist, U.S., Fish & Wildlife Service, Chris Massingill, Proper Functional Condition (PFC) consultant, Melanie Deason, New Mexico Environment Department, Steve McWilliams, Watershed Specialist, Santa Fe National Forest, USFS, McKinley Ben Miller, Woodlands Specialist, Abq. District, Bureau of Land Management, Travis Moisley, Jemez Ranger District, S.F.N.F. and Dan Cramsey, retired Forester, USFS, recorder.

The day's activities involved visits to specific sites to present and evaluate various assessment strategies. Here is a brief summary of the presentations and discussion at each site.

Participants met at the Bernalillo Park & Ride lot at I-25 & Hwy 44 (So.Hill Rd.). Mary Stuever, coordinator for the sessions, summarized the purpose of the exercise, outlined the day's activity, and had everyone introduce themself.

Discussion in vehicle: The Forest Service uses PFC for initial riparian assessment and TWALK for more quantitative analysis. Have trained 300 so far state wide in PFC. The challenge is the dryer riparian areas in New Mexico which do not fit strict definition of riparian. Thirty consecutive days of flow excludes much of NM. Do have subsurface flow. Situation is similar in southern Utah and Arizona where they have summer monsoons vs. in Sierras and Rockies where winter precipitation is dominant. Most streams are ephemeral and not perennial.

Discussed problem with definitions, especially Corp of Engineers' definition of wetland and riparian. Also discussed evolving definitions and use of terms; jurisdictional use of terms vs. land management use. Keep definition broad for application; don't throw out or eliminate if area doesn't meet exact definition. This is good reason for evaluation team to visit different sites to evaluate and discuss site variations.

Wetlands Vegetation Communities:
The first stop was the Canon site, shown on page 37 of the Handbook of Wetland Vegetation Communities of New Mexico. This is along the Jemez River near the La Junta Recreation area in the Jemez Mountains. The site was classed as a Coyote Willow/Redtop community type. Esteban Muldavin presented the New Mexico Wetlands Vegetation Classification System developed by NMNHP. He stated that over 300 sites had been visited and evaluated state wide to

serve as benchmarks and a database of reference sites and formed the representative sites in the Vegetation Communities classification in Volume I.

Este covered first the wetland vegetation classification, table 6 in Volume I , Classification and Community Descriptions, of the Handbook. This table identifies 135 plant communities within three major categories: forested wetlands, scrub-shrub wetlands and herbaceous wetlands. Each category includes a dichotomous key and community type description. The classification is hierarchical and conforms to the National Vegetation Classification System. So, the classification of the site visited was as follows: Scrub/shrub wetlands/ Temporarily flooded/Coyote Willow Alliance/ Coyote Willow/Redtop CT (Community Type). Refer to the section titled "Keys and Community Type Descriptions."

Question and discussion on the cross references in brackets to the wetlands classification of Cowardin et al.; FSWL publication on wetlands inventory mapping, and the incorporation of other publications embedded in this classification.

Este then explained the Vegetation Survey and Assessment Handbook that includes a site inventory form that is to be completed at each wetland/riparian site visited and evaluated. Also, an element occurrence inventory form is completed for each community type encountered. This form ranks each plant community element occurrence using three factors: condition, landscape, and size. Each factor has four rankings and corresponding points that are weighted and used to score the health of a vegetation community. Refer to section (volume 1) Assessment Methods.

Question on number of communities and frequency of occurrence. You can have many stands in one occurrence. On the Site Inventory form you may have several Community Types listed and will average the rankings to arrive at the quality of each site.

There are nine Condition Factors to be ranked. These include exotics vs. native canopy, undergrowth exotics, structural diversity and cover, species richness (percent of expected native species present), fire fuel loads, erosion, streambank conditions, contaminants present, and parasites and disease. There are four rankings, A to D, to help determine long-term viability of the occurrence. A is pristine; B with some human influence which may return to A with some work; C has some disruption and will take active management to restore the site to natural condition; and D has little hope of returning to original or natural functional condition.

Discussion: The group agreed one would want to invest one's money in the B & C categories. Many agencies tend to focus on the worst sites first. Also, comments on the importance of the factors and rankings. Each factor has a weight multiplier: multiply the point value by the weight factor and divide by the number of factors evaluated to arrive at a numerical value for the Condition Rating for the element occurrence. If uncomfortable with or don't have an answer for any of the factors, don't rank it and don't include it in the overall Condition Ranking. Divide the total by the number of factors ranked.

Further comments on the Condition Factors: C2 is Undergrowth Exotics. Rationale is that regulated sites will have more exotics. Also reflects the hydrology of the river.

C3 Structural Diversity & Cover: what is importance of a modification such as a powerline, which may have disturbed the vegetation and site during installation if the structural layers remain after the activity? Rank it as it stands now. Discussion on the importance of including any explanation of rankings in the Comments section.

C5 Fuels: should you give higher weight for ranking of areas like the lower Rio Grande? If use different weighting, add explanation in Comments so reviewing group can discuss and change if decide differently.

C6 Erosion/ Deposition (add to table 1): usually considered negative impact, but in some cases it is a beneficial factor, such as a sediment balance for the Reach or site you are assessing. Could be a positive event in a riparian area. The cutting and filling of a stream allows it to meander. Most agreed. One said you need specifically stated criteria before deciding if good or bad. Example in a floodplain: is it fully functional or is it degraded? Does this then become a landscape factor? Conclusion: we need more specific description or explanation including is it a site or Reach impact.

Comments: on site impact vs. area impact ; internal vs. external impact; sediment is internal component. If sediment comes internally from external sources, can't handle on a site basis; but if is internal, then need to address on site. This is similar problem with PFC. Erosion is covered in different places. We need to address in landscape section.

C8 Contaminates: includes oil, gas, waste, salts, radioactive materials on site. May have unknown contaminates on site, but don't affect. Evaluate how they are affecting the quality of the site or natural community. Could break down into organic and inorganic material. Only weight of 1. One suggested moving C8 contaminates to Landscape factors. What about jettyjacks? Contaminates could be considered a disturbance and evaluated in C3. Track outside influences on site as part of overall condition. Record what's on site. How you interpret the impact is a different matter. Red flag it on the side, but don't reflect in weight factor or rating. Just because the site has a contaminate doesn't mean you want to correct it, but it may affect your decision on priority to work on the site.

Last comment on CF: these assume the CF's are addressed in the descriptions. It becomes critical to measure how far different the site is from what it should be if left undisturbed. Erosion fits better in Hydrologic R in Landscape Factors.

There are seven landscape factors: three about the hydrological regime—stream flow, lateral stream movement, and channel conditions; two about fire regimes—size and frequency; landscape impacts/fragmentation; and landscape community diversity and function. Again, these are ranked A to D, with point values and are weighted.

L1 Stream Flow: this site is a B+. What is the current flow in relation to the historic flow in terms of upstream activities? Rejuvenation and maintenance of wetland/riparian communities can occur with minimum intervention. Get a sense of flow modification. Is flow sufficient to maintain vegetation? Want to know effect on long term viability of site. Need a natural hydrograph to quantify, otherwise have to use observation. Have modeled some flows and developed hydrographs. Will add these to the handbook after they are reviewed by agency. Hard for inexperienced person to estimate.

What is the erosion problem upstream? Sediment balance is a reach problem. Answer question: is it out of balance? Address only what you are concerned about. What are you looking for and what is referenced standard? Can use narrative. Don't have to quantify everything. Should be able to prioritize sites—where are we going to put our structures.

L2 Lateral Stream Movement: erosion is natural process. L4 & L5 Fire Regime size and Frequency. Mary Stuever's work on fire will help. We will address this on trip tomorrow.

L6 Landscapes Impacts/Fragmentation: here, we are in the middle of the wild part of reach. It is in the center of human activity. How much of the area has been converted? Can use a GIS map to help determine what percent of flood plain has been converted. Conversion vs. natural. Rankings are by percent converted.

L7 Landscape Community Diversity and Function: are all the community types we would expect for the area present now? What are the missing elements of the system compared with the referenced reach? What is the management concern? We are talking about a holistic approach. Group then discussed NM problem and water needs and ongoing dispute over water needs and uses in state. This will make the assessment inventory even more important, especially to which portions of the state wetland/riparian resources are critical to meeting needs and priorities for improvement work.

The third factor, size, is ranked only for the size encountered in relation to that expected under normal conditions for that vegetation community. Size becomes a big factor in that it represents one-third of the overall ranking. A large occurrence carries more weight than a small occurrence. Some felt that salt cedar shouldn't have same weight as cottonwood. Maybe size should not be a factor by itself, but combined with another. Could play with the ranking and adjust the influence of size.

Size vs. extent and compare to natural expected for the particular landscape. Some communities have small extent naturally or area can't support a larger extent. Springs are hard to work with and size is not important, but extent. What makes the Rio Grande so important is its extent—sixth longest in North America, 1,885 miles, international boundary for 1,300 miles. Then, distribution is important. Have to keep asking important in comparison to what? Use a benchmark.

Este summarized the site evaluation. Add up the ratings and divide to arrive at a final element occurrence rank. The Canon site, with five plant communities, ranked 3.3 or a B.

How best to use remaining time (Mary): Mary led discussion on how the group felt was the wisest use of the next day and half. Maybe limit time of presentations and see as many sites as possible to determine which methodology works best (Melanie); Agree; botany/ecology perspective (Sarah); Would like to see as many applications as possible; will need 15 to 20 minutes to go over HGM methods currently not in use in NM. Might modify your methodology if think it's good (Chuck). Would like to know what we're doing with PFC's (Pat). Chris answers that she and Steve can go through checklist in about one hour. Melanie: what's good about this is can compare and appreciate other methodologies; helps us to feel comfortable with our own method.

Mary asks Paul to give hydrological perspective; our focus is restoration; linked to endangered species. Travis: profitable to get to know what the assessment systems are all about; how to use for monitoring. Mary: have Travis explain project on the ground. Maybe go to Rio Puerco today. Ben comments: we need to identify and agree on parameters on wetland/riparian health which will be included in database to measure. Mary comment: trying to mesh in systems used, not trying to change everyone; not sure if this goal is reachable. Ben- whether what we do is or is not same or different, what matters is what can be contributed or can be modified to contribute to the database on riparian health. Rio Puerco is a dysfunctional system, changed by external factors, not worth looking at in view of this exercise. Distinguish assessment vs. monitoring. Steve: will introduce TWALK at some site down the road when convenient.

On return walk to vehicles, Travis explained work on the site: thinning single-seeded junipers to reduce fuel load and keep vegetation open for recreationalists. Provides diversity for wildlife. Used combination of cutting and herbicides to remove unwanted vegetation. Able to get cottonwood regeneration when have flood occurrence.

Lunch was provided by the Coordinator and enjoyed by the group at the La Cueva picnic area. The group walked down along San Antonio Creek in a blue spruce/thinleaf alder-Wood's rose community type.

Hydrogeomorphic (HGM) Assessment of Wetland Functions:
Chuck Klimas discussed an overview of the HGM and its background. HGM is intended to organize wetlands so that it reflects their functions rather than dominant vegetation. It is designed to answer regulatory questions. His handout included four parts: overview and status of federal & state HGM projects; examples of basic HGM concepts; the statewide HGM program used in Arkansas; and the federal/county river basin restoration program in Green River, WA. HGM is basic ecology.

The HGM approach consists of three parts: hydrogeomorphic classification, model development and classification, and model application. Procedure includes assembling data, building functional assessment models, and applying them. It begins with looking at the geomorphology, or its functions, not the vegetation. A functional assessment measures how water gets into and out of a system. HGM assumes that the most mature is the most functional (not always true). The five wetland or landscape classes are riverine, slope, fringe, depression, and flat. This morning's and afternoon's sites are riverine. Further sub-divisions are based on hydrology and regional variations. Ask what makes sense functionally.

The curves in the instructions (1st handout) show how long, in years, until you can get that back in the system. The HGM assessment models are developed by experts, using their knowledge and experience, in a workshop. The models then are based on best professional judgment. Then comes model application in the field where a specific set of indicators is evaluated in the field.

HGM is geared toward prioritizing restoration action and acquisition; getting an idea of how long to reclaim a particular function. Mitigation. Compare site to what area should look like if it had not been disturbed. What functions did it have?

Summary: three questions to answer:
1. What functions did the site originally have and which ones are missing?
2. How many years until we recover that function?
3. What's going to be self-perpetuating? What function does it have? What can be recovered? Ex. in Rio Grande cottonwoods eventually die out. Can we use Russian olive in its place?

Chuck reviewed the Arkansas, Middle Rio Grande Bosque, and Green/Duwamish River examples in the handouts. He advocated using a weighted system for ranking rather than a simple three ranking system such as good, fair and poor. People tend to ride the middle of the road.

Comments: Question on iBi (Melanie). HGM more oriented to evaluating conditions and nailing the bad guys rather than vegetation. Our method enters the modeling process after collecting a lot of vegetation data (Este). Chuck commented to Este that his landscape classification was good, but to tighten up the rating system (use 0-10 for ex.) because people inclined to select "medium" and ride middle of road.

Have to make own models; don't have to do whole state all at once; do most critical areas first such as the lower river systems where most of the problems are. (Este?)
However, need to heal upper areas first since they could wipe out efforts in lower river sections. Under TMBO & CBML priority sites for monitoring may not be priority sites for fixing (Melanie). Have to build models soon before we start assessments (Este).

Proper Functioning Condition (PFC) and TWALK:
The last stop was at the San Antonio Rec. site where Chris Massingill summarized PFC. It came out of BLM and was adopted by others including the Forest Service. The standard checklist includes three categories of factors to evaluate: Hydrologic Indicators, Vegetative Indicators and Erosion/Deposition Indicators. There are 17 questions on the checklist which must be answered by a team of experienced experts. The evaluators check yes, no, or not applicable to each indicator and shows if trend is upward or downward. There is an accompanying handbook, "Riparian Area Management, a user guide to assessing proper functional condition and supporting science for lotic areas".

PFC shows differences and similarities and is more management focused; shows what area looks like and where the red flags are; prioritization of projects and when and where. It is processed oriented. It's a qualitative system. Need to look over whole watershed. Could have a PFC, but a portion could be falling apart. Find out where monitoring needs to be. It is unweighted, i.e., qualitative. Decide what's important and what isn't. It looks at potential/capability. What is sustainable? It can show you where monitoring ought to be done. Identify where problems are and where measurement and monitoring should be done.

The assessment is only one-third of the process. It also includes training and cooperative participation in the restoration. The forms make you answer yes or no and why. Make sure area is representative of whole area before sampling. The functional ratings can be tough to call and create long discussions among the team. What management (decision makers) gets is a written summary with several attachments including original sheets, maps, photos, etc.

Comments: Does trend get assessed often (Sarah)? Yes (Chris). Even though can assess with just two species, use as many representatives of site as exists. Do assessment in representative areas. PFC should withstand 25 year rainfall 80% of the time. Highly subjective rating. It is qualitative with quantitative background. If you use different representative areas would you come out with different answer (Este)? Could happen. What about the variance among teams? In all the training of the various groups and different individuals-300- they usually agreed on outcome. Discussion on using just two species. Can't see accepting tamarisk site (Este). Agree must have site to reach stability. If reach PFC, no management action needed.

Steve McWilliams gave a rundown of TWALK, (Tarzwell Watershed Area Link) a follow up quantitative assessment of steam health in risk areas identified with PFC. TWALK addresses regulatory questions. They reviewed all legislation and regulation on water quality and used PFC to answer questions on at-risk. It involves a set of forms (very complex) to evaluate management need for a site. Quantify using point transects. In deepest part of stream, measure pool/ripple ratios, sediments, and stones. Reflects if anything is going on. Determine if action needed to meet regulations. Again, problem where most streams are ephemeral and not perennial.

Mary summarized the day. Asked for comments. Melanie expressed concern on the size factor in the Vegetation Method as skewing the results if it is just a guess. Questions to be discussed and answered by the group before exercise is complete:

- How do we capture elements of each system being used to develop an evaluation of wetland/riparian areas in New Mexico?
- How do we build a common database for New Mexico wetland/riparian areas?
- How do we best make this information available and/or distribute to users?

Appendix C

Database Fields and Descriptions and GIS Data layers

The first part of this appendix contains a complete field list for the tables in the Wetlands/Riparian Assessment Database. Included are the field names, descriptions, data types and field size. The tables are listed in two groups: the first group is tables created specifically for the Wetlands/Riparian Assessment Database and the second group is subsidiary tables that originated in the Ecology database and are included in the Wetland/Riparian Assessment Database. Figure 2 in the text shows how these tables relate to one another through key fields. The second part of this appendix contains a list of data layers used in the construction of the Wetlands GIS.

Apendix C—Part 1a. Tables from the Wetlands/Riparian Assessment Database:

tblSBR (Site Basic Record Table)

Name	Description	Type	Size
SiteCode	Site code - following Heritage protocols for site codes	Text	15
SiteName	Official site name	Text	50
BCDSiteCode	Official Heritage/BCD code	Text	50
SiteClass	Heritage Site Class Code	Text	2
SiteAlias	Old site names or names used by other agencies.	Text	250
SiteType	Micro or mega site?	Text	50
SiteLevel	Site type expressed as a number	Number	4
MacroSCode	Parent Macro Site Code if applicable	Text	15
MegaSCode	Parent Mega Site Code if applicable	Text	15
RipSCode	Riparian database old site code	Number	4
PlotSCode	Plot database old site code	Number	4
SiteNation	Nation in which site is located	Text	15
SiteState	State in which site is located	Text	50
SiteMap	Boundary derivation - (P=preliminary, F=field map, R=report, Y=verified by field survey)	Text	2
MapDate	Date on which site boundaries were drawn	Date/Time	8
Boundjust	Boundary justification - how were the site boundaries determined.	Memo	-
UTMNorthing	Northing of polygon centerpoint	Number	4
UTMEasting	Easting of polygon centerpoint	Number	4
Directions	Directions to site, and/or specific tracts in site	Memo	-
SiteDesc	Overall summary description of site	Memo	-
KeyEnviroFactors	Key environmental factors at the site	Memo	-
Minelev	Minimum elevation of the site	Number	4
Maxelev	Maximum elevation of the site	Number	4
ElevUnits	Elevation units - meters or feet?	Text	50
ClimateDesc	Climate description for site - what sort of climatic regime does it have?	Memo	-
LanduseHist	Landuse history for the site	Memo	-
CultFeat	Cultural features of the site - archaeological sites, etc.	Memo	-
PrimaryAcres	Number of acres in primary site	Number	4
SiteCom	Comments on site boundaries, size and ownership.	Memo	-
Biodivsig	Biodiversity significance rank	Text	5
Biodivcom	Comments on biodiversity rank	Memo	-
Othervalues	Othervalues rank	Text	5
Othervalucom	Comments on othervalues rank	Memo	-
Proturgency	Protection Urgency Rank	Text	5
Proturgcom	Comments on protection urgency rank	Memo	-
Mgmturgency	Management Urgency Rank	Text	5
Mgmturgcom	Comments on Management Urgency Rank	Memo	-
PFCFunctRate	PFC (Proper Functioning condition) Functional Rating	Text	50
PFCTrend	PFC Trend for Functional at Risk ratings	Text	50
PFCOutManCont	PFC - are factors contributing to at risk rating outside the control of the manager?	Text	50
PFC_OMCFlowReg	PFC - Factors outside managers control - Flow regulations	Yes/No	1
PFC_OMCChannelize	PFC - Factors outside managers control - Channelization	Yes/No	1
PFC_OMCAugmentFlow	PFC - Factors outside managers control - Augmented Flows	Yes/No	1
PFC_OMCMining	PFC - Factors outside managers control - Mining Activities	Yes/No	1
PFC_OMCRoad	PFC - Factors outside managers control - Road Encroachment	Yes/No	1
PFC_OMCUpstream	PFC - Factors outside managers control - Upstream channel conditions	Yes/No	1
PFC_OMCOil	PFC - Factors outside managers control - Oil field water discharge	Yes/No	1
PFC_OMCOther	PFC - Factors outside managers control - Other (specify)	Text	100
PFCComments	PFC - Comments	Text	250
GSR_type	Greenline Status Rating - type - Successional or Desired conditions.	Text	50
GSR_Rating	Greenline Status Rating - numerical rating	Number	4
GSR_Comments	Greenline Status Rating - comments	Text	250
GSR_BankStabRate	Greenline - Bank Stability Rating	Number	4
GSR_BankStabCom	Greenline - Bank Stability Comments	Text	250
Protcom	Protection comments	Memo	-
Landusecom	Landuse comments	Memo	-
Nathazcom	Natural Hazards Comments	Memo	-
Exoticcom	Exotic invasive comments	Memo	-
Offsite	landuse and other conservation impacts off site	Memo	-
Infoneeds	Info needs, missing information	Memo	-
Mgmtneeds	Management needs for protection	Memo	-
Macom	Management comments, other management agencies to work with	Memo	-
AddtilTopics	Additional topics on sites	Memo	-
ImageryCom	Imagery comments	Memo	-
Leadresp	Leadership responsibility	Text	250
Edition	Edition update date	Date/Time	8
EdAuthor	Edition author	Text	50
ManFileNotes	Manual file notes - locations, etc.	Memo	-

Apendix C—Part 1a. Tables from the Wetlands/Riparian Assessment Database (continued)

tblSBRmonitoring (Site Monitoring Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
SMdate	Site monitoring date	Date/Time	8
VisitType	Type of site visit	Text	250
NewData	Was new data collected on this visit?	Yes/No	1
NewDataCom	Comments about new data if collected	Memo	-
ChangeInCond	Was there a change in site condition since last visit?	Yes/No	1
ChangeInCondCom	Comments on change is in condition if relevant	Memo	-
DataLoc	Where is data from this visit located?	Text	250
SiteDesc	Site description from this visit	Memo	-
OtherCom	Other comments on this site visit.	Memo	-

tblSiteMonProject (Site Monitoring Project Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
SMdate	Site monitoring date	Date/Time	8
Project	Project code	Text	50

tblSiteMonSurveyor (Site Monitoring Surveyor Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
SMdate	Site monitoring date	Date/Time	8
SurveyorID	Surveyor identification code from surveyors table	Number (Long)	4

tblSiteCounty (Site County Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
COUNTYCODE	County code	Text	50

tblSiteMA (Site Managed Area Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
MACode	Managed area code	Text	255

tblSitePlot (Site Plots Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
PlotID	Plot Identification code	Text	7

tblSiteQuad (Site Quadrangles Table)

Name	Description	Type	Size
SiteCode	Site Code - following Heritage protocols for site codes	Text	15
QUADCODE	Quad code from Quad table	Text	50

Appendix C Part 1b-- Tables originating in the Ecology Database.

Plot (Plot Table)

Name	Description	Type	Size
Plot ID	Plot ID Code	Text	7
Type	Type of Plot (Standard, Releve, etc)	Text	3
Project	Project Code	Text	50
Subproject	Subproject Code	Text	25
Series Acronym	Community type Series Acronym	Text	7
HT Acronym	Community type Habitat Type Acronym	Text	7
HT Acronym 2	Community type Habitat Type 2 Acronym	Text	7
Class No	Community type Class Number	Text	10
Phase	Community type Phase Acronym	Text	25
Community Comments	Comments on Community type and changes to CT	Memo	-
Surveyors 1	Lead surveyor for plot	Number (Long)	4
Surveyors 2	Second surveyor for plot	Number (Long)	4
Surveyors 3	Third surveyor for plot	Number (Long)	4
SURVEY_DATE	Date plot was surveyed	Date/Time	8
SURVEYSITE	Site in which plot is located	Text	255
MARGNUM	Map margin number for plot	Text	3
UTM Northing	UTM Northing of plot	Text	7
UTM Easting	UTM Easting of plot	Text	6
Datum	Datum of UTMs	Text	10
Precision in Meters	Precision or plot location in meters	Number (Double)	8
GENDESC	General Description of plot	Memo	-
LAT	Latitude of plot	Text	7
LONG	Longitude of plot	Text	8
DIRECTIONS	Directions to plot	Memo	-
ELEV	Elevation of plot	Number (Double)	8
Aspect	Aspect of plot	Text	3
Slope	Slope of plot	Text	3
Slope Shape	Slope shape at plot location	Text	1
Surface Rock Type	Surface rock type at plot	Text	4
Soil Taxon/Map Unit	Soil Taxon for plot	Text	150
Erosion Potential	Erosion potential for plot	Text	2
Erosion Type	Erosion type for plot	Text	2
water/other	Percentage of plot ground cover that is water	Number (Double)	8
Soil	Percentage of plot ground cover that is soil	Number (Double)	8
Gravel	Percentage of plot ground cover that is gravel	Number (Double)	8
Rock	Percentage of plot ground cover that is rock	Number (Double)	8
Litter	Percentage of plot ground cover that is litter	Number (Double)	8
Wood	Percentage of plot ground cover that is wood	Number (Double)	8
Cryptogam	Percentage of plot ground cover that is cryptogams	Number (Double)	8
Basal Veg	Percentage of plot ground cover that is basal vegetation	Number (Double)	8
Vegetation Desc/Site Features	Vegetation description and site features for plot	Memo	-
Adjacent Communities	Vegetation communities adjacent to plot	Memo	-
Animals	Animal use of plot location	Memo	-
Disturbance Evidence	Disturbance evidence in plot area	Memo	-
Plot Dim L/R	Plot Dimensions - Length or Radius	Number (Double)	8
Plot Dim W	Plot Dimensions - Width	Number (Double)	8
Plot Dim Comment	Plot Dimensions comments	Text	100
Occurrence Size	Size of community occurrence that plot is within	Number (Double)	8
Occurrence Size Comment	Occurrence size comments	Text	255
Occurrence Condition	Condition of community occurrence that plot is within	Text	5
Occurrence Condition Comment	Comments of condition of occurrence	Text	255
Occurrence Viability	Viability of community occurrence that plot is within	Text	5
Occurrence Viability Comment	comments on viability of occurrence	Text	255
Occurrence Defensibility	Defensibility of community occurrence that plot is within	Text	5
Occurrence Defensibility Comment	comments of defensibility of occurrence	Text	255
Conservation Assessment Value		Yes/No	1
Field EO Rank	Element occurrence rank from field assessment	Text	5
EORANK	Final element occurrence rank	Text	5
EORANK Comment	Comments on final element occurrence rank	Text	255
Threats Protection Comments	Comments on threats to occurrence	Memo	-
Photo?	Where photos taken of the plot?	Yes/No	1

Appendix C Part 1b-- Tables originating in the Ecology Database (continued).

Communities (Communities Table)

Name	Description	Type	Size
Class Number	Identifying primary key code for community type	Text	20
Name	Scientific name of community type	Text	255
Common Name	Common name of community type	Text	255
Classification	Classification level number	Number (Integer)	2
Parent Class Number	Parent classification number	Text	20
Grank	Global rank of community	Text	10
Srank	State rank of community	Text	10
Source	Sources for community type	Text	255
Comments	Comments about community type	Memo	-
Series Acronym	Series acronym	Text	7
HT Acronym	Habitat type acronym	Text	7
Phase	Phase acronym	Text	10
HT Acronym 2	Habitat type 2 acronym	Text	15
Status	Status of community type (provisional, established)	Text	3
CT Acronym	Community type acronym	Text	50

Project (Project Table)

Name	Description	Type	Size
Project	Project code	Text	50
Project_name	Project name	Text	100
Level	Project level - project or subproject	Number (Single)	4
Parent_Project	Parent project code for subprojects	Text	50
OldCodes_Project	Previously used project codes	Text	250
OldCodes_SubProject	Previously used subproject codes	Text	250
Description	Description of project	Memo	-
Agency	Sponsoring agency for project	Text	250
Start Date	Project start date	Date/Time	8
End Date	Project end date	Date/Time	8
Complete	Is the project complete?	Yes/No	1
PI	Principal investigator for project	Text	50
Supervisor	Project supervisor	Text	50
Staff	Project staff	Text	250
Plot_data	Was plot data collected for this project?	Yes/No	1
Loc_Plot_data	If plot data was collected, where is it located	Text	250
Monitoring_data	Was monitoring data collected for this project?	Yes/No	1
Loc_Monitor_data	If monitoring data was collected, where is it located?	Text	250
Soils_data	Was soils data collected for this project?	Yes/No	1
Loc_Soils_data	If soils data was collected, where is it located?	Text	250
Photos	Were photos taken for this project?	Yes/No	1
Loc_Photos	If photos were taken, where are they located?	Text	250
Maps	Where maps made of this project?	Yes/No	1
Loc_Maps	If maps where made, where are they located?	Text	250
Database	Was a database(s) made for this project?	Yes/No	1
Loc_databases	If database(s) were made, where are they located?	Text	250
Site_data	Was site data collected for this project?	Yes/No	1
Loc_Site_data	If site data was collected, where is it located?	Text	250
Report	Was a report generated for this project?	Yes/No	1
Loc_Reports	If a report was generated, where is it located?	Text	250
GIS_Imaging	Was GIS Imaging produced for this project?	Yes/No	1
Loc_GIS_Imaging	If GIS Imaging was produced, where is it located?	Text	250
Loc_Admin_files	Where are the administration files for this project located?	Text	250
Loc_other_paper	Where are other miscellaneous paper files for this project located?	Text	250
Loc_other_magnetic	Where are other miscellaneous electronic files for this project located?	Text	250
QC_status	What is the quality control status of the data for this project?	Text	150
Report_Source_codes	What are the report source codes for project reports?	Text	100

Appendix C Part 1b-- Tables originating in the Ecology Database (continued).

County (County Table)

Name	Description	Type	Size
COUNTYCODE	County code	Text	255
COUNTYNAME	County name	Text	255

Managed Area (Managed Area Table)

Name	Description	Type	Size
MA Code	Managed area code	Text	255
Name	Managed area name	Text	255
MA alias	Managed area alias	Text	50

Quad (Quadrangle Table)

Name	Description	Type	Size
QUADCODE	7.5 minute USGS Quadrangle code	Text	50
QUADNAME	7.5 minute USGS Quadrangle name	Text	255

Surveyors (Surveyors Table)

Name	Description	Type	Size
ID	Surveyor Identification code	Number (Long)	4
Name	Name of surveyor	Text	50

Appendix D - Part 2

List of Data Sources for the Wetlands GIS

The following table is a list of the GIS shapefiles and images compiled and processed for the project. In addition to the *Name* of the shapefile/image, is the original *Source* of the data, *File Type*, and *Notes* about the principal processing procedures applied to the shapefiles/images. Data highlighted in gray in the *File Type* column were delivered with the final project.

File Type: S=ArcView shapefile, I=ERDAS Imagine image

NAME	FILE TYPE	SOURCE	NOTES
DRG	I	USGS	Digital Raster Graphics (DRG) are USGS 7.5' quadrangle maps in digital format.
nhd	S	USEPA/USGS	A shapefile developed from the National Hydrography Dataset (NHD). Surface hydrology represents 1:100,000 or better scale for the state of New Mexico. The original data source was geographic, and reprojected into UTM, NAD27, Zone 13.
nmtm_742	I	NM Geological Society/Earth Data Analysis Center	False color composite satellite image of New Mexico. Image is used for photo interpretation purposes to determine the extent of riparian areas. Image projection was UTM, NAD27.
refsites_1100	S	NMNHP	Data were extracted from the NMNHP Ecology and Wetlands/Riparian Assessment databases. These reference sites are polygons that delineate standard riparain sites as defined by NMNHP (see text). Associated with these polygons are the plot data (refplots_1100).
ownnm_utm99	S	New Mexico BLM	Ownership map of New Mexico.
plss	S	New Mexico BLM	Public Land Survey System - Township, Range and Section boundaries.
quads75_utm_wcodes	S	USGS/RGIS	7.5' Quadrangle map index. Note: The code field relates to the DRG files. The second-to-last number should be replaced by a letter, e.g., 1=A and 2=B.
refplots_1100	S	NMNHP	Data were extracted from the NMNHP Ecology and Wetlands/Riparian Assessment databases resulting in a subset of 400 riparian and wetlands plots (points) data.
sitepts_1100	S	NMNHP	This is a point layer constructed from the centerpoints of the reference site polygons (refsites_1100).
stateriversmj	S	NMNHP	Data for major rivers in New Mexico were extracted from USEPA/USGS nhd_reach layer by NMNHP and made into a new shapefile showing the major reaches.
500_huc_utm	S	USGS/EPA	Watersheds for the state of New Mexico. Watersheds are delineated at a scale of 1:500,000 or better, often 1:250,000.