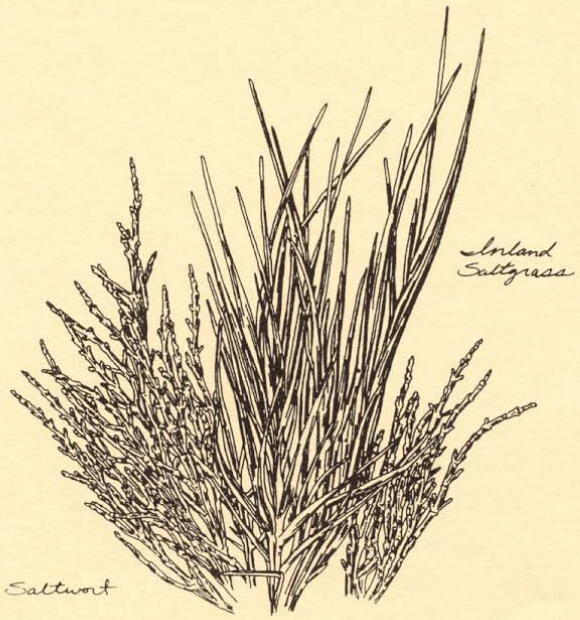
RESOURCE CATEGORIZATION

OF

NEBRASKA'S EASTERN SALINE WETLANDS



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SUMMARY

Eastern Nebraska saline wetlands are regionally unique, located in floodplain swales and depressions within the Salt Creek and Rock Creek watersheds in Lancaster and southern Saunders counties of Nebraska. Water regimes are temporarily-flooded and seasonally-flooded on saline mineral soils. Water sources are a combination of discharge from the aquifer of the Dakota sandstone formation, precipitation, and overbank flooding. Salts are concentrated in the soil during the dry periods. Wetland vegetation is characterized by halophytes including spearscale (Atriplex subspicata), inland saltgrass Distichlis spicata var. stricta), saltwort (Salicornia rubra), prairie bulrush (Scirpus maritimus var. paludosus), and sea blite (Suaeda depressa). Saline wetlands are considered the most threatened complex in Nebraska.

An updated inventory of these wetlands and a technical assessment of their values were conducted from September 1992 through September 1993. The goal of this interagency project was to produce maps showing the locations of wetlands occurring on saline soils, and assign category designations for future application to proactive wetland initiatives. A Nebraska Game and Parks Commission saline wetland survey and National Wetland Inventory mapping served as the principal data sources in map production. Review of existing data and field evaluations were conducted to determine category designations.

Criteria for categorization included the occurrence of the rare endemic Salt Creek tiger beetle (Cicindela nevadica var. lincolniana), presence of rare or restricted halophytes, historical significance, occurrence of halophytic associations, degree of degradation, and restoration potential. These criteria were then incorporated into a dichotomous key to facilitate a standardized wetland categorization procedure.

Four wetland categories were identified, corresponding to the relative quality of the remaining resources. Results were summarized in a database and used for geographic information system-based mapping. A total of 276 individual wetlands possessing saline characteristics was identified. Over 70% of these sites had sufficient data for category designation. A total of 5,644.1 acres of wetlands and deepwater habitats was identified within the study area.

INTRODUCTION

RESOURCE BACKGROUND

Eastern Nebraska saline wetlands are regionally unique, located in floodplain swales and depressions within the Salt Creek and Rock Creek watersheds in Lancaster and southern Saunders counties of Nebraska (Clausen et al. 1989). According to the Cowardin et al. (1979) classification, these wetlands are primarily palustrine of the emergent or unconsolidated shore class. Water regimes are temporarily-flooded and seasonally-flooded on saline rnineral soils. Water sources are a combination of discharge from the aquifer of the Dakota sandstone formation, precipitation, and overbank flooding. Salts are concentrated in the soil during dry periods.

Vegetation in these wetlands is characterized by halophytes including spearscale (Atriplex subspicata), inland saltgrass (Distichlis spicata var. stricta), saltwort (Salicornia rubra), prairie bulrush (Scirpus maritimus var. paludosus), sea blite (Suaeda depressa), and narrow-leaved cattail (Typha angustifolia). Saline wetlands harbor four plant species described as rare in Nebraska (Clausen et al. 1989) including saltmarsh aster (Aster subulatus var. ligulatus), seaside heliotrope (Heliotropium curassavicum), saltwort (S. rubra), and Texas dropseed (Sporobolus texanus).

Eastern Nebraska saline wetlands provide habitat for a variety of wildlife species, especially migratory birds (Ducey 1985). At one saline wetland where birding observations have been recorded since the early 1900's, 178 species have been observed. Of these, 28 have been known to breed in the area, 10 are on the National Audubon Society's Blue List, and 13 are listed as species of special concem[1] (Ducey 1987). Eastern saline wetlands are particularly important as migrational habitat for shorebirds, especially sandpipers of the genus Calidris (R. Lock, pers. comm.). The mudflats, usually most prevalent during the spring, provide abundant invertebrate foods for migrational needs. Further, these wetlands are the sole habitat for an endemic tiger beetle, Cicindela nevadica var. lincolniana (Clausen et al. 1989).

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[1]Tate, James Jr. 1986. *The Blue List for 1986*. American Birds 40:227-236

STATUS AND TRENDS

The City of Lincoln was founded in the mid-l800's along Salt Creek. The potential for commercial salt production from the saline wetlands played a key role in Lincoln's settlement and early history. However, the salt industry was short-lived as cheaper sources of salt were found in the region.

Over the last century, the saline marshes have undergone extensive degradation through commercial, residential and agricultural development. Recent inventory and assessment work by Gersib and Steinauer (1991) revealed extensive wetland losses due to the expansion of Lincoln and agricultural activities. They noted that all extant saline wetlands identified in their inventory have experienced recognizable degradation through drainage, diking, filling, farming and overgrazing. They also indicated that of 188 uncultivated wetland sites evaluated, 168 (89%) were considered to have a high or moderate vulnerability to future wetland degradation or loss. Commercial or residential development and road construction were considered to be the greatest threats to these wetlands. Today, eastern saline wetlands are considered one of the most restricted and imperilled natural community types in Nebraska (Kaul 1975, Clausen et al. 1989, Gersib and Steinauer 1991).

PROJECT BACKGROUND AND PURPOSE

Wetland inventory and public outreach efforts in Nebraska since 1988 have contributed to an increased awareness of eastern Nebraska saline wetlands and their importance. This awareness, and acknowledgement that a balanced, resource-based approach is needed for this area, has stimulated public interest in preservation, resource-sensitive urban planning, cooperative wetland enhancement efforts, and mitigation banking. To ensure that updated information continues to contribute to the further understanding of this wetland resource and creates opportunities for pro-active wetland initiatives, an updated inventory and technical assessment of existing saline wetlands and their values were conducted. The purpose of this study was to provide this information.

The goal of the interagency work team was to produce maps identifying the location of wetlands occurring on saline soils and assign wetland category designations for future application to pro-active wetland initiatives. The objectives of this study were to: a) provide the best information available on the location of saline wetlands in Lancaster and southern Saunders counties, and b) provide a qualitative assessment of individual saline wetlands and their relative potential to maintain historic functions and values. This study does not compare the existing wetland resource with its historic extent.

METHODS

GENERAL METHODS

An interagency work team comprised of individuals from the Nebraska Game and Parks Commission (NGPC), U.S. Army Corps of Engineers (USACE), Nebraska Department of Environmental Quality (NDEQ), U.S. Fish and Wildlife Service (FWS) and U.S. Environmental Protection Agency (USEPA) was formed to identify study boundaries, establish categorization criteria, and conduct individual site assessments.

Principal data for this application included: 1) NGPC wetland inventory maps and field assessment data forms from Gersib and Steinauer (1991)[2], 2) National Wetlands Inventory (NWI) mapping (Wilen and Pywell 1992), and 3) field assessments conducted by the interagency work team.

For NGPC mapping, available soils information and aerial photography were used for inventory and site assessments. U.S. Department of Agriculture Soil Conservation Service (SCS) county soil surveys for Lancaster and Saunders counties were used to identify soil types corresponding to saline wetlands (Elder et al. 1965, Brown et al. 1980). Soil types that support halophytic wetland communities are provided in Table I. Distribution of saline soils within the respective counties was used to establish study area boundaries. Boundaries for this study are consistent with NGPC mapping (Figure 1).

[2]Herafter referred to as "NGPC mapping"

Table 1. Characteristics of Lancaster and Saunders counties saline soils. Information adapted from SCS soil surveys (Elder et al. 1965, Brown et al. 1980) and SCS hydric soils list (Soil Conservation Service 1988).

Soil Name	Map Symbol	Hydric-Soil Component	Slope	Salinity (mmhos/cm)	Depth to Water Table (ft.)
Lancaster County					
Lamo silty-clay loam	Lm	Salmo soil inclusions	0-2%	<2	2.0-3.0
Salmo silt loam	Sa	Seasonally high water table inclusions	0-2%	4-16	2.0-3.0
Salmo silty-clay loam (channeled)	Sb	Entire map unit	0-2%	4-16	0.0-2.5
Salmo silty-clay loam	Sc	Entire map unit	0-2%	4-16	0.0-2.5
Zoe silty-clay loam	Zc	Entire map unit	0-2%	2-8	1.0-3.0
Saunders County					
Rauville silty-clay loam	Ra	Entire map unit	0-2%	No Data	1.0-3.0

NGPC mapping utilized 1981 U.S. Geological Survey (USGS) National High Altitude Photography color infrared photos enlarged to 1:24,000 scale as the principal source for photointerpretation. United States Department of Agriculture (USDA) Food Security Act wetland inventory data were also used as corollary information. Photointerpreted wetlands were overlayed on USGS 7½ minute base maps. Each wetland was assigned a unique

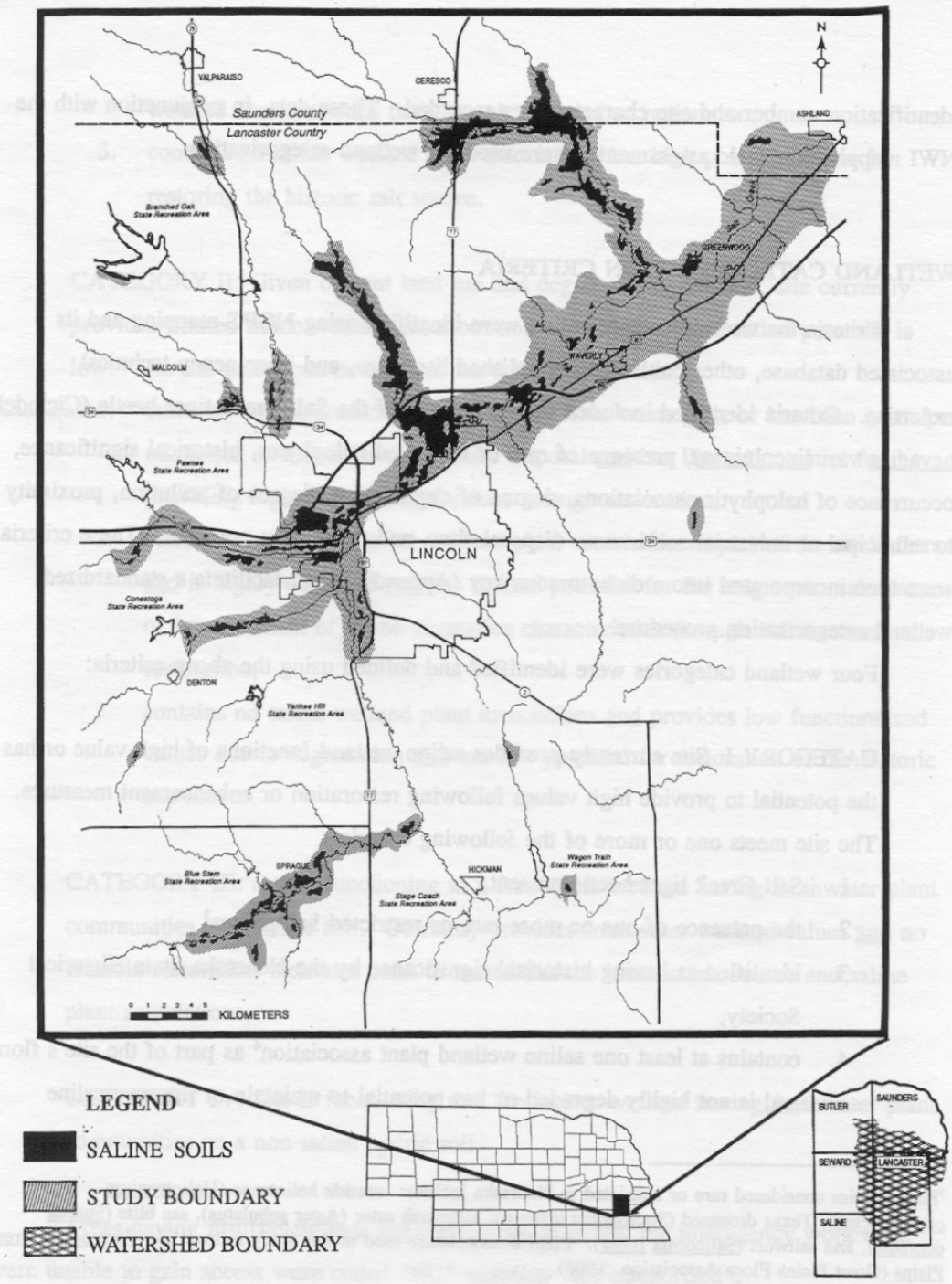

Figure 1. Eastern Nebraska Saline Wetland Study Area Boundary
(From Gersib and Steinauer 1991)

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identification number and site characteristics recorded. These data, in conjunction with the NWI mapping and field assessments, were used for wetland categorization.

WETLAND CATEGORIZATION CRITERIA

Criteria for wetland categorization were identified using NGPC mapping and its associated database, other published/unpublished literature, and interagency technical expertise. Criteria identified included the occurrence of the Salt Creek tiger beetle (Cicindela nevadica var. lincolniana), presence of rare or restricted halophytes, historical significance, occurrence of halophytic associations, degree of degradation, degree of pollution, proximity to municipal or industrial solid waste disposal sites, and restoration potential. These criteria were then incorporated into a dichotomous key (Appendix A) to facilitate a standardized wetland categorization procedure.

Four wetland categories were identified and defined using the above criteria:

CATEGORY I: Site currently provides saline wetland functions of high value or has the potential to provide high values following restoration or enhancement measures. The site meets one or more of the following criteria:

1. Salt Creek tiger beetle present;

2. the presence of one or more rare or restricted halophytes[3];

3. identified as having historical significance by the Nebraska State Historical Society;

4. contains at least one saline wetland association[4] as part of the site's flora and is not highly degraded or has potential to maintain or improve saline wetland characteristics through enhancement or restoration; and

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[3]Plant species considered rare or restricted in Nebraska include: seaside heliotrope (Heliotropium curassavicum), Texas dropseed (Sporobolus texanus), saltmarsh aster (Aster subulatus), sea blite (Suaeda depressa), and saltwort (Salicornia rubra). Plant nomenclature used in this study follows the Flora of the Great Plains (Great Plains Flora Association, 1986).

[4]Associations are defined by the following dominant/codominant species: saltwort (Salicornia rubra), sea blite (Suaeda depressa), inland saltgrass (Distichlis spicata var. stricta), prairie bulrush (Scirpus maritimus var. paludosus), and foxtail barley/marsh elder (Hordeum jubatum/Iva annua).

5. contains no saline wetland plant associations but high potential exists for restoring the historical salt source.

CATEGORY II: Given current land use and degree of degradation, site currently provides limited saline wetland functions and low values. Restoration potential is low. The site meets one or more of the following criteria:

1. currently contaminated by hazardous or toxic waste or is or has been used for municipal or industrial solid waste disposal and has limited potential for providing high functions and values through restoration;

2. contains at least one saline wetland plant association as part of the site's flora and is highly degraded and has limited potential for the long-term maintenance or improvement of saline vegetative characteristics through enhancement or restoration; and

3. contains no saline wetland plant associations and provides low functions and values due to degradation and has low potential for restoration of the historic salt source.

CATEGORY III: Site is functioning as a freshwater wetland having freshwater plant communities on a saline soil. Currently provides freshwater wetland values and no feasible restoration measures exist to reestablish the historic salt source and saline plant associations.

CATEGORY IV: Site is functioning as a freshwater wetland having freshwater plant communities on a non-saline hydric soil.

Areas having insufficient data for categorization or that the interagency work team were unable to gain access were coded "NC" meaning "not categorized."

CATEGORIZATION PROCESS

Site codes were assigned to all wetlands consistent with NGPC mapping and field data sheets. These data, in conjunction with Salt Creek tiger beetle location records (S. Spomer, pers. comm.) and Nebraska State Historical Society resource data (L. Puschendorf, pers. comm.) were used to identify sites with sufficient information for categorization without a field visit. All other sites were field visited prior to categorization.

Sites requiring a field visit were identified, and attempts were made to gain permission to access sites not adjacent to a public road. Wetland sites identified on NWI mapping and not on NGPC mapping (45 sites) were assigned a unique site code and were subject to field visit for categorization.

Interagency work team representatives from the NGPC, USACE, NDEQ and FWS were present during all site assessments. Site assessments were conducted during the growing season between September 1992 and September 1993. During each site visit, a standardized field assessment form (Appendix B) was completed. Each site was assigned an initial category designation based on the presence or absence of indicators identified in the dichotomous key. Site degradation factors and restoration potential were then identified.

The physical characteristics of each wetland were evaluated including: water sources, salt inputs, and observable hydrological modifications such as headcutting and drainage. Current land use and human or cultural encroachment (e.g., railroads, commercial or residential buildings) were also documented. These physical characteristics were factored into the final category designation. This determination was a qualitative judgement by the interagency work team as to the site's degree of disturbance or restorability. The final category designation could be lowered or elevated based on this evaluation. Consensus among the interagency work team was required in the final determination of a category designation.

MAPPING METHODS

Results of category designations were summarized in a database. These data were then imported as a relational table for geographic information system based mapping. ARC- INFO software was utilized in all digital data processing and analyses. NWI digital data served as the source for project mapping. Computer and manual data processing steps were as follows:

- Digitized study area on USGS 7½ minute quadrangle base maps.

- Merged NWI digital data for USGS 7½ minute quadrangles corresponding to the study area.

- Overlayed digital study area boundaries to extract NWI data for the area of interest, forming a unique coverage.

- Dissolved (lumped) Cowardin et al. (1979) wetland attributes to the system level of classification (palustrine, lacustrine, riverine).

- Produced hard-copy maps of the modified digital NWI data with polygon and line identification numbers annotated.

- Manually overlayed hard-copy maps derived from NWI digital data with hard-copy NGPC mapping to determine the intersection/non-intersection of respective map layers.

- Manually linked derivative polygon and line identification numbers to site identification codes from NGPC mapping in a database.

- Constructed relational table of identification numbers, site identification codes and category designations for import into ARC-INFO.

- Produced category designation maps from derived NWI digital data.

A one-to-one correspondence of derived NWI digital data to NGPC mapping did not always occur. In most instances, one or more polygon/line identification number(s) intersected a unique NGPC site code. For some wetlands assessed, more than one NGPC site code intersected one or more polygon/line identification numbers. In these instances, the highest category designation associated with multiple NGPC site codes was used to categorize the wetland.

For wetland polygons occurring on source NWI inventory mapping and not on NGPC mapping (45 sites), soil survey data were re-analyzed to determine inclusion in this study. If a polygon intersected a saline soil mapping unit, a new site code was assigned and the area was categorized consistent with methodology previously described. For wetland sites depicted on NGPC mapping, but not on source NWI data (29 sites),

point locational information was entered into the digital mapping files from the derived NWI mapping set. These areas are cartographically depicted by marsh symbols with the appropriate category designation color. Digital riverine and lacustrine data were maintained for illustrative purposes. Point data from the source NWI digital files were not used in this study.

RESULTS

A total of 276 individual wetlands possessing saline characteristics was identified. Over 70% of these sites had sufficient data, either through documentation from the NGPC mapping or field evaluations conducted by the interagency work team, to provide category designations. The number of sites per category and acreage information is provided in Table 2. A total of 5,644.1 acres of wetlands and deepwater habitats was identified within the study area.

Table 2. Summary of mapping characteristics for categories of eastern Nebraska saline wetlands. Polygon data only, line and point data not used in calculations

Wetland Designation	# Sites	Acres
Category I	98	3,244.3
Category II	29	416.5
Category III	70	648.1
Category IV	No Data	567.0
Not Categorized	79	160.8
Riverine	No Data	574.6
Lacustrine	No Data	32.8

Category I wetlands were the largest both in terms of number of sites and acreage. Classification was based upon the presence of saline dependent flora and fauna, or having

the potential to provide high values due to restorability to a saline character. No sites were classified as Category I based on historical significance.

Category I wetlands comprised approximately 57% of the total wetlands and deepwater habitats within the study area. Ecological characteristics of Category I wetlands as described by Cowardin et al. (1979)[5] indicated 70% classified as palustrine, emergent, temporarily-flooded, 9% palustrine, emergent, seasonally-flooded, and 7% as palustrine, emergent, temporarily-flooded, partly drained. The remaining 14% were comprised of 22 wetland types (no type comprised more than 3% of the total wetland acreage) with most in trace amounts (< 1 %).

Category II wetlands were the least frequent in terms of total acreage (7%). This category encompasses wetlands that have been significantly disturbed or degraded by adjacent land use or altered hydrology. Halophytes may occur as part of these site's flora, but current degree of degradation would not allow restoration to a higher quality saline character. Seventy percent of these were in the lacustrine system. Palustrine emergent wetlands of the temporarily-flooded and seasonally-flooded water regimes accounted for an additional 25%. The remaining 5% were represented by six Cowardin types in trace amounts.

Category III wetlands, freshwater vegetational communities on saline soils, ranked second to Category I wetlands in terms of acreage. This category accounted for 11% of the total wetlands and deepwater habitats. These sites generally represent former saline wetlands that have an influx of freshwater runoff due to urban or agricultural modifications within the watershed, thus diluting soil salt concentrations.

Category IV wetlands account for 10% of the total wetland acreage and deepwater habitats within the study area. No site data for Category IV wetlands was recorded, as these freshwater vegetational communities on non-saline soils were not a focus of this study. This category does, however, represent an important component of wetlands within the study area.

Category III and Category IV wetlands are distinguished ecologically by the presence or absence of saline soils. Vegetation composition is similar .The majority were palustrine emergent of the temporarily- and seasonally-flooded water regimes. Twenty-two Cowardin types were identified in these two categories.

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[5]Hereafter referred to as Cowardin types

Seventy-nine sites were not categorized. All were located on saline soils. The status, quality, and halophytic character of these wetlands are presently unknown.

Remaining wetlands and deepwater habitats within the study area are of the riverine and lacustrine system. Also, 38.4 acres represented by 21 polygons from source NWI digital data were deleted from analysis. These areas no longer meet wetland criteria and have no restoration potential.

RECOMMENDATIONS

To date, this study is the most complete inventory and assessment of eastern Nebraska's saline wetlands. Results of this study are available in computer mapping/database format. These data can be used in future applications for trend analysis, lanq use planning, and as a mechanism for prioritization of restoration sites. To maximize utility in these applications, digital data for land use classes, watershed units and soils should be incorporated into future geographic information system analyses.

Although qualitative surveys were an integral component of the categorization process, additional characterization and discrimination of the remaining saline wetlands is warranted for future stewardship and management initiatives. These technical studies should include:

- Long-term monitoring of vegetation/soil chemistry relationships at selected sites.
- Population viability studies of Salicornia rubra and Suaeda depressa.
- Shorebird time budget and habitat use studies.
- Water quality and aquatic invertebrate studies.
- Documentation of non-game wildlife utilization of selected habitat types.
- Evaluation of surface and groundwater interactions in selected watersheds.
- Experimental hydrological manipulation of selected sites to determine appropriate management strategies which augment saline wetland characteristics.

As the remaining saline wetlands are still threatened by urban development, a technical research agenda alone will not ensure the long-term viability of the resource.

Results of this study provide federal, state and local governments, business interests, and environmental groups with the best available information on the current status of the remaining saline wetlands on which future protection activities can be based. Some of the non-regulatory options which should be explored include tax incentives, voluntary restoration or acquisition projects, and additional environmental education efforts. Several regulatory protection options exist, including mitigation banking associated with the Clean Water Act, Section 404 permit program. This could also include local government sponsored sub-basin management plans incorporated with discharge specific or procedural Section 404 General Permits.

The above opportunities, both regulatory and non-regulatory, provide an opportunity for balancing environmental protection and development activities while striving for a net gain in resource values.

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APPENDICES

Appendix A – Saline Wetland Categorization Key

Appendix B – Saline Wetland Assessment Form

APPENDIX A
SALINE WETLAND CATEGORIZATION KEY

1 a. Sufficient data is available for category designation

2 a. The wetland is on a saline soil[1]

3 a. The wetland is used by the Salt Creek tiger beetle (Cicindela nevadica lincolniana).....Category I

3 b. Not as above

4 a. At least one plant species of special significance is present[2] **OR** the site is historically significant .....Category I[3]

4 b. Not as above

5 a. The site is currently contaminated by toxic or hazardous waste **OR** is/has been used for municipal or industrial solid waste disposal **AND** has limited potential for restoration.....Category II

5 b. Not as above

6 a. At least one or more saline plant associations occur as a significant part of the site's flora[4] .....Category I[3]

6 b. Not as above

7 a. A salt source can be restored.....Category I[3]

7 b. Not as above

8 a. Site currently provides **OR** has potential to provide high values as a freshwater wetland.....Category III

8 b. Not as above .....Category II

2 b. The wetland is not on a saline hydric soil .....Category IV

1 b. Insufficient data for category designation, subject to field review.....NC

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[1]The saline soils are: Salmo, Lamo, Zoe and Rauville.

[2]These species include: seaside heliotrope (Heliotropium curassavicum), Texas dropseed (Sporobolus texanus), saltmarsh aster (Aster subulatus), sea blite (Suaeda depressa) and saltwort (Salicornia rubra)

[3]Subject to interagency review for degradation.

[4]Associations are defined by the following dominant species: saltwort (Salicornia rubra), sea blite (Suaeda depressa), inland saltgrass (Distichlis spicata var. stricta), prairie bulrush (Scirpus maritimus var. paludosus), and foxtail barley/marsh elder (Hordeum jubatum/Iva annua).

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APPENDIX B
SALINE WETLAND ASSESSMENT FORM

SITE INFORMATION

Site Code (T-R-S-#)_____ County _____
Quad Name/Code _____ Date _____
Soil Type(s) _____ Investigators _____

OFFICE DATA

Site identified on NE G&PC mapping?	Yes	. . . . .	No
Site identified on NWI mapping?	Yes	. . . . .	No
Site associated with a saline complex	Yes	. . . . .	No
Historic wetland fragmented by cultural features	Yes	. . . . .	No
Site is historically significant [4a(ii)]	Yes	. . . . .	No Unk

FIELD DATA

Level of Inspection: Static Perimeter Transects - # _____

Species Information	Present	Dominant/Codominant
Species of Special Significance [4a(i)]		
Seaside heliotrope		
Texas dropseed		
Saltmarsh aster		
Suaeda		
Salicornia		
Saltgrass		
Prairie bulrush		
Foxtail barley		
Marsh elder		

Freshwater plant community (list dominants only) _____
_____
_____

Possible Salt Creek tiger beetles found? Yes No
Evidence of contamination/waste disposal Yes No
Land use types adjacent to assessment site (list) _____
_____

Comments _____
_____
_____

N
↑

Initial Category Designation: I II III IV Key: _____

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PHYSICAL CHARACTERISTICS
(circle all that apply)

Water sources: surface runoff seeps overbank flooding

Salt input present

Salt source can be restored

Hydrologic modifications
- sinkhole(s)
- headcutting
- affected by channelization
- partially drained - type? _____
- drained - type? _____
- diked
- impounded
- partial fill
- other - type? _____

Encroachment
- frontage to public road
- frontage to railroad facilities
- industrial - distance? _____
- commercial - distance? _____
- residential - distance? _____

Current land-use
- mowed/hayed
- farmed
- grazed
- idle
- managed for: wildlife recreation open space
- other - type? _____

Highly degraded: Yes No

Final Category Designation: I II III IV Key: _____

Justification: _____
_____
_____

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