TECHNICAL NOTE

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WETLAND DEVELOPMENT AND PLANNING
Biologist

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INTRODUCTION

This document incorporates the ideology and technological references found in the following literature:

Aronson, Myla and Susan Galatowitsch. December 2008. Long-term Vegetation Development of Restored Prairie Pothole Wetlands. Wetlands 28(4):883-895.

Euliss, Ned, Loren Smith, Douglas Wilcox, and Bryant Bowne. September 2008. Linking Ecosystem Processes with Wetland management Goals: Charting a Course for a Sustainable Future. Wetlands 28(3): 553-562.

Galatowitsch, Susan M. and Arnold G van der Valk. 1994. *Restoring Prairie Wetlands: an Ecological Approach*. Iowa State University Press, USA. 246 pp

Interagency Workgroup on Wetland Restoration 2003. An Introduction and User's Guide to Wetland Restoration, Creation, and Enhancement. 95 pp

Krapu, Gary, Pamela Pietz, David Brandt, and Robert Cox. 2004. Does Presence of Permanent Fresh Water Affect Recruitment in Prairie-Nesting Dabbling Ducks? Journal of Wildlife Management 68(2):332-341.

Natural Resources Conservation Service October 2006. Ecologically Isolated Wetlands. Fish and Wildlife Habitat Management Leaflet Number 38 8 pp.

The purpose of this document is to familiarize staff with the fundamental procedures necessary in the development and implementation of wetland habitat plans. For the purposes of this document, wetland habitat development involves one or more of the following philosophies: 1) wetland restoration, 2) wetland enhancement, and 3) wetland creation. Wetland preservation is beyond the scope of this document.

Before undertaking wetland planning, we must first define what restoration, enhancement, and creation mean to the South Dakota (SD) Natural Resources Conservation Service (NRCS). The definitions are derived from the NRCS Conservation Practice Standard (CPS) Wetland Restoration (657); the NRCS CPS Wetland Enhancement (659); and the NRCS CPS Wetland Creation (658). Additional definitions may be found in the NRCS Wetlands Reserve Program (WRP) Manual (440). The Conservation Reserve Program and Wildlife Habitat Improvement Program refer to NRCS CPSs and do not have additional definitions.

The CPS Wetland Restoration (657) defines wetland restoration as: *"The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site."*

The CPS Wetland Enhancement (659) defines wetland enhancement as: *"The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site; sometimes at the expense of other functions."*

The CPS Wetland Creation (658) defines wetland creation as: *"The creation of a wetland on a site that was historically nonwetland."*

Wetland restoration, enhancement, and creation are further shaped by the criteria established within each conservation practice standard. Planners must follow all criteria established in conservation practice standards, as applicable.

The WRP Manual (Subpart D – Restoration) defines restoration as: *"the rehabilitation of degraded or lost habitat in a manner such that:*

- *The original vegetation community and hydrology are, to the extent practical, re-established; or*

- *A community different from what likely existed prior to degradation of the site may be established on portions of the site. The hydrology and native self-sustaining vegetation of the alternative community established should substantially replace original habitat function and values but does not involve more than 30 percent of the wetland restoration area."*

- Thirty percent of the wetland restoration area means 30 percent of the total wetland acres in the easement area. For example, the WRP plan has 2 wetland sites; Site A is 10 acres and Site B is 20 acres. The maximum allowable alternative community is 9 acres (30 percent x 30 acres). The alternative community acres may occur on one site or applied to multiple sites as long as the total alternative community acres (in this case nine acres) in the easement area are not exceeded.

1. PLANNING PHILOSOPHY

According to the Fish and Wildlife Habitat Management Leaflet Number 38 (NRCS 2006), *"In areas where the majority of wetlands have been lost* or degraded*, restoring a single wetland will not restore the functions associated with historical wetland complexes. In these areas, restoration plans should be undertaken to restore not only a single wetland, but a number of wetlands that are ecologically connected in wetland complexes. In restoring wetland complexes, it is important to ensure that a variety of wetland types are restored."*

Both wetland restoration and wetland enhancement are similar and may be difficult to distinguish from each other. According to the definitions above, wetland restoration involves returning a wetland to the approximate original natural condition (e.g., filling a ditch so that a drained wetland becomes saturated and/or inundated), while wetland enhancement means changing the wetland so that one or more functions are increased beyond their original state (e.g., converting a seasonal wetland to a semipermanent wetland).

Enhancing a wetland in one way often degrades it in another way. In Euliss et *al*. (2008), even species that do best when wetlands contain water benefit from the dry phase that is needed to recycle nutrients required to enhance the food webs that they depend upon when wetlands reflood. Euliss (et *al*. 2008) further stipulated that actions that alter seasonality, depth, and duration of flooding or alter natural drawdown phases in wetlands may serve to meet short-term goals but they have the long-term effect of reducing wetland diversity and productivity. Euliss (et al. 2008) concluded that *"management actions which defy natural processes will be doomed to an eternal battle with nature and will risk long-term, high maintenance costs or failure. "*

When wetland enhancement is undertaken, the project goals should include minimizing any decrease in existing wetland functions. Galatowitsch and van der Valk (1994) contend, "*If the success of a wetland restoration is judged only by whether it contains any water or not or whether or not a duck has ever been seen on it, we will become satisfied with only partially restored wetlands at best. For example, a restored semi-permanent wetland without a sedge* [wet] *meadow, even if it is used by migrating ducks, is incomplete. Sedge meadows are full of small treasures, such as lilies, orchids, rails, jumping mice, and are nesting sites for waterfowl. Only a restored semi-permanent wetland with a sedge* [wet] *meadow is a truly successful restoration because it is comparable in composition and function to a natural one."*

Wetland creation is usually a difficult undertaking. The primary challenges in wetland creation is bringing water to a site where it does not naturally occur and establishing vegetation on soils that are not hydric. While creation is possible, it typically requires significantly more planning and effort than wetland restoration or enhancement, and the outcome of the effort is difficult to predict. Many attempts to convert uplands to wetlands result in ecosystems that do not closely

resemble natural wetlands and that provide limited wetland functions (valuable upland habitat might be lost in the process as well).

According to the Interagency Workgroup on Wetland Restoration (2003), *"Wetland habitat planners should implement only the actions necessary to re-establish natural wetland processes on a site. The first method to consider for renewing functions is to remove the factors causing wetland degradation or loss and let nature do the work of restoration. This method is often called the* ***passive approach****. For example, if wetland vegetation and water quality are degraded primarily as a result of cattle grazing, then removing the cows may be the only activity needed to restore the wetland system. Passive methods allow natural regeneration of wetland plant communities, natural re-colonization by animals, and re-establishment of wetland hydrology and soils. Passive approaches are most appropriate when the degraded site still retains basic wetland characteristics and the source of the degradation is an action that can be stopped. The success of passive methods usually depends on an accessible source of water, the close proximity of wetland plants and animals, and a mechanism for bringing species to the restoration site. The benefits of passive methods include low cost and a high degree of certainty that the resulting wetland will be compatible with the surrounding landscape.*

For many sites, passive methods are not enough to restore the natural system and an ***active approach*** *is necessary. Active approaches involve physical intervention in which humans directly control site processes to restore, create, or enhance wetland systems. The active approach is most appropriate when a wetland is severely degraded or when goals cannot be achieved in any other way, as is the case with wetland creation and most enhancements. Active methods include re-contouring a site to the desired topography, changing the water flow with water control structures (i.e., weirs or culverts), intensive planting and seeding, intensive non-native species control, and bringing soils to the site to provide the proper substrate for native species. The design, engineering, construction, and costs for such work can be significant."*

2. PLANNING

Good planning is a critical, but often overlooked, stage of wetland habitat development. Inadequate planning is often a major reason wetland habitat development projects fail to restore self-sustaining, naturally-functioning systems. Good wetland planning is important because:

- ✓ Planning requires collecting information about the landscape and the local area including but not limited to watershed size(s); basin size(s); potential restoration, enhancement, and creation sites; site topography; and other site constraints (e.g., property boundaries).
- ✓ Planning will help you determine the most reasonable goals for your site(s).
- ✓ Planning will help you establish clear and feasible objectives given the factors that may constrain the project.
- ✓ Planning identifies the materials, labor, and activities that will be needed to achieve the project's goals.

Not every project will require everything in each step. The extent of the planning required will depend on the condition of the project site and your goals. More complex projects require more planning. The following steps should be followed:

1. Understanding the Broader Landscape
2. Choosing the Wetland Site(s)
3. Knowing the Wetland Site(s)
4. Setting Wetland Habitat Goals/Objectives
5. Collecting Field Data
6. Designing the Wetland Sites
7. Building the Wetland Sites – not discussed in this document

2.1. Step 1 Understanding the Broader Landscape

As you begin planning a wetland project, use your offsite tools (e.g., Geographic Information System (GIS), United States Geological Survey (USGS) topographic maps, imagery, National Wetland Inventory (NWI) maps) to understand the broader landscape and identify the major natural features and any patterns in the way these natural features occur. Ask and answer the following questions:

1. Is the broader area fairly flat, hilly, or sloped? (These factors affect surface and groundwater drainage and ponding patterns.)

2. Do/did the wetlands occur throughout the landscape or are they concentrated in one place?

3. Are/were wetland complexes present? If so, characterize the wetland complexes (wetland class, number of each wetland class, linear, depressional, or pothole).

    a. Class I Ephemeral Wetland - low prairie zone
    b. Class II Temporary Wetland - low prairie and wet meadow zones
    c. Class III Seasonal Wetland - low prairie, wet meadow, and shallow marsh zones
    d. Class IV Semi-permanent Wetland - low prairie, wet meadow, shallow marsh, and deep marsh zones
    e. Class V Permanent Wetland

4. Are/were "Waters of the United States" (intermittent or perennial water courses) present? If so, do they affect site hydrology?

5. What are the characteristics of wetlands close to your potential sites that have the desired functions of your wetland sites?

2.2. Step 2 Choosing the Wetland Site(s)

The following seven factors are to be considered when choosing a restoration, enhancement, or creation site(s) within an area:

1. Hydrology sources – groundwater, surface runoff, precipitation, tile flows, combination
2. Hydrology losses – tiles, ditches, diversions, dikes, evaporation, etc.
3. Watershed size – reference wetland and proposed site
4. Watershed land use
5. Topography and geology
6. Soils
7. Other site constraints – land ownership, utilities, infrastructure

- Do not simply rely upon an NRCS official wetland determination – field verify.
- Specifically consider how to achieve the necessary volume, duration, and frequency for your planned wetland sites to produce wetland characteristics of the desired wetland classes (I, II, III, and/or IV) identified in Step 1.
- Look for locations which have potential characteristics with the hydrology, topography, and soils typical of the wetland classes (I, II, III, and/or IV) in your local area identified in Step 1.
- Look for the presence of hydric soils or drained wetland soils, which indicate places that would be appropriate for wetland restoration or enhancement.
- Look for locations that have underling soils with low hydraulic conductivities for wetland creations.

- Choosing a site that is close to an area with native wetland species or finding a site that already has native species might aid natural colonization of the site. The best sites are likely to be near wetlands similar to your target type.

2.3. Step 3 Knowing the Wetland Site(s)

The site assessment is a more focused version of the broader landscape evaluation and may utilize information resources used in Step 1. Before designing the wetland site(s), you will want to learn about the past and current conditions of the wetland site(s) by conducting a site assessment. The goals of a site assessment are to:

- ✓ understand former conditions on the site(s)
- ✓ determine whether or not a wetland ever existed on the site(s)
- ✓ determine what factors resulted in wetland degradation/loss, if a wetland did exist
- ✓ determine the current condition of the site(s)
- ✓ determine if it is feasible to restore, enhance, or create a wetland with the desired project wetland characteristics

You should look for conditions that could limit the project goals. Modifications to the wetland design(s) and/or maintenance plan may be needed to address problems such as:

1. Poor water quality.
2. Lack of sufficient water.
3. Lack of native species nearby.
4. Invasive and non-native species on adjacent land.s
5. Herbivores that could decimate new plants (Canada geese, muskrats, etc.).
6. Human uses (of the site and adjacent sites) that are incompatible with restoration.
7. Future land uses (around the site) that are incompatible with restoration.
8. Presence of cultural resources.

2.4. Step 4 Setting Wetland Habitat Goals/Objectives

Work with the participant to understand their goals and/or intent following standard NRCS planning procedures. Based on your evaluation in Steps 1 – 3 determine whether the site(s) can support the participant's objectives, or how close to these objectives can be met. <u>During the planning phase, do not promise the participant a specific hydroperiod (e.g., permanent water) because you will not know if the site(s) will be able to deliver the necessary hydrology.</u> In most instances in SD, wetland hydrology is not permanent and certainly is not predictive. If the participant wishes wetland enhancements and/or creations, then the use of wetland reference sites and site-specific water budget analysis may be required, so use caution when dealing with participants on these topics. Refer to the species group/guild habitat and landscape requirements from Biology Technical Note No. 15 for further information.

Table 1.0 identifies common wetland problems and corrections to consider when developing when developing wetland restoration goals/objectives.

Table 1.0 Common Wetland Problems and Potential Corrective Measures

Wetland Damage	Reason for Damage	Suggested Correction	Considerations
Altered Hydrology (drained)	Ditching or tile drains	Fill or plug ditches or drains; break tiles	Organic soil may have decomposed so that the elevation of the site is lower than it used to be.
Altered Hydrology (drained)	Former wetland diked off from its water sources	Remove/breach dikes or install water control structures	Substrate elevation may not be correct for vegetation; add soil or control water level with low maintenance structures
Raised Elevation	Soil dumping or fill	Remove material	Fill may have compressed soil to lower than initial elevation; take steps to avoid erosion.
Loss of Biodiversity	Change in original habitat	Evaluate the success potential for restoring native plant communities by natural or artificial processes. Evaluate whether native wildlife will potentially recolonize.	Allow plant species to colonize naturally; import species as appropriate. What adjustments may be necessary to attract targeted wildlife species?
Loss of Native Plant Species	Invasive and/or nonnative plants; change in hydrology; change in land use.	Remove invasive, non-native plants and allow native plants to re-colonize. If necessary, eliminate invasive species seed in the soil seed bank; try to reverse changes in hydrology.	Pick lowest impact removal method; repeat removal as nonnatives reinvade; alter conditions to discourage nonnative species.

2.5. Step 5 Collecting Field Data

Once you have an understanding of the broader landscape (Step 1), selected wetland site(s) (Step 2), develop an understanding of the selected wetland site(s) (Step 3), and have developed your goals/objectives (Step 4), it is time to collect actual field data. The purpose of collecting field data is to answer questions critical to wetland design and placement, wetland sustainability and success, and ensure wetland goals/objectives are being met.

In addition to qualitative information collected in Steps 1 and 2, collecting site-specific, quantitative (numerical) data is often necessary to determine the causes and cures for wetland loss or degradation. Quantitative site measurements may be required to obtain permits or to design the project. The following quantitative parameters should be measured in the field:

1. Exact elevations and topography of features (e.g., outlets, wetland bottom, manipulations at the wetland sites, areal extents associated with various estimated water depths – 6 inches, 12 inches, 18 inches, etc.).
2. Levels of soil nutrients, organic matter, and moisture (usually not applicable).
3. Water flow rates and timing.
4. Location of wetland soils, wetland plants, and wetland hydrology.
5. Diversity and cover of native and invasive or nonnative plant species.

The following questions have been developed to aid you in determining what field data should be collected. The questions are separated into 5 categories: 1) hydrology, 2) soils/substrates, 3) plant communities, 4) animal communities, and 5) wetland complexes. These questions have been grouped into categories based on creation, restoration, enhancement, or some combination thereof.

A. Hydrology:

Questions applicable to wetland *restoration, enhancement, and creation –*

1. What baseline hydrologic data is available (historical water levels, peak flow frequencies and duration data, groundwater data, etc.)?
2. What are the current hydrologic characteristics of the restoration site(s)?
3. Are there groundwater interactions at the site(s)?
4. What are the pre-disturbance hydrologic characteristics at hydrologically disturbed sites?
5. What caused changes to the hydrologic characteristics of the site(s) (document alterations in the watershed hydrology and/or manipulations at the site(s))?
6. What change might restore, enhance, and/or create hydrology?
7. Are there potential effects to down slope wetlands or other wetlands as a result of planned hydrologic changes at the site(s)?
8. What factors might constrain restoring full hydrological functioning? (restoration)
9. What are the likely reasons that the site(s) might fail to reach their hydrological goals?
10. What soft engineering or bioengineering methods are applicable to achieve the desired wetland characteristics?
11. Are the project goals reasonable, feasible, and likely to result in establishing the maximum ecological functioning possible for the site(s)?
12. What parameters should be monitored to assure that the project objectives are met? How often should they be monitored and for how long?

B. Soils and Substrates Questions:

Questions applicable to wetland *restoration, enhancement, and creation –*

1. Where is baseline information about local soils found?
2. What are the typical characteristics of substrates in the wetland(s)? Levels of organic matter, nutrients, soil moisture? Texture, particle sizes and soil structure?
3. Are there impervious soil layers contributing to the wetland dynamics?
4. What soil parameters should be sampled to characterize the wetland(s)?
5. What are typical substrate elevations, and microtopographic features of the wetland classes (including channels, islands, and mounding)?
6. What methods are available to bring the soil conditions and substrate elevation in line with predicted/former wetland classes?
7. Are the project goals reasonable, feasible, and likely to result in establishing the maximum ecological functioning possible for the site(s)?
8. What parameters should be monitored to assure that the project objectives are met? How often should they be monitored and for how long?

C. Wetland Plant Community Questions:

1. What native plant species would be expected to be found in pioneer and mature stages of the wetland classes? What are the dominant species?
2. What natural disturbances are typical of the wetland classes?
3. What soil and hydrological conditions on the restoration site(s) would constrain establishing the native community? How should these conditions be changed?
4. How should the site be prepared (adding soil amendments, removing nonnatives, etc.,) for establishing native plants?
5. What methods are available for eliminating the most damaging nonnative species?
6. Is it likely that native species will colonize the site(s) quickly? If not, what methods should be used to establish native plants?
7. What are the threats to newly established plants (herbivores, flooding, intense sun, etc.,) and how should they be combated?

8. What “offsite” habitats exist which may adversely affect colonization and/or establishment of anticipated wildlife?
9. Are the project goals reasonable, feasible, and likely to result in establishing the maximum ecological functioning possible for the site(s)?
10. What parameters should be monitored to assure that the project objectives are met? How often should they be monitored and for how long?

D. Wetland Animal Community Questions:

1. What native animal species are found in pioneer and mature stages of the wetland classes?
2. What natural disturbances affect animal species in the wetland classes?
3. What soil, hydrological, and plant community conditions on the restoration site(s) would constrain establishing the native community? How should these conditions be changed?
4. What habitat conditions will attract the typical animal groups and what specific habitat features can be added to attract wetland dependent animal groups?
5. What methods are available for eliminating the damaging nonnative species?
6. Is it likely that native species will colonize the site quickly? If not, what can be done?
7. What are the threats to newly established animal populations on the site (predators, flooding, pollution, human impacts, etc.,) and how should they be managed?
8. Are the project goals reasonable, feasible, and likely to result in establishing the maximum ecological functioning possible for the site?
9. What parameters should be monitored to assure that the project objectives are met? How often should they be monitored and for how long?

E. Wetland Landscape Questions (these questions relate somewhat to the hydrology questions above):

- Please note that the recent (historical) wetland complexes in eastern SD typically contain a Temporary (Class II) to Semipermanent (Class IV) ratio of about 7:1.
- Please note that the recent (historical) wetland complexes in eastern SD typically contain a Seasonal (Class III) to Semipermanent (Class IV) ratio of about 4:1.
- The aforementioned ratios should be the target condition to benefit wetland dependent wildlife.

1. What are the wetland classes (I, II, III, and IV) present within a mile of your restoration area?
2. Are there at least two temporary (Class II) or seasonal wetlands (Class III) present within one-half mile of nesting cover?
3. Is there at least one semipermanent (Class IV) wetland within a mile of your restoration area?
4. Are slope/linear wetlands present within your restoration area? If so, will they be converted to another wetland type (Class I, II, III, or IV)?
5. Will there be wetlands of all classes present on your restoration area?

2.6. Step 6 Designing the Wetland(s)

Use the information assembled in Steps 1, 2, 3, and 4 to help you answer the questions in Step 5. The answers to the questions in Step 5, which will most likely require field work, form the basis for the wetland restoration, creation, and/or enhancement site designs. Several tools and/or guides (nonengineering) were developed to assist you in the development of wetland designs, including: 1) Biology Technical Notes Nos. 16 and 18 and 2) the “Wetland Restoration Planning and Evaluation for Wildlife Habitat” worksheet (attached).

The information in Step 6 does not replace the criteria and engineering design requirements associated with NRCS CPSs. The following questions have been developed to aid you in

finalizing your designs: 1) design features/elements; 2) level of restoration; 3) level of enhancement and/or creation; and 4) wetland sustainability.

1. Have you conducted a wetland functional assessment and trade-off analysis? In other words, are you making the habitat "different" or making the habitat "better?"

    - The current wetland functional assessments in use by the SD NRCS are HGM based; the SD-LTP-26 and SD-LTP-19 are not wetland functional assessments as they solely focus on habitat.
    - The net effect of excavating certain wetlands would be to make the habitat different but not necessarily better (MN Interagency Wetlands Group 2000).
    - **Permanent water areas (even in semipermanent wetlands) can serve as mink refugia during drought and planners should be aware that by creating permanent wetland habitat mink predation during and after drought may increase, potentially leading to sever reductions in duck production** (Krapu et al. 2004).

2. If the site is a perennial or intermittent stream (blue line stream and/or clearly visible on aerial photography) with a defined channel (e.g., bed and bank are discernable even if encompassed with wetland vegetation), will you allow the surface runoff to flow to adjacent downstream wetlands at normal frequency and duration?

    - If you do not allow the surface runoff to continue to downstream wetlands at a normal frequency and duration, then your design will decrease downstream wetland function (beyond minimal) and your design will not be compliant with the CPS Wetland Enhancement (659.)
    - The site may be possible "Waters of the United States," seek United States Army Corps of Engineers (USACE) approval (individual permit, if necessary). Generally, the SD NRCS does not allow the plugging of a ditched blue-line and/or named stream.

3. If the site is a linear wetland and you are doing an enhancement, is your design displacing the linear wetland vegetation and linear wetland functions to the fringe of the wetland enhancement?

    - If your design does displace but continues to provide the same linear wetland functions then your design will be compatible with the NRCS SD-CPA-10 Expedited Minimal Effect Number 4 ("Wetland restorations and enhancements built according to COE Nationwide 27 and following a written plan or agreement with the FWS, NRCS, or South Dakota Game, Fish and Parks (SDGF&P).")

        i. According to the USACE Nationwide 27 Permit, "Except for the relocation of non-tidal waters on the project site, this NWP does not authorize the conversion of a stream or natural wetland to another aquatic habitat type (e.g., stream to wetland or vice versa) or uplands." [Provided there are net increases in aquatic resource functions and services.]

    - ***Displacement of wetland functions does result in compliance with the National Environmental Policy Act (NEPA) wetland policy (Executive Order 11990) because they are a minimal affect and do not rise to the level of mitigation.***

4. If the site is a linear wetland, is your design eliminating or reducing (net) linear wetland functions?

- If your design does not meet the requirements of a minimal effect or minimal effect with conditions, then your design will not meet NRCS CPSs.

5. If your site is a linear wetland or draw without a wetland and your design (e.g., enhancement or creation), is a plug (berm) above natural channel grade, will your site and the downstream wetland resource (if a wetland exists) draw down (go dry) during a similar time period (e.g., same season just different months)?

    - If your site location and/or your site design do not facilitate a similar drawdown period as the adjacent downstream wetland resource then your design will decrease downstream wetland function (beyond minimal) and your design will not be compliant with the CPS Wetland Enhancement (659).

6. If your design is a wetland creation, will your site have sufficient hydrology to meet the project objectives?

    - Do not want to make promises concerning wetland hydrology that are not likely to occur at the site?
    - Will the site have less than three feet of water?
    - What time of the season would you estimate the site dries up?
    - What is the intent of the creation?

7. Does your design include a pothole wetland with a shallow water excavation (dugout or a donut with a nesting island) in it or adjacent to it?

    - Are you sure you are only displacing the wetland functions and not drying up the fringes of the existing wetlands?
    - Keep in mind the expedited minimal effect criteria.
    - Keep in mind that the wetland functions are to be displaced to the fringes of the wetland and not lost.
    - ***Displacement of wetland functions does result in compliance with the NEPA wetland policy (Executive Order 11990) because they are a minimal affect and do not rise to the level of mitigation.***

8. Do your site conditions warrant a detailed topographic survey? Did you obtain such a survey?

    - Some or all of your sites may be flat too restore or enhance wetland hydrology.
    - Some or all of your sites may be located too close to property boundaries, public roads, utilities, infrastructure, or have other constraints that may cause saturation or inundation outside your project boundaries. Detailed surveys will help you avoid these problems.

9. Do your designs only include the restoration of wetlands (no enhancements) that do not warrant additional investigations?

    - If this is the case, then your designs should be acceptable.

10. Do your designs include wetland vegetation seeding/planting? If not, why?

    - A 20-year study conducted in the prairie pothole region of SD, MN, and IA determined that without a nearby seed source, wetlands (especially Class I, II, and III) should be seeded (Aronson and Galatowitsch 2008).

11. If your design includes wetland enhancement and/or wetland creation, did you consult a wetland reference site and determine the reference site characteristics?

- For example, if longer or deeper hydrologic regimes is proposed (e.g., a semi-permanent wetland on a site that currently has a temporary/seasonal regime before) then locate a semi-permanent wetland and measure its watershed size and/or conduct a water budget to ensure that your enhanced/created site will receive adequate hydrology.
- Please do not promise the participant a specific hydro-period (e.g., permanent water) during the planning phase because you will not know if the site(s) will be able to deliver the necessary hydrology.

So, what does Step 6 look like in the real world? In Part IV of this document, we will apply Planning Steps 1 through 5. In Part V of this document, we will work through a few real world examples of planning and designing wetland restoration/enhancement projects.

3. APPLYING THE PLANNING STEPS (1 through 5)

3.1. Step 1 Understanding the Broader Landscape

- Tools that will be important in this step are:

  - Aerial imagery – digitally rectified
  - NWI digital point, polygon, and line layers
  - USGS 7.5° topographic digital layer
  - Your county's certified wetland determination digital layer

1. Assemble your offsite tools for the potential project area and begin to develop a plan map in GIS.
2. Pick a wet image year that you believe best suits your county to use as a base map.
3. Overlay the NWI layer and county wetland layer on the base map image and answer Step 1, questions 2, 3, and 4 (using approximations.)

   a. Record the wetland complex answers on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet.

4. Overlay the USGS topographic layer on the base map and wetland layers. You will need to increase the transparency of the USGS topographic layer in the layer properties box in order to see the overlay.
5. Answer Step 1, questions 1 and 4 and the linear wetland portion of question 3, if necessary (using approximations.)

   a. Record the wetland complex answers on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet.
6. Continue to Step 2.

3.2. Step 2 Choosing the Wetland Site(s)

- Tools that will be important in this step are:

  - The answers from Step 1
  - Official or certified wetland determination for the field(s)
  - The base map and overlays from Step 1
  - Communication with the participant

1. During this step you will mainly consider the questions noted in Step 2.

2. Do not limit your potential wetland sites to only those the participant thinks should be included. Remember the bigger picture. Step 2 does not interfere with, and is independent of, program eligibility issues.

3. Continue to Step 3.

3.3. Step 3 Knowing the Wetland Site(s)

- Tools that will be important in this step are:

  - The answers from Step 1
  - Official or certified wetland determination for the field(s)
  - The base map and overlays from Step 1
  - The answers from Step 2

1. Determine the approximate wetland class ratios (temporary to semipermanent and seasonal to semipermanent within one mile of the project area. This step is a refinement of the complex information recorded in Step 1.

   a. Adjust the previously recorded wetland complex answers on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet as necessary.

2. Determine which sites require additional topographic survey information. Wetland zones (and, therefore; wetland classes) may not be able to be determined without survey information.

3. Continue to Step 4.

3.4. Step 4 Setting Wetland Habitat Goals/Objectives

- Tools that will be important in this step are:

  - The answers from Steps 1, 2, and 3

1. Meet with the participant and discuss the results of Steps 1 through 3.

2. Continue to Step 5.

3.5. Step 5 Collecting Field Data

- Tools that will be important in this step are:

  - The answers from Steps 1, 2, 3, and 4
  - The base map and overlays from Step 1
  - Additional technical support from specialists

1. Collect topographic survey information for the existing wetland or created wetland condition at site(s) proposed for wetland restoration, enhancement, and creation where site constraints may be critical.

   a. If you are only restoring to the approximate natural contour with no real site constraints then the topographic survey may be limited in extent.

   b. Record full pool and proportional pool information if applicable, on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet.

c. Record site constraints.

2. Field verify that the manipulated areas are or were wetlands in order to properly account for wetland acres restored, wetland acres enhanced, and wetland acres created. Acres may be approximated.

3. Adjust the wetland numbers and/or wetland boundaries (area) based on the field verification in the previous step.

   a. Adjust the previously recorded wetland complex answers on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet as necessary.

4. Verify the location and extent of hydrologic manipulations within each wetland basin.

5. Determine the watershed size of the proposed wetland restoration, enhancement, and/or creation site(s).

   a. If conducting wetland "enhancements" then watershed should be determined using the 1:24,000 USGS quadrangles and field verified in order to justify the cost of the additional construction/labor.

   b. If you are only restoring to the approximate natural contour with no real site constraints and the sites hydrologic sources (groundwater and surface water flow) are otherwise intact then the watershed size can be estimated using the 1:24,000 USGS quadrangles.

   c. For created wetlands, the watershed size can be estimated.

6. Identify wetland sites with invasive plant species (e.g., reed canarygrass, cattail) and note on conservation plan map

7. Verify the extent of vegetation development for each wetland zone within each wetland basin.

   a. Record vegetation development information on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet (currently being tested).
   b. Document plant species as necessary.

8. If necessary, verify the [tight] impervious soil layers in wetland basins proposed for excavation to ensure the excavation does not destroy the wetland hydrology.

   a. Record the soil conditions as necessary.

9. Record the dimensions of any macrotopographic (abandoned oxbows and channels) and microtopographic features (Biology Technical Note No. 18) that currently exist in the basin so that they may be recreated in other basins as appropriate.

10. Continue to Part 5, Step 6

4. APPLYING THE DESIGN STEP

4.1. Step 6 Designing the Wetland Sites

- Tools that will be important in this step are:

  - The answers from Steps 1, 2, 3, 4, and 5
  - The base map and overlays from Step 1
  - Additional technical support from specialists
  - Applicable CPS'

1. During this step you will mainly consider the questions noted in Part IV, Steps 1 through 5, paying particular attention to the answers to the Step 6 questions.

2. Actual site design and layout will be conducted on a site-specific basis and is beyond the scope of this document.

3. With the data obtained in Step 5 ensure that the proposed site conditions provide suitable habitat.

   a. Answer the "Planning Area Habitat Suitability" questions on the "Wetland Restoration Planning and Evaluation for Wildlife Habitat" worksheet.

Wetland Restoration Planning and Evaluation for Wildlife Habitat

INSERT HEADER INFORMATION HERE (NAME, LOCATION, DATE, ETC.)

Existing information is the condition of the basin prior to manipulation.

For each wetland/basin provide all of the information requested below.

EXISTING SITE CHARACTERISTICS	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
Wetland Size @ Full Pool (occular estimate of acres)												
Existing Wetland Zones (occular estimate of acres):												
Low Prairie (Temporary)												
Wet Meadow (Temporary)												
Shallow Marsh Zone (Seasonal)												
Deep Marsh (Semipermanent)												
Permanent Wetland												

Existing Wetland Complex Extent

Record the number and estimated acres of wetlands within 1.0 square mile centered on the wetland being restored.

Wetland Zone	Acres (est.)	Number of Wetlands
Low Prairie (Temporary)		
Wet Meadow (Temporary)		
Shallow Marsh Zone (Seasonal)		
Deep Marsh (Semipermanent)		
Permanent Wetland		

Total wetland acres _____

Wetland Complex Ratios (Fill in the existing ratio)

Existing	Ratio	Sustainable
	Temp: Seasonal	1.5:1.0
	Temp: SemiPerm	6.8:1.0
	Seasonal: SemiPerm	4.4:1.0
	Temp & Seasonal: SemiPerm	11.0:1.0

Answer the following questions as: yes = 2; no = 1	**Answer**
Are wetlands of all zones present?	2
Are linear or slope wetlands present?	2
Are there at least 2 wetlands with Low Prairie or Wet Meadow Zones within 1/2 mile of nesting cover?	2
Is there at least 1 Shallow Marsh or Deep marsh Zone within 1 mile of the center of the complex?	2
Are the exiting wetland complex ratios equivalent to the Sustainable ratios?	2

Existing Planning Area Vegetation Development — **Answer the following questions as: yes = 2; no = 1**

	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
Is the wetland dominated by native, non-aggressive vegetation? e.g. any native species except reed canary grass and cattail	2											

Existing Planning Area Habitat Suitability - General — **Answer the following questions as: yes = 2; no = 1**

	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
Is at least 50% of the wetland less than 18 inches deep?	2											
Does the wetland have less than 50% open water?	2											
Are all wetland zones present?	2											

EXISTING WETLAND ECOSYSTEM LANDSCAPE SCORE (max =18 points per wetland) **18**

Planned wetland projects shall achieve a wetland ecosystem score of at least 90% ot the total available points over the entire complex.

Comments/Notes:

For each wetland/basin provide all of the information requested below.

PROPOSED SITE CHARACTERISTICS	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
Basin Size @ Full Pool (occular estimate of acres)														
Existing Wetland Zones (occular estimate of acres):														
Low Prairie (Temporary)														
Wet Meadow (Temporary)														
Shallow Marsh Zone (Seasonal)														
Deep Marsh (Semipermanent)														
Permanent Wetland														

Proposed Baisn Complex Extent *Record the number and estimated acres of basins within 1.0*				*Record the number and estimated acres of basins restored, enhanced, and/or created*		
Basin Zone	**Acres**	**Number of**	**% of Basin**	**Acres**	**Acres Enhanced**	**Acres Created**
Low Prairie (Temporary)						
Wet Meadow (Temporary)						
Shallow Marsh Zone (Seasonal)						
Deep Marsh (Semipermanent)						
Permanent Basin						

Total basin acres _____

Answer the following questions as: yes = 2; no = 1	**Answer**
Are basins of all zonespresent?	2
Are linear or slope wetlands present?	2
Are there at least 2 basins with Low Prairie or Wet Meadow Zones within 1/2 mile of nesting cover?	2
Is there at least 1 Shallow Marsh or Deep marsh Zone within 1 mile of the center of the complex?	2
Are the planned basin complex ratios equivalent to the Sustainable ratios?	2

Planned Vegetation Development	**Answer the following questions as: yes = 2; no = 1**													
	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
Will the basin be dominated by native, non-aggressive vegetation? e.g. any native species except reed canary grass and cattail	2													

Planned Habitat Suitability - General	**Answer the following questions as: yes = 2; no = 1**													
	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
Will at least 50% of the basin be less than 18 inches deep?	2													
Will the basin have less than 50% open water?	2													
Will all basin zones be present?	2													

PLANNED BASIN ECOSYSTEM LANDSCAPE SCORE (max =18 points per basin) **18**

Planned basin projects shall achieve a basin ecosystem score of at least 90% ot the total available points over the entire complex.

Comments/Notes:

So, what is the "histrorical" (and sustainable) wetland complex in eastern SD?

According to Johnson and Higgins (SDSU, 1997) Wetland Resource of Eastern SD:

Concerning basin landscape coverage (Executive Summary)
1. Temporary wetlands account for approximately 1/2 (56%)
2. Seasonal wetlands account for approximately 1/3 (36%)
3. Semipermanent wetland account for approximately 1/10 (8%)
4. Permanent wetlands account for approximately 0.2%

Concerning Size Structure of Basins (page 16)
1. 58% of basins are ≤ 0.5 acres in size
2. 73% of basins are ≤ 1.0 acres in size
3. 84% of basins are ≤ 2.0 acres in size
4. 92% of basins are ≤ 5.0 acres in size

Although the ~75% of basins ≤ 1.0 acres in size comprise ~12% of total basin acreage, because they are small, nearly all have temporary or seasonal water regimes and provide different functions and values than larger, deeper basins that comprise a larger percentage of the total acreage.

Median Temporary basin size is 0.3 acres
Median Seasonal basin size is 0.5 acres
Median Semipermanent basin size is 2.3 acres
Median Permanent basin size is 98.5 acres

Temporary to Seasonal Ratio is 1.5:1.0
Temporary to Semipermanent Ratio is 6.8:1.0
Temporary to Permanent Ratio is 357:1

Temporary & Seasonal to Semipermanent Ratio is 11:1
Temporary & Seasonal to Permanent Ratio is 587:1

Seasonal to Semipermanent Ratio is 4.4:1
Seasonal to Permanent Ratio is 230:1

So, what is the "histrorical" (and sustainable) wetland complex in western SD?

According to Rieger, Higgins, Jenks, and Kjellsen (SDSU, 2006) Demographics of Western SD Wetlands and Basi

Concerning basin landscape coverage (Executive Summary)
1. Temporary wetlands account for approximately 1/3 (36%)
2. Seasonal wetlands account for approximately 1/4 (29%)
3. Semipermanent wetland account for approximately 1/3 (34%)
4. Permanent wetlands account for approximately 0.8%

Concerning Size Structure of Basins (page 14)
1. 62% of basins are ≤ 0.5 acres in size
2. 75% of basins are ≤ 1.0 acres in size
3. 85% of basins are ≤ 2.0 acres in size
4. 94% of basins are ≤ 5.0 acres in size

At least 50% of all basins are human made creations

Mean Temporary basin size is 0.7 acres
Mean Seasonal basin size is 1.0 acres
Mean Semipermanent basin size is 2.2 acres
Mean Permanent basin size is 37.3 acres

Temporary to Seasonal Ratio is 1.2:1.0
Temporary to Semipermanent Ratio is 1.0:1.0
Temporary to Permanent Ratio is 47:1

Temporary & Seasonal to Semipermanent Ratio is 1.9:1
Temporary & Seasonal to Permanent Ratio is 85:1

Seasonal to Semipermanent Ratio is 0.85:1
Seasonal to Permanent Ratio is 38:1