SOUTH DAKOTA ENGINEERING

DOCUMENTATION AND SPOT CHECKING MANUAL

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SOUTH DAKOTA ENGINEERING
DOCUMENTATION AND SPOT CHECKING MANUAL
GENERAL POLICY

REFERENCE: General Manual (GM) 450, Part 407, Documentation, Certification, and Spot Checking

These instructions outline the minimum data to be recorded in planning, installing, and checking a practice in accordance with GM, Section 450, Part 407, and South Dakota (SD) amendments thereto. In many cases, data will be tabulated and computation will be made as a part of design and plan preparation that may not be reflected or shown on documentary guidelines. These data sheets will also be filed with supporting data for the practices.

Procedure:

Note Keeping, Earth Work, Surveys and Measurements, Data Sheets

A. Survey Note Keeping

1. Structural Measures

a. General Instructions - Field Notes:

1. Loose-leaf field notes shall be used for most work typically performed at the field office (FO) level, except for those practices where special job sheets are used and work is or can be expected to be of a continuing nature. The sheets of loose-leaf notebooks will be filed with the plans, computations, and other supporting data relating to the work.

   Bound field books will be used for all large jobs, group jobs, watershed, and other jobs of a continuing nature. When bound books are used, they will be properly indexed and filed. Bound books may be numbered consecutively.

2. Field survey notes will conform to standard field notes as illustrated in Technical Release 62 (TR-62). All field notes pertaining to a particular job, or notes pertaining to any phase or portion of a job, shall contain the standard survey heading which will include:
   a. Name of practice and type of survey.
   b. Cooperator's name.
   c. Location of job by legal description.
   d. Date of survey and weather.
   e. Name of survey party.
   f. Location, description, and elevation of bench marks.

   This information is customarily put at the top of the sheet on which the survey notes are kept or on the title page of the survey notes.

3. Electronic data files derived from survey data collection using electronic Total Stations or Survey Grade Global Positioning Systems (GPS) equipment shall be printed and kept with the other supporting data relating to the work. Digital copies of the survey data should be stored and preserved for future retrieval and use.

B. Earthwork Calculations

Earthwork calculation procedures shall be standardized in computing the final quantities required under the various programs being carried out by the Natural Resources Conservation

Service (NRCS). The following outlines the methods, tables, charts, and forms that will be used when earthwork quantities are needed.

1. Earthwork quantities for dams, dikes or ditches, dugouts, etc., will be calculated as follows:
   a. Where the ground conditions are described by three regular survey points:
      1. Use the "three level section" method; the yardage tables as found in the Engineering Field Manual (EFM), Supplement 1; AREAVOL software; state approved computation spreadsheets developed on EXCEL software; or appropriate Computer Aided Design and Drafting (CADD) software with yardage calculation capabilities. When calculating quantities by the three level section method, form SD-ENG-32, Earthwork Computation Sheet, shall be used. When utilizing the excavation and embankment tables as listed above, provide adequate documentation of yardage computations. If software is used for yardage computation, include the printout with practice documentation.
   b. Where the base of the fill or top of the excavation is defined by more than three survey points.
      1. Earthwork calculations may be made by the "any level section method" which is described in Engineering Technical Note Design SD-1; or use AREAVOL; state approved computation spreadsheets developed on EXCEL software; or other applicable software. The various calculations can be made from the engineering notes. Post computation data on appropriate forms or worksheets or provide a software printout.
      2. As an alternative method, the survey readings and planned lines and grades may be plotted as cross sections on standard sized drawing sheets. Use American National Standards Institute ANSI "D" size - Full Size (22" x 34"), Half Size ANSI "B" Size (11"x 17"), or Page Size ANSI "A" size (8 ½" x 11") drawing sheets with grid markings for accurate plotting of the cross section data. The horizontal and vertical scales must be large enough for accuracy. The cross-sectioned areas may then be planimetered and data posted on appropriate forms or worksheets.
   c. Calculations for earthwork excavation in dugouts will be made by the use of dugout tables in the EFM, Supplement 1, or by using the formula for the volume of a prismatoid (as used on Job Plan 7.0).

      Dugout rehabilitation or enlargements should be surveyed by the cross-sectional method. The calculations can be based on the planimetered areas or by using the "any level section method" described in b (1) above.

      Computations will be checked by the same method as original computations. For volumes calculated with various software, the calculations themselves should be considered correct but the checker must verify that the values input into the program were correct.
2. Calculations for land leveling or shaping on leveled acreages will be made as follows:
   a. For land leveling jobs where the unit of work is based on the earthwork volume, use suitable design software or the four point method (ref.: National Engineering Handbook (NEH) 15, Irrigation, Chapter 12, Land Leveling) or computations from (CADD) software to determine the actual cubic yards of cut or fill.
   b. The "tenths method" (ref.: NEH 15, Irrigation, Chapter 12, Land Leveling) of determining balance of cuts and fills may be used for making preliminary

estimates and for balancing cuts and fills when the actual cubic yards of earthwork is not a cost or payment criteria.

C. Surveys and Measurements

In addition to the procedures described below, measurements using of Differential Global Positioning Systems (DRGS) or the use of mapping and digitizing capabilities using digital orthophotography and ArcView, ArcMap, or Customer Service Toolkit software outlined in the SD GM 450, Part 407, SD407.12, will be allowed. Please refer to the GM amendment for the specific procedures and applicability.

1. When cubic yards are the basis of measurement for contracting or program payment on earthwork, all measurements for quantity will be based on engineering surveys that use an instrument and rod for determining elevations. Typical examples of practices to which these procedures will apply are: earth dams, mains and laterals, large diversions, earthwork on irrigation systems, or waterspreading systems, etc.
2. When the unit of work or item is based on linear feet such as irrigation pipelines, ditch lining, etc., measurements will be made by a surveyors' chain, or tape, a total station, or with Survey Grade GPS equipment; except that stockwater pipelines may also be measured with a measuring wheel. When earthwork is based on linear feet, measurements may be made by a chain or tape, by a measuring wheel with a recorder, with a total station, or with Survey Grade GPS equipment.
3. When the practice is measured in acres, several methods can be used to determine quantities. For waterways, farmsteads, feedlots, or field windbreaks; the measurements should be made by a tape, chain, stadia, or measuring wheel with a recorder, total station, or with Survey Grade GPS equipment except field windbreaks may be scaled on an aerial photo when the limits of the windbreak can be identified on the photo. For contour farming, contour stripcropping, seedbed preparation, and pasture or range seedings, the acreage can be determined by the dot count procedure, planimetering aerial photos on which the boundaries have been determined, or by digital measurements using GIS software and tools.
4. Accuracy for certifications: Express rods, miles, tons, cubic yards of concrete, or rubble masonry and percentage of units to the nearest tenth. Express linear feet, pounds and cubic yards, or other materials in whole numbers. In calculating volumes of fill or excavation, compute the yardage between any given stations to the nearest tenth and arrive at a total to the nearest cubic yard.

   For earth embankments constructed using method type compaction (ref.: construction specification SD-7S), the total cubic yards of embankment will include the volume of earthwork to the design grade plus a five percent increase for settlement. For embankments constructed with overfills in excess of five percent, the volume of embankment over the five percent overfill will not be certified for payment. This five percent increase for settlement does not apply to any other practices even though the practice certification may be based on cubic yards of fill.

D. Other Supporting Data - (Forms - Construction Plans - Specifications, etc.)

1. The data sheets to be completed for structural practices are shown on the form index. Some practices require several sheets to properly record information, such as: hydraulic and hydrologic determinations, material estimates, cross sections, profiles, seeding. The more simple practices will normally require only one completed data sheet.
2. Some of the sheets require planned data to be posted when the conservation measure is planned and laid out in the field. Additional columns or lines are provided for the final

constructed elevations, dimensions, quantities, or other items which are posted by the technician when checking the final construction. The data sheets are not complete until all columns or applicable blanks are filled out as required.

3. "As Built" construction plans and specifications for structural practices are considered supporting data. Where standard specifications are used with no modifications or additions, a list of the standard specifications furnished is adequate.
4. Minimum required specifications for vegetative and management-type conservation practices should be recorded on appropriate worksheets, except specifications for noncost-shared practices or noncontract items may be recorded either on appropriate worksheets or in the conservation plan decision statement.
5. It is recommended that there will be timely inspections of the following engineering structures as they are being constructed: earth dams, agricultural waste management system facilities, drop structures, tile drains, canals and ditches, land leveling, waterways, terraces, and diversions.

   The purpose of these inspections is to determine that the structures are being constructed according to plans or drawings and specifications. The person making the inspection will record finding on form SD-ENG-19, Construction Inspection Report. The report will contain observations as to the quality of work, instructions given to the contractor or the landowner, and other pertinent information. A reminder list is on the back of these forms to assist the technician in determining items to be checked. These completed forms will be filed with the completed data sheets to show what inspections were made and to support certifications.

E. Variations Between Planned and Constructed Sections

The constructed section shall equal or exceed the planned section within tolerable limits. It should be possible to superimpose the completed cross sections and/or profiles upon the planned cross section or profile within tolerable limits and with allowance for settlement.

If the practice is constructed significantly different than designed; the practice must be reconstructed to meet the original design, or the as-constructed practice may be accepted, if, upon complete evaluation and concurrence by the person exercising engineering job approval authority for the practice installation, it is shown to be acceptable (complete documentation and recalculation of as-built quantities will also be required).

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GENERAL FORMAT

I. General

The instructions for documentation and supporting data contained herein are intended to supplement and compliment the South Dakota Technical Guide (SDTG) and the National Engineering Manual (NEM). If items contained in this manual conflict, the NEM and SDTG will govern.

II. Format

Engineering records usually consist of the following items as outlined below which were generally followed as the format of the SD Engineering Documentation and Spot Checking Manual (SDEDSCM) for the engineering practices:

A. GENERAL
   1. References

B. INVESTIGATIONS AND SURVEYS
   1. Design Investigations
   2. Design Surveys
   3. Environmental Inventory

C. DESIGN
   1. Design Data
   2. Permits

D. CONSTRUCTION PLANS AND SPECIFICATIONS
   1. Construction Plans
   2. Construction Specifications

E. LAYOUT
   1. Layout Surveys
   2. Earthwork Quantity Computations

F. COMPLIANCE CHECKING - “AS BUILT” PLANS
   1. Compliance Checking
   2. “As Built” Plans

III. Field Surveys

Field surveys are usually made for one or more of the following purposes:

A. Feasibility

Those surveys and determinations that are made at a site for purposes of determining feasibility or practicability. These surveys are usually of an investigational nature consisting of random instrument readings and normally it is not required to maintain formal notes on them unless such information is to be incorporated into subsequent surveys.

B. Design

Those surveys and determinations that are made at a site for purposes of developing a design and construction plan for the practice.

C. Layout

Those surveys and determinations that are made for the purpose of laying out parts or all of the work planned for construction and establishing quantities of the work to be completed.

D. Construction
Those surveys and determinations that are made during construction of the work for purposes of evaluating construction accomplished or ascertaining quantities of work done.

E. Compliance
Those surveys and determinations that are made at the completion of construction of the work for purposes of determining compliance with approved plans and specifications, or for the purpose of evaluating quality control activities, such as spot checking.

For practices with components that are designed to specific lines or grade, elevations shall be controlled by establishment and recording of at least one known elevation benchmark. Elevation of benchmarks for the smaller individual jobs may be either assumed or actual elevations. All benchmarks shall be clearly described as to identification and location.

IV. Field Notes

Field survey notes are one of the basic foundations of all our engineering design and construction. Instructions and sample field survey notes may be found in the EFH, Part 650, Chapter 1, Surveying, and in TR-62. These references establish basic formats for maintaining appropriate field note records.

V. Design Data Other Than Surveys

In the design and planning of many practices, it is essential to gather and compile data other than survey information. This may consist of any but is not limited to all of the following:

A. Soil mechanics information including soil profiles, soil classification, samples, and geological reports.
B. Soil survey information on limitations and treatment.
C. Hydrologic information including drainage areas, peak flood information, soil cover complexes, and hydrologic soil groups.
D. Hydraulic information including design quantities, capabilities, velocities, etc.
E. Materials information including quality and quantity.
F. A completed NRCS-CPA-52, Environmental Effects in Conservation Planning form.
G. Known cultural resource sites recorded on State Archeological Resources Management System (ARMS) Web site.
H. Review of certified wetland determinations.
I. For NPDES permits, see SD amendments.

In the more complex jobs, basic field information such as profiles, cross sections, topography, etc., are taken in the field and returned to the office for design of the job. In these cases, design factors, computations, etc., are usually compiled or determined in the office. A design folder will be used to contain all the analyses including all notes computations, drawing sketches and other data and must be recorded neatly and organized. Design narratives should be used to describe the objective, data, criteria, assumptions, procedures and decisions used in the design. Necessary information from this material is used to develop the plan drawing and standard or written specifications for the work. If the design is to be submitted to the state office for review or if the Job Class is a Class V or greater, it will require a design report as detailed in the NEM, Subpart B, Documentation, 511.11, Design folders. All such data is made a part of the official job file.

VI. Data Forms

An Engineering Forms Index is provided with a brief explanation of each form. Data forms used for specific practices will be found in the instructions for the practice.

The forms listed in the instructions are those normally used in the processing of the practice. The variability and complexity of the practice will dictate the use of the listed forms or other additional forms or data sheets not listed. All pertinent supporting data should be in the official job file or referenced to the official files at the completion of the work. South Dakota forms may be found at the following Web address: http://www.sd.nrcs.usda.gov/intranet/SouthDakotaForms.html.

VII. Tools

An Engineering Tools Index is provided with a brief explanation of each tool. The referenced tools may be downloaded from our SD NRCS Web site.

VIII. Documentation Checklist

The forms identify key information that is required documentation. However, not all practices are listed and not all the requirements may be identified.

IX. Other

Detailed instructions on factors such as frequency of cross-sections, profile stationing, slope stakes, etc., have purposely been held to a minimum because of the wide range of needs encountered in the field. Each individual is expected to exercise sound engineering judgment or secure guidance from an engineer.

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GUIDE FOR PREPARING THE ITEMS OF WORK AND PAYMENT DOCUMENT

Background

Engineering practices have numerous components that can be paid for in various ways through our conservation programs. For instance, an animal waste management system may have a waste storage pond, a sediment basin, and a diversion. A common way of designing the system is to obtain an earthwork balance where the amount of earth excavated for the waste storage pond is approximately equal to the amount of earth fill needed for the construction of the waste storage pond embankment, the sediment basin, and the diversion. The designer faces a decision in determining what portion of the earth work should be paid for as Excavation, Class S Earthfill, and Class A Earthfill.

The designer should try to determine how the practice will be constructed. The designer should envision the construction sequence and procedure. Once this is done, the designer can develop the appropriate measurement and payment items.

These instructions are meant to be a guide to categorize the various practice components and to give some consistency to how various components should be paid. However, the designer may vary from these guidelines with proper justification. Ultimately, the person exercising engineering Job Approval Authority (JAA) is responsible for the final determination of what is considered a pay item and what can be considered subsidiary to another item within NRCS program limitations.

The intent of this guidance is to provide templates for common conservation projects to be used by the designer, to modify for site-specific requirements and attach to the construction specifications. After completing the template and preconstruction conference, all parties involved should have a common understanding of the payment methods and requirements.

Recommendations

A. Payment vs. Subsidiary Items for Earthwork

The primary payment item is the earthfill. In most cases, the excavation item should be considered borrow and, therefore, subsidiary to the earthfill. A portion of the excavation should only be paid for when more excavation is required than can be used for the earthfill or the material is stockpiled or is unsuitable for use as borrow material. In this case, the excavated material is "wasted" or stockpiled in another location that should be designated on the plans or determined by the producer in consultation with the engineer.

For the purpose of consistency, payment for the earthfill item would be the governing specification. It requires placement to neat lines and grades and to a specific moisture and density (Class A) or by a specific method (Class S). Typically, this requires greater control than excavation. The excavation specification does not require a specific method of excavation and may not require the excavation to be completed to neat lines and grade. (Examples of notable exceptions are for liners in a waste storage pond or the excavation for an auxiliary spillway.)

The key question in determining if excavation should be paid for is "Can the contractor directly use the excavated material as earthfill?" If the answer is no, then the excavation should be paid for separately.

If the answer is yes, then the excavation should be considered as borrow material and be subsidiary to the earthfill.

B. Class A or Class S Earthfill Specification for Embankments

It is recommended that only the clay liner portion of the waste storage pond be built according to the Class A Earthfill specification. The Class S Earthfill specification should be used for the embankment portion of the holding pond. This will make the cost of the project less expensive than if the entire embankment is built according to the Class A specification. The liner will still provide for the containment of all the runoff. This would especially apply when offsite borrow for a clay liner is required. This will allow for permeability tests to be conducted at the end of construction and eliminate the need for extensive moisture and density testing.

It is recommended that all embankments (waste storage ponds, ponds, grade stabilization structures, or wetland structures) less than 25 feet high and located on a stable foundation be built according to the Class S Earthfill Specification. Embankments greater than 25 feet in height should be considered on a case-by-case basis.

C. Liner and Core Trench Excavations

The liner and core trench excavation should be paid for as both excavation and earthfill. Often times, the excavation is unsuitable for direct use as earthfill without stockpiling and further processing of the material, such as allowing it to dry or adding and incorporating moisture and then placing it in another location in the embankment. In these situations, the material cannot be directly used as earthfill and is either handled twice or new material must be brought to the site. One exception to this is when the liner is built on fill material. In this case, there is no excavation and, therefore, no excavation quantity should be paid.

D. Borrow Quantities

It is recognized that excavated material will generally be less dense than compacted earthfill. Therefore, when determining how much excavation is required to construct the earthfill components, a shrinkage factor must be used. This factor is a ratio of the additional amount of excavated material that must be hauled to make an equivalent amount of earthfill. For NRCS projects, a shrinkage factor of 130 percent **will be** used unless more site specific information is available.

E. Topsoil

Topsoiling, as identified in our national construction specification, “consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings.” There are two different methods for spreading topsoil that will be discussed below:

- Method 1: Consists of spreading topsoil over a designated area without incorporating it into the fill. No compactive effort is required.

- Method 2: Consists of placing topsoil concurrently with the earthfill and bonded with the compacted fill using compactive equipment.

When spreading topsoil for borrow areas (on and offsite), auxiliary spillways or other excavated areas Method 1 should apply. One payment item, topsoiling, will be included for the entire stripping, salvaging, stockpiling, and spreading of topsoil. No extra payment will be made for offsite topsoil.

The volume will be computed by the square yard (sq. yd.) of area to be topsoiled. The rate ($0.60 per sq. yd. or $3.60 per cubic yard (cu. yd.). for 6 inches of topsoil, contract year (CY) 2006 for topsoiling includes the handling of the material more than once.

When placing topsoil as part of earthfill for embankments, Method 2 will apply. Compensation will be made by measuring the area of the footprint of the earthfill (including the inside area of waste storage ponds and other required excavated areas) and determining the volume of stripping based upon six inches of depth. This volume will be paid by the cu. yd. as excavation. Topsoil placement in earthen embankments should be incorporated into the exposed surfaces of the fill during the construction operation and be included in the earthfill quantity. No extra payment will be made for topsoil; rather, the payment for placement will be made as part of the earthfill embankment quantity. The earthfill quantity will include the volume form the stripped surface to the neat lines of the constructed embankment. This payment for excavation and earthfill will compensate the contractor for not being able to use the material directly.

It should be recognized that it may not always be feasible to place topsoil concurrently when constructing an embankment, especially on small embankments where equipment limitations exist. In those situations, the designer may allow placement according to Method 1. However, the placement will still be considered earthfill and the payment will be part of the earthfill quantity. In these instances, the construction operation should include efforts to bond the topsoil to the embankment through scarification, disking, and/or rolling.

Several examples are listed below to help illustrate the various situations.

EXAMPLE 1. Waste storage pond with greater quantity of excavated material than necessary for fill.

Determine pay and subsidiary items for the following animal waste management facility consisting of the following:

Component	**Excavation CY**	**Earthfill CY**	**Required Borrow Excavation CY**
Waste storage pond (to constructed neat lines)	50,000	20,000 Class S (Includes 5 percent Settlement)	20,000 x 1.30 = 26,000
Stripping Volume	2,500 (within construction area)	1,000 Class S (Under Embankment)	1,000 x 1.3 = 1,300
Clay liner	4,500	4,500 Class A	4,500 x 1.30 = 5,850
Clean water diversion	1,500	1,500 Class S	1,500 x 1.30 = 1,950
Sediment basin	1,000	12,000 Class S (Includes 5 percent Settlement)	12,000 x 1.30 = 15,600
Total	**59,500**	**39,000**	**50,700**

Excavation

The total amount of excavation to be paid is the difference between the total excavation quantity and the quantity required to build the in-place, compacted earthfill. The excavation quantity is measured

from the stripped surface. 59,500 CY – 50,700 CY = 8,800 CY of excavation that has to be "wasted." This includes the 2,500 CY of stripping excavation and 4,500 CY of excavation required for the clay liner.

Pay Item

Excavation, Stripping 2,500 CY @ $1.20/CY	$3,000.00
Excavation, Clay Liner 4,500 CY @ $1.20/CY	$5,400.00
Excavation, Waste Material, 1,800 CY @ $1.20/CY	$2,160.00

Subsidiary to Earthfill

Borrow excavation for earthfill.
Top soil incorporated into the earthfill.

Earthfill

Pay Item:

Class A Earthfill, Clay Liner,	4,500 CY @ $2.08/CY	$9,360.00
Class S Earthfill, Embankment,	34,500 CY @ $1.40/CY	$48,300.00
	39,000 CY Total Compacted Earthfill	

Class S includes Embankment, 20,000 CY; Stripping, 1,000 CY; Clean Water Diversion 1,500 CY; and Sediment Basin, 12,000 CY.

EXAMPLE 2. Waste storage pond with greater quantity of earthfill than available borrow.

Determine pay and subsidiary items for the following animal waste management facility consisting of the following:

Component	**Excavation CY**	**Earthfill CY**	**Required Borrow Excavation CY**
Waste storage pond (to constructed neat lines)	25,000	20,000 Class S (Includes 5 percent Settlement)	20,000 x 1.30 = 26,000
Stripping Volume	2,500 (within construction area)	1,000 Class S (Under Embankment)	1,000 x 1.3 = 1,300
Clay liner	4,500	4,500 Class A	4,500 x 1.30 = 5, 850
Clean water diversion	1,500	1,500 Class S	1,500 x 1.30 = 1, 950
Sediment basin	1,000	12,000 Class S (Includes 5 percent Settlement)	12,000 x 1.30 = 15, 600
Total	**34,500**	**39,000**	**50,700**

The earthfill items will be the same as in Example 1.

Earthfill

Pay Item:
Class A Earthfill, 4,500 CY @ $2.08/CY $ 9,360.00
Class S Earthfill, 34,500 CY @ $1.40/CY $48,300.00
39,000 CY Total Compacted Earthfill

Class S includes Embankment, 20,000 CY; Stripping, 1,000 CY; Clean Water Diversion 1,500 CY; and Sediment Basin, 12,000 CY.

Excavation

In this case, there is more earthfill than excavation available for borrow. 34,500 CY– 50,700 CY = -16,200 CY of borrow would need to be provided. This borrow might need to be broken into two different components. If there is not suitable material available for the clay liner within 2,000 feet of the site, then a pay item for obtaining borrow more than 2,000 feet away is available. If this borrow source is available within 2,000 feet of the project, there would not be an additional pay item for providing borrow. Assume clay material is not available within 2,000 feet.

Pay Item:
Excavation of Clay Liner 4,500 CY@ $1.20/CY $5,400.00
Excavation of Stripping Volume 2,500 CY@ $1.20/CY $3,000.00

Pay Item:
Offsite Borrow for Clay Liner 5,850 CY @ $5.00/CY $29,250.00

The remaining 10,350 CY of borrow would not be a pay item. The reason is that there should be material closer to the site that might not be suitable for a clay liner but could still be used for Class S Earthfill.

Topsoil

A payment item should be used to compensate for the work involved in salvaging and spreading topsoil on an offsite borrow area. The borrow area should be top soiled to provide for reestablishment of vegetative cover. The measured disturbed area is 1.1 acres. Convert 1.1 acres to sq.yds. = 5,324 sq.yds.

Topsoil of Borrow Area 5,324 sq.yds. @ $0.60/SQ YD $3,194.40

Subsidiary to Earthfill
Borrow excavation for earthfill.
Top soil incorporated into the earthfill.

EXAMPLE 3.

Determine pay and subsidiary items for the following pond consisting of the following:

Component	Excavation CY	Earthfill CY (Class S)	Required Borrow Excavation CY
Embankment earthfill, Class S		20,000 (includes 5 percent settlement)	20,000 x 1.30 = 26,000
Core trench	1,500	1,500	1,500 x 1.30 = 1,950
Stripping	550	550	550 x 1.30 = 715
Top Soil Auxiliary Spillway	4,500 sq. yds.		
Auxiliary spillway (below stripping)	15,000	1,000 Aux. Spillway Dikes (includes 5 percent settlement)	1,000 x 1.30 = 1,300
Total	**17,050**	**23,050**	**29,965**

The earthfill items will be the total of the embankment, core trench, stripping, and auxiliary spillway dikes.

Earthfill

Pay Item:
Class S Earthfill, 23,050 CY @ $1.40/CY $32,270.00

Excavation

In this case, core trench material is generally not suitable to be used as earthfill without it being stockpiled and processed. The auxiliary spillway material, however, can be loaded directly and used as earthfill. The stripping material will be used as topsoil within the auxiliary spillway and earth embankment. Compensation will be made as a separate topsoil item for the placement in the auxiliary spillway. The stripping for the embankment will be paid as excavation. Since the top soil will be incorporated into the earthfill and be placed as part of the embankment, it will be paid as earthfill.

Pay Item:
Core Trench Excavation, 1,500 CY @ $1.20/CY $1,800.00
Stripping Excavation, 550 CY @ $1.20/CY $660.00

Topsoil

Pay Item:
Top soiling on Auxiliary Spillway 4,500 sq. yds. @ $0.60/sq.yds $2,700.00

Subsidiary to Earthfill
Auxiliary spillway excavation.

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ENGINEERING FORMS INDEX

Forms: The following engineering forms are listed on the SD NRCS SharePoint site located at https://nrcs.sc.egov.usda.gov/central/sd/default.aspx.

FORM	TITLE	USE
SD-ENG-1 (1/02)	Terrace	Use for terrace design data, construction check and certification.
SD-ENG-2 (1/02)	Certification Statement (Practice Component)	For certification of compliance for components of a practice which cannot be directly measured or checked after construction, such as core trench, etc. Form to be completed with designed dimensions, cuts, etc. entered by NRCS before presenting to owner or contractor, who enters "As Built" data before signing. (REF.: GM, 480, Part 407.11)
SD-ENG-5 (1/02)	Hydraulic Elements of Pipeline Design	Hydraulic calculations for pipeline design (pumped systems).
SD-ENG-6 (1/02)	Certification Statements Regarding Pond Water Permits	Used to inform operators of their responsibilities when installing ponds.
SD-ENG-7 (1/02)	Surface Irrigation Design Sheet	Design data for surface irrigation systems.
SD-ENG-8 (10/09)	Engineering Job Approval Authority	Form to maintain an employee's engineering job approval authority
SD-ENG-9 (10/11)	Sprinkler Irrigation Systems – Irrigation Water Management Plan	Inventory and irrigation water management plan information.
SD-ENG-9A (1/02)	Sprinkler Irrigation Design	Sprinkler irrigation design computations for set-type sprinkler systems.
SD-ENG-9B (3/04)	Irrigation System Inventory (Sprinkler)	Basic data sheet for sprinkler irrigation system design
SD-ENG-9C (12/05)	Documentation of Applied Irrigation Water Management	Producer certification sheet indicating they have completed irrigation water management.
SD-ENG-11 (4/12)	Participant Responsibilities	Used to inform operators of their responsibilities when installing conservation practices for

		permitting, easements, cultural resources, inspections, and O&M.
SD-ENG-13 (7/02)	Drilling Log Documentation	Worksheet for recording detailed logs of earth borings.
SD-ENG-14 (4/12)	Ditch Plug Job Plan	Construction plans and checkout information for ditch plugs.
SD-ENG-15 (1/02)	Permit for Site Assessment Surveys	Permit for investigation surveys where such permit is not covered by other documents, such as cooperative agreements, easements, etc.
SD-ENG-19 (4/12)	Construction Inspection Report (Survey Book)	Use for any inspection of work during construction to record pertinent items such as instructions given, progress of work, conditions of work, discussions with contractor, and/or owner regarding conduct of the job.
SD-ENG-19A (7/02)	Construction Inspection Report	Use for any inspection of work during construction to record pertinent items such as instructions given, progress of work, conditions of work, discussions with contractor, and/or owner regarding conduct of the job.
SD-ENG-24 (1/02)	Determination of Water Necessary to Refill Soil to Capacity	Worksheet for computation of total irrigation water required.
SD-ENG-27 (1/02)	Computation for Water Surface Profile	Worksheet for computation of water surface profiles.
SD-ENG-29 (1/02)	Hydrologic Data Sheet	General worksheet for computation of peak flows, storm volume, and annual yield. Reverse is worksheet for hydraulic computations for any spillway, ditch, diversion, waterway, principal spillway, or culvert.
SD-ENG-32 (10/11)	Earthwork Computation Sheet (3 Level Section)	Computation of cross section area of any cut or fill section described by three points.
SD-ENG-43 (7/03)	Dugout Volume Calculation	Computation for excavation of a standard type dugout.
SD-ENG-44 (9/00)	Cleanout of Existing Excavation Pond (Dugout)	Requirements and certification for cleanout of a dugout.

SD-ENG-49 (1/02)	Concrete Batch Certificate	Data to be furnished by ready mix plant for concrete mix supplied to job site.
SD-ENG-50 (1/02)	Well Plugging and Decommissioning	Instructions and specifications for plugging wells and certifying to DENR.
SD-ENG-51 (7/04)	Well	Well completion report to be filled out by driller and well certification by NRCS.
SD-ENG-52 (1/02)	Excavated Pond (Dugout) Installation and Check Data	Excavated pond layout by contractors and hand level construction check.
SD-ENG-53 (3/12)	Cathodic Protection data Form	Monitoring adequacy of cathodic protection for steel pipe and structures.
SD-ENG-55 (10/05)	Solar Pump Specifications	Specifications and certification for solar pumps.
SD-ENG-57 (10/09)	Documentation for Hazard Classification	Calculation of the hazard classification for a dam.
SD-ENG-58 (10/11)	Producer Agreement regarding the South Dakota DENR General Water Pollution Control Permit for Concentrated Animal Feeding Operations	Producer certification of items included within the design that may not be able to receive a CAFO permit from SD DENR.
SD-ENG-59 (10/11)	Roofed Animal Production Facilities Certification	Certification of the design and construction of a roofed structure for animal waste that is designed and certified by a non-NRCS engineer.
SD-ENG-60 (10/11)	Manure Storage Structural Certification	Certification of the design and construction of a part of a manure storage structure that has been designed and certified by a non-NRCS engineer.

SOUTH DAKOTA ENGINEERING

DOCUMENTATION AND SPOT CHECKING MANUAL

ENGINEERING TOOLS INDEX

The following engineering tools are listed on the SD NRCS Engineering Tools and Software site located at http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html:

TOOL	USE
Animal Waste Storage Facility Design	Used for the design of Type 1, Type 2, and evaporation ponds for animal waste facilities.
SD Vegetative Treatment Area Design Worksheet	Used to determine the minimum required size of an animal waste vegetative treatment area.
SD NRCS Bedded Pack Barn Design Worksheet	Used for the design of bedded pack barns for animal housing and associated solid manure stacking facilities.
Grassed Waterway Design Software	Tool to design grassed waterways, create specifications, develop plans, and associated documentation.
Any Level Earthwork Quantity Calculator	Calculates end-area earthwork quantities for various types of embankments or excavations after the user enters survey information.
Class I Pipeline Design and Job Forms	Tool to design pipelines and tanks, create specifications, develop plans, and associated documentation for Job Class 1 pipelines.
Class II Pipeline Design and Job Forms	Tool to design grassed waterways, create specifications, develop plans, and associated documentation.
Cathodic Protection Calculations	Used to determine the anode and current requirements for a cathodic protection system.
Drop Inlet Hydraulics Spreadsheet	Calculates flow capacity of a drop inlet pipe structure consisting of a full circular riser and a circular conduit.
Hood Inlet Hydraulics Spreadsheet	Calculates flow capacity of a hood inlet and a circular conduit.
Simple Dam Break DOS Program	Program used to complete a dam breach model to determine flood depths and peak flows.

The following engineering tools are listed on the SD NRCS SharePoint site located at https://nrcs.sc.egov.usda.gov/central/sd/ENG/Shared%20Documents/Forms/AllItems.aspx

TOOL	USE
Cost Estimate Worksheet	Used to complete cost estimate for engineering practices. The tool includes prices for different components.

SOUTH DAKOTA ENGINEERING

DOCUMENTATION AND SPOT CHECKING MANUAL

ENGINEERING PRACTICE SECTION

1. Animal Waste

Practice	Practice Code
Combined All Practices	
Air Filtration and Scrubbing	371
Anaerobic Digester	366
Animal Mortality Facility	316
Closure of Waste Impoundments	360
Composting Facility	317
Constructed Wetland	656
Heavy Use Area Protection	561
Roof Runoff Structure	558
Roofs and Covers	367
Solid/Liquid Waste Separation Facility	632
Stormwater Runoff Control	570
Vegetated Treatment Area	635
Waste Storage Facility	313
Waste Transfer	634
Waste Treatment	629
Waste Treatment Lagoon	359
Waste Utilization	633

2. Diversion

Practice	Practice Code
Diversion	362

3. Drainage

Practice	Practice Code
Combined All Practices	
Drainage Water Management	554
Subsurface Drain	606
Surface Drain, Field Ditch	607
Surface Drain, Main or Lateral	608

4. Earth Dam

Practice	Practice Code
Combined All Practices	
Dam	402
Dam, Diversion	348
Dike	356
Grade Stabilization Structure	410
Irrigation Reservoir	436
Pond	378
Structure for Water Control	587
Water and Sediment Control Basin	638

5. Grassed Waterway

Practice	Practice Code
Combined All Practices	
Grassed Waterway	412
Open Channel	582

6. Irrigation

Practice	Practice Code
Dry Hydrant	432
Combined – 320,428A,388	
Irrigation Canal or Lateral	320
Irrigation Ditch Lining	428A
Irrigation Field Ditch	388
Irrigation Land Leveling	464
Combined – 430, 442, 443, 441, 447	
Irrigation Pipeline	430
Irrigation System Sprinkler	442
Irrigation System Surface and Subsurface	443
Irrigation System, Microirrigation	441
Irrigation System, Tailwater Recovery	447
Irrigation Water Management	449
Lined Waterway or Outlet	468
Pumping Plant	533
Waterspreading	640

7. Other

Practice	Practice Code
Combined – 560, 575	
Access Road	560
Animal Trails and Walkways	575
Combined – 326, 500	
Clearing and Snagging	326
Obstruction Removal	500
Spoil Spreading	572

8. Livestock Pipeline and Watering Facility

Practice	Practice Code
Combined – 516, 614	
Livestock Pipeline	516
Watering Facility	614

9. Pond Lining

Practice	Practice Code
Combined – 521C, 521-D, 521A, 521B	
Pond Sealing or Lining-Bentonite Sealant	521C
Pond Sealing or Lining-Compacted Clay Treatment	521-D
Pond Sealing or Lining-Membrane Lining	521A
Pond Sealing or Lining-Soil Dispersant Treatment	521B

10. Spring Development

Practice	Practice Code
Spring Development	574

11. Streambank and Shoreline Protection

Practice	Practice Code
Combined – 584, 578, 580	
Channel Bed Stabilization	584
Stream Crossing	578
Streambank and Shoreline Protection	580

12. Terrace

Practice	Practice Code
Terrace	600
Underground Outlet	620

13. Water Well

Practice	Practice Code
Water Well	642
Water Well Decommissioning	351

14. Wetlands

Practice	Practice Code
Combined – 658, 659, 657	
Wetland Creation	658
Wetland Enhancement	659
Wetland Restoration	657

Note: All current engineering practices are listed in the tables above. If a new practice standard is released it will not be listed. In those cases, please use the documentation requirements associated with a similar type practice that is listed.

Sorted by Practice

Practice	Code	SDEDSCM Section
Access Road	560	Other
Air Filtration and Scrubbing	371	Animal Waste
Anaerobic Digester	366	Animal Waste
Animal Mortality Facility	316	Animal Waste
Animal Trails and Walkways	575	Other
Channel Bed Stabilization	584	Streambank and Shoreline Protection
Clearing and Snagging	326	Other
Closure of Waste Impoundments	360	Animal Waste
Composting Facility	317	Animal Waste
Constructed Wetland	656	Animal Waste
Dam	402	Earth Dam
Dam, Diversion	348	Earth Dam
Dike	356	Earth Dam
Diversion	362	Diversion
Drainage Water Management	554	Drainage
Dry Hydrant	432	Irrigation
Grade Stabilization Structure	410	Earth Dam
Grassed Waterway	412	Grassed Waterway
Heavy Use Area Protection	561	Animal Waste
Irrigation Canal or Lateral	320	Irrigation
Irrigation Ditch Lining	428A	Irrigation
Irrigation Field Ditch	388	Irrigation
Irrigation Land Leveling	464	Irrigation
Irrigation Pipeline	430	Irrigation
Irrigation Reservoir	436	Earth Dam
Irrigation System Sprinkler	442	Irrigation
Irrigation System Surface and Subsurface	443	Irrigation
Irrigation System, Microirrigation	441	Irrigation
Irrigation System, Tailwater Recovery	447	Irrigation
Irrigation Water Management	449	Irrigation
Lined Waterway or Outlet	468	Irrigation
Livestock Pipeline	516	Livestock Pipeline and Watering Facility
Obstruction Removal	500	Other
Open Channel	582	Grassed Waterway
Pond	378	Earth Dam
Pond Sealing or Lining-Bentonite Sealant	521C	Pond Lining
Pond Sealing or Lining-Compacted Clay Treatment	521-D	Pond Lining
Pond Sealing or Lining-Membrane Lining	521A	Pond Lining
Pond Sealing or Lining-Soil Dispersant Treatment	521B	Pond Lining
Pumping Plant	533	Irrigation
Roof Runoff Structure	558	Animal Waste
Roofs and Covers	367	Animal Waste

Solid/Liquid Waste Separation Facility	632	Animal Waste
Spoil Spreading	572	Other
Spring Development	574	Spring Development
Stormwater Runoff Control	570	Animal Waste
Stream Crossing	578	Streambank and Shoreline Protection
Streambank and Shoreline Protection	580	Streambank and Shoreline Protection
Structure for Water Control	587	Earth Dam
Subsurface Drain	606	Drainage
Surface Drain, Field Ditch	607	Drainage
Surface Drain, Main or Lateral	608	Drainage
Terrace	600	Terrace
Underground Outlet	620	Terrace
Vegetated Treatment Area	635	Animal Waste
Waste Storage Facility	313	Animal Waste
Waste Transfer	634	Animal Waste
Waste Treatment	629	Animal Waste
Waste Treatment Lagoon	359	Animal Waste
Waste Utilization	633	Animal Waste
Water and Sediment Control Basin	638	Earth Dam
Water Well	642	Water Well
Water Well Decommissioning	351	Water Well
Watering Facility	614	Livestock Pipeline and Watering Facility
Waterspreading	640	Irrigation
Wetland Creation	658	Wetlands
Wetland Enhancement	659	Wetlands
Wetland Restoration	657	Wetlands

Sorted by Practice Code

Practice	Code	SDEDSCM Section
Waste Storage Facility	313	Animal Waste
Animal Mortality Facility	316	Animal Waste
Composting Facility	317	Animal Waste
Irrigation Canal or Lateral	320	Irrigation
Clearing and Snagging	326	Other
Dam, Diversion	348	Earth Dam
Water Well Decommissioning	351	Water Well
Dike	356	Earth Dam
Waste Treatment Lagoon	359	Animal Waste
Closure of Waste Impoundments	360	Animal Waste
Diversion	362	Diversion
Anaerobic Digester	366	Animal Waste
Roofs and Covers	367	Animal Waste
Air Filtration and Scrubbing	371	Animal Waste
Pond	378	Earth Dam
Irrigation Field Ditch	388	Irrigation
Dam	402	Earth Dam
Grade Stabilization Structure	410	Earth Dam
Grassed Waterway	412	Grassed Waterway
Irrigation Pipeline	430	Irrigation
Dry Hydrant	432	Irrigation
Irrigation Reservoir	436	Earth Dam
Irrigation System, Microirrigation	441	Irrigation
Irrigation System Sprinkler	442	Irrigation
Irrigation System Surface and Subsurface	443	Irrigation
Irrigation System, Tailwater Recovery	447	Irrigation
Irrigation Water Management	449	Irrigation
Irrigation Land Leveling	464	Irrigation
Lined Waterway or Outlet	468	Irrigation
Obstruction Removal	500	Other
Livestock Pipeline	516	Livestock Pipeline and Watering Facility
Pumping Plant	533	Irrigation
Drainage Water Management	554	Drainage
Roof Runoff Structure	558	Animal Waste
Access Road	560	Other
Heavy Use Area Protection	561	Animal Waste
Stormwater Runoff Control	570	Animal Waste
Spoil Spreading	572	Other
Spring Development	574	Spring Development
Animal Trails and Walkways	575	Other
Stream Crossing	578	Streambank and Shoreline Protection
Streambank and Shoreline Protection	580	Streambank and Shoreline Protection

Open Channel	582	Grassed Waterway
Channel Bed Stabilization	584	Streambank and Shoreline Protection
Structure for Water Control	587	Earth Dam
Terrace	600	Terrace
Subsurface Drain	606	Drainage
Surface Drain, Field Ditch	607	Drainage
Surface Drain, Main or Lateral	608	Drainage
Watering Facility	614	Livestock Pipeline and Watering Facility
Underground Outlet	620	Terrace
Waste Treatment	629	Animal Waste
Solid/Liquid Waste Separation Facility	632	Animal Waste
Waste Utilization	633	Animal Waste
Waste Transfer	634	Animal Waste
Vegetated Treatment Area	635	Animal Waste
Water and Sediment Control Basin	638	Earth Dam
Waterspreading	640	Irrigation
Water Well	642	Water Well
Constructed Wetland	656	Animal Waste
Wetland Restoration	657	Wetlands
Wetland Creation	658	Wetlands
Wetland Enhancement	659	Wetlands
Irrigation Ditch Lining	428A	Irrigation
Pond Sealing or Lining-Membrane Lining	521A	Pond Lining
Pond Sealing or Lining-Soil Dispersant Treatment	521B	Pond Lining
Pond Sealing or Lining-Bentonite Sealant	521C	Pond Lining
Pond Sealing or Lining-Compacted Clay Treatment	521-D	Pond Lining

ACCESS ROADS (560)
ANIMAL TRAILS AND WALKWAYS (575)

I. GENERAL

A. References
   1. EFH, Part 650.
   2. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Soils map.
   2. Soil borings – record on form SD-ENG-45 or SD-ENG-10 as needed.
   3. Conservation plan for unit.
   4. Location of underground utilities.
   5. Location considering purpose, erosion, sedimentation, flooding etc.

B. Design Surveys
   1. Topographic map of area as needed.
      a. Drainage area.
      b. Topographic detail for design purposes (where needed).
   2. Culverts, stream crossing areas, etc.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
   1. Cultural resources inventory – use form SD-SSC-1.
   2. Wetland effects (if applicable).
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
      b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
   1. For access roads, please consider the type of vehicle or equipment, speed, loads, soil, climate, and other conditions where which vehicles and equipment are expected to operate.
      For trails and walkways, please consider the type of animals, vehicle or equipment, soil, climate, and other conditions where animals may be impacted and equipment are expected to operate.
   2. Hydraulic/Hydrology Data – evaluate needed crossings.
   3. Structural design computations, depending on structural needs.
   4. Quantity and cost estimates (SD-ENG 12).

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans – American National Standards Institute ANSSI “D” size – full size (22” x 34”), half size ANSI “B” size (11” x 17”), or page size ANSI A (81/2” x 11”) drawing sheets.

1. Overall plan view showing access road, gradient, and pertinent elevations.
2. Location map with legal description.
3. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
4. Quantities estimates – place on plans.
5. Job approval – see NEM, Part 501.
6. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: SD Specification Guide.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures.
4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – AS-BUILT PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).

1. Profiles.
2. Measured lengths.
3. Elevations.
4. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
5. Material certification statement (ref.: NEM, Part 512, Subpart C).
6. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As-built" Plans (Ref: NEM, SD512.51 and SD512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.

2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

ANIMAL WASTE

Air Filtration and Scrubbing (371)
Anaerobic Digester (366)
Animal Mortality Facility (316)
Closure of Waste Impoundments (360)
Composting Facility (317)
Constructed Wetland (656)
Heavy Use Area Protection (561)
Roof Runoff Structure (558)
Solid/Liquid Waste Separation Facility (632)
Stormwater Runoff Control (570)
Vegetated Treatment Area (635)
Waste Storage Facility (313)
Waste Transfer (634)
Waste Treatment (629)
Waste Treatment Lagoon (359)
Waste Utilization (633)

I. GENERAL

Animal waste management systems include different practice components required for the complete management of waste. Documentation requirements will be as outlined below in addition to the documentation requirements of the practice components used in the system.

A. References

1. Conservation Practice Standards (CPS) located within the SDTG, Section IV.
2. South Dakota Livestock Waste Management Manual (Cooperative Extension Service).
3. NEH, Part 651 – Agricultural Waste Management Field Handbook.
4. NEH, Part 650 – Engineering Field Handbook.
5. South Dakota Engineering Technical Notes.
6. SD DENR General Water Pollution Control Permit for Concentrated Animal Feeding Operations.
7. Midwest Plan Service, Livestock Waste Facilities Handbook (MWPS-18).
8. Design Technical Note No. SD-2009-2 – Vegetated Treatment Systems Guide - http://efotg.sc.egov.usda.gov/references/public/SD/Design_Technical_Note_SD 2009-2.pdf.
9. Design Technical Note No. SD-2011-1 – Beef and Dairy Bedded Pack Barn Planning and Design – ftp://ftp-fc.sc.egov.usda.gov/SD/www/Technical/Engineering/ Design_Technical_Note_SD2011-1.pdf.
10. Design spreadsheets for holding/evaporation ponds, vegetated treatment areas, and bedded pack barns - http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html.
11. NEH, Part 629 – Air Quality.
12. NEH, Part 631 – Geology.
13. NEH, Part 637 – Chapter 2 – Composting.
14. NEH, Part 637 – Chapter3 – Constructed Wetlands.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations (if applicable)
   1. Soil borings – record on form SD-ENG-13 or equivalent.
      a. Ground surface elevation of each hole.
      b. Depth to ground water and seasonal high water table.
      c. Description of each soil material (silty sand, lean clay, etc.)
      d. Unified soil classification of each material (SM, CL, etc.)
      e. Munsell soil color name (light brown, olive grey, grey, etc.)
      f. Estimate of soil permeability of underlying materials (permeable, low permeability, etc.)
      g. Whether the materials are oxidized or unoxidized.
   2. Inventory of system and proposed plans.
   3. Location of underground utilities.

B. Design Surveys
   1. Topographic surveys – of sufficient extent to cover the area of anticipated development (if applicable).
   2. Profiles - along centerline of proposed pipelines, ditches, diversions, etc., if outside limits of topographic map.

C. Environmental Inventory
   1. NEPA resources inventory – document inventory on form NRCS-CPA-52.
   2. Cultural resources inventory – use form SD-SSC-1.
   3. Wetland effects (if applicable).
      a. Use HGM model to determine effects of structure. If effects are minimal, then a minimal effect agreement (MEA) must be signed by owner.

III. DESIGN

A. Design Data
   1. Hydrologic determinations – documentation as applicable. This would include printouts from EFH2 or TR-55 computer programs or software/spreadsheets used for designs.
   2. Hydraulic determinations – required to determine capacities, sizes, and proportion of facilities such as pipelines, diversions, etc., forms SD-ENG-29 or computer software/spreadsheet printouts may be used.
   3. Flood routing data from IOWA PONDS, SITES computer programs, or equivalent used to evaluate pipe sizes for sediment basins.
   4. Manure production/volume calculations. Use hand calculations or design spreadsheets for storage computation and documentation.
   5. Structural design calculations.
   6. Construction material estimates – material volume computations – includes estimates of earthwork, pipe, concrete, rock, vegetative components, geotextile and erosion control fabrics, or other appurtenances, etc.
   7. Other design data as needed.

B. Permits and approvals (if applicable)
   1. 404 Permit – document if individual permit obtained, nationwide permit applies, or if practice is exempt.
   2. DENR approval – General Water Pollution Control Permit for Concentrated Feeding Operations.
   3. Local ordinance approval.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Items are in accordance with planned decisions and specifications are sufficient to inform owner and contractor of construction requirements within the practice standards.

A. Construction Plans – Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. When job plans are not used or additional drawings are necessary, use appropriate American National Standards Institute ANSI"D" size – Full Size (22" x 34"), Half Size ANSI "B" Size (11" x 17"), or Page Size ANSI "A" size (81/2" x 11") plan sheet.

1. Overall plan view – of sufficient detail to show all structural alignment, sizes, stationing, elevations, reference points, cultural features, and other details of the facility so they can be located and laid out in the field. These may be superimposed on site topography.
2. Profiles – show intended grades, elevations, stationing, pipes, and similar structures. The profiles need to be in sufficient detail for construction layout and construction purposes. May be superimposed on original ground surface or described on overall plan view as needed for clarity.
3. Location or vicinity map – location map with legal description.
4. Cross section – as needed to show all pertinent details such as side slopes, berms, bottom widths, and elevation. May be plotted or described on overall plan view as needed for clarity.
5. Structural details – includes dimensional plan views, sectional views to clearly show all needed details for construction. Reinforced concrete requires separate sectional and detailing views on all but simple projects.
6. Table of quantities.
7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. If excavation is taking place, construction plans shall include the following statement: **"According to South Dakota State Law, no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval authority (JAA) – (ref.: NEM, Part 501).
9. When plans are delivered to the cooperator, use form SD-ENG-11 to inform cooperators and certify their understanding of the participant responsibilities.

B. Construction Specifications

1. Use SD Construction and Material Specifications, or equivalent, for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed within JAA limitations.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys – record in field notebook or other survey notes
   1. Centerline alignment and reference stakes.
   2. Grade and slope stakes.
   3. All structural location alignment and reference stakes.

B. Earthwork Quantity Computations
   Use standard forms or engineering software or spreadsheets to calculate where possible. Final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS BUILT" PLANS – record on field notes or on plans.

A. Compliance checking
   1. Profiles and cross sections.
   2. Measured length of lines by sizes, kinds, and classes of pipe.
   3. Materials certification statement (ref.: NEM, Part 512, Subpart C).
   4. Number, type, location of appurtenances (inlet structures, pipe supports, valves, stand pipes, etc.)
   5. Construction inspection reports – form SD-ENG-19 (ref.: NEM, SD 512.41).
   6. Practice component certification statement – as needed – form SD-ENG-2.
   7. Results of required testing (concrete, pressure, soil proctor, compacted soil density, soil moisture, soil permeability, etc.)
   8. Statement of compliance – state that construction is complete according to plans and specifications and meets the criteria of the applicable practice standards. This should be dated and signed by the person with proper JAA.
   9. Certification of compliance by design engineer for applicable permits (if applicable).

B. "As Built" Plans – (ref.: NEM, Parts 512.51 and 512.52).
   "As Built" plans are a record of constructed facilities. Determination of the need for "As Built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by someone with appropriate JAA. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

CLEARING AND SNAGGING (326)
OBSTRUCTION REMOVAL (500)

I. GENERAL

A. References
1. EFH, Part 650.
2. SDTG, Section IV.
3. EFH, Part 650, Chapters 2 and 3.
4. Web Soil Survey

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Location of utilities.
2. Type and extent of obstructions to be removed.
3. Soil map/drilling to identify disposal areas.

B. Design Surveys
1. Topographic map of area as needed.
   a. Drainage area.
   b. Topographic detail for design purposes (where needed).

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data
1. Debris type, impacts to fish and wildlife, anticipated erosion
2. Hydraulic/Hydrology Data – before and after channel capacity
3. Quantity and cost estimates (SD-ENG 12).

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans – American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.
1. Overall plan view.
2. Location map with legal description.
3. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
4. Quantities estimates – place on plans.

5. Job approval – see NEM, Part 501.
6. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: SD Specification Guide.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys (use field notebook)

1. Identify snags, drifts, or other obstructions to be removed from the channel or drainageway.
2. Quantities – final quantities are either based on obstructions removed or volume of material removed or both.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).

1. Extent.
2. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
3. Material certification statement (ref.: NEM, Part 512, Subpart C).
4. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As-built" Plans (Ref: NEM, SD512.51 and SD512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

DIVERSION

Diversion (362)

I. GENERAL

A. References
1. NEH, Part 650, Chapter 3 – Hydraulics and Chapter 9 – Diversions.
2. SDTG – Diversion Conservation Practice Standard (362).
3. EFH2, Computer Software, TR-55, Ohio.
4. NRCS-TP-61, Handbook of Channel Design.
5. SD Engineering Technical Notes.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings – where needed to determine classification of soils for allowable design velocities and construction materials. Use form SD-ENG-13, Drilling Log Documentation, or equivalent.
2. Location of underground utilities.

B. Design Surveys[1/]
Record in standard field notebook or form SCS-ENG-28 and -29.
1. Description, location, and elevation of benchmarks.
2. Drawing of diversion location, direction of flow, etc.
3. Average land slope along proposed centerline. For significant land slope changes, divide diversion into reaches.
4. Profile along centerline of ditch.
5. Data on bridges and culverts which affect diversion design.

C. Environmental Inventory
1. NEPA resources inventory – document inventory on form NRCS-CPA-52.
2. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

[1/] On the smaller jobs, the design surveys can be combined with the layout surveys; dependent on judgment and experience of technician.

III. DESIGN

A. Design Data
1. Hydrology – for each reach – record on forms SD-ENG-29, EFH2 hydrology software, or equivalent.
2. Hydraulics – hydraulic elements of the diversion, i.e., cross section, slope, and capacity for each reach. Record on form SD-ENG-29, applicable software, or equivalent.
3. Quantities and cost estimates

B. Permits and Approvals (if applicable)

1. USACE 404 permit (if applicable) – document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans – Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. When job plans are not used or additional drawings are necessary use appropriate American National Standards Institute ANSI"D" size – Full Size (22" x 34"), Half Size ANSI "B" Size (11" x 17"), or Page Size ANSI "A" size (81/2" x 11") plan sheet.

1. Overall plan view showing the alignment, stationing, and other significant cultural features affecting construction.
2. Profile of designed channel and ridge superimposed on original centerline of ditch.
3. Cross sections – minimum of one cross section for each design reach showing bottom widths, side slopes, etc.
4. Location or vicinity map – location map with legal description.
5. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. **Construction plans for diversions shall include the following statement: "According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
6. Table of quantities estimates – place on plans.
7. Job approval – Ref.: NEM, Part 501.
8. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the participant responsibilities.

B. Construction Specifications

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys

On small jobs, layout surveys may be combined with design surveys. Use standard staking procedure (TR-62 Engineering Layout, Notes, Staking & Calculations). Record in field notebook or forms SCS-ENG-28 and 29.

1. Centerline, slope, and reference stakes.

a. Set stakes at maximum 100-foot intervals and necessary plus stations at grade or land slope changes.
b. Set a minimum of one slope stake or one centerline stake at each station.

2. Obtain sufficient cross sections to determine accurate volume, if volume is basis of payment.

B. Earthwork Quantity Computations

Compute by average end area method or appropriate computer software. Final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS BUILT PLANS"

A. Compliance Checking

Record in field notebook, job sheet, or survey notes as applicable.

1. Profile of completed channel bottom and ridge.
2. Cross sections showing bottom width, depth, side slopes, berm widths, etc. Check at least one cross section for each design section or reach.
3. Completed length.
4. Vegetative measures – statement regarding status of seeding or sodding.
5. Construction inspection reports – form SD-ENG-19 or equivalent.
6. Statement of compliance – state that construction is complete according to plans and specifications and meets the criteria of the applicable practice standards. This should be dated and signed by the person with proper job approval authority.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising JAA in accordance with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[2/] design changes.
2. Significant[2/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[2/] Determination of "significant" is a matter of judgment by someone with appropriate JAA. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

DRAINAGE

Drainage Water Management (554)
Subsurface Drain (606)
Surface Drain, Field Ditch (607)
Surface Drain, Main or Lateral (608)

I. GENERAL

A. References
   1. EFM, Chapter 14.
   2. NEH, Part 624 – Drainage.
   3. Drainmod computer software.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Geologic survey as needed.
      a. Soil borings – record on form SD-ENG-10 or SD-ENG-45 or other suitable means to document the subsurface investigation.
      b. Soil survey.
   2. Special studies such as ground water and hydraulic conductivity as needed for design.
   3. Location of underground utilities.

B. Design Surveys
   1. Topographic detail – as needed to reflect topography and details such as roads, fence lines, location, and elevation of test wells, etc., (field notes or data collector).
   2. Profile along centerline of drain.
   3. Cross sections off centerline as required.
   4. Control elevations and locations of outlets, test wells, ground water, inlets, and junctions.

C. Environmental Inventory

   NEPA inventory of resources – document inventory on form NRCS-CPA-52.
   1. Cultural resources inventory – use form SD-SSC-1.
   2. Wetland effects.
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.

III. DESIGN

A. Design Data
   1. Hydrologic computations (for surface drains) – record on form SD-ENG-29.
   2. Capacity requirements for interception drains.
   3. Spacing of lines and laterals.
   4. Drain hydraulics.

a. Size, type, and strength requirements for tile.
b. Spacing of lines and laterals.
c. Grade of slope of tile.

5. Filter design – kind, gradation, thickness, filter opening, etc.
6. Bedding material.
7. Drain appurtenances – inlets, vents, manholes, junctions, etc.
8. Quantities – estimates as needed.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. When job plans are not used or additional drawings are necessary use appropriate American National Standards Institute ANSI"D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI "A" size (81/2" x 11") plan sheets.

A. Construction Plans

1. Overall plan view showing drain location, alignment, and appurtenances in relation to field boundaries and outlets. Show linear stationing, benchmark locations, and elevations.
2. Profile along centerline of tile line. Show original ground elevation, tile invert, inlets, outlets, vents, manholes and junctions, groundwater elevations, and borings profile.
3. Typical cross sections – show trench, tile, filter, etc.
4. Appurtenant structure and details – include dimensional plans and sectional views to clearly show all intended details for construction.
5. Filter gradations.
6. Construction notes as needed to clarify drawings. Construction plans for subsurface drains shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
7. Quantities estimates – place on plans.
8. Job approval – ref.: NEM, Part 501.
9. Location or vicinity map – location map with legal description.
10. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout survey – record in field notebook.
   1. Centerline alignment and offset stakes:
      a. Set centerline stakes at maximum 100-foot intervals.
      b. Offset grade stakes at maximum 100-foot intervals. Reference grade stakes to tile flow line to 0.01 foot.
      c. Location and grade stakes for appurtenances.

B. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – AS-BUILT PLANS

A. Compliance Checking – record in field notes.
   1. Profile of completed tile line/ditch/main and flowline – if possible.
   2. Lengths, sizes, kind, and grade of tile lines/ditches/main.
   3. Filter thickness and kinds of material.
   4. Location and dimensions of appurtenances.
   5. Outlet pipe – length, kind, size, vertical distance between invert of outlet pipe and normal water level in outlet ditch or stream.
   6. Construction inspection report – form SD-ENG-19 - ref.: NEM, SD512.41.
   7. Material certification statement (ref.: NEM, Part 512, Subpart C).
   8. Statement of compliance – state that construction is complete according to plans and specifications. Date and sign by the technician with JAA.

B. As-built Plans (ref.: NEM, 512.51 and 512.52).
   As-built plans are a record of constructed facilities. Determination of need for As-built plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as As-built on plans.

[1/] Determination of “significant” is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

DRY HYDRANT (432)

I. GENERAL

A. References
   1. EFH, Part 650, Chapters 3, Hydraulics, and Chapter 11, Ponds and Reservoirs.
   2. NEH, Part 634, Hydraulic Engineering.
   3. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Soil borings – record on form SD-ENG-45 or SD-ENG-10 to determine trench and bedding requirements, as needed.
   2. Corrosion potential or conditions (for metal pipe) – soil resistivity readings or other published soils data.
   3. Location of underground utilities.

B. Design Surveys
   1. Profile along centerline of pipeline – include all control points, such as structure elevations, critical field elevations, road crossings, drain points, etc.
   2. Topographic map – where required to aid in positioning pipeline, determine outlet locations, etc.
   3. All pertinent water surface elevations

C. Environmental Inventory

   NEPA inventory of resources – document inventory on form NRCS-CPA-52.
   1. Cultural resources inventory – use form SD-SSC-1.
   2. Wetland effects (if applicable).
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
   1. Capacity requirements – determination of design capacity.
   2. Hydraulic data – use form SD-ENG-5, 5b, 7, 9, or 9a.
   3. Structural design computations, depending on structural needs.
   4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
   1. Water rights – owner is responsible for obtaining water rights from SD DENR.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS`

A. Construction Plans

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Overall plan view – should be of sufficient size to show alignment, stationing, areas involved, cultural features, reference points, and pipeline appurtenances.
2. Profiles and design grades – show original ground surface and pipeline invert elevations and grades. Should show stationing, appurtenances, and other information related to construction.
3. Hydraulics – pipe capacities and pressures
4. Structural details – as needed to clarify drawings and show construction details, include plan views and sectional views.
5. Table of quantities – estimates.
6. Location or vicinity map – with legal description.
7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval – see NEM, Part 501.
9. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities".

B. Construction Specifications

Ref: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures and pipeline appurtenances.

4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – AS-BUILT PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Profiles of pipe trench bottom (on short pipelines a minimum of three measurements required to determine depth of cover).
   2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
   3. Elevations at water control structures.
   4. Pipe gauges, thickness, pressure ratings, and markings.
   5. Protective coating used and/or cathodic protection provided.
   6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
   7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
   8. Material certification statement (ref.: NEM, Part 512, Subpart C).
   9. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. As-built Plans (Ref: NEM, SD512.51 and SD512.52).
   As-built plans are a record of constructed facilities. Determination of need for As-built plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as As-built on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

EARTH DAM

Dam (402)
Dam, Diversion (348)
Dike (356)
Grade Stabilization Structure (410)
Irrigation Reservoir (436)
Pond (378)
Structure for Water Control (587)
Water and Sediment Control Basin (638)

I. GENERAL

A. References
1. NEH, Part 650, Engineering Field Handbook (EFH), Chapters 6 and 11.
2. EFH, Supplement No. 1.
3. SDTG, Section IV. (FOTG)
4. SD Standard Engineering Plans (Job Plans).
5. TR 20, 55, 60, and others.
6. SD Engineering Technical Notes.
7. Computer Software – SITES 2005.1.4, WinPond, EFH2, TR-55, CADD.
8. NEH, Sections 5, 6, 19, and 20.
9. United States Geological Survey (USGS) Water Resources Investigation Report 98-4055.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings – document the subsurface investigation on SD forms or other suitable means.
   a. Materials Classification by Unified Soil Classification System.
   b. Determine structure foundation conditions.
   c. Locate borrow material.
   d. Characterize auxiliary spillway subsurface materials as necessary.
2. Corrosion potential
   a. Resistivity readings or published data.
3. Special erosion potential
   a. Indicator tests for dispersive clays (Crumb Test) must be completed for all embankment dam sites. Sites located west of the Missouri River may require further laboratory evaluations.
4. Location of any known underground utilities.

B. Design Surveys

On smaller projects, the design survey may be combined with the layout survey, depending upon the experience and judgment of the engineer or technician.
1. Topographic mapping.
   a. Irrigation reservoirs, grade stabilization structures, and multiple purpose dams – develop topographic map of reservoir area and dam site in sufficient detail to adequately design the structure. It is suggested that a maximum contour interval of four feet be utilized for the topographic map and the contours should extend beyond the

top of the proposed dam sufficient to describe the flood retention capacity of the proposed structure. The topographic map will be utilized in the development of the stage–storage information for the structure design.

b. Other earth dams – as needed, depending on site conditions and project needs. Surveys must be adequate in nature and extent to provide accurate design values for use in routing the design hydrograph for the structure design.

2. Profiles and cross sections – record in field notes.
   a. Centerline of embankments.
   b. Centerline of auxiliary spillway – from below inlet section to a point beyond control section to establish exit channel slope on Ponds (378) and down to base grade of outlet channel on all other earth dams.
   c. Centerline of principal spillway far enough downstream to determine tailwater conditions.
   d. Grade stabilization dam – profile in channel upstream and downstream from structure including area protected.
   e. Cross section at maximum fill section (this is a minimum requirement, depending on size, and type of structure).
   f. Cross section of auxiliary spillway at control section.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.

1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects.
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design Data – record on standard data sheets and/or appropriate worksheets.
   1. Hydrologic data – peak flow, storm runoff, annual yield (form SD-ENG-29 or SD-ENG-29a, EFM 2, TR-55, SITES, output from Curve Number Tool, etc.).
   2. Hydraulic data – auxiliary spillway, principal spillway, drawdown pipe, outlet channel (form SD-ENG-29, or documentation from SITES, WinPond programs).
   3. Structure data – surface area, storage, sediment volume. Stage-storage tables or curve depending on structural needs.
   4. Structural design computations and evaluations, depending on structural needs.
   5. Quantity and cost estimates using the SD Cost Estimate worksheet or other appropriate documentation.

B. Dam Hazard Classification.

Dam hazard classification must be documented by the individual with JAA (NEM, 520.23). Use form SD-ENG-57, Documentation for Hazard Classification.

C. Permits and Approvals (if applicable)

1. 404 Permit – document if individual permit obtained, nationwide permit applies, or if practice is exempt.
2. Safety of dams – when a structure is classified as a 'dam' by the SD DENR, the design shall be submitted to DENR for approval (see GM, 450, Part SD 405, for classification information)
3. Water rights – owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice; see GM, 450, Part 405. Document with form SD-ENG-6.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans.

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSI "D" size - Full Size (22" x 34"), Half Size ANSI "B" Size (11"x 17"), or Page Size ANSI "A" size (8 ½" x 11") drawing sheets.

1. Plan view of dam and reservoir area.
2. Profile and cross section of auxiliary spillway.
3. Profile on centerline of embankment and cross section at maximum fill section (This would be the minimum requirement. Depending on size and type of structure more detailed cross sections may be necessary).
4. Core trench profile and typical cross section.
5. Show elevations, slopes, dimensions, and stationing on all profiles and cross sections.
6. Show location and extent of borrow area.
7. Principal spillway and drawdown pipes.
   a. Profile along the centerline.
   b. Show stationing, dimensions, elevations.
   c. Show location of related appurtenances such as drainage diaphragm, pipe supports, gates, etc.
   d. Show skew angle on plan view of dam.
8. Structural details – as needed to clarify drawings.
9. Log of soil borings – show on plans for larger or more complex structures and on structures of any size where subsurface material or water may be significant for the proposed construction.
10. Table of quantities – estimates.
11. Location or vicinity map – with legal description.
12. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. **Construction plans shall include the following statement: "According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
13. Job approval – see NEM, Part 501.
14. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications – ref.: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys.

1. Centerline alignment stakes.
2. Offset grade stakes for principal spillway, drawdown pipe, irrigation supply conduit, etc., as necessary.
3. Slope or construction stakes for embankment and auxiliary spillway.
4. Location and grade stakes for structural components.

B. Earthwork Quantity Computations.

1. Compute quantities in embankments, dikes, cutoff trench, and other excavations as needed.
2. Methods to be used in making computations of quantities.
   a. EFM, Supplement No. 1.
   b. Three-level section (SD-ENG-32).
   c. Any level method (SCS-ENG-529, Technical Note, Engineering Design SD-1).
   d. Computer software - Area Vol., Ohio Cross-Sections with Quantities.
   e. Quantity computations generated by computer aided design and drafting (CADD) software.
3. Compute quantities from layout notes. Final quantities are based on staked lines and grades and/or approved changes.
4. Show quantities of all components in the table of quantities on the plans.

VI. COMPLIANCE CHECKING – "AS BUILT PLANS"

A. Compliance Checking – record on field notes, construction plans, or construction inspection reports. (SD-ENG-19).

1. Profiles on centerline of embankments, channels, auxiliary spillway, and pipelines.
2. Cross sections of auxiliary spillway, dam embankment, outlet channels.
3. Elevations at inlet and outlet of principal spillway and other pipes and control elevations of all structures.
4. Pipes – check length, gauge, thickness, type, diameter.
5. Number, type, location of appurtenances (gates, valves, trash racks, etc.).
6. Dimensions of appurtenances (trash racks, anti-vortex devices, pipe supports, etc.)
7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
8. Material certification statement (ref.: NEM, Part 512, Subpart C).
9. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans. Record the date and person who prepared the "As Built" plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

GRASSED WATERWAY

Grassed Waterway (412)
Open Channel (582)

I. GENERAL

A. The SD Grassed Waterway Design Software, which is located at http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html, was created to include all items required to design, develop construction plans and specifications, record as-built information, and certify grassed waterways.

B. References
1. NEH, Part 650, Chapter 7 – Grassed Waterways
2. NEH, Section 5 – Hydraulics
3. SDTG – CPS Grassed Waterway (412).
4. SCS-TP-61, Handbook of Channel Design for Soil and Water Conservation.
5. SD Engineering Technical Notes.
   a. Hydrology – SD-1 - Determining Capacity of Natural Waterways.
   b. Construction – SD-1 - Construction Tolerances.
6. Computer software – SD Grassed Waterway Design Software at http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html, Hydraulic Formulas, NEH, Chapter 2, Automatic Watershed Delineation Tool.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Drainage area. The simplified design method may be used if the drainage area produces a runoff of less than 100 CFS for a 10-year, 24-hour storm event. In all cases, this will be less than or equal to 100 acres.
2. Safe velocity for soil type.
3. Location of underground utilities.
4. Locations of waterway outlets considering erosion, sedimentation, and drainage laws.

B. Design Surveys
1. Centerline profile and cross sections as needed to provide information for design and quantities computations. The following survey information is needed:
   a. If the simplified design method is used, natural channel slope 1.0 percent or greater and control of waterway channel grade is not required.
      1. Use either hand level or engineering level.
      2. Check slope at a minimum of two locations per reach.
   b. If the simplified design method cannot be used, or natural channel slope is less than 1.0 percent, or control of waterway channel grade is required.
      1. Use engineering level.
      2. Use benchmark and record description, location, and elevation.

3. Survey profile and obtain sufficient cross sections to adequately design waterway and estimate volumes.

C. Environmental Inventory
   1. NEPA resources inventory – document inventory on form NRCS-CPA-52.
   2. Cultural resources inventory – use form SD-SSC-1.
   3. Wetland effects.
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design data – Utilize the SD Grassed Waterway Design Software at http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html.
   1. Hydrologic data – peak design flows for each reach.
   2. Hydraulic determinations – safe velocities for each reach based on soils and/or vegetal retardance.
   3. Determine required dimensions and capacity for each reach.
   4. Earthwork quantities – estimates as needed.
   5. For simplified design method, provide small waterway design printout.

B. Permits and Approvals
   1. USACE 404 permit (if applicable) – document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans – Use the SD Grassed Waterway Design Software at http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html to develop the construction plans. As a substitute, use the form SD-ENG-25 (Job Plan 8.0), equivalent job plans, or appropriate "E" or "N" sized sheets.
   1. Overall plan view – may be superimposed on location map. Show stationing and identify reaches.
   2. Profile – centerline of waterway. Show original ground superimposed on design, grade, stationing, reaches, etc. Centerline profiles are required on waterways requiring grade control or not meeting the simplified design method criteria. Also, for other waterways as needed based on judgment of technician with JAA.
   3. Cross sections – show typical cross sections or list dimensions for each reach.
   4. Construction notes – add notes to clarify or furnish direction in construction.
      a. On waterways with cross-sectional area less than 35 square feet that were surveyed with a hand level, the statement "**The completed waterway shall have no reverse grade.**" is required. The statement is optional on waterways surveyed with an engineering level.
      b. Construction plans for grassed waterways shall include the following statement: **"According to South Dakota State Law,**

no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."

5. Quantity estimates – place on plans.
6. Job approval – ref.: NEM, Part 501.
7. Location or vicinity map – location map with legal description.
8. When plans are delivered to the cooperator – use form SD-ENG-11W to inform cooperators and certify their understanding of the participant responsibilities.

B. Construction Specifications
   1. Use SD Construction and Material Specifications for each item of work and material, not shown on the job plan as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
   2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
   3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Waterways designed according to the simplified design method and waterways not requiring grade control – use hand level or engineering level and record in a field notebook or equivalent.
   1. Set stakes for alignment, depth, and grade as needed.
   2. Final quantities are based upon initial estimate.

B. Waterways not meeting the simplified design method criteria or waterways requiring grade control – use engineering level, record in field notebook or equivalent.
   1. Set a minimum of one reference stake or slope stake at each station to control alignment and grade as designed.
   2. Set stations on grade or land slope changes and at an interval based on the judgment of the technician with JAA. Recommended maximum interval – 100 feet.
   3. Obtain sufficient cross sections per design reach to calculate volumes by average end area method. Final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS BUILT PLANS"

A. Compliance Checking – record in the SD Grassed Waterway Design Software or field notes.

1. The same engineering equipment should be used to the same degree of intensity as used in design and construction check surveys.
2. Check profile for grade.
3. Check width, depth, and side slopes. Minimum of one cross section per design reach.
4. Measure length.
5. Statement on temporary or permanent erosion control measures installed.
6. Statement regarding status of seeding.
7. Construction inspection report – form SD-ENG-19 or equivalent.
8. Statement of compliance – state that construction is complete according to plans and specifications and meets the criteria of the applicable practice standards. This should be dated and signed by the person with proper job approval authority.

B. "As Built" Plans - (ref.: NEM, 512.51 and 512.52)

"As Built" plans are a record of constructed facilities. "As Built" plans are required for Job Class III and above waterways. Job Class I-II waterways do not require "As Built" plans provided there is sufficient compliance checking so that "As Built" plans could be developed at a later date. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.
5. Official compliance statement on the plans that is signed and dated and indicates whether completed construction meets standards and specifications.

[1/] Determination of "significant" is a matter of judgment by someone with appropriate JAA. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

IRRIGATION CANAL OR LATERAL (320)
IRRIGATION DITCH LINING (428)
IRRIGATION FIELD DITCH (388)

I. GENERAL

A. References
1. EFH, Part 650, Chapters 3, Hydraulics.
2. National Irrigation Handbook, Part 623, Irrigation.
3. NEH, Part 634, Hydraulic Engineering, and Part 636, Structural Design.
4. NEH, Part 652, Irrigation Guide, Chapter 7, Farm Distribution Components.
5. USDA, ARS, 1987, Stability Design of Grasslined Open Channels. Agricultural Handbook 667.
6. Hec-Ras Computer Program
7. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings where needed to determine classification of soils for allowable design velocities and construction materials. Use form SD-ENG-45 or SD-ENG-10.
2. Location of underground utilities.

B. Design Surveys
1. Profile along centerline of ditch – include all control points, such as structure elevations, critical field elevations, benchmarks, etc.
2. Average land slope along proposed centerline.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
1. Capacity requirements – determination of design capacity.
2. Hydraulic data – use form SD-ENG-5, 5b, 7, 9, or 9a.
3. Structural design computations, depending on structural needs (turnouts, flumes, etc.).
4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
1. Water rights – owner is responsible for obtaining water rights from SD DENR.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Overall plan view – should be of sufficient size to show alignment, stationing, areas involved, cultural features, reference points, and pipeline appurtenances.
2. Profiles and design grades – show original ground surface and pipeline invert elevations and grades. Should show stationing, appurtenances, and other information related to construction.
3. Hydraulics – pipe capacities and pressures
4. Structural details – as needed to clarify drawings and show construction details, include plan views and sectional views.
5. Table of quantities – estimates.
6. Location or vicinity map – with legal description.
7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval – see NEM, Part 501.
9. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.

3. Location and grade stakes for structures and pipeline appurtenances.
4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – AS BUILT PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Profiles of pipe trench bottom (on short pipelines a minimum of three measurements required to determine depth of cover).
   2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
   3. Elevations at water control structures.
   4. Pipe gauges, thickness, pressure ratings, and markings.
   5. Protective coating used and/or cathodic protection provided.
   6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
   7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
   8. Material certification statement (ref.: NEM, Part 512, Subpart C).
   9. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. As built plans (Ref: NEM, SD512.51 and SD512.52).
   As built plans are a record of constructed facilities. Determination of need for As built plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as As-built on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

IRRIGATION LAND LEVELING (464)

I. GENERAL

A. References
1. EFH, Part 650, Chapter 15, Irrigation.
2. SDTG, Section IV.
3. SD Irrigation Guide.
4. National Irrigation Handbook, Part 623, Irrigation
5. Irrigation plan for the unit.
   a. The proper field arrangement and farm distribution system must be planned before leveling is designed or installed. (Ref: Irrigation Planning Section of the SD Irrigation Guide.)
6. Computer software – Plane Surface Design (PSD), Terramodel, Civil 3D (or other design software).

II. INVESTIGATIONS AND SURVEYS

A. Design investigations
1. Detailed soil survey for irrigation – the published soil survey data is generally not detailed enough for the information required for land leveling design. A soil survey should be completed on the leveling area to determine irrigation suitability, topsoil depths, depth to gravel, and presence of any other features which would affect the designers decisions on allowable depth of cut, suitable borrow areas, etc.
2. Source, quantity, and quality of water.
3. Location of underground utilities.

B. Design Surveys
1. Topography or topographic map of survey area. Typically, the area will need to be gridded prior to making the survey. The grid points will provide reference points to use later when construction staking is completed. A topographic survey may be of value prior to making the grid survey on irregular shaped fields which have very gradual and irregular slopes. The resulting contour map can be useful in determining the most efficient direction to level which will then determine the direction for grid layout.
2. Grid point elevations – field notebook, grid sheet, or data collector (total station surveys).
3. Water surface elevations for supply and wastewater outlets.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.

III. DESIGN

A. Design data – record on land leveling grid (SCS-ENG-313, SCS-ENG-42, or CADD printout/plot).
   1. Determine and record ground elevation, design elevation, and cut/fill amounts for grid points.
   2. Planned grades for each field or bench.
   3. Supply laterals and drains.
   4. Location and elevations of structures, pads, ditches, etc., needed.
   5. Balance lines as needed (areas within which volumes of cut and fill are balanced).
   6. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
   1. Water rights – owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice; see GM, 450, Part 405.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans
   1. Overall plan view showing cuts and/or fills on grid points, design elevations, and slopes.
   2. Location of ditches, drains, field laterals, structures, pads, and roads.
   3. Balance lines as needed.
   4. Show location and extent of borrow areas as needed.
   5. Table of quantities – estimates.
   6. Location or vicinity map – with legal description.
   7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction Plans for land leveling systems shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   8. Job approval – see NEM, Part 501.
   9. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

   Ref: SD Specification Guide for the intended practice.
   1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
   2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
   3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys (use field notebook).
   1. Mark, cut, or fill on grade stakes at grid points.
   2. Location and grade stakes for ditches, ditch pads, drains, etc.

B. Earthwork quantity computations
   1. Quantities are based on design elevations or approved changes. Yardage volumes may be obtained using appropriate design software, or one of the manual computation methods in NEH, Part 623 Chapter 12, Land Leveling.

VI. COMPLIANCE CHECKING – AS BUILT PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Rod reading of elevations along selected lines showing constructed elevations and grades. Record in field notebook, on construction plan grid sheet, or using data collector. Check down slope and cross slope in selected locations.
   2. Recheck notes or elevations on parts of field that had to be reworked.
   3. Visual check for overall workmanship.
   4. Construction inspection reports (ref: NEM, Part 512, Subpart D).
   5. Material certification statement (ref: NEM, Part 512, Subpart C).
   6. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by the person with proper JAA.

B. "As-built" Plans (ref: NEM, SD512.51 and SD512.52).
   "As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "As built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

IRRIGATION SYSTEM

Irrigation Pipeline (430)
Irrigation System Sprinkle (442)
Irrigation System Micro Irrigation (441)
Irrigation System Surface and Subsurface (443)
Irrigation System Tailwater Recovery (447)

I. GENERAL

A. References
1. EFH, Part 650, Chapters 3, Hydraulics.
2. SD Irrigation Guide.
3. NEH, Part 652, Irrigation Guide.
4. NEH, Part 623, Irrigation, and Part 634, Hydraulic Engineering.
5. SDTG, Section IV.
6. SD Standard Engineering Plans (Job Plans).

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil Properties – Determine from the Web soil survey or onsite soils investigation. These properties include water holding capacity, soil intake characteristic, permeability, soil condition, organic matter, slope, water table depth, soil erodibility, chemical properties, salinity, and soil reaction (pH).
Soil Borings – Collected where needed to determine classification of soils for allowable design velocities and construction materials and trench and bedding requirements as needed. Use form SD-ENG-45 or SD-ENG-10.
2. Corrosion potential or conditions (for metal pipe) – soil resistivity readings or other published soils data.
3. Location of underground utilities.

B. Design Surveys
1. Profile along centerline of pipeline – include all control points, such as structure elevations, critical field elevations, road crossings, drain points, etc.
2. Topographic map – where required to aid in positioning pipeline, determine outlet locations, irrigation methods, etc.
3. All pertinent water surface elevations – water supply ditch, check structures, high water marks, etc.

C. Environmental Inventory
NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.

1. Capacity requirements – determination of design capacity; such as peak consumptive crop use, irrigation method requirements, irrigation water availability (may be determined by others on group systems or projects).
2. Hydraulic data – use form SD-ENG-5, 5b, 7, 9, or 9a.
3. Structural design computations, depending on structural needs.
4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)

1. Water rights – owner is responsible for obtaining water rights from SD DENR.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Overall plan view – should be of sufficient size to show alignment, stationing, areas involved, cultural features, reference points, and pipeline appurtenances.
2. Profiles and design grades – show original ground surface and pipeline invert elevations and grades. Should show stationing, appurtenances, and other information related to construction.
3. Hydraulics – pipe capacities and pressures
4. Structural details – as needed to clarify drawings and show construction details, include plan views and sectional views.
5. Table of quantities – estimates.
6. Location or vicinity map – with legal description.
7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval – see NEM, Part 501.
9. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures and pipeline appurtenances.
4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – AS-BUILT PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Profiles of pipe trench bottom (on short pipelines a minimum of three measurements required to determine depth of cover).
   2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
   3. Elevations at water control structures.
   4. Pipe gauges, thickness, pressure ratings, and markings.
   5. Protective coating used and/or cathodic protection provided.
   6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
   7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
   8. Material certification statement (ref.: NEM, Part 512, Subpart C).
   9. Statement of compliance - state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. As-built Plans (Ref: NEM, SD512.51 and SD512.52).
   As-built plans are a record of constructed facilities. Determination of need for As-built plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as As-built on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

IRRIGATION WATER MANAGEMENT (449)

I. GENERAL

A. References
1. EFH, Part 650, Chapters 3, Hydraulics.
2. SD Irrigation Guide.
3. NEH, Part 652, Irrigation Guide.
4. NEH, Part 623, Irrigation, and Part 634, Hydraulic Engineering.
5. Forms: SD-Eng-9 Sprinkler Irrigation System – Irrigation Water Management Plan, SD-ENG-9B, Irrigation System Inventory, SD-ENG-9C, Documentation of Applied Irrigation Water Management
6. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Evaluate the existing irrigation method including the crops to be grown, water source, water supply, and distribution system and existing sprinkler system if applicable. Use form SD-ENG-9B for inventorying existing sprinkler systems.
2. Soil Properties – determine from the Web Soil Survey or onsite soils investigation the following relevant soil properties: water holding capacity, soil intake characteristics, permeability, soil condition, organic matter, slope, water table depth, soil erodibility, chemical properties, salinity, and soil reaction (pH)
3. Topographic information – critical field elevations, etc.
4. All pertinent water surface elevations – water supply ditch, check structures, high water marks, etc.

B. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. System Evaluation and Documentation

A. Design data – record on standard data sheets and/or appropriate worksheets.
1. Capacity requirements – determination of design capacity; such as peak consumptive crop use, irrigation method requirements, irrigation water availability (may be determined by others on group systems or projects).
2. Use form SD-ENG-9 to evaluate system information and 9C to document applied irrigation water management. Use Nebraska WaterSaved Excel spreadsheet to determine net water saved.
3. Document the producer's method of irrigation scheduling on the SD-ENG-9C. The producer must then sign this form to certify their intent to

follow an irrigation scheduling method and provide proper operation and maintenance (O&M) to the irrigation system.

LINED WATERWAY OR OUTLET (468)

I. GENERAL

A. References
   1. EFH, Part 650, Chapters 3, Hydraulics.
   2. NEH, Part 634, Hydraulic Engineering, and Part 636, Structural Design.
   3. Computer Program – HEC-RAS
   3. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Soil borings where needed to determine classification of soils for allowable design and construction materials. Use form SD-ENG-45 or SD-ENG-10.
   2. Location of underground utilities.

B. Design Surveys
   1. Profile along centerline of waterway or outlet– include all control points, such as structure elevations, critical field elevations, road crossings, bench marks, drain points, etc.
   2. Average land slope along proposed centerline.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
   1. Cultural resources inventory – use form SD-SSC-1.
   2. Wetland effects (if applicable).
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
   1. Capacity requirements – determination of design capacity.
   2. Hydraulic data – HEC-RAS or other appropriate software may be used.
   3. Structural design computations, depending on structural needs.
   4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
   1. Water rights – owner is responsible for obtaining water rights from SD DENR.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"),

half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Overall plan view – should be of sufficient size to show alignment, stationing, areas involved, cultural features, reference points, and pipeline appurtenances.
2. Profiles and design grades – show original ground surface and pipeline invert elevations and grades. Should show stationing, appurtenances, and other information related to construction.
3. Hydraulics – pipe capacities and pressures
4. Structural details – as needed to clarify drawings and show construction details, include plan views and sectional views.
5. Table of quantities – estimates.
6. Location or vicinity map – with legal description.
7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval – see NEM, Part 501.
9. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures and pipeline appurtenances.
4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).

1. Profiles of pipe trench bottom (on short pipelines a minimum of three measurements required to determine depth of cover).

2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
3. Elevations at water control structures.
4. Pipe gauges, thickness, pressure ratings, and markings.
5. Protective coating used and/or cathodic protection provided.
6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
8. Material certification statement (ref.: NEM, Part 512, Subpart C).
9. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. As-built" Plans (Ref: NEM, SD512.51 and SD512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

LIVESTOCK PIPELINE

Livestock Pipeline (516)
Watering Facility (614)

I. GENERAL

A. References
1. SDTG, Section IV (FOTG).
2. EFH, Chapters 3, and Chapter 12.
3. SD Design Technical Note No. 2006-1, Watering Facility Design Criteria for Cattle, and Design Technical Note SD2009-1, Livestock Water Systems Guide.
4. NEM, Part 503 (Engineering Activities Affecting Utilities).
5. Design needs for domestic use.
6. SD Class I and Class II Pipeline Design Spreadsheets and Job Forms.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Livestock served in each pasture, total livestock served by system, season of use, number of farmsteads and houses.
2. Soils and geologic investigation – as required; determine routes considering soil depths and topography.
3. Source of water – available flow rates, dependability, presence of central storage, depth to water, and expected temperature.
4. Pressure at source – existing pump model number, pressure tank sizes and ratings, artesian pressures, etc.
5. Outlets – planned location and type of outlets, including planned tank sizes, and pressure required at houses.
6. Location of any known underground utilities.

B. Design Surveys
1. Profile along centerline of pipeline adequate to determine pipeline control elevations and lengths. Use USGS quadrangles, precision altimeters combined with aerial photos, GPS, or conventional surveys, as appropriate.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects (if applicable).
    a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.

III. DESIGN

A. Design Data

The NRCS staff are encouraged to utilize the SD-Class I or Class II Pipeline Design and Job Forms Tools to prepare and document livestock water pipeline and watering facility

practices. Record hand written computations on computation sheet (SCS-ENG-523A) or SD-ENG-47 worksheet.

Job Class I:

Form SD-ENG-48A may be used for typical systems. More complex systems should follow criteria for Job Class II and above.

Job Class II and above:

Use SD-ENG-5 Pipeline Design Calculations or other worksheet or software as applicable.

1. Design flow based on livestock served, household needs, tank sizes, etc.
2. Hydraulic determinations to support pipeline sizes, pressure requirements, etc.
3. Pipeline sizes and pressure ratings for each pipeline reach.
4. Tank capacity requirements (number of livestock served, days of storage required).
5. Tank storage volume calculations.
6. Material quantity computations.
7. Cost estimates – required for Job Class IV and above or as needed to prepare contract documents.

B. Permits and Wetland Impacts

1. USACE 404 Permit: On pipelines crossing live streams, document if individual permit obtained, nationwide permit applies, or if practice is exempt. Forms and more information are available at: http://www.usace.army.mil/inet/usace-docs/forms/formlib-all/e4345.pdf.
2. DENR Water Rights permit: domestic use for farm, ranch, household, and livestock use from other than a common water distribution system in excess of either 25,920 gpd (18 gpm continuously for 24 hrs.) or 25 gpm requires a water permit. Forms and more information are available at: http://www.state.sd.us/denr/DES/WaterRights/waterprg.htm.
3. Storm Water Discharge Permit (DENR) – required for Class IV and above pipelines or if the pipeline construction disturbs more than one acre of ground. Forms and more information are available at: http://www.state.sd.us/denr/DES/Surfacewater/surface.htm.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

NRCS staff are encouraged to utilize the SD-Class I or Class II Pipeline Design and Job Forms Tools to prepare and document livestock water pipeline and watering facility practices. Use Job Plans or appropriate American National Standards Institute ANSI "D" size - Full Size (22" x 34"), Half Size ANSI "B" size (11"x 17"), or Page Size ANSI "A" size (8 ½" x 11") NRCS plan sheets as deemed necessary. Additional drawings may be required for Job Class IV and above or to show additional features.

A. Construction Plans

Job Class I

A completed Form SD-ENG-48A may be used for typical systems to document design and to show pipe size, type, length, and burial depth.

1. Attach a map (DOQ or DRG) showing water source and type, pipelines, tanks, hydrants, valves, and other appurtenances.

2. As plans are delivered to the cooperator, use form SD-ENG-11P to inform cooperators of their responsibilities and to certify their understanding of their responsibilities.

Job Class II and Above

1. Overall plan view – showing all pipelines, tanks, physical features such as roads, fences, public or private utilities, etc. Show pipeline identification, stationing, and appurtenance locations. Use Job Plan 12.1 or attach a map.
2. Profile along centerline of pipelines – required on Class IV sized jobs (ref: NEM, Part 501.04) or larger. Profiles may also be needed on smaller jobs of above average complexity dependent on the judgment of the technician having job approval authority. A plan view superimposed on USGS topography and an electronic file of hydraulic grade line elevations may be substituted for a profile dependent on the judgment of the technician with job approval authority. (SD-ENG-5D) Show depths, appurtenances, pipe gradelines, hydraulic gradelines, static headline, changes in pipe sizes and ratings, etc. (Included on Job Plan 12.1).
3. Overall plan view of tank and facilities, including overflow/drain location and guard posts and timbers locations.
4. Section along centerline of tank, showing construction details such as inlet and outlet pipes, floor, walls, elevations, etc.
5. Appurtenance details – show details of pipelines appurtenances such as water bars, manholes, stop and drain valves, air release valves, regulators, etc., as needed and applicable. (Ref.: Job Plan 12B.)
6. Construction notes – add notes to clarify a component and furnish directions for installations, supplementing standard specifications. Construction plans for stockwater pipelines shall include the following statement: "According to SD State Law, no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474." (Included on Job Plan 12.1)
7. Location or vicinity map – show legal description and location from nearest town, city, etc., for Job Class IV and V. For other classes - location map with legal description. **(Included on Job Plan 12.1)**
8. Table of quantities. **(Included on Job Plan 12.1)**
9. Job approval – ref.: NEM, Part 501. **(Included on Job Plan 12.1)**
10. As plans are delivered to the cooperator, use form SD-ENG-11P for typical pipelines and SD-ENG-11 for complex pipelines to inform cooperators of their responsibilities and to certify their understanding of their responsibilities.

B. Construction Specifications

(Ref.: South Dakota Specification Guide for Pipelines)

1. SD Job Plan 12.1, SD-ENG-48, or SD-ENG-48A includes construction specifications and no other specifications are usually required for typical jobs.
2. For atypical or complex jobs use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
3. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.

4. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

C. Layout Surveys

1. Alignment stakes and flags as needed to mark pipeline route (also identifies area inventoried for cultural resources) and locate appurtenances, pipe changes, waterbars, etc.

V. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance Checking – record in field notebook, Job Plan 12.1, SD-ENG-5D or on form SD-ENG-48 or 48A as applicable.

1. Length and location of all lines including stationing of laterals, appurtenances, pipe changes, outlets, and method of measurement (wheel, chain, GPS, etc.).
2. Measured depth of lines (if checked during construction inspection).
3. Materials certification – record pipe markings. (All pipe shall be marked with: size, type of plastic, SDR or PR, ASTM, and manufacturer's name.) The NSF seal must be marked on pipe if pipeline is to be used for potable water. Pipe not marked with applicable markings will require a manufacturer's written certification.
7. Check on pertinent tank elevations, overflow/float, gravel base, guard posts and timbers, appurtenances, etc.
8. Sizes and dimensions of tank adequate to calculate storage volume.
6. Construction inspection – (ref.: NEM, SD512.32).
7. Certification statement – practice components – form SD-ENG-2, SD Job Plan 12.1, SD-ENG-48, or SD-ENG-48A.
8. Statement of compliance – state construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

Contractors may provide this documentation to NRCS for payment certification. Method of measurement of length must be documented. Measurement must be actual installed length rather than an estimate based upon the number of lengths of pipe used. Contractors providing this documentation will be spot checked by the NRCS field office staff on an annual basis according to GM, 450, Part 407.11.

When comparing contractor checkout notes to NRCS checkout notes, the acceptable tolerance is $\pm$1.5 percent not to exceed 25 feet per mile. That is, if the contractor billed length is less than NRCS checkout length the pipeline will be paid at the billed length. If the billed length is longer than the NRCS checkout length, but within 1.5 percent of NRCS checkout length, the contractor length may be paid. If the billed length exceeds 1.5 percent of NRCS checkout length the discrepancy should be resolved with the contractor. If the discrepancy cannot be resolved, NRCS lengths shall be used. (Ref.: Technical Note – Engineering – Construction – SD-1).

B. "As-Built" Plans (ref.: NEM 512.51 and 512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – measured quantities based on design route, layout, or other approved changes.
4. Identify as "As-built" on plans. Record the date and person who prepared the "As-built" plans.

VI. CONTRACTOR DESIGNED PIPELINES

Pipelines meeting Job Class I and the criteria outlined in SD-ENG-48A may be installed by experienced contractors without the standard documentation and supporting data requirements identified in items I through V above.

A. Procedure

1. NRCS determines need and feasibility, and determines whether proposed pipeline meets criteria of SD-ENG-48A and Job Class I.
2. NRCS completes cultural resource survey and locates key points of pipeline route in the field. The pipeline route is documented using GPS readings of the planned route (preferred method), or by marking on aerial photo. The cooperator and contractor are informed that the route is not to be changed without prior approval of NRCS. Form SD-ENG-11P is reviewed with the cooperator to inform them of their responsibilities and to certify their understanding of their responsibilities.
3. NRCS provides copy of SD-ENG-48 or SD-ENG-48A to cooperator for use by his contractor to certify completion and to document the pipe size, pipe pressure rating, bury depth, and total installed length.[2/]
4. Documentation for the practice consists of:
   a. Location as defined by a Toolkit/ArcView plan map or an aerial photo with the pipeline route marked.
   b. Completed SD-ENG-48 or SD-ENG-48A.
   c. NEPA documentation (Section II. C. above).
5. If the contractor chooses to install a different and/or more expensive product than what was planned (larger diameter pipe, different type of tank, different type of pipe, etc.,) and the installed product meets standards and specifications, the NRCS will only pay for the amount of the planned product. For example, 1¼" PVC is needed, and the producer and/or contractor choose to install 1½" PVC; the contract should include 1¼" PVC. Document that the installed product was acceptable but exceeded the minimum requirements of the practice.

The NRCS FO staffs will spot check five percent of the projects designed by each contractor on an annual basis. These pipelines are also to be included in the regular spot checks and program reviews.

ECP pipelines and tanks may be certified by the producer; therefore, no additional field work will be required by NRCS beyond the initial needs and feasibility. The EQIP and other programs requiring NRCS to certify completion of the practice will require plans and

specifications for any associated tanks to be provided to the producer, and a construction check on the pipeline and tanks.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

[2/] Contractor designed pipelines must meet Technical Guide Standard 516 and be installed in accordance with Construction Specification SD-20A, Pipeline; and Material Specification SD-55, Plastic Pipe. These specifications as well as typical appurtenance installations are to be reviewed with each contractor prior to implementation of this procedure.

POND LINING

Pond Sealing or Lining – Flexible Membrane (521A)
Pond Sealing or Lining – Soil Dispersant Treatment (521B)
Pond Sealing or Lining – Bentonite Treatment (521C)
Pond Sealing or Lining – Compacted Clay Treatment (521D)

I. GENERAL

A. References
1. CPSs located within the SDTG, Section IV.
2. NEH, Part 651 - Agricultural Waste Management Field Handbook.
3. NEH, Part 650 – EFHandbook.
4. SD DENR General Water Pollution Control Permit for Concentrated Animal Feeding Operations.
5. Midwest Plan Service, Livestock Waste Facilities Handbook (MWPS-18).
6. NEH, Part 631 – Geology.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations (if applicable)
1. Soil borings – record on form SD-ENG-13 or equivalent.
   a. Ground surface elevation of each hole.
   b. Depth to ground water and seasonal high water table.
   c. Description of each soil material (silty sand, lean clay, etc.)
   d. Unified soil classification of each material (SM, CL, etc.)
   e. Munsell soil color name (light brown, olive grey, grey, etc.)
   f. Estimate of soil permeability of underlying materials (permeable, low permeability, etc.)
   g. Whether the materials are oxidized or unoxidized.
2. Inventory of system and proposed plans.
3. Location of underground utilities.

B. Design Surveys
1. Topographic surveys – of sufficient extent to cover the area of anticipated development (if applicable).
2. Profiles – along centerline of proposed pipelines, ditches, diversions, etc., if outside limits of topographic map (if applicable).

C. Environmental Inventory
1. NEPA resources inventory – document inventory on form NRCS-CPA-52.
2. Cultural resources inventory- use form SD-SSC-1.
3. Wetland effects (if applicable).
   a. Use HGM model to determine effects of structure. If effects are minimal, then a minimal effect agreement must be signed by owner.

III. DESIGN

A. Design Data
   1. Hydrologic determinations – documentation as applicable. This would include printouts from EFH2 or TR-55 computer programs or software/spreadsheets used for designs.
   2. Structural design calculations.
   3. Construction material estimates – material volume computations – includes estimates of earthwork, pipe, concrete, rock, vegetative components, geotextile and erosion control fabrics, or other appurtenances, etc.
   4. Other design data as needed.

B. Permits and approvals (if applicable)
   1. 404 Permit – document if individual permit obtained, nationwide permit applies, or if practice is exempt.
   2. DENR approval – General Water Pollution Control Permit for Concentrated Feeding Operations.
   3. Local ordinance approval.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Items are in accordance with planned decisions and specifications are sufficient to inform owner and contractor of construction requirements within the practice standards.

A. Construction Plans – Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. When job plans are not used or additional drawings are necessary, use appropriate American National Standards Institute ANSI"D" size – Full Size (22" x 34"), Half Size ANSI "B" Size (11" x 17"), or Page Size ANSI "A" size (81/2" x 11") plan sheet.

   1. Overall plan view – of sufficient detail to show all structural alignment, sizes, stationing, elevations, reference points, cultural features, and other details of the facility so they can be located and laid out in the field. These may be superimposed on site topography.
   2. Location or vicinity map – location map with legal description.
   3. Cross section – as needed to show all pertinent details such as side slopes, berms, bottom widths, and elevation. May be plotted or described on overall plan view as needed for clarity.
   4. Structural details – includes dimensional plan views, sectional views to clearly show all needed details for construction. Concrete requires separate sectional and detailing views on all but simple projects.
   5. Table of quantities.
   6. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law, no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   7. JAA – (ref.: NEM, Part 501).

8. When plans are delivered to the cooperator, use form SD-ENG-11 to inform cooperators and certify their understanding of the participant responsibilities.

B. Construction Specifications
1. Use SD Construction and Material Specifications, or equivalent, for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed within JAA limitations.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys – record in field notebook or other survey notes
1. Centerline alignment and reference stakes.
2. Grade and slope stakes.
3. All structural location alignment and reference stakes.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS – record on field notes or on plans.

A. Compliance checking
1. Profiles and cross sections.
2. Measured length of lines by sizes, kinds, and classes of pipe.
3. Materials certification statement (ref.: NEM, Part 512, Subpart C).
4. Number, type, location of appurtenances (inlet structures, pipe supports, valves, stand pipes, etc.)
5. Construction inspection reports – form SD-ENG-19 (ref.: NEM, SD 512.41).
6. Practice component certification statement – as needed – form SD-ENG-2.
7. Results of required testing (concrete, pressure, soil proctor, compacted soil density, soil moisture, soil permeability, seams, etc.)
8. Statement of compliance – state that construction is complete according to plans and specifications and meets the criteria of the applicable practice standards. This should be dated and signed by the person with proper job approval authority.
9. Certification of compliance by design engineer for applicable permits (if applicable).

B. "As Built" Plans - (ref.: NEM, Parts 512.51 and 512.52).
"As-built" plans are a record of constructed facilities. Determination of the need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
1. Significant[1/] design changes.

2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as “As-built” on plans.

[1/] Determination of “significant” is a matter of judgment by someone with appropriate JAA. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

PUMPING PLANT (533)

I. GENERAL

A. References
1. EFH, Chapters 3, Hydraulics.
2. SD Technical Note SD2009-1, Livestock Water Systems Guide.
3. NEH, Part 652, Irrigation Guide, Chapter 7, Irrigation Water Management.
4. NEH, Part 623, Irrigation (NEH, Section 15, Irrigation, Chapter 8, Irrigation Pumping).
5. NEH, Part 651, Agricultural Waste Management Field Handbook.
5. SDTG, Section IV.
6. SD Standard Engineering Plans (Job Plans).

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Capacity requirements – determination of design capacity; source of the water supply.
2. Corrosion potential or conditions (for metal pipe) – soil resistivity readings or other published soils data.
3. Location of underground utilities.

B. Design Surveys
1. Profile along centerline of pipeline from pump to outlet – include all control points, such as pump elevation, critical field elevations, etc.
2. All pertinent water surface elevations

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a MEA must be signed by owner.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
1. Capacity requirements – determination of design capacity; type of pump; vertical suction lift; well information if appropriate; discharge capacity of the pump and the discharge head required.
2. Hydraulic data – SD-ENG-55, Solar Pump Specifications, or other form as appropriate.
3. Structural design computations, depending on structural needs.
4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
1. Water rights – owner is responsible for obtaining water rights from SD DENR.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Overall plan view – should be of sufficient size to show alignment, stationing, areas involved, cultural features, reference points, and pipeline appurtenances.
2. Profiles and design grades – show original ground surface and pipeline invert elevations and grades. Should show stationing, appurtenances, and other information related to construction.
3. Hydraulics – pipe capacities and pressures
4. Structural details – as needed to clarify drawings and show construction details, include plan views and sectional views.
5. Table of quantities – estimates.
6. Location or vicinity map – with legal description.
7. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval – see NEM, Part 501.
9. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures and pipeline appurtenances.

4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Profiles of pipe trench bottom (on short pipelines a minimum of three measurements required to determine depth of cover).
   2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
   3. Elevations at water control structures.
   4. Pipe gauges, thickness, pressure ratings, and markings.
   5. Protective coating used and/or cathodic protection provided.
   6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
   7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
   8. Material certification statement (ref.: NEM, Part 512, Subpart C).
   9. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As-built" Plans (Ref: NEM, SD512.51 and SD512.52).
   "As-built" plans are a record of constructed facilities. Determination of need for "as-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "as-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

SPOIL SPREADING (572)

I. GENERAL

A. References
   1. EFH, Part 650.
   2. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Location of underground utilities.
   2. Evaluate suitability of spoil material for spreading.
   3. Locate areas for spreading surplus spoil material.

B. Design Surveys
   1. Topographic map of area.

C. Environmental Inventory

   NEPA inventory of resources – document inventory on form NRCS-CPA-52.
   1. Cultural resources inventory – use form SD-SSC-1.
   2. Wetland effects (if applicable).
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
      b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
   1. Volume of spoil to be spread.
   2. Determine area required to spread spoil material.
   3. Quantity and cost estimates (SD-ENG 12).

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans – American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.
   1. Overall plan view.
   2. Location map with legal description.
   3. Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   4. Quantities estimates – place on plans.
   5. Job approval – see NEM, Part 501.
   6. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: SD Specification Guide.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)

1. Boundary of spoil spreading area.
2. Quantities – final quantities.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).

1. Application area
2. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
3. Material certification statement (ref.: NEM, Part 512, Subpart C).
4. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As-built" Plans (Ref: NEM, SD512.51 and SD512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "as-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

SPRING DEVELOPMENT

Spring Development (574)

I. GENERAL

A. References
1. SDTG, Section IV. (FOTG)
2. CPSs for Spring Development (574), Livestock Pipeline (516), and Watering Facility (614).
3. EFM, Chapters 3 and 12.
4. NEM.
5. SD Design Technical Note No. 2006-1, Watering Facility Design Criteria for Cattle
6. SD Design Technical Note SD2009-1 Livestock Water Systems Guide

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings – document the subsurface investigation on SD forms or other suitable means.
2. Livestock served in each pasture, total livestock served by the system, season of use, number of farmsteads and houses.
3. Geologic investigation – as required.
4. Location of any known underground utilities.

B. Design Surveys
1. Topographic information – record in field notes – as required for design.
2. Profiles and cross sections – as required.
3. Control elevations and locations of water levels.
   a) Impermeable or restrictive barriers.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects.
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.

III. DESIGN

A. Design Data
1. Estimated yield of spring, if such evidence exists.
2. Livestock or other water needs – ref.: SDTG CPSs 614 and 516.
3. Delivery and overflow pipe.
   a. Hydraulics – to support size, etc.
4. Collection system.
   a. Pipe size determinations.
   b. Gravel or filter pack design.
5. Material quantity estimates.

B. Permits and Wetland Impacts
   1. 404 Permit – document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans
   Use job plans or appropriate American National Standards Institute ANSI "D" size – Full Size (22" x 34"), Half Size ANSI "B" Size (11"x 17"), or Page Size ANSI "A" size (8 ½" x 11") NRCS plan sheets as deemed necessary.
   1. Overall plan view – showing layout of collection system, delivery and overflow pipe, and watering facilities and fencing.
   2. Profile – along centerline of collection system, collection box, delivery and overflow pipe, and watering facility. Show original ground level with facilities superimposed thereon, pertinent elevations, stationing, etc.
   3. Cross sections – as applicable.
   4. Gravel pack or filter gradations – as needed.
   5. Structural details – collection box, barrier, etc., as necessary to clarify intent.
   6. Location map with legal description.
   7. Table of quantities – quantity estimates – put on plans.
   8. Construction notes – as needed for clarity of drawings, specifications, etc. Construction Plans for spring developments shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   9. Job approval – ref.: NEM, Part 501.
   10. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications
   1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
   2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
   3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the check list of furnished specification or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys – record in field notebook.
   1. Set centerline alignment stakes for facilities.
   2. Offset grade or slope stakes.
   3. Location and grade stakes for structures.

B. Quantities of materials – final quantities are based on staked lines and grades and/or approved changes.

VI. COMPLIANCE CHECKING – "AS BUILT" PLANS

A. Compliance checking – record in field notebook, construction plans, or construction inspection report (SD-ENG-19).
   1. Collection system
      a. Pipe – size, type, length.
      b. Installed elevations.
      c. Gravel pack – dimensions, extent, gradation, etc.
      d. Collection box – sizes, materials, elevations.
   2. Delivery system
      a. Pipe – size, type, length, elevations.
   3. Water facility.
      a. Type, overflow outlet pipe materials, size.
   4. Materials certification – ref.: NEM, SD512.21.
   5. Certification statement – practice components – form SD-ENG-2.
   6. Construction inspection report – form SD-ENG-19 – ref.: NEM, SD512.32.
   7. Statement of compliance – state that construction is completed according to plans and specifications. This certification should be dated and signed by the technician with JAA.

B. "As-Built" Plans (ref.: NEM, 512.51 and 512.52).
"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are super-imposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "As-built" on plans. Record the date and person who prepared the "As-built" plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

STREAMBANK AND SHORELINE PROTECTION

Channel Bed Stabilization (584)
Stream Crossing (578)
Streambank and Shoreline Protection (580)
(and Bio-Engineering)

I. GENERAL

A. References

1. SDTG, Streambank and Shoreline Protection (580).
2. NEH, Part 650, Engineering Field Handbook (EFH); Chapter 16 (Streambank and Shoreline Protection), Chapter 18 (Soil Bio-Engineering for Upland Slope Protection and Erosion Protection), and NEH, Part 653, Stream Corridor Restoration.
3. TR25 – Design of Open Channels; TR59 – Hydraulic Design of Riprap Gradient Control Structures.
4. EFH, Chapter 10
5. National Biology Handbook, Part 614.00, Stream Visual Assessment Protocol – Version 2.
6. Applied River Morphology; Rosgen, 1996.
7. Stream Barb Design Note, Version 1, West Region Technical Specialists, 11/16/98.
8. Streambank Erosion Control Manual, U.S. Army COE, 3/93.
9. Federal Highway Administration HEC No. 23, Bridge Scour and Stream Instability Counter Measures (bendway weir design guidance).
10. Peak Flow Frequency Estimates through 1994 for Gauged Streams in South Dakota, U.S. Geological Survey, Open File Report 96-202, 1996.
11. Techniques for Estimating Peak-Flow Magnitude and Frequency Relations for South Dakota Streams, Report 98-4055, 1998.
12. Stream Channel Reference Sites: An illustrated Guide to Field Technique – General Technical Report RM-245, USDA FS.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations

1. Aerial photographs – as needed to compare historical photos with current stream configuration to assess recent changes, alterations, sinuosity, etc.
2. Soils investigations – bed and bank materials of stream.
3. Channel characteristics of stable reaches upstream or downstream of project, including riparian vegetation, channel geometry, grazing influences, etc.
4. Assessment of causes relative to the stream instability – channelization, downcutting, grazing impacts, natural lateral migration, other man caused disturbances, etc.
5. Project location relative to habitat/range of threatened and endangered species.
6. Location of any known underground utilities.

7. Stream classification – stream segments to be protected shall be classified to insure protection measures are compatible with stream type.
    a) Field determined bank full stage.
    b) Bank full discharge (1.5 yr.).
    c) Survey data – as needed to determine stream type.
    d) Width/depth ratio – an index value computed using the bankfull width/mean bank full depth.
    e) Entrenchment ratio – a computed index value which is the flood prone width (which occurs at an elevation twice the maximum bankfull depth)/bankfull width.

B. Design Surveys
1. Site topography – as needed to show physical features of site.
    a) Centerline profiles and cross sections – as needed upstream and downstream of project for water surface profile computation, stream classification, design, etc.
    b) Profiles of thalweg of channel, low bank height, water surface elevation.
    c) Location of stream morphology features – start and end of pool and riffle sections, etc.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects.
    a) Streambank stabilization projects will usually involve locations which are under COE jurisdiction and may require permitting under 404 regulations. Other determinations of wetland effects not required unless project will affect wetlands beyond bed and bank of the stream being stabilized.

III. DESIGN

A. Design Data
1. Determine frequency vs. discharge data – use EFH2, TR55, or USGS flood frequency data as applicable. (Note: Hydrology determined with EFH2 and/or TR55 may not accurately reflect the bankfull geomorphic characteristics of natural channels, but may provide a quick approximation.)
2. Hydraulic analysis – determine stage, discharge, velocity relationships. Calculate water surface profile elevations as appropriate (WSP2, HEC-RAS).
3. Protective measure analysis.
4. Bank protection measures are appropriate – considering geomorphic principals, risk tolerance, economics, esthetics, etc.
5. Stability analysis – as appropriate for structural and/or bio-engineering measures.
6. Structural analysis (not required for standard plan practices).
7. Design elevations.
8. Material volume computations – includes estimates of earthwork, rock, vegetative components, geotextile and erosion control fabrics, etc.
9. Cost estimates (include estimates of labor hours provided by sponsor/owner).

B. Permits and Approvals

1. 404 Permit – document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use standard drawing component details to the extent possible. These are available for many components on various Internet sites as CADD drawings available for download. These are to be supplemented by additional drawings or specification notes as needed on the drawings to provide full installation instructions. Larger or more complex structures require use of appropriate American National Standards Institute ANSI "D" size - Full Size (22" x 34"), Half Size ANSI "B" Size (11"x 17"), or Page Size ANSI "A" size (8 ½" x 11") NRCS plan sheets as deemed necessary.

1. Overall plan view – may be superimposed on site topography; show location, stationing, planned protective measures, etc.
2. Profile – profile along centerline of stream channel, as needed.
3. Sectional views – as required for detailing, dimensioning, planned elevations, etc.
4. Table of quantities – estimates.
5. Location or vicinity map – for Class IV or larger, show location of work from nearest city, town, etc., for other classes, location map with legal description.
6. Job approval – ref.: NEM, Part 501.
7. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed within JAA limitations.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys – record in field notebook.

1. Centerline and location alignment stakes.
2. Reference stakes – include extensions of the structural members to a point outside of the immediate construction area.
3. Grade stakes.
4. Quantities – final quantities are based on staked lines and grades or approved changes.

V. COMPLIANCE CHECKING – "AS-BUILT PLANS"

A. Compliance checking – record on field notes or construction plans.
   1. Construction surveys and measurements made during construction checks.
   2. Structural dimensions, controlling elevations, appurtenances, etc.
   3. Materials testing results.
   4. Construction inspection reports – (ref.: NEM, SD512.32).
   5. Statement of compliance – state that construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

B. "As-Built" Plans (ref.: NEM, 512.51 and 512.52).
"As-built" plans are a record of constructed facilities. Determination of the need for "as-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities – based on layout stake notes, measured quantities, and/or design quantities as appropriate, if no changes were approved and work meets planned lines and grades.
   4. Identify as "as-built" on plans. Record the date and person who prepared the "as-built" plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

TERRACE (600)

I. GENERAL

A. References
1. EFH, Part 650, Chapter 8, Terraces.
2. SDTG, Section IV.
4. Computer software EFM2.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soils map.
2. Conservation plan for unit.
3. Location of underground utilities.
4. Locations of outlets considering erosion, sedimentation, and drainage laws.

B. Design Surveys
1. Parallel terraces.
   a. Topographic map of area as needed.
   b. On small parallel terrace systems where a topographic map is not considered necessary for design, the design survey is usually combined with layout surveys and recorded on Job Plan 9.0, Terraces. All supplementary design information (surveys, etc.,) should be on field notes, CADD files, or worksheets.
2. Basin Terraces.
   a. Drainage area.
   b. Topographic detail for design purposes (where needed).
3. All other terraces – design survey is usually combined with layout survey and recorded on Job Plan 9.0, Terraces. All supplementary design surveys should be put on field notes.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data
1. Parallel terrace system – where topographic map is used for design.

a. Show layout of terrace system superimposed on topog showing terrace interval, alignment, spacing, planned cropping equipment width, etc.
b. Total estimated length.

2. All other terraces – including small parallel terrace systems as needed for terrace design.
   a. Terrace spacing.
   b. Vertical and horizontal interval.
   c. Planned terrace dimensions, grades, and lengths.
3. Basin Terraces.
   a. Hydrology.
   b. Cross-sectional computations for volumes.
   c. Earthwork volume estimates.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans – Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Parallel Terraces.
   a. Overall plan view showing terraces, spacing, gradient, and pertinent elevations. Delineate odd areas. Show turn row strips and farm roads as needed.
   b. Terrace cross section.
   c. Location map with legal description.
   d. Construction plans for terraces shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   e. Quantities estimates – place on plans.
   f. Job approval – see NEM, Part 501.
   g. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."
2. All other terraces – including small parallel terrace systems. Use Job Plan 9.0 if appropriate. Most of the following can be obtained during the layout survey:
   a. Location map with legal description.
   b. Plan view sketch with terrace numbers.
   c. Terrace kinds (level, gradient, parallel, etc.)
   d. Average land slope.
   e. Vertical and horizontal intervals.
   f. Grade by section.
   g. Estimated length of each terrace.
   h. Terrace cross section.
   i. Total lengths.

j. Construction plans for terraces shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**

k. Table of quantities – final quantities are based on staked lines and grades/or approved changes.

l. Job approval – see NEM, Part 501.

B. Construction Specifications

Ref.: SD Specification Guide for Terraces.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys – record in field notebook for basin and large parallel terrace systems and Job Plan 9.0 for other terraces.
   1. Centerline or baseline alignment stakes.
   2. Basic structural staking – as required for fills and cuts not normally included in baseline staking, etc.

B. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record in field notes or on Job Plan 9.0.
   1. Profile notes of channel and ridge for at least one of the new terraces. Cross-sectional notes of channel and ridge for the same terrace. The cross section should include the entire disturbed area of the terrace and must extend above the top of the terrace ridge on the uphill cut slope. The terrace selected should be the one that appears least likely to meet specifications if there is an apparent difference in the sizes of the terraces. In addition to minimum requirements for recorded data, the person doing the checking will run profiles and cross sections of as many terraces or parts of terraces as considered necessary to determine that all work meets specifications. Normally, sufficient terraces should be profiled so that approximately 10 percent or more of the total terrace length is checked.

      Use the backside of Job Plan 9.0, Terraces, for additional cross sections or profiles. For larger projects, use field notebook and "E" or "N" sized drawing sheets as appropriate for plotting profiles and cross sections.
   2. Compute channel cross-sectional area and record.

3. Check channel grades for gradient terraces and ridge grades for level terraces.
4. Statement as to adequacy of outlet protection when appropriate.
5. Size, slope, and type of closed conduits where appropriate.
6. Adequacy or status of seeding for grassed back and basin terraces.
7. Installed quantity of work or materials. Measure constructed length of each completed terrace, use measuring wheel, chain, or tape.
8. Construction inspection report – form SD-ENG-19 – ref.: NEM, SD512.32.
9. Statement of compliance – state that construction is complete according to plans and specifications, dated and signed by the technician with JAA.

B. "As-Built" Plans (ref.: NEM, 512.51 and 512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – based on final measurements (as staked or approved).
4. Identify as "as-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

UNDERGROUND OUTLET (620)

I. GENERAL

A. References
1. EFH, Part 650, Chapter 3, Hydraulics
2. NEH, Part 634, Hydraulic Engineering.
3. EFH, Part 650, Chapter 8, Terraces.
4. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings – record on form SD-ENG-45 or SD-ENG-10 to determine trench and bedding requirements, as needed.
2. Location of underground utilities.
3. Locations of outlets considering erosion, sedimentation, and drainage laws.

B. Design Surveys
1. Profile along centerline of pipeline – include all control points, such as structure elevations and critical field elevations.
2. Topographic map – where required to aid in positioning pipeline, determine outlet locations, etc.
3. All pertinent water surface elevations – water supply ditch, check structures, high watermarks, etc.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable):
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data – record on standard data sheets and/or appropriate worksheets.
1. Capacity requirements
2. Hydraulic data – use form SD-ENG-5, 5b, or other form as appropriate.
3. Structural design computations, depending on structural needs.
4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
1. Water rights – owner is responsible for obtaining water rights from SD DENR.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans – Use SD standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSSI "D" size – full size (22" x 34"), half size ANSI "B" size (11" x 17"), or page size ANSI A (81/2" x 11") drawing sheets.

1. Overall plan view showing underground outlets, gradient, and pertinent elevations.
2. Profiles and design grades.
3. Location map with legal description.
4. Construction plans for terraces shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
5. Quantities estimates – place on plans.
6. Job approval – see NEM, Part 501.
7. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."
8. Construction plans for terraces shall include the following statement: "According to SD State Law no excavator may begin any **excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
9. Table of quantities – final quantities are based on staked lines and grades/or approved changes.
10. Job approval – see NEM, Part 501.

B. Construction Specifications

Ref.: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys (use field notebook)

1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures and pipeline appurtenances.
4. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Profiles of pipe trench bottom (on short pipelines, a minimum of three measurements required to determine depth of cover).
   2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
   3. Elevations at water control structures.
   4. Pipe gauges, thickness, pressure ratings, and markings.
   5. Protective coating used and/or cathodic protection provided.
   6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
   7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
   8. Material certification statement (ref.: NEM, Part 512, Subpart C).
   9. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As-Built" Plans (ref.: NEM, 512.51 and 512.52).

"As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities – based on final measurements (as staked or approved).
4. Identify as "as-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

WATER WELL (642)

I. GENERAL

A. References
1. EFH, Part 650, Chapter 12.
2. SD Well Construction Standards
4. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Geological review – as required.
2. Well location.
3. Location of underground utilities.

III. DESIGN

A. Design Data
1. All significant and appropriate design information required for design purposes.
2. Sanitary protection requirements where water is intended for household or dairy sanitation use.
3. Artesian pressure confinement protection.

B. Permits and Approvals (as applicable)
1. Domestic use for farm, ranch, household, and livestock use from other than a common water distribution system in excess of either 25,920 gpd (18 gpm continuously for 24 hrs.) or 25 gpm requires a water permit.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans
1. Location map – use form SD-ENG-51 or other suitable design sheet, as applicable (i.e., a well driller's report to the state).
2. Completion of other appropriate parts of form SD-ENG-51.
3. Sanitation protection requirements, as required.
4. Plan view of facility – as required to show diversions, fencing, clearing, etc.

B. Construction Specifications

Ref.: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys – record in field notebook.
   1. As required for location, diversion, fencing, etc.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance Checking
   1. Obtain all significant and appropriate construction information as required on form SD-ENG-51 including:
      a. Drilling log (ref.: footnote[1/] on form SD-ENG-51); form SD-ENG-45 could be used if drilling contractor does not have his own log forms.
      b. Water quality sample – SD Well Construction Standards require "following completion of any public water supply or any well for domestic use, a water sample shall be collected and submitted." The owner is responsible for collecting and submitting the sample unless the well is operational when completed by the driller, in which case, the driller is responsible for submitting the sample.
   2. Adequacy of pumping equipment, storage and water facility – if installed at time of compliance checking.
   3. Material certification records (ref.: NEM, Part 512).
   4. Construction inspection report (ref.: NEM, Part 512).
   5. Well Driller's Compliance Certification – form SD-ENG-51.

WATER WELL DECOMMISSIONING (351)

I. GENERAL

A. References
1. EFH, Part 650, Chapter 12.
2. SD Well Construction Standards.
3. ASTM Standard guide for Decommission of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities.
4. SDTG, Section IV.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. "As-built" construction documents, maintenance records, and other available data.
2. Existing condition of the well.
3. Well location.
4. Location of underground utilities.

III. DESIGN

A. Design Data
1. All significant and appropriate design information required for design purposes.
2. Disinfection of the well.
3. Sealing materials

B. Permits and Approvals (as applicable)
1. Well drillers performing the work must be licensed in SD and must submit well plugging records to the SD OIC.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans
1. Location map – use form SD-ENG-50 or other suitable design sheet, as applicable (i.e., a well driller's report to the state).
2. Completion of other appropriate parts of form SD-ENG-50.
3. Sanitation protection requirements, as required.

4. Plan view of facility – as required to show diversions, fencing, clearing, etc.

B. Construction Specifications

Ref.: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys – record in field notebook.

1. As required for location, diversion, fencing, etc.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance Checking

1. Obtain all significant and appropriate construction information as required on form SD-ENG-51 including:
   a. Drilling log (ref.: footnote[1/] on form SD-ENG-51); form SD-ENG-45 could be used if drilling contractor does not have his own log forms.
   b. Water quality sample – SD Well Construction Standards require "following completion of any public water supply or any well for domestic use, a water sample shall be collected and submitted." The owner is responsible for collecting and submitting the sample unless the well is operational when completed by the driller, in which case, the driller is responsible for submitting the sample.
2. Adequacy of pumping equipment, storage and water facility – if installed at time of compliance checking.
3. Material certification records (ref.: NEM, Part 512).
4. Construction inspection report (ref.: NEM, Part 512).
5. Well Driller's Compliance Certification - form SD-ENG-51.

WATERSPREADING (640)

I. GENERAL

A. References
1. EFH, Part 650.
2. SDTG, Section IV.
3. Computer Software – SITES, EFH 2, TR-55.
4. SD Irrigation Guide.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil survey of spreading area to determine suitability of soils.
2. Soil borings as required.
3. Determine spreading area (consider water supply available for dependable and questionable yields).
4. Evaluate drainage area characteristics, (local knowledge on water yields, flow durations, etc.)
5. Location of underground utilities.

B. Design Surveys
1. Topography or topographic map of survey area. Determination of need by individual who will exercise JAA. A topographic map will normally be required for systems over five acres in size (total station survey) to include the spreading area as well as the storage pool of any retention dams.
2. Locate and survey centerline of existing diversions and proposed diversions and supply channels.
3. Locate all control elevations, outlets, etc.

C. Environmental Inventory

NEPA inventory of resources – document inventory on form NRCS-CPA-52.
1. Cultural resources inventory – use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a MEA must be signed by owner.

III. DESIGN

A. Design Data – record on standard data sheets and/or appropriate worksheets.
1. Hydrologic data – peak flow, storm runoff, annual yield (form SD-ENG-29, EFH 2, TR-55, SITES) and flow duration.
2. Hydraulic requirements – supply channel requirements, ditches, dikes, structures, emergency spillways, drains, etc.
3. Type of spreading system to be installed.
4. Design water requirements (dependable/questionable water supply).
5. Structure data – surface area, storage, sediment volume, structural design as needed.
6. Structural design computations, depending on structural needs.

7. Quantity and cost estimates (SD-ENG 12).

B. Permits and approvals (if applicable).
   1. 404 Permit – document if individual permit obtained, nationwide permit applies, or if practice is exempt.
   2. Safety of dams – when a structure is classified as a 'dam' by SD DENR, the design shall be submitted to DENR for approval.
   3. Water rights – owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of American National Standards Institute ANSI "D" size – full size (22" x 34"), half size ANSI "B" Size (11" x 17"), or page size ANSI "A" size (8 ½" x 11") drawing sheets.

1. Overall plan view – may include topography, layout, and location of diversions, ditches, dikes, structures, spillways, drain pipes, and streams. Show all necessary elevations, linear stationing, and other details of construction.
2. Profiles of supply channels, dams, pumping stations, emergency spillways, and outlet pipes as necessary for clarity of drawings.
3. Cross sections – show typical cross sections of ditches, supply channels, dikes and dams, emergency spillways, etc.
4. Structural details as needed to clarify drawings.
5. Log of soil borings.
6. Show location and extent of borrow area.
7. Table of quantities – estimates.
8. Location or vicinity map – with legal description.
9. Construction notes – add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans for water spreading systems shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
10. Job approval – see NEM, Part 501.
11. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: SD Specification Guide for the intended practice.

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in

the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook).
   1. Centerline alignment and cut/fill stakes.
      a. Dikes – front toe every 100 feet with centerline and back toe approximately every 400 feet.
      b. Spreader ditches – alignment or baseline stakes at 50-foot intervals. Upper slope stake on approximately 300-foot intervals to assist the contractor in elevation control.
      c. Supply or drainage ditches.
   2. Structure location, alignment, and elevations (drain pipes, water control structures, etc.).
   3. Diversion dams – refer to layout section for earth dams.

B. Earthwork Quantity Computations
   1. Compute from layout notes – final quantities are based on staked lines and grades or approved changes. Spreader ditches based on lineal feet from layout notes or approved changes.
   2. Methods to be used in making computations of quantities:
      a. Earthwork Computation Sheet (SD-ENG-33).
      b. Three level section (SD-ENG-32).
      c. Technical Note Engineering Design (SD-1).
      d. Computer software – Areavol, Ohio Cross Sections with quantities, Terra Model, Civil 3D.
   3. Show quantities of all components in the table of quantities on the plans.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance checking – record on field notes or construction plans (SD-ENG-19).
   1. Profiles on centerline of embankments, channels, dikes, and ditches.
      a. Check a minimum of one or more dikes or ditches per system. Sufficient checks will be made by the checker as considered necessary to determine that all work meets specifications.
   2. Cross sections of emergency spillways, dam embankments, channels, ditches, etc.
   3. Elevations and lengths of inlet and outlet of drain tubes, control structures and other appurtenances.
   4. Pipes – check length, gauge, thickness, type, diameter.
   5. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
   6. Material certification statement (ref.: NEM, Part 512, Subpart C).
   7. Statement of compliance – state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As-built" Plans (ref.: NEM, SD512.51 and SD512.52).
   "As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising JAA in accordance with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.

2. Significant[1/] changes in linear measurement.
3. Final quantities – may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as “As-built” on plans.

[1/] Determination of “significant” is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

WETLANDS

Wetland Creation (658)
Wetland Enhancement (659)
Wetland Restoration (657)

I. GENERAL

A. References
1. EFH , Part 650, Chapter 13. Wetland Restoration, Enhancement, or Creation.
2. Biology Technical Note Number 16, Wetland Vegetation Establishment.
3. Biology Technical Note Number 17, Wetland Development and Planning.
4. Biology Technical Note Number 18, Wetland Topographic Design.
5. EFM, Chapter 14.
6. SDTG CPSs 657, 658, and 659.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Geologic investigation as needed.
      a. Soil borings – document the subsurface investigation on SD forms or other suitable means.
      b. Soil survey.
   2. The soil, hydrology, and vegetative characteristics existing on the site and the contributing watershed shall be documented before any alteration of the site begins.
   3. Location of underground utilities.

B. Design Surveys
   1. Topographic detail – as needed to reflect existing topography and details such as roads, fence lines, outlets, wetland bottom, manipulations at the wetland sites, areal extents associated with various estimated water depth, and elevation of water control structures, etc., (field notes or data collector).
   2. Levels of soil nutrients, organic matter, and moisture.
   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 non-native plant species.

C. Environmental Inventory
   NEPA inventory of resources – document inventory on form NRCS-CPA-52.
   1. Cultural resources inventory-– use form SD-SSC-1.
   2. Wetland effects.
      a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner. This procedure only satisfies Swampbuster provisions in the NFSAM and does not fully satisfy Executive Order 11990. All projects must follow proper sequencing of first avoidance, then minimization, then mitigation.

III. DESIGN

A. Design Data

1. Document that soils and hydrologic conditions at the site will be adequate to accomplish the wetland restoration, enhancement, or creation and how conditions consistent with NRCS wetland criteria will be established.
2. Document the plant communities present and the measures planned to assure that a suitable wetland plant community will be established.
3. State Approved Equivalent Functional Type Assessment.
4. SD-CPA-19 and/or Biology Technical Note Number 17 Attachment A.
5. Biology Technical Note Number 16 wetland seeding mix documented on the SD-CPA-4.
6. Quantities – estimates as needed.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of "E" (21" x 30,") 11"x17," or "N" (10 1/2" x 15") sized, drawing sheets.

A. Construction Plans

1. Overall plan view showing location of existing and planned elements associated with the wetland work. Show linear stationing, benchmark locations, and elevations as necessary.
2. Location or vicinity map – location map with legal description.
3. Typical cross sections – as necessary.
4. Appurtenant structures and details - include dimensional plans and sectional views to clearly show all intended details for construction.
5. Construction notes as needed to clarify drawings. All Construction plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation.** 1-800-781-7474."
6. Quantities estimates – place on plans.
7. Engineering Job Approval – ref.: NEM, Part 501.
8. Documentation Checklist(s) – Wetland Restoration (Ditch Plug) (657) as applicable.
9. SD-ENG-14 form as applicable.
10. When plans are delivered to the cooperator – use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in

the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout survey – record in field notebook.
   1. Centerline alignment and offset stakes:
      a. Set centerline stakes at maximum 100-foot intervals.
      b. Offset grade stakes at maximum 100-foot intervals. Reference grade stakes to desired elevation to 0.1 foot.
      c. Location and grade stakes for appurtenances.

B. Quantities – final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING – "AS-BUILT" PLANS

A. Compliance Checking - record in field notes.
   1. Check completed earthwork to assure that planned features meet required depth, dimensions and slopes.
   2. Location and dimensions of appurtenances.
   3. Construction inspection report - form SD-ENG-19 - ref.: NEM, SD512.32.
   4. Material certification statement (ref.: NEM, Part 512, Subpart C).
   5. Statement of compliance - state that construction is complete according to plans and specifications. Date and sign by the technician with job approval authority.

B. "As-Built" Plans (ref.: NEM, 512.51 and 512.52).
   "As-built" plans are a record of constructed facilities. Determination of need for "As-built" plans will be made by the person exercising job approval authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "as-built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

SOUTH DAKOTA ENGINEERING
DOCUMENTATION AND SPOT CHECKING MANUAL

DOCUMENTATION CHECKLIST
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DOCUMENTATION CHECKLIST

EMBANKMENT POND (378)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	SD-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill, excavation, or pool will impact wetland; use Expedited ME #9 if applicable, or use HGM)	SD-CPA-10
PERMITS & CERTIFICATIONS (landowner responsible)	
____ Corps of Engineers Section 404 of Clean Water Act	ENG FORM 4345
____ Location Notice for Dam/Dugout	Location Notice ...
____ Water Right (if storing ≥ 25 acre-feet)	Appl. for Permit to Approp.
____ Safety of Dams review (if categorized as a dam by state law)	Water (Forms 2 & 2A)
____ Storm Water Permit (if disturbing more than 1 acre)	Letter to DENR (Water Rights)
____ Storm Water Pollution Prevention Plan (if disturbing more than 1 acre)	from NRCS Engineer
HAZARD CLASSIFICATION & BREACH ANALYSIS	
____ Hazard Classification with map	SD-ENG-57 & Map
____ Hazard Letter to Producer	
____ Breach Analysis	Simple Dam Break or other
DESIGN	
____ Design survey	SCS-ENG-28&29 or topo survey
____ Plastic Pipe calculations (if pipe being installed)	
____ Log of soil borings	SD-ENG-10 or SD-ENG-45
____ Hydrologic data (with USGS topographic map)	SD-ENG-29, OHIO or EFM2/EFH2
____ Hydraulic data	SD-ENG-29 or flood routing
____ Structure data (include the hazard class)	SD-ENG-29 and JP 1.0
____ Quantity calculations	SD-ENG-32, AreaVol, OHIO, etc.
____ Cathodic Protection & Soil Resistivity Tests (if needed)	
____ Layout survey	SCS-ENG-28&29
PLANS & SPECIFICATIONS	
____ Plan view, profile, and cross-sections	JP 1.0
____ Plan sheets for principal spillway, pipe supports, etc.	JP 2.0, 2.1, 3.8, etc.
____ Construction notes (with SD One-Call statement)	JP 1.0
____ Construction and Material Specifications	SD-4, SD-5, SD-7S, etc.
____ Table of quantities	JP 1.0 or SD-ENG-12
____ Signature for designer, checker, job approval	JP 1.0
____ Operation & Maintenance Guidelines	SD-O&M-378
____ Cost estimate	SD-ENG-12 or spreadsheet
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction check survey	SCS-ENG-28&29
____ As-built drawings & quantities with compliance statement	JP 1.0
____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
____ Construction inspection report (use if NRCS inspected)	SD-ENG-19

Note: This checklist is a guide. Some items may not be necessary for each project.

DOCUMENTATION CHECKLIST

EXCAVATED POND (DUGOUT) (378)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill or excavation will impact wetland; use Expedited ME #2 if applicable, or use HGM)	SD-CPA-10
PERMITS & CERTIFICATIONS (to be obtained by landowner)	
____ Location Notice for Dam/Dugout	Location Notice
____ Corps of Engineers Section 404 of Clean Water Act (needed if not using an Expedited ME)	ENG FORM 4345
DESIGN	
____ Design and/or Layout Survey	JP 7.0 or SD-ENG-52
____ Log of Soil Borings	SD-ENG-13
____ Hydrologic Data (with USGS topographic map)	SD-ENG-29 or OHIO
____ Quantity Calculations	SD-ENG-32 or JP 7.0
PLANS & SPECIFICATIONS	
____ Plan View	JP 7.0 or SD-ENG-52
____ Construction Notes (with SD One-Call statement) J	P 7.0 or SD-ENG-52
____ Construction and Material Specifications	SD-6
____ Table of Quantities	JP 7.0 or SD-ENG-12
____ Signature for designer, checker, job approval	JP 7.0 or SD-ENG-52
____ Operation and Maintenance Guidelines	SD-O&M-378
____ Cost Estimate	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction Check Survey	JP 7.0 or SD-ENG-52
____ As-built drawings and quantities with compliance statement	JP 7.0 or SD-ENG-52
____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

LIVESTOCK PIPELINE (516)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if pipeline crosses wetland; use Expedited ME #10)	SD-CPA-10
DESIGN	
____ Design Data	JP 12.1 or SD-ENG-48A
____ Hydraulics and Profile	SD-ENG-5D or PipeDesign
____ Material Estimates	JP 12.1 or SD-ENG-48A
PLANS & SPECIFICATIONS	
____ Plan view and profile	JP 12.1 or SD-ENG-48A
____ Pipeline Appurtenances	JP 12B
____ Construction Notes (with SD One-Call statement)	JP 12.1
____ Construction and Material Specifications	JP 12.1 or SD-ENG-48A
____ Signature for designer, checker, job approval	JP 12.1 or SD-ENG-48A
____ Operation and Maintenance Guidelines	SD-ENG-11P
____ Cost Estimate (not needed for Job Class III and under; contract documents are adequate)	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11P
CONSTRUCTION	
____ Construction Check Survey	JP 12.1 or SD-ENG-48A
____ As-built drawings and quantities with compliance statement	JP 12.1, SD-ENG-48A, or SD-ENG-5D
____ Certification Statement (contractor)	JP 12.1 or SD-ENG-48A
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

PUMPING PLANT (533)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	SD-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill, excavation, or pool will impact wetland; use Expedited ME #9 if applicable, or use HGM)	SD-CPA-10
PERMITS & CERTIFICATIONS (landowner responsible)	
____ Installation by licensed well driller or pump installer	http://denr.sd.gov/des/wr/dbdrillerlist.aspx
____ Homeowner Wiring Permit or wiring completed by licensed electrician.	http://dlr.sd.gov/bdcomm/electric/echomeowner.aspx
DESIGN	
____ Daily Water Requirement	SD-ENG-47
____ Pump Technical Data	Job Plan 12.1 or 22.0
____ Pressure Tank Size	Job Plan 12.1 or 22.0
____ Total Dynamic Head	Job Plan 12.1 or 22.0
____ Pressure Switch Settings	Job Plan 12.1 or 22.0
____ Pump Curve	Job Plan 12.1 or 22.0
PLANS & SPECIFICATIONS	
____ Plan view	Job Plan 12.1 or 22.0
____ Appurtenances (protection of above ground components)	Job Plan 12B
____ Construction notes (with SD One-Call statement)	Job Plan 12.1 or 22.0
____ Construction and Material Specifications	SD-ENG-11
____ Signature for designer, checker, job approval	Job Plan 12.1 or 22.0
____ Operation & Maintenance Guidelines	SD-ENG-11 (add)
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____Final Inspection of Homeowner Wiring	Sticker will be placed in well service panel by electrical inspector.
____ Construction check survey (Pump Curve, Brand, Model, Horsepower)	SCS-ENG-28&29
____ As-built drawings & quantities with compliance statement	Job Plan 12.0 or 22.0
____ Certification Statement (use if NRCS did not inspect)	Job Plan 12.1 or 22.0
____ Construction inspection report (use if NRCS inspected)	SD-ENG-19

Note: This checklist is a guide. Some items may not be necessary for each project.

DOCUMENTATION CHECKLIST

WATERING FACILITY (614)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
DESIGN	
____ Water Requirements	SD-ENG-47
____ Tank Capacity	SD-ENG-47
PLANS & SPECIFICATIONS	
____ Plan view and side view	JP 14.1, 14.2, 14.3, 14.5D, etc.
____ Guard post assembly	As shown on tank JP; or JP 14.6
____ Table of Quantities	Job Plans
____ Construction Notes (with SD One-Call statement)	Job Plans
____ Construction and Material Specifications	SD-16
____ Signature for designer, checker, job approval	Job Plans
____ Operation and Maintenance Guidelines	SD-ENG-11P
____ Cost Estimate (not needed for Job Class III and under; contract documents are adequate)	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11P
CONSTRUCTION	
____ Construction Check Survey	Job Plans
____ As-built drawings and quantities with compliance statement	Job Plans
____ Certification Statement (use if NRCS did not inspect)	JP 12.1
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

WATER WELL (642)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
DESIGN	
____ Record of Installation	SD-ENG-51
____ Well driller's log	Provided by well driller
____ Water analysis (if well is for domestic use)	Provided by driller or owner
PLANS & SPECIFICATIONS	
____ Construction and Material Specifications	SD-32
____ Signature for Job Approval	SD-ENG-51
____ Operation and Maintenance Guidelines	SD-O&M-642
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction Check Survey	SD-ENG-51
____ Certification Statement (well driller)	SD-ENG-51
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

SPRING DEVELOPMENT (574)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill, excavation, or collection trench will impact wetland; use HGM on a case-by-case basis)	SD-CPA-10
PERMITS & CERTIFICATIONS (to be obtained by landowner)	
____ Corps of Engineers Section 404 of Clean Water Act (if fill is to be placed in wetland)	ENG FORM 4345
DESIGN	
____ Quantity Calculations	SCS-ENG-523
PLANS & SPECIFICATIONS	
____ Plan view, profile, and detailed drawings	JP (Spring Development)
____ Construction notes (with SD One-Call statement)	JP (Spring Development)
____ Construction and Material Specifications	SD-7U, SD-20A, SD-55, etc.
____ Table of Quantities	JP (Spring Development)
____ Signature for designer, checker, job approval	JP (Spring Development)
____ Operation and Maintenance Guidelines	SD-O&M-574
____ Cost Estimate	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction check	JP (Spring Development)
____ As-built drawings and quantities with compliance statement	JP (Spring Development)
____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

GRASSED WATERWAY (412)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill or excavation will impact wetland; use Expedited ME #1 if applicable, or use HGM)	SD-CPA-10
PERMITS & CERTIFICATIONS (to be obtained by landowner)	
____ Corps of Engineers Section 404 of Clean Water Act (needed if not using an Expedited ME)	ENG FORM 4345
DESIGN	
____ Design Survey	SCS-ENG-28&29
____ Hydrologic Data (with USGS topographic map)	SD-ENG-29, OHIO, or EFM2/EFH2
____ Hydraulic Data	SD-ENG-29 or OHIO
____ Quantity Calculations	SD-ENG-32, AreaVol, or OHIO
____ Layout Survey	SD-ENG-28&29
PLANS & SPECIFICATIONS	
____ Plan view, profile, and cross-sections	JP 8.0
____ Construction notes (with SD One-Call statement)	JP 8.0
____ Construction and Material Specifications	SD-27, SD-28
____ Operation and Maintenance Guidelines	SD-O&M-412
____ Quantity estimates	JP 8.0
____ Signature for designer, checker, job approval	JP 8.0
____ Cost Estimate	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction Check Survey	SCS-ENG-28&29
____ As-built drawings and quantities with compliance statement	JP 8.0
____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

TERRACE (600)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
DESIGN	
____ Design Data	SCS-ENG-523 or NE Terrace
____ Hydrologic Data (with USGS topographic map)	SD-ENG-29, OHIO, or NE Terrace
____ Hydraulic Data	SD-ENG-29, OHIO or NE Terrace
____ Quantity Calculations	JP 9.0, SD-ENG-1, or NE Terrace
____ Layout Survey	SCS-ENG-28&29 or JP 9.0
PLANS & SPECIFICATIONS	
____ Plan view and typical cross-sections	JP 9.0 or SD-ENG-1
____ Construction notes (with SD One-Call statement)	JP 9.0 or SD-ENG-1
____ Construction and Material Specifications	SD-26, SD-28
____ Operation and Maintenance Guidelines	SD-O&M-600
____ Quantity Estimates	JP 9.0 or SD-ENG-1
____ Signature for designer, checker, job approval	JP 9.0 or SD-ENG-1
____ Cost Estimate	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction Check Survey	JP 9.0, SD-ENG-1, or NE Terrace
____ As-built elevations and quantities with compliance statement	JP 9.0 or SD-ENG-1
____ Certification Statement	SD-ENG-2 or SD-ENG-1
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

WETLAND RESTORATION (DITCH PLUG) (657)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill or excavation will impact wetland; use Expedited ME #6 if applicable, or use HGM)	SD-CPA-10
PERMITS & CERTIFICATIONS (to be obtained by landowner)	
____ Corps of Engineers Section 404 of Clean Water Act (NWP 27)	ENG FORM 4345
____ Location Notice for Dam/Dugout	Location Notice
____ Water Right (if storing ≥25 acre-feet)	Appl. for Permit to Approp.Water (Forms 2 & 2A)
____ Safety of Dams review (if categorized as a dam by state law)	Letter to DENR (Water Rights) from NRCS Engineer
DESIGN	
____ Design survey (not needed if installing as "each" in CRP)	SCS-ENG-28&29
____ Quantity Calculations (not needed if installing as "each" in CRP)	SD-ENG-32, AreaVol, or OHIO
____ Layout Survey (not needed if installing as "each" in CRP)	SCS-ENG-28&29
PLANS & SPECIFICATIONS	
____ Profile and Cross-Section	SD-ENG-14
____ Construction Notes (with SD One-Call statement)	SD-ENG-14
____ Construction and Material Specifications	SD-ENG-14
____ Table of Quantities	SD-ENG-14
____ Signature for designer, checker, job approval	SD-ENG-14
____ Cost estimate (not needed if installing as "each" in CRP)	SD Cost Estimate Worksheet
____ Participant Responsibilities	SD-ENG-11
CONSTRUCTION	
____ Construction Check Survey	SD-ENG-14 or SCS-ENG-28&29
____ As-built drawings and quantities with compliance statement	SD-ENG-14
____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

DOCUMENTATION CHECKLIST

GRASSED WATERWAY (412)

ITEM	FORM NUMBER
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	
____ Environmental Effects for Conservation Planning	NRCS-CPA-52
____ Cultural Resources Field Review	SD-SSC-1
____ Minimal Effect (if fill or excavation will impact wetland; use Expedited ME #1 if applicable, or use HGM)	SD-CPA-10
PERMITS & CERTIFICATIONS (to be obtained by landowner)	
____ Corps of Engineers Section 404 of Clean Water Act (needed if not using an Expedited ME)	ENG FORM 4345
DESIGN	
____ Design Survey	SCS-ENG-28&29
____ Hydrologic Data (with USGS topographic map)	SD-ENG-29, OHIO, or EFH2
____ Hydraulic Data	Grassed Waterway Design Software
____ Quantity Calculations	Grassed Waterway Design Software
____ Layout Survey	SCS-ENG-28&29
PLANS & SPECIFICATIONS	
____ Plan view, profile, and cross-sections	Grassed Waterway Design Software
____ Construction notes (with SD One-Call statement)	Grassed Waterway Design Software
____ Construction and Material Specifications	Grassed Waterway Design Software
____ Operation and Maintenance Guidelines	Grassed Waterway Design Software
____ Quantity estimates	Grassed Waterway Design Software
____ Signature for designer, checker, job approval	Grassed Waterway Design Software
____ Cost Estimate	Grassed Waterway Design Software
____ Participant Responsibilities	SD-ENG-11W, Grassed Waterway Design Software
CONSTRUCTION	
____ Construction Check Survey	Grassed Waterway Design Software
____ As-built drawings and quantities with compliance statement	Grassed Waterway Design Software
____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
____ Construction Inspection Report (use if NRCS inspected)	SD-ENG-19

NOTE: The Grassed Waterway Design Software is a spreadsheet tool that combines the design, quantity calculations, plans, specifications, operation and maintenance guidelines, construction quantities, cost estimate, certification, and participant responsibilities.

This spreadsheet is located @ http://www.sd.nrcs.usda.gov/technical/Engineering_Tools.html