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500.0 Purpose

A. This manual presents engineering policy clearly and completely so that NRCS engineering activities can be effectively and efficiently implemented. These policies are provided for the purpose of establishing and maintaining the technical excellence in engineering that results from a knowledge of engineering principles and the ability to apply that knowledge effectively. This manual also serves to coordinate an interdisciplinary team approach to engineering activity.

B. The policies in this manual apply to both Federal employees and contractors. Although it is NRCS policy to maintain a viable engineering staff, trained and experienced in the type of skills needed to support the NRCS natural resources conservation program, the agency recognizes that there will be situations for which sufficient staff or expertise is not available. Under these conditions, contracting is an alternative for expediting engineering activities.

C. The policies stated in this manual apply to engineering work performed for others under cooperative working agreements, in memoranda of understanding, or under any other agreement entered into by NRCS.

500.1 Abbreviations

A. CED.—Conservation Engineering Division

B. NEH.—National Engineering Handbook

C. NEM.—National Engineering Manual

D. NHCP.—National Handbook of Conservation Practices

500.2 Policy

All engineering work performed by or for NRCS must conform to the requirements stated in this manual.

§IA500.3 NRCS Engineering Services

A. NRCS performs engineering services to plan, design, and install conservation practices in accordance with conservation plans, District priorities, project measure plans, and/or other plans that are developed to further the mission of the agency and treat resource concerns. Technical assistance may be provided to individual landowners, groups of landowners, or to units of government.

(1) Technical Assistance to Individual Landowners

Technical assistance to individual landowners shall be provided on those practices where NRCS standards are available. Technical assistance is normally limited to Job Approval Classes I through V. Technical assistance on more complex jobs may be provided by the NRCS to the extent that personnel services are available from all required NRCS organizational levels.

(2) Technical Assistance to Groups of Landowners

Technical assistance to groups of landowners will be provided as described in (1) for individual landowners.

(3) Technical Assistance to Individual Landowners in Urban Areas

Technical assistance to individual landowners in urban areas shall be limited to Conservation District priorities.

(4) Technical Assistance to State and Local Units of Government

Policy for providing assistance to state and local units of government is presented in Title 440, General Manual, Part 401.

B. NRCS engineering assistance can best be used where:

(1) Engineering costs are high in relation to total project costs.
(2) The landowner needs added incentive to apply the practice.
(3) Private engineers are not available or not interested.
(4) The project meets goals and objectives set in the Conservation District's Plan of Operations.
(5) The landowner has surveys, maps, geologic investigations, or designs furnished by private engineers or will furnish personnel and equipment to assist with the work.
(6) NRCS has adequate resources available to do the work.

C. Part 505 provides policy on the use of non-NRCS engineering services.

§IA500.4 Area Engineer Responsibilities

A. The Assistant State Conservationist for Field Operations, ASTC (FO), with the concurrence of the State Conservation Engineer, will name one engineer in the area to provide engineering leadership to all programs.

B. This engineer shall be responsible for the quality of all engineering work in the area. Work will be done in accordance with assignments made by the ASTC (FO) or designated representative.

C. This engineer's duties will include:

(1) Provide engineering and engineering management guidance to the ASTC (FO).
(2) Take leadership in preparing area engineering policy and procedures.
(3) Coordinate the quality assurance reviews of engineering work.
(4) Evaluate engineering training needs.
(5) Develop and implement an engineering training program in the area.
(6) Assign all engineering job approval authority classifications in the area for employees in grades up to and including GS-10.
(7) Ensure that proper care and maintenance of engineering equipment occurs. Care and maintenance of equipment shall be in accordance with the Engineering Field Handbook, Chapter 1.
(8) Provide engineering equipment inventory updates to the ASTC (FO). Work in this area shall be in accordance with Title 120, General Manual, Part 407 – Real Property.

§IA500.5 Request for Assistance from Area Engineering Staff

A. Assistance should be requested for any project which exceeds the technical capability or workload of the field office. The District Conservationist will submit a request for engineering on Form IA-CPA-17 to the Assistant State Conservationist for Field Operations, ASTC (FO), or designated representative for each job. The Area Engineer will determine the minimum amount of information to be included with the request.

B. The ASTC (FO) or designated representative will review requests for completeness and establish priorities for assistance. After approval, the ASTC (FO) or designated representative will delegate the project to an appropriate staff member. The staff member will then schedule the needed assistance.

C. After making a field investigation, the engineering staff member will provide any recommendations and, if applicable, a preliminary cost estimate to the field office. When a substantial amount of engineering time will be required to carry out the job, the engineering staff member will consult with the ASTC (FO) or designated representative before returning the request and committing the time.

D. The engineering staff will provide assistance, as needed, with surveys, designs, preparation of drawings and specifications, and construction inspection on jobs that are beyond the capabilities of field office personnel.

§500.6 Request for Assistance from State Office Engineering Staff

For complex practices requiring NRCS engineering assistance from outside the area, the Assistant State Conservationist (Field Operations) shall submit a request for assistance to the State Conservationist with a copy to the State Conservation Engineer and shall receive approval prior to committing the NRCS to proceed beyond the Inventory and Evaluation level. This section does not apply to job class V or lower projects which are being submitted to the state office for review and approval purposes only.

The request will include but not be limited to the following items:

A. Location of the proposed site.

B. General description of the practice and a brief discussion of complexities involved including documentation of job approval classification and hazard classification.

C. Purpose of the practice.

D. Identification of the landuser(s) or entity requesting assistance.

E. Projected type and amount of assistance needed from outside the area. For example: feasibility, geologic, flood routings, structural design, etc.

Subpart A - Review and Approval

501.0 General

A. Engineering practices have the potential, upon failure, to affect public health and safety and cause loss of life and significant property damage, depending on the size, location, and complexity of the work. For this reason, the practice of engineering is regulated by State law governing professional engineering, requiring professional registration as described in Title 210, General Manual (GM), Part 402.

B. The development of engineering plans or engineering aspects of conservation practices requires that the approving engineer obtain and integrate the needed assistance from an interdisciplinary team.

C. Engineering job approval authority is the quality assurance process that ensures adequate consideration by competent NRCS employees in the planning, design, and installation of conservation engineering practices that, with proper operation and maintenance, will perform the intended functions for the planned practice service life. Engineering job approval authority additionally serves to maintain the credibility and trust of NRCS engineering with State engineering boards of licensure and with the public.

D. All conservation engineering practice designs must be approved by a qualified person who has appropriate engineering job approval authority. The work may be done by others under the direction of the qualified person. For the purpose of this policy, a conservation engineering practice is a conservation practice included in Title 450, National Handbook of Conservation Practices (NHCP), with an engineering discipline listed as the responsible lead or co-lead for the practice.

501.1 Scope

A. Each NRCS employee providing engineering technical assistance must be assigned an appropriate engineering job approval authority based upon training, experience, and demonstrated competence. No more than one level of review is required.

B. Non-NRCS employees operating under the technical supervision of an NRCS employee and providing engineering services must be evaluated and assigned an appropriate engineering job approval as provided in Section 501.1(A) with the following additional criteria:

(1) Non-NRCS employees who are Federal employees may be assigned engineering job approval authority on the same basis as NRCS employees.
(2) Non-NRCS employees who are licensed to practice engineering in the same State in which the engineering services are offered may be assigned engineering job approval authority on the same basis as NRCS employees.
(3) Non-NRCS employees who are not Federal employees and are not licensed to practice engineering in the State in which the engineering services are offered may be assigned engineering job approval authority when such authority does not conflict with State law. These employees include volunteers, employees of cooperative organizations or units of government, and other partners performing public services similarly to NRCS employees and, therefore, appearing to the public as NRCS employees.
(4) Policy on the use of non-NRCS engineering services is contained in Part 505.

501.2 Technical Quality

Engineering technical assistance for the planning, design, and installation of conservation practices is to provide for practices that—

(1) Function as planned.
(2) Exhibit sound engineering principles.
(3) Perform safely.
(4) Are cost effective with consideration of initial operation, maintenance, and removal or replacement costs.
(5) Meet the requirements of site-specific conditions, are sustainable, and address the indentified resource concerns.
(6) Comply with NRCS and industry-established practice standards, technical criteria, and policies.

501.3 Compliance of Engineering Work With Laws and Regulations

A. Engineering work must meet applicable requirements of Federal, State, and local laws, regulations, and codes. This is for all work that involves engineering activities during planning, design, construction, operation, maintenance, modification, rehabilitation, and removal or replacement.

B. Registered professional engineers are permitted to seal designs, construction plans, reports, and other engineering documents.

C. The State Conservation Engineer (SCE) develops policy and procedures for approving and sealing engineering plans—

(1) For works designed by NRCS and by non-NRCS employees working as partners with NRCS.
(2) That are required to be sent to regulatory agencies for review, approval, or the granting of permits.
(3) In States that have laws requiring the cooperating local organization to have plans for public works prepared under the direct supervision of a registered professional engineer.

501.4 Engineering Job Approval Authority

A. The SCE is delegated engineering job approval authority for all engineering work. Engineering jobs are classified with respect to hazard potential, complexity, and size, as shown in Section 501.8. Hazard potential is defined in Part 503. The SCE must comply with review requirements in Section 501.5.

B. State Engineering Job Approval Authority (Classes I Through V).

(1) Conservation engineering practices in Classes I through V must be of low hazard potential as defined in Part 503. Examples include low-hazard dams and class-III dikes. For practices with the potential for higher risk, limitations on selected controlling factors and hazard potential must be used to further define the engineering jobs by higher classes.
(2) Each SCE must develop policy and procedures for approval of engineering work carried out in the State. These apply to every individual providing engineering services, both NRCS employees and non-NRCS employees operating under NRCS technical supervision. The procedure used to assign engineering job approval authority for non-NRCS employees is to be the same as that used for NRCS employees, except as noted in Section 501.1(B).
(3) Engineering job approval authority must be delegated within a State according to the job classes established in the State engineering job approval authority chart. Individual engineering job approval authority must be assigned considering the employee's training, experience, and demonstrated competence. Engineering job approval authority need only be assigned for practices applicable in the geographic area the employee serves. Section 501.9 provides a guide for developing and presenting engineering job approval authority delegations. Use of available database tools to manage the job approval authority process is recommended. The practices listed in Section 501.9 are for example only. The SCE is to select, from Class V jobs, job type, controlling factors, units, and engineering job approval authority breakdowns appropriate for the conditions in the State. The controlling factors for the practices noted in Section 501. 8 must be used. Additional factors may be selected as needed.
(4) It is recommended that professional engineers registered in the State and working under NRCS technical supervision be routinely delegated Class IV engineering job approval authority.
(5) The engineer technically responsible for engineering work (e.g., field or area engineer) delegates engineering job approval authority to those working under their technical supervision. The individual's supervisor must concur in the delegation of the engineering job approval authority. The engineering job approval authority delegation must not be greater than that held by the delegating engineer. Individual engineering job approval authority must be reviewed annually for those in their present position for less than 3 years and updated as necessary, but at least every 3 years, for all others.
(6) The State engineering job approval authority chart must be reviewed and concurred by the Director, Conservation Engineering Division (CED).

C. Approval of Class VI Through Class VIII Jobs

(1) Class VI engineering job approval authority may be delegated to NRCS professional engineers registered in the State having demonstrated competence for the particular practice.
(2) For Class VII jobs, the independent review required under Section 501.5 must be completed prior to approval by the SCE.
(3) For Class VIII jobs concurrence of the Director, CED, is required. All reviews required under Section 501.5 and the concurrence of the Director, CED, must be obtained prior to approval by the SCE.

D. Engineering Job Approval Authority for Additional Work

The engineering job approval authority for work to be performed on an existing practice or structure is classified in accordance with procedures as listed in Section 501.7. This determination of engineering job approval authority applies to any additional work, such as repair, modification, rehabilitation, or removal. The classification is determined by the highest category of any single most-limiting factor for the job.

E. Documentation of Design Review and Engineering Job Approval

Review and approval of an engineering job, comprising the design, drawings, and specifications, is accomplished in one of the following ways:

(i) Signatures are placed on the design documentation or report and the cover or first sheet of the construction drawings.
(ii) Signatures are to be placed on an accompanying memorandum that describes the specific job and scope (including design documentation or report and plans).

F. Associated Plans and Specifications

Interdisciplinary design may produce associated drawings and specifications for erosion control,

vegetative planting, final grading, and other components. All associated plans and specifications that may affect the performance of an engineering job are subject to the engineering job approval process.

501.5 Engineering Job Review

A. Design Reviews

(1) Classes I through V.—No more than one level of design review of jobs in engineering job classes I through V is required to ensure technical quality during design.
(2) Classes VI through VIII.—One level of design review of jobs in engineering job classes VI through VIII is required.
(3) Design reviews will be performed as follows:
(i) Classes I–V.—As determined by the SCE.
(ii) Class VI.—State staff review if review capability exists within the State as determined by the SCE; otherwise, independent staff review is required.
(iii) Class VII.—Independent staff review is required.
(iv) Class VIII.—Director, CED, review and concurrence is required.
(v) An independent staff review is conducted by a staff that is not supervised by the SCE and that did not participate in the design. The Director, CED, will concur in the selection of an independent reviewer if outside NRCS.
(4) The policy on checking and reviewing engineering work is contained in Section 511.5.

B. Post Reviews

Post reviews are independent reviews made after the installation of the practice or structure. Spot checks, as required by GM-450, Part 407, are examples of post reviews. Post reviews are valuable for quality assurance, determination of technical competence and experience, determination of the need for additional training, and determination of the need for revision of engineering procedures and criteria. Supporting data, drawings, and specifications for the jobs selected for post review must be examined. The materials will be reviewed for conformance to national policy, standards, criteria, and sound engineering practice. Onsite reviews may be necessary, depending on the job's complexity, safety and health risks, or environmental risks. After each job is reviewed, the post reviewer must prepare a written report to the SCE. A copy will be sent to the Director, CED, for all Class VII and VIII jobs and for Class I through VI jobs if the findings indicate changes in national policy, procedures, or standards may be needed.

(i) Classes I–VI.—The SCE will develop the procedure for post review of representative engineering jobs Classes I through VI to ensure technical quality that conforms with GM-450, Part 407.
(ii) Classes VII–VIII.—The Director, CED, will determine the need for post reviews of engineering job Classes VII and VIII.

501.6 Engineering Work Reviewed for Other Agencies

A. Engineering Work Reviewed for Regulatory Agencies

(1) Approval procedures must also contain provisions for reviewing the engineering design components of plans for cooperating regulatory agencies and determining if the plans comply with NRCS technical standards. The approval authority for this type of review is to be the same as assigned for engineering job approval authority.
(2) NRCS employees are not to review designs that are outside NRCS's area of technical expertise. For example, NRCS is not to review the structural strength of a building with rooftop storage used for runoff management. For this design, the review should be for the functional aspects of the plan, including storage and release rates. Any apparent deficiencies in specific designs noted during the review should be called to the attention of the responsible agency, even though they are outside the scope of the review.
(3) Review responses must be expressed in terms of compliance or noncompliance of identified items and not in terms of approval or disapproval. Response comments must indicate the extent or nature of the review, such as: "Review was conducted in accordance with practice standard ___ and the following was determined. Review has been limited to the functional layout and size in accordance with the requirements of Regulation ___."
(4) In all cases, applicable requirements of Federal, State, and local laws, regulations, and codes must be met.

B. Engineering Work Reviewed for State and Other Federal Agencies

If engineering work is reviewed for other Federal or State agencies, the work must be checked against NRCS criteria (conservation practice standards) and sound engineering practices appropriate for the size and type of job. The review report provided to the agency must indicate compliance or noncompliance to NRCS standards and criteria. The approval of the review report is at the same level as engineering job approval for similar NRCS designs.

501.7 Classification of Engineering Jobs

A. The engineering job classifications that utilize controlling factors are displayed by conservation

engineering practice in Section 501.8. If the value of any one of the controlling factors is exceeded, the job becomes the next higher class.

B. Approval authority for all of the conservation engineering practices listed as Class V may be delegated as Classes I through V and those listed as Class VI may be delegated as Class VI by SCEs. The listed values of the controlling factors are maximums; therefore, SCEs may specify lower values of the controlling factors than those listed.

C. Approval authority for those conservation engineering practices that are not listed in Exhibit 1 also may be delegated as Classes I through V by SCEs unless the hazard classification is significant, high, or classified differently by the Director, CED. Hazard classification criteria for practices other than dams parallel those for dams (See Part 520 Subpart C – Dams, Section 520.21 definitions and classes). Additionally, any practice may be designated significant hazard where failure may result in impairment of water quality, environmental damage impacting wildlife or human health, or presents unacceptable economic risk. Any practice may be designated high hazard where failure would result in loss of life.

D. Those jobs covered by interim conservation practices standards will be classified by the Director, CED, when the interim conservation practice standards are approved.

501.8 Engineering Job Classifications That Utilize Controlling Factors

The Engineering Job Classifications That Utilize Controlling Factors contains the maximum values for engineering job Classes V and VI that can be used by States.

Click here for a copy of the Engineering Job Classifications That Utilized Controlling Factors

501.9 Engineering Job Approval Authority

The Engineering Job Approval Authority is a guide for a State to use in developing an engineering job approval authority chart. The practices listed are examples only. Section 501.4 describes the process by which the SCE is to delegate engineering job approval authority.

Click here for a copy of the Engineering Job Approval Authority

Part 501 - Authorizations

Subpart A - Review and Approval

§IA501.0 General

D. (1) All engineering work designed by NRCS must, before being furnished to the owner or sponsor, be approved by the qualified person closest to the job, whether an NRCS employee or other person with the appropriate delegated engineering job approval authority.

§IA501.1 Scope

B. (3) Non-NRCS employees who are not federal employees and are not licensed to practice engineering in the state will be limited to job class I or II approval authority for Inventory and Evaluation (I&E), design, and construction.

(i) Design job approval authority will be either job class I or II.
(ii) I&E and construction job approval authority will be job class I or II except that a job class III may be assigned when the employee is under NRCS technical supervision.

§IA501.3 Compliance of Engineering Work with Laws and Regulations

C. (2)(i) All plans for projects requiring a permit from state or federal agencies must be approved by an NRCS engineer with proper approval authority.

C. (3)(i) When a cooperator, a soil and water conservation district, a drainage board, a regulatory agency, or other governmental agency requires that engineering plans prepared by NRCS be sealed by a licensed professional engineer, the NRCS engineer who prepared or approved the plans may seal the plans if licensed in the State of Iowa. If the NRCS engineer is not licensed in Iowa, the plans must be sent to the State Conservation Engineer for sealing.

§IA501.4 Engineering Job Approval Authority

B. State Engineering Job Approval Authority (Classes I through V)

(2)(i) All engineering work by NRCS in Iowa must be reviewed and approved by the qualified person closest to the job, whether an

NRCS employee or other employee who is under NRCS technical supervision. All individuals having inventory and evaluation (I&E), design, or construction responsibility for engineering work will be assigned a job approval authority. Authority limitations will be based upon the individuals' training, experience, and demonstrated competence.

(3)(i) It is the responsibility of the employee, with concurrence from their supervisor, to seek and engage in opportunities which may lead to increasing the employees engineering job approval authority through demonstrated competence.

(5)(i) The State Conservation Engineer will determine job approval authority for GS-11 and GS-12 engineers. An engineer on the Assistant State Conservationist (Field Operations) staff will make determinations for all other personnel doing engineering work in their respective area. The employee's supervisor must concur in the delegation of the engineering job approval authority.

(5)(ii) Jobs falling in Classes III, IV, and V are usually costly. Layout and design are often difficult and time consuming. Therefore, care should be taken in rating persons to approve these job classes. Class IV approval for I&E and design will generally be made by GS-11 or higher engineers. Field engineers with Class V authority in any category may not delegate that authority to others without the concurrence of the State Conservation Engineer.

(5)(iii) Form IA-ENG-6 has been developed for recording the maximum approval authority assigned to an individual. The maximum approval authority assigned to an individual will be entered for each category. Form IA-ENG-6 includes an Inventory of Engineering Skills. This portion of the form may be used to document the survey, CADD, design, and construction skill levels of employees being assigned engineering job approval authority.

(5)(iv) Three copies of IA-ENG-6 will ordinarily be prepared. One copy will be furnished to the individual concerned, one to the engineer who made the determination, and one to the area office file. A fourth copy will be sent to the State Conservation Engineer if any class V authority has been delegated.

(5)(v) Engineering job approval for a project will be made by a person with the proper delegated approval authority. This will be done by placing signature, title, and date on NRCS copies of the design, drawings, construction records, or other supporting documents.

Initials are not acceptable. Persons must not commit NRCS on the feasibility of projects that exceed their approval authority.

(5)(vi) A person with the delegated approval authority is not required to perform all the steps leading to a complete project. It is expected that employees who do not have adequate approval authority for a project will perform functions such as surveys, design, drafting, etc., as far as their knowledge and abilities permit.

(5)(vii) Major changes are often proposed in an approved project during or preceding construction. These changes must be approved in the same manner as the originally approved project. When the changes must be approved by a person not readily available, verbal approval may be obtained to expedite the work. However, the completed records must include correct written approval.

(5)(viii) The review of engineering jobs ensures that jobs comply with current criteria and policies, fulfill project requirements, and are adapted to site conditions. Jobs must also conform to local, state, and federal laws.

C. Approval of Class VI Through Class VIII Jobs

(4) Designs or preliminary designs for Class V, VI, and VII jobs will be developed by the area engineering staff insofar as their capabilities permit. Complete or partial design files will be submitted to the State Conservation Engineer when approval, review, or preparation of final design is requested. The State Conservation Engineer will assign design engineers and other staff specialists to review complete designs for his or her approval or co-approval. Field engineers should consult with the State Conservation Engineer or his or her staff as needed to reach agreement on design approaches, criteria, procedures, or related matters prior to the design of Class V or higher jobs.

§IA501.5 Engineering Job Review

A. Design Reviews

(3)(i) Classes I-V - No additional review is required beyond the normal design approval process.

B. Post Reviews

(1)(i) Quality assurance reviews will be made in accordance with requirements in Title 450, General Manual, Part 407.

§IA501.7 Classification of Engineering Jobs

E. The engineering job class of each project must be shown on the construction drawings or the design documentation.

IOWA ENGINEERING JOB APPROVAL AUTHORITY

Name	**Title**	**Grade**
Determined By	**Title**	**Date**
Concurrence By	**Title**	**Date**

Code	Job Type	Controlling Factors		Units	Job Class I	Job Class II	Job Class III	Job Class IV	Job Class V	Maximum Approval Limits I&E	Maximum Approval Limits Design	Maximum Approval Limits Constr.
378	Pond	Requires permit from IDNR or other regulatory agency 2/		------	No	No	No	Yes	Yes			
402	Dam	Hazard Classification			Low	Low	Low	Low	Low			
410	Grade Stabilization Structure	Storage x Height			<3000	<3000	<3000	<3000	3000			
587	Structure for Water Control	Effective Height 1/ 2/		Feet	8	12	25	30	35			
	All with relatively impervious cutoff, simple foundation needs, and standard or proven designs.	Conduit Spillway - Inside Diameter		Inches	6	12	24	42	All			
		Drainage Area 2/		Acres	20	80	250	640	12,800			
	Notes:	Drop Spillway 3/	Net Drop	Feet	2*	4*	4*	6*	All			
	1/ The effective height of the dam is the difference in elevation in feet between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam.		Weir Depth	Feet	2*	2*	3*	4*	All			
			Weir Capacity	CFS	50	150	300	400	All			
		Steel or Aluminum Drop Spillway (Toewall)	Net Drop	Feet	2*	3*	4*	6*	All			
			Weir Capacity	CFS	50	150	300	600	All			
		Steel Sheet Pile	Net Drop	Feet	2*	4*	6*	8	All			
			Weir Capacity	CFS	0	0	400	600	All			
		Rock Chute	Net Drop	Feet	0	4*	8*	10	All			
	2/ These limits apply to all practices which store water including terraces, water and sediment control basins, diversions, and waste storage facilities.		Weir Capacity	CFS	0	50	150	300	All			
		Gabion Chute	Net Drop	Feet	0	4	8	10	All			
			Capacity	CFS	0	50	200	300	All			
		Concrete Block Chute	Net Drop	Feet	0	4*	8*	10*	All			
			Capacity	CFS	0	50	150	300	All			
	3/ These limits also apply to gabion drop spillways except that standard designs and drawings are not required.	Reinforced Concrete Chute	Net Drop	Feet	0	0	0	8*	All			
			Weir Depth	Feet	0	0	0	3	All			
			Weir Capacity	CFS	0	0	0	300	All			
		Reinforced Vegetated Chute Spillway	Net Drop	Feet	0	4*	8*	10	All			
	* Standard designs and standard detail drawings. These include all designs and drawings that have been approved for use in Iowa by the State Conservation Engineer.		Capacity	CFS	0	50	100	100	All			
		Box Inlet Drop Spillway	Net Drop	Feet	0	0	0	0	All			
		Box Inlet to Existing Culvert	Weir Capacity	CFS	0	0	0	0	All			
		Low Head Dry Dam - Conduit Diameter (Drop through conduit equal to or less than 15 feet.)		Inches	12	24	36	60	All			

Code	Job Type	Controlling Factors		Units	Job Class					Maximum Approval Limits		
					I	II	III	IV	V	I&E	Design	Constr.
560	Access Road	Length		Miles	0	0.5	1	2	All			
		Circular Culvert	Inside Diameter	Inches	24	36	48	60	All			
		Monolithic Concrete Culvert	Area of Opening	Sq. Feet	0	0	0	0	All			
		Bridge	Span	Feet	0	0	0	0	All			
309	Agrichemical Handling Facility			No.	0	0	0	0	All			
591	Amendments for Agricultural Waste	----		--	0	0	0	0	All			
366	Anaerobic Digester	----		No.	0	0	0	0	All			
316	Animal Mortality Facility	Incinerator - Capacity		Lbs.	0	0	0	400	1,000			
		Freezer		No.	0	0	0	0	All			
		Composting - Standard Design		No.	0	0	All	All	All			
575	Animal Trails and Walkways	Length		Feet	1000	5000	All	All	All			
310	Bedding	Area Treated		Acres	40	160	320	480	All			
326	Clearing and Snagging	Drainage Area		Sq. Miles	0	0	1	4	All			
360	Closure of Waste Impoundments	Surface Area - Full Operation Level		Acres	0	0.5	1.0	4.0	All			
317	Composting Facility	IDNR Permit Required for Livestock Operation			No	No	No	Yes	Yes			
		Forced Aeration		No.	0	0	0	All	All			
		Standard Design		No.	0	0	All	All	All			
656	Constructed Wetland	Animal Waste Treatment	Design Capacity - 1,000 lb Live Animal Weight	No.	0	0	0	300	All			
		Field Runoff Treatment	DA	Acres	0	0	300	1000	All			
348	Dam, Diversion	Streamflow		CFS	0	0	100	500	2,000			
		Flow Diverted		CFS	0	0	10	50	200			
		Height of Drop		Feet	0	0	4*	6*	8			
747	Denitrifying Bioreactor	Pipe diameter		Inches	0	0	0	All	All			
356	Dike	Water Height		Feet	0	0	4	10	All			
		Class		------	0	0	III	III	III			
362	Diversion	Design Capacity		CFS	40	100	200	500	All			
375	Dust Control from Animal Activity on Open Lot Surfaces	Area Treated		Acres	0	0.5	1	5	All			
374	Farmstead Energy Improvement	On farm energy audit recommendations		No.	0	0	0	All	All			
412	Grassed Waterway	Drainage Area		Acres	80	250	500	2,000	All			
561	Heavy Use Area Protection	Surface Protection Method		Type	Vegetative	Vegetative	Gravel	Concrete	All			
442 443	Irrigation System, Sprinkler Irrigation System, Surface and Subsurface	Area Irrigated		Acres	0	0	80	160	All			
430	Irrigation Water Conveyance	Pipeline Capacity	Greater than 50 psi	GPM	0	0	1,000	2,000	3,500			
			Less than 50 psi	GPM	0	0	1,000	3,500	5,000			
527	Karst Sinkhole Treatment	Area Treated		Acres	0	0	0	All	All			

Code	Job Type	Controlling Factors		Units	Job Class					Maximum Approval Limits		
					I	II	III	IV	V	I&E	Design	Constr.
460	Land Clearing	Area Cleared		Acres	5	10	20	All	All			
466	Land Smoothing	Other Land	Area Treated	Acres	20	80	200	400	All			
			Maximum Cut	Feet	1	2	3	5	All			
468	Lined Waterway or Outlet	Capacity		CFS	0	50	100	100	All			
		Net Drop		Feet	0	4	8	10	All			
634	Manure Transfer	Gravity Flow - Diameter		Inches	0	0	24	30	All			
		Pressurized System - Diameter		Inches	0	0	6	10	All			
353	Monitoring Well	Diameter		Inches	0	0	0	2	All			
500	Obstruction Removal	No Public Safety Hazard During Removal		Each	0	0	0	All	All			
582	Open Channel	Design Capacity		CFS	0	25	50	250	1000			
584	Channel Stabilization	Design Velocity		FPS	0	8	10	10	10			
608	Surface Drain, Main or Lateral											
516	Pipeline	Length - Maximum distance from source		Feet	1,000	1,500	2,500	10,000	All			
		Diameter		Inches	1	1.5	2	4	All			
		Pressure - Maximum operating pressure plus Water hammer		PSI	100	125	160	200	300			
521-A	Pond Sealing or Lining - Flexible Membrane	Surface Area		Acres	0	0	0	10	All			
521-B	Pond Sealing or Lining - Soil Dispersant											
521-C	Pond Sealing or Lining - Bentonite Sealant											
521-D	Pond Sealing or Lining - Compacted Clay											
462	Precision Land Forming	Area Treated		Acres	20	80	160	320	All			
464	Irrigation Land Leveling	Maximum Cut		Feet	1	2	3	5	All			
533	Pumping Plant for Water Control	Propeller Pump	Design Capacity	GPM	0	0	450	1,000	All			
			Static Head	Feet	0	0	8	10	All			
		Centrifugal Pump	Design Capacity	GPM	0	0	0	500	3,500			
			Static Head	Feet	0	0	0	50	350			
		Turbine Pump	Design Capacity	GPM	0	0	0	500	3,500			
			Static Head	Feet	0	0	0	50	500			
566	Recreation Land Grading and Shaping	Area Treated		Acres	0	5	20	40	All			
568	Recreation Trail and Walkway	Length		Miles	0	1	3	5	All			
558	Roof Runoff Management	Area of Roof		Sq. Feet	0	0	10,000	45,000	All			
367	Roofs and Covers	Cover Surface Area		$Feet^2$	0	0	10,000	45,000	All			
350	Sediment Basin	Effective Height of Dam		Feet	8	10	15	30	35			
	* Standard Designs and Drawings	Concrete Basin		-----	No	No	Yes*	Yes*	Yes			
		Others										
		Refer to Controlling Factors for Ponds										

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Code	Job Type	Controlling Factors	Units	Job Class					Maximum Approval Limits		
				I	II	III	IV	V	I&E	Design	Constr.
632	Solid/Liquid Waste Separation Facility	Mechanical Separator	No.	0	0	0	0	All			
		Sediment Basin - Livestock									
		Effective Height of Dam	Feet	8	10	15	30	35			
		Concrete Basin	--	No	No	Yes*	Yes*	Yes			
		Design Capacity - 1,000 lb Live Animal Weight	No.	20	50	100	500	All			
572	Spoil Spreading	Area receiving spoil	Acres	0.5	1	3	All	All			
574	Spring Development	Discharge	GPM	1	5	10	All	All			
578	Stream Crossing	Design Velocity	FPS	0	4	6	9	All			
580	Streambank and Shoreline Protection	Vegetative Protection	-----	0	0	All	All	All			
		Mechanical Protection — Bankfull Capacity	CFS	0	250	500	2,500	5,000			
		Design Velocity	FPS	0	6	8	10	10			
		Water Height above Shoreline	Feet	0	0	0	3	All			
606 620 980 554	Subsurface Drain Underground Outlet Tile Intake Replacement (Interim) Drainage Water Management	Pipe Diameter	Inches	6	12	18	30	All			
607	Surface Drainage, Field Ditch	Design Capacity	CFS	10	20	50	80	All			
		Drainage Area	Acres	60	120	320	640	All			
		Circular Culvert, Inside Diameter	Inches	24	36	48	60	72			
600 638	Terrace Water and Sediment Control Basin (Also refer to Controlling Factors for Ponds)	Fill Height - Distance from top of ridge to ground surface at ridge line	Feet	6	10	15	All	All			
635	Vegetated Treatment Area	Design Capacity - 1,000 lb Live Animal Weight	No.	0	0	0	300	All			
634	Waste Recycling	Gravity Flow - Diameter	inches	0	0	24	30	All			
		Pressurized Systems - Diameter	inches	0	0	6	10	All			
		Reception Tank	No.	0	0	All	All	All			
313	Waste Storage Facility (Controlling Factors for Ponds also apply)	Design Capacity - 1,000 lb. Live Animal Weight	No.	0	0	300	1,000	All			
		IDNR or EPA Permit Required		No	No	No	Yes	Yes			
		Storage Capacity	Cu. Feet	0	0	500,000	1,000,000	2,000,000			
		Earthen Waste Storage Structure									
		Effective Height of Dam	Feet	0	0	20	30	35			
		Other Structures									
		* standard designs and standard detail drawings									
		Below Ground - Wall Height	Feet	0	0	8*	14*	All			
		Span	Feet	0	0	6*	12*	All			
		Above Ground - Wall Height	Feet	0	0	8*	14*	All			
		Span	Feet	0	0	40*	60*	All			
		Round Structures - Diameter	Feet	0	0	0	120*	All			

Code	Job Type	Controlling Factors	Units	Job Class					Maximum Approval Limits		
				I	II	III	IV	V	I&E	Design	Constr.
629	Waste Treatment	Design Capacity - 1,000 lb. Live Animal Weight	No.	0	0	0	0	All			
		Milking Center Waste Water Produced	Gpd	0	0	0	0	All			
359	Waste Treatment Lagoon	Anerobic - Volume	Cu. Feet	0	0	250,000	500,000	2,000,000			
	(Controlling Factors for Ponds also apply)	Aerobic - Surface Area	Acres	0	0	1	5	25			
		Effective Height of Dam	Feet	0	0	25	30	35			
642	Water Well	Design and Construction to be completed by a well driller certified in Iowa		0	0	0	All	All			
351	Water Well Decommissioning	Diameter	Inches	0	0	6	16	All			
614	Watering Facility			All	All	All	All	All			
981	Wellhead Protection (Interim)	CMP casing		0	0	All	All	All			
		All other casing materials		0	0	0	All	All			
355	Well Water Testing	No.	Each	0	0	All	All	All			
657	Wetland Restoration	DEPRESSION Hydrogeomorphic (HGM) Class									
658	Wetland Creation	T&E or listed species in or near the site		No	No	Yes	Yes	Yes			
659	Wetland Enhancement	Requires Permit from IDNR or other regulatory agency		No	No	No	Yes	Yes			
		Wetland Area	Acres	2	5	10	25	All			
	Refer to the limits for associated practices, as required	RIVERINE HGM Class									
		T&E or listed species in or near the site		No	No	Yes	Yes	Yes			
		Requires Permit from IDNR or other regulatory agency		No	No	No	Yes	Yes			
	Wetland area includes all land classified as wetland or expected to meet wetland criteria in the project area following project completion.	Wetland Area	Acres	0	10	50	400	All			
		Channel Modification planned		No	No	No	Yes	Yes			
		Channel/Stream Corridor Restoration		No	No	Yes	Yes	Yes			
		Protected Floodplain		No	No	Yes	Yes	Yes			
	See Engineering Field Handbook Chapter 13, for definitions of HGM classes.	SLOPE HGM Class									
		T&E or listed species in or near the site		No	No	Yes	Yes	Yes			
		Requires Permit from IDNR or other regulatory agency		No	No	No	Yes	Yes			
	Also refer to other applicable standards.	Wetland Area	Acres	2	5	10	25	All			
		Grade Stabilization/Water Surface Profile Modification		No	No	Yes	Yes	Yes			
		Organic Soil		No	No	No	Yes	Yes			

DEFINITIONS OF MAXIMUM APPROVAL LIMITS COLUMNS

Inventory and Evaluation (I&E) - On-site observations of an exploratory nature and preparation of sound alternative solutions of sufficient intensity for the cooperator to make treatment decisions.

Design - Designing and checking all aspects of the supporting data, drawings, and specifications to insure that the planned practice will meet the purpose for which it is installed.

Construction - Surveys, layout, staking, inspection of materials and work, and making tests to determine that the job meets specifications.

Inventory of Engineering Skills

(For use in determining the level of design and construction approval authority)

Yes or No

Surveying Skills

	Laser level or Self-leveling level
	Adjustment of Laser or Self-leveling levels
	Digital Transit
	Total Station
	Total Station – multiple setups with turns
	Survey Grade GPS
	Construction Staking using Total Station or GPS

CADD Skills

	Survey Import & Adjustment
	Contour Development
	Storage Volume computations
	Design layout & surface creation of planned construction
	Profiles & cross-sections
	Earthwork quantities
	Prepare final construction drawings
	Export of staking information to data collector
	LiDAR importing / GPS ground truth checks

Design Skills

	Meets all Core Course Requirements for the Position
	Can develop a stage storage table
	Can balance Cuts and Fills
	Can develop a cost estimate
	Can develop data input for Engineering Plan Development Software
	Can use Engineering Plan Development Software
	Can customize IA construction and material specifications for specific jobs
	Knows where to use and how to complete standard base drawing sheets
	Can assemble non-complex Plans and Contract information
	Can assemble complex Plans and Contract information

Construction Skills

	Concrete and Steel placement (inspection only)
	Concrete and Steel placement (inspection and concrete testing)
	Conduit installation (smooth steel pipe)
	Conduit installation (plastic pipe)
	Conduit installation (concrete pipe)
	Conduit installation (corrugated metal pipe)
	Conduit installation (pipe with cathodic protection)
	Construction Surveys (Non-complex Plans, elevation/baseline/cross section surveys)
	Construction Surveys (Complex Plans, radial layout and curves)
	Drainfill (Proper Placement)
	Drainfill (Gradation Testing)
	Can judge if IA construction and material specifications are being followed
	Can judge if NEH 20 construction and material specifications are being followed
	Can judge if Standard Drawings are being followed
	Can judge if construction complies with the terms of a non-complex contract
	Can judge if construction complies with the terms of a complex contract
	Can determine if Class C (method) compaction requirements are met
	Can do the testing associated with Class A compaction requirements
	Can judge if backfill adjacent to structures is adequate
	Can do a field identification using the United Soil Classification System

Subpart B - Repair and Rehabilitation

501.20 General

Many engineering practices require repair or rehabilitation because of advancements in technology, changes in criteria, land use changes, or deterioration from age. A rehabilitated structure should be safe and functional for an extended period of time with normal maintenance. The application of sound engineering principles in the design of the repair or rehabilitation will result in continued satisfactory performance.

501.21 Scope

Repair or rehabilitation of all engineering practices, whether originally installed with NRCS assistance or not, must be performed in accordance with provisions of this subpart. These instructions do not apply to operation and maintenance activities.

501.22 Applicable Standards

A. When it has been determined that assistance is to be provided for the repair or rehabilitation of a practice that was originally installed with NRCS assistance, the applicable standards must be determined. Normally, these are the standards that were used in preparing the original design; however, the individuals with job approval authority (see Section 501.4) must determine whether the original standards are still acceptable in light of new engineering knowledge and current NRCS State and national criteria. If the original standards are unacceptable, current standards must be used.

B. If NRCS assistance is provided for the repair or rehabilitation of a practice that was originally installed without NRCS assistance, the practice or part of a system must conform to current engineering standards when completed (see Section 501.23). This ensures a durable, functional practice that justifies the use of NRCS resources.

C. If the practice is an interdependent part of a system or if an element of a practice is to be repaired or rehabilitated, the entire system or practice is to be carefully evaluated. The system must be sufficiently sound to permit the practice being repaired or rebuilt to function as designed.

501.23 Dams Installed Without NRCS Assistance

A. Because of the hazards associated with dams, a careful and deliberate approach is necessary when assistance is requested for the repair or rehabilitation of a dam that was built without NRCS assistance. Before any commitment for financial assistance is made, the condition of the dam must be determined and a comprehensive engineering report prepared. This report describes the current physical condition of the dam, specifies the repairs needed to meet NRCS standards, and includes an estimate of the costs for repair or rehabilitation. The report is the basis for the decision to commit resources.

B. If the dam exceeds Class V (see Section 501.4), the report is prepared by a non-NRCS registered professional engineer who is experienced in the design and construction of dams. The report must be reviewed in accordance with the job class as required in Section 501.5. Technical acceptance of the report by the State Conservation Engineer (SCE) is necessary before resources can be committed for repair or rehabilitation.

C. If the dam is of a size normally approved by the SCE or other employees within the State, the report may be prepared by the owner, sponsor, or by NRCS engineers. The report must be accepted or approved by an engineer with appropriate engineering job approval authority before resources can be committed.

501.24 Special Conditions

A. If urgent action is necessary to safeguard life and property against flood damage, structure failure, etc., NRCS may provide technical assistance for temporary measures to lessen the immediate threat. If NRCS subsequently makes permanent repairs, they must conform to Section 501.22.

B. Repairs or rehabilitations under the Emergency Conservation Program are carried out as specified by the Farm Service Agency. The practices not restored to original or current criteria must be functional, but if the repaired or replaced practices would create a safety hazard, they must be restored to meet current NRCS standards.

C. Repairs or rehabilitations under the Emergency Watershed Protection Program or other emergency assistance program are carried out as specified for that program, but if the repaired or replaced practice would create a safety hazard, it must be restored to meet current NRCS standards.

Subpart C - Variance and Changes

501.30 General

Improvement in construction methods, equipment, and material, as well as findings of research and experience, makes occasional revision of standards necessary and desirable. However, because conservation practice standards reflect minimum requirements, plans and designs must be site specific and provide for a structure that will safely and economically accomplish its intended purpose for the duration of its planned economic life with normal operation and maintenance. Frequently, site conditions require additional features or precautions. Less frequently, compensating conditions justify a request for a variance from a standard.

501.31 NHCP

Variances from the requirements of the conservation practice standards in Title 450, National Handbook of Conservation Practices (NHCP), are handled in accordance with Title 450, General Manual, (GM-450), Part 401, Subpart B, Conservation Practice Standards, Section 401.16.

501.32 Channel Stability Criteria

A. The analysis of channel stability requires sound judgment. The best-known design techniques and criteria are available in Technical Release No. 25, Design of Open Channels; Title 210, National Engineering Handbook, Chapter 654, "Stream Restoration Design "; and Conservation Practice Standard 582, Open Channel (NHCP) . However, there are situations in which channel and site conditions in association with the methods of construction and maintenance indicate that variations from minimum stability criteria are warranted.

B. If the SCE determines that a variation from stability criteria is warranted, the results of the analysis and the proposed approach are to be submitted to the Director, Conservation Engineering Division (CED). The Director, CED, and the State will jointly study the data and proposal.

Subpart D - Engineering Work on National Forests

501.40 General

A. The Forest Service has the responsibility for establishing the standards and criteria used for engineering works installed on national forests. NRCS often assists in engineering works on these lands.

B. Coordination of engineering criteria and procedures is necessary so that the completed practice will meet the requirements of both agencies and will function for its planned economic life with normal operation and maintenance.

Subpart E - Assistance of Shoreline Erosion Control

501.50 General

A. Because shoreline erosion is complex, erosion control measures for stabilization differ greatly from those used for upland erosion control and can be very costly.

B. Effective installation of erosion control measures can be achieved by proper coordination with other Federal and State agencies. This coordination eliminates duplication of services and provides for sharing knowledge in a rapidly changing technology.

501.51 Scope

A. NRCS can provide assistance in controlling shoreline erosion if all the following conditions are met:

(1) The problem is not created by wave action on the open and unprotected shores of the ocean fronts or the Great Lakes.
(2) The problem can be solved with vegetation, normal upland erosion control practices, or minor structural measures, such as gabions or riprap revetment, masonry or timber bulkheads, or rock or timber barbs or vanes. All revetments, bulkheads, or groins are to be no higher than 3 feet above mean high tide or, in nontidal areas, no higher than 3 feet above mean high water. As used here, bulkheads are designed primarily to resist lateral earth pressures; revetments are not. Bulkheads and revetments are generally placed parallel to the shore; groins, barbs, or vanes are generally perpendicular to the shore.
(3) Failure of structural measures because of high intensity storms will not create an immediate hazard to life or result in serious damage to buildings, residences, roads, or other high-value property.
(4) Installation of the recommended measures will have no significant adverse effects on the environment or on adjacent lands, waters, or installations.
(5) Sponsors and cooperators understand the level of protection being provided and their responsibility for maintenance and repair.
(6) Plans and schedules for installing structures and establishing vegetation are acceptable to local, State, and Federal agencies that have jurisdiction.

B. NRCS is not to provide design or construction assistance to solve erosion problems created by wave action on the open and unprotected shores of major ocean fronts or the Great Lakes. Advice and counsel can be provided on complementary erosion control practices used in conjunction with complex or expensive installations built by others at these locations. Assistance can be provided for normal erosion control on lands adjacent to these shorelines but only at elevations not affected by wave action.

501.52 Coordination with U.S. Army Corps of Engineers (USACE)

A. USACE has responsibility for beach erosion control and shore protection on certain public lands and navigable waters. They have authority to provide technical and engineering assistance to non-Federal public interests for shore and streambank erosion. This may include assistance to soil conservation districts. USACE has defined "shore and streambank erosion" to apply to shorelines of oceans, bluffs, bays, estuaries, the Great Lakes, inland lakes and reservoirs, and along banks of navigable rivers and their tributaries. They also have responsibility for issuing permits for structures and work in or affecting navigable waters.

B. The following kinds of work must be coordinated with the appropriate USACE district engineer:

(1) Any work that will have offsite effects, such as entrapment or diversion of littoral drift.
(2) Any work that affects USACE jurisdictional waters.
(3) Any work that requires permits.
(4) Any work that may be a duplication of effort.

501.53 Requirements for Assistance

A. Assistance on shore erosion problems for individual landowners or groups of landowners is subject to the cooperator assistance priority controls established by the conservation district.

B. Technical assistance must be coordinated with the agencies issuing permits to ensure conformance with their criteria. Sponsors and cooperators must obtain any required permits. Data that NRCS has collected in the course of making an investigation may be used by cooperators in preparing their requests for permits.

C. Special authorization will be considered for providing assistance during emergencies or for meeting the requirements of special legislation.

Subpart A - Engineering Activities Affecting Utilities

503.0 General

A. Private and public utilities may be jeopardized and equipment operators and others may be injured during site investigations and construction of engineering conservation practices and project structures if proper safety precautions and procedures are not followed.

B. Established procedures for locating utilities and notifying owners are the first step in eliminating many potential accidents. These procedures, if followed, will reduce personal injuries, property damage, and interruption of utility service.

503.1 Scope

A. This subpart provides the minimum requirements for developing a plan to prevent damage to public or private utilities and injury to people from contact with utilities during engineering and construction activities.

B. Public and private utilities include all transmission lines, cables, fiber optic lines, and pipelines.

C. Other buried infrastructure, such as landowner-installed drainage tile or private water lines, are the responsibility of the landowner to locate.

503.2 General Considerations

A. NRCS personnel must take adequate precautions to minimize hazards from or damages to utilities, both overhead and underground, during location, investigation, design, and construction of any works carried out under NRCS programs, technical assistance, or both.

B. Landowners or operators, sponsoring organizations, and contractors must be informed that they are liable for any damage resulting from disruption of service caused by construction activities. They must also be informed that NRCS makes no representation on the existence or nonexistence of any utilities. A letter may be used for this purpose. Absence of utilities on construction drawings is not assurance that no utilities are present at the site.

C. NRCS may be held responsible for damage done by its employees during site investigations.

D. Clearly show location of known utilities on construction drawings with appropriate symbols and identification. Specify on the construction drawings that the contractor or landowner is responsible for contacting the utility companies prior to construction or contact the One Call system for the State.

E. Each State office must develop a procedure for carrying out its responsibilities within these guidelines.

503.3 Investigations

If subsurface investigation or construction is proposed, the responsible NRCS employee must check with the landowner-operator or with the sponsoring organizations to determine if there are underground utilities in the work area. During field inspection, particular attention should be given to utility markers set in fence lines or elsewhere.

503.4 Buried Utilities

A. If buried utilities are known to be in the vicinity of the proposed work, the responsible NRCS employee must notify the landowner-operator or the sponsoring organizations of this fact and of the landowner-operator or the sponsoring organization's responsibility to take the following actions:

(1) Notify the Utility Notification Center (i.e., One Call Center, Dig Safe, or equivalent) or the affected utility company of time, place, and type of work to be performed.
(2) Request that the utility owner locate and stake the buried utility on the ground, both horizontally and vertically.
(3) Request that a representative of the utility company be present during any excavation operations.
(4) Notify the contractor of the location of the utility in relation to the job work area.
(5) Supply to NRCS in writing either the ticket number from the Utility Notification Center or a certification that the affected utility company has been notified. States may set up their own procedures, with the aforementioned being the minimum requirement. Failure to notify NRCS that utilities have been contacted will result in termination of NRCS assistance.

B. The responsible NRCS employee must ensure that the preceding steps have been carried out by the landowner-operator or the sponsoring organizations before beginning work in the vicinity of the buried utility.

503.5 Documentation

The responsible NRCS employee must document action taken pertaining to work in the vicinity of buried utilities. The documentation must be maintained in the NRCS job file. In lieu of a separate

checklist, the same documentation could be kept in the conservation assistance notes.

503.6 State Laws

If State laws and regulations have different requirements, NRCS must comply with State laws and regulations. Procedures may vary from Section 503.4 if equivalent in effectiveness. If State requirements are more stringent, the State Conservation Engineer may supplement Section 503.4, as needed.

Part 503 - Safety

Subpart A – Engineering Activities Affecting Utilities

§IA503.0 General

C. If a utility is damaged or an individual harmed as a result of an incident involving a utility on a job which NRCS has contracted or provided technical assistance, the Assistant State Conservationist for Field Operations, ASTC (FO), is to be notified immediately. In turn, the ASTC (FO) shall notify the State Conservationist.

D. If a utility is damaged as a result of excavation, the excavator shall notify the utility company as soon as practical after the incident. The notice shall include the type and extent of damage to the utility. If the damage results in an emergency, the excavator shall take all reasonable actions to alleviate the emergency.

§IA503.2 General Considerations

E. All Construction and excavation activities in Iowa are covered by the "Iowa One Call" law. Some of the important features of the law are as follows:

(1) The Contractor or person doing excavation is the responsible party for notifying Iowa One Call.
(2) Excavation is defined as any "operation in which a structure or earth, rock, or other material in or on the ground is moved, removed, or compressed, or otherwise displaced by means of any tools, equipment, or explosives and includes, but is not limited to, grading, trenching, tiling, digging, ditching, drilling, auguring, tunneling, scraping, cable or pipe plowing, driving, and demolition of structures."
(3) Normal farming operations are exempt. Tillage operations more than fifteen inches in depth are not exempt. Likewise, digging or driving a post in a new location is not exempt.
(4) Any person doing excavation shall contact Iowa One Call and provide notice of the planned activity. This notice must be given at least forty-eight hours prior to the commencement of the excavation, excluding Saturdays, Sundays, and legal holidays.
(5) Iowa One Call must be notified for every project.
(6) The toll-free telephone number to Iowa One Call is 1-800-292-8989.
(7) Information which must be provided to Iowa One Call includes:

(i) The name of the person providing the notice.
(ii) The precise location of the proposed area of excavation, including the township, range, section, and quarter section.
(iii) The 911 street address of the project.

(iv) The name and address of the excavator.
(v) The excavator's telephone number.
(vi) The type and extent of the proposed excavation.
(vii) The date and time when the excavation is scheduled to begin.
(viii) Approximate location of the excavation on the property.

(8) All underground facility operators participating in Iowa One Call will be notified. However, be aware that there may be some operators of underground facilities, both public and private, who are not registered with Iowa One Call in the area of excavation.

§IA503.3 Investigations

A. Several types of routine NRCS investigation activities are covered by the Iowa One Call law. Some examples of these activities are as follows:

(1) Foundation investigations performed with the drill rig.
(2) Investigations performed with the Giddings probe.
(3) Soil investigations done with a hand probe, auger, or bucket auger.
(4) Backhoe pits.

B. Each District should obtain a reference number from Iowa One Call. This can be done by registering on the Iowa One Call website. The reference number is assigned to frequent callers to the system. The reference number can then be used for all NRCS investigation activities in the District. A reference number is not required; however, it will make the use of the system more efficient.

C. On project activities, the area or state office staff person scheduling the work will be responsible for notifying Iowa One Call unless they have made arrangements for the field office to make the contact.

D. On CO-01 work, the field office will be responsible for making the call to Iowa One Call. It is important to note that this is not for construction activities; it is only for investigation activities. The contractor is responsible for making the call for all construction activities.

E. For any other type of NRCS activity covered by the Iowa One Call law, the NRCS person responsible for scheduling the activity will be the person responsible for notifying Iowa One Call.

§IA503.4 Buried Utilities

C. NRCS will include a reminder for contractors to notify Iowa One Call on each project. This may be accomplished by a note on the construction drawings, construction specifications, in correspondence, or other material specific to a job.

§IA503.5 Documentation

A. Work completed by NRCS personnel in the vicinity of a buried utility shall be documented on the IA-CONS-15, Conservation Assistance Notes, or other appropriate notes specific to a project.

503.10 General

Many NRCS-assisted structures, by nature, may be hazardous to the public. Features designed for recreation or fish and wildlife enhancement invite the public. Children especially are attracted to structures that provide an opportunity to play in water. Reservoirs and structures such as open-top spillway risers, high- or steep-walled channels and chutes, plunge pools, and stilling basins are especially hazardous and require special attention to ensure public safety.

503.11 Scope

All NRCS-assisted designs and structures must include necessary safety measures, regardless of who is responsible for installation and maintenance of safety measures.

503.12 Recommended Safety Measures

All structures must be designed to avoid hazardous conditions where possible; safeguards must be provided to protect the public where hazards are unavoidable. Following are examples of specific safety measures that should be used where appropriate:

(1) Post warning signs where they are clearly visible, visually appealing, and appropriately sized.
(2) Paint "DANGER—STAY OFF" on risers and highwalls. Use only if no other method is appropriate.
(3) Locate riser in the reservoir rather than in the embankment if climatic conditions permit.
(4) Use a covered-top drop inlet.
(5) Use a low-level inlet to keep the normal water level below the main inlet.
(6) Do not install permanent ladders.
(7) Use a trash rack that cannot be easily entered.
(8) Use catwalks only where absolutely necessary and use guard rails or protective fences with a locked gate where catwalks are necessary.
(9) Prevent access to deep stilling basins, drop structures, plunge pools, chutes, steep or vertical walled channels, etc., with a protective chain-link fence, provide escape routes, or both.
(10) Flatten side slopes of pools on at least one side.
(11) Install guard rails on the top of highwalls and steep cuts that cannot be protected with fences.

503.13 Maintenance of Steep Slopes

A. Advise farmers, maintenance personnel, and others against operating equipment on steep slopes.

B. Recommend use of proper safety devices on equipment (protective frames, crush-resistant cabs, and seat belts).

C. Call attention to hazards in maintenance plans and agreements.

D. Specify safe procedures in maintenance plans and agreements that clearly exclude operation of equipment on steep slopes.

Subpart C - Safety During Geologic Investigations

503.20 General

Geologic investigations can be hazardous to the personnel involved because of the nature of site terrain and equipment used. These conditions require a careful analysis of the investigation process to anticipate and fully evaluate the potential safety hazard that may exist.

503.21 Scope

All NRCS detailed geologic investigation plans must include an assessment of anticipated safety hazards and a schedule of planned precautionary measures, known as the "safety plan." This plan must include a schedule of safety meetings.

503.22 Hazard Potential

The following potential hazards related to geologic investigations are cited for illustration. This list is not intended to be all inclusive, and site-specific safety evaluations must be made.

(A) Rock falls and avalanches
(B) Landslides
(C) Flash floods
(D) Overhead utilities
(E) Underground utilities
(F) Dead trees and snags
(G) Pit and trench walls
(H) Lightning
(I) Hazards associated with equipment use
(J) Snakebite and insect bites
(K) Open test pits or bore holes
(L) Sinkholes
(M) Subsidence
(N) Weak bridges
(O) Hazardous waste
(P) Poisonous plants
(Q) Heat
(R) Sunburn

Subpart D - Dam Safety

503.50 Involvement With Dams

A. NRCS involvement with dams and dam safety includes activities in planning and design and, to some degree, construction, operation, and maintenance. NRCS is concerned about the safety of dams and addresses safety aspects at the appropriate stages of involvement.

B. NRCS provides technical assistance on more dams than any other Government agency or consulting firm. NRCS does not own these dams, and most of them are non-Federal. For some, financial assistance is available through project programs. NRCS is involved in operation and maintenance (O&M) activities through the preparation of O&M plans for all inventory dams (Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart C, Section 500.20). In addition, NRCS receives inspection reports for dams installed under project activities (180-NOMM, Part 500, Subpart E, Section 500.43). Additional technical assistance is provided for O&M as determined by the State Conservationist.

C. The Federal Guidelines for Dam Safety were put in place by the Presidential memorandum of October 4, 1979, which stated, "... I ask that the head of each Federal Agency responsible for or involved with planning, site selection, design, construction, certification or regulation, inspection, maintenance and operation, repair, financial or technical assistance, or ultimate disposition of dams adopt and implement the Federal guidelines, as applicable."

503.51 USDA Involvement

A. USDA Departmental Regulation 1043-018 establishes a USDA Dam Safety Committee and requires the Farm Service Agency, Rural Housing Service, Forest Service (FS), Rural Utility Service, Agricultural Research Service, and NRCS each to designate a dam safety officer to make up the committee. This regulation was issued in implementing the Federal Guidelines for Dam Safety.

B. The Under Secretary for Natural Resources and Environment chairs the committee. The NRCS dam safety officer is the executive secretary of the committee.

C. The executive secretary of the committee is the USDA contact with the chief of dam safety of the Department of Homeland Security (DHS) on technical matters.

503.52 NRCS Dam Safety Officer

A. The Director, Conservation Engineering Division, is the NRCS dam safety officer.

B. The dam safety officer reports directly to the Chief on issues that affect dam safety. Directives and needed actions are implemented through normal channels.

C. The dam safety officer has responsibility for—

(1) Ensuring that policy and procedures related to dam safety are adequate.
(2) Making reasonable and prudent efforts to ensure that dams installed with NRCS assistance are safe.
(3) Seeing that all levels of NRCS are aware of the need for actions to ensure that dams installed with NRCS assistance are safe.
(4) Evaluating safety-related administrative and technical practices concerning the design, construction, operation, maintenance, periodic inspections, and rehabilitation of dams.
(5) Maintaining an inventory of NRCS-assisted dams meeting the inclusion criteria (see section 520.21F).
(6) Providing leadership in representing NRCS in Federal and other activities leading to the establishment of policy, procedure, and criteria for dam safety.

503.53 Interagency Involvement

A. NRCS is involved with other Federal agencies at the national level in dam safety activities, both formally and informally. As executive secretary of the USDA Dam Safety Committee, the Director, Conservation Engineering Division, is the USDA member on the Interagency Committee on Dam Safety (ICODS).

B. State Conservationists are encouraged to work with other Federal and State agencies in dam safety activities.

503.54 Other (Nongovernmental) Involvement

NRCS encourages its employees to become involved at all levels with various technical and professional groups in dam safety activities.

503.55 NRCS-State Relationships

NRCS supports strong State dam safety programs. A strong State dam safety program is imperative to protect public health and safety. NRCS lacks O&M authority on dams installed with Federal assistance and does not have continuing responsibility for the non-Federal dams installed under NRCS programs.

It is NRCS policy to complement and not compete with State dam safety programs.

503.56 Responsibility for Dams

The owner of a dam is responsible for potential hazards created by the dam, both during construction and in the years following construction. States are responsible for safeguarding the lives and property of their citizens. NRCS is responsible for ensuring that the assistance it provides for dams is technically sound and meets applicable State regulations and criteria.

503.57 NRCS Assistance

A. Each State Conservationist must assist the State to develop and implement a strong dam safety program, as needed. The State Conservationist must work with the State, as appropriate, at the policy level, such as by providing model legislation and regulations and by technology transfer. NRCS involvement in formal inspections could be limited to some percentage of the NRCS-assisted dams. This involvement, however, permits NRCS and the State to derive the benefits of mutual technology exchange. NRCS participation in at least some of the initial inspections may also be particularly desirable to provide feedback to the design process.

B. Each State Conservationist must establish needed working arrangements with the State for NRCS assistance in maintaining a strong State dam safety program.

503.58 Key Factors

Several key factors must be considered in developing and maintaining the State dam safety program including—

(1) Consistency with the Federal guidelines for dam safety.
(2) Consistency with the model State law prepared by the Association of State Dam Safety Officials.
(3) Recognition that some classification system is desirable—not all dams are necessarily high hazard dams.
(4) Assurance of proper engineering criteria through a State approval or certification system covering both design and construction.
(5) Requirements for adequate maintenance of dams.
(6) Procedures for adequate inspection, including appropriate participation by qualified personnel.
(7) Provisions for periodic reviews of hazard class and educational programs and regulations to discourage development downstream of low and significant hazard dams that would change the classification.
(8) Provisions for emergency action plans for all high hazard dams.
(9) Authority to take action to alleviate unsafe conditions, such as by modifying or removal of the dam or removing the hazard.
(10) Adequacy of staffing and funding on a continuing basis.
(11) Inclusion of all inventory-type dams (see Section 520.21(F)) in the State-regulated program.

503.59 Interim Assistance

State dam safety programs should provide for adequate inspection of dams already in existence and for new ones that are built. Until a State implements its dam safety program, the State Conservationist may wish to assist by making inspection assistance available. As a general rule, the State Conservationist should encourage the State to eventually take on full responsibility and phase out NRCS assistance. NRCS assistance may also be desirable for the initial formal inspections of new significant and high hazard dams.

503.60 Department of Homeland Security

A. The chairman of the USDA Dam Safety Committee is the primary contact with DHS for dam safety.

B. The executive secretary participates in DHS activities and represents the Department in the chairman's absence. The executive secretary is the point of contact with DHS in technical matters.

Subpart E - Prohibited Technical Assistance

503.70 General

NRCS is often asked to provide technical assistance in many areas. However, this assistance must not be provided for activities that are outside the normal area of expertise if these activities expose NRCS field employees to hazardous conditions or expose the agency to uncontrolled liability.

503.71 Prohibited Activities

The following activities are prohibited:

Assistance with removal of underground storage tanks.

Subpart A - Problems and Deficiencies

504.0 General

A. Engineering activities must be carried out with a high level of technical competence if the results are to be of proper quality. The appropriate level of quality can be maintained only by engineers who use high-quality specifications, criteria, standards, and procedures. These tools must be constantly updated because of advancements in technology and experience. Problems, deficiencies, and failures often reflect a breakdown in the quality control of engineering activities.

B. Special investigations, studies, and reports of engineering problems and deficiencies must clearly define the conditions that led to the problem or deficiency. These studies should—

(1) Describe the situation that existed at the time of the study, in detail, including induced damages.
(2) Define additional survey or investigation needs.
(3) Determine the cause of the problem.
(4) Provide recommendations for resolving the problem or deficiency.
(5) Provide recommendations or changes needed to avoid a recurrence.
(6) Fully document findings in an engineering report, providing the information needed to improve future engineering work and resolve possible claims or litigation.

504.1 Scope

A. An investigation is required and a report prepared whenever an engineering practice, system, structure, structural element, or material does not function as planned. Deficiencies or failures that become evident during construction must also be investigated and reported.

B. An investigation must be initiated as soon as signs of instability or serious distress are detected in engineering practices. Deterioration of concrete, severe erosion in channels, movement or cracking of an embankment, malfunction of pipelines, and excessive seepage are some examples of serious distress.

504.2 Reporting Problems, Deficiencies, and Failures

A. The State Conservationist and Regional Conservationist must be notified immediately of a problem or deficiency that might create a serious emergency or a failure that has led or might lead to loss of life, serious offsite damages, disruption of public utilities, or major economic losses for owners, sponsors, contractors, or NRCS. The State Conservationist must telephone and email the Chief promptly. The telephoned report must include such critical information as identification of the structure, project, and location and a description of the situation at the time of the call. When a major dam, Class V or larger (see Section 501.4 of this manual) is affected, the State Conservationist must see that the State Conservation Engineer (SCE) provides the report required in paragraph D of this section.

B. Normal lines of communication will be used when reporting problems, deficiencies, or failures other than those described in paragraph A of this section. Political and social effects must be considered in determining the urgency of the notification to line officers and the need for informing others. Jobs in Classes I through IV (see Section 501.4 of this manual) do not usually merit special reporting because they rarely have the potential to create significant damages.

C. If there is a significant danger to life or property, the State Conservationist must ensure that appropriate authorities, owners, and sponsors are notified.

D. If there is failure or potential failure of a Class V or larger dam or other structure that may cause major economic losses, the SCE must telephone and email the Director, Conservation Engineering Division (CED), and report the situation. The Director, CED, must provide engineering guidance on emergency or remedial measures and, if appropriate, arrange for special engineering assistance. The SCE must keep the Director, CED, informed of changes in the situation.

504.3 Committee Assignments

A. An investigating committee must be named as soon as possible after a problem, deficiency, or failure has been identified. An investigating engineer may be named in lieu of a committee if the cause of the problem is obvious and the practice or structure is minor. Jobs in Classes I through IV are usually considered minor. A committee may be named for these minor structures if the problem is unusually complex.

B. Committee members or investigating engineers should not have had any significant prior participation in the design, construction, or approval of the practice or structure. SCEs may not be members of committees in their States. Non-NRCS personnel will be named to the committee only if specifically approved by the Director, CED. The committee may also include sponsors, State agencies, or others as observers.

C. The committee must include specialists in appropriate disciplines, such as design, hydraulics, soil mechanics, construction engineering, geology, or others.

D. For a minor practice or structure (Class I through IV) the State Conservationist, if so instructed, appoints the investigating committee or the investigating engineer. The SCE provides recommendations on membership for the committee.

E. For Class V or VI jobs, the State Conservationist must appoint the committee based upon the recommendations from the Director, CED, and the SCE. Depending on the nature of the issue, it may be necessary to arrange for engineers or other specialists from the National Design Construction and Soil Mechanics Center, other centers, or from outside the State to serve on the committee.

F. For Class VII or VIII jobs, the State Conservationist and the Director, CED, will determine the committee membership and the disciplines to be included. The State Conservationist must arrange for the participation of the members and issue the letter of appointment.

G. If the problem is unusual, national in scope, or especially significant, the Chief may appoint a separate board to study the problem. The Director, CED, will make the recommendation for the board and its membership. The State Conservationist must be notified when a board will be established. If an investigating committee has been established, its members will submit their findings to the board and, as appropriate, serve as staff for the board.

H. The SCE provides general guidance and technical support and arranges for any assistance required by the committee or board.

I. The appointment letter provides general guidance on the scope of the investigation and tentative schedule. If there are problems or questions about the assignment, the chairman or the investigating engineer must resolve these issues as soon as possible.

504.4 Procedures

A. General guidance in conducting and reporting the investigation of a problem or deficiency is contained in Technical Release No. 24, Investigating Structure Failures.

B. Because evidence may be obscured by subsequent flow of water, continued deterioration of the structure, or emergency repairs, the investigation must begin as soon as possible. The district conservationist (or anyone visiting the site) should photograph the site as soon as possible.

C. The investigating committee must—

(1) Inspect the structure.
(2) Obtain photographs of the structure and affected areas.
(3) Determine the high-water level that prevailed.
(4) Interview eyewitnesses and record their statements, giving particular attention to the sequence and timing of events.
(5) Determine when the deficiency was discovered and when the structure was last inspected.
(6) Assemble and review construction records, such as diaries, reports, test data, as-built plans and as-built reports on construction geology.
(7) Review the design file.
(8) Gather any other information regarding the event, such as precipitation and stream flow records.
(9) Define field surveys required to record topography and physical changes.
(10) Specify any geologic investigations and soil mechanics testing needed.
(11) Review all communications and staffing assignments during the design and installation of the structure.

D. After compiling the necessary data, the committee or investigating engineer must—

(1) Determine the causes of the problem, deficiency, or failure. Support for each cause must be presented carefully so as to define completely the conditions that led to the problem.
(2) Define and support conclusions.
(3) List, as appropriate, suggestions on how procedures, criteria, designs, staffing, etc., should be changed to avoid a recurrence.
(4) When directed by the appointing official, make suggestions for alternative treatments in descriptive concepts and not treatment design details. This is a secondary purpose of the report.

504.5 Engineering Report

A. An engineering report must be prepared for each investigation. The detail and composition of the report must be consistent with the size, complexity, and significance of the problem, deficiency, or failure.

B. The engineering report must include—

(1) A brief description of the committee activities.
(2) A description of the structure, with pertinent data on name, location, size, age, etc.
(3) Appropriate geologic and engineering information.
(4) A detailed description and explanation of the situation. Include photographs to enhance the explanation.
(5) Sufficient narrative and data to fully document facts and support findings and conclusions.

The report must discuss where standards, criteria, procedures, or practices failed or were improperly followed. The questions "What went wrong to permit the incident to occur and what would have prevented it?" must be answered to the best of the committee's ability.

(6) Pertinent drawings, specifications, reports, etc.

C. An abstract must be prepared for all engineering reports of measures that are Class V–VIII. The abstract is used to inform other engineers so they can gain from the experience. The abstract should not be more than two pages and must include—

(1) Data on location, size, etc.
(2) Description of the problem, deficiency, or failure.
(3) Statement of the cause and effect.
(4) Discussion of the findings and conclusions, including any identified procedure or practice that, if followed, would have prevented or alleviated the situation.
(5) Sketches, as appropriate.

504.6 Report Review and Acceptance

A. The committee or the investigating engineer must submit the report to the State Conservationist through the SCE. The SCE will coordinate the reviews required and upon technical acceptance, forward the report with his recommendations to the State Conservationist for distribution.

B. The SCE must solicit review comments by employees who were responsible for preparing the design and inspecting the construction. The SCE and the employees' comments must be attached to all copies of the report. Before the reports are released, they must be reviewed and accepted, as follows:

(1) Classes I–IV.—The SCE determines when the report is technically acceptable. The SCE will work with the committee to resolve all issues raised. If the report identifies problems resulting from inadequate national specifications, practice standards, or procedures or otherwise merits special attention, the SCE will request review comments from the Director, CED. After all issues are resolved and the SCE has determined that the report is acceptable, the SCE must submit the report to the State Conservationist and indicate its technical acceptance.
(2) Classes V– VIII.—The report must be submitted to the Director, CED. The Director, CED will review the report and indicate that the report is acceptable or request additional details, study, or other action needed for acceptance. After all issues are resolved and the report is accepted, the SCE must submit the report to the State Conservationist and indicate its technical acceptance.

504.7 Release and Distribution of Reports

A. After technical acceptance and receipt by the State Conservationist, the report may be released to others and may be used as supporting documentation for requesting funds to correct problems or deficiencies. Owners, sponsors, State agencies, and others may be given copies after the report is accepted.

B. As a minimum, a copy of the accepted report must be forwarded to the Director, CED.

Subpart B - Emergency Spillway Performance

504.10 General

A. Thousands of auxiliary spillways have been installed since 1954, when NRCS began using the present procedure for design. More are installed each year. Major spillway flows can be expected at several structures each year.

B. Current auxiliary spillway criteria is outlined in Title 210, National Engineering Handbook (NEH), Part 628, Dams, and is based on judgment and experience gained over the years. However, most research and field evaluations to date have been on structures with drainage areas of less than 10 square miles. Further research is needed, but laboratory model studies are not always directly applicable and large field models or prototype studies are only now being undertaken. An alternative is to make field studies of the operation of existing structures.

C. The purpose of auxiliary spillway performance and overtopping analyses studies is to carry out a continuing program to provide information that will be helpful in confirming or improving existing design criteria, give an indication of the upper limits of applicability of various types of spillways and earthen embankments, and show the extent and cost of spillway and embankment maintenance required after flood flows.

504.11 Scope

A study must be made of any earth, rock (except massive, unweathered rock), or vegetated spillway built since 1954 if it is determined that the information from an auxiliary spillway, overtopping flow, or both would help with continued Agricultural Research Service research and development of the models used by NRCS. The need for a study will be made on a case-by-case basis by contacting the Director, Conservation Engineering Division (CED), if any of the following conditions occurred:

(1) The water surface in the reservoir has reached an elevation above the crest of the auxiliary spillway of 3 feet or more.
(2) The auxiliary spillway has suffered severe damage, has approached breaching, or has breached to any degree.
(3) The auxiliary spillway has sustained continuous discharge for 7 days or more.
(4) Flow resulted in overtopping of the embankment.

504.12 Reporting Major Flows

If conditions require a study (see Section 504.11), the Director, CED, must be notified. This notification may be sent by email and must include the watershed names; site names, site numbers, or both; and preliminary flow data. Notification must be made as soon as possible in order to aid in data collection efforts if further investigation is required.

504.13 Assignments

The Director, CED, will determine the need to develop performance studies on a case-by-case basis. If it is determined that a study is needed, it is to be made by qualified engineers. The Director, CED, will coordinate with the State Conservation Engineer (SCE) to formulate members of the evaluation team. Hydrologists, hydraulic engineers, and geologists are needed in various parts of the evaluation.

504.14 Procedures

If an auxiliary spillway study, overtopping study, or both are needed, the performance study should be made as soon after the occurrence as practical. The study and the report must consider and document the following information:

(1) Name of the watershed
(2) Name or number of the structure and inventory number
(3) Location (State and latitude and longitude to nearest degree and minute)
(4) Date built
(5) Drainage area in square miles
(6) Height of dam
(7) Plan and profile along the auxiliary spillway centerline from entrance to streambed
(8) Cross sections at control section and at selected points in the exit channel showing the depth and width of the constructed spillway
(9) Profiles along the embankment top, starting from the upstream side of the top and across the embankment back slope at intervals that show the erosion that occurred, and embankment cross sections at selected locations that show the length of back slope at different intersection points along the profile
(10) Geologic map and profiles of the embankment, the auxiliary spillway control section and the exit channel, or both
(11) Statement regarding the condition of the embankment, the auxiliary spillway, or both before the flood event, including the density and type of vegetation
(12) A copy of the last maintenance and inspection report before the storm

(13) Photographs, if available, of prestorm conditions
(14) Date of flood
(15) Rainfall depths for various durations according to either official rain gages or a "bucket survey," and the related frequency for each duration
(16) Runoff; if a stream gage is available, U.S. Geological Survey provisional data should be included
(17) Observed or reconstructed inflow and outflow hydrographs at the structure, including maximum reservoir stage and duration of overtopping, auxiliary spillway flow, or both
(18) Physical factors of drainage area related to a weighted "curve number," including antecedent moisture and vegetative cover conditions immediately preceding the storm
(19) Description of the damage on the embankment, in the auxiliary spillway, or both, including location, depth, and severity of erosion
(20) Photographs of poststorm conditions in the spillway and downstream
(21) Estimate of volume of soil and rock eroded from various sections of the spillway
(22) An estimate of the cost to repair the spillway
(23) Any other pertinent information

504.15 Report

A. A separate spillway flow report is required for every flood event meeting the conditions in Section 504.11. If a storm event affects many structures over a wide area, a reconnaissance may be made to determine the need for making a field study on every structure. If this situation occurs, the SCE must advise the Director, CED, and reach agreement on the studies needed. An auxiliary spillway performance study does not alter circumstances under which a problem or deficiency study may be required.

B. A report must be prepared for each site, except as provided in the preceding paragraph. A copy of each report must be submitted to the Director, CED. After the report has been approved and accepted, a copy is submitted to the State Conservationist, the State agency responsible for dam safety, and to the owner or sponsor of the structure.

504.16 Review and Approval

A. The SCE must approve the report before it is sent to the Director, CED.

B. The Director, CED, notifies the State Conservationist of acceptance of the report or of additional data required.

Subpart C - Reservoir Sedimentation Surveys

504.20 General

A. Sediment has a major impact on water quality, water and land use, environmental value, and structure performance. Sedimentation surveys provide States with more reliable and defensible procedures for quantifying the off-farm impacts of sediment, assessing the effects of conservation practices on these off-farm impacts, and predicting sedimentation rates in ponds and reservoirs. Measurements of the sediment accumulating in reservoirs and determining the physical conditions influencing the sediment yield from the contributing watersheds provide some of the best data that can be obtained on erosion and deposition.

B. Selection of sites and interpretation and analysis of data must be made by the State for local applications.

504.21 Procedures

The detailed procedures for making these surveys are described in Title 210, National Engineering Handbook (NEH), Section 3, Chapter 7, and in ASTM/D4581.

504.22 Reports

A. Reservoir sedimentation reports must be prepared by the State for each survey as described in "Outline of Report," 210-NEH, Section 3, Chapter 7. The reservoir sediment accumulation data collected must be sufficient to complete Form NRCS-ENG-34 and provide the data on related watershed conditions (e.g., soils, surface geology, topography and land forms, land use and treatment, and all types of significant erosion).

B. The Director, Conservation Engineering Division, provides data from the completed Form SCS-ENG-34 to the Subcommittee on Sedimentation and the Interagency Advisory Committee on Water Data to add to the database.

Part 504 – Special Investigations, Studies, and Reports

Subpart C. - Reservoir Sedimentation Surveys

§504.20 General

C. Iowa sites designated for surveys:

(1) Reservoirs at these structure sites have all been surveyed one or more times and have data available for comparison with follow-up surveys. Any surveys undertaken for the purpose of quantifying sedimentation rates (e.g., to monitor effects of conservation treatment, assess watershed erosion rates, identify sediment sources, etc.) should be selected from this list. Existing survey data is located in the State Office and can be obtained from the NRCS geologist(s).

Watershed/Site No.	County	Year First Surveyed	Drainage Area (ac)
Mule Creek R	Mills	1955	524
Big Wyacondah 27-1	Davis	1966	659
Diamond Lake C-14	Poweshiek	1973	410
Pioneer M-1 (Lake Pajoha)	Lyon	1974	3,846
Walters Creek 18-2	Adams	1975	410
Glen Ellen 3-2	Woodbury	2001	106
Bear Creek 13	Houston (MN)	2003	457
Heisler Creek 2-1	Woodbury	2003	494
Troublesome Creek 66-4	Audubon	2003	90
Twelve-Mile Creek 62-5	Union	2003	317
Bear Creek 25	Winneshiek	2004	294
E. Fork of Grand River A-49	Ringgold	2004	256
Soap Creek 4-98	Appanoose	2004	1,480

(2) Any site in the table that undergoes modification(s) which alters the sediment volume in the reservoir should be removed from the table. If this occurs, the existing survey data are no longer valid for comparison with follow-up surveys.

Subpart D - Field Trials and Evaluations

504.30 General

A. New products, procedures, and techniques are essential in maintaining a technically strong and current engineering program. These new items become available over time. There are requests from industry and others to put these items into immediate use. Many of these items have great potential for use in engineering. Others, while appearing to have merit, may in fact be inferior and unacceptable. Before NRCS adopts a product or procedure, it must be determined that it will function as designed and last for the design life. This may require detailed study and testing.

B. Field trials and evaluations, in conjunction with test data, can provide the necessary information to support the approval of a material or procedure for NRCS use. Before a new product or procedure is included in standards or specifications, it must be documented that it will meet the design criteria. Field trials and evaluations are frequently the only methods for developing acceptable data.

C. Trials and evaluations must conform to policy stated in GM-450, Part 403.

504.31 Scope

Field trials and evaluations must be considered if there is a need for determining if a product, procedure, or technique can be used to alter, replace, or supplement existing standards, criteria, or procedures.

504.32 Approval Procedures

A. Proposed field trials or evaluations that may change procedures, policy, standards, or criteria must be submitted to the Director, Conservation Engineering Division (CED). Proposals must be specific as to the scope of the trial and the materials or procedures to be tested.

B. The Director, CED, makes a recommendation on each proposal. This may include guidance on the scope and intensity of the study to ensure national application of results. This technical recommendation for the study does not constitute approval for expenditure of resources. If necessary, a request for funds and personnel should be made to the appropriate source by the State asking for the request.

C. Proposed field trials or evaluations that do not require a variance from standards, criteria, specifications, policies, or procedures may be approved by the State Conservationist.

504.33 Study Plan

A. Generally, the brief statement describing the trial or test that accompanies the request for approval is not sufficiently detailed to define the scope, intensity, purpose, and plan for the study.

B. The study plan must fully describe the need, benefits, approach to be taken, anticipated schedule, and resources required. These must be sufficiently detailed to permit a valid assessment of the potential for obtaining the needed data and of the potential demands for resources (personnel, equipment, and costs).

504.34 Reports

A. Each State must maintain an index and a schedule for all field trials and evaluations.

B. At the time the study is approved, a schedule must be established for progress reports. These reports must be appropriate to the trials and evaluations.

C. When the trial or evaluation is completed, a final report must be prepared.

D. Copies of all reports are submitted to the Director, CED.

Subpart A - Introduction

505.0 General

A. Non-NRCS engineering and other technical services are used to meet NRCS workload demands and specific technical and program needs. It is essential that NRCS not engage in engineering services and activities that are in direct conflict or competition with services available in the private sector. NRCS must maintain a quality, well-trained engineering staff to support the delivery of NRCS programs and work with non-NRCS employees called on to assist in our work. In using non-NRCS services, NRCS will strive to ensure—

(1) Professionalism and respect for others.
(2) Quality work.
(3) Excellence in customer service.
(4) Teamwork with others.
(5) Clearly defined responsibilities.
(6) Partnerships with State boards of registration.
(7) Sustainable solutions.
(8) Effective empowerment.

B. For the purpose of this policy, non-NRCS engineering services means services provided by any engineer, landscape architect, geologist, or others employed by a consulting firm, sponsoring local organization, other unit of government, private individual land users, technical service providers (TSPs), manufacturers of structural elements or components, and construction contractors.

C. For the purpose of this policy, the term "technical services" means engineering-related and construction-support activities provided by private individuals, such as individual landowners and users, conservation contractors, and others. Individuals providing these services are not under the supervision of an NRCS employee and may not be licensed to practice engineering. NRCS may use the documentation furnished by private individuals performing technical services for reporting and certifying conservation practices. Non-NRCS engineers must certify to NRCS that all work meets current NRCS standards. This certification may be the basis for NRCS acceptance.

505.1 State Criteria

Opportunities to use non-NRCS engineering services vary greatly from State to State. State Conservationists must periodically review the scope, type, and volume of engineering work in their States, consider the availability of non-NRCS engineering sources, and establish criteria in accordance with this policy for the kinds of jobs for which these sources are to be used. Each State must maintain liaison with consulting engineering organizations in that State to ensure an understanding of the division of work.

505.2 Exchange of Technical Services Between Government Agencies

NRCS participates in the exchange of engineering services between Government agencies to expedite and improve technical work of the agencies by sharing expertise and enhancing on-the-job training. An agreement for exchange of services may be formal or informal depending on the nature of the work. Generally, simple routine exchanges are arranged by correspondence between the agencies. More complex jobs require formal agreements.

505.3 Review of Technical Services Performed by Others

A. Standard designs and drawings prepared by others. NRCS is often requested to approve standard drawings for such measures as manure tanks or prefabricated structures. State Conservation Engineers (SCEs) must use all appropriate means to handle these requests efficiently.

(1) The SCE may perform the review and, if appropriate, provide approval using available NRCS resources.
  (i) The SCE may request the firm to supply a peer review conducted by an independent engineering firm.
  (ii) The SCE must require the firm to supply NRCS with a certification by a licensed professional engineer registered in the State where the measure will be installed. The engineer must certify whether the measure meets all NRCS standards for the States where the measure is to be applied.
  (iii) Designs to be reviewed by NRCS must be accompanied by all necessary substantiating data, including calculations, design constraints, and limitations.
  (iv) The SCE will notify the Director, Conservation Engineering Division (CED), of all approved standard designs and drawings prepared by others.

B. Site-Specific Plans and Specifications.—Designs, drawings, and specifications completed for NRCS, sponsors, or landowners by consultants and others can expedite implementation of NRCS-administered programs.

(1) Non-NRCS Individuals and Non-TSP
  (i) NRCS will provide the non-NRCS individual with the applicable NRCS standards and provide

appropriate predesign support at the request of the landowner or sponsor.

(ii) The individual will certify on the drawings that "to the best of my professional knowledge, judgment, and belief, these plans meet applicable NRCS standards."

(iii) An NRCS employee with the appropriate job approval authority must perform a functional review to ensure, at a minimum, that the work—

Achieves the objectives of the plan and programs.

Meets the criteria in the applicable conservation practice standards.

Complies with the applicable State and Federal programs.

Includes an inspection plan and operation and maintenance plan.

Does not require a technical review as defined in Section 511.5

(2) TSP

(i) NRCS will provide the applicable NRCS standards and provide appropriate predesign support at the request of the landowner.

(ii) The individual must certify on the drawings that "to the best of my professional knowledge, judgment, and belief, these plans meet applicable NRCS standards" and submit all deliverables as required to the local NRCS field office.

C. Site-Specific Installations.—Landowners and sponsors are encouraged to use the non-NRCS individuals to provide construction inspection.

(1) Non-NRCS Individuals (Non-TSP)

(i) The landowner or sponsor must submit final as-built drawings with a certification by the responsible individual that "to the best of my professional knowledge, judgment, and belief, this practice is installed in accordance with the plans and specifications and meets NRCS standards."

(ii) NRCS may make a field visit to review the application.

(iii) NRCS will make any necessary program certification for cost sharing.

(2) TSP

(i) The certification of practices or activities accomplished by the TSP is the responsibility of the TSP. The TSP must furnish documentation as outlined in the statement of work for the conservation practice or activity. This documentation must be on file before payment is made to the landowner for cost-share practices.

(ii) The TSP must certify on the drawings that "to the best of my professional knowledge, judgment, and belief, these plans meet applicable NRCS standards" and submit all deliverables, as required, to the local NRCS field office.

Part 505 – Non-NRCS Engineering Services

Subpart A – Introduction

§IA505.3 Review of Technical Services Performed by Others

B. (1) Non-NRCS Individuals and Non-TSP

(iv) All deliverables as required by individual practice standard Statements of Work shall be submitted to the local NRCS Field Office and reviewed by an NRCS Employee with appropriate job approval authority prior to construction.

B. (3) Designs, construction drawings, and specifications may be prepared by Technical Service Providers (TSP) or any other Professional Engineer (PE) licensed in the state of Iowa for the appropriate discipline.

Some practices include component structures such as hoop buildings or mono-slope buildings as part of an animal waste management system. In these cases, it is common to have two designers working on the project. One designs the structure while the other designs the rest of the system including the site plan, appurtenances, foundations, supports, etc.

In this case, the engineer who designs only a component of the system must certify the following:

> "To the best of my professional knowledge, judgment, and belief, this design, construction drawings, and specifications meet applicable NRCS standards and specifications."

This certification must be accompanied by his/her Iowa license stamp or seal. With this statement, the engineer is automatically certifying that his/her work meets the applicable criteria from other standards which are referenced in the NRCS standards.

It is important to recognize that certification of the structure design itself is not a sealed set of plans for the entire site. The overall site design must be certified and stamped/sealed also. The engineer who does the overall site design and drawings must use the same certification statement as shown above.

If one engineer does the entire design and drawings, including all structures and components, then that engineer must certify the design and drawings using the above statement accompanied by his/her Iowa license stamp or seal.

C. (1) Non-NRCS Individuals (Non-TSP)

(iv) All deliverables as required by individual practice standard Statements of Work shall be submitted to the local NRCS field office.

C. (3) After construction is completed, the licensed engineer must certify the following:

"To the best of my professional knowledge, judgment, and belief, this practice is installed in accordance with the plans and specifications and meets NRCS standards."

This certification must be stamped/sealed and must be accompanied with the final "as-built" drawings and other deliverables as shown in the practice Statement(s) of Work.

As with the design, it is possible to have two certifications for construction. For example, one engineer may certify a component of the system, such as a structure, while the other engineer may certify the rest of the project. In this case, each engineer would be required to use the above statement with their stamp/seal and provide the appropriate deliverables for their portion of the work.

Subpart B - Use of Non-NRCS Engineering Services

505.10 General

Non-NRCS engineering services are used to meet workload demands and to provide specialized expertise, both for Non-Project and Project activities. Non-Project activities are those supporting planning, design and installation of conservation practices and systems by landowner or group engaged contractors. Project activities are those in support of work installed under Federal or locally-awarded contract and project agreement with a local sponsor as authorized by programs such as the Small Watershed Program.

505.11 Non-Project Activities

A. Non-NRCS Engineering Services

(1) Non-NRCS engineering services may be used to provide assistance to individual and groups on planning, design, and inspection services for conservation practices. Small individual and group jobs unattractive to non-NRCS sources have priority for NRCS assistance. For the larger individual and group jobs, NRCS strongly encourages using non-NRCS engineering services to make field surveys, soil and geologic investigations, and other special investigations to prepare plans and specifications and to provide construction inspection services.

(2) State Conservationists are to utilize non-NRCS sources to meet program needs and to satisfy appropriate interest expressed by non-NRCS sources. Generally, non-NRCS engineering services are used for larger jobs to free NRCS for other work for which non-NRCS engineering services cannot be obtained.

(i) The State engineering job approval classification may be used to delineate the upper limits of size and complexity of jobs NRCS regularly handles in the State or area. For example, the State Conservationist may decide that in a given area, NRCS will not handle jobs outside the approval authority of the responsible engineer and that non-NRCS engineering services should be used for such jobs.

(ii) If non-NRCS engineering services are used in NRCS programs, NRCS generally makes preliminary investigations and studies needed to support the development of the conservation plan and, as necessary, provides needs and feasibility determinations. NRCS also provides criteria and consultation and maintains contact with the work to ensure that it meets the conservation objectives of the program and that it is acceptable by NRCS standards.

(3) When a landowner elects to use non-NRCS engineering services to design or inspect the installation of a conservation practice, the responsible NRCS employee must ensure that the landowner and consultant understand the responsibilities of all parties involved, especially if the practice involves cost sharing. It is recommended that a letter similar to the sample shown in Subpart E, Exhibits, Section 505.43, be used to ensure effective communications with all involved parties.

B. Technical Services

(1) Conservation contractors often provide technical services to landowners and land users in conjunction with the installation of terraces, diversions, grassed waterways, stabilization structures, on-farm drainage and irrigation systems, low hazard agricultural waste management systems, land grading and leveling, and other conservation practices. These services are considered support activities. To enhance the working relationship between conservation contractors and NRCS, a memorandum of understanding (MOU) has been signed between the Land Improvement Contractors of America (LICA) and NRCS.

(2) NRCS is responsible for technical standards, conservation planning and application, and the certification and reporting of conservation practices. When technical services are provided during the installation phase, the field office staff will review the checkout and/or layout and other construction documentation provided by the contractors to ensure that the documentation submitted shows that the practices were installed in accordance with the approved drawings and specifications. Practice documentation must comply with GM-450, Part 407, "Documentation, Certification, and Spot-Checking." Documentation aids may be developed by NRCS staff to assist contractors in providing the necessary documentation.

(3) NRCS will ensure that the quality of services provided by the contractor during the design phase meets NRCS program needs and technical standards. Contractor-developed designs will be reviewed for technical adequacy by an individual having engineering job approval authority for the work.

(4) The State Conservationist will establish procedures to make random, periodic field checks and quality reviews to ensure that practices were installed in accordance with the documentation furnished by the contractor and approved drawings and specifications. Records will be maintained in the field office to document that the contractor provides services meeting NRCS standards.

(5) In the event a deficiency exists with the contractor's documentation or installation, corrective action must be taken in conformance with GM-340, Part 404, Subpart C, "Quality Assurance." In addition to notifying the participant or owner, the field office staff must work with the contractor to satisfactorily resolve the issues. A satisfactory resolution ranges from correcting a simple error or misunderstanding to not accepting future documentation until such

documentation is submitted in an accurate, acceptable manner.

(6) Upon request from a contractor, the field office staff will furnish information related to acceptance of his or her work by NRCS. The sample letter shown in Subpart E, Exhibits, Section 505.42, should be used in responding to the contractor. The practices and elements of work performed (construction of a practice and checkout, layout, design documentation, or any combination of these) are shown as examples only. Each letter will be tailored to identify the acceptance of construction and documentation for the individual contractor. This information is protected by the Privacy Act from unwarranted disclosure and may not be divulged by NRCS to any individual or organization other than the contractor to whom it pertains. Exceptions to this require approval of the Freedom of Information Act officer.

505.12 Project Activities

A. Scope.—Engineering services for work in project activities are provided by NRCS or by non-NRCS engineering staffs, including sponsoring local organizations, State agencies, or other units of government; private engineers under contract with NRCS; and private engineers under contract with sponsoring local organizations.

B. Staffing.—NRCS must have an adequate staff of engineers and other personnel to maintain a technically sound program and rate of progress consistent with the intent of Congress and the administration. The engineering staff should be large enough for the normal workload of preparing plans, making field surveys and investigations, preparing construction drawings and specifications, and inspecting construction. For some projects, part of this workload is performed by non-NRCS sources. Sponsoring local organizations may elect to provide engineering services.

C. Use of Non-NRCS Engineering Services.—Non-NRCS engineering services contracted by NRCS or sponsoring local organizations are used to perform—

(1) Engineering work in excess of the amounts NRCS and sponsoring local organizations can do because of peak loads greater than normal seasonal peaks.
(2) Unusual kinds of work for which NRCS and the sponsoring local organizations lack the necessary facilities or specialized knowledge.
(3) Engineering services for which sponsoring local organizations elect to employ private engineers.
(4) Consulting services and special studies, such as review and evaluation of engineering data, independent safety reviews for design of dams, consultation in design of complex or unusual structures, and hydraulic model studies.
(5) Certain engineering and architectural services for basic facilities for recreation or fish and wildlife and for municipal and industrial water supply.

D. Inspections.—Local organizations provide for all inspections of features not paid for from NRCS funds. NRCS inspects features whose malfunction or failure could adversely affect portions of the work that are paid from NRCS funds. When inspection of construction paid from NRCS funds is performed by non-NRCS personnel, the NRCS representative provides such supervision as necessary to ensure that the inspection is adequate and that the work meets the requirements of the construction contract. Inspection of construction in which NRCS-administered funds are invested is usually provided by NRCS. These services may be provided by others if one of the following circumstances prevails:

(1) Qualified NRCS personnel are not available.
(2) The work was designed by non-NRCS engineers because NRCS did not have the skills to do the design work.
(3) The work is principally financed by the sponsoring local organization or other non-NRCS interest.
(4) The work includes installations or parts of installations requiring specialized knowledge and experience not available in NRCS.

E. Recreation and Fish and Wildlife Facilities.—Basic facilities for recreation or fish and wildlife are planned by sponsoring local organizations, private engineers or other professionals, or NRCS. These facilities are designed by sponsoring local organizations, private engineers, or other professionals, not by NRCS.

(1) Standard plans developed by State or Federal agencies and approved by NRCS can be used as guides. Criteria for facilities for which no standards are available must be established by conference of the interested parties.
(2) Basic facility plans must be detailed enough to establish the general location and size of the major elements, the types and approximate quality and quantity of the various features, and to provide reasonable estimates of costs.
(3) The general location and size of the major elements and the types, quality, and quantity of the various features of basic facilities are to be designed in conformance with the information in the plan.
(4) NRCS review of the design documents, drawings, and specifications is limited to that needed to determine that they clearly specify the work to be done, are consistent and compatible with all other provisions of the contract document, the facilities conform to the details established in the work plan, and public health and safety are protected.

F. Single-Purpose Municipal and Industrial Water Supply.—NRCS does not provide or contract for

engineering services for the planning, design, or installation of single-purpose structures for municipal and industrial water supply.

G. Multiple-Purpose Municipal and Industrial Water Supply.—Multiple-purpose structures for municipal and industrial water supply can have provisions for flood control, irrigation water management, recreation, fish and wildlife, water quality management, or any combination of these or other purposes. The division of engineering work among NRCS and others depends on which purposes are included.

(1) In the planning stage, if storage of water for municipal or industrial use is proposed in a multiple-purpose structure, the sponsoring local organization provides or contracts for engineering services at no cost to NRCS. This includes all surveys and investigations necessary to determine what storage volume is needed for municipal and industrial water, whether the water yield and quality are adequate, and whether the proposed structure will hold water without undue loss. The sponsoring local organization or a non-NRCS engineering source employed by the local organization also plans all water-control features required exclusively for the municipal and industrial water and all other features for which NRCS cost-sharing is not authorized.

(i) NRCS makes or contracts for studies of water yield and quality and potential seepage loss or gain of reservoirs. The data are used to evaluate the feasibility of storing water for irrigation, recreation, fish and wildlife, water quality management, or other purpose for which NRCS cost sharing is provided.

(ii) To avoid duplication of effort, NRCS and the sponsoring local organizations share and exchange information. If similar studies are needed for the various purposes, independent studies must be made as each considers necessary.

(iii) NRCS makes or contracts for all foundation investigations and other needed studies in addition to those provided by the sponsoring local organization. This ensures that the proposed structure can be constructed at a reasonable cost, will be safe, and perform the functions for which NRCS cost sharing is provided.

(2) In the design stage, non-NRCS engineering services are used for multiple-purpose structures with municipal or industrial water supply features. These services include but are not limited to field surveys, geologic and soil investigations, design studies and computations, and preparation of construction drawings and specifications.

(i) NRCS does not perform engineering work for the design of structures for municipal or industrial water, even if the work is paid for in part by NRCS funds.

(ii) The Chief may consider exceptions to this rule at the request of sponsoring local organizations and on submission of justification if the storage volume for municipal and industrial water is less than 20 percent of the total water storage volume.

505.13 River Basin Studies

River basin studies are overall studies and assessments of water and related land resources, regional and river basin plans of a preliminary or reconnaissance nature, and implementation studies of program or project feasibility. In overall studies and in regional and river basin planning, NRCS usually provides the engineering services or consultative assistance to others performing the work. In implementation studies of program or project feasibility, engineering services can be provided by NRCS, non-NRCS sources, or both.

505.14 Engineering Services Not Provided by NRCS

A. Frequently, engineering services that NRCS does not provide are needed for carrying out NRCS programs. Cooperating individuals, groups, and organizations must arrange for such services from non-NRCS sources.

B. Among the services NRCS engineers do not provide are the following:

(1) Boundary or location surveys for legal purposes, unless the State Conservationist has determined that providing such service in a State meets the requirements of the State Professional Engineers and Land Surveyors Board.

(2) Representation of drainage or irrigation districts or similar enterprises in legal proceedings required by State laws, unless non-NRCS sources are not available and the State Conservationist presents justification acceptable to the Chief.

(3) Obtaining water rights or filing applications with regulating agencies for pollution abatement facilities, except as provided in GM-130, Part 400.

Part 505 – Non-NRCS Engineering Services

Subpart B - Use of Non-NRCS Engineering Services

§IA505.11 Non-Project Activities

A. Non-NRCS Engineering Services

(4) Generally, non-NRCS engineering services should be used for the following types of work:

(i) Projects requiring Class VI or higher approval authority.
(ii) Projects for which no NRCS standards exist.
(iii) Projects which require expertise that is not available within NRCS.
(iv) NRCS personnel resources are limited.
(v) Assistance in urban areas.
(vi) Animal waste management systems which involve over 1,000 animal units.
(vii) Recreation projects.

Subpart C - Criteria

505.20 Non-Project Activities

NRCS encourages conservation district cooperators and others it assists to follow applicable NRCS standards when conservation work is performed for them by private engineers. If Federal cost sharing or technical assistance is provided, the work must comply with NRCS standards.

505.21 Project Activities

A. Non-NRCS engineering services provided under contract with NRCS usually require the use of NRCS standard drawings, specifications, and design criteria.

B. Sponsoring local organizations that elect to furnish engineering services for work cost shared by NRCS must be encouraged to use applicable NRCS standard drawings, specifications, and design criteria, but may use other drawings, specifications, and design criteria acceptable to NRCS, as agreed to prior to a design start. The quality of all work (performance, durability, safety, and economy) must be equal to the quality required by NRCS standards. Drawings and specifications must be compatible with the general provisions and special provisions to be used in the construction contract.

Subpart D - Procedures

505.30 Engineering Services, Contracts, and Agreements

A. If NRCS contracts directly for engineering services, the appropriate architect-engineer evaluation board selects the best qualified sources and establishes the order of priority for negotiating purposes. The contracting officer negotiates the contract. If the sponsoring local organization is to pay a part of the cost of the work performed under an NRCS contract, an agreement for services is required.

B. If NRCS provides funds for engineering performed by a sponsoring local organization or by a private source engaged by a sponsoring local organization, an agreement for services is required. If a sponsoring local organization elects to employ a private source whose services will be paid for with NRCS funds, the State Administrative Officer and the State Conservation Engineer (SCE) assist in selection and negotiation.

C. If a higher level of approval for the practice or project is required, the specifications for engineering services contracts and agreements must be prepared jointly, and contractual negotiations are not to be initiated until concurrence is received.

D. Instructions for preparing and negotiating engineering services contracts and agreements are given in the Federal and NRCS procurement regulations. Detailed guidance in the engineering aspects of preparing and negotiating engineering services contracts is provided in the National Contracts, Grants, and Cooperative Agreements Manual.

505.31 Selection of Non-NRCS Engineering Services

A. If non-NRCS engineering services are to be paid for by NRCS, whether the contract is negotiated by NRCS or by a sponsoring local organization, NRCS is responsible for proper expenditure of funds and will assist in the selection and negotiation. The cost of non-NRCS engineering services must be reasonable compared to the cost of using NRCS engineering services, considering any differential between private and public costs.

B. Non-NRCS engineering sources must be approved by the State Administrative Officer and the SCE and must meet the following requirements:

(1) Registration is necessary in the State in which the work is to be undertaken if registration is required by State law, and non-NRCS engineering sources must be properly authorized to practice in compliance with other State laws.
(2) They must have had satisfactory experience in the kind of engineering work to be undertaken and must be available to supervise the work directly.
(3) They must have the necessary facilities and staff to do the work in the specified time.

505.32 Responsibility for Engineering Services Performed Under Engineering Services, Contracts, and Agreements

A. Non-NRCS sources performing engineering services bear the primary responsibility for the soundness and adequacy of engineering services. NRCS and sponsoring local organizations also assume certain responsibilities in setting criteria for the work, in financing and sponsoring it, and in reviewing, approving, and accepting it.

(1) Approval and acceptance of the work by NRCS or by the local organization does not absolve the non-NRCS sources of responsibility. The extent of their responsibility depends on the nature of the services required. There are three general categories of non-NRCS engineering services:
(i) Routine design and drafting or other routine work strictly following NRCS criteria, standards, and instructions. The non-NRCS source is responsible for errors or deficiencies in the prepared designs, drawings, and specifications.
(ii) Engineering services requiring professional experience and judgment. The contract may require that NRCS criteria and standards be followed insofar as they are applicable, but the non-NRCS source is expected to make independent decisions. To the extent that the contract requires, the source furnishing services of this kind is held responsible for the soundness and adequacy of the designs, drawings, specifications, and other services performed under the contract. A professional is responsible to the public in general for safe and sound engineering services.
(iii) Engineering services outside the realm of NRCS knowledge and experience. A contract for design work of this kind usually provides for construction inspection by those responsible for the design. When this is the case, in accepting the work, NRCS relies largely on the competence and dependability of the professional.
(2) A contract for design work under section 505.32A(1) (ii) or (iii) normally provides for services during construction, whether the non-NRCS source performs the inspection or not. These services include concurrence in any deviations from the design. The source must be permitted to retain control over the design if they are to be held responsible for it, and any changes made without their concurrence tend to relieve them of responsibility. Basic design changes must not be made until approved by the professional responsible for the design. Approval of minor deviations and corrections that become necessary during construction is to be obtained as quickly as practical, but construction should not be delayed to await approval unless there is

reason to doubt that the change will be approved.

(3) If engineering services are furnished by a sponsoring local organization under an agreement for services, the sponsoring local organization assumes responsibility for the soundness and adequacy of the work. This applies to services performed by the local organization itself and to services performed by others under contract with the local organization. NRCS approval and acceptance of the work does not relieve the sponsoring local organization of its responsibility. If problems caused by a deficiency in engineering services furnished by a sponsoring local organization arise during or after construction of any works of improvement, NRCS holds the local organization liable for any damage to others that may result and for any additional construction costs to correct the situation.

B. If NRCS-administered Federal construction funds are paid, or works of improvement paid by NRCS funds are affected, NRCS must protect the Government's interest—namely, the works of improvement must satisfactorily and safely perform the functions for which funds are invested. The performance of engineering services and assumption of attendant responsibility by non-NRCS sources does not relieve NRCS of this responsibility.

(1) If the detailed construction inspection of work paid from NRCS funds is performed by other than NRCS personnel, the NRCS representative must verify that the work complies with the requirements of the construction contract. Such verification requires spot checking of inspection procedures, continuous review of job records and reports, and periodic observation of the work.

(2) NRCS engineering job approval authority (part 501, subpart A) is the same for engineering work done by non-NRCS sources as for work done by NRCS.

(3) NRCS is not liable for damages or additional costs caused by deficient or improper investigations, designs, or other engineering services performed by others.

Subpart E - Exhibits

505.40 Reserved

505.41 Reserved

505.42 Conservation Contractor – Sample Letter

Click here for a copy of the Conservation Contractor - Sample Letter

505.43 Landowner Use of a Consultant – Sample Letter

Click here for a copy of the Landowner Use of a Consultant - Sample Letter

Part 506 - Technical Materials

506.0 General

National conservation engineering technical materials, including documents, drawings, and computer programs, have been developed and refined over many years. These materials reflect NRCS technical expertise, experience, and procedures in the engineering, geologic, and landscape architecture disciplines. Most of these engineering materials are developed to serve as permanent references for providing technical assistance across the range of agency programs. Other engineering materials are produced to provide information to the public on agency projects and practices.

506.1 Definitions

A. Conservation Practice.—A specific treatment, such as a structural or vegetative measure, or management technique commonly used to meet specific needs in planning and conservation for which standards and specifications have been developed.

B. Conservation Practice Specification.—A general or site-specific document that establishes the technical details and workmanship required to install the practice in accordance with the practice standard.

C. Conservation Practice Standard.—A set of statements (criteria) that establish the acceptable level of quality for planning, designing, constructing, operating, and maintaining conservation practices.

D. Criteria.—A policy statement of specific quantitative technical requirements that can contain reference to procedures. As a policy statement, criteria are, by definition, a subset of policy.

E. Guide.—A compendium of information or series of options that does not recommend a specific course of action.

F. Policy.—A statement of an adopted and definitive course of action.

G. Procedure.—A method of analysis that can be either a technical or an administrative process methodology. It contains a series of steps to be taken to determine a result for a desired objective.

H. Specification.—An explicit set of requirements to be satisfied by a material, product, system, or service, such as construction. It also identifies the methods for determining whether each of the requirements is satisfied.

I. Standard.—A statement of acceptable quality or technical excellence in terms of both form and function (performance), usually expressed in terms of limits (i.e., minimum or maximum).

506.2 Organization of Permanent Materials

A. Permanent national engineering materials have been issued in the past under a wide variety of titles, formats, and organizations, including National Engineering Handbook (NEH) sections, technical releases, field manuals, design notes, specification notes, etc.

B. NRCS currently utilizes an agencywide coordinated system to organize, issue and manage its permanent documents. This system is detailed in Title 120, General Manual (GM).

C. Within the NRCS directives system, all permanent engineering materials will be organized into the following:

(1) General Manual (GM).—The GM is used to issue policy that applies to all offices. Engineering parts of the GM fall within the 210 title number. Additional policies applicable to engineering may be found within the 450 title number (Technology).
(2) National Engineering Manual (NEM).—The NEM is a topical manual used to issue policy for engineering work. The NEM is included in the 210 title number, and part numbers must fall within the range of 500 to 559.
(3) National Engineering Handbook (NEH).—The NEH is a topical handbook used to issue detailed "how-to" instructions (i.e., procedures, guides, and specifications). The NEH is included in the 210 title number, and part numbers must fall within the range of 600 to 659.
(4) National Handbook of Conservation Practices (NHCP).—The NHCP is also a topical handbook used to issue National Conservation Practice Standards and Specifications. This material is established as agency policy and criteria by cross-reference in the GM. The NHCP is in the 450 title number.
(5) User Guides.—User guides provide specific instructions on the use and operation of NRCS-supported software applications and databases.
(6) National Instructions (part numbers 300-359) are also available to issue information, but are seldom used for engineering technical materials.

D. NEH has been established to provide a unified topical handbook for all permanent conservation engineering procedures, guides, and specifications, except those covered in the NHCP. The purpose is to provide a uniform framework for locating technical references, eliminating duplication of distributed materials, and managing the development of new materials. All new or revised technical procedures and specifications must be titled and developed as an integral part of the NEH.

(1) The primary table of contents for the NEH parallels the table of contents for this NEM. Part names and numbers match, except that part numbers will be 6xx. The primary table of contents for the NEH will also contain additional part names and part numbers for field handbooks that contain engineering material but are intended primarily for use by nonengineers.
(2) The secondary table of contents for the NEH may differ from the NEM numbering and titles and will be adjusted as new procedures or specifications are added to any part.

506.3 Reserved

506.4 Developing NEH Materials

A. The development or major revision of national engineering technical materials must follow an organized process to—

(1) Focus efforts on priority agency needs.
(2) Involve appropriate disciplines and staffs.
(3) Plan the scope of the final product.
(4) Assure organized integration into the NEH.

B. Anyone using NRCS national technical materials may propose development or revision of any NEH materials that are needed to provide technical assistance under agency programs. Anyone that has developed technical materials for State or regional use may also propose refinement of the material for national use and inclusion into the NEH. All proposals must be directed to the State Conservation Engineer (SCE) for consideration. The SCE then will forward important proposals to the Director, Conservation Engineering Division.

506.5 Distribution of Engineering Technical Materials Within NRCS

Engineering technical publications are produced and distributed in electronic form through the NRCS eDirectives System at http://directives.sc.egov.usda.gov/. Notification of the posting of new and updated technical materials will be provided by announcement on the NRCS eDirectives site.

506.6 Distribution of Engineering Technical Materials Outside NRCS

NRCS offices at all levels must respond to requests for engineering technical materials from non-NRCS individuals or organizations.

(1) Generally, requestors should be referred to the materials available on the NRCS eDirectives site.
(2) Copies may be distributed to Federal, State, and local agencies, individuals with whom NRCS has established a professional relationship, contractors working with NRCS, and others who may be involved with NRCS programs and contracts.

§IA506.4 Developing NEH Materials

C. Approval Process for State Level Design Tools.

In order to share design process efficiencies improved by the use of locally developed tools, such as spreadsheets, drawings, and documents, developers shall use the following procedure for review and approval of engineering design tools for state-wide use:

(1) The developer submits the tool to their Area Engineer for consideration.
(2) The Area Engineer evaluates the need for the tool and determines if a tool currently exists that addresses the need. If not, the Area Engineer forwards a recommendation to the State Conservation Engineer regarding the implementation of the tool.
(3) The State Conservation Engineer evaluates the Area Engineer's findings and assigns staff to perform a technical review of the tool.
(4) The technical reviewer(s) will confirm that the tool conforms to NRCS policy and ensures that adequate documentation is included. Any modifications to the tool will be coordinated between the reviewer(s) and the developer(s).
(5) Based on the findings of the technical review the State Conservation Engineer will approve or disapprove the tool for state-wide use.
(6) Approved tools will be made available via the state website or share point.
(7) The need for training on the use of the tool will be evaluated.

Part 510 - Planning

510.0 General

A. Planning for the conservation and sustained use of natural resources often requires engineering input, which should be provided early in the planning process. Planning should be in sufficient detail to ensure that decisions by individuals, groups, units of government, and sponsors can be implemented without extensive changes in scope, purpose, or cost. All plans must be formulated so as to be complete, effective, efficient, acceptable, and in conformance with local, State, and Federal laws, rules, and regulations. Additional guidance on specific NRCS planning procedures can be found in Title 180, National Planning Procedures Handbook (NPPH), Part 600, Subpart A, Framework for Planning.

510.1 Scope

A. The approach taken during a planning study will vary according to the scope, size, and complexity of the issues involved.

(1) A simple conservation practice involving just one individual might proceed rapidly through planning, design, construction, and operation. However, even simple measures must be planned with due consideration for their impact on the larger system or the plan for the area.
(2) More complex practices, involving several individuals, ecological components, or both, require more intense planning and input from a number of disciplines and organizations. For these complex practices, several approaches and multiple alternatives within those approaches may need to be developed and evaluated.
(3) A combination of practices comprising a plan may (or may not) be on a single parcel and address one or more resource concerns. It may require a suite of practices used together to resolve the resource problems.

B. The planning guidance in the NPPH is applicable to planning for all NRCS programs. Plan content and criteria may vary for each individual program or funding source.

C. Preliminary engineering work may be needed during phases I and II of the planning process outlined in the NPPH. The land user or sponsor must understand the scope, size, economics, and operational obligations for each alternative being considered before significant engineering resources are expended in more detailed studies.

D. Site investigations conducted during planning for engineering measures are often less intense than those required for final design. Final design investigations may reveal some adverse conditions not identified during the planning process. Land users or sponsors should be informed by NRCS staff that it is possible that agreements reached on the details of planned measures, needed land rights, and estimated costs in the planning phase may require revision during final design and construction. Upstream and downstream development that takes place after planning can also greatly affect the design.

E. The data collected and the resulting analyses must be sufficiently detailed to aid in selecting alternatives. Engineering job classes should be identified early to establish proper engineering job approval authorities and an appropriate review process. An individual having appropriate engineering job approval authority for the practices being considered must be consulted during the planning process and review and sign the approved engineering plan.

F. Expertise from all appropriate disciplines associated with natural resource management should be involved as early as possible in the planning process.

510.2 Documentation

Document engineering investigations and analyses. Computations, other data, and documentation supporting engineering decisions must be checked for accuracy and reasonableness by personnel with appropriate job approval authority. Documentation provides for expediting reviews, allows the work to progress smoothly into final design and construction, and aids in post reviews. The degree of supporting data must be commensurate with the specific situation and the type of project planned. The data are to be documented and filed so that later investigations for detailed design can build on, rather than repeat, investigations and analyses accomplished during the planning phase. Supporting documentation must include the project name and location, who performed the work, who checked the work, and the date of the work. The checker must initial the materials checked.

510.3 Engineering Data to Support Plans

A. Perform engineering analysis to the extent necessary to ensure that all engineering measures will function properly and achieve the planned results. Surveys, investigations, and preliminary designs must be performed in sufficient detail to prepare necessary cost estimates, land rights requirements, etc.

B. The size and complexity of planned actions dictate the level of detail required for the engineering report. Design the format and content of the report to meet the needs of the client. The report must clearly describe the problems, investigations, alternatives, and conclusions. Use graphics as necessary

to provide a clear understanding. The final planning report must be tailored to meet program requirements, as appropriate. In all cases, the report must be sufficient to document decisions in a professional manner.

C. Review and approval is required for planning reports containing engineering data and analysis. This review and approval includes technical approval of the overall system of engineering measures to ensure that they perform their planned functions.

510.4 Criteria

A. Current engineering standards and procedures are to be used for planning all measures.

B. If revisions or modifications are made to the plans, the current criteria must be used for at least the following situations:

(1) New structural measures not included in the original plan.
(2) Structural measures modified enough to require a supplement to the plan.
(3) Structural measures included in the approved plan that, if built according to original criteria, would endanger new structural measures, existing structures, or ones that are to be modified.

510.5 Cost Estimates

Determine all costs, including installation costs and expected periodic costs. Costs must be current in accordance with the most recent available information. The costs of engineering measures generally include the following:

(1) Engineering.—The direct cost of engineers and other personnel for surveys, investigations, design, preparation of plans and specifications, preparation of the operation and maintenance plan, and the cost of inspection during construction.
(2) Land Rights.—The actual cost or value of land required for construction and operation of the measures, including changes to fixed improvements.
(3) Water Rights.—The actual cost or value of water rights required by local interests for carrying out the measure.
(4) Contract Administration.—The expected cost of administering the contracts, cost of permits, and any legal costs.
(5) Construction.—The expected cost of constructing the measure. Construction estimates during planning should include specific estimates for all the identifiable components. Contingencies should be included to allow for unforeseen conditions and costs that are likely to be identified during the final design and construction phases. Contingencies are established according to the detail of planning. Higher contingencies should be allowed for less detailed planning.
(6) Operation, Maintenance, and Replacement.—The cost required to operate and maintain the measure, including necessary inspections and repairs for the planned life of the project. Any items to be replaced during the evaluation period must be included.

510.6 Post Design Life Considerations

At the end of their design life, some practices may create safety, health, and environmental concerns. Those issues should be considered when alternatives are formulated and discussed with the land user, sponsor, or both. Costs for replacement, rehabilitation, or decommissioning of these practices should be anticipated, estimated to the extent possible, documented in the plan report, and communicated to the landowner or sponsor.

Subpart A - Procedures

511.0 General

A. Engineering design is an organized and rational process that applies the natural laws of science for the enhancement of human welfare. Engineering design should be sensitive to the needs of people, their activities, and the landscape.

B. Engineering design is performed at many organizational and geographic locations. The designs prepared are of varying complexity and are often performed at locations some distance from the construction site. The design is performed by personnel having various levels of knowledge and skill. The designs often require review and approval by someone at a location other than the construction site or design office. Designs must be reviewed to ensure adequate performance and safety (see Part 501). Because of the diverse nature of the design activities in NRCS, some standardization of basic nomenclature and procedures is needed.

511.1 Scope

A. The principles defined in this part apply to all sizes and complexities of designs. The detail to which the procedures are to be followed varies according to the need. The simplest conservation practice may require only a few notes, computations, and drawings. Larger and more complex works may require numerous notes, computations, and drawings to complete all stages of the design. Likewise, the complexity of site conditions and engineering along with the number of alternatives and organizational units affects the intensity and duration of work at each design stage.

B. Engineering design must provide for the quality and durability required for the economic life of the practice or component at the least total cost consistent with functional requirements. Engineering designs must be determined by comparative design studies and cost estimates prepared with full consideration of the landscape, environment, topography, foundation, and other site conditions and the economy and feasibility of construction, operation, and maintenance. Economic comparisons of alternative designs are determined by the amortized average annual cost of installation (including costs of land rights), operation, and maintenance. Environmental comparisons must consider ecological, cultural, and aesthetic values.

511.2 Design Stages

A. To provide standard terminology for orderly scheduling and coordination of work, three stages of design activity are defined. This terminology is to be used in all NRCS correspondence, publications, and documents relating to design. The design activities included in these stages may be further subdivided into phases or subphases as necessary to control NRCS work or to administer engineering services contracts and agreements.

B. On small and simple structural measures, all three stages of design can be accomplished in one brief period of time and in such a manner that they are nearly inseparable. On larger works, such as projects, much of the work in stages one and two may be completed during planning (see Section 510.1). Items for which the final design data are known during planning, such as topographic, hydrologic, and hydraulic features, should be completed for final design purpose at that time. The planning data need only be reviewed before design commences to verify accuracy and adequacy. In this manner, data gathered during planning can be used to avoid duplication of effort and ensure that there is little or no modification needed in the general layout during final design. Similarly, data should be gathered on the geology and foundation if assurance against significant cost changes is desired.

C. Stage one includes data collection and evaluation for all information on—

(1) Physical data: topographic, hydrologic, visual, biologic, geologic, seismic, and archeological data.
(2) System and structure functional requirements and purpose: the capacity, controlled water level, and location.
(3) Site constraints: information on ownership boundaries, easements, utilities, and water rights.

D. Stage two is the preliminary design, which consists of developing the general features of the works of improvement. It includes selecting the most suitable types of structures, the optimum layout and arrangement of the elements of the structural system in the landscape, the types and locations of appurtenant mechanical equipment, and, if applicable, the most feasible power source. Also, cost studies and an economic feasibility examination must be made. The conceptual phase of preliminary design is the point at which design alternatives and configurations for key elements have been developed but not selected.

(1) Hydraulic design must be sufficient to select alignment, grade, size, and critical elevations for each evaluated alternative.
(2) Foundation conditions must be analyzed and the embankments designed in sufficient detail to provide seepage control and stability requirements.
(3) Structural details of alternate designs are developed sufficiently to prepare reasonable

quantity and cost estimates.
(4) Landscape resource objectives, preliminary landscape resource designs, and preliminary plans are sufficiently developed to determine feasibility and prepare preliminary cost estimates.
(5) Specifications of material and work requirements are outlined, and a schedule of work and payment items is to be included.
(6) Cost estimates are determined by estimating construction costs. Alternate designs must be compared according to the average annual cost of installation, operation, and maintenance, including costs of land, easements, rights-of-way, and relocation of roads, utilities, or both.
(7) A design report is to be compiled to include all information, either directly or in appendices, necessary for a technical review by others. Such review may be internal or by outside organizations.

E. Stage three is the final design, which consists of—

(1) Checking the adequacy of the surveys and investigations and the accuracy of the layout chosen in the preliminary design.
(2) Refining and revising the preliminary design information.
(3) Detailing the layout and hydraulic design.
(4) Completing the structural design.
(5) Refining the landscape resources design.
(6) Preparing the construction drawings, contract specifications, bid schedule, engineer's estimate, and construction schedule.
(7) Preparing the design report.
(8) Preparing the operation and maintenance plan.
(9) Preparing the quality assurance plan.

511.3 Operating Procedures

A. The operating procedures to be followed depend on the organizational level at which the design is done. If the design is done by many offices or by offices that are remote from one another, the need for an established documented procedure is greater. Designs made at field and area offices are usually processed by simple informal procedures.

B. The more complex designs often require technical assistance, peer review, and concurrence by the Director, Conservation Engineering Division (CED). The design may be prepared by—

(1) The NRCS State engineering staff (field, area, or State office).
(2) A multistate design team or the National Design, Construction, and Soil Mechanics Center (NDCSMC) using data collected by State staffs.
(3) The engineering staff of a sponsoring local agency under an agreement for engineering services.
(4) A private engineer under a contract for engineering services negotiated either by NRCS or the sponsoring local agency.

C. If it is anticipated that the design will require assistance, independent review by the NDCSMC or others, or concurrence by the Director, CED, the State Conservation Engineer (SCE) must prepare a realistic design and construction schedule. In addition, the SCE develops operating procedures for preparing designs, construction drawings, and specifications and for accomplishing their orderly and timely review and approval (see Section 501.4). Operating procedures must comply with the following:

(1) The State engineering staff is responsible for all surveys and investigations.
(2) The office providing the design assistance, independent review, or concurrence will be consulted at the conceptual phase to provide review and concurrence as needed, before key project elements and configurations have been selected or significant detailed design work has begun. Any significant changes in elements and configurations at later stages of the design must be made in consultation with those providing independent review and concurrence.
(3) The work must be completed by the State engineering staff if qualified design engineers are available.
(4) NDCSMC assistance may be requested at any stage in the preparation of the design.
(5) If designs prepared by local sponsoring agencies or by architect-engineer (A&E) contractors require independent review, the review must include task orders including independent Government estimates (IGE), specifications for engineering services, or agreements covering the work. Performance time must be adequate to permit the necessary review. The State will perform necessary quality assurance of deliverables before submitting for independent review.
(6) Construction drawings and specifications are prepared concurrently so that they can be properly coordinated.
(7) Contract specifications must be compiled by the office responsible for the design of the work.

D. Operating procedures for continuity between employees performing site investigations, design, and construction are not complicated for small or simple jobs if the work is prepared at one or two offices. However, if there are several offices and employees involved or segments of the work are prepared by specialists, maintaining continuity is much more difficult. In these more complex operations, coordination and communication must be facilitated between engineers, geologists, and others during stages two and three of design and during construction. This is coordinated by the designer, the soil

engineer assisting the geologist in planning and evaluating the site investigation, or both. Field reviews during the investigation may be necessary to ensure all information needed for the design is obtained. Likewise, the designer arranges for transfer of information to the construction inspection staff. For more complex projects, the design and soil engineers, geologist, construction engineer, and inspector may meet to exchange information. This preconstruction meeting should cover critical interpretation and assumptions dealing with design features and those items that need verification during construction.

511.4 Design Analysis

A. The design analysis defines the scope of the design and evaluates the relationships of the principles that determine the design. It consists of a step-by-step description of the procedures used. Each step must be described concisely and completely.

B. The design analysis must include the data used, criteria, and procedures. The design analysis must be technically sound, performed in a logical manner, and documented.

511.5 Design Checking and Review

A. Checking during design is essential. Checking consists of an examination of the narrative, computations, and drawings for accuracy, conformation with procedures, and consistency between the various parts of the design. The checker must be experienced in the type of design, the criteria, and the procedures. The checker initials each sheet completed and verifies that—

(1) The basic data were correctly applied and assumptions were applied appropriately and used in the computations.
(2) Mathematic computations are accurate.
(3) Details are consistent from sheet to sheet.
(4) Drawings comply with the design.
(5) Drawings comply with the specifications.
(6) Computed critical elevations, costs, and quantities are accurate.
(7) Construction drawings are complete.

B. Reviews must be made during the design to ensure technical quality. All designs, drawings, and specifications must be reviewed (see Part 501). Reviews must be made progressively by the responsible design office through an examination of narrative, computations, and drawings. The reviewer assumes responsibility with the designer for the functional adequacy and structural soundness of the structure or structural system. The reviewer's capability must be equal to that needed to do the design. The review must determine that—

(1) The design provides for the planned purpose.
(2) The basic data are adequate.
(3) The design assumptions are valid.
(4) The methods of analysis are valid.
(5) The alternatives evaluated are equal in meeting minimum performance requirements.
(6) The solution is appropriate to the problem or site condition.
(7) The design complies with policy and criteria.
(8) The design is consistent with sound engineering practice.

C. The review procedures as outlined in Section 501.05A(3) depend upon the operating procedures used for Class I through VIII jobs. The review procedures for Class VI and VII jobs are the responsibility of the SCE. Review procedures for Class VIII jobs are the responsibility of the SCE with concurrence by the Director, Conservation Engineering Division. The SCE must ensure that the design schedule provides enough time for review by the appropriate authorities at the various design stages. Review schedules must reflect a realistic consideration of the locations of the reviewing offices, time needed to transmit material, and coordination of the work with the rest of the workload of the offices.

511.6 External Reviews

Consideration must be given to the need for an external review of dams and other engineering structures that, when installed, will become a potential hazard to human life in case of failure. See Section 520.26 for the procedure to be used for dams. When necessary, a similar procedure should be used for other structures.

511.7 Design Criteria

A. Design criteria established by policy directives are often of a general nature. The criteria provide guidance in obtaining the quality of acceptable work. Designs must be prepared to satisfy the functional purpose in a safe and stable manner, which may often result in requiring more restrictive limits than the established minimum criteria. In other words, meeting minimum engineering criteria will not, in all cases, ensure adequate designs.

B. Minimum design criteria established by policy are to be met.

C. Criteria used in preparing project plans are normally used in the design and construction of structural measures. At the time of final design, the individual having the appropriate engineering job

approval authority (see Section 501.4) must reaffirm that all aspects of the engineering plans are legally permissible and that the structure will perform its assigned function in a normal manner during its service life. The design criteria are to be changed from that used in planning if—

(1) The planned design is not acceptable in light of new engineering knowledge as reflected in the revised criteria. In this situation, the measure must be designed to meet new criteria.
(2) Downstream development requires a change in structure classification before construction. In this situation, the structure must be reclassified and designed in accordance with the latest criteria.

D. The sponsors or landowners must be informed of changes that increase the cost or require alterations in land rights.

511.8 Construction Drawings and Specifications

A. The preparation of construction drawings and specifications is the final step in the design process. The drawings are a graphical description, and the specifications are the narrative description of the works to be constructed. The construction drawings and specifications provide descriptive information on the quantity and quality of the completed work. The work must be clearly described so that the owner and constructor will understand the requirements. This provides a mutual understanding when the requirements are met.

B. Construction drawings must be prepared and assembled in a clear and logical manner. The minimum requirements are contained in Part 541.

C. Construction specifications must include both materials and construction methods. The minimum requirements are contained in Part 542. Requirements must be established in terms of a specified end product.

D. Construction drawings and specifications must be completed and approved prior to commencing of the work, unless directed by the SCE.

Subpart B - Documentation

511.10 Scope

Design folders must be prepared for all designs within approval categories VI, VII, and VIII (see Part 501) and for all dams that have importance for reasons of public safety (see Section 520.21(F)).

511.11 Design Folders

A. The design folder contains the design analyses, design report, construction drawings, specifications, bid schedule, performance schedule, inspection plan, and operation and maintenance plan. All notes, computations, drawings, sketches, and other data must be recorded neatly and organized in a manner that allows reproduction and incorporation in reports with a minimum of editing. Design drawings, diagrams, graphs, sketches, or other pictorial representations should be incorporated into the computation file if the size and scale permit. Designs drawn on larger sheets that cannot be folded to computation sheet size must be cited at the appropriate place in the computations by a notation that fully identifies the drawing and its file location. The design documents should be kept in a binder to keep them in order.

(1) Design records must be kept orderly and current to allow for efficient review at any stage. They must be complete and understandable because they may be used for later actions, such as:
  (i) Design changes required during construction.
  (ii) Structural modification or addition during operation or maintenance.
  (iii) Investigation of performance.
(2) Design records must completely document the—
  (i) Data gathered to demonstrate the physical, chemical, and biological conditions at the site.
  (ii) Purpose and function of works designed.
  (iii) Standards, criteria, and limitations used as design guidance.
  (iv) Problem conditions to be considered.
  (v) Qualitative and quantitative design analysis.

B. Design reports summarize in narrative form the design objective, data, criteria, assumptions, procedures, and decisions used in the design. Selected structure dimensions, elevations, and capacities should be used to augment the narrative, but are not to serve as a replacement.

C. Previously developed requirements established during the planning phase must be included by reference. Design reports may vary in length from a brief synopsis to an extensive review. A design report addresses the topics in the following list, as appropriate. The report contents should be commensurate with the design complexity and significance; some items listed may not be relevant, and if not, need not be included.

(1) Summary.—A concise statement of the history and status of the design, previous reviews for disposition of applicable policy items, justification for departure from standards, receipt of waivers, etc.
(2) Description of the Job.—A brief description of the major features, hazard classification, drainage area, storm frequencies, landscape resources, capacities, etc., must be included. Include any variance from project plans.
(3) Design Objective.—A brief, clear statement that may be a summary from a project plan. Differences identified from plans must be supported by proper approvals.
(4) Basis for Design.—A listing of reference documents used in the design, such as handbooks, codes, reports, studies, and criteria.
(5) General Basic Data.—Hazard analyses, seismic assessment, limiting conditions or restraints that may influence the design, construction, or facility operation.
(6) Location and Layout.—Consideration of site configuration or landscape conditions that had an effect.
(7) Hydrology.—The data reference, procedures, spillway operation frequency water yield, reservoir operational studies, and summary of precipitation amount and intensity.
(8) Hydraulic Design.—A summary of the hydraulic shape and proportioning selected. Include channel stability and sediment transport considerations.
(9) Foundations, Embankment Design, or Both.—A summary of data, site conditions, assumptions, treatments selected, and design analyses used to—
  (i) Make seepage analyses and design control measures.
  (ii) Make stability analyses and determine material quality and quantity.
  (iii) Make foundation design analyses.
  (iv) Permit planning instrumentation systems.
(10) Structural Design.—A summary listing the assumptions, loading conditions, and design procedures.
(11) Environmental Considerations.—Features or practices to provide for conservation of visual, biological, and surface and ground water resources that may be affected by the planned measures, both during and after construction.
(12) Construction Drawings.—Mention of standard detail drawings or any use of previously prepared special drawings.

(13) Specifications.—Mention of special specifications and why they were needed. Explain special conditions or the need for special provisions in the construction contract.
(14) Bid Schedule.—Give the rationale for selection of lump sum or subsidiary items.
(15) Cost Estimate.—The considerations used that may be affected by the season or changes in size of contract.
(16) Construction Schedule.—Explanation of any critical starting, delay, or completion dates.
(17) Operation and Maintenance (O&M).—Explanation of conditions in which design assumptions depend on proper O&M and significant O&M activities are anticipated (for example, grasses in the emergency spillway to protect against erosion during flow). Items identified and evaluated during the design that are planned for replacement during the evaluation period must be noted and described.
(18) Construction Review.—A summary of those items, conditions, or features encountered during construction that require a field review by the designer, geologist, soil engineer, or other specialist to ensure that conditions anticipated during the design are verified and consistent with the design assumptions. Include the request for timely notification. Note whether a preconstruction conference is needed.
(19) Authority.—The name (with signature) and title of the designer and approving officer must appear on the report.

Subpart C - Instrumentation

511.20 General

A. Structures, including foundations, abutments, and the surrounding area of influence, are instrumented to facilitate evaluation of their condition and performance during and after construction.

B. Instruments are installed to measure water levels or pore pressures, earth or rock loads and pressures, settlements, deflections or other movements, ground motions during earthquakes, leakage rates or volumes, and other important items relating to safety and performance.

C. Instruments are used if it is determined that information is needed for determining one or more of the following:

(1) Safe rates of earth fill placement
(2) If structural strength is adequate for backfill placement or for shoring removal
(3) Safe rates or limits of excavation
(4) Water levels and pressures within soil and rock formations
(5) Seepage rates or volumes
(6) Safe rates of reservoir filling
(7) The instability of natural or constructed slopes

511.21 Scope

The use of instrumentation must be considered for all high hazard dams over 30 feet in height and any dam that has over 600 acre-feet of storage. Earth dams or other structures with unique or complex foundations, abutment problems, or uncertain soil conditions must also be considered for performance monitoring with instruments.

511.22 Need for Reliable Instruments

Many types of instruments are commercially manufactured or can be assembled to perform the measurements needed. Only instruments proven to be reliable and serviceable may be included. If NRCS lacks experience in the use of an instrument, check with other users to determine its reliability.

511.23 Use of Instrumentation

A. The decision on whether to monitor with instruments depends on the following:

(1) Reliability and completeness of the investigation information.
(2) Whether soil and rock conditions or criteria used in analyses are sufficiently conservative.
(3) The consequences of misjudging these items.

B. In the design folder, document the process by which the decision to instrument or not to instrument was made and the rationale for that decision.

C. Instrumentation must be used in all situations in which the effects of treatment have any degree of uncertainty that would result in unsafe conditions or an inadequate structure. All safety conditions, including safety to the construction force, must be considered. The design must include the details and specifications for the instruments and their installation.

D. For earth structures, the design analyses must determine the magnitude of water pressure, physical movement, soil pressure, or other measurable items where potentially unstable or undesirable conditions exist. This information must be included in the design report and used in the development of a plan for reading the instruments.

511.24 Instrumentation Plans

A. Instrumentation designs must include a plan that describes the purpose, layout and location, type of instruments to be used, and limits of loading, pressures, movement, or volumes for satisfactory structure performance. The plan must include installation details and sequence. Instructions must be included that indicate the timing and frequency of reading and recording both during and after construction. Special attention must be given to the critical periods in the life of the structure, such as during the first filling, any rapid raising or lowering of water, and after an earthquake or other disturbance. The plan is part of the design documentation and must have the same review and approval as the other design items.

B. As the instruments are installed and reading procedures are started, the instrumentation plan must be adjusted to include procedures for data reporting and reduction or plotting. Forms for recording data may be developed. Individuals responsible for interpreting the results are to be specified. Emergency procedures must be developed that indicate those individuals to be notified when critical readings are approached and steps to be taken if necessary.

C. When the project is completed and the structure is in operation, the plan may need to be supplemented for use by new personnel who will read and evaluate the instruments or for the different operating personnel and conditions. The plan should also include the location and method of data storage.

511.25 Instrumentation Monitoring and Reporting

A. The State Conservationist provides assistance to ensure that the needed monitoring is performed, recorded, and reported. This may be included in the operation and maintenance agreement.

B. An annual report of the monitoring is a summary to update the instrumentation plan. The report is to be made to the State Conservation Engineer (SCE) until monitoring is terminated. The Director, Conservation Engineering Division (CED), must receive a copy of this report if any unusual readings are reported.

C. The monitoring program may be terminated on completion of the intended purpose with mutual consent of the SCE and the Director, CED, on Class VIII jobs. A completion report must be prepared.

D. A summary of the site condition and structure performance exhibited by the instrumentation readings must be made on termination of the monitoring program. This summary must include an appropriate graphical array of the readings and interpretations or conclusions regarding the performance. Additional conclusions and recommendations for improvement may be made regarding the instrument's location, performance, and installation.

Subpart A - General Information

512.0 Introduction

Engineering conservation practices and project structures must be installed in accordance with approved drawings and specifications if the practice is to serve its intended purpose and expected service life with anticipated normal operation and maintenance. In order to achieve proper installation, NRCS has standardized construction practices and procedures to promote a common understanding between all parties involved with the design and installation of an engineering practice. Quality assurance (QA) activities are an important part of NRCS standard construction practices.

512.1 Scope

This policy applies to all conservation engineering practices, structures, and systems in every NRCS programs for Engineering Job Approval Classes I through VIII as defined in Part 501 of this manual. QA activities may vary in accordance with complexity and hazard class of the structures.

512.2 Definitions

A. Owner.—The party responsible for contracting for construction. The owner pays the contractor and accepts the completed work. The owner may be NRCS (Federal contract), a contracting local organization (CLO), or a private individual or group.

B. Contract.—A mutually binding legal relationship obligating the seller to furnish the supplies or services (including construction) and the buyer to pay for them. For purposes of this part contracts can be considered to fall within three basic categories:

(1) Federal Contract.—This contract type is governed by the Federal Acquisition Regulation (FAR) and is administered by NRCS.
(2) CLO.—This contract is governed by a project agreement between NRCS and the local sponsor, and the local sponsor administers the contract.
(3) Private Contracts.—This contract is between a private individual or group and a contractor.

C. Contractor.—The individual or firm that performs the construction or installs the project or conservation measure. Contractors are responsible for providing a finished product in accordance with plans and specifications, quality control, and safety. Project sponsors may function as a contractor under provisions that may include division of work, performance of work, or force account.

D. Contracting Officer (CO).—Individuals with the authority to enter into, administer, or terminate contracts on behalf of the Government and who may bind the Government only to the extent of the authority delegated to them. COs ensure performance of all necessary actions for effective contracting, ensure compliance with the terms of the contract, and safeguard the interests of their governmental unit in its contractual relationships. COs should request and consider the advice of specialists in audit, law, engineering, information security, transportation, and other fields as appropriate. A Federal CO is required on a FAR contract and the equivalent of a CO is required for a CLO contract. Nongovernmental contracts may not require COs.

E. Project Engineer.—The project representative for the owner and assigned technical and contract administration duties as outlined in the quality assurance plan (QAP) and appointment letter issued by the CO under Federal contracts. The project engineer may be an NRCS employee, an employee of an architectural and engineering (A&E) firm under contract with NRCS or CLO, or an employee of the CLO or partnership agency. The main responsibility of the project engineer is to verify that the construction complies with the plans and specifications.

F. Government Representative (GR).—An NRCS employee responsible for protecting the Government's interest and maintaining close working relations with the CLO for all construction work performed under contracts let by a CLO. If the project agreement specifies that NRCS has quality assurance (QA) responsibility for a construction contract, then the GR must be an engineer. The State Conservationist will appoint a GR in writing for all construction contracts that are administered by others and utilize Federal funds. A GR appointment is not normally provided for contracts handled by private individuals or informal groups.

G. CO's Technical Representative (COTR).—If the project is a Federal contract, a COTR may be appointed by the CO. If the procurement activity is related to engineering, construction, or both, then the COTR must be an engineer whose primary duties are QA responsibilities, such that the Government's interests are protected. The NRCS CO will appoint, by letter, a COTR for design and construction contracts. The COTR can be the project engineer or the project QA inspector.

H. Project QA Inspector.—Responsible for QA testing, engineering surveys, daily documentation of project activities, coordination with the contractor's quality control personnel, maintenance of the project files, and "as-built" documentation. The NRCS CO will appoint, in writing, project QA inspectors with the qualifications outlined in the QA plan on Federal contracts. The State administrative officer (SAO) will appoint the GR on CLO contracts. The GR then appoints project QA inspectors if the CLO project agreement states that NRCS will provide QA.

I. Value Engineering Change Proposal (VECP).—A proposal submitted by a contractor under the value

engineering (VE) provisions of the FAR that would create acquisition savings for the Government through a change in the project's plans, designs, or specifications as defined in the contract. The contractor and the Government share the savings if a VECP is accepted. Any proposed change to an engineering structure must be approved by the designer and a person with the appropriate job approval authority.

512.3 Value Engineering

A. Authority

(1) 48 CFR Parts 48 and 52 describe the policy and procedures for using and administering VE techniques in contracts.
(2) Office of Management and Budget Circular A-131 requires Federal agencies to use VE as a management tool, where appropriate, to reduce program and acquisition costs.

B. Contractors may use VECP to—

(1) Voluntarily suggest design alternatives that may be more economical or less costly to install, where both the owner and contractor would benefit.
(2) Identify and submit to the Government methods for performing work more economically. FAR, Part 48, "Value Engineering," provides the terms and conditions. Consideration of any VECP must include the comparison of future costs of operation and maintenance and other costs that may be affected as a result of the change.

C. Contractors must submit VECPs in writing, including supporting computations, drawings, rationale, or some combination of these showing how the requested change will result in both cost savings and a product that is technically equivalent or superior.

D. States' Responsibilities

(1) Each State will establish internal guidelines for processing VECPs and procedures for funding the contractor's share of the collateral savings.
(2) Approval of VECPs must be reported to the State Conservation Engineer (SCE).

E. Written requests for changes to conservation engineering practices proposed by the contractor should be handled similar to a VECP. When the change is technically acceptable (meets NRCS standards and specifications), the decision to accept the change remains with the landowner-operator. NRCS will provide adequate review of the proposal and provide the decision maker with the necessary information to support the acceptance or rejection of the proposal. Any proposed change to an engineering structure must be approved by a person with the appropriate engineering job approval authority.

Subpart B - Preconstruction Activities

512.10 Selection of the Contractor

Design engineers, project engineers, or both may be asked to contribute their technical expertise in determining the ability of a contractor to perform the project for a sealed-bid project. They may also be asked by the contracting officer (CO) to lead or participate on the technical selection panel for contractor selection on negotiated contracts under the Federal Acquisition Regulation (FAR). The CO is responsible for determining if the offeror is responsible, the submitted proposal is responsive, and the determination of either the offeror providing the best value or establishment of the lowest bid.

512.11 Prebid or Proposal Meeting (Site Showing)

A. A date and time must be included for the prebid or proposal meeting and site showing in all requests for offers or bids from contractors, regardless of the contractual vehicle used.

B. The requirements of the bid package must be discussed at the prebid or proposal meeting. The CO and engineer, or their authorized representatives, should chair the meeting for a Federal Government contract. The project engineer should be present regardless of whether the contract type is contracting local organization (CLO) or private.

C. Potential offerors will be given the opportunity to tour the project site so that they may inspect the area. Stakes, flagging, or both must be in place at the time of the site showing to identify the major items of work and their relationship to other elements of the proposed project.

D. If the contract is a Federal contract, the CO must make a written record of all questions asked and any answers given at the prebid or proposal meeting. Engineering staff present at the prebid or proposal meeting must not express opinions as to the difficulty or the ease of performing work elements and must not interpret the contract or contract conditions.

E. When individual landowners-operators hire a contractor, prebid or proposal meetings for engineering conservation practices may be less formal. The landowner-operator may request that an NRCS employee be present to assist with the site showing. A job diary, conservation assistance notes, or other permanent record will be utilized to document questions and answers and other pertinent items discussed at the showing.

F. It is critical that all responses to questions that may affect a contractor's evaluation and potential bid or proposal be shared with all solicitation package holders. This may require a written followup or an amendment to the solicitation, as required by Agriculture Acquisition Regulation (AGAR) 452.237-71. The followup or amendment is the responsibility of the CO for Federal or CLO contracts and the landowner for private contracts.

G. The prebid or proposal meeting and site showing must be fully documented, regardless of contract type. The CO must prepare the documentation. The CO's technical representative or Government representative must submit copies of all notes taken at the site showing to the CO. Copies of the documentation must be given to the Federal CO, the CLO contracting official, or to the landowner for private contracts. These individuals issue the formal minutes. Copies of the documentation must be maintained in the project file.

512.12 Evaluation of Bidders

A. Prior to Award.—After the bids or proposals are received, the contractor's responsibility and the responsiveness of their offer must be evaluated prior to award of a construction contract. The responsibility and responsiveness of the contractor must be determined by the NRCS CO for a Federal contract, the local sponsor's CO for a CLO contract, and by the landowner for a private contract. NRCS may provide technical assistance (TA) to the local sponsor or landowner-operator in evaluating bidders, but should not make recommendations.

B. Determining the Contract Awardee.—Government agencies have the choice of several contracting methods and contract types, depending on the complexity of the work and the anticipated competition. For example, a contract may be awarded using sealed bids, where the award is made to the bidder whose responsible bid is the most advantageous to the Government, considering only price and the price-related factors, or a negotiated contract, where tradeoffs are made between technical qualifications and price and price-related factors to provide the best value to the Government. Technical qualifications on a best-value acquisition are based on evaluation factors published with the solicitation. Project sponsors with contract administration duties have similar contractual opportunities. Individual owners have similar interests to ensure quality and timely installation of their works of improvement at a reasonable cost. The CO (NRCS or CLO) or the owner determines the contract awardee. The criteria for determining responsiveness and responsibility must be included in the invitation for bid or the request for proposal (if a Federal contract) or in the announcement for a local sponsor or private contract.

C. Documentation.—Any information collected on behalf of the CO that deals with bidder evaluation must be given to the CO for inclusion with their files. Copies should not be maintained in the project file.

512.13 Preconstruction Conference

A. This is usually the first meeting between the owner and contractor following the contract award. Individuals representing the contractor and subcontractors, the owner, major suppliers, and others who will be working together in the execution of the contract should be present. The authorities and responsibilities of these individuals must be jointly understood. The conference will be used to develop a positive working relationship and generate a discussion that centers on the procedures the contractor plans to implement to meet the terms and conditions of the contract.

B. The preconstruction conference minutes must be recorded. Minutes must be reviewed by the Government attendees, finalized, and shared with all participants. Any questions and answers and any interpretations of contract documents provided at the preconstruction conference will be included in the minutes. Any questions that could not be answered by the contract documents (where interpretation is provided) will be addressed and included in the minutes. A contract modification may be necessary if a response affects the length of the contract or a change in the extent of the work or final cost of the contract. The preconstruction conference minutes will be included as part of the project's permanent record.

C. Reviewing the extent of the work required of the contractor for installing engineering conservation practices for an individual owner-operator is equally important for non-Federal contracts. Documentation is the responsibility of the owner or sponsor and can be accomplished through the use of the job diary, conservation assistance notes, other permanent record, sharing in writing of agreed-to action items, or any combination of these. The owner must be involved in any decision that could affect the practice installation, final cost, or both.

512.14 Partnering

A. "Partnering" means a relationship of open communication and close cooperation that involves both Government and contractor personnel working together for the purpose of establishing a mutually beneficial, proactive, cooperative environment to achieve contract objectives and resolve issues and implementing actions, as required. Partnering involves an agreement in principle to share the risks involved in completing a project and to establish and promote a partnership environment. Partnering is not a contractual agreement in itself, does not create any legally enforceable rights, or change the responsibility for risks established by the contract. Instead, partnering seeks to create a cooperative attitude in completing Government contracts.

B. Benefits to partnering include the following:

(1) The establishment of a partnering environment usually leads to higher-quality products, completed more quickly, at lower overall costs, and with fewer accidents and litigation.
(2) The use of partnering is encouraged as it has been shown to reduce the average contract cost, schedule growth, and the number of contract claims and litigation.

C. Partnering should be used on a contract when the CO, in coordination with the project engineer, determines that the benefits to be achieved from its use are expected to be greater than the costs. In determining whether the benefits of partnering are greater than the costs, the following factors should be considered:

(1) The estimated dollar value of the contract.
(2) The complexity of the work to be performed.
(3) The contemplated length of the contract.
(4) The estimated costs to be incurred in conducting the partnership development and team building initial and followup workshops or meetings.

D. The partnership for construction contracts may be established through a facilitated process. The costs to conduct a partnering workshop must be agreed to and shared equally by all parties, with no change in contract price. Accordingly, the contractor will not include costs associated with this partnering effort as part of the bid or proposal price, nor will such costs be allowable under the contract. This partnering effort conveys no legally enforceable rights or duties; any changes to the contract must be made by the CO under the terms of the written contract. The participants should represent all levels of each organization involved with the construction contract. A partnering charter or similar agreement should be developed and shared with all participants.

E. When issues that arise during the contract period are not resolved to the satisfaction of those directly involved at one level, the issues are elevated to the next management level for resolution. Partnering has the potential to expedite the resolution process.

Subpart C - Evaluation of Construction Materials

512.20 General

A. Quality requirements for construction materials are contained in Title 450, National Handbook of Conservation Practices (NHCP), and Title 210, National Engineering Handbook (NEH). Many of these specifications and standards refer to standards and specifications used in the industry, such as the following:

(1) American Society for Testing and Materials International (ASTM)
(2) American Association of State Highways and Transportation Officials (AASHTO)
(3) American Water Works Association (AWWA)
(4) USA Standards Institute
(5) American Concrete Institute (ACI)
(6) Federal Supply Service (FSS)
(7) Product standards published by the National Bureau of Standards (NBS) and others

B. These referenced standards and specifications set forth requirements for material performance, material testing, quality control, and quality assurance.

C. To ensure that construction materials meet job requirements as defined by the plans and specifications, an evaluation of material quality in relation to applicable industry standards, specifications, or both must be made. The nature, time, and place of this evaluation depend on the type of material, specifications, the kind of construction, and other factors that could affect the public's health and safety.

512.21 Evaluation Procedures

A. Material quality will be evaluated by a procedure specified by the design engineer. Evaluation procedures may include laboratory testing, manufacturer certifications, examination at the job site, or prequalification.

B. State Conservation Engineers (SCEs) must establish guidelines for accepting and incorporating used materials in systems for which NRCS provides technical or financial assistance. The owner must pay special attention to used items during operation and maintenance activities. Used materials are acceptable if they meet all of the following requirements:

(1) Are suitable for the proposed work.
(2) Meet testing requirements.
(3) Have an expected service life equal to or greater than the projected design service life for the overall structure or system.
(4) Are structurally adequate and environmentally acceptable.
(5) Do not increase operations or maintenance costs over the use of new materials.

C. New products that have not been used previously for conservation practice application must be evaluated and approved for use by the SCE before being specified. Trial use of new products must be under the approval of the SCE and must be supported by industry or applicable standards, specifications, evaluation data, reports, or some combination of these. Reports on the material placement, properties, and durability may be required.

D. SCEs must designate new or used materials that require certification, testing, or both based on the quantity of the items used, the life of the item in relation to the life of structures in which it is used, the cost of the types of structures in which it is used, the difficulty of replacement, and the consequences of failure of the structures in which it is used. Acceptance of a material on the basis of certification is permissible only if the material meets all of the specification requirements.

512.22 Waivers of Material Certifications

NRCS contracts require certification for all materials incorporated in the works of improvement unless specifically waived. Certification may be waived under certain conditions, as determined by the design or project engineer with the concurrence of the SCE or approving authority.

512.23 Prequalification of Materials

A. Prequalification is the evaluation and determination of materials that may be used without further certifications. Prequalification eliminates the need for requesting and furnishing individual certifications and test results for each project or contract. Acceptable materials to consider for prequalification are those items that are manufactured under close quality control and consistently meet the applicable specifications. For small projects, the use of prequalified materials is a viable alternative to ensure material quality.

B. Prequalified materials may be used in NRCS construction by referring to the certification, test data file, or both. When a prequalified item or product is used, its use must be recorded on the as-built drawings, recorded in the job diary, or documented by other suitable methods as determined by the SCE.

C. States have the authority to prepare and maintain a list of materials approved for prequalification

when the quantity of materials being used economically justifies its preparation.

D. Many factors affect the quality and acceptability of manufactured products. Prequalified products, materials, or both may require occasional review to ensure minimum quality requirements are current. The SCE determines the review frequency at the time the material is initially placed on the prequalification list.

Subpart D - Quality Assurance Activities

512.30 General

A. For Federal construction contracts, the general and special provisions of the contract and the quality assurance plan (QAP) outline construction quality assurance (QA) requirements. The construction specifications outline the duties and responsibilities of the contractor's quality control (CQC) program. For contracting local organization (CLO) and private contracts, the contracting officers (COs) or landowners may decide to outline the CQC responsibilities in the construction specifications or contract, where applicable.

B. QA activities may vary in accordance with the complexity and hazard class of the engineering measures being constructed. QAPs will be prepared during the design phase with input from construction engineers and the State Conservation Engineer (SCE).

512.31 Definitions

A. Quality Control.—Activities performed by the contractor to document that the work installed meets the minimum requirements of the contract. CQC required by 210-NEH, Part 642, "Construction Specification (CS) 94, Contractor Quality Control," may be a bid item if using sealed bids, and must be included in any negotiated construction contract.

B. Quality Assurance (QA).—Activities performed by or for the owner, including observing construction methods and procedures, reviewing the CQC testing activities and test results, conducting periodic material testing to evaluate the CQC system, and other measures to ensure compliance with the contract provisions. The duties and responsibilities for this activity are outlined in the QA plan (QAP) for the specific project being installed. NRCS should only perform active QA duties on a CLO if QA is included in the project agreement. Monitoring and surveillance of CQC and QA on a CLO must be performed regardless of whether QA is included in the project agreement.

C. Quality Assurance Plan (QAP).—This plan defines NRCS QA duties. A QAP will outline the technical and administrative expertise required, identify the individuals with that expertise, outline the frequency and timing of technical assistance (TA), estimate the contract completion date, and be approved by all responsible supervisors and the appropriate line officer. QAPs are required on all Federal and CLO contracts.

512.32 QA Procedures

A. States may develop QAP templates for engineering conservation practices with Engineering Job Approval Class I–V. These QAP templates must provide the minimum QA needed for proper installation. The responsible line officer and the responsible technical staff person must review the QAP template to determine the adequacy and availability of the technical resources required. This determination will be evaluated and established prior to practice layout. The line officer must assign this responsibility to the appropriate personnel and provide adequate time to ensure quality installation.

B. QAPs for Engineering Job Class VI–VIII will be developed per project and will be signed by the SCE and State Conservationist. QAPs will be prepared by the design engineer and supplemented by the SCE who has knowledge of individuals with QA technical skills and are available for appointment for the project. Under no circumstances will certification stating that work has been accomplished in compliance with the drawings, specifications, and other contract provisions occur without a physical review and documentation of the work performed.

(1) Continuous QA is required for construction activities where the quality of work cannot be verified by intermittent observations. Continuous inspection is also required for work that cannot be readily removed and replaced if it fails to meet the requirements of the contract.
(2) Intermittent or periodic QA may be adequate for certain phases of project activities depending on the complexity of the installation and the potential impacts upon the health and welfare of the public.

512.33 Inspection of Materials

A. Construction materials, including prequalified materials, must be inspected as part of the CQC program prior to installation. Documentation of verification of the material certification must be recorded in the project job diary, conservation assistance notes, contract records or on the as-built drawings.

B. NRCS will only perform QA functions at factories, locations of fabrication, or other sources of supply if the SCE determines this to be necessary.

C. QA of materials compliant with specifications or standards may include—

(1) Field verification of the CQC certification of materials, such as the size, dimensions, standards (ASTM, ACI, AWWA), other standards and specifications, or some combination of these.
(2) Verification of material sampling and testing and specification compliance submitted by the

contractor.

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Subpart D – Quality Assurance Activities

§IA512.32 Quality Assurance (QA) procedures

A.(1) A person with the appropriate engineering job approval authority is responsible for determining inspection needs for jobs approved by the field office staff.

A.(2) The following guidelines will be used in determining the degree of inspection for a Class I, II, or III job:

(i) Work being installed by a contractor:

1. Is the contractor experienced in this type of work?
2. Has his past work been satisfactory?
3. Have all site conditions which may affect the job been determined?
4. Have adequate plans been furnished and discussed with the contractor?
5. Can the job be built without special knowledge other than that normally expected from contractors doing this type of work?
6. Will all components of the practice be visible when the job is completed, or will the contractor's past performance give reasonable assurance that underground work will be installed correctly?

If the answer to any of these questions indicate that technical help is needed during construction, at least one inspection should be scheduled.

If the answers to the above questions indicate that no technical help is needed, no inspection need be made during construction. A final checkout will suffice or a certification of completion from the contractor may be accepted.

(ii) Work being installed by the landuser:

1. Has the landuser had any experience with this type of work?
2. Does the result of similar work on the farm indicate that the landuser can install the practice without difficulty?
3. Does the landuser have adequate equipment for the job?
4. Does the job have any technical factors of a critical nature

which the landuser might not understand or know about?

5. Have adequate plans been furnished and personally discussed with the landuser?
6. Have specifications been personally explained to the landuser?
7. Do site conditions indicate that difficult construction problems may be expected?
8. Will any components of the practice be buried and not accessible after the job is completed?

If the answer to any of these questions indicates that technical help is needed during construction, a minimum of one inspection shall be scheduled.

If the answers to the above questions indicate that no technical help is needed, no inspection need be made during construction. A final checkout will suffice.

A.(3) Class IV-V jobs

(i) An Inspection Plan shall be required for class IV and higher jobs. The Plan shall include the level and frequency of inspection required for the major components of the project. The frequency of inspection must be sufficient to control all major technical factors of installation.

(ii) Because of the wide variety and complexity of jobs, needed inspections may vary from one, two, or three inspections to almost daily spot inspections of certain jobs.

C. An Inventory of Skills shall be completed for all Natural Resources Conservation Service personnel who may be involved in formal construction contracts as the Government Representative (GR), Contracting Officer's Technical Representative (COTR), or Inspector. The Inventory of Skills (IA-ENG-46 and IA-ENG-47) shall be completed by the GR, COTR, or Inspector and approved by their technical supervisor. A current copy of the Inventory of Skills shall be attached to the Inspection Plan prior to approval by the Principal Technical Staff Member and the Assistant State Conservationist-Management. The forms may be found at the engineering forms section of the Iowa NRCS website.

Subpart E - Equipment, Records, and Coordination

512.40 Engineering Equipment

A. Each State Conservation Engineer (SCE) must develop a list of engineering equipment that will be permanently assigned to each field or technical service office. Procedures must be established to ensure that all engineering equipment is periodically inspected for accuracy and serviceability (see Part 544, "Equipment").

B. Specialty equipment may only be assigned to qualified individuals with the necessary skills and approvals to operate and maintain the equipment. This requirement includes, but is not limited, to survey-grade geospatial positioning system (GPS) survey equipment and portable nuclear gauges. Under the Nuclear Regulatory Commission license to USDA, nuclear gauge users are required to be qualified and have permits. The USDA entity responsible for nuclear safety is the Radiation Safety Division. Qualifications and permit requirements and other information can be found on their Web site at http://www.rss.usda.gov/about_rss.htm.

512.41 Records

A. Job Diary.—A job diary must be maintained to document the daily activities of Federal contracts utilized to install conservation engineering practices or project elements and for all Engineering Job Class VI–VIII practices and projects. On Engineering Job Approval Class I–V, details must be recorded in either the job diary or conservation assistance notes, hereafter referred to as a job diary.

(1) The level of detail recorded directly corresponds to the complexity of the work and potential impacts upon public health and safety, and must be thorough enough to show that all aspects of the completed project meet the specifications or standards.
(2) The SCE, contracting officer (CO), Government representative, or CO's technical representative, individually or jointly, will determine which quality assurance (QA) personnel will maintain a job diary to record the progress and other elements of the project.
(3) It may be beneficial on projects where construction activity is occurring at more than one location to have more than one diary to ensure important information is recorded. The job diary serves as a source of factual data related to the contractor's performance in both quantity and quality.

B. Photographs.—The job diary must be supplemented with photographs to detail site conditions, quality of work, etc. Photographs may be digital or film, and should be clearly labeled with the date, project, and item being viewed.

C. Construction contracts that include construction specification (CS) 94, Contractor Quality Control (CQC), will include specific testing and documentation and other requirements for the contractor.

512.42 Coordination Between Disciplines

A. The engineer or technician responsible for onsite QA, or both must ensure that items in the design report are addressed, and all recommended testing and examinations are properly completed as outlined in the QA plan. QA personnel must understand the design report and recognize potential variations during the construction phase. When variations from the design are detected on a Federal contract, the CO must be notified of the potential for a change. After notifying the CO, any design-related changes in the work must be reviewed and concurred with by the designer and an individual with appropriate job approval authority. The appropriate disciplines necessary to review potential variations must be contacted as early as possible to minimize delays in the performance of the work.

B. On contracting local organization (CLO) and private contracts where variations from design requirements or standards is noted, the NRCS personnel must inform the CLO or landowner and the appropriate line officer, as well as document the variations in the job diary or conservation assistance notes. The design engineer must also be notified.

C. On smaller projects (Class I–V), the QA process may be less rigorous. However, changes must meet the following requirements:

(1) All parties involved must be aware of and concur with any changes prior to formalization as a modification.
(2) Contract and program requirements continue to be satisfied.
(3) The function of the project or practice being installed must not be impaired.

Subpart F - As-Builts

512.50 General

A. "As-built" drawings are a set of drawings that depict the actual as-built conditions of the completed construction and provide the owner with a permanent record of each project feature. As-built drawings and specifications are also known as "redlined" or "record" drawings and specifications. These drawings are important in providing critical information for those physical features of the structure that are not visible following completion of the project installation. Note that the term "as-built drawings" refers to all plans and specifications that have been altered during construction.

B. As-built drawings may be prepared by the project engineer or by an architect-engineer (A&E) firm, if applicable. If the A&E firm is responsible for preparing as-builts, the A&E's working, as-built drawings must be reviewed at least monthly by the project engineer.

C. All changes (no matter how minor) and clarifications are entered on the as-built documents. Changes and clarifications refer to shop drawings, field engineering change proposals, change orders, modifications, and requests for information that have been reviewed and approved by the Government.

512.51 Scope

A. As-built drawings must be prepared for all major (Class VI–VIII) structural works of improvement and for all inventory size dams. As-built drawings must also be prepared for any engineering job approval class structures when any of the following apply:

(1) Another government entity or agency requires as-built plans (for example, statewide utility notification system for buried pipes).
(2) The final installed plans are required to properly locate structural features and perform operation and maintenance (for example, pipeline system where the as-built shows the final location of valves, drains, and pipe sizes).
(3) Future plans could include additions to the present structure, adaptations, or both (for example, plans include the extension of the pipeline system).

B. As-built drawings for structures in the Engineering Job Class I–V will be prepared as determined by the State Conservation Engineer (SCE).

512.52 Documentation

A. Recording Changes.—All changes during construction must be recorded on the drawings or in the specifications to indicate as-built conditions. The SCE must outline procedures for supplementing the design report to include analysis and supporting data. If a structure is altered at any time following initial completion, the as-built plans must be retrieved and revised to indicate the alterations. After the drawings have been revised to include the additions and modifications, updated as-built plans will be redistributed to the same offices or entities as the original as-built plans.

B. Labeling.—Each sheet of the completed as-built drawings must be clearly identified as "AS-BUILT." The title sheet of the drawings must list the contractor, contract number, construction completion date, names of the Government quality assurance (QA) inspectors, and final amount of the contract. The title sheet will also contain the name of the Government representative (GR) or contracting officer's technical representative (COTR) and his or her signature to certify that all work under the contract was installed in accordance with the as-built drawings and specifications and that the as-built documents are a true and correct record. Similarly, if construction oversight and QA is provided by an architect-engineer (A&E) firm, the title sheet must include all of the information listed above, the name and address of the firm, and the name and contact information for the firm's president.

C. Checking.—Following construction, the as-built plans must be certified complete by the COTR, project engineer, GR, or A&E engineer of record. The certifying individual must initial each sheet of the drawings and sign the title sheet. The as-built drawings must be submitted to the NRCS office that has the technical responsibility for the project work and be available for future reference.

D. Reproduction.—After NRCS review and approval, these marked-up drawings may be digitized in a noneditable format. Paper copies, electronic copies, or both will be transferred to each sponsor or owner of the project, the local NRCS office that had responsibility for the project, the State office, and other outside governmental agencies requiring documentation. Follow GM-120, Part 408, Subpart D, Section 408.63, for transferral of copies of the as-built plans and specifications.

E. Operation and maintenance information, including shop drawings for equipment that was installed for the project, practice, or both must be included with the as-built drawings for the sponsors, owner, or operator. It is recommended that operation and maintenance information also be available in electronic format, if possible.

F. As-builts prepared for conservation engineering practices, when required under Section 512.51, must be maintained at the local NRCS office and may be provided to the landowner-operator following completion and acceptance of the work.

512.53 Disposition

For the disposition of as-built files for structures installed as part of a total project, see GM-120, Part 408, Subpart D, Section 408.63, under File Code 210-12-11.

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Subpart F – As-Builts

§IA512.50 General

A.(1) As-built records for projects installed under formal construction contracts shall include the following materials:

- Hazard classification documentation
- Geologic investigation report
- Soil mechanics report
- Hydrology reports with flood routings and breach analysis
- Design report and design folder with pertinent calculations
- Construction and material specifications
- Inundation map and Real Property map for all sites
- Emergency action plan (EAP) for high hazard sites
- Material certifications and construction tests
- Construction photographs
- Job diaries and engineering field notebooks
- Pertinent correspondence
- Contract modifications and final contract payment estimate
- As-built plans
- Construction completion report

§IA512.51 Scope

B. As-Built records shall be prepared for:

(1) Practices built under formal contract by NRCS or a cooperating local sponsor.

(2) Practices such as dams, diversions, dikes, grade stabilization structures, waste storage facilities, and waste treatment lagoons which could endanger human life or cause significant property or environmental damage if they should fail.

(3) All engineering job class V and larger practices.

§IA512.52 Documentation

A. Recording Changes.

(1) The NRCS personnel with construction approval authority will be responsible for recording changes on the as-built plan.

B. Labeling.

(1) For non-contract work, the as-built drawings must be marked “AS-BUILT”, list the contractor, QA personnel, construction completion date, and signature of certifying official.

C. Checking.

(1) The NRCS Dam Inventory, IA-ENG-40, shall be sent to the state office with all as-built plans of inventory type dams.

D. Reproduction.

(1) The state office will print one copy of the as-built (l1" x 17" maximum) for each sponsor who has operation and maintenance responsibilities.

§IA512.53 Disposition

A. For formal construction contracts, the original as-built plans of structures shall be retained in the state office for 10 years and then returned to the sponsor.

(1) The State Office will retain either paper or electronic copies.

B. All other as-builts shall be retained by the responsible field office for the evaluated life of the practice.

Subpart G - Safety

512.60 General

Safety is a major concern for all parties on a construction site, including the contractor's and subcontractors' personnel and NRCS personnel. NRCS is required to furnish a place of employment free from recognized hazards that cause or are likely to cause death or serious physical harm.

512.61 Personal Protective Equipment (PPE)

All NRCS personnel on a construction site must be issued a hard hat. Each State determines policy concerning the provision of other PPE, such as steel-toed shoes and hearing and eye protection, in accordance with Occupational Safety and Health Administration (OSHA) rules, and the anticipated safety hazards. It is the employee's responsibility to comply with safety and occupational health requirements, wear prescribed safety and health equipment, report unsafe conditions or activities, prevent avoidable accidents, and work in a safe manner. Visitors to a construction site must be temporarily issued a hard hat at a minimum.

512.62 Training

All NRCS personnel on a construction site for engineering job Class VI-VIII must have completed the 10-hour OSHA safety training course as a minimum. If the complexity of the construction warrants it, the 30-hour OSHA safety training course is recommended. The level of safety training required for any project is the decision of the State Conservation Engineer. The OSHA safety training courses are generally available as distance learning (online) and may be applied to the maintenance training requirements for contracting officers' technical representatives.

Subpart A - Erosion and Sediment Control

520.0 General

A. Effective erosion and sediment control requires a comprehensive system of engineering and cultural practices applied to the land for the specific purpose of controlling erosion and preventing excessive sediment accumulation. Federal, Tribal and State laws, rules, regulations, and executive orders have emphasized the need to conserve natural resources and to improve the quality of the environment. Erosion and sediment control systems address this need.

B. Erosion occurs in many areas other than cropland. Construction sites, parks, playgrounds, roads, and urban areas are major sources of erosion. NRCS is often asked for technical assistance in the planning, design, and construction of erosion and sediment control systems.

520.1 Minimizing Erosion and Sediment During Construction

A. NRCS must include practices and techniques to minimize erosion and sediment for construction operations carried out under all programs. The need for sediment abatement must be determined for each site by evaluating the sediment hazard and its relation to the sediment tolerance or standard for the area in question. A review of State and local standards established as a result of the Federal Water Pollution Control Act (the Clean Water Act, as amended) should be conducted when determining the control necessary for special sites.

B. Sediment control measures must be included as a part of all construction operations administered by NRCS through formal contract or force account procedures.

C. Sediment control measures must be included as a part of all construction operations administered by local organizations (through formal contract or otherwise) in which NRCS provides the engineering design, installation services, or both.

D. All construction administered by local organizations, either with their own engineering organization or with engineering consultants retained by them with NRCS financial assistance, must comply with the intent of this policy; however, some leeway is allowed with regard to the specific details.

E. Engineering plans prepared by NRCS for individuals and groups must include satisfactory sediment and erosion control measures.

F. Because the measures required to control erosion and sediment may be unique to each site, national guide specifications for such measures will not be established. States must develop plans and specifications for the specific measures that are required for individual structures or sites or by using Title 210, National Engineering Handbook, Part 642, "Specifications for Construction Contracts," or Title 450, National Handbook of Conservation Practices, as appropriate.

G. Field surveys and site investigations must include the information required to properly plan and design the measures needed to provide an acceptable degree of sediment erosion control for a site. Requirements for vegetative control measures must be included along with structural measures.

H. Requirements for erosion and sediment control measures must be clearly outlined in construction contracts. In many contracts, these requirements may be included in the items of work and construction details section.

I. Control measures included in construction contracts must be discussed with the contractors at the prebid site showing and at the preconstruction conference.

J. If special sediment problems arise during construction or if special measures not in the contract are needed, they must be brought to the attention of the contracting officer for contract modification or other appropriate action.

K. In preparing plans and specifications for structures or projects at locations where sediment tolerances may be exceeded, consider that—

(1) The area and duration of exposure of erodible soils should be reduced to the greatest extent practicable.
(2) Soils should be protected by using temporary vegetation or mulch or by accelerated establishment of permanent vegetation. Segments of work should be completed and protected as rapidly as construction schedules allow.
(3) The rate of runoff from the construction site should be mechanically retarded and the disposal of runoff should be controlled.
(4) Sediment resulting from construction should be trapped in temporary or permanent debris basins.
(5) Dust should be maintained within tolerable limits on haul roads and at the site by applying water or other dust suppressors.
(6) Temporary bridges or culverts should be used where fording of streams is objectionable. Borrow should not be taken from areas where erosion and sediment from the operation is inevitable.
(7) Temporary measures should be used to keep erosion under control if construction is suspended for any appreciable length of time.
(8) Construction should be timed to avoid rainy seasons if practical.

Subpart B - Floodplain Management

520.10 General

Floodplain management is essential in the development of plans to reduce flood damages. Floodplain management requires the application of sound engineering principles.

520.11 Scope

Floodplain management includes structural and nonstructural measures to reduce flood damages and is subject to the rules and regulations in 7 CFR Section 650.25.

520.12 Description

A. Floodplain management is a tool to obtain a given set of objectives for reducing flood damage. A floodplain management system should—

(l) Avoid direct or indirect support of floodplain development if there is a feasible alternative.
(2) Ensure that the risk of floodplain use is compatible with the degree of flooding expected.
(3) Protect human safety, health, and welfare.
(4) Preserve and restore important environmental values.

B. The methods for meeting floodplain management goals may be grouped under those for "people control" that reduce the effect of and susceptibility to flooding and those for "flood control" that reduce the amount of flooding.

520.13 Types of Measures

A. Structural measures, such as dams, channels, and diversions, that are included to modify the flood water are generally well understood and are not described in this subpart.

B. Nonstructural measures include the following:

(l) Acquisition, including purchase in fee title or suitable easements, for the purpose of precluding future uses that would be incompatible with the expected degree of flooding or setting time limits for which inhabitable buildings can be used.
(2) Relocation of residential, commercial, industrial, and other buildings to flood-free areas to reduce or prevent flood damages.
(3) Regulation, including actions by local government entities through zoning, building codes, etc., to keep land use compatible with the expected degree of flooding. Regulation may apply to a floodway, which is the part of the floodplain that can contain a flood without causing an excessive increase in the elevation of the water surface. This increase is usually l foot, but some communities have a lower limit. The flood fringe is the area of the floodplain below the increased elevation (as defined above) and outside the floodway. The floodway is to remain unobstructed. Development may be allowed in the flood fringe if structures are elevated above the area of flooding. In these areas, the need for ingress and egress as well as the possibility of larger floods occurring must be considered.
(4) Floodproofing consists of modifications of existing structures, their sites, and building contents to reduce the probability and adverse effects of water entry.
(5) Flood warning systems and emergency action plans provide information on the time of occurrence and magnitude of flooding to be expected. Features could include visual observations, stage recorders in streams, precipitation data in the uplands, continuous or periodic data collection, manual or automatic relay systems, flood warning markers, etc. The degree of sophistication varies with the needs of the local community and the hydrologic characteristics of the area. The warning system must be integrated with the emergency action plan. Both must be compatible with the local situation. It is desirable to provide a warning time of several hours—perhaps 10 to 12 hours. However, if only a 1- or 2-hour warning is possible, the emergency plan must be implemented with due consideration to the short time available.
(6) Information and education are essential to any floodplain management system. The development of needed technical information and its dissemination to the public, especially local government officials, planners, and affected landowners, are essential. Included are flood warning markers on the ground that designate areas subject to flooding so that the hazards can be recognized. These could be referenced to historic floods, percent chance floods, or the floodway location.
(7) Flood insurance is a method of spreading economic loss over time and among a relatively large number of people. It does not directly reduce damage.
(8) Flood emergency measures include contingency and emergency floodproofing that can be completed in anticipation of flooding. It should be recognized that one of the functions of overall flood plain management is to reduce the need for this type of emergency action.

520.14 Risk to Life and Property

The risk to human life and property is considered in evaluating various floodplain management alternatives. Although risk is difficult to measure, certain physical parameters can be used to assess

the potential risk for each structure.

(1) Frequency of flooding determines the probability of occurrence. The l00-year frequency flood (l percent chance in any l year) is the minimum acceptable if there is risk to human life. For certain critical facilities such as hospitals, schools, nursing homes, utilities, and facilities for producing or storing volatile, toxic, or water-reactive materials, the effects of the 500-year frequency flood should be considered.

(2) Depth of flooding is a crucial factor. Some areas may tolerate depths of from l to 3 feet without being considered hazardous to life.

(3) Estimated warning time for evacuation may be significant.

(4) Velocities should be considered either along or in combination with depth and other parameters.

(5) Combinations of depth (in feet) and velocity (in fps) can be used as indicators of risk. Products of 4 or greater have been used as a limit for "people safety" and values of l5 or 20 for "structural safety."

(6) Duration of flooding may be a significant factor for some agricultural crops.

(7) Other factors may also be available to evaluate risk.

Subpart C - Dams

520.20 General

A. Dams are essential to soil and water resource development. Controls to ensure safety of dams are needed to protect life and property.

B. Uniform, high- quality standards must be used in the planning, design, and construction of dams to ensure consistently safe, efficient performance.

520.21 Definition and Classes

A. As used in this manual, a dam is an artificial barrier, together with any associated spillways and appurtenant works, that does or may impound or divert water.

B. Storage is the capacity of the reservoir in acre-feet below the elevation of the crest of the lowest auxiliary spillway or the elevation of the top of the dam if there is no open channel auxiliary spillway.

C. Overall height is the difference in elevation in feet between the top of the dam and the lowest elevation at the downstream toe.

D. Effective height is the difference in elevation in feet between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section on the centerline of the dam. If there is no open channel auxiliary spillway, the top of the dam becomes the upper limit.

E. Dams are classified according to the potential hazard to life and property if the dam should suddenly breach or fail. Existing and future downstream development, including controls for future development, must be considered when classifying the dam. The classification of a dam is determined only by the potential hazard from failure, not by the criteria.

(l) Low Hazard.—Dams in rural or agricultural areas where failure may damage farm buildings, agricultural land, or township and country roads.
(2) Significant Hazard.—Dams in predominantly rural or agricultural areas where failure may damage isolated homes, main highways, or minor railroads or interrupt service of relatively important public utilities.
(3) High Hazard.—Dams where failure may cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads.

F. Some dams have greater significance than others because of their potential for affecting public safety. The public concern for safety of dams is often identified with the size of the dam and reservoir. Because dams, even though small, initially may present no hazard in terms of loss of human life, their degree of hazard can change as a result of downstream development. Because of this, and the need to manage an overall NRCS program for dam safety, a national inventory of NRCS-assisted dams must be maintained by the Director, Conservation Engineering Division (CED). Each State Conservationist must develop the inventory in their State. The following dams must be included in the inventory and are considered as NRCS inventory dams:

(l) All significant hazard and high hazard dams.
(2) Low hazard dams more than 6 feet in overall height and with a storage capacity of 50 acre-feet or more.
(3) Low hazard dams with an overall height of 25 feet or more and a storage capacity of more than l5 acre-feet.

G. The NRCS inventory dams must be current and accurate. The State Conservationist is responsible to keep all inventory fields current and to update the hazard classification of each project dam as required in the National Operations and Maintenance Manual (NOMM) specifically to note any change to high hazard from a lower hazard classification.

H. The NRCS Inventory of dams contains some sensitive data and is intended for internal agency use with limited access. The non sensitive data is transmitted by the Director, CED, as required by law, to the Corps of Engineers for inclusion in the National Inventory of Dams (NID). The NID data can be accessed from the NID Web site.

520.22 Design Criteria

A. Low hazard earth dams with a product of storage times the effective height of the dam of less than 3,000 and with an effective height of the dam of 35 feet or less must meet or exceed the requirements of conservation practice standard Pond, Code 378 (NHCP).

B. Low hazard earth dams whose product of storage times the effective height of the dam is 3,000 or more; those more than 35 feet in effective height; and all significant hazard and high hazard dams must meet or exceed the requirements of Technical Release No. 60.

C. Dams of materials other than earth must comply with the applicable portions of conservation practice standard Pond, Code 378 and Technical Release No. 60. Other features must meet or exceed the requirements as stated in other applicable NRCS standards.

520.23 Classification

A. Classification of dams is determined at the time of inventory and evaluation and verified immediately prior to construction. The person having the appropriate engineering job approval authority (section 50l.4) is responsible for the classification.

B. Documentation of the classification of dams is required. Documentation must include but is not limited to location and description of the dam, configuration of the valley, description of existing development (houses, utilities, highways, railroads, farm or commercial buildings, and other pertinent improvements), potential for future development, recommended classification, and signatures of those performing and concurring in the classification. It must also include results obtained from breach routings, if breach routings are used as part of the classification process.

C. If there are indications that any existing dam is misclassified, including changes resulting from downstream development, proposals for reclassification must be submitted to the State Conservation Engineer (SCE) for action. If the SCE approves, the dam is officially reclassified. When this occurs, the case file must be documented, proper notification made, and the updated information added to the inventory of NRCS-assisted dams.

520.24 Special Considerations

A. Most of the requirements in conservation practice standard Pond Code 378 and Technical Release No. 60 are stated as maximum and minimum limits and are not to be construed as satisfactory criteria for all dams.

(l) Special considerations must be given to dams in series, to those with drainage areas of more than l0 square miles, and to those located in regions of high earthquake hazard.
(2) Low hazard dams for municipal or industrial water supplies must be designed with minimum criteria equivalent to that for significant hazard dams.
(3) High hazard dams and those with permanent storage must not be constructed over an active fault without the concurrence of the Director, CED.

B. Local experience, State laws and regulations, site conditions, or other special features may require the use of more stringent criteria to ensure a satisfactory dam.

520.25 Clearing Reservoirs

A. Reservoir areas are cleared to facilitate the movement of water, to provide for the proper functioning of outlets and spillways, to provide convenient access to dams and related structures for operation and maintenance, and to comply with State and local laws and regulations.

B. The following minimum standards are used to determine the clearing required for reservoir areas:

(l) Dry Dams.—Minimum requirements include the following:
(i) Reservoir areas must be cleared to a distance of 200 feet upstream from the principal spillway inlet, except that no clearing is necessary above the elevation of the top of the inlet.
(ii) Areas immediately upstream from auxiliary spillways must be cleared to the extent required to permit spillways to function properly.
(2) Dams That Retain Water in a Reservoir.—This includes dams in which space is allocated for sediment storage and dams that provide water storage for beneficial use. Minimum requirements include the following:
(i) Reservoir areas must be cleared at least up to the elevation of the crest of the lowest ungated principal spillway inlet.
(ii) Less clearing may be approved for a specific site if the structure incorporates fish and wildlife features and the sponsor or owner requests that the area not be cleared, or if the cost of clearing is disproportionate to the other costs of the structure and lack of clearing will not interfere with the functioning of the reservoir. The minimum area cleared must extend the full length of the dam for a distance of 400 feet upstream from the principal spillway and include the area upstream from the emergency spillway to the extent required for it to function properly. Specific procedures addressing the potential for debris on the dam frontslope and around the principal spillway must be included in the operation and maintenance plan.

520.26 External Reviews for Dam Safety

A. Definition of an External Review.—An external review is an examination and evaluation of procedures used and decisions made during the design and construction of a dam by peers from outside NRCS or from an organizational unit other than the one responsible for the design and construction. "Design" is used here in the broad sense as defined in Section 511.2.

B. Purpose of an External Review.—External reviews are made to ensure that design and construction procedures and decisions reflect safety considerations and economy. Dam safety considerations are directly related to the potential for loss of life, damage to valuable property, or disruption of transportation and utility facilities if the dam fails. The classification of dams is determined by the potential for such losses and damage (see Section 520.2l). The reviewer must determine whether the methods of analyses are appropriate and the assumptions are justified by the site conditions and whether the results are reasonable. An external review is not a substitute for expertise needed during design and construction.

C. Design Reviews.—Design reviews are made as established in Section 511.5. Independent reviews for quality assurance are made as established in Section 501.5. An independent review can be considered an external review only if the office performing the independent review had little or no role in the design.

D. Determination of Need for an External Review.—All dams proposed for construction, modification, or repair must be evaluated by the SCE to determine the need for an external review. The need for an external review must be determined during preliminary design (see Section 511.2C). For project structures, the determination must be made during planning when the preliminary design is prepared.

(1) For high hazard dams, factors to be considered are the level of risk, size of the dam, reservoir volume, complexity of site geology, complexity and margin of safety reflected by the design layout and construction methods, and other unique condition or complexity noted during planning, design, or construction.
(2) To determine the need for an external review for all other dams, consider site complexity, unique design features, or other special conditions requiring special expertise.

E. Procedure for Establishing an External Review

(l) The SCE and the Director, CED, on Class VIII jobs make a joint recommendation to the State Conservationist on whether an external review is needed. The recommendation must be supported by a justification statement and include a brief description of the site, the proposed structure layout, composition of technical specialists making up the review team, and other essential data. This becomes part of the design folder. An external review may be initiated at any stage of the design or construction process.
(2) The State Conservationist is responsible for implementing the external review and advising the Director, CED, of the plan to conduct the external review.
(3) When an external review is recommended, the State Conservationist must request a list of employees and others qualified to make the review from the Director, CED.
(4) The State Conservationist makes the necessary arrangements for appointing the review board and assigning their responsibilities. If the board is composed of more than one member, a chairperson must be designated.
(5) The review board must be permitted to make reviews at the times they determine necessary. The review assignment must require evaluation until construction is completed.

520.27 Emergency Action Plans – High Hazard Dams

A. Applicability.—An emergency action plan must be prepared for each high hazard dam for which NRCS provides technical or financial assistance. The State Conservationist must determine that an emergency action plan is prepared prior to the initiation of construction.

B. Inundation Maps.—NRCS must provide appropriate inundation maps. These maps define areas that would be affected in an emergency situation and provide other appropriate information. The inundation areas to be delineated on the maps must show the following two conditions:

(l) Outflow from routing the auxiliary spillway hydrograph (or larger hydrograph) through the spillways and downstream.
(2) Discharge due to a sudden breach of the dam. Unless otherwise determined by the SCE, the conditions at the time of breach may be water level in the reservoir at or above the crest elevation of the lowest open channel auxiliary spillway and "nonstorm" conditions downstream of the dam.
(i) For dams in series, an evaluation should be made to determine if breach of an upstream dam would endanger a downstream dam. If the downstream dam is endangered, the breach inundation map should be based on multiple failures.
(ii) For dams not in series but which would affect a common downstream area, it is usually adequate to consider the failure of each dam individually unless special circumstances would warrant multiple failures.

520.28 Potential Impact Area – Low Hazard Dams of Inventory Size and All Significant Hazard Dams

A. Applicability.—For each low hazard dam of inventory size and each significant hazard dam, the area that could be inundated in event of a breach must be determined. This is completed as part of the hazard classification (Section 520.21(E)) and its documentation (Section 520.23(B)).

B. Requirements

(l) The potential impact area may be determined by performing breach routings or by other methods.
(2) The potential impact area must be clearly described by the use of maps, narrative description, or both. In addition to the description of the area, precautions outlining the desire to exclude future development within the impact area must be included. These precautions may be specific (e.g., if based on breach inundation studies) or may point out the need for breach routings in the future if development is ever considered. The landowner or sponsor should be made aware of the potential impact area as early as practicable and before expending significant resources in design.

C. Distribution

(l) As early as practicable but no later than initiation of construction, the State Conservationist must officially transmit the description of the potential impact area and precautions on development to the owner or sponsor. It is the responsibility of the owner or sponsor to transmit the description of the potential impact area and precautions on development to—

(i) The local land-use control agency or county.

(ii) The State agency responsible for dam safety.

(iii) The conservation districts and others, as appropriate.

(2) If requested by the owner or sponsor, or if the owner or sponsor fails to act, the State Conservationist must make the specified notification.

Part 520 – Soil and Water Resource Development

Subpart C – Dams

§IA520.21 Definition and Classes.

F. Additionally, NRCS policy in Iowa for maintaining an inventory of dams includes those which meet the criteria below:

(4) All dams with an overall height of 35 feet or more.

(5) All project detention type structures regardless of size or hazard class.

I. Inventory size dams will be included in the NRCS inventory if they meet any of the following:

(1) Dam was built with NRCS technical and/or financial assistance.

(2) The dam was built according to NRCS standards and specifications in effect at the time of construction.

(3) Alterations to the dam since the time of construction have been made in accordance with NRCS standards and specifications.

J. All information requested on Form IA-ENG-40 is to be included in the NRCS inventory. A copy of the form may be found at the Iowa website. Instructions for completing the form are included following this section.

K. Inventory of new dams. As new dams are constructed, the required data is to be added to the NRCS inventory on the basis of design and construction records. The individual approving the design shall, to the extent possible, complete form IA-ENG-40. The individual making the final construction check will check form IA-ENG-40, make any needed as-built corrections, and verify that all items are complete. One copy of IA-ENG-40 is to be forwarded to the State Conservation Engineer (SCE) and one copy retained in the case file. The As-Built plans and design report should accompany this form.

L. Iowa Department of Natural Resources (IDNR) dam inventory. The state office will send inventory information to the IDNR on form IA-ENG-40. The IDNR will assign National Inventory of Dams ID numbers (NID ID). The IDNR is the state agency responsible for assigning these national numbers.

M. Entry, storage, and retrieval of data.

(1) Data will be entered in the NID database and maintained at the State Office.

(2) Inventory data will be retrieved as needed by the State Office and copies of the inventory furnished to respective area and field offices if sensitive data is not included.

N. Keeping the inventory current.

(1) Data on new inventory type dams, or updated or corrected data, on previously submitted dams can be submitted at any time. Data on all inventory type dams completed during a calendar year shall be forwarded to the SCE by January 15 of the following year. This data will then be entered into the dam inventory database.

O. Responsibility.

(1) The SCE provides overall coordination for the inventory of dams.

(2) Each ASTC-FO insures the field offices carry out the inventory policy.

P. INSTRUCTIONS FOR COMPLETING THE NRCS NATIONAL INVENTORY OF DAMS (IA-ENG-40).

(1) The following explanations correspond with the item numbers on the Inventory form. Periods and commas are not needed for punctuation.

(2) Please be sure to complete the bottom line giving the date the form was filled out and the name of the person completing the report.

(3) The description in parentheses behind the label for the entry field describes the type of data required and the number of columns allotted to this data.

1. DAM NAME (alphanumeric, 65) - Enter the official name of the dam. For dams that do not have an official name, use the popular name of the dam. Do not insert meaningless information such as "Noname" or "Unknown" which only serve to increase the size of the file. If a project dam, enter the watershed project name, measure plan name (for Little Sioux use LS plus the Subwatershed name), and the site number as on the drawings. For others, use the official name or owner's name, i.e.:

Soap Creek 26-65	(Watershed)	Deer Ridge 1	(RC&D)
LS Dutch Hollow M-4	(Little Sioux)	Ralph Smith	(CO-01)

   If "Ralph Smith" has more than one dam, use something in the DAM NAME to uniquely identify it such as "Ralph Smith #2" or "Ralph J Smith 99."

2. OTHER DAM NAMES (alphanumeric, 65) – If there are names other than the official name (i.e., reservoir name) of the dam in common use, enter the names in this space. Separate names using a semicolon. Leave blank if none.

3. DAM FORMER NAMES (alphanumeric, 65) – Enter any previous reservoir or dam name(s), if changed. Separate names using a semicolon. Leave blank if none.

4. FEDERAL AGENCY ID (alphanumeric, 15) - NRCS dams in Iowa have a federal agency ID consisting of 10 characters, the first two containing the state abbreviation IA. The need for a unique identifier has been replaced by the NID ID (Field 5). All new dams will use the NID ID (see item 5) followed by three zeros.

5. NID ID (alphanumeric, 7) – The IDNR will enter the official NID identification number for the dam. This is assigned by the IDNR for NRCS dams in Iowa. This field is the unique identifier for each dam in the Nation. The ID numbers are requested from IDNR after the forms are received in the State Office.

6. LONGITUDE (number, 12) – Enter the longitude at the dam centerline to the nearest second. Insert the values for degrees, minutes and seconds. The database program will automatically convert the DEG MIN SEC format to decimal degrees (Degrees + Minutes/60 + Seconds/3600). This is the X-coordinate for geocoding.

7. LATITUDE (number, 12) - Enter the latitude at the dam centerline to the nearest second. Insert the values for degrees, minutes and seconds. The database program will automatically convert the DEG MIN SEC format to decimal degrees (Degrees + Minutes/60 + Seconds/3600). This is the Y-coordinate for geocoding.

8. LOCATION (alphanumeric, 30) - Enter the 40 acre tract designation including section, township and range where the dam is located. For example: SENW 09 T87N R42W. This location should be as if you were describing the land for a legal description. It is an abbreviation for the Southeast ¼ of the Northwest ¼, Section 9, Township 87 North, Range 42 West. Always use a two-digit designation for the Section Number and do not use periods or commas.

9. COUNTY (alphanumeric, 30) - Name of county where dam is located.

10. RIVER OR STREAM (alphanumeric, 30) - Name of river or stream on which dam is built. If the stream is unnamed, identify it as a tributary to a named river, e.g., TR-Snake. If the dam is located offstream, enter the name of the river or stream and identify as offstream, e.g., Snake-OS.

11. NEAREST CITY/TOWN (alphanumeric, 30) - Name of the nearest downstream city, town, or village that is most likely to be affected by floods resulting from failure of the dam.

12. DISTANCE TO NEAREST TOWN/CITY, MILES (Number, 3) - Distance to nearest downstream city, town, or village, to the nearest mile.

13. NON-FEDERAL DAM ON FEDERAL PROPERTY (alphanumeric, 1) - Enter the code indicating whether the dam is a non-federal dam on federal property, such as in National Forests. Y for Yes or N for No. (Normally N in Iowa)

14. OWNER NAME (alphanumeric, 50) - Name of the owner of the dam.

15. OWNER TYPE (alphanumeric, 1) – Use the following codes to indicate the type of owner:

P for Private Owner	F for Federal
U for Public Utility	S for State
L for Local Government	

For NRCS, use L if Field #57 = WS, PT, RC or FP.

16. DAM DESIGNER (alphanumeric, 65) – Enter the name of the principal firm(s) or agency accomplishing design of the dam and major appurtenances, operating features, and major modifications. List original designer, then modification designers (if applicable). Separate the names using a semi-colon. Typically for NRCS, if the design was prepared by an A & E, and NRCS approved the plans, this field would show the name of the A & E, and Field #50 would show NRCS involvement. Show "USDA NRCS" if the dam was designed by NRCS.

17. DAM TYPE (alphanumeric, 6) - Enter one or more of the following codes to indicate the type of dam. List in the order of importance. For example an entry of CNCB would indicate a concrete buttress dam type. Most Iowa dams will probably be RE.

RE for Earth	VA for Arch	ER for Rockfill
MV for Multi-Arch	ST for Stone	PG for Gravity
CN for Concrete	TC for Timber Crib	CB for Buttress
MS for Masonry	OT for Other	
RC for Roller Compacted Concrete		

18. CORE (alphanumeric, 3) – Enter code to indicate position, type of watertight member, and certainty. Do not separate with a comma. Typically for NRCS, most dams would be HEK.

Position:	F	for upstream facing
	H	for homogenous dam
	I	for core
	X	for unlisted/unknown
Type:	A	for bituminous concrete
	C	for concrete
	E	for earth
	M	for metal
	P	for plastic
	X	for unlisted/unknown
Certainty:	K	for known
	Z	for estimated

19. FOUNDATION (alphanumeric, 3) – Code for the material upon which the dam is founded followed by the certainty; do not separate with a comma. Most NRCS dams will be SK.

Material:	R	for rock
	RS	for rock and soil
	S	for soil
	U	for unlisted/unknown
Certainty:	K	for known
	Z	for estimated

20. PURPOSES (alphanumeric, 8) - Enter one or more of the following codes to indicate the purpose(s) for which the reservoir is used. List, in order of importance, up to four purposes. Generally, the project structures should just list the major purpose for which the structure was built, i.e. G or CG.

C	Flood Control and Storm Water Management	I	Irrigation
D	Debris Control	N	Navigation
F	Fish and Wildlife Pond	R	Recreation
G	Grade Control	S	Water Supply
H	Hydroelectric	T	Tailings
P	Fire Protection, Stock, or Small Farm Pond	O	Other

21. YEAR COMPLETED (alphanumeric, 5) - Year in which the original main dam structure was completed. The NID allows addition of an "E" to indicate an estimated date. Enter the four-digit year. Entry date is not to be changed when modifications or rehabilitation are done; use Field #22 below.

22. YEAR MODIFIED (alphanumeric, 60) – Year of major modification or rehabilitation of dam or major control structure is completed. Enter the four-digit year. Major changes are defined as structural, foundation, or mechanical construction activity which significantly restores the project to original condition; changes the projects operation, capacity or structural characteristics (e.g., spillway

or seismic modification); or increases the longevity, stability, or safety of the dam. Use the codes below to indicate the type of modification; up to ten may be entered, separated by semi-colons.

S	for structural	F	for foundation	M	for mechanical
E	for seismic	H	for hydraulic	O	for other

23. DAM LENGTH, feet (number, 7) - Length of dam, in feet, defined as length along top of dam. Also includes spillway, power plant, navigation lock, fish pass, etc., where these form part of the length of the dam. If detached from the dam, these structures should not be added. This should be measured from the plan or computed from the cross section on centerline including the auxiliary spillway bottom width and a distance equal to the freeboard height times the cutslope ratio. For a 3 to 1 cutslope and a FB height of three feet this distance would be 9 feet.

24. DAM HEIGHT, feet (number, 6) – Enter the overall height of the dam to the nearest foot. This is defined as the vertical distance between the lowest point along the crest of the dam (settled top or design top) and the lowest point at the downstream toe which usually occurs in the natural bed of the stream or watercourse.

25. STRUCTURAL HEIGHT, feet (number, 6) - Enter in feet, the structural height of the dam, which is defined as the vertical distance from the lowest point of the excavated foundation to the top of the dam (optional and not required).

26. HYDRAULIC HEIGHT, feet (number, 6) - Enter in feet, the hydraulic height of the dam, which is the vertical distance between the maximum design water level (freeboard design flood, if used) and the lowest point at the downstream toe. Typically for NRCS, this is the same as Field #24 (optional and not required).

27. SURFACE AREA, acres (number, 8) - Enter the surface area, rounded to the nearest acre, of the impoundment at its normal level, the crest of the principal spillway.

28. DRAINAGE AREA, square miles (number, 9) - Enter the drainage area of the dam in square miles to the nearest hundredth. This is defined as the TOTAL area that drains to the dam on a river or stream (acres/640=Square Miles).

29. UNCONTROLLED DRAINAGE AREA, acres (number, 9) - Enter the uncontrolled drainage area of the dam in acres. This is defined as the area not controlled by a designed upstream structure(s). For dams not in series this will be the same (acres) as the drainage area in Field #28.

30. DOWNSTREAM HAZARD POTENTIAL (alphanumeric, 1) - Code to indicate the most current potential hazard classification as defined in the NEM. Use best and latest available information. Qualify currentness in Field #32. Do not use any other codes since this Field is a critical filter for inclusion in the NID.

L for Low **S** for Significant **H** for High

31. HAZARD CLASSIFICATION AS DESIGNED OR MODIFIED (alphanumeric, 1) - Code to indicate the potential hazard to the downstream area at the time the dam was built or modified. If an existing dam was modified to reflect a change in classification, enter the most recent classification for which the dam was designed and modified.

    L for Low **S** for Significant **H** for High

32. HAZARD POTENTIAL CLASSIFICATION YEAR (number, 4) – Year of most recent verification of Hazard Potential Classification in Field #30 by qualified NRCS personnel. Use four digits for the year. For most new NRCS dams this should be the same as Field #21, Year Completed.

33. EMERGENCY ACTION PLAN (EAP)? (alphanumeric, 2) - Enter the code indicating whether or not the dam has an Emergency Action Plan (EAP) developed by the dam owner.

    Y for Yes N for No NR for Not Required

    For NRCS, if Field #30 is L or S, this Field is NR.

33A. EAP YEAR (number, 4) – Year of completion of the most recent Emergency Action Plan

34. POPULATION AT RISK (number, 5) – All those persons that would be exposed to flood waters if they took no action to evacuate. It should be the maximum combination of people reasonably expected in the dam breach inundation zone simultaneously at any time of the day or night, including permanent residents, seasonal transients (campers, recreationists, etc.), and daily transients (workers, students, shoppers, commuters, etc). Accuracy of the data should be qualified by Field #35.

35. POPULATION AT RISK ACCURACY (alphanumeric, 1) - Code indicating if the Population at Risk number in Field #34 is based on a visual estimate or a breach inundation map analysis.

    E for Estimated visually **A** for Analyzed with breach inundation map

36. INSPECTION DATE (date, 10) - Date of the most recent inspection of the dam prior to submission of data. Typically for NRCS, this means formal inspection led by a qualified engineer (can be NRCS or non-NRCS) as defined in NRCS National Operation and Maintenance Manual(NO&MM). Enter date using the following format: mm/dd/yyyy such as (08/09/2011).

37. INSPECTION FREQUENCY (number, 1) - Scheduled frequency interval for periodic inspections in years. Typically for NRCS, this is the frequency of formal inspections required by the State dam regulatory authority. For all new dams in Iowa use the following:

Design Hazard, (Field #31)

H use 3	**S** use 5	**L** leave blank

38. SPILLWAY TYPE (alphanumeric, 1) - Letter code that describes the type of auxiliary spillway. Typically for NRCS; if Field #20 includes I, leave this field blank; if Field #42 is NO, Use N for this field; if Field #42 is not NO, use U for this field. (Normally U).

U for Uncontrolled	C for Controlled	N for None.

39. SPILLWAY WIDTH, feet (number, 4) - The width of the auxiliary spillway, to the nearest foot, available for discharge when the reservoir is at its maximum designed water surface elevation. Typically for NRCS, this is the bottom width of the open channel auxiliary spillway.

40. OUTLET GATES (alphanumeric, 15) - Use one or more of the following codes to describe the type of spillway and controlled outlet gates, if any. Use up to five types in decreasing size order, separated by semi-colons, followed by number of gates. Typically for NRCS, if Field #38 is U, this Field is U; if Field #38 is N, this field is X.

X for none	U for uncontrolled	T for tainter (radial)
R for roller	B for bascule	L for vertical lift
D for drum	N for needle	F for flap
S for slide	V for valve	O for other controlled

41. VOLUME OF DAM, cubic yards (number, 10) - Total number of cubic yards of materials used in the dam structure. Include portions of the powerhouse, locks, and spillways, only if they are an integral part of the dam and are required for structural stability.

42. PRIMARY AUXILIARY SPILLWAY (AS1) TYPE (alphanumeric, 2) Code identifying the spillway type of the first auxiliary (emergency) spillway. Most auxiliary spillways in Iowa will be VE. Values are as follows:

VE for Vegetated	RK for Rock	ST for Structural
EA for Earth	OT for Other	NO for None
HR for Hard Rock	SR for Soft Rock	

43. SECONDARY AUXILIARY SPILLWAY (AS2) TYPE (alphanumeric, 2) Code identifying the spillway type of the second auxiliary (emergency) spillway. Enter NO if the site does not have a second auxiliary spillway. Use the codes under Field #42 above.

44. TERTIARY AUXILIARY SPILLWAY (AS3) TYPE (alphanumeric, 2) Code identifying the spillway type of the third auxiliary (emergency) spillway. Enter NO if the site does not have a third auxiliary spillway. Use the codes under Field #42 above.

45. MAXIMUM DISCHARGE, cfs (number, 7) - Enter the number of cubic feet per second (cfs) which the auxiliary spillway is capable of discharging when the pool is at its maximum designed water surface (settled top of dam) elevation.

46. NUMBER OF LOCKS (number, 1) - Number of existing navigation locks for the project. Typically 0 for NRCS.

47. LENGTH OF LOCKS (number, 4) - Length of primary navigation lock. Leave blank for NRCS dams.

48. LOCK WIDTH (number, 3) - Width of the primary navigation lock to the nearest foot. Leave blank for NRCS dams.

The following eight fields (#49 - #56) comprise additional data fields that are only provided by participating federal agencies submitting data to the NID. Typically NRCS should enter data for only other USDA agencies involved with NRCS assisted dams. Use the following codes as applicable for each field:

USDA NRCS	Natural Resources Conservation Service, formerly SCS
USDA FS	Forest Service
USDA RHS	Rural Housing Service, formerly part of FmHA
USDA RUS	Rural Utilities Service, formerly part of FmHA or REA
USDA FSA	Farm Services Agency, formerly ASCS
USDA ARS	Agricultural Research Service

49. FEDERAL AGENCY INVOLVEMENT IN FUNDING (alphanumeric, 20) Federal agency involved in funding of the dam. Codes are concatenated if several agencies were involved. Typically for NRCS, this should be USDA NRCS if Field #57 = WS, PT, RC, FP.

50. FEDERAL AGENCY INVOLVEMENT IN DESIGN (alphanumeric, 20) Federal agency involved in design of the dam. Codes are concatenated if several agencies were involved. See Field # 16 for further discussion of this item.

51. FEDERAL AGENCY INVOLVEMENT IN CONSTRUCTION (alphanumeric, 20) - Federal agency involved in construction of the dam. Codes are concatenated if several agencies were involved.

52. FEDERAL AGENCY INVOLVEMENT IN REGULATORY (alphanumeric, 20) – Federal agency involved in regulating the dam. Codes are concatenated if several agencies were involved. Typically for NRCS, this field should be blank.

53. FEDERAL AGENCY INVOLVEMENT IN INSPECTION (alphanumeric, 20) - Federal agency involved in Operation and Maintenance type inspections (not construction inspection) of the dam. Codes are concatenated if several agencies were involved. Typically for NRCS, this field should be blank. USDA NRCS involvement means formal inspection by an NRCS engineer as defined in NRCS National Operation & Maintenance Manual (NO&MM).

54. FEDERAL AGENCY INVOLVEMENT IN OPERATION (alphanumeric, 20) – Federal agency involved in operating the dam. Codes are concatenated if several agencies were involved. Typically for NRCS, this field should be blank.

55. FEDERAL AGENCY OWNER (alphanumeric, 20) – Federal agency which partly or wholly owns the dam. Codes are concatenated if several agencies were involved. Typically for NRCS, this field should be blank.

56. FEDERAL AGENCY INVOLVEMENT – OTHER (alphanumeric, 20) – Federal agency involved in other aspects of the dam. Codes are concatenated if several agencies were involved. Typically for NRCS, this field should be blank.

57. PROGRAM AUTHORIZATION (alphanumeric, 2) - Code to reflect the authorization of the dam as follows:

CO for CO-01	FP for WF-03	RC for RC&D
WS for PL-566	PT for PILOT	GP for GPCP
OT for Other		

Dams authorized under **WS**, **PT**, **RC**, or **FP** are considered "project" dams.

58. WATERSHED NUMBER (number, 4) - Contains the 4 digit watershed number for PL-566 dams. Typically the range is 2001 to 2800 for dams included in watershed plans developed within the state or 2801 to 2999 for dams included in plans developed by an adjoining state. This is required for PL-566. Leave blank for CO-01 structures. See pages IA520.28-13 and 14 for a listing of watershed projects in Iowa.

59. WATERSHED NAME (alphanumeric, 40) - Name of watershed project for PL-566 dams. See Field #58.

60. PLANNED SERVICE LIFE (alphanumeric, 3) - Number of years used to amortize the benefits of a project dam and/or determine the volume of sediment storage provided in the sediment pool. Typically project dams will be 50, 75 or 100 years while CO dams will be 35.

61. STATE REGULATED DAM (alphanumeric, 1) - Code to indicate whether the dam is considered "State Regulated" by the National Dam Safety Program Act. A "State Regulated Dam" is defined in the Act as a dam for which the state executes one or more of the following general responsibilities: (a) Inspection; (b) Enforcement; or (c) Permitting:

Y for Yes N for No

62. STATE REGULATORY AGENCY (alphanumeric, 30) - Name of the primary state agency with regulatory or approval authority over the dam. Enter "IDNR" in this space.

63. O&M INSPECTION RESPONSIBILITY (alphanumeric, 5) - Code to indicate the party assigned operation and maintenance inspection responsibility by an O&M Agreement or supplemental legal document for a project dam. Leave blank for non-project dams.

OWNER for owner in Field #14 NRCS for NRCS
JOINT for OWNER & NRCS OTHER for other party
NONE for no existing or non-enforceable O&M Agreement

64. O&M INSPECTION CURRENT (alphanumeric, 1) - Code to indicate if an O&M Inspection and written report were completed on a project dam during the current or past calendar year. Leave blank for non-project dams.

Y for Yes N for No

65. O&M COMPLETED (alphanumeric, 1) - Code to indicate if O&M needs reported in prior O&M Inspection Report(s) for project dams have been completed. Leave blank for non-project dams.

Y for Yes N for No

66. SEDIMENT STORAGE, acre-feet (number, 10) - The sediment storage capacity of the reservoir, to the nearest acre foot. For single purpose structures, include all storage up to the principal spillway crest. For multi-purpose structures show the amount allocated for sediment storage.

67. FLOOD STORAGE, acre-feet (number, 10) - The flood storage capacity of the reservoir, to the nearest acre foot. Typically, this is the capacity of the reservoir between the elevation of the permanent pool and the crest of the auxiliary (emergency) spillway. Include any aerated sediment (storage allocated above the principal crest elevation).

68. SURCHARGE STORAGE, acre-feet (number, 10) - The surcharge capacity of the reservoir, to the nearest acre foot. Typically, this is the capacity of the reservoir between the elevations of the auxiliary (emergency) spillway crest and the settled top of dam.

69. OTHER STORAGE, acre-feet (number, 10) - Any other beneficial capacity of the reservoir, to the nearest acre foot. This would normally be for municipal or industrial water supply, irrigation, fish and wildlife, etc. Typically zero (0) unless the structure is multi-purpose.

70. MAXIMUM STORAGE, acre-feet (number, 10) - The sum of #66, #67, #68, and #69. The computer totals these entries.

71. NORMAL STORAGE, acre-feet (number, 10) - The sum of #66, and #69, (Sediment and Other). The computer totals these entries.

72. PRINCIPAL SPILLWAY TYPE (alphanumeric, 2) - Contains the 2-character code identifying the type of principal spillway as follows:

CB	Concrete Box	OT	Other	
CM	Corrugated Metal Pipe	PL	Plastic	
CP	Concrete Pipe	WS	Welded Steel	
OC	Open Pipe (or chute)	NO	None	

73. CONDUIT HEIGHT, feet (number, 4) Contains the height (size) of the largest conduit through the dam to the nearest one tenth of a foot. For round conduits, enter the diameter to the nearest one tenth of a foot.

74. CONDUIT WIDTH, feet (number, 4) - Contains the width (size) of the largest conduit through the dam to the nearest one tenth of a foot. The value may be zero (or blank) if the conduit is round and the diameter has been entered in #73.

75. NUMBER OF CONDUITS (number, 2) - Number of (principal spillway) conduits through the dam.

76. COOL WATER RELEASE (alphanumeric, 1) - Contains a 1-character code indicating if a cold water release exists at the site.

Y for Yes N for No

77. PRINCIPAL SPILLWAY DISCHARGE cfs (number, 5) - The discharge, to the nearest cfs, that the principal spillway conduit is capable of discharging when the pool is at the auxiliary (emergency) spillway crest elevation.

78. Construction Cost, dollars (money, 10) - Enter the construction cost of the structure to the nearest dollar. This is a required entry for WS, FP, and RC structures and optional for others.

79. Enter the name of the person completing the inventory form and the date the form was completed.

80. Enter the date the IA-ENG-40 form was prepared.

Watershed Project Codes

Code	Project Numerical Listing
2001	Honey Creek
2002	Mule Creek
2003	Floyd Creek
2004	Harmony Creek
2005	Rocky Branch
2006	Simpson Creek
2007	Crooked Creek
2008	Big Park
2009	Mill-Picayune Creek
2010	Badger Creek
2011	Hamburg
2012	Moulton
2013	Indian Creek
2014	Pony Creek
2015	Ryan-Henschal
2016	Davids Creek
2017	Hound Dog Creek
2018	Bee-Jay
2019	Davis Battle Creek
2020	Big Wyacondah
2021	Pierce Creek
2022	Stennett-Red Oak Creek
2023	Held
2024	English Bench
2025	South Hungerford
2026	Diamond Lake
2027	Blockton
2028	Beaver
2029	Walters Creek
2030	Turkey Creek
2031	Mosquito of Harrison
2032	West Douglas
2033	Gant Creek
2034	Dane Ridge
2035	Deer Creek
2036	Three Mile Creek
2037	Leutzinger-Lowe Run
2038	West Sunnyside
2039	North Pigeon
2040	Waubonsie Creek
2041	Ledgewood Creek
2042	Pioneer
2043	Simon Run

Project Alphabetical Listing	Code
A & T Long Branch	2053
Bacon Creek	2044
Badger Creek	2010
Bear Creek	2058
Beaver	2028
Bee-Jay	2018
Big Park	2008
Big Wyacondah	2020
Blockton	2027
Crooked Creek	2007
Dane Ridge	2034
Davids Creek	2016
Davis Battle Creek	2019
Deer Creek	2035
Diamond Lake	2026
East Fork of Big Creek	2801
East Fork of Grand River	2804
English Bench	2024
Floyd Creek	2003
Gant Creek	2033
Hacklebarney	2049
Hamburg	2011
Harmony Creek	2004
Held	2023
Honey Creek	2001
Hound Dog Creek	2017
Indian Creek	2013
Indian Creek-Van Buren	2050
Ledgewood Creek	2041
Leutzinger-Lowe Run	2037
Little Paint Creek	2057
Little River	2048
Little Sioux River FP	7601
Long Branch	2054
Mill Creek	2056
Mill-Picayune Creek	2009
Morlee	2052
Mosquito of Harrison	2031
Moulton	2012
Mule Creek	2002
North Pigeon	2039
Pierce Creek	2021
Pierce Creek #2	2047

Code	Project Numerical Listing	Project Alphabetical Listing	Code
2044	Bacon Creek	Pioneer	2042
2045	Troublesome Creek	Pony Creek	2014
2046	Twelve Mile Creek	Rocky Branch	2005
2047	Pierce Creek #2	Ryan-Henschal	2015
2048	Little River	Simon Run	2043
2049	Hacklebarney	Simpson Creek	2006
2050	Indian Creek-Van Buren	Soap Creek	2055
2051	Twin Ponies	South Hungerford	2025
2052	Morlee	Stennett-Red Oak Creek	2022
2053	A & T Long Branch	Three Mile Creek	2036
2054	Long Branch	Troublesome Creek	2045
2055	Soap Creek	Turkey Creek	2030
2056	Mill Creek	Twelve Mile Creek	2046
2057	Little Paint Creek	Twin Ponies	2051
2058	Bear Creek	Upper Locust Creek	2803
2801	East Fork of Big Creek	Walters Creek	2029
2802	West Fork of Big Creek	Waubonsie Creek	2040
2803	Upper Locust Creek	West Douglas	2032
2804	East Fork of Grand River	West Fork of Big Creek	2802
7601	Little Sioux River FP	West Sunnyside	2038

NRCS NATIONAL INVENTORY OF DAMS

(1)	DAM NAME:	JOHN Q SMITH			
(2)	Other Dam Names:		(40)	Outlet Gates:	U
(3)	Former Names:		(41)	Vol of Dam, CY:	46457
(4)	Federal ID:	IA0	(42)	Aux. Spwy #1 Type:	VE
(5)	National ID (NID_ID):	IA0	(43)	Aux. #2 Type:	NO
		95 45 15	(44)	Aux #3 Type:	NO
(6)	Longitude (Dec. Deg):	-95.7542	(45)	Aux Max Flow, CFS:	650
		42 21 5	(46)	Locks, Number:	0
(7)	Latitude (Dec. Deg):	42.3514	(47)	Length:	0
			(48)	Width:	0
(8)	Geodetic Location	SENW 09 T87N R42W	(49)	Funding:	USDA NRCS
(9)	County:	WOODBURY	(50)	Design:	USDA NRCS
(10)	River/Stream:	TR-DRY BRANCH	(51)	Construction:	USDA NRCS
(11)	Nearest City, Town:	SIOUX CITY	(52)	Regulatory:	(blank)
(12)	Distance to Town, Mi.	22	(53)	Inspection:	(blank)
(13)	NFDFP? Y/N	N	(54)	Operation:	(blank)
(14)	Owner Name:	JOHN Q SMITH	(55)	Owner:	(blank)
(15)	Owner Type:	L	(56)	Others:	(blank)
(16)	Dam Designer:	USDA NRCS	(57)	Program Authorization:	CO
(17)	Dam Type:	RE	(58)	Watershed No:	
(18)	Core: (3-character)	HEK	(59)	Watershed Name:	
(19)	Foundation: (2, 3 char)	SK	(60)	Service Life, Yr:	35
(20)	Purposes: (Up to 4)	CGFR	(61)	State Regulated, Y/N:	Y
(21)	Year Completed:	2007	(62)	State Agency:	IDNR
(22)	Year Modified:		(63)	OM Insp Resp:	OWNER
(23)	Dam Length, feet:	635	(64)	OM Insp Current (Y/N):	Y
(24)	Dam Height, feet:	28	(65)	OM Completed (Y/N):	Y
(25)	Structural Ht, feet:	NR	(66)	Sediment Storage:	26
(26)	Hydraulic Ht, feet:	NR	(67)	Flood Stor:	45
(27)	Surface Area, Acres:	18	(68)	Surcharge Stor:	25
(28)	Total ADA, SQ. MI:	1.23	(69)	Other Stor:	0
(29)	Uncontrolled DA, Acres	787	(70)	Maximum Stor:	96
(30)	Current DS Hazard:	L	(71)	Normal Stor:	26
(31)	Haz Class as Designed	L	(72)	Principal Spillway Type:	CM
(32)	Hazard Class Year:	2005	(73)	Conduit Ht/Dia:	2.5
(33)	Emer. Action Plan EAP	NR	(74)	Conduit Width:	
33A	EAP Year		(75)	No. of conduits:	1
(34)	Population at Risk, No:	0	(76)	Cool Water Release (Y/N):	N
(35)	Population Accuracy	E	(77)	PS Discharge, cfs :	102
(36)	Last Inspection Date:		(78)	Const Cost (Project): $	57542
(37)	Inspection Frequency:		(79)	By:	Lee White
(38)	Spillway Type:	U	(80)	Date:	3/27/2008
(39)	Spillway Width	56			

See NEM IA 520.21 for further definitions and explanations

Part 520 – Soil and Water Resource Development

Subpart C – Dams

§IA520.23 Classification

C.(1) The reclassification shall be recorded in the NRCS Dam Inventory (see §520.21 G.) by the person responsible for reclassification. The District Conservationist is to notify the owner or sponsor and the Iowa Department of Natural Resources (IDNR) of the NRCS evaluated classification change.

§IA520.24 Special Considerations

C. The landowner or sponsor is responsible for obtaining all necessary permits. The application for the permits shall include the complete engineering report, plans and specifications and other data deemed necessary by the IDNR or Corps of Engineers. All permits and approvals shall be obtained by the landowner or sponsor before the NRCS will provide any construction or contracting assistance.

D. The District Conservationist will be responsible for submitting complete engineering reports, plans and specifications to the landowner or sponsor on all dams. The NRCS Engineer with adequate job approval authority shall develop or review and approve all information submitted with the permit.

E. A separate approval from the IDNR is required to temporarily or permanently raise or lower the level of water impounded by a permit-sized dam unless the raising or lowering has been authorized as part of an approved operating plan. Other alterations to the dam or auxiliary spillway also require prior approval from the IDNR. This approval can be secured by an exchange of correspondence. The following additional information shall be included in the letter of request:

(1) The date the raising or lowering will be initiated, the level to which the impoundment will be raised or lowered and, if temporary, the anticipated date when the normal water level will be restored.

(2) Evidence that during raising of the water level the required minimum downstream release rate will be maintained.

(3) Evidence that the discharge rate during lowering will not exceed the capacity of the stream channel below the dam.

§IA520.28 Potential Impact Area – Low Hazard Dams of Inventory Size and All Significant Hazard Dams

B. Requirements

(1)(i) Use breach routing procedures for all significant hazard dams.

(ii) For low hazard dams, the individual exercising design approval authority will determine the need for a breach routing. A conservative estimate may be made in place of breach routing. A conservative estimate of the potential impacted area could be determined as follows: The impact area is the area flooded from the dam location downstream to a major receiving stream. Depth of the flood wave is to be two-thirds of the dam height at the upper end and decreasing uniformly to a depth which covers the flood plain at the lower end.

(2)(i) A map such as a USGS topographic map or aerial photograph will be used to show the impact area determined by breach routing.

(ii) When a conservative estimate is made to determine the impact area, a written narrative and a map as required in (2)(i) will be used to describe the impact area.

(iii) The map and a written narrative along with the documentation of the method or thought process used to develop the potential impact area shall be included in the design report.

(iv) An engineer with design approval authority will prepare a map and impact letter indicating precautions to further development (see Exhibit A). The impact letter will be signed by the District Conservationist for structures in Job Class I through IV or by the State Conservationist or his/her designee for Job Class V and above. The map and impact letter will then be forwarded to:

1. The owner or sponsor, and
2. The Iowa Department of Natural Resources, and
3. The Soil and Water Conservation District by the District Conservationist for Job Class I through IV, or by
4. The State Conservationist or delegated representative for Job Class V and above.

Exhibit A

September 21, 2011

Mr. Will E. Flood
123 Street Address
River City, Iowa Zip Code

Dear Mr. Flood:

The USDA, Natural Resources Conservation Service (NRCS) has designed a dam for you in the SW1/4 NW1/4 Sec. 16 T71N, R34W on a tributary of the East Nodaway River. Under the Dam Safety Act, we are required to analyze the potential impact area in the event of a dam failure. Due to the overall height from the top of the dam to the downstream toe (34 feet) and storage capacity below the auxiliary spillway (96 acre-feet), your dam falls within the size category in which potential downstream damage should be considered. This does not reflect on the adequacy of the design or construction of the dam.

An evaluation was made of the area below your dam that could be flooded should a sudden failure occur. This evaluation indicated that the flooded area affected would be fences, valley cropland, woodland, pasture, and secondary roads. The estimated width of the flooded area immediately downstream from the dam would be approximately 200 feet. The flood wave would be carried in the ditch bank about 1000 feet downstream. The attached breach inundation map indicates the area subject to damage.

As a result, the dam was assigned a low hazard rating. The design of the dam and auxiliary spillway was based on this classification. If future development should occur immediately downstream of the dam or should another dam be built upstream, the hazard classification could change. You need to be aware of this, so that you might alert future developers to the hazard that could occur. This is your responsibility.

NRCS stands ready to help you or your private engineer evaluate the potential impact area that sudden failure of your dam could have on a downstream development, should any occur.

A copy of this letter and attached map are being sent to the Iowa Department of Natural Resources, which is the state agency responsible for dam safety, and to the Any County Soil and Water Conservation District.

If you have any questions on this matter, please do not hesitate to contact the Any County Soil and Water Conservation District.

Sincerely,

/s/ DC, STC, or STC Designee Signature
NRCS Title

Subpart D - Open Channels

520.30 General

A. Channels are used for a variety of purposes. Excessive bank erosion and bed degradation, excessive sediment accumulation, or both, may cause channels to function improperly. It is important that channels be maintained to ensure satisfactory performance for their anticipated life.

B. The design of stable channels requires many analyses. Channel design principles are complex and must be applied with adequate data and sound judgment.

520.31 Definition

An open channel is either a natural or constructed channel, with boundaries of earth, rock or structural components, in which water flows with a free surface.

520.32 Design Criteria

A. Open earth channels are to meet or exceed the requirements of conservation practice standard Open Channel, Code 582, (NHCP), and Technical Release No. 25. Exceptions for small drainage areas or other practices are noted in the Standard. Stream restoration planning must conform to the guidelines included in National Engineering Handbook (NEH), Part 653, Stream Corridor Restoration: Principles, Processes, and Practices. Stream restoration design must conform to the guidelines found in NEH Part 654 Stream Restoration Design.

B. Open channels of material other than earth are to comply with the applicable portions of conservation practice standard Open Channel, Code 582 and Technical Release No. 25. Other features are to meet or exceed the requirements as stated in other applicable NRCS standards.

Part 521 - Pollution Abatement and Water Quality Improvement

521.0 General

A. NRCS is authorized to provide assistance for practices that prevent or reduce the delivery of agriculture-related pollutants to surface and ground water and that achieve NRCS quality criteria for identified water quality resource concerns. Agriculture-related pollutants include but are not limited to limiting plant nutrients, pesticides, sediments, salts, and pollutants commonly associated with animal manures (such as nitrates, phosphorus, pathogens, and oxygen demanding organics). This is primarily accomplished at the field level through the planning and implementation of conservation practices that are included in Section IV of the Field Office Technical Guide. It is the intent of NRCS to integrate water quality considerations into all NRCS programs and activities (see GM-460, Part 401).

B. NRCS is authorized to provide assistance for pollutant prevention, abatement, and water quality improvement on nonagricultural lands, including recreational and abandoned mined land. Common pollutants from abandoned mined land include sediments, heavy metals, and acidic mine drainage.

C. Pollution prevention, abatement, and water quality improvement are also to be considered in the planning, design, and construction phases of conservation operations and project activities.

521.1 Pollution Abatement in Conservation Operations

A. Planning.—Pollution containment, abatement, and management must be considered in planning resource management systems and conservation practices in agricultural areas. When planning for manure management, individual practices must be identified in a manure management system that may be part of a comprehensive nutrient management plan.

B. Design.—Agricultural waste management and pollution abatement practices must be designed in conformance with Title 450, National Handbook of Conservation Practices, and applicable Federal, State, and local requirements.

C. Installation.—System components and practices must be installed in a sequence that ensures that each will function as intended without being hazardous to others or to the overall system.

D. Operation and Maintenance.—The owner or operator must operate and maintain systems and their component practices. A written plan for operation and maintenance must be prepared and agreed to by the owner, operator, or both.

521.2 Pollution Abatement in Project Activities

Pollution abatement at structure sites and throughout the watershed must be considered in the planning, design, construction, operation, and maintenance of all project activities. The water quality requirements of the project must be evaluated to ensure that the effects of activities on the identified resources are suitable for the intended project use. Also evaluate the effect a project will have on the quality of impounded or downstream surface water and ground water. Include appropriate provisions to minimize pollution.

521.3 Effect of NRCS Activities on Water Quality

A. Conservation Operations.—Evaluate the effect of recommended conservation practices and land use on the quality of surface and ground water. Consider current and potential use of water, as well as public health and established water quality standards.

B. Project Activities.—Water quality investigations, analysis, and interpretations in project activities must be carried out to establish baseline conditions and determine the effects of projects on the quality of surface and ground water. (See Title 450, National Water Quality Handbook (NWQH), Part 603.)

521.4 Effect of Water Quality on NRCS Activities

A. Consider the effect of the quality of impounded or managed water in NRCS-assisted practices and projects. Impoundments in particular are sensitive to nutrients and pesticides in the water delivered to them. Saline or strongly acidic water can have an adverse effect on components of conservation practices.

B. Water for recreation and other uses must meet established criteria relative to pathogens, suspended and dissolved solids, taste, and odor, etc. (See 450-NWQH, Part 603.)

Part 522 - Snow Survey and Water Supply Forecasting

522.0 Reservoir Operations Guides

A. Selecting appropriate storage levels and average release rates for reservoirs in snowmelt runoff environments is a prerequisite to sound water management. A number of impoundments, operated for single- or multiple-purpose use in the United States, lack adequate management tools to guide this process each year. Seasonal volume forecasts improve water management at these reservoirs.

B. Reservoir operations guides are decision support tools to help reservoir operators manage their facilities by using streamflow forecasts. Reservoir operations guides provide a means to optimize water use while minimizing flood damages. This policy has been developed to assure that operation guides are technically sound and meet the operator's needs.

522.1 Authority and Request for Assistance

A reservoir operations guide can be prepared for any reservoir upon receipt of a written request from the reservoir operator or owner. Requests must be reviewed by the soil and water conservation district before forwarding to the State Conservationist for approval.

522.2 Responsibility

A. Upon receipt of a request, a determination of feasibility and desirability of preparing a reservoir operations guide will be made jointly by the State Conservation Engineer (SCE) and the water supply specialist or the data collection office supervisor. Their concurrence is required before proceeding with the development of the reservoir operations guide.

B. For federally owned, operated, or funded structures, it is essential that full agreement on the feasibility and desirability of developing a reservoir operations guide be reached between the Federal agency (non-NRCS), the sponsor or land user, and NRCS.

522.3 NRCS Technical Review

The SCE and the National Water and Climate Center will be actively involved in the development and review of the reservoir operations guide. A copy of the reservoir operations guide must be sent to the State agency responsible for administering dam regulations during the NRCS review process.

522.4 Reservoir Operations Guide Review

For the first 3 years after the reservoir operations guide is implemented, there will be an annual review by the SCE to determine its effectiveness as a management tool. After the first 3 years, the frequency of review must be reevaluated to determine an appropriate review frequency.

Part 523 - Irrigation

523.0 General

A. Agricultural irrigation is the application of water to land, for purposes of sustained crop production. In arid regions, irrigation provides the majority of crop water requirements, while in humid areas it is used to supplement natural rainfall for withstanding periods of drought or to ensure crop productivity.

B. As part of an agricultural water management system, irrigation requires careful planning, design, construction, and operation. Properly designed system components will facilitate the effective management of irrigation water supplies, to maximize production while minimizing degradation of water quality, water consumption, and energy use.

523.1 Scope

Each State Conservationist must prepare a State Irrigation Guide, setting forth the basic design and management criteria for all irrigation methods applicable to local combinations of crops, soils, topography, water supply, water quality, and climatic conditions. The State Conservationist may assign leadership responsibility to a staff member for irrigation guide development and updates. Although NRCS has the technical responsibility for preparing the irrigation guide, cooperation from partners such as representatives from State agencies, State universities, State experiment stations, the Cooperative Extension Service, and the Agricultural Research Service, is desirable.

Part 524 - Drainage

524.0 General

A. Agricultural drainage is the collection and removal of excess surface or subsurface water from agricultural land. In humid areas, its dominant purpose is to remove excess soil water, to allow the timely movement of field equipment, warm soils early in the season, provide adequate aeration for root activity and plant growth, reduce diseases in crops and livestock, and reduce surface runoff. Benefits include reduced risk in farming, higher yields and better quality crops. In arid regions where land is irrigated, the dominant purpose of drainage is to remove salts from the root zone.

B. As part of an agricultural water management system, drainage requires careful planning, design, construction, and operation. Properly designed system components will facilitate the effective management of soil moisture, to maximize benefits to the land while minimizing negative impacts to the environment.

524.1 Scope

Each State Conservationist must prepare a State Drainage Guide to set forth the basic design and management criteria for all drainage methods applicable to local combinations of crops, soils, topography, water quality, and climatic conditions. State Conservationists may assign leadership responsibility to a staff member for drainage guide development and updates. Although NRCS has the technical responsibility for preparing the drainage guide, cooperation from partners such as representatives from State agencies, State universities, State experiment stations, the Cooperative Extension Service, and the Agricultural Research Service, is desirable.

Part 529 - Pollution Abatement and Air Quality Improvement

529.0 General

A. NRCS is authorized to provide assistance for agricultural air emissions management that appropriately manages agriculturally related air pollutants and achieves NRCS quality criteria for identified atmospheric resource concerns. Agriculturally related air emissions include, but are not limited to, particulate matter (both coarse and fine particulates), and certain gases, including those that may undergo transformation in the atmosphere to form fine particulates or ozone. Specifically, the gases to be addressed are volatile organic compounds: ammonia, oxides of nitrogen, and odorous sulfur compounds (such as hydrogen sulfide and greenhouse gases (carbon dioxide, methane, and nitrous oxide)). Management of these agricultural air emissions is primarily accomplished at the field level through the planning and implementation of conservation practices that are included in section IV of the Field Office Technical Guide.

B. Agricultural air emissions management must be considered in the planning, design, and construction phases of conservation operations and project activities.

529.1 Air Emissions Management in Conservation Operations

A. Planning.—Air emissions management must be considered in planning resource management systems and conservation practices in agricultural areas. When planning for manure management, individual practices must be identified in a manure management system that is part of a comprehensive nutrient management plan.

B. Design.—Manure management and pollution abatement practices designs must conform to Title 450, National Handbook of Conservation Practices, and applicable Federal, State, and local requirements.

C. Installation.—System components and practices must be installed in a sequence that ensures that each will function as intended without being hazardous to others or to the overall system.

D. Operation and Maintenance.—The owner or operator operates and maintains systems and their component practices. A written plan for operation and maintenance must be prepared and agreed to by the owner, operator, or both.

529.2 Air Emissions Management in Project Activities

Air emissions management at structure sites and throughout the airshed must be considered in the planning, design, construction, operation, and maintenance of all project activities. The atmospheric emissions requirements of the project must be evaluated to ensure that the expected quality of the resources is suitable for the intended project use. The effect a project will have on the ambient air quality must also be evaluated. Appropriate provisions will be included to minimize excessive contributions to ambient air concentrations or management of the emissions so as to mitigate impacts on receptors of concern.

529.3 Effect of NRCS Activities on Atmospheric Resources

The effect of recommended conservation practices and land use on air quality must be evaluated. The use of the "Conservation Practice Physical Effect" worksheet is a tool that can be used as an initial indicator of potential effects. Current and potential emissions to the atmosphere, public health, and established air quality standards are to be considered.

Subpart A - Hydrologic Investigations

530.0 General

Hydrologic investigations and analyses are essential for determining the location, quantity, timing, and availability of water resources in the planning and design of water-related structures and projects and for project monitoring and evaluation. Hydrologic investigations and analyses rely on available hydrologic data, such as volumes and rates of stream flow; meteorological data, such as precipitation rates and amounts; and watershed characteristics. Collectively, these are referred to as hydrometeorological data. If existing hydrometeorological data are inadequate, the installation of instruments for the collection of data may be necessary.

530.1 Available Hydrometeorological Information

A. When available, existing hydrometeorological data must be used for planning, design, and operation of water-related structures and systems. Hydrometeorological data are available through numerous sources, including—

(1) NRCS National Water and Climate Center (NWCC).
(2) U.S. Geological Survey (USGS).
(3) National Oceanic and Atmospheric Administration (NOAA).
  (i) National Weather Service (NWS).
  (ii) National Climatic Data Center (NCDC).
(4) Regional climate centers (RCCs).
(5) State climatologists.
(6) USDA sister agencies.
  (i) Agricultural Research Service
  (ii) Forest Service
(7) Other Federal, State, and local agencies having planning responsibilities for water-related projects, operational responsibilities, or both.

B. Hydrometeorological data may also be found in various watershed and floodplain reports, which can be found in the libraries of Federal agencies involved in study and report preparation.

530.2 Hydrometeorological Instrumentation

A. Need for Hydrometeorological Instrumentation.—Hydrometeorological instrumentation may be required for project planning, monitoring, and evaluation.

(1) Project Planning.—If existing data are inadequate for making reliable hydrologic estimates for project development, hydrometeorological instrumentation may be required. This may be particularly important for projects that include storage for irrigation or other beneficial use and for which accurate estimates of available water supply are essential to the project's performance and justification.
(2) Monitoring and Evaluation.—Monitoring and evaluation are actions and activities used to measure the effectiveness of conservation practices and systems. The data may be used for model development, verification, or validation, and is particularly useful when applying models to unmonitored areas.

B. Types of Hydrometeorological Instruments.—Hydrometeorological instruments include but are not limited to water stage recorders; devices for measuring snow depth and snow-water content; and instruments for collecting data on precipitation, soil moisture, maximum and minimum temperatures, wind direction and speed, relative humidity, evaporation, and solar radiation.

C. Planning and Installation of Hydrometeorological Instrumentation

(1) A plan for collecting needed hydrometeorological data must be developed at the earliest possible date, consistent with project planning or project operation objectives. This plan must include a statement of justification for the instrumentation; the type of instruments required including numbers, kind, and proposed location; a schedule for installation; and anticipated operation and maintenance costs.
(2) Instruments must be installed as soon as practical after planning begins and concurrently with other planning activities to ensure that longest possible record is available.
(3) Instruments installed for planning may be temporary or permanent, depending on their probable future usefulness. For planning purposes, instruments are usually as inexpensive as possible to keep planning costs to a minimum. However, if the sites will be used for both planning and operation, more sophisticated equipment may be selected.
(4) Sites selected must consider future installation of more sophisticated equipment, additional instruments, or both at a later date, if needed.
(5) Projects authorized for construction that did not include needed hydrometeorological instruments in the initial plan should be supplemented to include the needed instruments.
(6) In developing proposals that include hydrometeorological instrumentation, appropriate Federal guidelines must be followed to avoid duplication of effort and to ensure efficiency of the data collection system. Instrumentation may be required for planning, operation, or both.

D. Operation and Maintenance of Hydrometeorological Instruments

(1) Projects that include hydrometeorological instrumentation for monitoring purposes must have an appropriate operation and maintenance plan that includes appropriate considerations for NRCS and partner responsibilities, including the costs associated with the operation and maintenance of the instrumentation. Such funding should be included as part of the engineering services cost of the structure.

(2) Inspection and Followup.—Significant items to consider in inspection and follow up include evidence that—

(i) Hydrometeorological instruments are maintained in good working order so that reliable data are obtained.

(ii) Data are collected and used in a timely manner according to the operating needs of the reservoir.

(iii) Forecast procedures are updated and accuracy is improved as additional data are collected.

(iv) Reservoir gates and other project features are operated so as to regulate the storage or release of water for project purposes in accordance with the operation and maintenance agreement.

530.3 Hydrologic Reports

A. Need for Hydrologic Reports.—Hydrologic reports provide—

(1) A record of investigations performed.
(2) Factors considered in selection of project alternatives.
(3) Information for future studies.
(4) A record of how a structure or system of structures operates under design conditions.

B. Types of Hydrologic Reports.—Reports may include, but are not limited to, the following:

(1) Investigation of water supply for a water storage site
(2) Effects of alternative systems of floodwater retarding structures on downstream discharges
(3) Report on unusual storm or flood discharge
(4) Report on field study of emergency spillway performance
(5) Reservoir operation plans
(6) Floodplain management and flood insurance reports
(7) Dam breach and inundation studies for emergency action plans
(8) Water budget analysis for wetland restoration, enhancement, and construction

C. Review and Approval of Reports.—The preparation, review, and approval of these reports and investigations must be consistent with job approval authority.

Subpart B - Hydrologic Procedures and Criteria

530.10 General

Hydrologic procedures are developed within NRCS to assist in the planning and design of onfarm conservation practices, including water control structures, and to solve hydrologic problems encountered in developing plans and designs for project activities. Because structure or project costs may range from several hundred to several million dollars, it is important that the most suitable hydrologic procedure be used for a particular problem. The procedure selected must provide the desired level of accuracy and complement other design procedures to ensure that the structure or project meets its functional objective. Hydrologic criteria for designing conservation practices and water control structures have been developed largely from field experience and represent minimum acceptable standards consistent with the objectives of the practice or structure.

530.11 Hydrologic Procedures

Numerous NRCS-developed hydrologic procedures and computer models are available for making hydrologic analyses. All engineers and technicians must be trained in the use of NRCS hydrologic procedures and computer programs needed for the planning, design, and installations of conservation measures.

(1) For onfarm conservation practices, procedures in Title 210, National Engineering Handbook (NEH), Part 650, Chapter 2, Section 650.2, "Estimating Runoff and Peak Discharge," and the associated computer program, EFH2, are preferred and must be used unless specifically excepted by the State Conservation Engineer (SCE).
(2) To the maximum extent practicable, hydrologic analyses of soil and water conservation practices are to be carried out using procedures in 210-NEH Part 630, Hydrology, and other designated references, including the WinTR-55 (Small Watershed Hydrology) and WinTR-20 (Computer Program for Project Formulation – Hydrology) computer programs.
(3) Other designated references and procedures outside the scope of the NEH may be used with prior approval of the SCE.

530.12 Hydrologic Criteria

Hydrologic criteria established in standards and directives must be used for designing conservation practices and water control structures. Exceptions to use of national criteria must be obtained from the Director, Conservation Engineering Division. Requests for such actions must include the recommendations of the SCE.

Subpart A - Geologic Investigations

531.0 General

A. The State Conservation Engineer (SCE) is responsible for ensuring that geologic conditions at NRCS project sites are sufficiently characterized to support proper conservation planning and sound engineering design and construction.

(1) NRCS geologists have primary responsibility for geologic investigations and interpretations for NRCS projects, although the SCE may delegate responsibility for reconnaissance investigations and preliminary geologic investigations of low-hazard structures and practices, except Group I dams.
(2) NRCS nongeologists may perform reconnaissance and preliminary geologic investigations if they are qualified to recognize geologic conditions and hazards pertinent to the site and to perform the needed geologic investigations to determine site hazards related to design, construction, and function of the practice.

B. Investigations are conducted by a person holding the appropriate job approval authority for the class of structure, as outlined in Section 501.04, and who is trained to recognize geologic hazards and to provide information adequate for practice design. A qualified geologist must conduct investigations in areas where experience or information is limited, where geologic conditions are complex or unstable, where the kinds of construction materials to be used are complex or questionable, or where the potential for significant economic or environmental damage or loss of life is high if the structure or practice were to fail or perform poorly.

C. A qualified geologist is defined as an individual who meets the minimum requirements for the practice of geology as defined by the State Board of Registration of the State in which the individual resides. In the absence of State registration requirements or a State definition of geologist for the practice of geology, a qualified geologist must meet the requirements for the title of "certified professional geologist," as defined by the American Institute of Professional Geologists (http://www.aipg.org).

D. The NRCS geologist must review geological analyses and reports completed by non-NRCS geologists as part of NRCS-assisted projects, assist with preparation of the geology sections of soil survey reports, and revise conservation practice standards and specifications as needed to ensure that geology-related resource concerns are adequately considered.

E. NRCS geologists may not conduct mineral remoteness determinations for tax, regulatory, or legal purposes. NRCS geologists provide mineral assessment reports when requested in support of conservation programs requiring easements.

F. Geologic investigations may include, but are not limited to—

(1) Proposed construction sites, including feasibility assessments, site characterization, and data collection and analysis of foundations, abutments, and rock and earthen materials for construction.
(2) Dams during construction ("as-built").
(3) Existing structures and practices requiring repair or rehabilitation.
(4) Projects to decommission dams and other engineering structures.
(5) Small, low-hazard embankment structures and other practices that entail significant ground-disturbing activity to generally assess suitability, identify and characterize any potential geologic hazards, and collect other geologic information to support planning and design.
(6) Assessments of geologic conditions in support of conservation planning and practice implementation, including characterization of in-situ geologic material for erosion control projects, locating and characterizing rock and earthen construction materials, and locating and documenting undeveloped geologic resources and unique geologic features with scenic and other intangible values (Subpart A, Geologic Investigations, Section 531.2).
(7) Geomorphic evaluations of stream corridors to support planning and design of streambank stabilization and fluvial geomorphic restoration projects (Subpart D, Geomorphic, Erosion, and Sedimentation Investigations, Section 531.33).
(8) Watershed sediment yield studies to support planning and design of reservoirs, sediment basins, and other sediment or water control practices (Subpart D, Geomorphic, Erosion, and Sedimentation Investigations, Section 531.32).
(9) Watershed geomorphic investigations to identify and characterize erosion and sedimentation impacts and hazards associated with natural and anthropogenic watershed disturbances and to evaluate the impacts of proposed and existing practices and management systems on upland erosion conditions, downstream sedimentation, and surface water quality (Subpart D, Geomorphic, Erosion, and Sedimentation Investigations, Section 531.34).
(10) Hydrogeologic investigations to support planning and design of waste storage facilities and other practices that potentially impact (or are impacted by) groundwater quantity, quality , or both.
(11) Hydrogeologic investigations for planning and design of water wells and other groundwater resource development practices (Subpart E, Hydrogeologic Investigations, Section 531.43).

531.1 Scope and Intensity of Geologic Investigations

A. General

(1) The scope and intensity of geologic investigations must be consistent with the geologic and geomorphic complexity and stability of the site; pertinent social, economic, and safety considerations; size and purpose of the structure, practice, or project; kinds of construction materials to be used; and the potential for damage or loss of life if the structure or practice fails.
(2) At a minimum, geologic investigations conducted by NRCS must conform to guidance in ASTM D420, Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes, to foster consistency of practice and to ensure rational, flexible planning of the investigation.
(3) All geologic investigations begin with a reconnaissance to generally characterize site conditions and identify potential impacts of geologic processes and conditions on existing or proposed structures or conservation practices. If the results of the reconnaissance indicate a need for additional work, a preliminary geologic investigation is conducted to collect sufficient data and information to support late-stage planning and preliminary design. For more costly, significant, high-hazard, or complex projects, a detailed geologic investigation may be needed for sound design, layout, construction, and performance of the structure or practice.
(4) Geologic investigations also include determinations of the geology during and immediately following construction (as-built), engineering investigations of existing structures or conservation practices, and other investigations related to slope stability, stream restoration, erosion and sediment control, and groundwater resource management. Rehabilitation or decommissioning of existing dams requires concomitant site investigations consistent with the design elements of the rehabilitation or decommissioning.

B. Geologic Reconnaissance

(1) A geologic reconnaissance is required where geologic processes, conditions, or attributes are likely to impact (or be impacted by) existing or proposed NRCS structures or conservation practices.
(2) Geologic reconnaissance includes the collection and review of existing data. Characteristics of the site should be assessed, including geomorphology, topography, drainage, and other conditions that might affect the suitability of the site for its intended use and for potential impact on natural resources. Site visits are conducted to assess the suitability of the area for the proposed project, to verify the accuracy or adequacy of existing information, and to identify significant gaps in information needed to continue with the design.
(3) The engineering properties of soil and rock materials must be evaluated. Consideration of how the operation of the proposed project, structure, or practice might affect local natural resources must be addressed. Logistical concerns, such as access, that may affect future activities must also be addressed. Existing data and information should be reviewed before going to the field. Data and information sources include geologic maps, topographic maps, well logs, aerial photographs and other imagery, soil surveys, water and mineral resource reports, and other reports and sources that pertain to the area of the site and the nature of the project.
(4) The results of the geologic reconnaissance are used to assess the need for more detailed investigation and whether additional technical expertise is needed. A geologic investigation report must be prepared in accordance with Section 531.2(H).

C. Preliminary Geologic Investigations

(1) A preliminary geologic investigation must be conducted to augment findings and recommendations of the geologic reconnaissance (specifically, to collect and analyze data to support late-stage planning and preliminary engineering design and to assess the need for and scope of a detailed geologic investigation). Preliminary geologic investigations for dams and other significant or high hazard structures or practices must be conducted under the supervision of a qualified geologist.
(2) A preliminary geologic investigation may include a shallow subsurface investigation, using a back hoe or hand auger, to generally characterize shallow stratigraphy, soil mechanics properties of underlying geologic materials, groundwater hydrologic conditions, and other geologic attributes required to complete a geologic site assessment and support preliminary engineering design.
(3) Classification, logging, sampling, and testing of disturbed and undisturbed samples completed as part of a preliminary geologic investigation must be completed in accordance with Sections 531.2(E) and 531.2(F).
(4) The findings, conclusions, and recommendations must be documented in a preliminary geologic investigation report, prepared in accordance with Sections 531.2(H) and 531.2(I).
(5) In areas where the soils and geologic conditions are well known, a detailed investigation may not be necessary for small, low-hazard structures. For such structures, the preliminary investigation must be sufficiently detailed to provide relevant information on site materials, conditions, and engineering characteristics for planning, design, and cost estimates.
(6) The preliminary geologic investigation report must include a summary of findings, a description of surface and subsurface materials, pertinent features, and conditions in the project area. The report must present conclusions from the investigation and recommendations for additional, detailed investigations. The report must provide a sufficient basis for preliminary

planning, design, and cost estimates.

D. Detailed Geologic Investigations

(1) A detailed geologic investigation must be conducted to provide detailed surface and subsurface information needed for sound project design, layout, construction, and performance of the structure or practice throughout its design life.
(2) All detailed geologic investigations must be conducted under the supervision of a qualified geologist, as defined in Section 531.0. The investigating geologist works in cooperation with the design engineer to develop a detailed geologic investigation plan that describes what data is needed and how the data will be used to support sound engineering design.
(3) Classification, logging, sampling, and testing of disturbed and undisturbed samples completed as part of a detailed geologic investigation must be completed in accordance with Sections 531.2(E) and 531.2(F).
(4) Findings, conclusions, and recommendations must be documented in a detailed geologic investigation report, prepared in accordance Section 531.2(I).
(5) A detailed geologic investigation may include any combination of the following:
(i) Conducting subsurface investigations, including drilling, trenching, geophysical, and seismic evaluations.
(ii) Obtaining soil and rock samples for laboratory analysis and performing in-situ testing.
(iii) Analyzing remotely sensed data and imagery.
(iv) Evaluating the geomorphology, geologic units, and structures at and near the site.
(v) Developing sediment budgets, including sediment production, transport, and yield.
(vi) Defining structural or cultural features in the area of interest.

531.2 Requirements for All Geologic Investigations

A. Evaluation of Geologic Conditions That May Impact Project Design, Construction, and Performance

(1) The potential impacts of geologic processes, conditions, and attributes on the design, cost, construction, performance, and safety of the proposed structures and other conservation practices must be considered, and additional geologic investigations must be conducted as needed to ensure sound engineering design. Site conditions that require special consideration include, but are not limited to the following:
(i) Seismic Shaking and Fault Rupture.—The risk of fault rupture, seismic shaking, and the attendant hazards associated with seismic loading, liquefaction, differential settlement, seiche generation, and slope failure on the design and performance of structures and other conservation practices must be considered and evaluated, as appropriate. All dam sites require a more detailed seismic analysis, as set forth in Section 531.11(H), below. For other structures and practices, the SCE must develop policy and procedures for seismic hazard characterization, based on known hazards and their attendant uncertainties, potential damages associated with failure, and State and local laws.
(ii) Karst.—For structures and conservation practices in areas underlain by limestone, dolomite, gypsum, or other soluble rocks, the potential impacts of the unique geologic and hydrogeologic conditions posed by karst must be considered and evaluated as appropriate. Potential hazards posed by karst include hydrologic modification, seepage, subsidence, and collapse.
(iii) Dispersive Clays.—Dispersive clays are typically extremely erosive, which poses a potential risk of damage and failure of structures and other conservation practices underlain by or constructed of dispersive materials. The presence and potential impacts of dispersive clays must be considered and evaluated as appropriate. Where a detailed geologic investigation is conducted to locate and characterize dispersive clays, special sampling procedures, including obtaining a large number of discrete samples preserved at their natural water content, will typically be required.
(iv) Collapsible Deposits.—Some unconsolidated materials, such as alluvial fans, terraces, and eolian materials in arid and semiarid regions, can potentially collapse when saturated or wetted. Other deposits may collapse with changes in water content, including gypsiferous soils, pyritic or fissile shales, and stress relief and rebound joints. If the potential exists, the site must be investigated and appropriate samples collected for laboratory analysis to provide quantitative information for design and construction.
(v) Unstable Slopes, Slope Failure, and Mass Movements.—The impacts of all structures and conservation practices on slope stability must be considered and evaluated, as appropriate. Alternative practices that significantly increase the risk of slope failure must be dropped from further consideration. Landslides and their potential to occur at dam and reservoir sites must be assessed, including the history of mass movements in the project area.
(vi) Subsidence.—The potential for ground surface subsidence caused by past or future extraction of minerals or fluids, including groundwater and natural gas, must be assessed if subsidence has been documented in the area.
(2) Other geologic conditions or materials that have engineering significance may be present and should be considered and evaluated, as appropriate. These include, but are not limited to, dispersive soil, soil containing highly soluble sodium salts, expansive soil, gypsiferous soil, soil that has vertic properties, gap-graded soil, sensitive clay, highly compressible soil, pyritic shale, fissile shale, stress relief and rebound joints, and artesian groundwater.

B. Site Safety

(1) Geologic investigations must be conducted in accordance with Occupational Safety and Health Administration (OSHA) requirements for pit and trench safety, and for working around heavy machinery, including drill rigs, backhoes, tractors, and earth-moving equipment.
(2) Exploratory bore holes and trenches must be sealed, covered, or backfilled in accordance with local and State ordinances or requirements.

C. Cultural and Scientific Resources Discovered at Site

Materials discovered during the site investigation or construction that may have historical, archeological, cultural, or scientific significance or value must be reported in accordance with policy contained in GM-420, Part 401, Cultural Resources, Archeological and Historical Properties.

D. Erosion, Sediment, and Pollution Control during Site Investigations

Criteria for erosion, sediment, and pollution control contained in Section 520.1, apply during geologic site investigations.

E. Classification and Logging of Earth (Geologic) Material

(1) Soil material must be classified in the field according to the Unified Soil Classification System, ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). In the laboratory, samples are classified according to ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
(2) Rock material must be classified by common rock-type names according to a simplified geologic scheme, as shown in Title 210, National Engineering Handbook (NEH), Part 628, Chapter 52, Table 52-1. Rock used for specific engineering purposes in NRCS work must be classified by 210-NEH, Part 631, Chapter 12, "Rock Material Field Classification System."
(3) Earth material that is transitional between soil and rock must be classified by its genetic category and unconfined compressive strength. Strength must be estimated in the field for cohesionless and cohesive materials, using field strength tests described in 210-NEH, Part 628, Chapter 52, Tables 52-2, 52-3, and 52-4. Transitional material that can be characterized using criteria in ASTM D2488 is considered soil for classification purposes.
(4) Field logs and documentation of geologic investigations must conform to guidance in ASTM D5434, Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock; and ASTM D2113, Standard Practice for Diamond Core Drilling for Site Investigation.

F. Geologic Sample Collection, Transport, and Disposition

(1) All samples must be labeled with the following information: project name, county, State, date of sample, project location, depth interval of sample, sampling location number, and the name of the person securing the sample. All rock cores are labeled and photographed according to ASTM D5079 and ENG Geology Note 5. Photographs must be annotated and filed with the project design folder.
(2) Requirements must conform to ASTM D4220, Standard Practices for Preserving and Transporting Soil Samples; and ASTM D5079, Standard Practices for Preserving and Transporting Rock Core Samples.
(3) Soil samples stored at project locations for purposes of site showings and material classification may be disposed of after completion of the construction contract. Rock core stored at project locations for purposes of site showings and material classification may be disposed of after photographic documentation and logging of the core are completed or after completion of the construction contract.
(4) Soil and rock samples tested at NRCS facilities may be disposed of at the discretion of the facility.
(5) For sites that have special construction or material problems, the submitting NRCS office may request that the testing facility hold the samples for a specified period. Such samples are disposed of by the facility with the concurrence of the submitting office. Soil and rock samples must be stored and discarded in compliance with all applicable pest control regulations.
(6) Before soil samples and rock cores are discarded, they may be offered to a State geological survey or geological repository; departments of geology, engineering, archaeology, or anthropology at local schools, colleges, or universities; or any interested civil or cultural organization.

G. Quarantines on Transport of Soil Samples and Earth Material Sampling and Moving Equipment

(1) Soil movement regulations are designed to stop the human-assisted spread of agricultural pests. The shipping or transport of all soil samples and soil-moving equipment under any NRCS activity or program must conform to regulations of the USDA Animal and Plant Health Inspection Service (APHIS). The current list of regulated areas is available at http://www.aphis.usda.gov. Contact APHIS for the current list of counties under Federal domestic plant quarantine, including the address and phone number of the APHIS area office located in each State.
(2) Note that the current APHIS Plant Protection Quarantine (PPQ) defines "soil" as any earth material containing organic matter. The following items are exempt from USDA soil regulation (APHIS Circular Q-330.300-1, Soil (01/2010) Revised, 7 CFR Section 330.300):
(i) Peat, cosmetic mud, and other mud products from fresh water estuaries or the earth's upper surface, if processed to a uniform consistency and free of plant parts or seeds.

(ii) Volcanic rock, pumice, geologic samples, drilling cores, or mud, if mined so it is free of organic material.
(iii) Any sediment, mud, or rock from the oceans of the earth.

(3) Regulated soil samples must be shipped only to USDA-approved facilities for processing, testing, or analysis.

(4) Regulated soil samples must be shipped so that no spillage or breakage occurs in transit. Undisturbed samples in moisture-proof containers may be shipped using procedures outlined in ASTM D4220, Standard Practices for Preserving and Transporting Soil Samples.

(5) Soil samples taken from below a depth of 3 feet in regulated areas may be shipped as unregulated samples if care is taken not to contaminate them while collecting and preparing them for shipment. If there is any question of contamination, ship as regulated samples.

(6) The exterior of each shipping carton containing regulated soil samples must be clearly marked "CONTENTS: SOIL SAMPLES."
(i) Domestic Samples.—Each sample must be identified by stamping or printing the word "REGULATED" in red on both the inside and outside tags and on the shipping container.
(ii) Samples sent to the NRCS Soil Mechanics Laboratories must be identified as "regulated" on Form NRCS-ENG-534, "Soil Sample List," and Form NRCS-ENG-356, "Request for Soil Mechanics Laboratory Test."
(iii) Overseas Samples.—All soil samples from any foreign source, offshore possession, or Hawaii are required to be shipped under permit. Form PPQ-525 is required (this form can be obtained from APHIS).

(7) Equipment and hand tools used to collect soil samples in regulated areas must be thoroughly cleaned of all soil residues at the collection site before removal to unregulated areas.

(8) Soil-moving equipment being transported from regulated areas to unregulated areas must be cleaned of all soil residues at the work site from which it is being moved. These regulations apply to NRCS-owned and operated equipment and to the tools and equipment of drilling and earth-moving contractors.

(9) Contractors must be advised of quarantine requirements through the applicable clause in bid notifications and contracts as covered under general or special provisions.

(10) Soil samples from regulated areas must not be sent or transported to any facility without first determining whether the receiving facility is approved by APHIS. The following NRCS facilities are approved by APHIS to receive soil samples:
(i) Soil Mechanics Center, Lincoln, NE
(ii) National Design, Construction, and Soil Mechanics Center (NDCSMC), Fort Worth, TX
(iii) National Soil Survey Center, Lincoln, NE

(11) The Soil Mechanics Center in Lincoln, NE, is the only NRCS facility that accepts Pacific Islands and foreign soil materials.

H. Geologic Maps

(1) A map or sketch that locates all geologic attributes pertinent to the geologic investigation must be completed and submitted as part of the geologic report. Typically, the map will delineate the interpreted distribution of geologic map units across the site and document locations of key rock outcrops, springs, seeps, water wells, landslides, streams, gullies, and any other pertinent geologic and geomorphic features.

(2) Maps are prepared on the best available topographic base map or aerial photograph using standard signs and symbols, at a chosen scale and projection. The standard is the Digital Cartographic Standard for Geologic Map Symbolization by the Federal Geographic Data Committee (FGDC-STD-013-2006, http://www.fgdc.com). Maps drawn to scale must include a graphic scale and note the original scale at which the map was produced, published, or both. Maps with exaggerated vertical scales are explained with a statement, such as "1 inch equals 1 mile," or a representative fraction, such as "1:2000." The legend of profiles or cross sections with exaggerated vertical scales must include a statement such as "vertical scale = 10X horizontal scale." All maps and sketches must include a title or subject, area covered, key to symbols used, scale, north arrow, date, and name and title of mapper.

(3) The accuracy and scale of the map will vary, depending on the scope, complexity, potential hazards associated with the project, and on the geologic complexity of the project site.

(4) An engineering geologic map must be drawn to identify and spatially represent zones of geologic material that meet similar engineering performance criteria. The map must include the locations of all measurements, samples, or observations, and the data collected. Supplements may include structural contour maps showing elevations of geologic contacts, tops of key beds, or other surfaces of interest and isopach maps showing contoured thicknesses of a mapped unit. Cross sections, profiles, fence diagrams, columnar sections, perspective drawings, and other illustrations may be used to represent geologic features. In some cases, a geomorphic map, showing landforms, slope stability, and topography is appropriate.

(5) A geologic evaluation map is a plan view illustration, representing a given area, depicting the orientation and location of key geologic and related features that could significantly affect the performance of a proposed or existing structure or practice. Cross sections, profiles, fence diagrams, columnar sections, perspective drawings, and other illustrations may be used to represent geologic features. The map may include profiles, cross sections, or other supplemental figures to help illustrate the information. A geologic evaluation map is used to support planning documents such as an environmental assessment or environmental impact statement. It may

include profiles, cross sections, or other supplemental figures to help illustrate the information.
(6) For small structures at low-hazard sites, a site sketch may be adequate. A site sketch is typically drawn freehand or on a Geographic Information System-based platform, from observation or uncontrolled surveys, showing approximate space, scale, and orientation of the main features of the site or area. The accuracy and scale of a map must commensurate with the scope of the project and complexity of the site.
(7) Plane table, air photo, Global Positioning System (GPS), and conventional surveying techniques may be applied to develop a detailed geologic map.

I. Geologic Reports

(1) All geologic reports of investigation are prepared, signed, and dated by the investigating geologist. The report must include a geologic map as prescribed in Section 531.2(H), photos, and figures necessary to adequately depict geologic units and features, geologic structure, and other pertinent conditions, such as rock outcrops, springs, seeps, water wells, landslides, streams, gullies, and any cultural features are documented.
(2) The general outline and contents of the report must conform to guidance presented in ASTM D420. At a minimum, the report must include the following headings:
(i) Location of the Area Investigated.—The location must be given in terms pertinent to the project and may include maps, sketches, and annotated photographs.
(ii) Procedures.—This section must include a description of the field procedures used in the geologic investigation, including field tests to determine in-situ mass properties, and subsequent laboratory testing to determine mass and material properties of secured samples.
(iii) Factual Findings.—Factual findings must be clearly separated from interpretations of results. All borings and test-hole logs, graphic representation of geophysical measurements, and laboratory test results must be included. Cross sections presented with basic data from the investigation are limited to the ground surface profile and factual subsurface data obtained at specific exploration locations. Stratigraphic units may be extrapolated between boreholes on cross sections only if supported by continuous geophysical profiles or other evidence of positive correlation. Cross sections that show interpretive information must be documented separately from factual findings and supported by explanatory notes. Only factual findings will be provided to potential contractors.
(iv) Interpretation of Results.—This section includes appropriate recommendations and disclaimers for the use of the report. Recommendations for design parameters are subject to restrictions imposed by State licensing law, and may only be made by professional engineers and geologists specializing in the field of geotechnical engineering and engineering geology and who are familiar with the purpose, conditions, and requirements of the investigation.
(v) References.—Complete citations of all published materials noted in the report must be included. Inclusion of materials from outside sources must conform to copyright law.
(3) Geologic terms and symbols not specifically defined in NRCS guidelines must conform to ASTM D653, Standard Terminology Relating to Soil, Rock, and Contained Fluids; the American Geological Institute (AGI) Glossary of Geology; AGI Data Sheets; or the Digital Cartographic Standard for Geologic Map Symbolization by the FGDC (FGDC-STD-013-2006, http://www.fgdc.com).

531.3 Classification of Dam Sites for Geologic Investigation

To establish criteria for geologic investigation and sampling, dam sites are categorized into two groups according to the fill height of the structure, construction materials, purpose of structure, and structure class.

A. Group I Dams

Group I dams include—
(1) High-hazard (H) dams.
(2) Significant-hazard (S) dams.
(3) Low-hazard (L) dams with a maximum fill height of 35 feet or less, as measured from low point on centerline.
(4) Structures greater than 20 feet high of the following types:
(i) Concrete or masonry arch or gravity dams
(ii) Drop spillways
(iii) Box-inlet drop spillways
(iv) Chutes
(5) Dams with a maximum fill height equal to or greater than 20 feet, as measured from low point on centerline, where the principal purpose is forming storage reservoirs for recreation, municipal water supply, or irrigation, and where the product of the storage (in acre-feet) times the height (in feet) of the dam is equal to or greater than 3,000.

B. Group II Dams and Embankments

Group II dams include all other types of dams and embankments that do not classify as Group I, such as the following conservation practices (standard number): Pond (378), Waste Storage Facility (313), and Grade Stabilization Structure (410).

531.4 Repair, Rehabilitation, and Decommissioning of Dams

A. Geologic Investigations of Existing Structures for Repair and Rehabilitation

(1) Engineering structures and practices requiring repair or rehabilitation may need additional geologic information. This supports design changes that may result from a change to a higher hazard class or changes in criteria or standards.
(2) The determination of the adequacy of available geologic information is conducted as part of the design review process. The design engineer and geologist jointly determine the need for additional information and develop a plan for the geologic investigation based on the results of the review.
(3) The geologic report must be filed with the engineering records for the repaired or rehabilitated structure or practice.

B. Geologic Investigations for Decommissioning of Structures

(1) Engineering structures and practices selected for decommissioning may involve the complete or partial removal of a structure or a change in its original design function.
(2) The determination of the adequacy of available geologic information must be conducted as part of the design review process. The design engineer and geologist must jointly determine the need for additional information and develop a plan for the geologic investigation based on the results of the review.
(3) Investigations of impoundment structures and practices selected for decommissioning must address the quantity, location, type, quality, and fate of sediment that will be affected by the decommissioning project, either by capping, by exposure to erosion and downstream transport, or by sluicing, dredging, or excavation.
(4) Assessment must also include the potential effects of changes in the sediment-water balance on streams upstream and downstream from the reservoir sediment pool area.
(5) The geologic report must be filed with the engineering records for the decommissioned structure or practice.

Part 531 – Geology

Subpart A – Geologic Investigations

§IA531.0 General

A. Responsibilities

(8) Responsibilities of the Field Engineer(s)

(i) The field engineer will submit an investigation request on Form IA-ENG-36, Investigation Request Report (available on the Iowa Engineering Website), at least two months prior to the desired date of investigation.

(ii) The field engineer is responsible for preparation of Form IA-ENG-35, Engineer's Site Report (available on the Iowa Engineering Website), and drawings 35A and 35B (also 35C, if required) prior to the start of the geologic investigation of the site. These materials will be provided to the geologist at least one week before the investigation begins.

(iii) The field engineer is responsible for contacting Iowa One-Call for utility clearance at least 48 business hours before the start of the field investigation.

(iv) For sites to be drilled, the field engineer is responsible for providing a Driller's Helper capable of lifting heavy augers for the duration of the investigation.

(9) Scheduling

(i) For multiple requests, the geologist will prepare an investigation schedule for approval by the State Conservation Engineer. The geologist will schedule site investigations and associated travel in a manner that maximizes efficiency and economy of staff time and equipment use.

(ii) The geologist will notify Assistant State Conservationists (Field Operations) and District Conservationists of scheduled movement into areas at least one week before the investigation(s).

(iii) The geologist will notify all parties taking part in the investigation as soon as possible when changes are made to the schedule.

(10) Permits for Investigation

(i) Permission must be obtained from the landowner before the investigation is started. This may be done by one of the following methods:

1. District Cooperator Agreement - the agreement between the landowner and the local district (SWCD) provides for the right of ingress and egress to the property.
2. Easements - these are secured by the project sponsor(s) and grant rights for surveys, investigations, construction, operation and maintenance, and inspection.
3. Written Permit - a written permit from the landowner for specific purposes such as surveys and geologic investigations.

(ii) The District Conservationist shall notify the landowner and/or occupants of any planned investigation and drilling.

§IA531.1 Scope and Intensity of Geologic Investigations

A. General

(2) Minimum Investigation Requirements for Group A and B Structures in Iowa. (Refer to §IA531.3 C., Classification of Structure Sites for Geologic Investigations in Iowa)

(i) Group A structures. Investigations must be made by a qualified geologist. This applies to the preliminary investigation as well as the detailed subsurface exploration. The geologist will consult with the design engineer to determine what is needed in the way of a detailed site study. Disturbed and undisturbed samples for laboratory analysis are required.

(ii) Group B-1 structures. Investigations must be made under the supervision of a qualified geologist. General experience in the area and available geologic information may provide enough information so that a limited amount of subsurface exploration will suffice for some sites in this group. The geologist and field engineer will assess the extent of soil sampling that is needed on a site-specific basis.

(iii) Group B-2 structures. The intensity of investigation needed can be determined by persons holding job approval authority for the job class of structure under consideration. Investigation by a geologist is not required, but may be conducted by NRCS non-geologists who are qualified to recognize geologic conditions, limitations, and hazards pertinent to the site. Samples for laboratory analysis are not usually necessary for these structures. {Note: In areas where there is little geologic information available or little experience on which to base conclusions, a geologist will be consulted.}

(iv) For any structure in categories (i) – (iii) where the channel is inaccessible to a drill rig and the permeability of the foundation cannot be reliably predicted, the geologist may determine during a preliminary site visit that a backhoe investigation of the channel bottom is needed. If a backhoe is not provided, it must be stated on the drawings that a "Geologist is required to be onsite for core trench excavation."

§IA531.2 Requirements for All Geologic Investigations

H. Geologic Maps

(5) The field engineer is responsible for preparation of a plan view drawing (35A), a centerline profile drawing (35B), and an auxiliary spillway profile drawing (35C, if required) for the structure site. At a minimum, these elements are required on the drawings:

(i) Plan View (35A)

~ Centerline of structure
~ Station of centerline
~ Centerline of principal spillway
~ Baseline
~ Outline of auxiliary spillway
~ Creek channel
~ Topographic contour lines
~ Fences
~ North arrow
~ Scale (1 inch = 50 feet or 40 feet or multiples of)
~ Significant features, i.e.: wells, power lines, gas lines, reference pins, etc.

(ii) Structure Centerline Profile (35B)

~ Ground line
~ Elevations – Top of dam, auxiliary spillway, and principal spillway
~ Tie in baseline (reference to plan view)
~ Horizontal scale (1 inch = 50 ft. or 40 ft. or multiples of)
~ Vertical scale (1 inch = 10 ft. or 20 ft.)
~ Principal spillway profile for Group A structures (Refer to §IA531.3.C., Classification of Structure Sites for Geologic Investigations in Iowa)

(iii) Auxiliary Spillway Centerline Profile (35C) for sites with over 10,000 cu. yds. of cut

~ Centerline of auxiliary spillway showing inlet, control section, and outlet
~ Stationing
~ Location of cross sections

§IA531.3 Classification of Structure Sites for Geologic Investigation

C. Structure sites in Iowa are classified in one of the following three groups:

(1) Group A structures. These include:

(i) High-hazard (H) dams
(ii) Significant-hazard (S) dams
(iii) Low-hazard (L) dams of Job Class VI or higher
(iv) Drop spillways, box-inlet drop spillways, and reinforced concrete chute spillways which have a maximum fill height greater than 20 feet

(2) Group B1 structures. These include:

(i) Job Class V structures except as noted in (3)(ii) below
(ii) Job Class III and IV structures in areas where geologic conditions are potentially complex or are known to be variable or unpredictable

(3) Group B2 structures. These include:

(i) All other types of structures that do not classify as Group A or Group B1. These may include conservation practices such as Pond (378), Waste Storage Facility (313), Grade Stabilization Structure (410), etc.
(ii) Job Class V structures that are classed as V only because of the principal spillway pipe diameter.

Subpart B - Geologic Investigations of Group I Dam Sites

531.10 Geologic Investigations of Group 1 Dam Sites

A. General

(1) Engineering geologic investigations of Group 1 dam sites are undertaken to characterize, document, and assess all geologic materials and features with engineering significance that potentially impact the planning, design, construction, performance, and safety of the proposed structure.

(2) Preliminary and detailed engineering geology investigations, as generally described in Sections 531.1(C) and (D), must be conducted for all NRCS dam sites under the supervision of a qualified geologist (as defined in Section 531.1(C)) in accordance with current industry standards and as required by State or local law.

(3) The geologist and design engineer must jointly develop a detailed geologic investigation plan that describes what data to collect and how the data will be used to support sound engineering design. Products and outcomes may include, but are not limited to—

(i) Classification and determination of both material and mass properties of geologic materials in the foundation, abutments, spillway, auxiliary spillway, and reservoir area. Stratigraphic and structural discontinuities, such as faults, joints, and fractures with engineering significance must also be characterized.

(ii) Delineating the incompressible rock surface, where it occurs within the depth of influence of the structure.

(iii) Evaluating the need for hydraulic pressure testing in rock foundations and abutments of proposed dams for water storage reservoirs.

(iv) Assessing the influence of rock mass properties on the slope stability of rock materials in the spillway cut slopes.

(v) Evaluating excavation characteristics of materials in proposed open spillway cuts.

(vi) Locating earth material proposed for use as fill and determining its quantity and engineering suitability.

(vii) Determining the depth to groundwater, seasonal variation of water table, and extent and character of aquifers within the zone of influence of the structure.

(viii) Evaluating the need for controlling groundwater during construction and determine the need for controlling moisture content in borrow material.

(vix) Evaluating the seepage potential of the permanent pool area and dam site of water holding reservoir sites.

(x) Evaluating whether economic mineral deposits, including sand and gravel, occur within the area of influence or would be preempted or otherwise impacted by the project.

(xi) Assessing the effects of earthquake loading on the proposed dam.

(xii) Determining reservoir sediment storage requirements based on results of a watershed sediment yield study as described in Section 531.25, below.

(4) The investigating geologist, the engineer designated for soil mechanics leadership, and the design engineer must periodically review preliminary findings to determine the adequacy of the subsurface investigation, including in-situ testing and sampling for soil mechanics testing. The data are reviewed for adequacy for use in all stages of design and construction.

B. Subsurface Exploration

(1) Subsurface exploration must be of sufficient intensity to determine all conditions that can influence the design, layout, construction, and functioning of the proposed structure.

(2) All soil and rock units must be characterized beneath the footprint of the structure and the abutments.

(i) For all earth fill dams in Group I, borings at all stations within the footprint of the structure must be extended to depths equal to or greater than the equivalent proposed height of fill associated with the points of boring or to hard, massive, unaltered rock or similar limiting layer.

(ii) For all concrete dams, borings must extend to depths equivalent to at least 1.5 times the proposed effective height of the dam as measured from the maximum proposed depth of excavation.

(3) Sufficient borings must be made along the proposed centerline of dams to provide correlation of geologic materials and to define the rock surface profile. Borings must be extended deep enough into rock to establish whether it is in situ.

(4) Sufficient borings must be made along the proposed centerlines of risers, inlet structures, or other conduits to provide correlation of geologic materials from the riser to the outlet, and to a depth equal to the zone of influence of the structure. At least one bore hole must be placed at the riser, at the intersection of the centerlines of the dam and conduit, and at the outlet.

(5) Other requirements are as follows:

(i) Delineate the incompressible rock surface where it occurs within the depth of influence of the structure.

(ii) Locate earth material proposed for use as fill and determine its quantity and engineering suitability using appropriate soil mechanics tests.

(iii) Determine the depth to groundwater, seasonal variation of water table, and extent and

character of aquifers within the zone of influence of the structure.
(iv) Evaluate the need to control groundwater during construction and determine the need to control moisture content in borrow material.
(v) Evaluate whether economic mineral deposits, including sand and gravel, occur within the area of influence or would be preempted or otherwise impacted by the project.
(vi) Evaluate excavation characteristics of materials in proposed open spillway cuts.
(vii) Assess the influence of rock mass properties on the slope stability of rock materials in the spillway cut slopes.
(viii) Investigate earth auxiliary spillways in accordance with Sections 531.11(G) and 531.16 (D) of this manual.
(ix) Evaluate the need for hydraulic pressure testing in rock foundations and abutments of the proposed dam.

C. Sampling and Testing

(1) For classification purposes, obtain representative samples of all geologic materials identified in the foundation, borrow, relief well, principal spillway, and auxiliary spillway areas.
(2) Obtain undisturbed samples for shear and compaction tests from all strata of fine grained soils of questionable stability in the foundation within a depth equivalent to one-half the maximum fill height of the dam, as measured from low point on centerline.
(3) Samples for compaction tests must be obtained from borrow and auxiliary spillway areas where information and experience in the area are inadequate to conclusively predict the engineering behavior of the materials.

D. Dams with Permanent Storage

(1) For dams with permanent storage, undisturbed samples for consolidation tests are obtained of all compressible, fine-grained materials from the foundation within a depth equivalent to the maximum height of the dam, as measured from low point on centerline. If compressible materials are suspected to occur at greater depths, drill and sample the compressible materials to depths within the zone of influence.
(2) Samples for compaction and shear tests must be obtained from the borrow areas and auxiliary spillway areas.
(3) For all dam sites with permanent storage, the groundwater regime and hydraulic characteristics of the entire reservoir area, the abutments, and embankment foundation must be evaluated to determine leakage potential and the need for reservoir sealing. Where significant leakage is suspected, samples must be obtained of materials underlying the permanent pool area to determine reservoir sealing requirements.
(4) Potential effects, including damages, of seepage from a reservoir on lands adjacent to or downstream from the structure must be evaluated.

E. Dams Subject to Deep Subsidence

A geologist must determine whether sinkholes, solution cavities, underground mine collapse, or the removal of fluids such as petroleum, water, and natural gas could impact the design, function, and safety of the dams, particularly by abrupt differential settlement. The geologist must provide recommendations to the design engineer on identified geologic concerns that need to be addressed in the operations and management plan for the structure. Subordination of mineral rights within a limited area at the site does not necessarily prevent subsidence of the structure. If studies indicate that the predicted subsidence cannot be remedied, the site must be abandoned.

F. Dams Underlain by Economic Mineral Deposits

(1) The geologist must identify and generally characterize any economic mineral deposits underlying the dam site that might be mined in the future. The geological investigation must encompass an area that extends outward beyond the base of the dam, a horizontal distance equivalent to the depth of the deepest mineral deposit below ground surface. This requirement may be modified as a result of a detailed, site-specific study by, and at the consequent recommendation of, a qualified mining engineer.
(2) Results of the investigation may be used to recommend measures or actions to—
(i) Prevent the development or removal of such minerals from unmined areas in order to prevent subsidence of the structure.
(ii) Preserve or build and maintain adequate support to ensure against future subsidence of the structure foundation for mined areas.

G. Earth Spillways

(1) For all dams with earth spillways, the geologist must provide specific geologic information to the design engineer for the stability analysis and integrity analysis of auxiliary spillways, as explained in 210-NEH, Part 628, Chapter 50, "Earth Spillway Design," and Chapter 51, "Earth Spillway Erosion Model, SITES Program."
(2) All earth materials occurring beneath the spillway down to the elevation of the floodplain are mapped by the headcut erodibility index (Kh) in accordance with 210-NEH, Part 628, Chapter 52, "Field Procedures Guide for the Headcut Erodibility Index." The investigation must be sufficiently detailed to provide all input parameters for the index, and must include a plan view map and longitudinal sections. The investigating geologist and responsible engineer jointly determine the engineering significance of all material that has a (Kh) less than or equal to 10.

H. Potential Seismic Hazards

(1) Evaluation of seismic hazards must comply with local, State, and Federal laws and regulations. For non-Federal dams, the State dam safety office must be consulted to determine seismic hazard evaluation requirements.

(2) Fault Rupture.—Geologic investigations must document the existence or absence at the site of faults classified as Holocene-active, with evidence of fault rupture within the past 12,000 years, or conditionally active, with evidence of Quaternary fault rupture during the last 35,000 years but without a history of displacement. Dams may not be located on Holocene-active faults without the concurrence of the Director, Conservation Engineering Division (CED). High-hazard dams with permanent storage may not be located on conditionally active faults without specific design features that address potential fault movement.

(3) Earthquake Loading.—The effects of earthquake loading must be considered for all dams. As part of the reconnaissance investigation, the geologist and the responsible engineer must jointly determine if additional seismic analysis is required. Where State or local laws do not specify the scope of the investigation, the screening tool in Figure 531-B1 must be used.

Figure 531-B1

Probable Ground Acceleration (PGA) With 2% Probability of Exceedance in 50 Years (%g)	Seismic Risk	Hazard Class (NEM Part 520, Subpart C-Dams	Effective Dam Height (ft)	Additional Seismic Evaluation Required?
<10	Low	All	Any	No
10 to <20	Medium	Low	<35	No
			≥ 35	Yes
		Significant	<20	No
			≥ 20	Yes
		High	<20	No
			≥ 20	Yes
20 to <40	High	All	Any	Yes
≥ 40	Very High	All	Any	Yes

(4) Where additional seismic evaluation is required, the geologist and responsible engineer must jointly determine sampling, testing, and other data requirements for a detailed earthquake loading analysis, which will vary depending on the method and approach used. The method and scope of the analysis that is undertaken as part of geologic and engineering investigation of the dam site will be a function of local and State laws and regulations, regional seismic hazards, the potential consequences of dam failure, and other site-specific characteristics that influence the performance of the dam under earthquake loading.

(i) Where State or local laws and regulations require a particular method of analysis, that method must be used.

(ii) Where no method is specified, a probabilistic determination of minimum earthquake loading using the exceedence probabilities listed figure 531-B2 must be used, assuming a shear-wave velocity that reasonably characterizes the site.

Figure 531-B2

Hazard Class	Annual Approximate Probability of Exceedance in 50 Years	Exceedance Probability	Return Period (Years)
Low	1 x 10-3	-1,000	5 %
Significant	4 x 10-4	-2,500	2 %
High (with no potential for loss of life from failure at permanent pool)	2 x 10-4	-5,000	1 %
High (with potential for loss of life from failure at permanent pool)	1 x 10-4	-10,000	0.5 %

(5) For significant or high-hazard dams, a site-specific seismotectonic study, performed in accordance with the Federal Guidelines for Dam Safety: Earthquake Analysis and Design of Dams, may be performed in lieu of using the loadings shown above, if allowed by State or local law.

(6) Liquefaction.—For dam sites where additional seismic evaluation is required based on criteria set forth in Figure 531-B1 (or as required by State or local law), the preliminary engineering geologic investigation must include an assessment of liquefaction potential. The geology investigation must—

(i) Document historic occurrences of liquefaction in the dam site area.

(ii) Compile a geomorphic map that delineates active depositional areas, including stream channels, active floodplains, marshes, and estuaries, and inactive depositional units, such as older terraces.

(iii) Determine the highest groundwater level anticipated to occur, assuming as-built conditions.

(iv) Characterize and map the distribution of surficial geologic units and soils, with an emphasis on Quaternary-age, unconsolidated to moderately consolidated deposits.

(7) A geotechnical field investigation to support an engineering analysis of liquefaction potential must be conducted by the geologist in consultation with the geotechnical engineer, design engineer, or both if results of the preliminary assessment document the presence of any of the following conditions:

(i) Evidence that liquefaction has occurred during historical earthquakes

(ii) Uncompacted or poorly compacted fills containing liquefaction-susceptible materials that are saturated, nearly saturated, or may become saturated

(iii) Unconsolidated sediments in active depositional environments where the highest anticipated groundwater is less than 40 feet from the ground surface and the anticipated earthquake probable ground acceleration (PGA) having a 10-percent probability of being exceeded in 50 years is greater than 0.1g

(iv) Moderately consolidated Holocene-age sediments in inactive depositional environments, such as terraces, where the highest anticipated groundwater is less than 30 feet from the ground surface, and the 10-percent-per-50-year PGA is greater than 0.2g

(v) Late Pleistocene-age deposits that are approximately 15,000 to 12,000 years old, where the highest anticipated groundwater is less than 20 feet from the ground surface and the 10-percent-per-50-year PGA is greater than 0.3g

(8) For geotechnical field testing of liquefaction potential, the standard penetration test (SPT) is the preferred method for measuring resistance. If other field tests are used, they must be calibrated with SPT measurements taken from the project site.

531.11 Requirements for Geologic Investigation of Group I Dams During Construction and Project Implementation (As-Built)

A. A geologic investigation must be conducted during construction of all Group I dams, as defined in Section 531.20, to verify all assumptions and interpretations made in previous investigations and to identify differing conditions that may impact the long-term performance of the structure. Differing geologic conditions that require design modification must be documented in the as-built records.

B. If an unanticipated geologic condition that requires design modification is encountered during construction of any NRCS project, structure, practice, or component, the responsible field person must notify and apprise the State Conservation Engineer (SCE) as soon as possible. The SCE determines the need for and secures the services of a qualified geologist to conduct a site visit to assess the unanticipated geologic condition and provide interpretations and technical support for design or installation changes.

C. A geologic investigation must be conducted or supervised by a qualified geologist during construction of all Group I dams. Throughout construction, the project engineer must notify the geologist as geologic materials become exposed during excavation of pipeline trenches, structure foundations, core trenches, auxiliary spillway cuts, and borrow areas.

D. The geologist must prepare an as-built geologic report, following criteria set forth in Section 531.2 (H). Findings and interpretations that differ from those reported in previous geologic investigations must be identified and explained. Differing conditions with engineering and geomorphic significance are, to the extent possible, measured and assessed in the field. They must be documented in a report that includes logs, cross sections, engineering geologic maps, hand sketches, and photographs to support the documentation.

E. Documentation may also include revised geologic maps, cross sections prepared in earlier investigations, photos or video recordings, or supplemental topographic or geospatial positioning system (GPS) surveys.

F. The report is filed as a supplement to the engineering design folder for the project.

Part 531 – Geology

Subpart B – Geologic Investigation of Group A Structure Sites

§IA531.10 Geologic Investigations of Group A Structure Sites

A. General

(4) The geologist will supervise NRCS drilling operations. Contract drilling will be done in accordance with contract provisions. The field engineer will be present or readily available for consultation during site investigation.

(5) The geologist is responsible for the completion of the SCS-ENG-533T, Log of Test Holes. Each test hole will be logged in sufficient detail so that adequate detail is recorded for design purposes. The Unified Soil Classification System (USCS) will be used.

(6) The Cooperator on CO-01 work is expected to furnish any special exploratory equipment (dozers, backhoes, and so on) needed for an adequate site investigation and not available through NRCS. The Cooperator is also expected to provide access roads and temporary channel crossings for drilling equipment where needed. The District Conservationist is responsible for notifying affected parties of these needs.

B. Subsurface Exploration

(3) The location of the test holes is the responsibility of the geologist, who will consult with the design engineer in advance. The number of test holes will be adequate to enable interpretation and correlation of the foundation beneath all elements of the structure, including dam or structure centerline, principal spillway, auxiliary spillway, and drains. At a minimum, they shall include:

(i) A test hole as near as possible to each channel bank
(ii) A test hole at each abutment
(iii) Test holes no more than 150 feet apart on structure centerline
(iv) A test hole in the channel bottom
(v) Two or more test holes on the auxiliary spillway
(vi) At least three test holes on the principal spillway, including one at the riser, one at the intersection of the centerlines of dam and conduit, and one at the outlet
(vii) At least two test holes downstream of the structure centerline. One of these may be the outlet test hole as required in (vi).
(viii) At least one test hole in each potential borrow area
(ix) A test hole at the relief well location where applicable

C. Sampling and Testing

(4) The geologist is responsible for adequate on-site geologic determinations in consultation with the design and field engineers. The geologist will identify materials, obtain samples for laboratory analysis, and direct onsite geological and geophysical tests. The minimum requirements for sampling and testing for Group A structures are:

(i) Two undisturbed samples on structure centerline. If samples are unobtainable, down-hole vane shear tests will be substituted for undisturbed samples in saturated soils.
(ii) Two cone penetration tests on structure centerline
(iii) One undisturbed sample at the downstream prop location of concrete principal spillways
(iv) One large disturbed sample from each potential borrow area
(v) A small undisturbed sample at the relief well location where applicable

§IA531.11 Requirements for Geologic Investigation of Group A Structures During Construction (As-Built)

A. Requirements

(3) A geologist must be present sometime during the construction of Group A dams to conduct an as-built investigation of the core trench. The purpose is to verify the validity of all assumptions and interpretations made in previous investigations and to identify differing conditions that may impact the long-term performance of the structure. Differing conditions that require design modifications must be documented in the as-built records.

(4) The geologist must prepare an as-built geologic report which identifies and explains conditions and/or interpretations that differ from those reported in previous investigations. These differences must be documented through logs, cross-sections, maps, and photographs.

Subpart C - Geologic Investigations for Group II Dam Sites and Embankments

531.20 Embankments and Other Ground-Disturbing Practices

A. General

(1) Geologic investigations must be conducted for existing or proposed Group II dams, embankments, and other practices that entail significant ground-disturbing activity. This is necessary to generally assess suitability, identify and characterize any potential geologic hazards, and collect any other geologic information to support planning and design.
(2) The scope, intensity, and requirements for geologic investigations must be consistent with criteria set forth in Sections 531.1 and 531.2.
(3) The State Conservation Engineer (SCE) may delegate responsibility for reconnaissance investigations and preliminary geologic investigations of Group II dams and embankments to NRCS nongeologists who are qualified to recognize geologic conditions and hazards pertinent to the site. A geologist is consulted in areas where experience or information is limited, or geologic conditions are complex.

B. Seismic Hazard Evaluations

The SCE must develop policy and procedures for seismic hazard characterization based on known hazards and their attendant uncertainties, potential damages associated with failure, and State and local laws.

C. Waste Storage Ponds and Tanks

Site suitability must be evaluated in accordance with minimum criteria in conservation practice standards for waste storage or treatment and State, local, and Tribal requirements. Geologic investigations focus on the depth and gradient of the groundwater table or piezometric surface, suitability of construction materials, foundation strength, and overall site feasibility.

D. As-Built Investigations

If, during construction of any NRCS project, an unanticipated geologic condition that requires design modification is encountered, the responsible field person must notify the SCE as soon as possible. The SCE determines the need for and secures the services of a qualified geologist to conduct a site visit to assess the unanticipated geologic condition and provide interpretations and technical support for design or installation changes.

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Subpart C – Geologic Investigations for Group B Structures

§IA531.20 Embankments and Other Ground-Disturbing Practices

A. Requirements

(4) Geologic investigations for Group B1 structure sites will include:

(i) A minimum of two test holes on structure centerline
(ii) A minimum of one test hole in each potential borrow area
(iii) Additional test holes on centerline as needed to adequately identify and correlate subsurface materials, and to identify geologic hazards and limitations that could potentially affect planning or design
(iv) One large disturbed sample from each potential borrow area
(v) Disturbed samples for laboratory analysis, as deemed necessary by the geologist to adequately characterize the subsurface

(5) Geologic investigations for Group B2 structure sites will include:

(i) A minimum of one test hole in the channel bottom on structure centerline
(ii) Additional test holes as needed to adequately characterize the subsurface conditions and identify geologic limitations that could potentially affect design
(iii) Samples for laboratory analysis are not usually necessary.
(iv) Structures planned where experience or information is limited, or where geologic conditions are complex or unpredictable, are classed as Group B1 structures and require investigation by an NRCS geologist (Refer to §531.1.A.2. and §531.3.C.)

F. As-Built Investigations

(2) As-built geologic investigation of Group B1 and B2 structures is not required. However, the field engineer is encouraged to contact a geologist when conditions are found during construction that jeopardize long-term performance of the structure or significantly hinder construction activities.

Subpart D - Geomorphic, Erosion, and Sedimentation Investigations

531.30 Geomorphic Investigations of Watershed Erosion and Sedimentation

A. The effects of natural and anthropogenic sources of erosion and sedimentation, both onsite and offsite, must be assessed in all NRCS programs. Geomorphic processes and their impacts on resource conservation activities that are assessed by the geologist include but are not limited to—

(1) Sediment storage design for reservoirs and ponds.
(2) Sediment yield and sediment budgets for watersheds.
(3) Reservoir sedimentation.
(4) Surface water quality degradation by sediment.
(5) Structural deficiencies caused by sedimentation and erosion.
(6) Stream channel and stream corridor function, including erosion, deposition, and fluvial sediment balance.
(7) Evaluation of rock for erosion control.

B. Watershed geomorphic investigations may be conducted to support the planning, design, and evaluation of conservation practices. Investigations may entail, but are not limited to—

(1) Assessing the relative impacts of historic and current land-use practices and significant natural disturbances (including flood events, wildfire, earthquakes, mining, land use conversions, etc.) on present, near-term, and future geomorphic processes, including sedimentation.
(2) Assessing the relative contributions of different processes (including sheet and rill erosion of upland slopes; erosion and hydrologic modification associated with roads, landslides, and other slope failures; streambank degradation or scour; floodplain scour; gullying; etc.) and subregions in a watershed to average annual and event-based estimates of sediment yield.
(3) Evaluating the impacts of proposed and existing practices and management systems on upland erosion conditions, downstream sedimentation, and surface water quality.

C. The scope and intensity of geomorphic investigations must be consistent with the geomorphic complexity of the study area; pertinent social, economic, and safety considerations; and the purpose and complexity of the structure, practice or project.

D. Methods for determining watershed sediment yield are provided in Title 210, National Engineering Handbook (NEH), Section 3, Chapter 8 , and may include an analysis of reservoir sediment survey results as described in Sections 531.32 (B) and (C). Geomorphic processes, including sediment and debris production, transport, and deposition, are spatially and temporally variable and complex, and are difficult to quantify in an absolute sense. Other methods not described in 210-NEH, Section 3, may be considered at the discretion of the investigating geologist.

E. A report must be written and submitted that summarizes observations, methods used, assumptions, conclusions, and recommendations as described in Section 531.2(I).

531.31 Investigation of Structural Problems Caused by Erosion or Sedimentation

A. Policy contained in Part 504, Subpart A, Problems and Deficiencies, provides requirements for investigating engineering problems and deficiencies and structural problems caused by erosion or sedimentation. It also provides for committee assignments, procedures, and engineering reports.

B. If structural problems are caused by erosion or sedimentation, an engineering investigation may be conducted at the discretion of the State Conservation Engineer (SCE). For example, excessive sediment accumulations in a pond, reservoir, or other sediment-retaining structure may exceed the designed rate, and may result in functional limitations during the structure's design life. The investigation must address the extent of the problem, identify the causes of the increased sedimentation rate, and outline possible solutions.

C. A sedimentation study is also required during engineering investigations of structural problems caused by channel instability.

531.32 Watershed Sediment Yield Studies for Dams and Conservation Practices

A. General

(1) Watershed sediment yield studies, including the development of watershed sediment budgets, are conducted to evaluate the effectiveness of land treatment and structural measures in controlling erosion and reducing sediment yield and related damages in the treated area. They also provide basic data for the planning and design of soil and water conservation measures and programs.
(2) Watershed sediment yield studies are also undertaken to support sound engineering design of all dams and of other sediment- or water-control structures where erosion, transport, and sedimentation processes potentially impact feasibility, design, or performance. Numerous empirical and theoretical methodologies and models have been developed to estimate average annual and event-based sedimentation rates, which in part reflects the large spatial and temporal variability and complexity of erosion, transport, and sedimentation processes. Sound technical judgment, therefore, is requisite in the consideration of process relationships, the

selection of field techniques to be used in studies, and the formulation of hypotheses.
(3) Methods for determining watershed sediment yield are provided in 210-NEH, Section 3; ASTM D6145-97 Standard Guide for Monitoring Sediment in Watersheds; and other appropriate ASTM standards related to sediment studies.
(4) Results of reservoir sediment surveys, including published results of previous surveys, or surveys conducted as part of the geological investigation for a project site, provide valuable data that may be used to estimate watershed sediment yield in support of dam and embankment structure design.

B. Reservoir Sedimentation Surveys

(1) Reservoir sedimentation surveys may be conducted as part of the geological investigation of existing or proposed dam sites as described in subpart B to help determine sediment storage criteria and predict sedimentation impacts on other components of design and performance. Reservoir sedimentation surveys of Ponds (378) must be conducted by personnel trained in performing such surveys. Surveys of Group I and II dams and Dams (402) must be conducted or supervised by a qualified geologist.
(2) The Reservoir Sedimentation Survey Database (RESSED) is available online at http://ida.water.usgs.gov/ressed/. The site contains sediment survey data collected from about 1,800 reservoirs.
(3) Reservoir sediment surveys may also be conducted as part of geological investigations to support proper planning and design of ponds and other embankment structures as described in Subpart C or for other purposes as directed by the SCE.
(4) Sedimentation surveys must conform to procedures in 210-NEH, Section 3, and to the appropriate ASTM standards. Sound technical judgment is required, and industry standards will be used at the discretion of the investigating geologist. The data collection format must conform to ASTM D4581, Standard Guide for Measurement of Morphologic Characteristics of Surface Water Bodies.
(5) Reports for each reservoir sedimentation survey must be prepared according to requirements in 210-NEH, Section 3, and must include data on watershed conditions that affect sediment yield, including soils, surface geology, topography and land forms, land use and treatment, and all types of significant erosion. The report must include information about land-use management changes through time in the contributing watershed.
(6) The SCE is responsible for the technical adequacy of the report. Copies must be filed in the State office and submitted to the Director, Conservation Engineering Division.

C. Sediment Storage Design for Reservoirs and Ponds

(1) Sediment storage allocations are provided by the geologist to the design engineer as part of the geologic investigation of dam sites as described in Section 531.32(D). The investigating geologist, in consultation with the design engineer, must use methods set forth in 210-NEH, Section 3, Chapter 8, "Sediment Storage Design and Criteria." Other methodologies that are more appropriate to the region may be applied if approved by the SCE.
(2) Sediment storage criteria may also be developed for embankment and other low-hazard water- or sediment-control structures where sedimentation potentially impacts planning, design, or performance. The criteria may be developed by the person holding the appropriate job approval authority for the practice or as directed by the SCE. A geologist must be consulted in areas where experience or information is limited, or geomorphic conditions are complex.
(3) Sediment studies for rehabilitation or decommissioning of dams and embankments are conducted in accordance with Subpart B, Sections 531.19(A) and (B).

531.33 Geologic Investigation of Sedimentation and Erosion Processes in the Stream Channel and Stream Corridor

A. Geomorphic investigations of stream corridors are conducted to support the planning, design, and implementation of streambank stabilization and fluvial geomorphic restoration practices and projects. The complexity of fluvial geomorphic processes necessitates an interdisciplinary approach to assessing stream form and function and may include input from or consultation with geomorphologists, hydrologists, geologists, biologists, soil scientists, and engineers.

B. The science of fluvial geomorphology is still developing, and numerous methods are available with which to investigate and assess stream systems. None of these methods are perfect. They vary considerably in the information they provide, the information they require, the spatial and temporal scales they consider, and the complexity, expertise, and resources required for their use. To be successful, any method's design recommendations must take into full consideration the fundamental principles and modern theories of fluvial geomorphology, particularly the dynamic equilibrium of a stream.

C. Fluvial geomorphic investigations may include analyzing sediment transport capacity of the channel, determining change in transport capacity caused by the planned modification, and determining bedload sediment sources. Stream channel investigations may consider the dimension, pattern, profile, and other pertinent geomorphic factors of the stream, as well as activities in the watershed that can affect sediment supply and subsequent stream channel behavior and stability.

D. A stream assessment generally includes data collection, a process-based identification of potentially destabilizing factors, and a determination of the equilibrium stage of the stream. The equilibrium stage of various stream reaches and the changes occurring in the stream system must be accurately assessed to allow for the prediction of a proposed project's impact on stream geomorphology, on the equilibrium of the system, and the impact the natural processes will have on the functionality of the project.

E. Stream channel classification, analyses, and interpretations for predicting the behavior of the channel and riparian area that have alternative designs take into full consideration fundamental principles and modern theories of fluvial geomorphology.

F. Recommendations for design must give full consideration to channel stability concepts for natural streams that allow a stream to develop a dimension, pattern, and profile that will be in dynamic equilibrium over the life of the project.

G. Title 210-NEH, Part 653, Stream Corridor Restoration — Principles, Processes, and Practices, contains background information on stream corridors, their processes, characteristics, and functions. It contains guidance on the development of a stream corridor restoration plan, and on applying restoration principles.

H. Technical guidance and detailed procedures for stream assessments, principals of channel design, and treatment techniques for streambank stabilization are provided in 210-NEH, Part 654, Stream Restoration Design Handbook.

531.34 Evaluation of Rock for Erosion Control

A. Rock material is commonly used in erosion control applications as filter bedding, riprap, armor stone, and breakwater stone, and in groin and gabion structures.

B. The intensity of evaluation of rock material to be used for erosion control depends on the size and design requirements of the individual project, the quantity and quality of rock required, and the potential risk of property damage or loss of human life.

C. The acceptability of an identified source of rock material may be based on experience and previous performance of use for similar applications under comparable performance conditions.

D. The assessment of questionable sources of rock to be used for erosion control is conducted according to ASTM D4992, Standard Practice for Evaluation of Rock to Be Used for Erosion Control, and other related ASTM standards.

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Subpart D – Geomorphic, Erosion, and Sedimentation Investigations

§IA531.32 Watershed Sediment Yield Studies for Dams and Conservation Practices

C. Sediment Storage Design for Reservoirs and Ponds

(2) Minimum sediment storage requirements for ponds and reservoirs shall be determined based on the engineering job classification of the project:

(i) Engineering Job Class VI and VII: Storage requirements shall be determined by a geologist using Form IA-ENG-309, Reservoir Sedimentation Design Summary. Requests for assistance from a geologist will be made on Form IA-ENG-41, Sedimentation Investigation Request Site Report.

(ii) Engineering Job Class V: Storage requirements shall be determined by either a geologist, or by an engineer and reviewed by a geologist, using Form IA-ENG-309, Reservoir Sedimentation Design Summary.

(iii) Engineering Job Class I through IV: Storage requirements shall be determined by a person having the appropriate job approval authority for the structure using the Small Structure Sedimentation Form, IA-ENG-39. If the drainage area is greater than 250 acres, a safety factor of 1.2 shall be applied to the final totals for sediment storage required below crest and above crest (acre-feet). (Note: when using Form IA-ENG-39, the safety factor is automatically applied.)

(3) If Form IA-ENG-309, Reservoir Sedimentation Design Summary, is available but is over five years old, the engineer shall request the geologist to review or update the summary.

Subpart E - Hydrogeologic Investigations

531.40 General

A. Hydrogeologic investigations are conducted to characterize groundwater conditions to help assess the feasibility and design requirements of conservation practices and to evaluate the impacts of proposed measures on groundwater hydrology (including flow, water table depths and fluctuations, and volume) and groundwater quality.

B. A qualified geologist, as defined in Subpart A, Geologic Investigations, Section 531.0, in consultation with the responsible engineer, conducts investigations and evaluations of groundwater hydrology, groundwater quality, and groundwater resource development, as directed by the State Conservation Engineer (SCE).

C. The scope, intensity, and requirements for hydrogeologic investigations must be consistent with criteria for geologic investigations set forth in Sections 531.1 and 531.2. Methodologies and models used for the investigations must be appropriate for the intended application and must conform to State, local, and Tribal laws and regulations.

531.41 Groundwater Hydrology for Conservation Engineering

A. The NRCS person holding the appropriate engineering job approval authority for the class of structure investigates and evaluates—

(1) Agricultural drainage and irrigation water management activities.
(2) Engineering drainage for excavation dewatering of foundations, borrow areas, quarries, buildings, and mines.
(3) Seepage evaluations for blankets, drains, filters, and grouting.
(4) Engineering subsurface drainage for slope stability.
(5) Groundwater conditions as part of a geological investigation of dam sites (Subpart B, Geologic Investigations of Group I Dam Sites, Section 531.11).
(6) Engineering performance of conservation practices or components by employing groundwater quality monitoring, sampling, and testing methods, practices, or geophysical techniques according to appropriate ASTM standards.
(7) Subsidence associated with groundwater withdrawal.
(8) The influence of karst terrain on construction and performance of conservation practices and structures, including locating groundwater divides and delimiting recharge areas.

B. Technical guidance for investigation of the water table is found in Title 210, National Engineering Handbook (NEH), Part 651, Chapter 7, "Geologic and Groundwater Considerations" (revised 2010); 210-NEH, Section 16, "Drainage of Agricultural Land"; and 210-NEH, Part 631, Chapters 30 through 33. A geologist must be consulted in areas where experience or information is limited, or geologic conditions are complex.

531.42 Groundwater Quality Management

A. Hydrogeologic investigations are conducted to support the planning and design of reservoirs, waste storage facilities, and other practices that potentially impact (or are impacted by) groundwater quality.

B. Guidance on groundwater quality investigations is in 210-NEH, Part 651, Chapter 7, "Geologic and Groundwater Considerations." Anticipated changes in the groundwater regime must be evaluated with respect to the intended function of the structure.

C. To provide sufficient information for planning or design, the NRCS geologist investigates and evaluates the following:

(1) Groundwater pollution potential of agricultural point and nonpoint sources, including components of agricultural waste management systems
(2) Wellhead protection, including delineating wellhead protection zones
(3) Aquifer restoration or enhancement
(4) Location, construction, rehabilitation, decommissioning, and problem investigations of water wells
(5) Groundwater pollution potential relative to agricultural point and nonpoint sources
(6) Potential for groundwater pollution by components of agricultural waste management systems by point and nonpoint sources
(7) Delimiting recharge areas in karst terrain and other highly solutioned geologic materials, and the influence of karst topography on construction and performance of conservation practices and structures
(8) Areas having groundwater recharge potential
(9) Locating groundwater divides and determining aquifer characteristics
(10) Saline seeps and areas where they may develop
(11) Areas with potential for saltwater intrusion

531.43 Groundwater Resources Development

A. Technical guidance for groundwater development is found in 210-NEH, Part 631, Chapters 30 through 33; Engineering Field Handbook, Chapter 12, "Springs and Wells"; and the Ground Water Manual (U.S. Bureau of Reclamation, http://www.usbr.gov/library/). Other methods not described in these references may be considered at the discretion of the investigating geologist.

B. The NRCS geologist is responsible for—

(1) Rehabilitation, decommissioning, and problem investigations of water wells.
(2) Assessing groundwater recharge potential.
(3) Evaluating groundwater development potential of aquifers.
(4) Conducting groundwater budget analyses in watersheds and evaluating groundwater overdraft potential.
(5) Estimating groundwater consumption or demand in watersheds.
(6) Evaluating potential for underground disposal of surface waters.
(7) Evaluating potential for conjunctive use of groundwater with surface water supplies.
(8) Determining aquifer boundary conditions and potential for well interference.
(9) Evaluating groundwater quantity, quality, and geologic factors that influence design and construction of production wells and wellhead protection measures.

Subpart A - Engineering Classification of Soils

533.0 General

A. Soils are used as construction materials and foundations for engineering structures. The wide range of soil properties and conditions affect their performance and use.

B. An engineering soil classification system indicates engineering soil properties and provides a preliminary understanding of the behavior of soils under various engineering conditions. It is used to communicate this information in simple notations and brief descriptions. Soil engineers and geologists, for example, frequently communicate this information. Soil engineers perform soil testing programs, engineering designs, and soil engineering-related construction activities. Geologists perform site investigations to gather information on soil properties and conditions to be used by soil engineers.

533.1 Scope

This soil classification systems identified in the policy will be used in NRCS engineering activities, including the engineering sections of soil survey reports.

533.2 Soil Classification Systems

A. The Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System, or USCS), is to be used in NRCS engineering activities. The USCS is the standard accepted by the American Society for Testing and Materials (ASTM), Designation D2487: Classification of Soils for Engineering Purposes; and Designation D2488: Description and Identification of Soils (Visual-Manual Procedure).

B. The USDA National System of Soil Classification (Soil Taxonomy) is the pedological classification used in the National Cooperative Soil Survey. Additional information can be obtained from Title 430, National Soil Survey Handbook. The engineering sections of soil survey reports include both the USDA and the USCS soil classification systems.

C. Soil classes determined by the USCS and the USDA textural classes in the pedological system provide information on the nature and size of soil particles. If the full combination of characteristics denoted by pedological soil names is used, additional information such as natural drainage condition can also be deduced. Soil surveys show the location and extent of different soils; however, site-specific identification or classification determined by soil testing is needed for designing engineering structures. Soil classification for engineering uses is best interpreted by the USCS.

D. Data contained in available soil survey reports can be used and should be supplemented as necessary to classify soils at specific sites. For some small farm-type structures, soil survey information properly interpreted may provide much of the soil information needed for planning and installation.

E. All engineers and geologists must be trained to use both the USCS and the USDA textural systems with competence. Construction inspectors, engineering and physical science technicians, and conservation technicians must also be trained in these soil classification systems needed for the planning, design, and installation of conservation practices.

Subpart B - Operations

533.10 General

A. Soil mechanics is the part of physical science that deals with the action of forces on soil bodies. These actions are usually measured in testing laboratories. Soil engineering is the practice of engineering that involves the action of forces on soil masses.

B. Collection and analysis of soil engineering data are essential in the investigation and design of engineering structures. The examination and verification of soil properties during construction are also critical. Special training and experience usually are needed because many factors depend on interpretation and judgment. Close coordination is needed between the investigation, soil testing, design, and construction functions.

C. Soil mechanics testing provides data for evaluating soil and rock as engineering materials for planning, design, and construction. Test results identify the index, chemical, and engineering properties used in the analyses and design of foundations and earth or earth-supported structures.

533.11 Data Collection

A. The State Conservation Engineer (SCE) is responsible for all site investigations and the collection of samples. The engineering staff or team that prepares the final design must assist in planning the site investigation, sample selection, and final testing program.

B. All data needed for analyzing soil conditions pertinent to planning, designing, and constructing engineering structures must be obtained for each phase. Field tests and interpretation procedures in Part 531, Subpart A, Geologic Investigations, must be used to determine as many in-situ soil properties as practical. If further testing is needed or verification of field conditions is in order, appropriate representative samples must be obtained for laboratory testing.

C. Before completion of the geologic investigation, the geologist, the engineer designated for soils mechanics leadership, the project engineer, or some combination of these individuals must jointly review the results of the investigation and the adequacy of sampling for testing. The data must be examined to determine that it is adequate to be used for all stages of design and construction.

533.12 Testing

A. Soil mechanics testing must conform to established NRCS standards and procedures. The testing must be completed at appropriate times during the investigation, design, and construction phases. To facilitate field investigations and construction operations, index and chemical tests may be performed in either local NRCS or commercial facilities. Laboratory tests for engineering properties (shear, consolidation, permeability, etc.) must be performed in laboratories supervised by engineers with soil engineering expertise.

B. For designs prepared through engineering services contracts, the testing may be performed as a phase of the total design contract (see Part 505). Soil mechanics testing facilities may also use engineering services contracts with commercial geotechnical facilities to supplement their own forces, redistribute peak workloads, and provide more efficient operation. Testing by non-NRCS facilities must be reviewed and checked for accuracy and proper procedures by NRCS engineers with soil engineering expertise.

C. NRCS soil mechanics testing services are provided through the National Design, Construction, and Soil Mechanics Centers-Soil Mechanics Laboratories (NDCSMC-SM) in Lincoln, NE. The center has two testing laboratories available to perform the testing services: the main laboratory located in Lincoln, NE, serves all the States in the West Region, northern States in the Central Region, and northern States in the East Region; a satellite laboratory in Fort Worth, TX, serves the southern States in the Central and East Regions. Figure 533-B1 shows which laboratory services each State.

Figure 533-B1: Laboratory Facility Service Location

State	Laboratory Service Location		State	Laboratory Service Location
Alabama	Fort Worth, TX		Nevada	Lincoln, NE
Alaska	Lincoln, NE		New Hampshire	Lincoln, NE
Arizona	Lincoln, NE		New Jersey	Lincoln, NE
Arkansas	Fort Worth, TX		New Mexico	Lincoln, NE
California	Lincoln, NE		New York	Lincoln, NE
Colorado	Lincoln, NE		North Carolina	Fort Worth, TX
Connecticut	Lincoln, NE		North Dakota	Lincoln, NE
Delaware	Lincoln, NE		Ohio	Lincoln, NE
Florida	Fort Worth, TX		Oklahoma	Fort Worth, TX
Georgia	Fort Worth, TX		Oregon	Lincoln, NE
Hawaii	Lincoln, NE		Pennsylvania	Lincoln, NE

Idaho	Lincoln, NE		Rhode Island	Lincoln, NE
Illinois	Lincoln, NE		South Carolina	Fort Worth, TX
Indiana	Lincoln, NE		South Dakota	Lincoln, NE
Iowa	Lincoln, NE		Tennessee	Fort Worth, TX
Kansas	Lincoln, NE		Texas	Fort Worth, TX
Kentucky	Lincoln, NE		Utah	Lincoln, NE
Louisiana	Fort Worth, TX		Vermont	Lincoln, NE
Maine	Lincoln, NE		Virginia	Lincoln, NE
Maryland	Lincoln, NE		Washington	Lincoln, NE
Massachusetts	Lincoln, NE		West Virginia	Lincoln, NE
Michigan	Lincoln, NE		Wisconsin	Lincoln, NE
Minnesota	Lincoln, NE		Wyoming	Lincoln, NE
Mississippi	Fort Worth, TX		Pacific Basin	Lincoln, NE
Missouri	Lincoln, NE		Puerto Rico	Fort Worth, TX
Montana	Lincoln, NE		U.S. Virgin Islands	Fort Worth, TX
Nebraska	Lincoln, NE			

D. Both facilities have the equipment and personnel to run all tests routinely required for NRCS work. The testing laboratories are technically managed under one codirector and assist each other by providing testing services during peak workload periods, when special testing is required, and other activities as their resources permit.

E. NRCS laboratory testing is accomplished on a first-come, first-served basis. Testing services may be requested by letter, fax, or electronic mail. More detailed directions, including information on sample size, shipping information, sample list form, and the testing request form can be downloaded from the centers' Web site. The request must include the name and address of sender, name of site or project, financial project code, name of watershed or location, type of project and brief description, list of samples and type (disturbed or undisturbed), hazard class (for dams), testing requested, and other pertinent information. States are not charged directly for testing services or assistance.

F. If the NDCSMC-SM laboratories are to perform engineering analyses, samples submitted must be accompanied by geologic and engineering reports commensurate with the complexity of the structure. The reports must be submitted to the head of the testing laboratory by the SCE or others with delegated authority from the SCE.

G. The engineering report must include the preliminary design and other information required for setting up a testing program, establishing testing pressures, rates, and other details for completing soil tests. The report must also explain the purpose for which samples were obtained, the potential use of the soil represented by the samples, and the expected use for the test results.

H. The SCE must maintain close contact with the testing facility on needed changes in the testing program as it progresses. On jobs requiring design assistance from other engineering staffs or teams, the SCE will keep that staff informed of any proposed changes in the testing.

I. The testing facility will submit a report to the SCE that includes all requested test data and a narrative giving details of the testing work, soil classifications, descriptions of soils, condition of samples, and observed test performances.

J. Soil mechanics testing standards must be established by the Director, Conservation Engineering Division (CED). Inspection of NRCS soil mechanics testing facilities that are national, regional, or multistate in scope are under the direction of the director of CED. The codirector of the NDCSMC laboratories directs the inspection of State soil mechanics testing facilities and other soil mechanics testing facilities under contract or agreement with NRCS.

K. NRCS soil mechanics testing facilities that receive soil samples from areas where quarantine regulations are imposed must comply with the requirements of the Animal and Plant Health Inspection Service for receiving and disposing of soil samples. Each facility must obtain a permit for receiving these samples. Requirements for taking and shipping soil samples under quarantine regulations are included in Part 531, Subpart A, Geologic Investigations, Sections 531.2(F) and (G).

533.13 Soil Engineering Analyses

A. Soil engineering analyses must be made by the engineer closest to the field who has the necessary expertise and training. If possible, this work is done concurrently with other design work.

(1) One staff engineer must be designated to provide soil engineering leadership in each State that has a significant earth dam or other activity requiring soil engineering expertise. This engineer must be trained in soil engineering principles. Engineers with specialized training and broad experience are usually required to make judgments and analyses for structures that require extensive soil engineering expertise, such as large earth dams and foundations with complex conditions.

(2) States that do not have the necessary expertise can obtain this assistance from another State within their region, a multistate design staff, an outside source, or NDCSMC staff.

B. Each SCE must evaluate workload and staff capabilities regarding soil engineering expertise, and develop an operational plan that defines the scope of assistance or staffing needed and the training

required.

C. If soil engineering analyses by the NDCSMC laboratories are requested in conjunction with the soil mechanics testing, the SCE will arrange for the assistance and analyses (see Section 533.13(A)). The engineer responsible for the analyses must participate in the soil engineering phases of investigation, soil testing, design, and soil-related problems during construction.

D. The soils engineering analyses report must be provided to the SCE documenting site conditions, preliminary design assumptions, engineering properties of soils used in the analyses, and other factors pertinent to the design and construction of the works of improvement. Appropriate recommendations for design features must be included.

E. If site investigations, sampling, testing, or soil engineering analyses are carried out by local sponsoring agencies or consultants, the SCE must see that the work is reviewed by NRCS personnel that have the necessary expertise. States that regularly request soil engineering assistance from another State on designs completed by in-State NRCS personnel must also obtain that State's assistance on preparing contracts and reviewing soil engineering work completed by local sponsoring agencies or consultants.

533.14 National Benefit Activities

A. The NDCSMC laboratories provides assistance to CED for a variety of activities of national benefit, including the following:

(1) Training engineers and geologists in soil mechanics. This includes short-term staff position assignments.
(2) Developing or refining new or specialized testing techniques and equipment.
(3) Developing technical references in soil mechanics.
(4) Maintaining a testing database and preparing correlations for design reference.
(5) Laboratory testing for correlation of test results.
(6) Investigating behavior and performance of soil as related to engineering use.

B. The Director, CED, and the codirector of the NDCSMC in Lincoln, NE, will jointly develop annual and long-range plans of the kinds of activities that can be accomplished and the priorities of national benefit work.

Subpart C - Engineering Interpretations of Soil Surveys

533.20 General

Soil scientists oversee engineering interpretations and for complete the engineering sections of soil survey reports and other forms and documents in connection with the National Cooperative Soil Survey. These interpretations, reports, and narrative sections must be made by or with the assistance of technical staff personnel.

533.21 Scope

A. This policy establishes the role of engineers and engineering geologists in soil survey activities.

B. The policies, guidelines, and procedures relating to soil survey work are in GM-430, Part 402.

533.22 Engineering Responsibilities

A. Engineers and geologists must assist in soil survey engineering interpretations. They must participate fully in decisions on the following:

(1) Whether engineering interpretations are to be made for a given use.
(2) Criteria and guides for making soil engineering interpretations for specific uses.
(3) The quality of soil engineering interpretations for published soil surveys, special reports, or special planning efforts.
(4) The method of presentation of data dealing with interpretations and narrative reports on engineering uses of soil.
(5) Training of soil scientists and engineers to make engineering interpretations.

B. Engineers and geologists must participate in making soil potential ratings. They assist in determining realistic corrective measures, costs, and continuing limitations for agricultural uses that require engineering practices. For nonagricultural uses, experts from outside NRCS must be invited to participate in determining corrective measures, costs, and continuing limitations, with final acceptance by NRCS engineers. Engineers determine if adequate data are being used to determine soil potential ratings. If certain soils are not normally used for the purpose being rated, the outside experts may need to complete more investigations and engineering testing to determine the types of corrective measures that are appropriate. NRCS engineers and geologists act as advisors to personnel responsible for providing leadership in making soil potential ratings. In this advisory capacity, they assist in the work, make recommendations, and point out deficiencies or incorrect procedures.

C. Directors from the Conservation Engineering Division and the Soil Survey Division must work jointly to develop guidelines and criteria for soil survey work that requires engineering interpretations. All engineering interpretation work for soil surveys must be prepared in accordance with established guidelines and criteria.

D. The State Conservation Engineer assists in engineering interpretation work for soil survey activities in the State and must work closely with the responsible soil scientist. This authority may be delegated to a staff engineer who has been assigned leadership in soil engineering or to a geologist or field engineer with sufficient training and experience.

E. Engineers and geologists should keep informed on the development and use of engineering interpretations for soil surveys. Engineering training programs must include appropriate instruction.

Part 535 - Landscape Architecture

535.0 General

NRCS conservation and project work results in apparent and permanent changes to the landscape across the United States on millions of acres. On a national scale, the public need for conservation of landscape resources becomes more important as development, population, and management pressures increase. In recent years, legislation has recognized the public need for landscape resource conservation. The National Environmental Policy Act, the Soil and Water Resources Conservation Act, and the Surface Mining Control and Reclamation Act require NRCS to consider and mitigate landscape resources.

535.1 Scope

A. NRCS policy is to maintain or enhance the landscape resource—a composite of the ecological, social, and aesthetic attributes of the landscape and a determination of how people use and value the landscape. NRCS must also abide by legislative intent and meet the public need. This commitment is accomplished by maintaining leadership in conservation technology and dealing with landscape resources in all conservation activities.

B. The objective of landscape architecture is to provide the technical procedures, training guidance, and management tools to conserve or rehabilitate the landscape resource in all programs, projects, and activities through conservation technical assistance.

C. The basic principles of landscape architecture are to be applied as an integral part of all engineering work. They must be considered early in planning and continued through design, construction, operation, and maintenance to ensure safe, appropriate, cost effective, functional, and efficient results.

535.2 Definitions

A. Landscape Architecture.—The science of planning and designing the landscape for sustainable use and the conservation of landscape resources. It is an integrating discipline that links biophysical sciences, engineering, and sociopolitical sciences into holistic site and landscape scale designs. Landscape architecture evaluates traits, patterns, and structure of geographic areas, including the biological and physical characteristics and its social and economic relationships.

B. Ecological Attributes.—The functions of the landscape in sustaining life cycle processes.

C. Social Attributes.—The use of the landscape for economic, functional, and cultural purposes.

D. Aesthetic Attributes.—The classifiable appearance of a landscape.

535.3 NRCS Technical Assistance for Landscape Architecture

A. Landscape resource planning procedures must be performed in accordance with Technical Release Number 65, "Procedure to Establish Landscape Resource Priorities."

B. Landscape resource factors must receive equal consideration with other factors in conservation work.

C. NRCS landscape architects, or the landscape architectural services of private firms or individuals, must be used for both planning and design. Sponsors and governmental or educational institutions that have specialized landscape resource planning capabilities may also be used.

D. A landscape resource planning procedure, as detailed in Technical Release Number 65, must be performed on all proposed conservation work to inventory and assess landscape condition, use and perception by people, and potential project impacts. The need for further investigations may also be determined.

E. If additional assessments are necessary, procedures for making detailed landscape architectural investigations must be provided by the State, technical center, or national landscape architect. The State Conservation Engineer may also provide guidance on procuring landscape architectural services.

F. Other inventories, investigations, and studies of the landscape resource may be required in special situations. Guidance for these special studies is to be provided by the national landscape architect.

Part 536 - Structural Engineering

536.0 General

Structural engineering assistance is provided in a variety of applications. In many cases, structures serve a similar purpose, thus making the size range of the structural components limited. In other cases, structures require complex, site-specific designs.

536.1 to 536.9 Reserved

536.10 Method

A. The method selected for the analysis and design of structures must be based on a systematic and comprehensive evaluation of the structural functions expected during the design life. Consideration must be given to the structural resiliency, redundancy, robustness, durability, and sustainability.

B. The structural design method must include an evaluation of the following: function, operation, loading, stability analysis, structural analysis, and material criteria. In practice, the structural design will typically involve an iterative evaluation of each of these elements.

536.11 Function

All structure functions, whether intended or not, must be considered in the structural design evaluation. Functions typically include all the operational structure conditions for each external condition imposed on the structure. The designer must consider structure conditions imposed during construction, normal operations, extreme events, and maintenance activities.

536.12 Loads

A. All anticipated loads and load combinations must be considered in the design of a structure. Such loads may include wind, snow, hydraulic, earth, occupancy, vehicular, equipment, and seismic.

B. Standard loads and load combinations must be used whenever possible. NRCS practice standards and references provide minimum required loads for the design of many structures. In many jurisdictions, minimum loads and load combinations are mandated by building codes such as the International Building Code. In the absence of a required building code, the current American Society of Civil Engineers (ASCE) standard, ASCE 7, Minimum Design Loads for Buildings and Other Structures, must be used to develop design loads and load combinations.

536.13 to 536.19 Reserved

536.20 Design Criteria for Reinforced Concrete

A. The structural design of reinforced concrete structures is commonly guided by the American Concrete Institute (ACI) Standard, Building Code Requirements for Structural Concrete (ACI 3l8). The ACI 318 code covers the design and construction of structural concrete buildings. The ACI 318 code provides minimum requirements and contains several precautions about special attention needed when corrosive environments or other severe exposure conditions exist, such as liquid-tight tanks. NRCS uses reinforced concrete in hydraulic structures for components of water resource, environmental, hydraulic, and irrigation projects. These structures are often subject to severe exposure. Because of the type of structure usually involved, design must often exceed the minimums required by building codes, such as ACI 318. Therefore components of water resource, environmental, hydraulic, and irrigation projects must be designed to meet the requirements of the current ACI 350, Code Requirements for Environmental Concrete Structures, as a minimum.

B. Concrete is to be designated by class. The class corresponds to the compressive strength assumed in the design and specified in construction. The class selected for use is determined by evaluating the requirements for strength and durability. The availability of materials and construction quality control must also be recognized in making the determination. The strength values normally used are 2,500, 3,000, 4,000, 4,500, and 5,000 pounds per square inch (psi).

C. With one exception contained in the criteria for agriculture waste storage structures, structural design in reinforced concrete may be carried out by either strength design or working stress design methods.

(1) For agriculture waste storage structures, design must be in accordance with Practice Standard 313, Waste Storage Structure, contained in Title 450, National Handbook of Conservation Practices (NHCP).
(2) For Service hydraulic structures, the design yield strength, fy, is to be taken as 60 psi for Grade 60 steel. The design should meet the requirements of ACI 350 with a maximum flexural stress of 20 ksi under unfactored loads. Additionally, the effective load factor, which includes the environmental durability factor and load factors, must be 2.7 and the maximum steel ratio must be based on 0.546 ρbal.
(3) The only exception to this general requirement is for a special design at critical locations where higher yield strengths will reduce excessive congestion of reinforcement and the potential

for accelerated deterioration due to increased flexural cracking is acceptable.

(i) The strength design method must be in accordance with the requirements of ACI 350, as supplemented by Technical Release No. 67, Reinforced Concrete Strength Design.

(ii) The working stress design method must be in accordance with requirements of ACI 350-06, Appendix I, Alternate Design Method, as supplemented by Section 6, Structural Design, Subsection 4, Reinforced Concrete.

(4) For other structures—in uncontrolled environments—that are exposed to flowing water or are impounding water or other nonhazardous liquids, the design yield strength, fy, should be based on 60 ksi for Grade 60 steel. The design should have a maximum flexural stress of 36 ksi under unfactored loads. The maximum steel ratio, ρmax, should be based on 0.3 ρbal. The load factors and strength reduction factors should be in accordance with the current ACI 318 or ACI 350. If ACI 350 is used, the environmental durability factor must be 1.0.

(i) The strength design method is to be in accordance with the requirements of the current ACI 318 as supplemented by Technical Release No. 67, Reinforced Concrete Strength Design, except that temperature and shrinkage steel may be in accordance with current ACI Standard, Building Code Requirements for Reinforced Concrete (ACI 318).

(ii) The working stress design method must be in accordance with the current ACI Standard, Code Requirements for Environmental Engineering Concrete Structures (ACI 350), Appendix I, Alternate Design Method, except that the allowable extreme fiber stress in compression is to be fc = 0.45 f'c and the distribution of flexural reinforcement must be in accordance with Section 10.6 of the current ACI 350. The z-factor is no longer an acceptable method for controlling flexural crack widths for reinforced concrete structures exposed to liquids. As is the case for strength design, the maximum allowable flexural steel stress is 36 ksi for unfactored loads.

(5) For other structures—in controlled environments—that are not exposed to flowing liquids, are not impounding liquids, and do not serve as secondary or primary containment of hazardous wastes, design must be in accordance with the current ACI Standard, Building Code Requirements for Structural Concrete (ACI 318).

D. The following additional criteria must be used in the design of service hydraulic structures:

(1) Reinforcing steel is required in both faces and in both (orthogonal) directions in all concrete slabs and walls, except that only one grid of reinforcing steel is required in—

(i) Concrete linings of trapezoidal channels.

(ii) Structures of Job Class V or less, as defined in Section 501.4, if authorized by the State conservation engineer (SCE). If authorized by the SCE under this exception, a single grid of steel reinforcement is permitted in walls having a maximum thickness of 8 inches, provided the steel is positioned approximately in the middle of the wall, wall steel is anchored in the slab in accordance with current ACI 318 or ACI 350, and strength and durability requirements are satisfied.

(2) Redistribution of moments in continuous members is not permitted in any case.

536.21 to 536.29 Reserved

536.30 Design Criteria for Steel Structures

Design of steel structures must comply with the applicable provisions of the current American Institute of Steel Construction, Steel Construction Manual. The preferred methodology is Load and Resistance Factor Design (LRFD) for structural steel design. An additional requirement for structural steel structures and elements of hydraulic structures:

A. A reliability factor of 0.85 must be applied to the strength reduction factors.

B. Load factors and load combinations must be based on the current ASCE Minimum Design Loads for Buildings and Other Structures (ASCE 7).

536.31 to 536.39 Reserved

536.40 Design Criteria for Wood Structures

A. Design of wood structures must comply with the applicable provisions of the current American Forest and Paper Association national design specification for wood construction.

B. Structural loads, including loads due to wind and seismic forces, must be incorporated into the design of wood structures, in accordance with applicable provisions of the current ASCE Minimum Design Loads for Buildings and Other Structures (ASCE 7).

536.41 to 536.49 Reserved

536.50 Design Criteria for Masonry Structures

Design of masonry structures must comply with the applicable provisions of the current ACI Building Code Requirements for Masonry Structures (ACI 530).

536.51 to 536.59 Reserved

536.60 Design Criteria for Bridges

Vehicle and pedestrian bridges must be designed in accordance with the current American Association of State Highway and Transportation Official LRFD bridge design specifications.

536.61 to 536.69 Reserved

536.70 Standard Drawings

A. Developing a series of construction drawings for frequently used structural components is an efficient way of providing technical assistance. The use of standard detail drawings based on conservative design assumptions to permit adapting to widely varying site conditions usually does not significantly affect the total construction cost.

B. Standards of quality for engineering structures are established in structural detail drawings for construction plans. One of the ways the general quality of NRCS construction can be maintained in a uniform manner and at an acceptable level is through the development and use of standard detail drawings.

536.71 Standard Detail Drawings

A. Standard detail drawings are detailed construction drawings according to standardized design assumptions. The design assumptions must be selected so that the design and detail drawings for structures, spillways, and appurtenances will provide for the requirements of many sites.

B. Standard detail drawings are essentially complete and are used directly in preparing construction drawings for contract purposes. They must be complete in construction or fabrication detail.

C. The structures in the drawings must be designed to perform satisfactorily within the range of conditions assumed in their development. The assumed range of conditions must be indicated in reference drawings, handbooks, technical releases, or design notes. Include design assumptions, design loads, material strengths, and notes on material quality on the drawings.

D. Portions of the drawings may provide for changes in size or length and thus require some additions for completion. These changes must not affect the performance capability of the structure and must be considered in the design. The provisions for these adaptations must be incorporated into the drawings to facilitate their use. By including provisions for such adaptations, the coverage of a range of sizes may be completed with fewer drawings.

E. Each standard detail drawing must be supported by design notes, computations, drawings, sketches, and other data. It must be recorded and organized in a folder in a manner that allows reproduction and incorporation into a design folder (see Sections 511.10 and 511.11(A)) for the entire job.

536.72 Use of Standard Detail Drawings

A. Standard detail drawings are used when appropriate during the development of construction plans. The designer analyzes the site conditions, structure function, and hydraulic and structural requirements; examines the applicability of a standard detail drawing; and includes in the design notes the verification for the selection of a standard detail drawing or, if conditions differ significantly, the need for a special design.

B. The approving engineer determines the appropriate use of standard detail drawings by considering—

(1) Acceptability of performance.
(2) Overall efficiency of design preparation and installation costs.
(3) Risk of making errors during extensive modifications.

C. Standard detail drawings are not to be developed by the State office if drawings are available at the national level for the same size and kind of structure, component, or appurtenance.

536.73 Adaptation of Standard Detail Drawings

A. It is sometimes necessary to make additions to standard detail drawings by including reference-drawing numbers, notes, or details to minimize construction error. These additions usually should not affect the hydraulic or structural performance as originally designed.

B. If an adaptation of the standard detail drawing affects the hydraulic or structural performance of the original design, document the effects if the adaptation by amending the original design notes and computation from the drawing and incorporating the amendments into the design folder for the entire job. This documentation must include the new or differing design assumptions, the adaptations and modifications, the effect of the modification on the original design assumptions, and the analysis and design of the structure to ensure adequate performance.

536.74 Revision of Standard Detail Drawings

Standard detail drawings need periodic review and revision to meet current design needs and to be

compatible with current construction practices. The use of the drawings provides for such a review. Identified errors and suggestions for improvement must be forwarded to the office responsible for preparing the drawing.

536.75 Availability of Standard Detail Drawings to the Public

A. The Freedom of Information Act requires that copies of standard detail drawings be available to the public on demand. Copies of drawings must be provided when requested, in accordance with the procedures in Title 120, General Manual (GM), Part 408, Subpart C.

B. Each drawing provided must include the following information:

(1) A precautionary statement: "STANDARDIZED DESIGNS – Must be Adapted to the Specific Site."
(2) The material design strength and quality assumptions.
(3) The site conditions assumed in the design.
(4) The name and address of the office in which the folder containing the design notes and computations is available.

536.76 National Standard Detail Drawings

A. Standard detail drawings are prepared for structures, spillways, and appurtenances. These drawings are prepared according to hydraulic and structural design criteria in Title 210, National Engineering Handbook (NEH); technical releases; or design notes. The drawings are prepared to permit direct use without any significant change.

B. The drawings may be prepared as a series to provide the range of sizes frequently needed. The kind of structure and range of sizes is to be determined by the Director, Conservation Engineering Division (CED).

C. Drawings are available to the State design offices for use in preparing plans for specific structures. TIFF format electronic copies of the detail drawings are to be requested only as needed for each job. The original drawings must be kept on file at the Conservation Engineering Division. Indexes of available standard detail drawings are in Design Note 18.

536.77 NDCSMC Standard Detail Drawings

A. As approved by the Director, CED, standard detail drawings must be prepared for structures and appurtenances that would be usable by more than one State. These drawings are to be complementary and supplementary to those provided nationally (i.e., not replaced in kind). The drawings are to be prepared as requested by State offices or initiated by the co-director of the National Design, Construction, and Soil Mechanic Center (NDCSMC) staff to meet a common need.

B. The folder containing the design notes and computations made during the preparation of standard detail drawings must be kept on file for reference as long as the drawings are available.

536.78 State Standard Detail Drawings

A. Standard detail drawings are only prepared for structural appurtenances and details that are frequently used and for which such drawings are not available nationally or through the NDCSMC. The design supporting the drawings must be in accordance with all NRCS design procedures, criteria, and materials specifications. The quality of drafting must be in accordance with Part 541. Standard detail drawings are not to be prepared to duplicate the kind or size of either the national or the NDCSMC drawings or to be equivalent to them in purpose and function.

B. The folder containing the design notes and computations made during the preparation of these drawings must be kept on file for reference as long as the drawings are available.

C. A current index of standard detail drawings prepared by a State must be maintained by that State.

D. The index of State standard detail drawings must contain the following:

(1) Name or type of structure, structure element, or appurtenance
(2) State responsible for the design
(3) Data of design
(4) Location of folder containing design notes and computations
(5) Types of materials used in the structure or element, size ranges, general application, and significant limiting assumptions

E. The SCE should review all standard drawings as part of the design review before approval is given. This may require the SCE to request the design folder with the design notes and computations that support the standard drawing from the State that developed the standard drawing.

F. The use of State standard detail drawings in Class VI or VII jobs is allowed as long as the proper design review process is followed as outlined in, Part 501, Subpart A, Review and Approval, Section 501.4.

536.79 Standard Detail Drawings Prepared by Non-NRCS Engineers

A. Standard detail drawings are prepared by other engineering organizations, vendors, or fabricators. The drawings are for structures and structural elements or appurtenances frequently used in construction drawings for conservation practices and systems but not portrayed in SCS standard detail drawings. The design documentation supporting the drawings and the materials used in the structures or appurtenances must meet minimum NRCS criteria and should be of professional quality.

B. A folder of design notes and computations must be completed during the design and preparation of the drawing. The folder must be prepared professionally and be of professional quality. The folder must be kept on file for reference as long as the drawing is available for use.

C. The SCE must review and concur in any use of standard detail drawings prepared by non-NRCS engineers. In conducting the review, the SCE may request assistance from the NDCSMC. Such requests must be accompanied by documentation indicating the frequency of use and an estimate of the regional application of the drawing. All drawings must be accompanied by a folder containing design notes and computations.

D. Use of standard detail drawings prepared by non-NRCS engineers in Job Class VI or VII jobs is allowed as long as the proper design review process is followed as outlined in Part 501, Subpart A, Review and Approval, Section 501.4.

E. An index of currently use standard detail drawings used in the State and prepared by non-NRCS engineers must be maintained by the SCE.

F. The State's index of standard detail drawings prepared by non-NRCS engineers must contain the following information:

(1) Name and type of structure, structural element, or appurtenance
(2) Name and address of designer
(3) Name and address of the vendor, distributor, or fabricator
(4) Identifying name and number of the drawing
(5) Date of original design and all revisions
(6) Location of the folder containing design notes and computations
(7) Type of materials used in the structure or element, size ranges, general application, and significant limiting assumptions

G. The SCE should review the consolidated index and, as appropriate, request from the State, vendor, or fabricator a copy of the desired standard detail drawing. When a standard detail drawing so obtained is to be used, the SCE must obtain a copy of the folder containing the design notes and computations, including design assumptions that identify the limitations for use of the structure or elements.

§IA536.78 State Standard Detail Drawings

F. Iowa Standard Drawings

(1) Iowa standard drawings and standard details shall be used to the maximum extent possible to facilitate the consistent and efficient production of construction plans.
(2) The official version of all Iowa standard drawings and standard details shall be posted on the Iowa NRCS website or other NRCS sponsored sources such as the eFOTG.
(3) All standard drawings, whether used individually or as part of a set of plans, shall be reviewed and approved as per §536.70-79. If a standard drawing or standard detail is changed from its original design, the approval to continue use of the altered drawing or detail as a standard must be obtained from the State Conservation Engineer.
(4) Iowa standard drawings shall be categorized by the practice grouping and four digit drawing number(s). Each standard drawing will have an individual drawing name, four digit number, and a revision or approval date. The drawing categories and associated number ranges are defined in Table 1 below:

Table 1. Iowa Standard Drawing Organizational Chart

Drawing Category / Practice Groupings	Contents	Number Range
General Drawings	Template drawings for cover page, title sheets, plan views, cross-sections, etc.	1000 – 1099
Dams, Ponds, and Other Water Detention Structures	All water detention structures and appurtenances	1100 – 1299
Wetlands	Wetland structures and practices	1300 – 1399
In-Channel Structures	Grade stabilization structures, channel crossings, stream bank stabilization structures, etc.	1400 – 1499
Erosion and Water Management Practices	Common erosion control practices (i.e.: terrace, grassed waterway, underground outlet, etc.)	1500 – 1599
Waste Management Structures	Manure storage structures and manure management structural practices	1600 – 1799
Other Livestock	Livestock related structures (i.e.: watering facilities, roof structures, pipelines, etc.)	1800 – 1899
Miscellaneous Drawings	Other drawings (i.e.: fence, irrigation, etc.)	1900 – 1999

(5) Technical errors or deficiencies found on an Iowa standard drawing shall be reported to the State Conservation Engineer immediately.
(6) Requests for new standard drawings or the use of NRCS standard drawings from other states shall be made to the State Conservation Engineer.

Part 540 - Field Surveys

540.0 General

Concise, accurate, and legible engineering notes are necessary to document planning, design, and construction. They provide the basis for expenditure of Federal and other funds for conservation installations. The Title 210, National Engineering Handbook (NEH), Part 650, Chapter 1, "Engineering Surveys," provide the recommended format for engineering notes and related staking.

540.1 Responsibility

A. All surveys and surveyor qualifications must comply with local and State regulations, as applicable.

B. The information from basic staking of earthwork normally becomes the basis for measurement of payment quantities. Therefore, basic staking must be performed by NRCS, an architect-engineer (A-E), the local contracting organization, the owner, or the contractor as described within the appropriate construction contracts, grants, or agreements.

540.2 Format

Each State Conservation Engineer (SCE) is to establish the format and minimum requirements for engineering note keeping based on the NEH. Engineering records are to be uniform to simplify training, improve clarity and overall efficiency, and allow consistency if personnel change through the course of a project. If local contracting organizations elect to use their own engineering staffs or if consulting engineers or other qualified persons, such as licensed surveyors, perform the survey, note keeping must be of comparable quality and similar content to the sample format in the NEH. When using electronic data collection systems to record survey data, the SCE must develop a method to provide hard copy documentation of the recorded data.

A. For Class V - VIII jobs and work performed by Federal or local contract:

(1) Bound field notebooks must be used to record engineering surveys and notes when electronic data collection systems are not used.
(2) When electronic data collection systems are used to record the engineering surveys, an unaltered hardcopy of the survey data must be downloaded from the data collector and permanently filed with the bound field notebook, which contains other important project survey information for that project. A copy must also be kept with the contract files.

B. Loose-leaf notebooks, special forms, or hard copies of downloaded electronic data may be used for recording engineering surveys, notes, and design data for onfarm conservation practices (Class I - V jobs) such as ponds, terraces, diversions, waterways, and animal waste management facilities. The documentation for the engineering surveys for conservation practices must provide the minimum information as outlined in the NEH.

540.3 Precision and Accuracy

The required precision and accuracy of each survey will vary with its purpose; therefore, each SCE must establish the minimum requirements for precision and accuracy within the framework outlined in the NEH.

540.4 Staking

A. Basic Stakes.—Basic staking is defined as alignment and grade stakes for structures other than embankments and channels. For channels and embankments, basic staking includes alignment and grade stakes plus slope stakes at the normal interval for the work. Normal interval is 100-foot stations on tangents and may decrease to as little as 25 feet on sharp curves. When construction pay quantities are determined from basic staking, a fair and equitable description of the ground surface is needed for the calculation of performance quantities.

B. Construction Stakes.—Additional stakes necessary for forming the structure, constructing the slopes of embankments above the slope stakes, or constructing the sides of channels below the slope stakes or between stations are "construction" stakes. They are the responsibility of the construction contractor.

540.5 Contractor Surveys

Contractor surveys are applicable to construction contracts and conservation operations that require the contractor to provide basic staking, quantity surveys, measurements, and computations for progress payments. When authorized, contractors will provide original and final surveys for final quantity determinations. Use 210-NEH, Part 642, Specifications for Construction Contracts, must be used to provide contract requirements for contractor surveys. Surveys completed under conservation operations must follow the requirements of 210-NEH, Part 650, Chapter 1, "Engineering Surveys." Primary controls, which include items such as baselines, control points, and bench marks, must be sufficiently defined to allow the contractor to perform the required surveys.

540.6 Checking

NRCS employees or individuals under contract with NRCS must conduct quality assurance checking. Checking includes a visual review of survey markings, notes, and random surveys to check for accuracy.

§IA540.3 Precision and Accuracy

A. Surveys shall be completed within the precision and accuracy requirements as shown in the specific practice Statement of Work. If a practice Statement of Work is not clear as to the accuracy required for the survey data, the Area Engineer will make that determination.

Part 541 - Drafting and Drawings

541.0 General

A. Engineering designs are normally described, displayed, and documented with construction drawings. These drawings provide details of the location, content, and dimensions of the components needed to complete the work.

B. Drawings need to communicate information clearly and effectively among designers, reviewers, owners, and contractors at different locations. This requires uniformity and consistency in drawing layout and style.

C. Drawings reflect the professional quality of NRCS engineering services to the owner, contractor, and general public. Drawings must be legible, accurate, complete, and have a consistent appearance throughout the agency.

541.1 Media

A. Drawings can be developed by manual drafting techniques, computer aided design (CAD) methods, or both.

B. Paper is appropriate for most NRCS conservation work. More durable media, such as vellum or mylar, should be considered for standard drawings that will be reused repeatedly, or for drawings that need to be retained for many years.

C. CAD files should be saved on media appropriate for the retention period shown in the NRCS Records Management Guide. Permanent record files should be upgraded to newer, more durable media as technology evolves.

541.2 Sheet Size

A. Drawing sheet size should be appropriate for presentation of required information in a neat and uncluttered manner.

B. Standard sheet sizes for NRCS work are as follows:

(1) Full Size.—22 inches by 34 inches (American National Standards Institute (ANSI) D size)
(2) Half Size.—11 inches by 17 inches (ANSI B size)
(3) Page Size.—8.5 inches by 11 inches (ANSI A size)

C. Normally, full-size sheets should be used for projects involving large land areas or complex structures. Half-size sheets should be used for smaller, simpler work. Page-size sheets should be limited to simple details.

D. Other-size paper may be used for NRCS work if necessary due to local paper supply availability or special plotting, copying, or reproduction equipment limitations.

541.3 Title Blocks

A. Each sheet in a set of construction drawings must have a title block to identify the drawing and provide other information about the drawing. Location data, including State, county, township, section, or similar information, must be included in each title block.

B. Full- and half-size drawing sheets must have a vertical title block on the right side of the sheet. Page-size sheets must have horizontal title blocks across the bottom of the sheet.

C. The standard title blocks for NRCS work shown in Sections 541.7 through 541.10 must be used for all new drawings or drawing forms prepared by NRCS.

D. Alternative title blocks may be used or added for work prepared by other agencies, local organizations, or private firms. Such alternate title blocks must contain at least the same drawing identity and other information as contained on the NRCS standard title block.

541.4 Cover Sheet

A. Each set of construction drawings consisting of more than five sheets must have a cover sheet showing the name and location of the project, the names of the sponsoring agencies or owners, an index of the drawings, space for approval signatures, and professional seals, as appropriate.

B. The cover sheet for major, long-lasting NRCS work, such as dams and channels, may also include a location map, general notes, and project data.

541.5 Orientation

A. Maps should be drawn with north toward the top of the sheet. If this orientation is not feasible, the map should be drawn with north toward the left. A north arrow must be shown on all maps.

B. Layout drawings (plan view) should be drawn so that the direction of flow is from left to right or bottom to top of the sheet. A north arrow and flow arrow indicating direction of flow must be shown.

C. Cross section and elevation views of structures representing surfaces essentially parallel to the direction of the stream flow should be drawn so that flow is from left to right.

D. Cross section and elevation views representing surfaces essentially normal to flow should be drawn so that they are viewed looking downstream. If such orientation makes the drawing unclear, it may be changed and the orientation labeled on the drawing; for example, orientation could be labeled as "Looking Upstream."

E. Stationing on open channels can be stationed upstream or downstream, depending on local practice, design software, or existing drawings.

F. Multiple cross sections on a sheet should be arranged sequentially, according to stationing.

G. Orientation of views and directions of stationing must be consistent throughout the drawing set.

541.6 Style and Content

A. Drawings should present as much related information as reasonable on the same sheet for efficiency and clarity. If possible, details should be drawn on the same sheet as the work to which they apply. If details are shown on a separate sheet, appropriate sheet references must be noted. Dimensions and sizes of components should be shown on the drawings rather than referenced to the specifications.

B. Drawings must follow agency and industry standards for content, appearance, details, and symbols to best communicate requirements to reviewers, contractors, and the building trades. Standards include the following:

(1) American Concrete Institute (ACI)
  (i) ACI 315 – Details and Detailing of Concrete Reinforcement
  (ii) ACI 315R – Manual of Engineering and Placing Drawings for Reinforced Concrete Structures
(2) American Institute of Steel Construction (AISC)
  AISC – Manual of Steel Construction
(3) American Society of Mechanical Engineers (ASME)
  ASME Y14.1 to Y14.5 – Drawings, Dimensions, etc.
(4) NRCS
  Title 170, National Digital Geospatial Map Symbols Handbook, Part 601
(5) National Institute of Building Sciences
  U.S. National CAD Standard, Version 2.0

C. Scales for drawings should be selected carefully to assure clarity of details and accommodate reduced-size reproductions. Bar scales are preferred for maps and plan views and are necessary for any drawings that will be reduced for contracting.

D. The minimum scale for structural drawings should be as follows:

(1) One-fourth inch equals one foot for layout sheets.
(2) Three-eighths inch equals one foot for reinforcing steel sheets.
(3) One-half inch equals one foot for any sheets that will be reduced. Drawings that will be reduced must include bar or graphic scales, or each reduced sheet must bear a prominent warning note stating that the drawing is a reduced size and the indicated scales are not accurate.

E. Notes on the drawings should be limited to those required for complete and accurate description of the drawings and those required to supplement the contract specifications.

F. All lines and letters must be clear, sharp, and dense to ensure clear reproductions and one-half scale reductions. Manually drafted letters must be single-stroke type.

G. Drawings should include geographic location information. Routine work should show at least a simple location map containing readily identifiable landmarks. Major work should include structure reference lines and right-of-way limits referenced to fixed and readily identifiable geographical points.

H. Drawings should include geologic and soils information where available. Boring numbers, station and offset of borings, waterline depth and date of waterline, and soil classification at various depths can be displayed on cross section and profile views.

I. Drawings should include survey information (i.e., benchmark location, data and datum used) where available.

541.7 Standard Title Block for ANSI A (8.5x11) Sheet

Click here for a copy of the Standard Title Block for ANSI Sheet

541.8 Standard Title Block for ANSI B (11x17) and ANSI D (22x34) Sheets

Click here for a copy of the Standard Title Block ANSI B and ANSI D Sheets

541.9 Standard ANSI A (8.5x11) Sheet

Click here for a copy of the Standard ANSI A Sheets

541.10 Standard ANSI D (22x34) and ANSI B (11x17) Sheets

Click here for a copy of the Standard ANSI D and ANSI B Sheets

Subpart A - Construction Specifications

542.0 General

A. NRCS uses standard construction specifications as a tool to ensure consistency and efficiency with the many contracts administered through various programs.

B. Specifications are the written portion of the contract documents that covey the requirements for materials, equipment, systems, standards, workmanship for the project, and performance of related services. The national standard specifications must be supplemented for specific projects. The content of the standard specifications will be developed and maintained in a manner that ensures adherence to State laws and NRCS regulations and prevents conflict with other contract provisions. The national specifications can be found in Title 210, National Engineering Handbook (NEH), Part 642, on the eDirectives Web site.

C. Generally, specifications take precedence over the construction drawings in claims or disputes. Equal attention must be given to both when developing suitable site-unique drawings and project-unique specifications.

542.1 Scope

A. Specifications must be developed as outlined in 210-NEH, Part 642, Specifications for Construction Contracts, and incorporated in all contracts prepared for projects that are designed or installed by NRCS. Exceptions may be granted by the State Conservation Engineer (SCE) if the type of work is outside the standard NRCS scope of expertise or due to other concerns. Specifications formats must remain consistent throughout a set of contract documents.

B. Design drawings and specifications must reflect the level of complexity of the project. The responsible engineer or employee determines the adequacy of the drawings and specifications. Responsibility is determined in accordance with the level of engineering approval authority as defined in Part 501.

C. Contracts for NRCS-funded projects designed by others and installed under non-Federal contracts may use specifications other than NRCS construction and material specifications. Sponsoring local organizations that either prepare their own designs or hire architect-engineer (A-E) firms for design are not required to use NRCS standard specifications but are encouraged to do so. Non-NRCS specifications must be compatible with all other provisions in the contract documents and must be equivalent to the NRCS standard specifications such that the completed project achieves similar standards of quality to NRCS construction efforts.

D. Agreements with sponsoring local organizations and contracts with A-E firms for engineering design services must include preparation of construction and material specifications in the appropriate format (see Sections 542.1 (A) and(C)).

542.2 Preparation of Standard Specifications

A. Procedures for preparing specifications for construction contracts are outlined in 210-NEH, Part 642, Chapter 1. National standard specifications for construction are located 210-NEH, Part 642, Specification for Construction Contracts, Chapter 2, and material specifications are in Chapter 3.

B. The national standard specifications must be utilized verbatim, except for the deletion of alternative methods that do not apply to the project as described in 210-NEH, Part 642, Chapter 1.

C. National standard specifications will be revised and issued through the Director, Conservation Engineering Division (CED), and become effective immediately upon posting on the eDirectives Web site.

D. The SCE may adapt the national construction and material specifications to better fit specific State needs.

(1) The national specifications may be adapted if the amended specification is more stringent than the national specification.
(2) If the SCE determines that a less-stringent specification is needed for certain practices within the State, then the amended specification and the circumstances for use must be approved by the Director, CED.

E. The SCE is responsible for the development of any new specifications at the State level. A new specification at the State level is issued as an interim specification with a maximum lifespan of 3 years following the issue date. At the end of an interim specification life, the SCE may allow the specification to expire or request action from the national construction engineer. There are two possible outcomes from requesting action:

(1) If the specification has limited applicability (useful only in one or two States), the specification may be granted permanent status for the State submitting it. Maintenance of the specification will be the responsibility of the SCE.
(2) If the specification is applicable to three or more States, the Director, CED, will evaluate it for inclusion as a national specification. The lifespan of the original interim specification may be

extended until such time as the new national specification is released. State experience and recommendations must be provided if inclusion in the national specifications is requested.

F. Interim specifications may be written to address new technologies or materials. A variance must be requested from the Director, CED, prior to use in any contract documents. For each product or technology, include—

(1) Technical data.
(2) Benefits provided.
(3) References where the product or technology has been used.
(4) Independent laboratory test results, if applicable.
(5) Draft specifications for the product or technology.

G. Variances may be approved on an evaluation basis. The manufacturer or supplier must be willing to be present during installation, as applicable, to ensure recommended procedures are followed. Do not use product or technology names in writing specifications.

542.3 Reference Specifications

A. Reference specifications are those specifications developed and issued by other agencies, associations, societies, or institutes, which are cited in 210-NEH, Parts 642, and Title 450, National Handbook of Conservation Practices (NHCP).

B. The SCE must develop a system to maintain all current reference specifications cited in 210-NEH, Part 642, and the NHCP, as noted in Section 542.40 of this manual, with the exception of American Society for Testing and Materials (ASTM) standards (see Section 542.3(E)).

C. Other NRCS engineering staff members designated by the SCE are to maintain or have direct access to copies of reference specifications as noted in Section 542.40.

D. Reference specifications that are outdated must be removed from the reference file at the time a revised or updated version is received.

E. ASTM standards cited in 210-NEH, Parts 642, and the NHCP are maintained in a national "library" database. The library is updated whenever ASTM reference standards are changed and reflects only the most current standards.

(1) Each SCE can provide two contacts for access to the national ASTM library, or purchase the reference standards from ASTM for the cited standards.
(2) Copies of ASTM standards not on the current index will be available upon request from the National Design, Construction, and Soil Mechanics Center (NDCSMC) in Fort Worth, TX.
(3) If an ASTM standard is available on the library, but an older version is needed, the previous version may be requested from the NDCSMC.
(4) ASTM standards downloaded from the library may not be transmitted electronically, in accordance with the NRCS agreement with ASTM.

F. "As-built" documents and files must contain a list of all of the specific construction contract reference specifications used.

Subpart B - Engineering Services Specifications

542.10 General

Technical assistance may be obtained from other sources for various reasons, including:

(1) Resources are not available to meet commitments; and
(2) Specialty area expertise is not available within the agency.

542.11 Technical Services

A. Technical expertise in differing subject areas may be needed to assist NRCS in meeting program commitments. This assistance would generally be considered in one of the following categories:

(1) Professional services
(2) Architectural and engineering (A&E) services

B. Procurement for the above-listed services must be in accordance with applicable Federal Acquisition Regulations and Department of Agriculture Acquisition Regulations.

C. The contracting officer (CO) is responsible for development of the contract. The State Conservation Engineer (SCE) is responsible for developing the technical requirements for the procurement. The SCE must outline clear and concise requirements for service contracts.

D. The SCE, under the direction of the CO, must develop quality control and quality assurance (QA/QC) plans and contract administration procedures for A&E contracts.

Subpart C - Exhibits

542.20 List of Reference Specifications

A. An index that includes the designation, current issue date, and title of reference specifications (with the exception of American Society for Testing and Materials standards) will be maintained by each State Conservation Engineer (SCE). These are the specifications referenced in Title 210, National Engineering Handbook, Parts 642, and Title 450, National Handbook of Conservation Practices.

B. Each SCE must post a current index of reference specifications electronically so that it is available to all offices and individuals. Alternatively, hardcopies may be provided.

C. Only the most current copy of each reference specification must be used for contract purposes. The reference specification included in the contract is the applicable standard for that project, regardless of whether the reference specification is changed or updated after contract award. The contract may be modified to include the updated reference specification, if needed. Care must be taken to avoid the potential use of obsolete or out-of-date specifications.

D. Reference specifications that may be listed in this section could include but are not limited to the following:

(1) American Association of State Highway and Transportation Officials (AASHTO)
(2) American Society for Testing and Materials (ASTM)
(3) American Concrete Institute (ACI)
(4) American National Standards Institute (ANSI)
(5) American Water Works Association (AWWA)
(6) American Welding Society (AWS)
(7) American Wood Preservers Association
(8) Product standards
(9) Steel Structures Painting Council

Part 543 - Materials

543.0 General

The designer is responsible for the choice of materials used in a design, the coordination of the design, and the material specifications. Materials used in construction must comply with the material specifications.

543.1 Scope

Materials are selected based on a number of factors, including but not limited to quality, project budget, availability, cost, longevity, project economic life, ease of installation and maintenance, life cycle costs, compatibility with site conditions and other materials, and public health and safety. Materials may be those items or products used in either conservation practices or construction specifications. NRCS does not maintain a national approved-products list for construction-related materials, although States may maintain such a list.

543.2 Use of New Materials

A. New materials are those materials that are not specifically identified either in a conservation practice standard or national material specification (Title 210, National Engineering Handbook, Part 642).

B. New materials and products frequently appear on the market. They may be selected for use with a conservation practice or construction project. The objective in selecting a new material is to meet or exceed the physical, cost, or functional characteristics of the currently specified material, including the longevity or design life of the material. If a new material could impact the cost or design life of a structure or practice, then the rationale for its use must be documented for the files.

C. A new material's physical or functional characteristics should meet or exceed those of the standard specified material. The new material should have reference standards directly applicable to it, so the physical characteristics can be verified and quantified. The decisionmaking process should also include verification of the material's or product's past performance and independent laboratory test results. The State Conservation Engineer (SCE) is responsible for the selection, evaluation, and decision to use a new material within the appropriate level of engineering design approval authority. If a new material is proposed for a conservation practice, a variance from the conservation practice standard may need to be requested.

D. New products should be used on an evaluation basis. The manufacturer or supplier should be willing to provide the product and be present during installation to ensure recommended procedures are followed. Upon completion of the practice installation or construction project, the new material must be evaluated. The evaluation period should generally be 1 year, unless a longer period is deemed necessary. The evaluation should include such factors as material quality control, ease of installation, records from any periodic inspections conducted during the evaluation period, problems encountered, and assessment of future use. A brief evaluation report must be prepared after the completion of the evaluation period.

E. The SCE must forward copies of any completed evaluation reports to the Director, Conservation Engineering Division. The SCE should include a recommendation on each new material used (i.e., discontinue use, research further, or include in specifications or conservation practice standards). The evaluation reports will be made available to others within NRCS and to agency partners and used to determine if a new material has a potential for future inclusion into a conservation practice standard or national material specification.

543.3 New Material Specification Preparation

A. The designer is responsible for preparing project-specific material specifications if there are no applicable material specifications in 210-NEH, Part 642. The designer must ensure that the material specifications are coordinated with the materials used in the design.

B. Performance specifications are preferred. A performance specification states requirements in terms of the required results and provides criteria for verifying compliance, but it does not state methods for achieving results. It defines the functional requirements for the product, the environment in which it must operate, and the interface and interchangeability requirements. Avoid brand name descriptions.

Part 544 - Equipment

544.0 General

Much of the equipment utilized to collect data, test materials, and store samples are sensitive to vibration, weather, or other environmental conditions. All equipment must be maintained, transported, and stored properly. Taking extra care to handle equipment properly and in accordance with the manufacturer's recommendations helps ensure accurate data collection and reduces downtime due to inoperable equipment. Nuclear moisture and moisture/density gauges have special requirements for permitting, including training, due to the license requirements of USDA from the Nuclear Regulatory Commission.

544.1 Radiation Use Permits

Permits issued by the USDA Office of Procurement and Property Management, Radiation Safety Division, are required to operate, store, and transport nuclear gauges. Refer to the permit conditions for moisture/density gauges posted by the Radiation Safety Division at http://www.rss.usda.gov/publications/gaugepc.pdf. The permit conditions cover requirements for authorized users, field use, transportation, storage, personnel radiation monitoring, equipment testing, training, disposal, and record keeping.

544.2 Transporting Equipment

Sensitive equipment, such as survey equipment, requires special handling and transport. Follow all manufacturers' recommendations concerning the operation, maintenance, transport, and storage of the equipment. Equipment will be transported only in the appropriate containers and braced to minimize shifting. Special requirements must be followed in the handling and transporting of equipment that contain radioactive sources. The manufacturers' requirements and all terms and conditions of the permit for a nuclear moisture/density gauge must be followed.

544.3 Adjustment and Calibration

All equipment utilized to collect data for designs and to provide quality assurance must be checked frequently to ensure accurate information is being obtained. All engineering survey and material testing equipment must be checked, calibrated, and adjusted at least annually (more often if recommended by the manufacturer). Adjustment and checking of equipment must be done in accordance with the manufacturers' recommendations, preferably by personnel trained in the care and maintenance of the equipment.

544.4 Maintenance

All equipment must be kept in good working order, following the maintenance instructions provided by the manufacturer. Do not attempt any maintenance that exposes the radioactive source of a nuclear moisture/density gauge.

544.5 Storage

All equipment must be stored in clean, dry conditions as recommended by the manufacturer. Nuclear moisture/density gauges have requirements concerning location, security, and signage. Storage and security requirements for nuclear moisture/density gauges are covered in the permit conditions for moisture/density gauges (see Section 544.1).

544.6 State Procedures

A. Each State Conservation Engineer must develop specific procedures for ensuring proper care and maintenance of engineering equipment, including storage and carrying cases. The procedures should outline the minimum skills needed to operate the equipment, specific transport requirements, and specific guidelines to follow during usage.

B. Information about proper cleaning, maintenance, and repairs should be available to all personnel assigned or permitted for equipment. Scanned copies of manufacturers' information and manuals posted on a shared drive or other electronically accessible portal is acceptable, as is posting links in the same locations to manufacturers' Web sites. If hard copies are the only format available, then copies of the manufacturers' information should be provided to all personnel with responsibilities for that equipment type and model. If the State has individuals with equipment operation and maintenance responsibilities, their names and telephone numbers should be provided to offices within the State with equipment.

§IA544.3 Adjustment and Calibration

A. Survey equipment shall be serviced by a repair technician at the following intervals, or sooner if the unit shows signs of inconsistent performance.

(1) Survey Grade GPS – 5 years
(2) Total Station – Daily use – 1 year ~ Weekly use – 3 years
(3) Laser levels – 3 years
(4) Transits and levels – 5 years

B. A log of checking, adjustments, and repairs shall be maintained for all surveying and testing equipment.