

**USDA-NRCS's ROLE FOR SOILS INFORMATION IN THE SURFACE
MINING CONTROL AND RECLAMATION ACT OF 1977 (PUBLIC LAW
95-87)¹**

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Abstract. The Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87) authorizes the Secretary of the Interior to implement a regulatory program to control the environmental impacts of mining operations. The Secretary of Interior administers this program through the Office of Surface Mining Reclamation and Enforcement (OSM) with assistance from state and other federal agencies as specified in the law. All functions and responsibilities assigned to USDA by Public Law 95-87 were delegated by the Secretary of Agriculture to the Chief of USDA-NRCS (formerly the SCS), except those that relate to the National Forest Service System Lands and to the USDA-Agriculture Research Service. This paper briefly presents the role USDA-NRCS had in the development of the rules, regulations, and guidelines to comply with Public Law 95-87 that pertained to soils before, during, and after surface mining for coal.

Additional Key Words: Historically used as cropland, Soil Conservation Service, State Regulatory Authority, Prime Farmland, Code of Federal Regulations, High Capability Land, policy and procedures³, and Proof of Restoration.

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³ The history presented in this paper happened when the agency's name was the Soil Conservation Service (SCS). It seems only appropriate that the event during the SCS era be shown as SCS in this paper. So, events that happened before the name changed to the Natural Resources Conservation Service (NRCS) will be shown as SCS. The several and long quotes will hopefully help the reader appreciate the style of writing during that era and the force those written words had on the SCS employees working at that time. Some of the early SCS policy and procedures contained in various SCS documents are paraphrased or occasionally the exact wording is used in this paper.

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Introduction

This paper describes the role that the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) has on lands disturbed by coal mining. The history of mining for coal started when coal outcrops were mined for domestic use early in U.S. history (Plass, 2000). In 1914 the first machine became operational for surface mining for coal (Harper et al., 2003).

For the first 63 years, those surface mining for coal totally ignored how the soils were left after mining. Testimony in the Congressional Record (1977) explains some concerns about surface mining for coal. If the soils were cropland before mining, most soils were not even suitable as agricultural land after surface mining and then only for pastureland. It was considered pastureland because it was only traversable by livestock and then considered substandard at best for pasture. Another critical concern was the effect of strip mining on assessed valuation of mined lands. A final concern addressed efforts to implement state laws to locally regulate mining and reclamation. This has been frustrating legally because the courts block every attempt to implement state laws.

This paper addresses the time period before Public Law 95-87 (Pub. L. 95-87) was enacted, during the signing of Pub. L. 95-87, and after President Carter signed the Surface Mining and Reclamation Act of 1977 into law on August 3, 1977. The part of the paper, after August 3, 1977, gives a brief history of 1) SCS's involvement in the Law, 2) SCS's delegation of responsibilities, the early role of SCS in Pub. L. 95-87, 3) initial state activities, 4) SCS's role in the permit application, 5) SCS's role in the review of the permit application, 6) SCS's role in the soil reconstruction specification, 7) revegetation and restoration of soil productivity, 8) proof of restoration of reconstructed prime farmland, 9) reclamation not the same everywhere, 10) other folks and organizations, and 11) concluding remarks.

Years prior to Surface Mining Control and Reclamation Act of 1977

Surface mining for coal started about 20 years before SCS came into existence. This part of the paper will discuss the United States Department Agriculture (USDA) and its agencies activities prior to Surface Mining Control and Reclamation Act of 1977.

USDA Program for Reclamation of Lands Affected by Mining (RECLAM)

RECLAM was a program within the USDA for coordinating and managing USDA activities related to mine land reclamation. The SCS was a member of RECLAM.

Background. The USDA is responsible for all phases of agriculture on rural lands that are important for producing food and fiber for the nation. Many areas of rural forests lands in the East, grasslands and croplands of the Midwest, and rangeland of the northern Great Plains may be surface mined. USDA recognizes that surface mining for coal on prime farmland is necessary to supply energy for the needs of our nation. However, without appropriate reclamation measures these former prime farmlands will contribute little or nothing to the food and fiber needs of the nation.

Policy

"The Department of Agriculture recognizes that meeting these energy needs requires disturbing some rural land. It is therefore the policy of this department to see that this is done in a reasoned, selective and orderly manner, without sacrificing our food and fiber production base, quality of living in rural areas, or quality of the environment."
(Secretary's Memorandum, 1976).

Program. To address these concerns, USDA established in 1976 the "USDA Program for Reclamation of Lands Affected by Mining (RECLAM).

"The RECLAM program is designed to provide leadership, technology, and assistance in 1) protecting land and related resources, 2) maintaining and developing agricultural production systems, 3) helping rural people, communities, and people in other economic systems deal with problems, needs, and opportunities affected by mining and related activities, and 4) identify critical land areas that should not be disturbed" (USDA, 1976).

"To accomplish these program goals, it was necessary to coordinate the related reclamation activities of several USDA agencies in the areas of research, development and application; on-site technical assistance; inventory of baseline data; financial assistance; and actual reclamation of national forest system land affected by past mining activities" (USDA, 1976).

The USDA recognized that to accomplish these four items above, it needed the assistance of other departments and non-USDA agencies. These departments and non-USDA agencies would have the major responsibility for mining management and environmental research and regulations.

Implementation. USDA established a coordinating committee for the RECLAM program. It was comprised of the Administrators of Agriculture Research Service (ARS), Agriculture Stabilization and Conservation Service (ASCS), Cooperative State Research Service (CSRS), Economic Research Service (ERS), Extension Service (ES), Forest Service (FS), and Soil Conservation Service (SCS). The Assistant Secretary of Conservation, Research, and Education was an ex-officio committee member (USDA, 1976).

The Coordinating Committee was served by a Task Force comprised of one representative from each member agency as well as a representative from the Office of Management and Finance. The Task Force was involved in all aspects of the Program. For example, in dealing with research and development it was served by a Research and Development Work Group. It was comprised of representatives from ARS, CSRS, ERS, FS, and SCS (USDA, 1976).

R. M. Davis (1976) sent the Secretary's Memorandum No. 1898 to all SCS offices as an attachment to Conservation Planning Memorandum - 20 dated June 24, 1976. His memorandum stated "SCS helps implement the RECLAM program as part of our ongoing activities in assisting conservation districts." Assistance was given in four phases of the surface mining reclamation work: (1) reclamation planning before mining; (2) applying planned stabilization and conservation treatment measures during mining operations; (3) additional reclamation planning and application after surface mining; and (4) reclamation planning and application assistance on abandoned mine lands.

Research Prior to the Surface Mining Control and Reclamation Act of 1977

Research for reclamation of mined lands after surface mining for coal involved the following USDA agencies: Agriculture Research Service (ARS), Cooperative State Research Service and Extension Service (CSRS and ES, respectively, now the Cooperative State Research, Education, and Extension Service, CSREES), and the Soil Survey Division of the Soil Conservation Service

(SCS, now the Natural Resources Conservation Service, NRCS) (Knighton, 2004; General Manual-403Soil, Part 402, 1999; and Gardner, 1998).

Research Applicable to Surface Mining before 1978. A large volume of research on soils and soil management was done during the early and middle parts of the twentieth century. One of the studies demonstrated that corn roots will penetrate to a depth of 5 feet or more in rooting media that is friable and fertile (Fehrenbacher and Snider, 1954, Fehrenbacher and Rust, 1956, Fehrenbacher et al., 1960, and IL Agric. Exp. Stn., 1967). Selection of soil rooting media during soil reconstruction after surface mining for coal was documented by McCormack (1974, 1976a, and 1976b). Yield prediction was explained by Odell, (1958). Scientists worked on indices for rating the agricultural value of soils (Storie, 1933 and 1978, and Storie et al., 1948).

"In the west (Montana, Wyoming, North Dakota, and New Mexico) the basic three step approach recommended for the reclamation of strip-mined land is: (1) inventory and map the soil and overburden in the proposed mining area, characterizing their physical and chemical properties; (2) relate these properties to potential productivity of adapted plant species; and (3) devise a mining plan that will economically extract the coal resources and leave the landscape in condition to develop the productivity potential of the disturbed area" (Power et al., 1977).

Other documents developed during the early and middle parts of the twentieth century took peer reviewed papers and field experiments to explain the relationship between soil properties and soil management (Soil Survey Staff, 1951 and 1975). SCS staff gave briefing presentations to members of Congress, especially on reconstruction and restoring soil productivity on surface mined land (Johnson et al., 1977, McCormack, 1977, and Sampson, 1977). Additional research need and done after Pub. L. 95-87 was passed is discussed later in the paper.

SCS involvement in the Surface Mining Control and Reclamation Act of 1977

Everyone recognized something had to be done about the loss of prime farmland (Davis, 1975, 1977 and 1978, Flach, 1978 and 1979, Grant, 1974, Johnson et al., 1977, McCormack 1974 and 1976, Sampson et al., 1977, and Slusher, 1978 and 1979). There were many others, but these people were some of the movers and shakers within SCS who were actively involved in

furnishing information prior to the signing of the Surface Mining Control and Reclamation Act of 1977.

The congressional staffers and conservation districts requested information from SCS in writing the Bill and several sections of the bill indicate SCS had considerable input.

Signing of the Surface Mining Control and Reclamation Act of 1977

After five years of effort, Congress on July 21, 1977, completed its work on the Surface Mining Control and Reclamation Act of 1977 (HR 2). The House voted by nearly a 5 to 1 margin to accept the conference report. The Act established federal regulations on the strip mining of coal in all parts of the United States. Many people believe that it is among the relatively few bills that genuinely deserved to be called "landmark legislation". (Wagner, 1977).

The following quote by Wagner (1977) gives an idea how fever pitched the feelings of different people and groups were when it came to Pub. L. 95-87.

"For once, supporters of strip mining control did not have to worry about a veto. Jimmy Carter supported such legislation during the 1976 presidential campaign, and he urged the 95th congress to pass the bill quickly as a corner-stone of his national energy policy.

Until 1977, environmentalists and others who supported the legislation had been thwarted. The House approved a bill in 1972 but the Senate did not act. President Ford pocket-vetoed a bill in 1974 after the 93rd Congress had adjourned. In May 1975 Ford vetoed another bill and the House failed to override by only three votes. Twice in 1976, with a veto still certain, the House Rules Committee prevented strip mining bills from reaching the floor."

The SCS announced

"On August 3, 1977, President Carter signed the Surface Mining and Reclamation Act of 1977 into law. The Act calls for the establishment of a nationwide program to protect society and the environment from the adverse effect of surface coal mining" (Margheim et al., 1977).

Wagner (1977) reported that

"As finally approved in 1977, HR 2 pleased environmental lobbyists for the most part. Coal mining representatives who had opposed all such legislation were unhappy with the

bill, but relived that certain exemptions and variances had been allowed. Senate and House conferees generally felt they had reached a good compromise. Rep. Morris K. Udall (D Ariz.) a principal advocate of strip mining control, said through a spokesman that he felt "personally satisfied" that the long struggle had been won."

**Surface Mining Control and Reclamation Act of 1977 Assigned to the Secretary of
Agriculture**

The Secretary of Agriculture was assigned a number of responsibilities in Pub. L. 95-87. These included the regulatory and reclamation programs to reduce the adverse effects on coal mining on prime farmland. The Secretary of Agriculture delegated to the SCS Chief all functions and responsibilities assigned to USDA by Pub. L. 95-87, except those that related to the National Forest Service System Lands and the ARS (USDA-SCS, 1983).

Pub. L. 95-87 has three Titles in which SCS was either delegated responsibility or was involved; 1) Title IV - Abandoned Mine Reclamation, 2) Title V - Control of the Environmental Impacts of Surface Coal Mining, and 3) Title VIII - University Coal Research laboratories.

Title IV

Title IV, though very important, will be left to another author and paper. It deals with the reclamation and restoration of land and water resources adversely affected by past coal mining, including but not limited to, reclamation and restoration of abandoned surface mine areas, abandoned coal processing areas, and abandoned coal refuse disposal areas; sealing and filling abandoned deep mine entries and voids, and other mining activities prior to August 3, 1977.

The next two paragraphs that Dr. W. L. Burlison, Head of the Agronomy Department at Illinois, Emeritus, wrote as a foreword in a publication by Grandt and Lang (1958) describe the challenge of reclaiming soils after surface mining for coal.

"Making agronomic species grow where none grew before is an accomplishment worthy of man's efforts. The challenge presents itself on many thousands of acres of what was good corn belt land, where the 'stripping' method of mining has replaced the original land surface with a new mass of varying materials.

Barren parallel ridges left by stripping practices, temporarily disturb the social and economic aspects of a community. The disturbance can be overcome in whole or in part by making new lands produce agronomic species or trees, or by developing chosen sites for recreational facilities" (Grandt and Lang, 1958).

Title VIII

Title VIII, though not specifically assigned to SCS, has particular interest to SCS through its memorandum of understanding with the Land Grant Universities and working relationships with CSRS and ES. They did much of the needed soil research before and after Pub. L. 95-87 (Dunker and Barnhisel, 2000). The University of Illinois is an example of an institution doing soil reclamation research.

"The Illinois Agricultural Experiment Station has conducted research on surface-mined land since 1945. The earliest experiments were conducted when there were no legal requirements for leveling the land, for providing a suitable rooting medium, or for replacing surface soil" (Fehrenbacher, J. B. et al., 1977).

"In 1977, the Illinois Agricultural Experiment Station started comprehensive studies to develop information that will improve reclamation procedures without adding unduly to the energy costs. Several coal companies and federal agencies provided financial support. Specific areas of research that Illinois planned to undertake are 1) changes in amount and condition of cropland, 2) factors that affect crop rooting and stands, 3) segregation and replacement of darkened surface soil and root medium, 4) how moisture content at various stages of handling spoils affects moisture regime in reclaimed soils, and 5) use of runoff for irrigation" (Fehrenbacher et al., 1977).

Top soil replacement and mixing was a controversial issue that needed research to support its replacement (Carter and Doll, 1983). Acknowledgement was expressed to people in SCS for their assistance in the top soil replacement studies by different researchers. Field studies compared selected soil properties of soil before the soils were mined and after they were reconstructed (Barnhisel et al., 1979).

Favorable subsoil rooting media means the difference between successful crop production and crop failure (Fehrenbacher et al., 1982). Merrill et al. (1998) studied the relationship between subsoil characteristics and landscape position on productivity of reconstructed mine

soils. Scientists worked on indices for rating the agricultural value of soils (Barnhisel et al., 1992 and Soil Survey Staff, 2000). Fanning et al. (2002) explained special soil manipulation and reclamation strategies where sulfide bearing soil materials are exposed by land disturbance activities.

Schroeder (1992) stated that small grain yields on downslope positions produce 30 to 80 percent higher yields than upslope positions when averaged over years. This indicated that landscape position played an important role in small grain yields. Thus, methodology to maximize water availability by adjusting topographic effects during reclamation will be a key to regulatory requirements of "equal to better than" premining productivity levels.

Olson (1992) worked on assessment of reclaimed farmland disturbed by surface mining in Illinois. Olson and Lang (2000) developed publications showing optimum and average crop productivity ratings for Illinois soils. Their information indicates that corn yields can differ as much as 42 to 48 bushel per acre between the soil before mining and the reclaimed soil.

Title V

Title V addresses land areas that had not been mined. It involved steps in the reconstruction of a soil similar to that which existed before surface mining for coal, or at least from the standpoint of the reconstructed soil's productivity. It explains SCS activities with prime farmland historically used as cropland (Pub. L. 95-87 and 30 CFR, 2002a).

To keep this paper to a reasonable length, the remainder of this paper will discuss the SCS activities with prime farmland historically used as cropland (30 CFR, 2002a).

Years Immediately after the Carter Years

What happened to P.L 95-87 after the Carter years? As mentioned earlier in this paper, there were people and groups for and against Pub. L. 95-87. Now the detractors were going to undo what the advocates did a few years earlier. With even a higher pitched fever than a few years before the detractors nearly accomplished their goal. The Act survived, but it was in parts only token words. Following are a few quotes taken from a paper written by Smith (1981).

"One of the Reagan Administration's earliest reversals of environmental policy is occurring in the regulation of stripping. The Department of the Interior, under Secretary

James Watt, is recasting virtually every rule written in the 4 years since Congress passed the Surface Mining Control and Reclamation Act, with the effect of drastically reducing federal involvement in the act's enforcement. Watt's plan is to give state authorities added discretion to interpret the law according to regional conditions, a decision that lets individual mine owners avoid some mining and reclamation procedures that they believe are too difficult and costly.

As with much of Watt's agenda, the strip-mining plan has provoked strong opposition from environmental community, as well as from farmers and ranchers in mining areas."

Federal officials took the attitude that requirements had to be spelled out in utmost detail or they would be circumvented."

A small group of officials from other federal agencies meets daily at the Office of Surface Mining to "streamline" the existing rules. "We've taken out a lot of the verbiage, a lot of the specific criteria for reclamation and mining operations," says Edward Johnson, an acting assistant administrator on loan from the Agriculture Department. "the idea is to accomplish great changes without a legislative fight.

Surface mining officials also plan to relax or eliminate a rule regarding reclaiming prime farmland. Mine operators would no longer have to farm the land for several years and compare its yield to that of neighboring unmined farms in order to prove that it had been returned to full productivity."

Fortunately for agriculture, the result of "streamlining" the existing rules and regulations did not make any significant changes in the restoration of prime farmland after surface mining for coal and its original productivity.

SCS Responsibilities Under Title V

SCS Delegation of Responsibilities

National Headquarters. The SCS staff at National Headquarters coordinated USDA responsibilities with the Office of Surface Mining (OSM) on the development, approval, and implementation of rules and regulations related to PL 95-87. Davis (1977 and 1978), Flach (1978 and 1979), Gillman (1984), McCormack (1979 and 1980), Newman (1979), and Slusher

(1978, 1979a, and 1979b) were some of the staff at National Headquarters that were involved during this writing of the rules and regulations.

Dr. Donald E. McCormack deserves special mention for his contribution to PL 95-87. McCormack was the technical person who understood how the interaction of soil removal, storage, reconstruction, and proof of successful reclamation had to be written for the code of federal regulations. His technical leadership was demonstrated by his technical papers and many appearances in court as an expert witness.

National Technical Centers. The SCS staff at the four National Technical Centers conducted the technical training, ensured effective implementation of procedures, provided coordination among States, provided assistance with technology transfer, and served as liaison with OSM field offices and the Eastern and Western OSM technical centers.

State Offices. State Conservationists and their staffs had primary responsibility for implementing the prime farmland reconstruction provisions in the state, jointly establishing procedures for working with the State Regulatory Authority (SRA) and providing information and materials to SRA. They also had responsibility to maintain liaison with the OSM field office.

Field Offices. The staff at the SCS field offices provided assistance to OSM and land owners. This assistance usually entailed the review of an application for erosion practices needed during and after reconstruction of the mined area (USDA-SCS, 1983b).

Initial State Activities

Each State Conservationist established liaison with the Director of the Field Office, United States Department of Interior (USDI) Office of Surface Mining (OSM), responsible for surface mining activities in the state and the Director of the OSM Technical Service Center servicing the state.

The SCS assisted state regulatory agencies (SRA) and mine operators to identify and restore, after mining, prime farmland historically used as cropland. The reader needs to know the

definition of "historically" since it allows some prime farmlands to be reclaimed differently than other prime farmlands.

"Historically used for cropland are those lands that have been used for cropland for any 5 years or more out of the 10 years immediately preceding the acquisition, including purchase, lease, or option of the land for the purpose of conducting or allowing through resale, lease, or option the conduct of surface coal mining and reclamation operations ... productivity of the land" (30 CFR, 2002a).

SCS helped SRA and mine operators to identify prime farmland and restore these lands after mining. These responsibilities were done in cooperation with SRA and with the assistance of other USDA agencies. The SCS was responsible for the coordination of USDA review and comment at the State level on proposed SRA mine land reclamation program and amendments to the program. The SCS documented that state laws and regulations were compatible with Federal law and regulations. A State could elect to not develop a regulatory program. In this situation OSM would develop a Federal program in lieu of the state program. The same review procedure was done by the SCS as with a State program. The only difference is OSM had the functions of the SRA (USDA-SCS, 1983a).

SCS Role in the Permit Application

Soil Surveys. The soil survey shall provide the basis for -- 1) reconstruction specifications on prime farmland and identification of prime farmland soils. Upon request, either from the mining operator or SRA, SCS gave priority to preparing soil surveys of areas for which permit applications are being developed. It was not required that soil surveys be prepared by SCS; however, they must be prepared according to standards of the National Cooperative Soil Survey (NCSS). Material assembled to supplement the soil survey map in the permit application included detailed soil descriptions of the soil series mapped (USDA-SCS, 1983b).

Prime Farmland. The SCS provided several documents to SRA for their information and use: 1) a soil survey progress map for the state; 2) copies of all published soil surveys; 3) a list of prime farmland soil mapping units; 4) copies of Soil Taxonomy, Soil Survey Manual, and National Soil Handbook; 5) soil series description with its Soil Interpretations Records for each

soil series that has some map unit(s) that qualify as prime farmland; and 6) county/parish prime farmland maps where available (USDA-SCS, 1983b).

Reconnaissance Inspection. Inspection determined whether the permit area contained prime farmland soils historically used for cropland. If prime farmland existed, a soil survey was to be included in the permit application (USDA-SCS, 1983b).

Review of the Permit Application

Applications to SRA for any permit to carry out surface mining of coal required numerous documents that enable evaluation of the soil, water, and related resources at the site before mining. Also, statements about any other likely environmental impacts of surface mining were required in the application. Finally, the kinds of actions required to restore on prime farmland to its original cropland potentials and productivity of the soil after mining (USDA-SCS, 1983b).

Permit Application with Prime Farmland. The Act required the SRA to consult with the Secretary of Agriculture regarding all permits containing prime farmland. This consultation was assigned to State Conservationist by the Secretary of Agriculture. The main purpose of the consultation was to determine whether the mine operator had the technological capability to restore the productivity of the soil after mining. If the State Conservationist's staff considered the proposed reconstruction methods to be inadequate, the State Conservationist would recommend to the SRA revisions that would result in adequate soil reconstruction to assure that soil productivity would be restored, or would recommend that the permit not be approved in those cases where technology did not exist to restore soil productivity (USDA-SCS, 1983b).

Permit Review. The degree of detail required for the review is determined by the state conservationist. Items to be considered in making this determination included the size of area in permit, the complexity of reclamation required, and the expertise of personnel in the field. In making judgements necessary to properly advise the SRA, the SCS reviewed the academic studies and other scientific data that the operator included in the permit application to demonstrate that the proposed method of reclamation will restore soil productivity, plus any other pertinent data. An informed soil scientist made the final decision as to the required soil

reconstruction methods, with additional provisions that emphasis is given to the use of the most cost-effective approach available that fully restores productivity. To ensure that the best available expertise is applied, the State Conservationist arranged for joint discussions with the soil scientists and agronomists of cooperating agencies, including the agricultural experiment station (USDA-SCS, 1983b).

Review Guidelines. In reviewing permit applications and plans for surface mining of prime farmland, SCS will do the following (USDA-SCS, 1983b):

- 1) Verify that the soil survey meets National Cooperative Soil Survey standards;
- 2) Check to see if map units are correctly identified as prime or nonprime, keeping in mind that the historical use provision may eliminate some map units, or parts of map units, from the application of standards for soil reconstruction of prime farmland;
- 3) Check to see if there is soil map unit description of each prime farmland soil map unit and that the description properly reflect the soil condition in the area;
- 4) Check the reference crops proposed to be grown and the estimated yield (target yield) for determining technological capability. Target yields should be equal or higher than those given for the high level of management in the SCS Field Office Technical Guide,
- 5) Examine the plan for methods of removal, storage, and replacement of soil horizons that will minimize compaction and damage soil structure. Particular emphasis was given to carrying out these steps when soil moisture levels are such that compaction and damage to soil structure can be minimized;
- 6) Check the bulk density value given in the permit application of each prime farmland soil. Where the bulk density values in the permit application are higher than those normally expected in the soil, the SCS advised SRA that rechecking of the densities before mining is advisable;
- 7) Check to see the depth of soil material to be removed and replaced for reconstruction or prime farmland is equal to or greater than the pre-mined soil;
- 8) Topsoil is removed to the correct depth and stockpiled separately;
- 9) Check for proposed mixing of B and C horizons;
- 10) Check plans for final grade to ensure proper surface drainage;
- 11) check plan for installation of adequate erosion and sediment control practices;

- 12) Evaluate the type of equipment available to the applicant and determine adequacy for segregation, removal, and replacement of soil horizons without excessive mixing or compaction;
- 13) Determine that the applicant has plans to utilize personnel with the expertise to identify major soil horizons and determine their thickness before removal and after replacement. Ensure that plans provide for monitoring of compaction during soil replacement;
- 14) Determine applicants' plans to ensure that final grades and drainage system met planned standards;
- 15) Evaluate plans for revegetation after soil reconstruction. Check rates of fertilization, seedbed preparation, seeding mixtures, seeding rates, and time of seeding for crops to be grown from time of soil reconstruction to release of bond. Determine that reference crops selected to demonstrate success of soil reconstruction are those mostly commonly grown on prime farmland in the area.

Soil Reconstruction Specification

Surface Mining Control and Reclamation Act of 1977 (SMCRA) requires the Secretary of Agriculture to establish specifications for removal, storage, replacement, and reconstruction of prime farmland soils. The SCS first proposed mining specifications for prime farmland during February 1988 (53 FR 4989). Beginning in 1997, NRCS and OSM began reviewing and updating these specifications to be published as a rule in the Federal Register. The process included review of comments received from the 1988 Federal Register and knowledge gained from field experiences since 1988 including field reviews conducted with SRA.

During the process of developing these specifications, NRCS concluded that these specifications should be published through a Notice in the Federal Register rather than a rule because the specifications are not regulatory. These specifications serve as guidelines to NRCS State Conservationists for developing state-specifications and may assist the various states in developing state standards. They will also help the mining industry, SRA, and OSM develop reclamation plans, which if implemented, will provide the best opportunity to meet the post-reclamation crop production standards required by SMCRA.

NRCS determined that national specifications for soil handling must allow for consideration of the wide diversity of soils, geology, climate, mining equipment and crops in coal mining areas across the nation. These differences are recognized in 30 CFR, 2002c). The NRCS developed the specifications set forth in the notice to ensure that local and site-specific factors are considered. Within the individual states, each NRCS state office will maintain and make available a local version of these specifications that incorporate the general criteria set forth in the notice's specifications and any modifications made by the respective State (USDA-NRCS, 1999 and USDA-SCS, 1984).

Revegetation and Restoration of Soil Productivity

The revegetation and restoration of soil productivity were the most controversial items during the development of the rules and regulations for Pub. L. 95-87. Mine companies were emphatic that they were not farmers. The environmentalist, farmers, and others wanted a procedure to determine if the reclaimed soils were as productive as the pre-mined soils.

The SRA is the responsible agency to work with the mining companies to determine if crop yields on reclaimed soils are equal to or better than the premined soils, but NRCS has a major input to the process. The guides to follow for proof of productivity are:

The 3-year Proof of Productivity

Three crop years are not necessarily consecutive crop years. Thus, use of crop rotations is permitted. The actual elapsed time depends on the rotation and the reference crop(s) selected. Proof should be achieved within a reasonable time after the effort is begun. The soil's productivity was measured on a representative sample or all of the reconstructed prime farmland, using the reference crop (USDA-SCS, 1983b).

Reference Crop

The reference crop(s) is/are the crops most commonly produced on the surrounding prime farmland. Where row crops are the dominant crops, the row crop requiring the greatest rooting depth shall be selected as one of the reference crops. If a common rotation in the surrounding area is corn-soybeans-wheat, one of the reference crops selected shall be corn and, where

approved by the regulatory authority, additional reference crops could soybeans or wheat (USDA-SCS, 1983b).

Equal or Exceeds

The Act requires that the operator restore productivity to "equal or greater" productivity as compared to same or similar non-mined prime farmland soils in the surrounding area. The 3-year proof of productivity was conducted using the same management levels as those used on representative local farms in the surrounding area on the same or similar non-mined prime farmland soils (USDA-SCS, 1983b).

Timing of Proof of Soil Productivity

The mining operator initiates the proof of soil productivity period within 10 years after completion of soil replacement (USDA-SCS, 1983b).

Proof of Restoration of Reconstructed Prime Farmland

There was controversy on how to evaluate prime farmland reclamation success. The two alternatives proposed were soil survey properties and crop production as measures of prime farmland reclamation success (Smith, unknown, Mavrolas, 1980. Reybold and McCormack, 1980). Crop production as a measure of prime farmland reclamation success was selected (30 CFR, 2002c). Stout (1998) explains the situation of prime farmland variability in meeting post-mining yield targets. In his paper, Stout discusses the citizen concerns as well as yields.

Dunker et al. (1991) describes reclaimed soils after surface mining.

"Poor soil physical condition has proven to be the most severe and difficult limiting factor in the reclamation of many prime farmland soils. Newly constructed soils commonly lack a continuous network necessary for water movement, aeration, and root system extension. Also, plant root growth is often severely inhibited by excessive high soil strength.

Because of the need for deep soils in the heart of the corn belt, compaction is particularly serious and the solution is particularly difficult. Natural soils of the Midwest are commonly 60 inches deep. The predominate crops can effectively exploit soils of that

depth. The rainfall is adequate to completely recharge a 60 inch soil in most years. In addition, periods of drought stress during the growing season are sufficiently common as to require maximum available water storage in soils for maximum yields."

Hooks (1998) describes a very reliable and efficient method to measure compaction (soil strength) for a field. Availability water to the plant decreases as soil strength increases. He discusses the relationship of soil strength to yield.

Barnhisel et al. (1979), Dunker et al. (2000), Grossman et al. (1992), Indorrante et al. (1981), McSweeney and Jansen (1984), Ralston (1984), and Vance et al. (1992) explain some morphological and physical changes in reclaimed soils after surface mining for coal. The micropores, macropores, soil structure, saturated hydraulic conductivity (K_s) available water capacity (AWC), and soil strength in reclaimed soils would nearly always be less favorable for roots to explore the entire root media as compared to the pre-mined soils. The decision to use crop production rather than soil morphology and selected soil properties as a measure of prime farmland reclamation success was a win-win for everyone. AWC without considering the other properties is the limiting factor that determines plant growth and crop yield. Many prime farmland soils before being mined have 30 cm or more of AWC. Most reconstructed soils have at the very most 24 cm and most much less. Corn is the commonly grown crop in Illinois and Indiana on prime farmland soils. With a lower AWC, reclaimed soils required to produce equal or higher yields than premined soils must have above normal precipitation during July and August. Typically, in at least one year out of ten, the months of July and August will have what farmers refer to as a wet July and August. The year with wet July and August is the year that corn yields are reported to SRA for bond release in some states.

Reclamation not the Same Everywhere

As a result of Pub. L. 95-87, the land reclaimed after surface mining for coal was improved in most states. Illinois rules and regulations for soil reclamation were more strict before and after Pub. L. 95-87 was signed into law. It is the only state, to my knowledge, that recognized that these prime farmland soils are the very best prime farmland soils in the world for producing crops commonly grown in that area. Illinois recognized other soils that are as productive as some prime farmland soils, but require some conservation practices not needed on prime farmland soils. Illinois named these other soils "High Capability Land."

"High capability land means land not meeting the definition of prime farmland or land exempted in accordance with 62 Ill. Adm. Code 1785.17 where the Department determines the following three facts are present together: 1) The land is capable of being reclaimed for row-crop agricultural purposes; 2) The land is suitable for row-crop agricultural purposes based on U.S. Department of Agriculture, Soil Conservation Service soil survey classifications of the affected land prior to mining (all soil types in capability Classes I, II, III and those soil types in capability Class IV with slopes of five percent or less), as set forth in Land-Capability Classification, Agriculture Handbook No. 210, published by the U.S. Department of Agriculture, Soil Conservation Service in 1973; and 3) The optimum future use of the land is for row-crop agricultural purposes" (Illinois, 2003).

The Land-Capability Classification System was probably used because more of the public and units of government understood it better than any other similar classification system (Klingebiel, 1958 and Klingebiel and Montgomery, 1961).

High capability land has more restrictive rules (reconstructs a better soil) for reconstruction of reclaimed mined soils than Pub. L. 95-87. High Capability required 120 cm of rooting media as early as 1971 even though some soils had a fragipan, claypan, or similar root limiting layers. In 1976, high capability land required a minimum of 20 cm of topsoil in comparison to the 15 cm as specified in Pub. L. 95-87. Illinois is proposing additional legislation to ensure high capability land is restored to original productivity (John S. Lohse, 2003)

Future generations will thank the legislators and soil scientists in Illinois for being visionary. They will appreciate having mined land reclaimed to a condition in which the soils can produce the food and fiber for their very existence (Sorensen et al., 1997). Pub. L. 95-87 was to have established a level playing field, economically, wherever prime farmland soils were surfaced mined for coal. Illinois folks showed they were not as interested in a level playing field as they were in protecting their most important resource -- SOIL.

Other Folks and Organizations

Thanks to our form of government, everyone who has concerns is heard and most times resulting for the better. Two such people are Pam Mavrolas and Anna Sophia Johnson. Pam

Mavrolas was associated with The Illinois South Project, Inc. in Herrin, Illinois (Southern Illinois). Ms. Johnson was associated with a group in Knox County, Illinois (Northern Illinois). The SCS file contains copies of their correspondence. Their contribution was to let elected officials, scientists, and other government officials know that there must be a better method of reclaiming soils than had been done in the past.

The coal companies worked with the SCS and with other researchers to gather the research needed to learn how to reclaim soils surface mined for coal. Their generous funding helped universities and other researchers buy equipment and hire staff to do the needed research. They had their staff do research to complement research already done so needed questions on reclamation could be answered (Grandt and Lang, 1958 and Grandt, 1978).

Concluding Remarks

In the introduction to this paper there were three concerns (1) reclamation and restoration of farmland, (2) effects of strip mining on assessed valuation of mined lands, and (3) efforts to implement laws to locally regulate mining and reclamation. The day President Carter signed Pub. L. 95-87 into law was the day these three concerns were addressed. This law guaranteed that prime farmland would remain arable after surface mining for coal. The NRCS is still involved in the reclamation of land after surface mining for coal and research. Farmland reclaimed under Pub. L. 95-87 will have a higher assessed value than mined lands before Pub. L. 95-87. Pub. L. 95-87 allows the SRA to enforce the rules and regulations for reclamation of soils after surface mining for coal. Another important thing to note - this was the first time prime farmland was used for a regulatory purpose.

The paper hopefully recognizes some of the people who helped get this legislation enacted and the researchers who provided the science to reclaim soils surfaced mined for coal to be productive cropland. Hardin (1968) wrote about farming the seas or developing new strains of wheat and has a few lines about managing soil resources to feed the worlds population. Pub. L. 95-87 will postpone what Hardin discusses in his article. William Jennings Bryan (1896) probably described the fate of some rural areas with prime farmland before mining for coal in this quote,

"Burn down your cities and leave our farms, and your cities will spring up again as if by magic; but destroy our farms and the grass will grow in the streets of every city in the country."

The prophecy of his quote tells the story of many American towns in the rural areas that experienced mining prime farmland before 1977. Many rural towns no longer exist today or are only ghosts of what they were a hundred years ago. The loss of prime farmland during surface mining for coal helped out with the disappearance of many economically stable rural communities.

In closing, the author is taking the liberty of making a statement that will be discussed by many people. They may or may not agree depending on their point of view. The statement is "the implementation of PL 95-87 was probably one of the most united efforts by everyone in SCS since the agency was established."

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