Chronological History of the Standards for Soil Erosion and Sediment Control in New Jersey to 1999 & The Early Years of the Soil Erosion and Sediment Control Program in New Jersey

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Acid Soil Appendix (1836-1999)

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Although the acid soil problem created by iron sulfide-bearing material received increased attention in the 1970s and early 1980s, this problem was known in New Jersey long before the 1970s as discussed below. Copies of most of the documents (or portions thereof) cited in this Appendix are contained in the "Acid Soil Supplements."

This Appendix and its Supplements are not the product of professional or academic quality historical research, and are limited to documents I obtained in the time available. Nevertheless, this Appendix and its Supplements provide much information about this acid soil problem in New Jersey, and should be of interest in this regard.

The major divisions of this Appendix are as follows:

- 1836 and 1868 Reports by the New Jersey State Geologist; 1880 Annual Report of the New Jersey State Agricultural Experiment Station
- 1965 Water Control Guide; 1962-1972 Soil Conservation Service (SCS) soil surveys; 1972-1982 State Soil Conservation Committee (SSCC) Standards
- Examples of 1975-1983 project documents and correspondence
- Soil Conservation Service: 1980-1982 Technical Notes and recommendations
- New Jersey Department of Environmental Protection (NJDEP): 1984-1985 rules, technical notes, and strategy
- 1987 SSCC Standards; 1990 NJDEP/SSCC Memorandum of Agreement; 1995-1996 NJDEP rules and general permit fact sheet; 1999 SSCC Standard

(All footnotes in this Appendix were added by William Minervini; none of them were in the original documents.)

1836 and 1868 Reports by the New Jersey State Geologist; 1880 Annual Report of the New Jersey State Agricultural Experiment Station

The effects on crops of material dug from sulfur rich strata in New Jersey's coastal plain received serious official attention **before 1840**. In the era before mass produced commercial fertilizers, there was much interest, as shown by the first annual report

(1836)[1] by Henry Rogers, first New Jersey State Geologist, in identifying local New Jersey mineral deposits that improved agricultural productivity when applied to the soil. Among these mineral substances was "green sand marl" with "its rare powers as a fertilizing agent"[2] (see page 7). A considerable part of Chapter I of this report (see pages 10-12, 19-21, 26-31, 53-54, 66-68, 86-88, and 91) was devoted to:

- Describing and explaining in detail the relationship between (i) this "green sand marl" or "true marl"; and (ii) the commonly overlying (and in some locations intermixed) iron and sulfur rich "spurious marl, or dark astringent clay," which "if used incautiously" causes "serious and long continued *sterility*" [italics in original] seemingly "attributable to the acid reaction of the astringent ingredients which it possesses, namely, the copperas ["free sulphate of iron"] and alum earth ["sulphate of alumine"]." These ingredients can be detected by "a yellowish or whitish incrustation" on an exposed marl's moist surface, by "an astringent inky taste," or by simple chemical tests using "lime-water" or "a solution of oak bark."

- Guiding farmers in the manner of applying (where "green sand marl" free of "astringent clay" is unavailable) deposits where many "fertilizing green grains" are intermixed with noxious "astringent clay." Specified precautions included digging the clay several months before its use, and spreading it out "in broad, shallow, flat heaps, where the rains may soak through it and carry away the copperas and alum earth"; a "far more promising suggestion ... to add to every heap of this spurious astringent marl, a small quantity of *freshly burnt lime*[3] [italics in original] and to mingle them thoroughly together" (a "bushel of lime to every hundred bushels or five tons of the mass, will in most cases be sufficient"); composting the spurious astringent marl with farm manure; and spreading upon every badly poisoned acre "a few bushels of newly made lime."

Information and guidance along similar lines was set forth in Chapter III ("Greensand Marl") in the **1868** report[4] by New Jersey State Geologist George H. Cook (see especially Sections III and IV), some of which is quoted below:

> ... Marls of any kind, which are acid from containing sulphate of iron or sulphate of alumina, are applied sparingly and with care ...

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[1] Available at https://www.state.nj.us/dep/njgs/enviroed/oldpubs/Survey1836.pdf .

[2] For a modern review of this subject, see Greensand and Greensand Soils of New Jersey: A Review by J.C.F. Tedrow (2002). Rutgers University, Department of Ecology, Evolution and Natural Resources: New Brunswick, New Jersey (www.glauconite.ru/greensand.pdf). This review attributes the beneficial effects of greensand to an apparent combination of factors.

[3] Probably referring to a caustic material (also called "quicklime") containing calcium oxide rather than calcium carbonate.

[4] Available at https://www.nj.gov/dep/njgs/enviroed/oldpubs/SG-GEOLOGY-NJ-1868.PDF

> a dressing of fifty tons to an acre has sometimes destroyed all vegetation. The safe way of using such marls is found to be upon well limed lands, or else in dressings of from ten to twenty tons per acre, or else composted with lime...
>
> ... It cannot ... be too strongly insisted upon, that lime will certainly correct the injurious effects of such marls, and no cases can probably be found but what one bushel of slaked lime[5] to ten bushels of marl will be sufficient for the purpose, and generally a half, or even a quarter of that amount will be enough. The effect of the lime is to decompose the sulphate of iron or alumina and form sulphate of lime (plaster), which is a valuable fertilizer, and would greatly improve the quality and effects of the marls, so that these *poison* or *black* marls [italics in original], when properly corrected, are more valuable than those which are not poisonous. This is abundantly verified by the experience of good farmers.
>
> ...
>
> A bare inspection of a pile of poisonous marl is generally sufficient to tell its nature. After a rain it will remain wet, when the pure marls have quite dried out, and when dry, it is covered with a yellowish-white efflorescence or coating of copperas or alum.

Chapter III also noted that the "sulphuric acid" in this marl "can always be detected ... by its astrIngent and inky taste" or by simple chemical tests using "the purple infusion of red cabbage" or "strong tea."

The First Annual Report of the New Jersey State Agricultural Experiment Station for the Year 1880 included, in its discussion of "Cranberry Scald or Rot" (pages 65-67), the following statement:

> On a recent visit to the farm of the late Chalkley Albertson, near Haddonfield, attention was called to a deposit of "poison marl." This

[5] Probably referring to a caustic material (also called "hydrated lime" and other names) containing calcium hydroxide rather than calcium carbonate.

> marl destroyed all vegetation when applied in the ordinary way as a top dressing for crops. Yet piles of the marl which had been lying out and exposed to the weather for some years, were now covered with a luxuriant growth of cranberries. A visit to the locality showed the cranberry plants with the fruit still on them in April, and the plants healthy and vigorous... the earth on which they grew ... composed mainly of sand with a very little loam in it ... had a strong inky taste, and was decidedly acid to the tongue as well as to chemical tests ...

This discussion also quantified the amount of "sulphuric acid" and "copperas" ("ferrous-sulphate") in the top 13 inches of the earth on which these plants grew[6], and continued:

> ... It is quite certain that many of the bogs in which cranberries thrive contain sulphate of iron, and it will be an interesting question, for this season, to ascertain whether all the good cranberry bogs are acid from the presence of that substance or from some organic acid. And also to ascertain whether those bogs where the cranberry fails most completely, are not lacking in this acid property.

1965 Water Control Guide; 1962-1972 Soil Conservation Service (SCS) soil surveys; 1972-1982 State Soil Conservation Committee (SSCC) Standards

Eighty-five years later, the Water Control Guide for Suburban and Rural-Residential New Jersey (1965)[7] included the following as part of its "Soil Properties Affecting System Design and Performance" section:

> **Chemical Properties.** There are some wet, poorly drained soil layers and underlying geological strata that contain large amounts of sulphide and soluble iron. When exposed to air the sulphide-bearing material becomes very acid, rendering it corrosive to metal, destructive to concrete, and injurious to plants. Soluble iron

[6] The 13 inch depth was "below where any roots were seen."

[7] Kurt Nathan, Russell B. Alderfer, Stephen A. Decter, Robert M. Hanna, Mark E. Singley, Kenneth S. Werkman, and Kenneth P. Wilson. Circular 605. Rutgers University, College of Agriculture and Environmental Science, New Jersey Agricultural Experiment Station: New Brunswick, New Jersey.

in water can quickly plug drainage tile with a gel-like precipitate.

Only one of the SCS soil surveys published in the 1962-1972 period for relevant New Jersey counties discussed iron sulfide as a cause of extreme acidity — the Soil Survey of Burlington County (1971)[8]. This Survey's discussion of clay pits noted (page 41):

> ... The clay was excavated primarily to make bricks ... The source of the material was the Merchantville, Woodbury, and Hornerstown Formations. These formations contain iron pyrite, which can form sulfuric acid. In places ponds in these clay pits are so acid that fish cannot reproduce ...
>
> Abandoned clay pits normally have abrupt vertical side slopes, but some have been smoothed. Revegetation of these slopes is slow, partly because extreme acidity and severe frost heaving prevent most plants from living through the first winter.

In addition, this Survey's discussion of the Keyport soil series (pages 27-28) noted that "in places the C horizon contains 6 to 12 inches of sandy loam over underlying clay loam, silty clay, or clay beds.... The clay beds ... contain numerous nodules of iron pyrite that form sulphuric acid in solution."

With one narrow exception, the 1972 and 1974 Standards for Soil Erosion and Sediment Control in New Jersey did **not** expressly mention such sulfide-bearing material. The exception was in the then new 1974 Standard for Subsurface Drainage, which included the following provision: "When iron sulfide chemical reaction causes sealing of joints or perforations, the drain shall be enclosed in a clean sand-gravel filter. Riser pipes for flushing the line shall be provided at intervals not to exceed 500 feet." As noted above, the Water Control Guide for Suburban and Rural-Residential New Jersey (1965) had stated that "Soluble iron in water can quickly plug drainage tile with a gel-like precipitate."

In addition, the 1972 and 1974 Standards for Permanent Vegetative Cover **did** include this provision:

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[8] Available at https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/new_jersey/burlingtonNJ1971/burlingtonNJ1971.pdf.

The Soil Survey of Salem County (1969) noted that "in some salty marshes the soil material contains sulfides and becomes extremely acid if drained." All the pertinent soil surveys noted that the surface layer of many Coastal Plain soils is naturally extremely acid, defined as pH below 4.5, but such extreme acidity (as so defined) can in many places be caused for reasons other than sulfides.

> Acid soil conditions:
>
> Soils having a pH of 4 or less shall be covered with a minimum of 12 inches of soil having a pH of 5 or more before seedbed preparation.

The Appendix A3 Guide for Construction Specifications[9] in the 1972 and 1974 Standards included this in one respect more specific provision: "Exposed soil having a pH value of less than 4 shall be covered with a minimum of 12 inches of soil material no coarser than a sandy loam or SM[10] and that can be corrected to a minimum pH of 6.5."

In addition, the Standards for Topsoiling in the 1972 and 1974 Standards provided that "topsoil should be used" in various places including "where soils are ... extremely acid (less than pH 4.0)." This meant placing suitable topsoil on top of such extremely acid soil; the topsoil should meet certain criteria including "a pH range of 5.0-7.5."

These vegetative cover and topsoiling standards also had other general provisions (applicable whether or not pH was under 4.0) concerning limestone and pH. Collectively, however, these provisions were not adequate to address such sulfide-bearing material. They did not (i) seek to prevent soil pH from falling below 4.0 in the first place by drawing attention to and preventing indiscriminate exposure of such material; or (ii) adequately account for the large amount of acid generated by exposing such material.

The next express mention in SSCC Standards of soils high in sulfides was made in certain 1979 (effective 1980) revised or new Vegetative and Engineering Standards.[11] Mentioning these soils may have been part of the increased attention to iron sulfide discussed below under "Examples of 1975-1983 project documents and correspondence." The 1979 revised Standard for Temporary Vegetative Cover for Soil Stabilization included the following provision not found in the 1972 and 1974 Standards:

> Soils high in sulfides or having a pH of 4 or less should be mulched only. See Standards for Stabilization with Mulch Only, page 3.31.

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[9] Unlike the vegetative and engineering standards in the 1974 Standards, this Guide was **not** included in the SSCC rules adopted to implement the Soil Erosion and Sediment Control Act. See NJAC 2:90-1.3 (1-8-76).

[10] SM means silty sand in the Unified Soil Classification System (USCS).

[11] The September 1979 changes to the 1974 Vegetative and Engineering Standards were incorporated in the SSCC Chapter 251 rules effective July 3, 1980. For convenience, Standards effective that date are sometimes referred to as "1979" Standards. These 1979 Vegetative and Engineering Standards were included in the fourth edition of the Standards for Soil Erosion and Sediment Control in New Jersey, which is dated November 1982 (and were probably also included in the earlier, so far unavailable third edition).

The 1979 revised Standard for Permanent Vegetative Cover for Soil Stabilization included the following revised provision:

> Acid soil conditions:
>
> Soils having a pH of 4 or less or containing iron sulfide shall be covered with a minimum of 12 inches of soil having a pH of 5 or more before seedbed preparation. The added soil shall be limed as above.

The 1982 revised Appendix A3 Guide for Construction Specifications, however, included the same acid soil provision that was in the 1972 and 1974 Standards version of this Guide: "Exposed soil having a pH value of less than 4 shall be covered with a minimum of 12 inches of soil material no coarser than a sandy loam or SM and that can be corrected to a minimum pH of 6.5." (Note that this provision did not mention iron sulfide.)

In contrast, the "Applying Topsoil" section of the 1979 revised Standard for Topsoiling included the following provision **not** found in the 1972 and 1974 Standards version: "Soils with a pH of 4.0 or less or containing iron sulfide shall be covered with a minimum depth of 12 inches of soil having a pH of 5.0 or more."

The 1979 Standard for Subsurface Drainage included the following provision which was the same as that in the corresponding 1974 SSCC Standard:

> "When iron sulfide chemical reaction causes sealing of joints or perforations, the drain shall be enclosed in a clean sand-gravel filter. Riser pipes for flushing the line shall be provided at intervals not to exceed 500 feet."

<u>Examples of 1975-1983 project documents and correspondence</u>

Probably due in part to increasing interest in soil erosion and water pollution (as seen for example in the Federal Water Pollution Control Act Amendments of 1972, the New Jersey Soil Erosion and Sediment Control Act, and increased environmental review of proposed public infrastructure projects), such sulfide-bearing material received increased attention in the 1970s and early 1980s as discussed in the project specific examples below.

The November 1975 <u>Draft Environmental Statement</u> prepared by the U.S. Army Engineer New York District concerning a proposed flood control project for Pine Brook (widening and deepening of approximately 6000 ft.) in Manalapan Township stated, in part:

Mineral acid clay formations, which are high in iron and aluminum are found at various depths throughout northern and western Monmouth County. The acidity is generally caused by a pyrite content. This material forms sulphuric acid when exposed to air. Pyrite has been reported in the following formations: Woodbury, Englishtown, Wenonah, and Marshalltown.

At present, Pine Brook waters have a pH of about 4.0. This acid condition may be aggraviated [sic] as a result of acid soil exposure in the watershed. Where extreme amounts of acid material has been exposed pH readings have been less than 2.5 (Dept. of Agriculture, 1974)[12]. (page 7)

2.10. Fish. Due to the acidic condition found in the waters of Pine Brook (pH 4.0-4.5), it is deemed unlikely, under present conditions, that any significant amount of aquatic life could exist in the stream (U. S. Dept. of Interior). The only possible exception, may be the presence of the mud minnow (N.J. Dept. of Env. Protection), which could tolerate these low pH conditions. In addition, during site visits made by the U.S. Army Corps of Engineers during January, March and June 1975, no aquatic life was observed (See Fig. 6)... (page 14)

4.07. Soils. There is a possibility that the proposed project may expose acid-laden clay deposits during construction and thereby further lower the pH of Pine Brook and of waters downstream of the project site. While this occurrence does not seem likely, the Corps will implement protective measures to insure that these effects are minimized (See paragraph 4.10). (page 34)

4.10. Water Quality. As previously mentioned, the waters of the Pine Brook have been found to be acidic due primairily [sic] to natural

[12] U.S. Dept. of Agriculture, 1974: Field investigation of Pine Brook Watershed. (Reference as listed in the original.)

mineral acid soils within the watershed. The question of whether excavation from the proposed project will increase the stream acidity by uncovering these acid deposits has been raised by the U.S. Dept. of Interior and the Dept. of Agriculture. Field investigations of the Pine Brook watershed made by the U.S. Army Corps of Engineers and U.S. Dept. of Interior (See 2.12), indicated that the acidic condition of the waters in Pine Brook is in evidence above the study area as well as in the Matchaponix Brook (below the study area). It seems therefore likely that this condition is regional and not limited to a source only in the study area. Furthermore, from the soil samples taken eariler [sic] (see 2.03), the pH readings of the stream bed materials show less acidity than those of the water sample. Therefore it would appear that the proposed excavation should have little effect, if any, on decreasing the pH of the waters downstream of the study area.

As on added precaution in preventing downstream transport of any disturbed acid-laden silt during construction, the follwoing [sic] mitigation methods will be adhered to:

1. A silt screen will be utilized during channelization to confine suspended materials.

2. Stream bank and spoil areas will be vegetatively stabilized immediately following construction to reduce project silitation [sic] and acid drainage.

Other precautionary measures recommended by the U.S. Department of the Interior and the New Jersey Department of Environmental Protection include:

1. Performance of construction activities during the fall and/or winter months when water temperatures are low and impact on downstream fishery resources in the Matachaponix and South Rivers is minimal.

2. The addition of lime during channelization to neutralize the acid.

> These suggestions will be investigated and implemented if possible. (page 35)

A November 16, 1976 letter from Chester F. Bellard, SCS (now NRCS) State Conservationist, to F. Howard Zahn, Chief, Bureau of Environmental Analysis, New Jersey Department of Transportation (NJDOT) about proposed completion of Route I-295 in Gloucester County said, in part:

> Of particular concern on this project is the underlying Woodbury and Merchantville geologic formations which become extremely acid when excavated due to oxidation. The acidity of these formations results from the content of iron pyrite, (FeS_2). On exposure, the iron pyrite decomposes readily, especially in a moist atmosphere, to various sulfates and sulfuric acid producing soils with a pH as low as 2 or 3, so low that revegetation is an extremely difficult and costly undertaking. These compounds also prove to be highly corrosive to unproperly treated metal pipe and concrete structures incorporated into the highway drainage system.
>
> Our concern is that you address this geologic condition and make adequate provisions to protect drainage appurtenances and to properly treat or bury this material both along the right of way and on any borrow areas such that adequate revegetation is accomplished. (emphasis in original)
>
> Mr. Joseph Voschin, of our Williamstown Office, Route 42, Black Horse Pike, P.O. Box L, Williamstown, N.J. 08094, will be glad to assist you in developing solutions to the problems you may encounter along these lines.

A March 30, 1977 letter to Lawrence Schmidt, Office of Environmental Review, NJDEP from Stephen A. Decter, Assistant Research Professor, Rutgers University presented the University’s proposed technical approach and budget for evaluating potential environmental impacts of the proposed NJDOT Route I-195 crossings of the Manasquan River at Squankum in Monmouth County.

This letter expressed “particular concern” about potential increased acidity due to exposure of "black or poison greensand marls" underlying the Manasquan River flood plain. The letter proposed that soil cores, taken from the planned construction area at locations determined by Professor Stephen J. Toth, be examined by him and his staff for pH, for the “potential acidity” (incubation test) that might develop in these marls once they are exposed, and for release of heavy metals during incubation (water and 0.05 N HCl extracts). The University would also suggest possible methods for mitigating possible deleterious ecological effects of such release.

A February 27, 1978 letter from Professor Toth[13] to Donald J. Kroeck, Supervising Engineer, Bureau of Water Supply Planning and Management, NJDEP, replied “to the criticisms of Mr. Zahn [of NJDOT] concerning acid soils, greensand marls and a review of the use of the ‘Freehold Soil Conservation District Standards’, for acid soils.” Following are some excerpts from this letter:

> Upon checking with the Freehold Soil Conservation District and the offices of the Soil Conservation Service in New Brunswick, I found that no one was aware of such standards being used and in fact they pointed out they used amelioration procedures for these soils as outlined in in a paper entitled, "Acid Soils" which I presented to a joint meeting of the two groups several years ago.
>
> I would like to know where and from whom the D.O.T. obtained these so-called standards and if detailed field tests were conducted to justify their use.
>
> ...
>
> The incubation technique to determine the potential acidity of soils or soil materials does not differentiate between the chemical and biological oxidation of Fe S but rather represents a total or sum of the two processes operating during incubation. It is, at the present, the best method for differentiating between normal and highly acid soils (potential).
>
> ...
>
> It has been our experience that values for acidity obtained by a six week incubation when neutralized by bases or carbonates will not require additional treatments to maintain pH values.

[13] Rutgers University Professor of Soil Colloids

> The acidity developed during incubation increases the solubility of heavy metals such as Fe, Al, Mn, Cu, Zn, Ni, Cr, Cd and Pb. We believe that the increased solubility of these metals is responsible for plant death rather than the production of acids. I would also like to emphasize that Al ions at low concentrations (1-5 ppm) are extremely toxic to trout and other fish.
>
> The drying of a soil sample and the determination of pH will not differentiate between soils of low and high potential acidities...
>
> The use of one foot of non-acid soil plus 6 inches of topsoil to ameliorate conditions produced by the presence of acid soils is not sufficient. At least 3 feet of a non-acid soil will be required plus at least 1 foot of topsoil to do an adequate job.
>
> I would also like to raise the question as to the source of non-acid soil that the D.O.T. would use for this purpose, especially since all South Jersey soils are acid.

A June 14, 1978 letter from Lawrence Schmidt, Chief, Office of Environmental Review, NJDEP to Colonel Clark H. Benn, District Engineer, Corps of Engineers provided comments on a public notice for the Corps' proposed Pine Brook flood control project. This letter included the detailed comments from the NJDEP Division of Water Resources on the project's Final EIS (Environmental Impact Statement). These comments stated, in part:

> <u>2.03 Soil Conditions</u>
>
> The soil sampling analysis as exhibited may not be a true indicator of the potential range of pH. The comment that "this material forms sulphuric acid when exposed to air" is too simplified and does not address the associated impact of introducing heavy metals into the system. When FeS_2 is exposed to the atmosphere in the presence of an acid media, H_2S is the resulting formation. The resulting oxidation of S_2 produces the sulfuric acid.

> Perhaps the most important aspect of this process, which was neglected in the Final EIS, is the potential for "an increase in concentration of heavy metals by acid solubilization." The FW-2 classification[14] certainly requires that this aspect be addressed. Furthermore, the sampling and testing procedures should be reexamined. The soils should be taken to the depth of the deepest excavation at that sample site (which may or may not have been the case) and the samples should undergo an incubation period of at least two weeks (see Dr. Stephen J. Toth, 1970).
>
> ...
>
> 2.18 Flood Damage
>
> Much of the claimed project benefits appear to be for 1971 flood damage to new landscaping. Cracked basement walls, seepage and failed attempts at revegetation are cited. When this project was constructed, organic and acid-bearing soils were observed being used for fill. How much of the "flood damage" to foundations and landscaping is in fact a result of consolidation, oxidation (and subsequent settling) and acid soil conditions?

An October 20, 1978 letter from Judith H. Miller, Review Coordinator, NJDEP to A. J. Weiss, Chief, Engineering Division, New York District, U.S. Army Corps of Engineers identified additional information that the Corps must submit prior to NJDEP issuing "water quality certification"[15] of the Corps' proposed Pine Brook dredging and channelization project. This letter included the following paragraph:

> Since the Corps of Engineers proposes to remove virtually all of the surrounding vegetation, precisely with what do they intend to replace it? The use of conventional perrenial [sic] laron

[14] Almost all fresh surface waters in this part of New Jersey had the FW-2 classification in the NJDEP Surface Water Quality Standards.

[15] Under Section 401 of the Federal Clean Water Act (33 U.S.C. 1341) and Section 5 of the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-5).

> grasses would not be advisable since these will not thrive in such acid soil, requiring the expenditure of large quantities of lime and fertilizer annually in order to maintain soil cover and retard erosion. If so, the runoff from the stream banks would contribute significant amounts of calcium, phosphorus and nitrogen to the brook which could have an adverse effect on the water quality downstream. Additional information is needed from the Corps of Engineers on this subject before a full evaluation can be made.

A February 6, 1979 letter concerning this Pine Brook project from P. A. Descenza, Chief, Engineering Division, New York District, U.S. Army Corps of Engineers to Charles H. Parkell, Review Coordinator, Division of Water Resources, NJDEP, stated, in part:

> As stated before, limestone riprap will be used as a mitigating measure to counter any harmful effect of the project on the pH of Pine Brook. A full planting program will be conducted to stabilize the channelized banks of the stream, and prevent further acid run-off.

An April 2, 1979 letter from Dirk C. Hofman, Acting Director, Division of Water Resources, NJDEP to Richard Maraldo, Chief, Civil Projects Management Branch, New York District, U.S. Army Corps of Engineers set forth more “minimum quantitative data” required by the Division for “water quality certification” of this Pine Brook project. This data included:

> A. <u>Quantification of the Effects of Acid Soil</u>
>
> 1. The lower 2 feet of each of the 8 cores sampled along the proposed project area should be used for the pH-incubation lime requirement test, phosphorus test and extractable heavy metals tests.
>
> 2. The procedure for the pH-incubation test is:
>
>   a. Record initial pH in 0.1 N KCl with a pH meter.
>
>   b. Twenty-five grams of duplicate soil samples are brought to optimum

moisture (60% of field capacity) and put into 250 ml flasks and stoppered with cotton plugs.

c. The flasks are weighed and their weights recorded.

d. Distilled water is added each Monday, Wednesday and Friday in an amount to restore each flask to its original weight.

e. The flasks are maintained at 37°C by storage in an incubator.

f. Duplicate samples are titrated with 0.04 N $Ca(OH)_2$ before incubation and at 2, 4 and 6 weeks of incubation time. To prepare each sample for titration, 50 ml of 0.5 M $CaCl_2$ is added to the 25 grams of soil. After 5 minutes, the pH is taken and Ca(OH)2 is added with frequent stirring, in amounts sufficient to bring the pH to 7.0.

g. A plot of $Ca(OH)_2$ (ml added) vs. pH is then constructed.

h. The results are given in tons of limestone ($CaCO_3$) per acre (6.6 inches in depth) necessary.

3. A second set of 25 grams, duplicate samples for the extractable metals should be leached with dilute acid (0.1 N HCl) at the same time intervals as the titrations above. These soil samples should also be subjected to incubation, and the amounts of total extractable Copper, Zinc, Mercury, Cadmium and Phosphorus should be reported in mg/kg of soil (ppm).

...

D. Quantification of the Chemical Effects on Water Quality and Aquatic Life

...

3. Based upon the results of the core sample pH incubation tests and the mean stream flows the following questions are to be addressed:

   a. Will the Brook's water pH be depressed by the exposure of the iron pyrite bearing soil and to what mean value will it drop?

   b. How long will any pH depression be observed after the completion of the project?

   c. Taking into account the buffering capability of Matchaponix Brook and the mean flows of both the Matchaponix and Pine Brook, how much depression of pH in the Matchaponix can be expected both during and after the project.

...

F. Quantitative Data on Proposed Limestone Riprap

You have proposed using limestone riprap as a mitigating measure to counter any harmful effects of the project on the pH of the Pine Brook due to the disturbance of acid soils.

1. What is the specific type of limestone to be used and in what locations?

2. What is the quantity and the size?

3. What is the life expectancy?

Please include all calculations.

A July 17, 1979 letter from Gerald N. Sonnenblick, Manalapan Township Attorney to Charles Rooney, U.S. Army Corps of Engineers forwarded a July 11, 1979 letter from

Rutgers University Professor of Soils S. J. Toth listing the pH values of 22 recently collected soil cores for this Pine Brook project. Professor Toth reported that 13 of the samples “have the potential for developing acid soil conditions upon exposure to air. However, this point should be verified by conducting ‘incubation tests’ on the samples.” (For these 13 samples, all listed pH values were at or below 4.1, and were marked “May contain iron sulfide, which may upon exposure to oxygen oxide [sic; “oxidize” probably meant] to H_2SO_4. To verify, incubation tests are required.”)

A January 8, 1980 letter concerning this Pine Brook project from P. A. Descenza, Chief, Engineering Division, New York District, U.S. Army Corps of Engineers to Charles H. Parkell, Division of Water Resources, NJDEP provided the results from the pH incubation tests requested in the above mentioned April 2, 1979 NJDEP letter, and recommended a meeting “to discuss the need for additional testing and/or the modification of the project” and “the eligibility of the project for a Water Quality Certificate.”

The test results consisted of pH and “meq [milliequivalents] added $Ca(OH)_2$” values for each of 13 samples (presumably related to the 13 samples listed in Professor Toth’s July 11, 1979 letter) at various times in the six week incubation period. No interpretation of the results was provided except for the statement that “plots of $Ca(OH)_2$ added vs. pH have not been constructed since based on the values obtained there is no slope. This was discussed with Dr. Toth.”

This letter was followed by a July 23, 1980 letter to Chief Descenza from Dirk C. Hofman, Deputy Director, Division of Water Resources, NJDEP concerning this Pine Brook project. Most of this letter is quoted below:

> Thank you for sending us the additional information regarding the pH soil incubation tests on the core samples from the above referenced project site. As we have stated before, we are in agreement that some type of relief from periodic flooding must be provided to the area residents. The proposed project is unique, however, in that it involves the disruption of pyritic/marlitic (acid) soils that are unstable, and have the peculiar property of both bacteriologically and chemically producing an extremely acid condition upon exposure to air.
>
> This property has caused considerable damage to the aquatic environment both downstream from the project site and in other locations in New Jersey (e.g. Matawan Lake, which is now at a pH of 2.O and considered "dead" in that even algae will not grow in it). The exposure of these soils is the primary reason that both the Western Monmouth

Utilities Authority and the Englishtown Auction acreage at the lower end of Pine Brook will not support vegetative re-growth. Under normal weathering, it may take decades for the soil to return to the original pH level.

The pH incubation tests showed that, in addition to releasing heavy metals, none of the 13 soil samples showed any significant increase in pH, and 11 of the 13 samples showed a decrease in pH. These results indicate that, even after 6 weeks the samples had not reached the equilibrium necessary to compute the total amount of lime that would be required to bring these soils to circumneutral if they were exposed. One of our Soils Scientists has estimated, based on our experience with Matawan Lake, that such exposure of the acid producing clay lenses in the Pine Brook area would reduce the pH in the Brook to 2.0-2.5. This drop would have an additional impact not only on the lower Matchaponix but also on Duhurnal Lake [sic] which is used as both a process and drinking water source.

...

I have attached a copy of two reports summarizing the results of our analysis. Limestone riprap was ruled out as it would cause a precipitation of iron oxide and become coated fairly swiftly. The coating would effectively seal it off and prevent any further dissolving. The most startling information came from the Bureau of Mines who stated that the speed of the bacterial growth is such that any exposed soil must be covered within a short period of time or an irreversible acidic condition would prevail which would require Herculean efforts to alleviate.

At the last Quarterly Coordination meeting on June 18, 1980, Dennis Suszkowski asked the name of the bacteria that causes this acidic formation. They are chemoautotrophic organisms such as:

Ferrobacillus ferrooxidans
Ferrobacillus sulfooxidans
Thiobacillus thiooxidans

> Thiobacillus ferrooxidans
>
> The Water Pollution Control Research Series, published by the U.S. Department of Interior, Federal Water Quality Administration covers this topic in "Microbial Factor in Acid Mine Drainage Formation", 14010 DKN 11/70, dated July, 1970, and others.
>
> After your engineers have had time to review the reports, we would like to set up a meeting to discuss the project...

Sometime after September 1981 (the date on the examined copy of the letter is unclear), Chief Descenza sent a letter concerning this Pine Brook project to Deputy Director Dirk C. Hofman. The body of this letter is quoted below:

> Reference is made to the Corps' application for a Water Quality Certificate for the Pine Brook Flood Control Project, Manalapan Township, New Jersey.
>
> Pursuant to the State's request to mitigate against acid soil conditions in the project area, the subject project has been modified to include a bentonite layer to protect the waters of the Pine Brook. As recommended in NJDEP Memo, dated 4 May 1981, soil samples were sent to the American Colloid Company to test the durability of the bentonite layer and to determine the required application rate of the bentonite. Attached is a copy of the test results (Incl. 1).
>
> Based on the recommended application rates of the bentonite, a revised total construction cost estimate was prepared (Incl. 2). The total construction cost including 10% contingency, engineering and design, and supervision and administration is $1,398,389 (September 1981). This represents an annual cost of $109,402 using an interest rate of 7 5/8% for a 50 year project life. The updated annual benefits for the project are estimated to be $72,690 (October 1981 price level). The current Benefit to Cost Ratio (BCR) is .66.

> Since the BCR is less than one (1.0), the Corps cannot participate in the project as currently designed.
>
> Prior to informing Manalapan Township, the local sponsor, of this decision kindly inform my office of NJDEP's recommendation. Should you wish to meet to discuss the project, please call Mr. Charles J. Rooney, Project Manager, (212) 264-9080.

An October 27, 1983 letter from James E. Farry. P.E., Schoor, De Palma & Gillen, Inc. to Rick Reilly, Division of Water Resources, NJDEP was concerned with a Western Monmouth Utilities Authority (WMUA) application for an NJDEP stream encroachment permit for slope stabilization of the same Pine Brook. The main paragraph of this letter is quoted below:

> As per your verbal request, we have estimated the cost for excavating an additional (1') foot of acidic material and replacing same with non-acidic material. The additional work is required in all areas where excavation of the existing material is necessary in order to grade the slopes to the proposed contours. The additional work includes the excavation and offsite disposal of the acid soil and importing, placing and compacting non-acidic soil on the slopes. We estimate the cost of this additional work will be in excess of $120,000. Enclosed is a copy of our estimate.

<u>Soil Conservation Service: 1980-1982 Technical Notes and recommendations</u>

On January 17, 1980, the SCS (now NRCS) Somerset, New Jersey office issued <u>New Jersey Technical Note 28</u> “to distribute current information [developed by Frank H. Webb, Plant Materials Specialist] on establishment of vegetation on extremely acid soils.” This <u>Technical Note</u> said, in part:

> Many situations exist in central New Jersey and surrounding states where exposed soil is extremely acidic. With pH readings in some cases as low as 2.3 absolutely no plant species will survive. However, there is an urgent need to establish vegetation on these sites, some of which are extensive.

In recent years several trials have been conducted by SCS Plant Materials and university personnel to find answers to this problem.

Traditionally the application of lime (calcareous or dolomitic) has worked well where acidifying factors were organic in nature and initial pH was 5.0 or higher. Below that figure the quantities required are not usually practical.

With the situations to be dealt with in this technica1 note the involved soils contain iron sulfide and buffering factors. When such soils are exposed to the air iron sulfide ultimately forms sulfuric acid.

...

Depending on the concentration of available sulfur and resultant acid, involved soils may require application of up to 150 tons of lime per acre. Such application is obviously not practical.

Trials have been conducted to determine how much soil "lift" material must be applied over the acidic soil to permit establishment of lasting vegatative [sic] cover.

Using the "incubation type of lime requirement procedure" Toth[16] tested and treated soils over a period of weeks. In the example shown below an initial need of 4.3 tons of lime was indicated. After a six-week incubation period and four treatments, it was apparent that the actual requirement was almost 80 tons.

...

Obviously any extensive area of this soil could not be adequately limed under efficient management. Covering it with a 6" to 12" lift of suitable material would seem more practical.

[16] Dr. Stephen Toth, Professor of Soil Chemistry, Rutgers University

On May 15, 1981, the SCS (now NRCS) Northeast Technical Service Center (Broomall, Pennsylvania) issued Technical Note Plant Materials No. 9 - Use Of Lime And Soil Cover To Provide Vegetation On Extremely Acid Soils (prepared by W. Curtis Sharp, Plant Materials Specialist). This Technical Note observed that while "acid soils are common place in the humid parts of the U.S." for several reasons (principally "the production of carbonic acid from the decomposition of organic matter"):

> Another natural condition, also producing acid soils, results from the presence of iron sulfides in the soil. This condition is frequently encountered in surface coal mining operations. Earth movement for mining, construction, etc., occasionally uncovers such material. When exposed to the air, the iron sulfide ultimately forms sulfuric acid ...
>
> ...
>
> When these reactions take place, there is a rapid increase in surface acidity and increased a1uminum and manganese availability which is brought into solution by the free acid. Both conditions can prohibit plant growth. Usually the pH will be in the range of 2.0-3.5. As the bare spoil erodes, additional spoil is exposed and the iron sulfide in it is oxidized and the toxic conditions are maintained. Unti1 the site is stabilized either with vegetation or some other protective cover, the process will continue.

This Technical Note further observed "as much as 150 tons" (per acre) of agricultural lime "may be required to neutralize the potential acid producing capabilities of the spoil" and that "such applications are obviously not practical." (To determine the amount of lime, this Technical Note outlined a time-consuming "incubation method."[17]) Uniform incorporation of more than 20 to 30 tons per acre "into the top 6-8 inches of reclaimed surface mine land is nearly impossible." Moreover, "this much lime applied at one time, will initially push the pH well above 7.0, and years may be required for all the sulfides to oxidize and the pH stabilizes within a desirable range."

[17] In this method, soil samples are "treated to raise the pH to a predetermined level, usually 6.0. They are then incubated for several weeks to allow additional sulfuric acid to be produced. Lime is again applied and the-process repeated until the pH remains stable."

Once it is decided "that liming is not a practical solution, the next most logical approach is to cover the affected area with adequate soil cover to reduce or eliminate additional oxidation and provide a medium in which vegetation can grow." To shed light on how deep must the soil cover be, and on how far and fast (if at all) the acid in the subsoil will move up into the soil cover, field studies were conducted in Ocean County, New Jersey and Macoupin County, Illinois by the SCS Cape May Plant Material Center (PMC) and Argonne Laboratories, respectively.[18] Study results suggested that "under any circumstances," the depth of soil cover "should not be less than 6 inches and little justification exists for it to be in access [sic] of 12 inches if the purpose is only to stabilize the site against erosion," and that also applying up to 20 tons per acre of lime before applying the soil cover may be worthwhile.

On April 9, 1982, SCS State Conservationist Plater T. Campbell distributed, to multiple persons inside and outside New Jersey, a March 1982 recommendation on acid soils developed by Cluster R. Belcher, Manager, SCS Cape May PMC. Mr. Belcher mentioned the above cited SCS Technical Notes, and discussed analyses and treatments for soils "with low pH values and having high residual sulphur contents with Professor Roy Flannery, Cook College, Rutgers," who:

> "has conducted research on extremely acid soils and is in charge of the Soil Laboratory. Dr. Flannery suggested that the Incubated lime requirements procedure be conducted on extremely acid soils rather than a simple pH test. This is more expensive and may require up to 8 weeks but the results are much more dependable than the regular pH test."

Mr. Belcher calculated that limestone broadcast at 100 tons/acre would be less than one inch thick, and reported that "Dr. Flannery did not see any problem with working this rate of limestone into the soil with a rotary tiller or disc harrow." Mr. Belcher also got price quotations were from construction companies in Cape May County, and reported that "the cost of one-half acre foot of topsoil is clearly more expensive than 100 tons of limestone. Spreading and leveling of the topsoil would be an extra expense but would cost more than the incorporation of the lime. However, the cost of the topsoil would be somewhat less than stated if it was on site ..."

Finally, Mr. Belcher stated that "in our work, six inches of good quality topsoil over acid soil on level sites seems to be sufficient. However, six inches of topsoil or maybe one and one-half feet may not be sufficiently thick to prevent acid seeps from surfacing [sic] on unlevel sites."

[18] The Ocean County study was conducted on a silty clay loam subsoil with a pH range of 2.2 to 3.3. The Illinois study was conducted on a coal mine gob pile with a pH of approximately 3.8.

New Jersey Department of Environmental Protection (NJDEP): 1984-1985 rules, technical notes, and strategy

The "Acid-Producing Deposits" strategy in subchapter II.A.5 of the NJDEP December 1985 Statewide Water Quality Management Program Plan (Statewide WQM Plan)[19] summarized NJDEP's concerns, activities, objectives, and policy approach related to these deposits. This strategy briefly discussed the adverse effects of exposing "deposits with iron sulfide minerals (pyrite or marcasite)" on plants and water quality, and also noted that "in recent years" what was then the NJDEP Division of Water Resources:

> ... has become concerned about acid-producing deposits in its review of proposals for construction of sewerage facilities, interstate highways, State-owned reservoirs, and stream channelization projects. For example, the "acid soils" problem was discussed at length in the "Environmental Impact Analysis for the Proposed Manasquan Reservoir System Project" (June 1978) prepared for the Division by Rutgers University, and the "disruption of pyritic/marlitic (acid) soils" was a major issue in the Division's review of a proposed Corps of Engineers Flood Control Project along Pine Brook in Monmouth County. ...

Some of these projects are discussed above under "Examples of project documents and correspondence: 1975-1983."

This strategy asserted that the then current SSCC "Standards for Permanent Vegetative Cover for Soil Stabilization" and the above cited SCS Technical Notes:

> ... partially address the problem of acid-producing deposits but do not, in the Department's present judgement, give sufficient attention to preventive appproaches [sic] that could minimize the rate and geographic extent of acid production. For example, where it is known from pre-construction investigation that acid-producing deposits would be encountered on a particular construction site, steps could be taken to prevent the prolonged exposure of acid-producing deposits (where practicable) and to prevent the indiscriminate spreading of acid-

[19] Notice of Statewide WQM Plan adoption was published at 18 N.J.R. 110(b)). Like the other "Water Quality and Wastewater Management Planning Strategies" in this Plan, the "Acid Producing Deposits" strategy did not have regulatory force.

> producing material onto uncontaminated soil. Preventive measures could be particularly important where high water tables would permit the movement of extremely acid ground water into lift material.

This strategy also described the NJDEP's then most recent work in this regard as follows:

> On May 21, 1984, comprehensive Department Flood Hazard Area Regulations became effective (N.J.A.C. 7:13-1.1 et seq.). These regulations[20] list nine Coastal Plain geologic formations in which acid-producing deposits are sometimes found, and include special provisions to control the exposure of acid-producing deposits resulting from construction within floodway or encroachment lines. Included are provisions for site evaluation and mitigation plans, chemical and physical analysis of soil material samples, and the application of preventive and remedial mitigative measures to minimize the production of acid and to promote the establishment of vegetation. Projects which would expose acid-producing deposits along more than 50 feet of stream channel are classified as "Projects of Special Concern" which will not be approved except in special circumstances.
>
> Specific mitigation measures are described in the "Technical Notes Concerning Acid-Producing Deposits"[21] included in the Division of Water Resources "Flood Plain Management Technical Manual, Stream Encroachments" (August 1984). Figure 4, which is included in these "Technical Notes," identifies the general location of the nine geologic formations listed in the adopted

[20] N.J.A.C. 7: 13-5.2(d) and N.J.A.C. 7:13-5.10, Projects exposing acid-producing deposits, as published at 16 N.J.R. 1220 and 1223.

[21] There were some remarkable similarities between these 1984 Technical Notes (directed at construction) and the discussion of "astringent clay" (directed at farming) in Chapter I of the 1836 annual report by Henry Rogers, first New Jersey State Geologist. Both documents discussed adverse effects of acid produced from sulfur compounds (including compounds with iron) in the deposits; both documents discussed the general location of these deposits in New Jersey, how to recognize these deposits in the field, and simple chemical tests for these deposits; and both documents recommended methods for managing these deposits.

> regulations (Raritan Formation, Magothy Formation, Merchantville Formation, Woodbury Clay, Englishtown Sand, Marshalltown Formation, Navesink Formation, Red Bank Sand, and Kirkwood Formation).
>
> This report includes guidance for site evaluation and descriptions of simple chemical tests for acid-producing deposits. The mitigation procedures described in this report can be applied where land is disturbed for stream encroachment or other purposes.

This strategy also noted that the Flood Hazard Area Regulations do not control the exposure of acid-producing deposits outside floodway or encroachment lines, or control their exposure for "non-regulated uses" such as residential lawns and gardens. To address this gap, this strategy stated:

> ... in the future, it would be desirable to achieve, by mutual agreement between the Department and the State Soil Conservation Committee, greater consistency between DEP requirements and the "Standards for Soil Erosion and Sediment Control in New Jersey." The Department, through its representation on the State Soil Conservation Committee, will endeavor to persuade the Committee to review the provisions for acid-producing deposits in Department documents and the current "Standards for Soil Erosion and Sediment Control in New Jersey," and to make recommendations for modifications to achieve greater consistency.

A December 8, 1983 letter from Carl J. Montana, P.E., State Conservation Engineer, to George Horzepa, Chief, NJDEP Bureau of Planning and Standards, stated:

> As requested by your letter of November 7, 1983, we have reviewed the copy you provided of Mitigation Procedures for Acid Producing Deposits.
>
> An excellent job was done in the preparation of this document. We have no suggestions for changes or additions.

1987 SSCC Standards; 1990 NJDEP/SSCC Memorandum of Agreement; 1995-1996 NJDEP rules and general permit fact sheet; 1999 SSCC Standard

The Standard for Temporary Vegetative Cover for Soil Stabilization in the 1987 Standards for Soil Erosion and Sediment Control in New Jersey included the following provision essentially the same as that in the corresponding 1979 Standard:

> Soils high on [sic] sulfides or having a pH of 4 or less should be mulched only. See Standards for Stabilization with Mulch Only, p. 3.3.1.

The Standard for Permanent Vegetative Cover for Soil Stabilization in the 1987 Standards included the following provision which was the same as that in the corresponding 1979 SSCC Standard:

> Acid soil conditions:
>
> Soils having a pH of 4 or less or containing iron sulfide shall be covered with a minimum of 12 inches of soil having a pH of 5 or more before seedbed preparation. The added soil shall be limed as above.

The Standard for Topsoiling in the 1987 Standards included the following provision which was the same as that in the corresponding 1979 SSCC Standard: "Soils with a pH of 4.0 or less or containing iron sulfide shall be covered with a minimum depth of 12 inches of soil having a pH of 5.0 or more."

The Standard for Subsurface Drainage in the 1987 Standards included the following provision which was the same as that in the corresponding 1979 SSCC Standard:

> "When iron sulfide chemical reaction causes sealing of joints or perforations, the drain shall be enclosed in a clean sand-gravel filter. Riser pipes for flushing the line shall be provided at intervals not to exceed 500 feet."

The Appendix A3 Guide for Construction Specifications in the 1987 Standards included the same acid soil provision that was in the 1982 version of this Guide: "Exposed soil having a pH value of less than 4 shall be covered with a minimum of 12 inches of soil material no coarser than a sandy loam or SM and that can be corrected to a minimum pH of 6.5." (Note that this provision still did not mention iron sulfide.)

In regard to acid soils, there thus was still much inconsistency between NJDEP requirements and the 1987 SSCC Standards for vegetative cover and Guide for Construction Specifications.

The December 27, 1990 Interagency Agreement for Coordination of Stormwater Management and Soil Erosion Control between NJDEP and SSCC included the following "Point of Agreement":

> Section 12 - Acid Soil Mitigation - Monitoring by SCD
>
> As necessary, the Soil Conservation District will monitor all acid soil mitigation for stream encroachment permits. A project report of compliance will not be issued by the SCD until completion of appropriate acid soil mitigation measures. Any non-compliance with the acid soil mitigation plan will be reported to New Jersey Department of Environmental Protection.

Effective March 20, 1995 (see 27 N.J.R. 1211(a)), the NJDEP replaced its 1984 Flood Hazard Area Regulations with new Flood Hazard Area Control Rules at N.J.A.C. 7:13. As part of this rulemaking, N.J.A.C. 7:13-3.7, Projects exposing deposits of acid-producing soils, replaced N.J.A.C. 7:13-5.10, Projects exposing acid-producing deposits. N.J.A.C. 7:13-3.7 (1995) was very similar to N.J.A.C. 7:13-5.10 (1984) except for some administrative language about the section's relationship to various stages in the stream encroachment permit process.[22]

The Summary of Public Comments and Agency Response in the 1995 rule adoption included three public comments on N.J.A.C. 7:13-3.7 (Comments-Responses 247, 248, and 249 at 27 N.J.R. 1239). Comments 248 and 249 criticized rule provisions concerning site evaluation by a "professional" and special laboratory analysis. Following is the NJDEP's full summary of and response to the broader Comment 247 submitted by William Brash, Jr. of the Mercer County Soil Conservation District (commenter 8):

> 247. COMMENT: Although N.J.A.C. 7:13-3.7(d) requires mitigation of acid soils exposed by proposed regulated activity, the practice has always been handled by the Soil Conservation Districts (SCDs), rarely by the Department [of Environmental Protection]. The Memorandum of Agreement between DEP and the Department of

[22] See also N.J.A.C. 7:13-1.3(a), a 1995 permit applicability provision which dealt with "acid-producing soils" among other matters, and which replaced N.J.A.C. 7:13-5.2(d) including its references to "acid-producing deposits." (In this regard, N.J.A.C. 7:13-1.3(a)3i erroneously cross-referenced former N.J.A.C. 7:13-5.10 rather than N.J.A.C. 7:13-3.7.) See also N.J.A.C. 7:13-4.1(j), a 1995 permit application information provision which required an "environmental report" including "6. A site evaluation and mitigation plan for acid-producing soils, where applicable."

> Agriculture stipulates that the SCDs will oversee the mitigation of acid soils since SCDs are the only entity that can realistically mitigate acid soil. (8)
>
> RESPONSE: The Memorandum of Agreement stipulates that the SCDs will, as necessary, monitor all acid soil mitigation for stream encroachment permits and report non-compliance to the Department. While, the SCDs are better equipped to performing this activity, the authority to require the mitigation is still under the authority of the stream encroachment regulations. It is beyond the scope of this revision to transfer the regulation of acid soils to the Soil Conservation Districts. Therefore, this section will remain in the rule. The Department is open to discussions regarding the transfer of the responsibility for the regulation of acid soils.

In addition, NJDEP discussed acid-producing deposits in Sections III.E and IV.A.2 of its February 5, 1996 Fact Sheet for Revocation and Reissuance of NJPDES General Permit No. NJ0088323. For most of the 1990s, this "construction activity" general permit, also called the “5G3” permit, regulated stormwater discharges from certain construction, mining, and quarrying activities.[23] In discussing the problem of “acid-producing deposits,” Section III.E cited the NJDEP Flood Hazard Area Control Rules (N.J.A.C. 7:13-3.7) and the “Technical Notes Concerning Acid-Producing Deposits” in the associated Technical Manual (which NJDEP had revised in September 1995), and noted that exposing these deposits by construction and mining activities “decreases the pH of stormwater (which, in turn, increases the concentration of dissolved metals in stormwater), and can also increase the discharge of sediment in stormwater by creating soil conditions toxic to vegetation used for erosion and sediment control.”

As discussed in Section IV.A.2, however, NJDEP did **not** use this general permit to expand the scope of NJDEP requirements concerning such deposits:

> Section III.E of this fact sheet discusses the problem of “acid-producing deposits.” Because exposure of such deposits creates soil conditions

[23] NJDEP first issued this general permit in 1992 as a regulatory Appendix B in the New Jersey Pollutant Discharge Elimination System (NJPDES) rules at N.J.A.C. 7:14A-3. (The associated 1992 Fact Sheet did not discuss acid-producing deposits.) In 1997 NJDEP issued the revoked and reissued general permit as a regulatory Appendix B in the reorganized NJPDES rules at N.J.A.C. 7:14A-11. The February 5, 1996 Fact Sheet for revocation and reissuance of this general permit was mentioned in the NJPDES rule proposal notice at 28 N.J.R. 432.

> toxic to vegetation used for erosion and sediment control, this problem often can be addressed under the Soil Erosion and Sediment Control Act. The Department generally prefers that this problem be addressed under that Act and under Department rules at N.J.A.C. 7:13-3.7, where applicable, and has not included specific provisions concerning acid-producing deposits in draft reissued General Permit No. NJ0088323. However, if the Department determines (more likely at a location where N.J.A.C. 7:13-3.7 does not apply) that problems caused by acid-producing deposits are not being adequately addressed under the Soil Erosion and Sediment Control Act and General Permit No. NJ0088323, the Department may take action under proposed N.J.A.C. 7:14A-6.13 to revoke the facility's authorization under that permit.

A major milestone was reached in 1999 when the new SSCC "Standard for Management of High Acid Producing Soils" was adopted and became effective and operative (see 31 N.J.R. 1799(a)). This was the first time the SSCC Standards addressed this issue comprehensively. This Standard's "Definition" is:

> "Identifying high acid producing soil which may be exposed during excavation and land grading activities and practices for its burial. High acid producing soils are soils with a pH of 4 or less or contain iron sulfide."

Other elements of this Standard's general approach are expressed in (i) this Standard's "Purpose," which begins "To prevent or limit exposure [of high acid producing soil], exposure time and spreading by equipment or rainfall on and off site and minimize erosion, sedimentation and acid leachate related damages..."; and (ii) this Standard's "Planning Criteria," which begin: "Early recognition and burial, removal or disposal of high acid producing soils is essential for limiting the amount of acidic material produced." These criteria list the same nine geologic formations listed in the then current NJDEP Flood Hazard Area Control Rules at N.J.A.C. 7:13-3.7 (and provide an updated geologic map); direct the user to contact the local SCD "to determine the historical presence of high acid producing soils in the vicinity of the proposed development site"; and provide other information useful in identifying these soils. This Standard's "Methods and Materials" set forth various specific requirements and recommendations to prevent or limit exposure, exposure time, and spreading of these soils, and to monitor and mitigate the effects of such exposure. Following are two of the summarized comments and SSCC responses concerning this Standard as provided in the SSCC adoption notice for the 1999 Standards:

> COMMENT: A commenter suggested that exposure of high acid producing soils be limited to eight hours except where absolutely necessary.
>
> RESPONSE: The SSCC disagrees. While this period may be suitable for exposure of small quantities of acid soil, it is not realistic for dealing with large quantities. It is not uncommon for these stockpiles on large projects to remain for several months during land development. Conservation Districts have been dealing with this problem for more than 20 years and that experience is contained in this standard. Language was added to provide an option for stockpiles to remain for more than 60 days to be covered with black polyethylene.
>
> ...
>
> COMMENT: A commenter suggested that six tons per acre of limestone when burying high acid producing soils should be substantially increased. He also referred to an editorial error for converting six tons per acre to pounds per 1,000 square feet.
>
> RESPONSE: Expert opinions vary as to the amount of limestone needed on buried, high acid producing soils. A minimum of six tons per acre is a supportable threshold. When this soil is buried, acid production stops. The SSCC will consider future changes if deemed appropriate by scientific recommendation. Also, the corrected rate of 275 pounds per 1,000 square feet was made.

The Standard for Subsurface Drainage in the 1999 Standards included the following provision which was the same as that in the corresponding 1987 SSCC Standard: When iron sulfide chemical reaction causes sealing of joints or perforations, the drain shall be enclosed in a clean sand-gravel filter. Riser pipes for flushing the line shall be provided at intervals not to exceed 500 feet.”

The Appendix A3 Guide for Construction Specifications in the 1999 Standards included the following revised acid soil provision: “Exposed soil having a pH value of less than 4 shall be shall be treated in accordance with the standard for Management of Highly Acid Soil, pg. 1-1.” (Note that this revised provision still did **not** mention iron sulfide.)