Exhibit 1

THE FLORIDA PHOSPHORUS INDEX

Introduction

The Florida Phosphorus (P) Index was concurred in on November 13, 2000, by the USDA State Technical Committee and adopted by T. Niles Glasgow, NRCS State Conservationist. The Florida P Index was adopted with the stipulation that in six months the P Index committee will report on any additional recommendations to the USDA State Technical Committee. Additional copies the Florida P Index may be obtained from the website http://seweb.ga.nrcs.usda.gov/fl (click on Technical Resources, then Technical Tools, and then Phosphorus Index).

This document includes a brief history, suggestions on utilization, the matrix, category descriptions, interpretation of site P Index number, site characteristics rationale, and considerations for reducing the vulnerability of the site.

The P Index is a site specific, qualitative vulnerability assessment tool. The P Index allows a conservation planner to determine, from among a series of proposed phosphorus application sites, which sites are potentially most vulnerable to the off-site movement of phosphorus. These sites based on this information should then be considered for more careful management of phosphorus.

USDA, Natural Resources Conservation Service (NRCS) policy for nutrient management, identified the P Index as a technique which offers the greatest amount of flexibility for making phosphorus application and management decisions for nutrient management. In this policy, the P Index is used to determine when animal by-products, primarily manure utilization, may be based on a nitrogen-based budget and when such utilization must be based on a phosphorus-based budget. The policy also stresses the use of this tool in any designated phosphorus limited areas.

The purpose of the P Index is to aid NRCS planners and others in the decision making process involved in designing conservation plans related to land application of animal wastes. The phosphorus index is not intended to be an evaluation scale for determining whether landusers are abiding within water quality or nutrient management standards that have been established by local, state or federal agencies. Any attempt to use this index as a regulatory scale would be grossly beyond the intent of the assessment tool and the concept and philosophy of the working group that developed it.

Background

The concept of the P Index is a product of a group of scientists who collaborated in the early 1990s and became identified as the Phosphorus Index Core Team (PICT). The PICT was made up of a national group of scientists that included USDA, universities, Cooperative Extension Service, private agencies and industry. The original committee has since evolved into a much larger group now known as the SERA IEG 17 (Southern Extension and Research Area Information and Exchange Group). This group continues to improve and validate the P Index and to pursue and promote other activities related to phosphorus with an overall desire to reduce phosphorus transport to ground and surface water bodies. The guidance used to develop the P Index is contained in the document "The Phosphorus Index A Phosphorus Assessment Tool" and may can be viewed at the web site http://www.nhq.nrcs.usda.gov/BCS/nutri/phosphor.html

The Florida P Index was developed by a group of scientists and laypersons to incorporate those characteristics that are to be used Florida. The P Index is a process that should be reviewed regularly and modified to incorporate additional research and information as it becomes available. The P Index for Florida was primarily developed for use by NRCS personnel and other nutrient management planners in conformance with NRCS nutrient management policy.

Nutrient Policy Implementation within NRCS

NRCS has established a two-year timeline during which State Conservationists are expected to fully implement the agency's revised policy for nutrient management (May 26, 2001). Policy implementation will be accomplished through revision of the conservation practice standard for Nutrient Management (Code 590), employee training and certification, and implementation of the necessary technology and tools field employees will need to provide nutrient related assistance according to the new requirements. The P Index is one of these tools. The goal is to implement the P Index in all states by the end of 2000. Knowledge gained and lessons learned from the initial work sessions are being used to assist Florida and other states in implementing the P Index.

Scientific Support for P Index Development

The initial work in Florida began in August 1998 at a subcommittee meeting of the Florida USDA State Technical Committee on phosphorus concerns. A workgroup was established as a part of the USDA State Technical Committee, which is made up of various agencies, organizations, groups, and private individuals. Membership on the Florida P Index workgroup is open to all persons concerned with an interest in the development and use of this tool.

Several meetings and field evaluations of various drafts of the P Index have led to the adoption of the present P Index.

The major participants in developing the P Index are:

University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) – Dr. Donald Graetz, Dr. Vimala Nair, Dr. Willie Harris, Dr. Gerald Kidder, Dr. Ken Campbell, and Dr. Rao Mylavarapu.

NRCS - Winston Tooke, Wade Hurt, Warren Henderson, Bill Reck, and Pete Deal.

Florida Department of Agriculture and Consumer Service (FDOACS) – Joel Love and Darrell Smith

USDA, Agriculture Research Service (ARS) – Dr. Clint Truman

Several other participants, representing these and other agencies, organizations and private individuals, have been involved at various meetings and stages of development.

Implementation Activities

Implementation of the P Index involves a number of specific steps, which should be implemented in a logical order. These steps include:

- Understanding the Concept of the P Index
- Identifying Site Characteristics
- Populating the Matrix
- Selecting a Mathematical Processing Model
- Calibrating the P Index

- Field Testing
- Recalibrating the P Index
- Implementing the P Index
- Using the Results of a P Index Analysis
- Assessing the P Index
- Some Additional Planning Factors for Consideration

A brief discussion is included below for each of these steps. More detailed information is included in the paper "The Phosphorus Index A Phosphorus Assessment Tool."

Understanding the Concept of the P Index

Before any implementation activity can be started, the person(s) who will participate in the implementation of the P Index must understand its concept. The P Index is as much a concept as it is anything else. A properly designed P Index becomes an important decision making tool which can be used to support conservation planning and the development of component plans for nutrient management. The P Index can be particularly helpful in making decisions for allocating and utilizing animal manures or other organic by-products applied to the land as a source of nutrients. The P Index becomes a consistent and systematic tool that field staff can use to identify P resource concerns and communicate management and conservation practices through conservation planning with the landowner.

The concept of the P Index embodies these considerations:

After phosphorus material is applied to the land it may be transported from the site of application in surface and subsurface runoff or by wind erosion.

The movement of phosphorus may occur attached to eroding soil and organic particles; with surface runoff (transported in soluble form) or leaching (transported in leachate beyond the root zone toward shallow ground water or resurface in surface waters).

Individual sites have different sources of phosphorus.

Individual sites have different vulnerability to phosphorus transport that makes phosphorus loss more or less probable.

The proximity of a surface water body or shallow depth to ground water, particularly waters sensitive to additional P, makes water quality impairment more likely, if other site features make transport probable.

Not every part of a field site delivers phosphorus off-site, even though phosphorus movement may occur across the entire site.

Different sites behave differently, subject to the soil, source, and transport characteristics that are specific to them.

Management of the site (erosion and runoff control, application timing and placement, and water management) affect the site vulnerability to transport.

To be an effective planning tool, the P Index must be customized to the predominant geomorphology, hydrology, and climate of the area(s) in which it will be used. A P Index developed in another state will not normally meet the needs of a user in a specific area.

The installation of conservation practices and/or changes in management techniques can affect phosphorus transport. Some will reduce phosphorus transport and others may increase it.

Finally, that the P Index is a qualitative assessment tool. Although it uses numbers and mathematical processes to determine vulnerability rating, the numbers are used only for calculation purposes. Numerical comparisons should not be made among different locations as values (concentrations) of actual phosphorus movement offsite. Such comparisons are presently beyond the scope of the P Index. However, comparisons can be made among the individual site characteristics at a specific location. The P Index leads the planner and landowner into a decision-making process.

Identifying Site Characteristics

As previously mentioned, it will be rare for any specific version of the P Index to work for multiple locations. Some adaptation or change will almost certainly be needed each time the P Index is applied somewhere else.

The P Index assesses two major categories of site characteristics, those related to phosphorus transport and those related to phosphorus sources. The result of an analysis using the P Index gives the producer a vulnerability rating for each field analyzed. This rating may be LOW, MEDIUM, HIGH, and VERY HIGH. As the vulnerability rating increases, so does the potential for phosphorus transport off-site, and for phosphorus to become associated with water quality impairment.

The site characteristics of the area or region in which the P Index is being developed must be identified as the P Index is being adapted for use in that area. Although some site characteristics may be common among many regions, some may be unique to one or a limited number of areas. When beginning to work with the P Index, the site characteristics that are important in determining/controlling phosphorus transport in the region are identified. Examples of site characteristics include:

Transport Characteristics:

- Soil Erosion
- Soil Runoff Class
- Irrigation Runoff and Erosion
- Hydrologic Soil Group
- Distance to Water Body, Stream Channel, or Water Course
- Leaching Potential
- Flooding Frequency

Phosphorus Source Management Characteristics:

- Phosphorus fertility Index Value
- Soil Phosphorus Adsorption Capacity
- Soil Texture and Mineralogy
- Commercial Phosphorus Application Rate
- Commercial Phosphorus Application Method (how & when applied)
- Organic Phosphorus Application Rate
- Organic Phosphorus Application Method (how & when applied)
- Amount of Irrigation Water Applied in excess of plant needs

Populating the Matrix

Early adaptations of the P Index have been developed from the additive matrix used in the original version. Site characteristics are listed in the first column of the matrix. As the P Index evolved, it became typical to group site characteristics according to whether they are associated with transport or with phosphorus source management. Ranges were then established for each site characteristics which determine what vulnerability category a user assigns to a site when making an evaluation (e.g. low soil erosion = low vulnerability; excessive soil erosion = very high vulnerability; erosion that exceeds low but is not excessive is divided between the medium and high vulnerability categories). Ranges are established for each site characteristic. Identifying the numbers or other values, which determine these ranges, is part of the calibration process.

The type of mathematical processing model chosen, rates site characteristics weighting factors and phosphorus loss rating values in a relative relationship and is entered in the matrix. The weighting factors compare the importance of a particular site's characteristics to one another. The phosphorus loss rating values allows the mathematical process to provide magnitude in the numeric answer.

A variety of mathematical processes to interrelate information for individual site characteristics and to determine the final vulnerability rating for the site have been utilized and modified. The final answer is a qualitative rating for the site.

Florida's P Index uses eight characteristics to obtain an overall rating for a site. See table 1. These characteristics are weighted to reflect their degree of importance to P loss. At present, the weighting factors are based on the professional judgement of the scientists that developed the P Index.

Selecting a Mathematical Processing Model

After the major site characteristics have been identified, ranges established, and matrix populated; the mathematical process which will be used to perform the calculations must be selected. To date, individual developers of the P Index have used different mathematical techniques to perform the calculations by which the P Index arrives at an answer.

The original P Index used a technique, which multiplies the site characteristics weighting factor times the phosphorus loss rating value to calculate the vulnerable value for each site characteristic. The values for each specific site characteristic are then added to determine the vulnerability rating for the site. This has been called the **Additive Approach**.

An adaptation of the P Index uses a **Multiplicative Approach**. Individual subtotals are calculated for the site characteristic associated with transport and management before they are related to one another. The subtotal for phosphorus management site characteristics is determined by adding the individual site characteristic values together. The subtotals for transport and management factors are calculated by multiplying individual factor values. The overall site index is then determined as the product of transport and management subtotals.

Florida's adaptation uses features of both the additive approach and multiplicative approach. However, site factors are grouped slightly differently into site characteristics (i.e., erosion, runoff, distance to waterbody, and soil P) and management factors (i.e., phosphorus application rate, and method of application).

Because the final answer is translated into a qualitative rating, any of the mathematical processes described could be used. However, one consideration in selecting a mathematical processing model should be the process used in adjoining states. As different mathematical models may be more appropriate for different areas, the magnitude of the final P Index value will vary. For example, P Index values using Florida's version may be an order of magnitude greater than those for versions used in other states.

Although this is not necessarily important to arriving at an answer, it becomes important when comparisons of various adaptations of the P Index are made, particularly across state lines. In situations when different mathematical processing models are being used in different versions of the P Index, the different versions should be compared to be sure that they are generating the same qualitative rating for a common site. If they are not, problems will develop.

Calibrating the P Index

After identifying site characteristics, populating the matrix, and selecting the mathematical processing model that will be used, the initial calibration of the matrix was accomplished. This initial calibration involves identifying the numeric ranges for each of the site characteristics. Identifying the appropriate numeric values for the LOW and VERY HIGH vulnerability categories was easier than for the two intermediate vulnerability categories. Specific guidance for accomplishing this is contained in the paper "The Phosphorus Index A Phosphorus Assessment Tool."

Field Testing

After the initial calibration of the P Index was accomplished, it was field-tested. Testing involves using the P Index to perform evaluations on sites considered to have HIGH vulnerability, on sites considered to have LOW vulnerability, and on some sites considered to be between LOW and HIGH. After reviewing the results of testing several adjustments were made to the factors in order to place these sites in their proper vulnerability category.

Recalibrating the P Index

The results of the field testing process were used to make necessary adjustments needed in the numbers used to make calculations to ensure that the P Index is calculating answers, which are reasonable.

Implementing the P Index

The P Index may be implemented in the area for which it was developed. The implementation process should include classroom and field training for those who use it. It may also include field demonstrations with those for whom it will be used to make evaluations. Some consideration of sites is wise when planning demonstrations. A series of sites selected for demonstration purposes should produce different vulnerability ratings.

Users are encouraged to perform some of their initial evaluations manually, even in situations when an automated tool may be available. This will help them gain a better understanding of the P Index and how it functions. Automated techniques are preferred only after a person gains an understanding of the P Index. Lack of understanding of the P Index may make it a "black box" to the user.

Using the Results of a P Index Analysis

A P Index analysis helps the planner assist the producer in making phosphorus management decisions. On site with a LOW or MEDIUM vulnerability rating, it may be possible to manage animal manures using a nitrogen-based budget to determine manure application rates. On sites with a HIGH or VERY HIGH vulnerability rating, it may be desirable to manage animal manures using a phosphorus-based budget to determine manure application rates.

Since output from the P Index includes information specific to each of the site characteristics, the planner can identify those site characteristics which have had the greatest influence in determining the final vulnerability rating and may be targeted for remedial action.

Assessing the P Index Results

The numerical result of the P Index has no absolute value, but is immediately translated into a qualitative rating (LOW, MEDIUM, HIGH, or VERY HIGH). For each qualitative rating a description is given for the level of concern that each specifically assessed field has for P loss potential. Some general guidance is given for each qualitative level as to the intensity and type of remedial action or mitigation that would be necessary to reduce P loss risk. Reviewing each individual site characteristic rating will identify whether the cause and severity of the risk warrants management attention. Using the planning process, each individual site characteristic can be used to communicate with the landowner the potential for P loss. Management actions and conservation practices can then be planned and implemented to reduce the P loss risk. The P Index assessment leads directly to the planning process and thus makes the numerical value of the initial P Index insignificant after the conservation plan is in place and implemented.

Some Additional Planning Factors For Consideration

Best management practices and management techniques can be used to reduce the risk of P loss from the field.

Identification of 'where' and 'how' the potential P loss risk could occur are vital to the successful use of the P Index.

Scale of application of the P Index generally applies to the field unit or specific acreage.

There may be a situation where the whole field is not contributing phosphorus loss to the environment (i.e., a localized critical source). In this case, only the critical source area would require conservation treatment. In other cases, there may be neither a potential source or transport mechanism to move the P.

Long-term application and soil buildup of phosphorus material is not the long-term solution to a farm-level imbalance of phosphorus. A single catastrophic event (flood, hurricane) can remove many years of soil-accumulated phosphorus.

Table 1. The Florida P Index Matrix.

Part A: Phosphorus transport potential due to site and transport characteristics

TRANSPORT	**PHOSPHORUS LOSS RATING (VALUES)**					**VALUE**
Soil Erosion	No Surface Outlet **0**	<5 T/A **1**	5-10 T/A **2**	10-15 T/A **4**	>15 T/A **8**	
Runoff Potential [1/]	Very Low **0**	Low **1**	Medium **2**	High **4**	Very High **8**	
Leaching Potential [1/]	Very Low **0**	Low **1**	Medium **2**	High **4**	Very High **8**	
Potential to reach water body [1/]	Very Low **0**	Low **1**	Medium **2**	High **4**		

[1/] See page 10 and 11 of this document for category descriptions.

Part A: Total Site Value _______

Part B: Phosphorus loss potential due to management practices

MANAGEMENT	**PHOSPHORUS LOSS RATING (VALUES)**				**VALUE**
Fertility Index Value	Soil Fertility Index x 0.025 (______ ppm P x 2 x 0.025)				
P Application Rate	0.05 x (_______ lbs P_2O_5) for fertilizer, manure or compost 0.025 x (_______ lbs P_2O_5) for biosolids 0.10 x (_______ lbs P_2O_5) for waste water				
Application Method	No Surface Outlet **0**	Applied via irrigation on a periodic basis **2**	Incorporated within 5 days of application **4**	Surface applied without incorporation **6**	
Waste Water Application Volume	0.20 x _____ acre-inches/year				

Part B: Total Management Value: ______

Multiply Part A (______) x Part B (_______) = _______ P Loss Rating

Exhibit 1

Client Name: ______________________ County: __________________ Date: ______________
Planner: ______________________ Field(s): __________________ Crop: ______________

Enter below notes that may be used to help explain, clarify, and/or define the site-specific criteria information used to evaluate this site.

TRANSPORT

Soil Erosion	
Runoff Potential [1/]	
Leaching Potential [1/]	
Potential to reach water body [1/]	

[1/] See page 10 and 11 of this document for category descriptions.

MANAGEMENT

Fertility Index Value	
P Application Rate	
Application Method	
Waste Water Application Volume	

CATEGORY DESCRIPTIONS FOR PART A OF TABLE 1

Soil Erosion: Soil erosion by water is predicted using the Revised Universal Soil Loss Equation (RUSLE). The value is determined from each application site. The ranges are shown in tons of soil loss per acre per year.

Field Evaluation of Runoff and Leaching Potential - Usage of the following runoff and leaching potential criteria is based on a minimum of 10 observations (may be soil borings) per spray field/application area unless the number of borings identify the site as a problem area or a uniform area. At lease one observation is to be made in each landform present. Examples of landforms are flats, flatwoods, depressions, terraces, rises, knolls, hills, hillsides, sideslopes, toeslopes, footslopes, etc. If there is no surface outlet for the field in consideration, the rating is Very Low (0) for Runoff Potential.

Runoff Potential Criteria

Very Low (0): Soils in Hydrologic Soil Group A with >75% ground cover,

or:

Any hydrologic soil group with no surface outlet.

Low (1): Soils in Hydrologic Soil Groups A with < 75% ground cover with surface outlet and A/D **(**with artificial drainage**) and slopes of 8% or less** (Artificial drainage – water control that is designed and maintained according to NRCS standards that will perform the desired water control.)

Medium (2): Soils in Hydrologic Group A and A/D (with sufficient artificial drainage to lower the water table permanently) **and slopes of more than 8%**.

or:

Soils in Hydrologic Groups B and B/D **(**with artificial drainage**) and slopes of 5% or less**

High (4): Soils in Hydrologic Group B and B/D (with sufficient artificial drainage to lower the water table permanently) **and slopes of more than 5% up to and including 8%.**

or

Soils in Hydrologic Groups C and C/D (with sufficient artificial drainage to lower the water table permanently) **and slopes of 5% or less**.

Very High (8): Soils in Hydrologic Group B and B/D (with sufficient artificial drainage to lower the water table permanently) **and slopes of more than 8%.**

or

Soils in Hydrologic Groups C and C/D. (with sufficient artificial drainage to lower the water table permanently) **and slopes of more than 5%.**

or

Soils in Hydrologic Groups D and A/D, B/D, and C/D in undrained condition (without sufficient artificial drainage to lower the water table permanently**)**.

Leaching Potential Criteria

Very Low (0): At least 80 percent of observations have a Loamy or clayey layer at least 25 cm (10”) thick starting within 50 cm (20”)(e.g., Typic Paleudults),

Low (1): At least 80 percent of observations have a Loamy or clayey layer at least 25 cm (10”) thick layer starting within 200 cm (80”) (e.g., Arenic and Grossarenic Paleudults) or direct discharge to Class 4 water body.

Medium (2): At least 80 percent of observations have a loamy or clayey layer at least 25 cm (10”) thick starting at some depth above seasonal high saturation (to include depths starting below 200 cm (80”) and sand grains in the E and Bw horizons have coatings (chroma>=3) to a depth of at least 1 m. (40”)

High (4): At least 20 percent of observations have no loamy or clayey layer,

or

the loamy or clayey layer is less than 25 cm (10”) thick, and the combined thickness of layers with coated sand grains (chroma $\geq$ 3 in the E, Bw, and C horizons **and any chroma in the Bh horizons) is greater than 50 cm (20”).**

Very High (8) At least 20 percent of observations have no loamy or clayey layer (or the layer is less than 25 cm (10”) thick) and the combined thickness of layers with coated sand grains (chroma $\geq$ 3 in the E, Bw, and C horizons and **any chroma in the Bh horizons) is equal to or less than 50 cm (20”).**

Potential to Reach Water Body

Very Low (0): No direct discharge from the edge of the field.

Low (1): Discharge through wetlands, buffer area, stormwater detention, or overland treatment.

Medium (2): Ditch drainage to or direct discharge to a Class 3 water body.

High (4): Direct discharges to a lake, sinkhole, Class 1 or 2 water body, or Outstanding Florida Water body.

INTERPRETATION OF THE P INDEX

Table 2. Interpretation of the P Index number. [1/]

P Index for Site	Generalized Interpretation of P index for Site
< 75	**LOW** potential for P movement from the site. If farming practices are maintained at the current level there is a low probability of an adverse impact to surface waters from P losses at this site. Nitrogen-based nutrient management planning is satisfactory for this site. Soil P levels and P loss potential may increase in the future due to N-based nutrient management.
75 - 150	**MEDIUM** potential for P movement from this site. The chance for an adverse impact to surface waters exists. *Nitrogen-based nutrient management planning is satisfactory for this site when conservation measures are taken to lessen the probability of P loss*. Soil P levels and P loss potential may increase in the future due to N-based nutrient management
151 - 225	**HIGH** potential for P movement from the site and for an adverse impact on surface waters to occur unless remedial action is taken. Soil and water conservation as well as P management practices are necessary (if practical) to reduce the risk of P movement and water quality degradation. If risk cannot be reduced then a P-based management budget based on crop removal will be utilized.
>225	**VERY HIGH** potential for P movement from the site and for an adverse impact on surface waters. Remedial action is required to reduce the risk of P movement. All necessary soil and water conservation practices, plus a P based management plan must be put in place to avoid the potential for water quality degradation. The P based management plan will be based on less than crop removal to reduce P over a defined period (not to exceed 20 years).

[1/] The index numbers and the interpretations, as well as the whole document will continue to be reviewed and evaluated and are subject to modifications as further discussions and field tests occur.

CONSIDERATIONS FOR REDUCING VULNERABILITY

When the reviewer of the application site has performed the evaluation based on the present conditions, the reviewer will determine what factors are creating the highest levels of concern. When these factors have been determined then an assessment should be made to evaluate the feasibility of making various changes to reduce the vulnerability rating to an acceptable level. This may require several trials and combinations of various possible decisions to achieve the desired reduction of Phosphorus leaving the site. There may be sites or portions of the site that the vulnerability cannot be reduced enough to apply animal by-products. In this case alternate sites would need to be considered.

Portions of a site, when large enough, that has significant characteristics should be considered as separate sites to determine if animal by-products may be applied to that portion within the rating criteria.

The following is a list of NRCS conservation practice standards, located in the Field Office Technical Guide Section IV, and potential effects related to the transport potential and management practice factors in Part A and Part B. Note - implementation of one or more practices may have positive effects on some factors while causing negative effects on other factors. LC is used to designate little or no change or effect on the factor.

NRCS Conservation Practice Standard Name and Code Number	Part A - Transport				Part B - Management Practices			
	Soil Erosion	Runoff	Leaching	Water body	Fertility Index	P App. Rate	Applica-tion Method	Waste Water Volume
Residue management (329A, 329B, 329C, 344)	Decrease	Decrease	Increase	Increase/ decrease	Increase/ decrease	LC	LC	LC
Constructed Wetlands (656)	Decrease	Decrease	LC	Decrease	LC	LC	LC	LC
Conservation Crop Rotation (328)	Decrease /increase	Decrease /increase	Decrease /increase	Decrease /increase	Decrease	Increase	LC	Increase
Contour Buffer Strips (332)	Decrease	Decrease	Increase/ decrease	Decrease	Decrease	LC	LC	LC
Contour Strip Cropping (585)	Decrease	Decrease	Increase/ decrease	Decrease	Decrease	Increase	Increase	LC
Diversion (362)	Decrease	Decrease	Increase/ decrease	Decrease	LC	LC	LC	LC
Field Border (386)	Decrease	Decrease	LC	Decrease	LC	LC	LC	LC
Filter Strip (393A)	Decrease	Decrease	Increase	Decrease	LC	LC	LC	LC
Forage Harvest Management (511)	LC	LC	LC	LC	Decrease	Increase	LC	Increase
Irrigation Water Management (449)	Decrease	Decrease	Decrease	LC	Decrease	Decrease /increase	Decrease	Decrease
Nutrient Management (590)	Decrease	Decrease	Decrease	Decrease /increase	Decrease /increase	Decrease /increase	Decrease	LC
Prescribed Grazing (528A)	Decrease	Decrease	LC	Decrease	Decrease	LC	LC	LC
Stripcropping, Field (586)	Decrease	Decrease	Decrease	Decrease	Decrease /increase	Decrease /increase	Decrease	LC

Runoff Management System:(includes several engineering practices	Decrease /increase	Decrease	Increase	Decrease /increase	LC	LC	LC	LC
Use Exclusion (472)	Decrease	LC	LC	Decrease	Decrease	Decrease	LC	LC
Waste Utilization (633)	LC	LC	Decrease	LC	decrease	decrease	Decrease	Decrease
Mulching (484)	Decrease	Decrease /increase	Decrease /increase	Decrease /increase	Decrease /increase	LC	LC	LC

APPENDIX A

Site Characteristic Rationale

Soil Erosion: For this document soil erosion by water is defined as the loss of soil along the slope or unsheltered distance and is estimated from erosion prediction models. The most current and accepted model is the Revised Universal Soil Loss Equation (RUSLE). RUSLE is used in this index to indicate an average annual long-term movement of soil, thus potential for sediment and attached P movement toward a water body.

The value category in the P Index is given in tons of soil loss per acre per year.

Runoff Potential: Runoff potential, the relative risk of surface movement of P to water bodies, under the current P Index scheme is mainly a function of land slope and soil permeability. Many of Florida soils and geological features have a very low or low runoff potential due to prevalence of gentle slopes and sandy soils with high infiltration rate. However, surface runoff is a concern on many Florida soils due to naturally occurring high water table conditions (spodic horizons, clay layers, etc.). This is especially a concern during wet periods in areas without extensive artificial drainage.

This rating scheme addresses the issue of vulnerability of surface runoff in the drained and undrained condition. Since many Florida soils have high infiltration rate, high hydraulic conductivity, and low P retention, those soils with low surface runoff potential are likely vulnerable to P transport by leaching, either deep vertically to aquifers or shallow laterally to adjacent ditches, streams, or other water bodies.

NRCS Hydrologic Soil Groups and Soil Series Classification were selected to evaluate runoff potential under Florida conditions.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C: Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Effective Drainage Depth In Inches [1/]	Hydrological Soil Group
Less than 20	D
20 to 36	C
36 to 48	B
Greater than 48	A

[1/] Effective drainage is defined as having good surface drainage with a designed subsurface drainage system properly installed and maintained with a removal rate of at least 0.5 inches per day.

NOTE: *If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas. The chart below is taken from USDA, NRCS "Technical Release No. 55, Amendment FL3" for reclassification of hydrologic soil group based on drainage.*

Soil Series Classification is based on USDA, NRCS Agricultural Handbook 436, *Soil Taxonomy, Second Edition, 1999*.

Leaching Potential: Leaching potential, the relative risk of vertical P movement through soils, is not assessed by the generic P indexing scheme or by other states P Indexes' that are in current circulation. Up to now they account only for P movement via surface runoff and erosion. However, leaching is a concern in Florida due to prevalence of gentle slopes and sandy soils with high infiltration rate, high hydraulic conductivity, and low P retention. In effect, soils that would not be rated as vulnerable under most schemes may actually be problematic due to leaching.

Soils with a relatively thick near surface loamy/clayey layer are rated as having a Very Low Leaching Potential and soils with a similar layer starting at greater depths are rated as having a Low Leaching Potential. The difference is significant in that the sandy layer(s) may allow for lateral transport of P to a vertical "leak". Similarly, soils with no significant loamy/clayey layer but a significant layer with coated sand grains are rated as having a High Leaching Potential and soils that lack both a significant loamy/clayey layer and coated sand grains layer are rated as having a Very High Leaching Potential. Again, the difference is significant in that a coated sand grains layer allows for the capture of vertically moving P, while uncoated sands lack this ability.

The rating of Medium Leaching Potential may be unique to Florida. This rating allows for deeper observation of soils that would normally be rated as High or Very High Leaching Potential. The rating of Medium Leaching Potential is given to soils with a significant loamy/clayey layer below the normal (2 m or 80 inch) soil classification depth. The rating is higher than Low or Very Low because of the greater probability of lateral movement of P to a vertical 'leak".

Use of ground penetrating radar and/or geological investigations will be necessary to evaluate a site to move the rating down to Medium Potential for leaching.

Potential to Affect Water Body: This parameter is used to address the potential for runoff to reach a water body. If there is no direct discharge from the edge of a field, the potential to affect a water body is considered to be "very low". If the P concentration of the runoff can be attenuated by flow through a wetland, buffer strip or overland treatment area, the potential is considered "low". If there is ditch drainage or direct discharge to a Class 3 water body, the index value is increased to "medium". When there is potential for direct discharge to a lake, sink hole, Class 1 or 2 water body, or Outstanding Florida Water body, the potential for water quality degradation by P is enhanced and the index rating is increased to "high".

Since the State of Florida does not classify water bodies with regard to N or P limitation at this time, the current Florida water quality standards system (http://www.dep.state.fl.us/water/watershed/surface/surface.htm) is used in the P index in an attempt to incorporate an existing water body quality factor into the index. The five classes of water bodies in Florida as defined by the Florida Department of Environmental Protection are:

- Class 1: Potable water supplies including impoundments and associated tributaries, certain lakes, rivers, or potions of rivers, used as a drinking water supply;
- Class 2: Waters used for shellfish propagation or harvesting which generally consist of coastal waters where commercial shellfish harvesting occurs;
- Class 3: Waters used for recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife;
- Class 4: Waters used for agricultural water supplies;
- Class 5: Waters used only for navigation, utility, and industrial use. There are currently no class 5 water bodies.

A complement to classes is the designation of Outstanding Florida Waters (OFW). An OFW is a water worthy of special protection due to its natural attributes (403.061 F.S.). The intent of an OFW designation is to maintain ambient water quality, even if these designations are more protective than those required for the classification of the individual water body. Most OFWs are within the state or federal park system such as aquatic preserves, national seashores, or wildlife refuges.

Sinkholes are defined as spaces and caverns that have been formed where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that have been naturally dissolved by ground water circulating through them. A subsidence sinkhole forms when soil or weak rock falls into underlying cavernous limestone. The sinkhole depth to width ratio tends to relate to soil slope stability; typically in Florida the width is 5 times the depth.

Sinkholes can be intimately connected to the groundwater system. If movement of the water level within a sinkhole closely matches the phreatic surface movement of the aquifer, a good connection between the sinkhole and the aquifer exist and thus chances of groundwater contamination are high.

Sinkhole location surveys can be conducted using geophysical methods such as ground penetrating radar (GPR) and surface resisitivity. The GPR and resisitivity methods are non-destructive, and can locate sinkholes relatively quickly and effectively compared to probing or drilling methods.

In all areas considered high risk according to Figure *FL7-1 High Risk Areas for Siting Waste Facilities* from NRCS's Agricultural Waste Management Field Handbook, the GPR will be used to determine whether or not underground sinkholes exist. Underground sinks which have a continuous loamy or clayey layer at least 25 cm (10") thick above the limestone would not be considered as a sinkhole for the purposes of the P Index rating.

Portions of the field may still be used for nutrient application by following the setbacks provided in the NRCS conservation practice standard Nutrient Management, Code 590. The Nutrient Management standard will be used to determine minimum setback from classic or open sinks.

APPENDIX B

Management Practices Rationale

Fertility Index Value: It was felt that some measure of existing soil P levels should be included in the P Index. Florida elected to follow the Maryland example and use a "fertility index". The "fertility index" is defined as Mehlich 1 extractable P, of a 0 to 6 inch depth soil sample, in ppm (parts per million) multiplied by 2. The 0.025 multiplication factor was selected to provide a value range similar to those used for other parameters in the P Index.

P Application Rate: The multiplication factor for biosolids was lowered because of evidence that the Fe and Al content of biosolids will decrease the P availability in biosolids-amended soils. In contrast, we felt that P in water from municipal and lagoon effluents was mostly in a soluble form and therefore had a greater transport potential than P from inorganic fertilizer and organic waste materials.

Application Method: Application method parameters were selected to represent application of P via an irrigation system (municipal effluent or lagoon effluent from animal production facilities) and solid materials (fertilizer, compost, biosolids, animal wastes) surface-applied with and without incorporation into the soil. It was believed that because effluents are typically applied frequently (weekly, bi-weekly) and in small amounts, the potential for P loss would be low. In contrast, solids surface-applied and not incorporated would have a high potential for loss, particularly through surface runoff.

Waste Water Application Volume: Excessive volumes of water may exacerbate movement of P via downward or lateral leaching depending on the landscape. The 0.20 multiplication factor was selected to provide a value range similar to those used for other parameters in the P Index.

SUPPLEMENT TO THE FLORIDA PHOSPHORUS INDEX
December 11, 2000

The purpose of this supplement is to provide clarification to portions of the Florida P Index.

These clarifications do not change the intent of the P Index but are changes to specific areas that need to be addressed. Additional changes or clarification should be addressed to Don Graetz and Greg Hendricks.

The matrix shown on pages 8 and 9 has been developed into a NRCS field worksheet that contains additional information, see Fl-CPA-41, Phosphorus Index Worksheet page 4 and 5 in this supplement. It is to be used as a single sheet printed front and back.

Changes to the original P Index are provided in italics and will be in the P- Index posted on the website.

*Spelling corrections: Page 1-**rational** to **rationale**, page 15 – **Index's** to **Indexes'**, **hat** to **that**, (next to last paragraph last sentence) **that** to **than**, Page 10 Soil Erosion: Last sentence in this paragraph change the word **is** to **in,** page 16 **continuos** to **continuous***.

<u>Page 8 Part B, under Management, Application Method</u>

In the blocks where the 4 points and the 6 points are shown: When the application of animal by-products are not incorporated within 5 days then it will be considered the same as surfaced applied without incorporation even if incorporated after the 5 day period.

<u>Page 10 under Runoff Potential Criteria</u>

Very Low (0): Soil in Hydrologic Soil Group A with >75% ground cover or no surface outlet.

<u>change to read as follows</u>

Very Low (0): *Soils in Hydrologic Soil Group A with >75% ground cover,*

or

any hydrologic soil group with no surface outlet.

<u>Page 10 under Runoff Potential Criteria</u>

High (4): …………**and slopes of more than 5% to 8%.** Substitute the word "to" with "up to and including" <u>so the sentence reads</u> ……… ***and slopes of more than 5% up to and including 8%.***

<u>Page 11 under Potential to Reach Water Body</u>

Low (1): Add the following before the period ending the sentence ", *or direct discharge to Class 4 water body."*

<u>Page 13 – Considerations For Reducing Vulnerability</u>

The purpose of the information contained under this heading is provided to give the nutrient management planner a partial list of potential practices that may assist with controlling movement of phosphorus from the agricultural management zone. The list is not all-inclusive and many of the effects listed may have the reverse effect. The extent of the effect depends on many factors and the information shown is not to be used to place a definitive value on the practice or group of practices.

As stated in this section "…., the reviewer will determine what factors are creating the highest levels of concern." The purpose of the listing of practices is to provide the planner various practices or groups of practices that may decrease the potential for phosphorus movement. The planner must understand the potential effect on the "factor" of concern, evaluate which practice(s) will be favorable in reducing phosphorus movement and evaluate unfavorable effects they may have on other factors.

Page 17 last sentence

Replace the sentence "The Nutrient Management standard calls for a 300-ft setback from any known sinkholes.", with "*The Nutrient Management standard will be used to determine minimum setback from classic or open sinks*.

As used in the P Index the following definitions apply

No Surface Outlet – The combination of slope and permeability of the application site that will not discharge surface flow from that site in a 2 year rainfall event.

(This level of evaluating runoff is not intended to require calculation for the rainfall events but is intended to evaluate those sites that do not have external surface flows during most years. Where these sites occur, additional comments may need to be recorded on the back of form FL-CPA-41)

Compost – animal wastes and plant debris that has gone through the composting process.

Biosolids – Residuals, domestic wastewater residuals and/or septage as defined in Chapter 62-640 Florida Administrative Code. Biosolids include co-compost with a minimum of 50% biosolids.

Landform - Any physical, recognizable form or feature of the earth's surface, having a characteristic shape and produced by natural causes.

Examples of individual landforms and their definitions are:

Karst - Topography with sinkholes, caves, and underground drainage that is formed in limestone, gypsum, or other rocks by dissolution, and that is characterized by sinkholes, caves, and underground drainage.

Knoll - A small, low, rounded hill rising above adjacent landforms.

Many other landforms such as depression, flat, floodplain, marine terrace (colloquially referred to as flatwoods in Florida), and slough and their definitions can be obtained from the National Soil Survey Handbook. Part 629 - Glossary of Landform and Geologic Terms: http://www.statlab.iastate.edu/soils/nssh

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

FL-CPA-41
12/2000

Phosphorus Index Worksheet

Client Name ______________ County ______________ Date ______________
Assisted by ______________ Farm No. ______________ Tract No. ______________
Field(s) ______________ Crop(s) ______________

Part A: Phosphorus transport potential due to site and transport characteristics

TRANSPORT	**PHOSPHORUS LOSS RATING**					**Value** Evaluation	Evaluation
Soil Erosion	No Surface Outlet **0**	<5 T/A **1**	5-10 T/A **2**	10-15 T/A **4**	>15 T/A **8**		
Runoff Potential	Very Low **0**	Low **1**	Medium **2**	High **4**	Very High **8**		
Leaching Potential	Very Low **0**	Low **1**	Medium **2**	High **4**	Very High **8**		
Potential to reach water body	Very Low **0**	Low **1**	Medium **2**	High **4**			

Part A: Total Site Value		

Part B: Phosphorus loss potential due to management practices

Fertility Index Value	Soil Fertility Index x 0.025 (______ ppm P X 2 X 0.025)					
Phosphorus Application Rate	0.05 X (_______ lbs/ac P_2O_5) for fertilizer, manure or compost 0.025 X (_______ lbs/ac P_2O_5) for biosolids 0.10 X (_______ lbs/ac P_2O_5) for waste water					
Application Method	No Surface Outlet **0**	Applied via irrigation on a periodic basis **2**	Incorporated within 5 days of application **4**	Surface applied without incorporation **6**		
Waste Water App. Vol.	0.20 X acre-inches/acre/year					

Part B: Total Management Value		
Multiply Part A (______) X Part B (_______)		
Interpretation Rating (low to very high)		

Supplement 1

Note: Evaluation columns under value are for a conservation treatment unit (CTU) which can be more than one field, one field, or a part of a field.

A sketch of CTU's used are identified by number or letter and recorded on a sketch or map of the CTU.

To convert P to P_2O_5 multiply by 2.29

To convert P_2O_5 to P multiply by 0.437

Enter notes below that may be used to help explain, clarify, and/or define the site-specific criteria information used to evaluate this site.

TRANSPORT

Soil Erosion	
Runoff Potential	
Leaching Potential	
Potential to reach water body	

MANAGEMENT

Fertility Index Value	
Phosphorus Application Rate	
Application Method	
Waste Water Application Volume.	