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Buffer Delineation Model for New Jersey Pinelands Wetlands: Field Test

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Division of Pinelands Research

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FINAL REPORT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

New Jersey Pinelands wetlands are protected under the Wetlands Management Program of the New Jersey Pinelands Comprehensive Management Plan.[1] This Program prohibits most types of development in wetlands.[2] Further, development is not permitted within 300 ft of a wetland, unless the applicant can demonstrate that the proposed development will not have a significant adverse impact on the wetland. If so demonstrated, then reduction of the 300 ft buffer can be considered. Within the context of this buffer requirement, Roman and Good have proposed a Model for determining the minimum site-specific buffer width required to protect wetlands from impacts associated with upland development.[3] This systematic and comprehensive approach to buffer delineation is based on an evaluation of overall wetland quality, values and functions, and, on an assessment of potential impacts associated with the proposed development. In addition, the proposed Model is designed within the framework of the Pinelands regional land use planning strategy.

In this report we present the results of a field test and Model verification exercise. Twenty-eight applications for development were selected from Pinelands Commission files. These applications included a diversity of development categories, ranging from low intensity development in the Preservation Area District to high intensity development in Regional Growth Areas. This insured a comprehensive test of the Model. Each application was field tested independently by at least two evaluators. The evaluators were from the Pinelands Commission, the NJ Department of Environmental Protection (Division of Coastal Resources), the US Army Corps of Engineers, and academia. The verification results suggest that when the Model is applied independently, at the same proposed development site, comparable buffer widths are derived. Further, the results imply that buffer widths derived from the Model are consistent with the intent of the Pinelands land use planning strategy. This was further confirmed by evaluators comments.

Based on the test results and on evaluators comments, several revisions to the proposed Model are presented. The Pinelands Commission will determine if the field tested and revised buffer delineation Model should be implemented as a decision-making tool within the Comprehensive Management Plan's development review process.

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[1] Wetlands Management Program; Article 6, Part 1, sections 6-101 through 6-114. In, Comprehensive Management Plan for the Pinelands National Reserve (National Parks and Recreation Act, 1978) and Pinelands Area (New Jersey Pinelands Protection Act, 1979). New Jersey Pinelands Commission, New Lisbon, New Jersey. 446 p. (1980).

[2] See Article 6, Part 1, sections 6-108 through 6-113 for conditional exceptions.

[3] Roman and Good. 1983. Wetlands of the New Jersey Pinelands: Values, functions, impacts and a proposed buffer delineation model. Division of Pinelands Research, Center for Coastal and Environmental Studies, Rutgers - The State University of New Jersey, New Brunswick, NJ. 123 p.

ACKNOWLEDGMENTS

The field testing of our proposed buffer delineation model represents a cooperative effort by several individuals. Their numerous interpretations and comments provided a sound basis for revision of the Model. We gratefully acknowledge this input. Kevin Broderick, Robert Piel and Robert Tudor - New Jersey Department of Environmental Protection, Division of Coastal Resources; Jeffrey Steen - U.S. Army Corps of Engineers, Philadelphia District; John Schneider - Center for Coastal and Environmental Studies, Rutgers University; Raymond Walker - Rider College; Lynn Brass, Richard Brown, Susan Hullings-Slim, Nancy Immesberger, Donna McBride, Joseph Pratzner and Robert Zampella - New Jersey Pinelands Commission. Thanks are extended to William Harrison, John Stokes and Robert Zampella, all of the Pinelands Commission, for providing advice throughout the duration of this project.

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INTRODUCTION

Wetlands are considered a valuable and essential part of the New Jersey Pinelands ecosystem, and thus, are provided protection from development impacts under the Wetlands Management Program of the New Jersey Pinelands Comprehensive Management Plan (hereafter referred to as CMP; New Jersey Pinelands Commission 1980; Article 6, Part 1, sections 6-101 through 6-114). This program prohibits most types of development on Pinelands wetlands. Conditional exceptions are made for some activities such as agriculture and horticulture, forestry, fish and wildlife management, low intensity recreational uses, water dependent recreational facilities and public improvements.[1] To preserve the natural upland to wetland transition and to reduce the potential for impacts from upland development activities, development is not permitted within 300 ft of any wetland, unless the applicant can demonstrate that the proposed development will not have a significant adverse impact on the wetland (see Article 6, Part 1, section 6-114). If so demonstrated, then reduction of the 300 ft buffer can be considered.

Roman and Good (1983) have proposed a buffer delineation model designed to assist the Pinelands Commission, other regulatory agencies and applicants in determining the minimum site-specific buffer width required to protect the ecological integrity of wetlands. This model provides a systematic and comprehensive approach to delineating wetland buffer areas. The model is based on an evaluation of overall wetland quality, values and functions, and, on an assessment of potential impacts from the proposed development. Further, delineation of appropriate buffer areas is intended to fit within the overall planning and land allocation strategy as set forth in the CMP.

The objective of this study is to verify the effectiveness of the Roman and Good (1983) model as a consistent and practical approach to delineating buffer protection areas within the overall framework of the CMP. Some specific questions to be answered during this verification exercise include:

- Are similar buffer widths derived when the Model is independently applied by several evaluators at the same site?

- Are the buffer widths derived from the Model consistent with the intent of the land allocation program of the CMP?

This report includes results of the field verification effort and appropriate revisions to the Model. The Pinelands Commission will determine if the buffer delineation model, as proposed by Roman and Good (1983) and revised herein, should be implemented as a decision-making tool within the CMP's development review process.

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[1] See Article 6, Part 1, sections 6-108 through 6-113 for a detailed description of these conditional exceptions.

This report includes:

- a general review of the buffer delineation Model as proposed by Roman and Good (1983).

- an explanation of the Model verification procedure.

- results of the Model verification.

- revisions to the proposed Model based on the verification results.

It is intended that the reader of this report be familiar with, and preferably, have a working knowledge of the proposed buffer delineation Model. The reader should have available a copy of the proposed Model while reviewing this report.

GENERAL REVIEW OF THE PROPOSED MODEL (p. 57)[2]

The basic components of the proposed buffer delination Model are shown in Fig. 1. First, the evaluator must gather the necessary preliminary information. This includes the applicants site plan(s), aerial photographs, USGS topographic maps, Pinelands Commission vegetation maps, National Wetlands Inventory maps, Soil Conservation Service maps, and other available data sources which will aid in the description and ecological interpretation of the site and surrounding areas. Next, the evaluator is directed to the Special Case Buffer Delineation Guidelines. These pertain to particular Pinelands areas, wetland types, and development impacts which warrant priority consideration. As noted in Fig. 1, if the Guidelines are not appropriate to the proposed development activity or wetland site, then the evaluator should proceed to the Land Capability Areas Buffer Delineation Procedure. This multiparameter procedure considers the relative wetland quality, the relative potential for impacts, and the designated potential of the area for accommodating environmentally compatible growth.

SPECIAL CASE BUFFER DELINEATION GUIDELINES (p. 64)

Six Guidelines are presented in the Model. These Guidelines should be evaluated according to the sequence provided in Fig. 2. For each Guideline, Roman and Good (1983) include, a) a buffer distance recommendation, b) a statement clarifying the intent of the recommendation, and c) a rationale statement supporting the Guideline. These Guidelines are presented in Table 1.

LAND CAPABILITY AREAS BUFFER DELINEATION PROCEDURE (p. 74)

Following review of the Guidelines, the evaluator may be directed to the Procedure (Fig. 1). For this Procedure the evaluator must, 1) define boundaries for evaluation, 2) evaluate the relative quality of the wetland, 3) assess the potential for impacts associated with the proposed development, and 4) assign a buffer width based on the relative wetland quality, potential for impacts and the land capability area in which the proposed development is located. These basic components of the Procedure are illustrated in Fig. 3.

DEFINING BOUNDARIES FOR EVALUATION (p. 74)

The evaluator is directed to the wetland site review area when detailed field observations are required for the relative wetland quality evaluation, This area should range from 0.25 to 1.0 acre. The evaluator derives information from maps or aerials for analysis of the wetland area. The wetland area should not exceed 200 acres. To maintain consistency in the Procedure, Roman and Good (1983) present specific instructions for delineating the wetland site review area and the larger wetland area.

[2] Throughout the text, page numbers in parentheses refer to the Roman and Good (1983) proposed buffer delineation model.

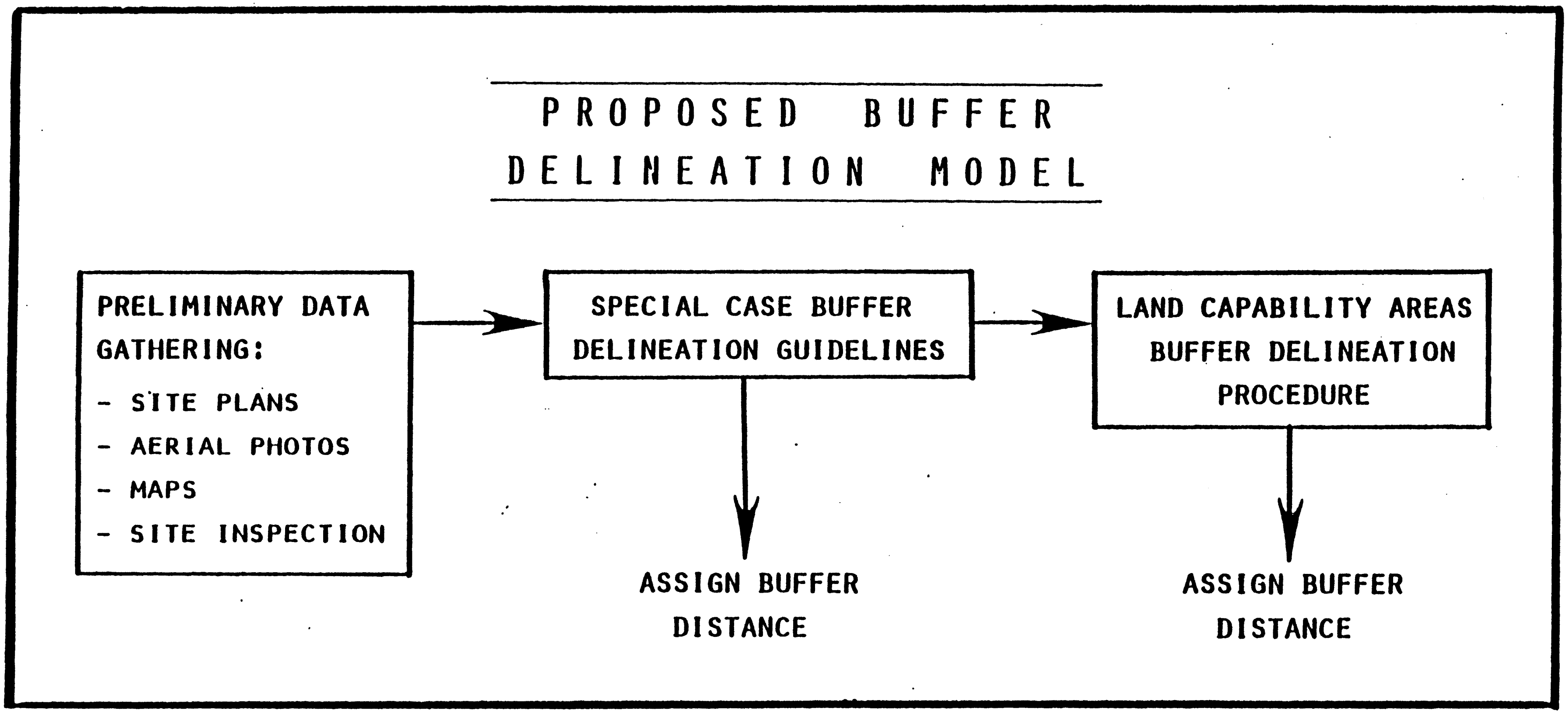

Fig. 1. Flow diagram of the Roman and Good (1983) proposed buffer delineation model.

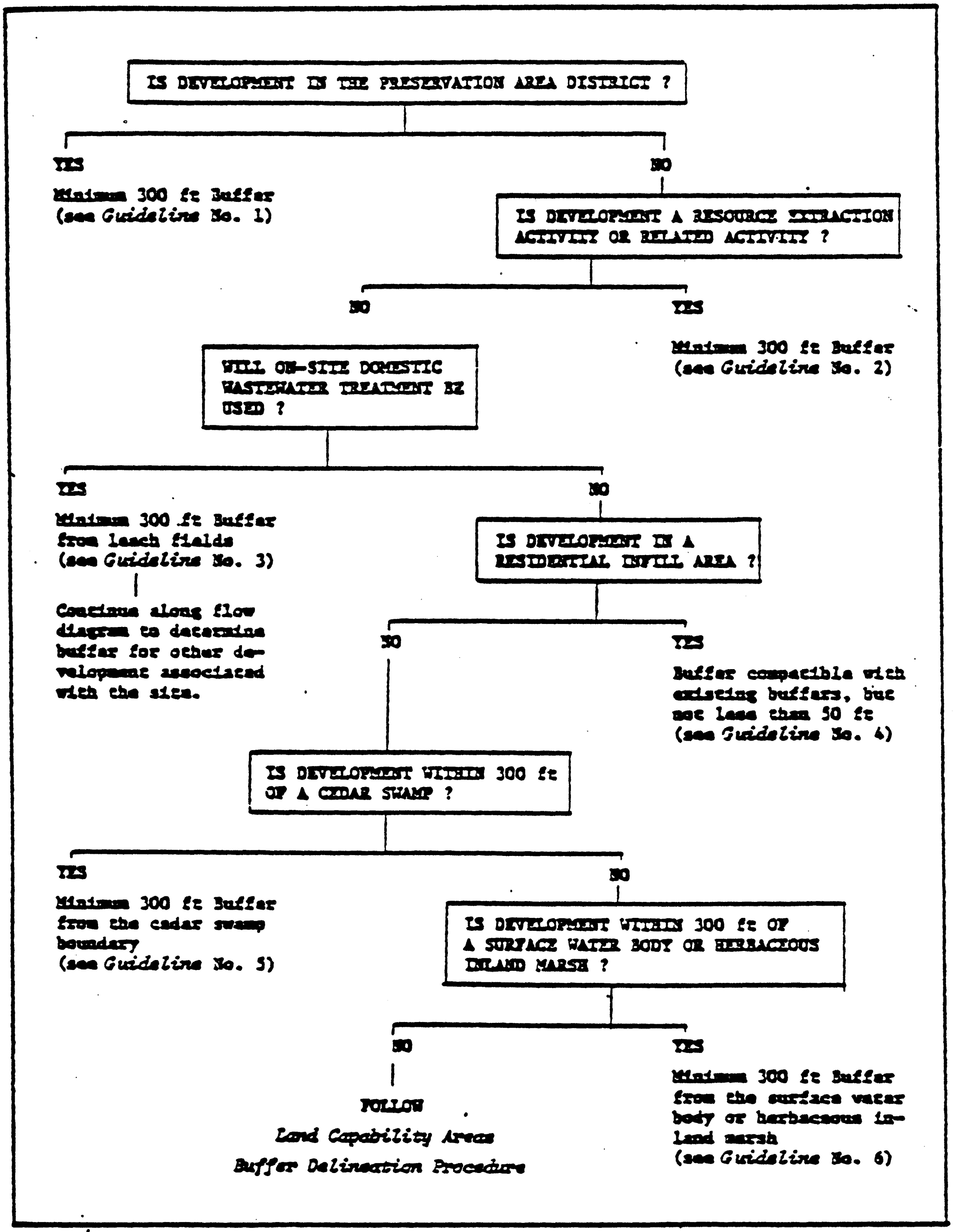

Fig. 2. Decision-making flow diagram for Special Case Buffer Delineation Guidelines (from, Fig. 5 in Roman and Good 1983).

Table 1. Special Case Buffer Delineation Guidelines as presented in the proposed buffer delineation model (Roman and Good 1983). Refer to Roman and Good (1983) for a complete discussion of these Guidelines.

Guideline No. 1, PRESERVATION AREA DISTRICT; It is recommended that a minimum 300 ft buffer be maintained between wetland boundaries and any permanent development activities proposed for adjacent upland areas in the Pinelands Preservation Area District.

Guideline No. 2, RESOURCE EXTRACTION; It is recommended that minimum 300 ft buffer areas be maintained between all Pinelands wetlands and any resource extraction activity.

Guideline No. 3, ON-SITE DOMESTIC WASTEWATER TREATMENT; It is recommended that a minimum 300 ft buffer be maintained between the wetland boundary and the septic leach field of on-site wastewater treatment systems.

Guideline No. 4, INFILL-TYPE RESIDENTIAL DEVELOPMENT; If a proposed residential development is considered an infill-type development then it is recommended that the assigned buffer be compatible with adjacent and nearby existing buffers, but not less than 50 ft.

Guideline No. 5, ATLANTIC WHITE CEDAR SWAMPS; It is recommended that minimum 300 ft buffer areas be maintained between all Pinelands Atlantic White Cedar Swamp boundaries and any permanent development which is proposed for adjacent uplands.

Guideline No. 6, SURFACE WATER BODIES/HERBACEOUS INLAND MARSHES; It is recommended that minimum 300 ft buffer areas be maintained between the edge/shoreline of all Pinelands surface water bodies or herbaceous inland marshes and any permanent development which is proposed for adjacent uplands.

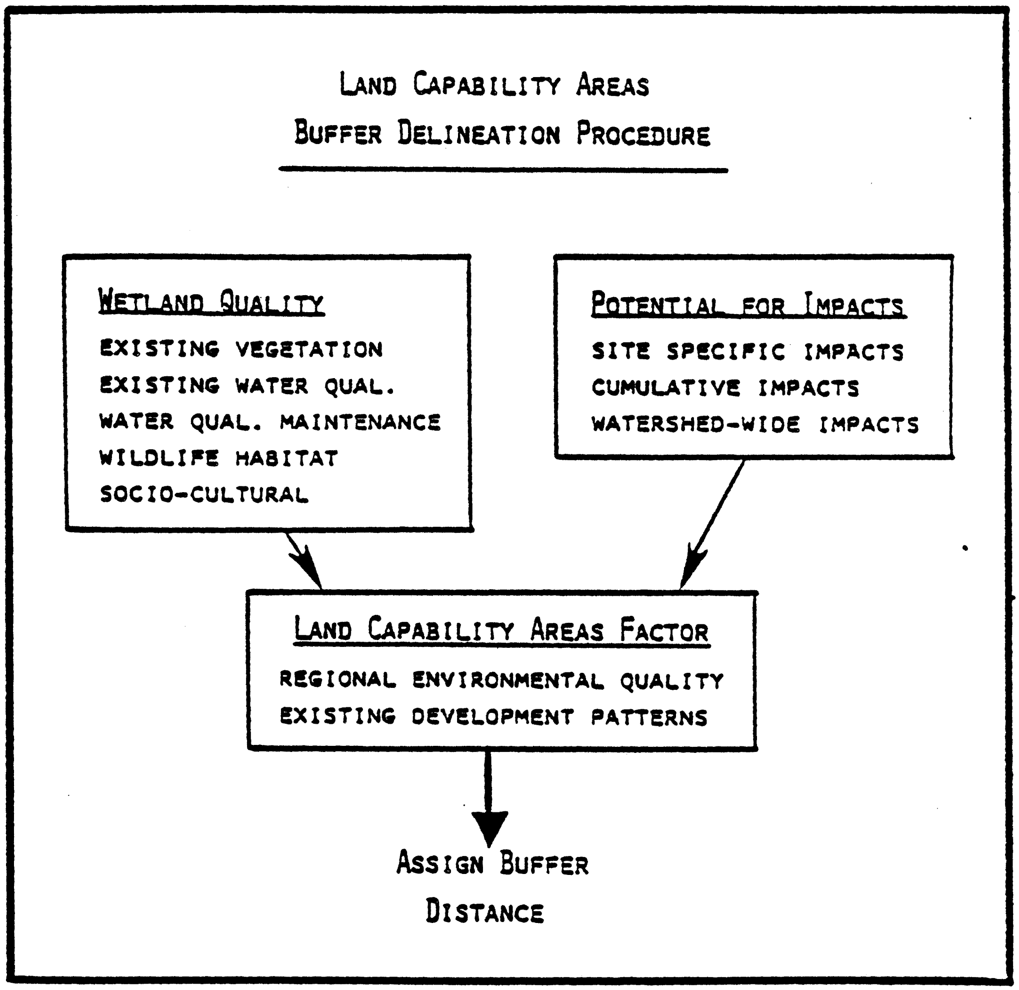

Fig. 3. Flow diagram of the proposed Land Capability Areas Buffer Delineation Procedure. The evaluator must determine the relative quality of the wetland, the potential for impacts, and then, assign a buffer distance based on the land capability area in which the proposed development is located.

THE WETLAND EVALUATION SCHEME (p. 75)

Determing the relative quality of a particular wetland is based on an evaluation of five factors related to quality, value and function (Fig. 3). These factors are briefly described below. In addition, the scheme's scoring system is presented.

Vegetation Composition (p. 76)

The evaluator must assess the relative quality of vegetation within the wetland site review area by determining the percent of the total shrub cover which is occupied by species characteristic of relatively undisturbed wetlands. This analysis is based on vegetation data presented by Ehrenfeld (1983).

Existing Surface Water quality (p. 79)

To assess the relative quality of surface waters associated with a particular wetland, the evaluator must acquire available pH and/or nitrate values. Based on existing Pinelands surface water quality data, Roman and Good (1983) developed a relative scale for ranking particular water courses from low to high water quality.

Water Quality Maintenance Value (p. 83)

To evaluate the relative capability of a wetland to retain or remove nutrients, and thus, aid in maintaining regional/watershed-wide water quality, several factors must be considered. These include: a) the potential for nutrient inputs to the wetland, b) nutrient removal/storage/retention capacity of the wetland soils, and c) nutrient retention/storage by vegetation.

Wildlife Habitat Value (p. 85)

To evaluate the relative habitat value of a wetland, the evaluator must study habitat features, such as vegetation interspersion, wetland size and the quality of surrounding upland habitat.

Socio-cultural Values (p. 87)

The socio-cultural evaluation is based on an analysis of the wetlands a) recreational potential, b) research and education potential, c) visual-aesthetic attributes, and d) uniqueness.

Wetland Evaluation Scoring System (p.89)

For each of the factors and associated subfactors listed above, the evaluator is provided with a relative scale ranging from 1.0 (relative low quality) to 3.0 (relative high quality). In this multifactor approach, the high scores contribute to a greater buffer distance, while conversely, low scores contribute to lesser buffers. The wetland evaluation scoring system, with ultimate derivation of a relative wetland quality index is shown in Fig. 4. As noted, if the wetland in question supports any threatened or endangered species (plant or animal), then the evaluator must increase the relative wetland quality index by one (1.0) unit. However, even with the threatened and endangered factor, the index cannot exceed 3.0.

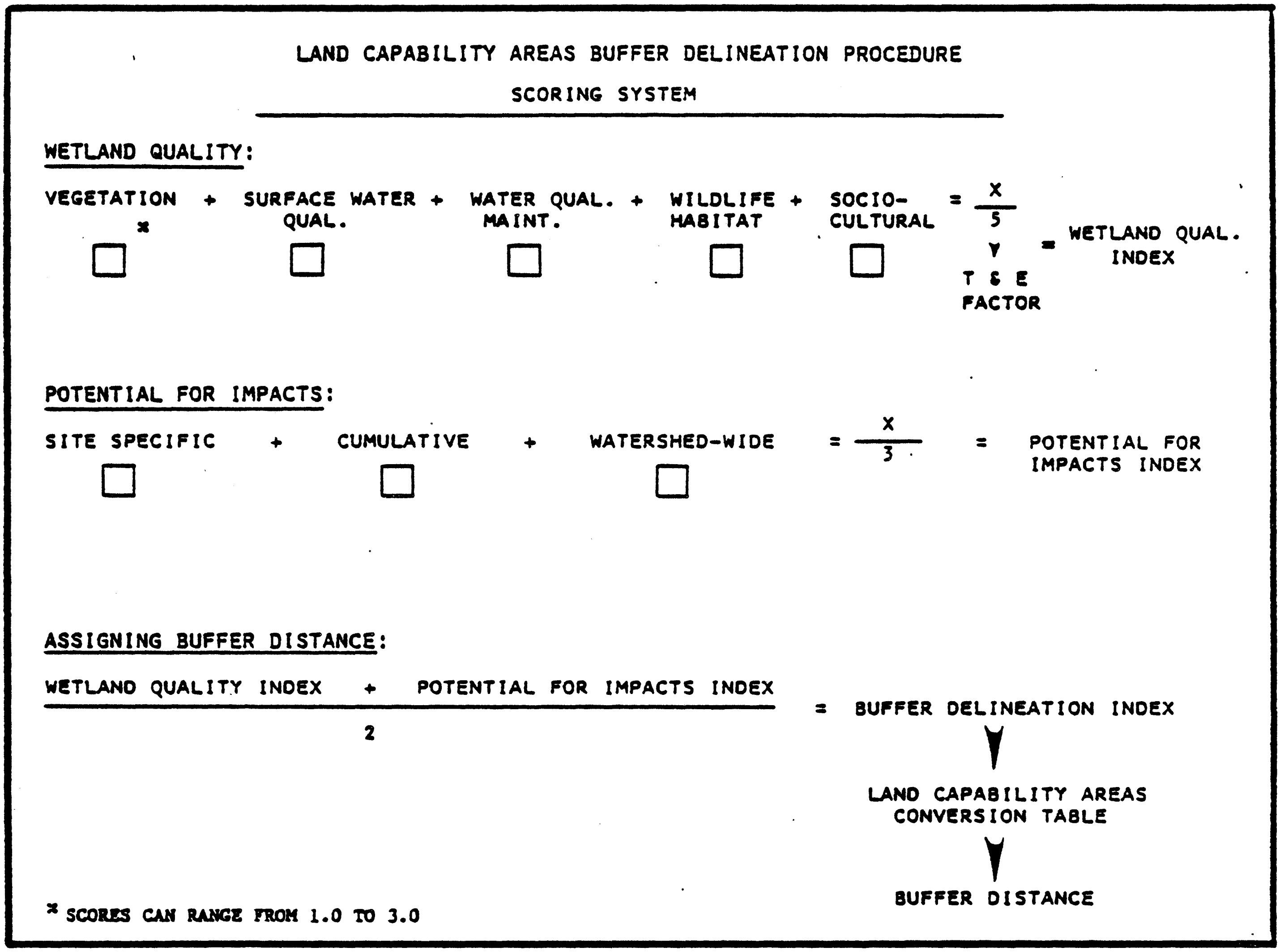

Fig. 4. Scoring system for the Land Capability Areas Buffer Delineation Procedure.

POTENTIAL FOR IMPACTS SCHEME (p. 90)

To evaluate the potential for impacts to be impose on wetlands by upland development, the evaluator must assess a) site-specific impacts, b) cumulative impacts and c) watershed-wide impacts (Fig. 3).

Potential for Site-Specific Wetland Impacts (p.90)

This factor relates to the intensity of development proposed on the upland. In general, as development intensity increases, the potential for significant adverse impacts on the wetland increases.

Potential for Cumulative Impacts (p. 94)

To predict the cumulative and long-term potential for wetland impacts, the evaluator must refer to municipal density or zoning requirements. It is assumed that areas zoned for low density development will have less potential for cumulative impacts, relative to high density areas.

Significance of Watershed-wide Impacts (p. 93)

Evaluating the relative significance of watershed-wide impacts is based on the apparent environmental sensitivity of downstream and surrounding wetland areas to impacts. For example, State Forests, cranberry areas, or parts of the Preservation Area are considered as environmentally sensitive, whereas high intensity developed sections of a Regional Growth Area are considered less sensitive and would be assigned a low potential for significant watershed-wide impacts.

Potential for Impacts Scoring System (p. 95)

As noted in Fig. 4, these three factors are combined to calculate a relative potential for impacts index. A high relative potential for impacts on the immediate wetland and associated wetlands will contribute to a greater buffer.

ASSIGNING BUFFER AREAS (p. 96)

The wetland value and potential for impacts indices are averaged to derive a buffer delineation index (Fig. 4). The evaluator can then assign an actual buffer distance by referring to Table 2 (Table 17, p. 97, in Roman and Good 1983). In all land capability areas, a buffer index of 3.0 (i.e., high quality wetland, and proposed development determined to have a high potential for impacts) would result in delineation of the maximum assignable buffer of 300 ft. However, if the buffer index is less than 3.0, then the assigned buffer distance is dependent on the land capability area in which the proposed development is located. With a progression from Forest Areas to Regional Growth Areas, it is noted that the same buffer index would respectively result in assignment of a lesser buffer distance. From Forest Areas to Growth Areas, there is a general gradient of decreasing regional environmental quality and increasing patterns of development, or increased potential to accommodate environmentally compatible development; thus, providing justification for this variable buffer provision in the Procedure.

Table 2. Buffer index to buffer distance conversion table for the Land Capability Areas Buffer Delineation Procedure (Table 17 in Roman and Good 1983).

Land Capability Areas	Buffer Index	Buffer Distance (ft)
Forest Areas and Agricultural Production Areas	3.0	300
	2.5	275
	2.0	250
	1.5	225
	1.0	200
Rural Development Areas and some Villages/Towns[1]	3.0	300
	2.5	250
	2.0	200
	1.5	150
	1.0	100
Regional Growth Areas and some Villages/Towns[1]	3.0	300
	2.5	240
	2.0	175
	1.5	110
	1.0	50

[1]See potential for impacts scheme (cumulative impacts section) to determine appropriate scale (i.e., Rural Development or Regional Growth) to use for Villages/Towns.

MODEL VERIFICATION PROCEDURE

METHODS

Twenty-eight (28) applications for development were selected from Pinelands Commission active or recently closed files. Two applications were tested for each of the Special Case Buffer Delineation Guidelines, while the majority of applications tested pertained to the Land Capability Areas Buffer Delineation Procedure. For each application a brief description of the proposed development activity is included in Table 3. It should be noted that 16 of the 28 applications tested were for proposed development in Rural Development and Regional Growth Areas. This emphasis on growth-oriented areas was intentional. Of all residential units approve in the Pinelands over a 2½ year period (January 1981 through June 1983), 96% were in Regional Growth Areas, Rural Development Areas and Pinelands Villages/Towns. Eighty percent (80%) of all commercial/industrial approvals were also within these growth management areas (NJ Pinelands Commission 1983).

Fig. 5 shows that the applications tested exhibited a fairly broad regional distribution. The cluster of applications in the Mays Landing area (Hamilton Township) is consistent with the NJ Pinelands Commission's (1983) analysis of recent development trends which indicated that 46% of all approved residential units (from January 1981 through June 1983) were in Hamilton Township.

Each application was tested independently by at least two evaluators (Table 3). The evaluators were from the Pinelands Commission staff (7 evaluators), the New Jersey Department of Environmental Protection, Division of Coastal Resources (3 evaluators), the United States Army Corps of Engineers (1 evaluator), and academics (2 evaluators). In addition, the first author of this report conducted independent tests of 13 applications. All evaluators were knowledgeable of Pinelands wetlands ecology and were familiar with the pertinent scientific literature. All evaluators, except those from the academic sector, had first hand work experience with the Pinelands regulatory and decision-making procedures. The evaluators from academics had experience in management oriented inland wetlands research. It can be concluded that each evaluator was capable of providing a responsible and well-informed evaluation/interpretation of the Model.

For each application tested, the evaluators conducted a field inspection and then independently completed a standard evaluation form (see Appendix 1). The responses provided on these forms, and additional comments communicated to us by the evaluators and other interested parties, provided a basis for 1) the Model verification results, and 2) the suggested revisions to the proposed Model.

MODEL VERIFICATION RESULTS AND RECOMMENDED REVISIONS

Results of the Model verification are presented below. A short discussion of the verification results is included with each particular aspect of the Model, beginning with the Guidelines. Following each individual discussion, appropriate revisions to the Model are often presented. These

Table 3. Brief description of the 28 test applications. Applications specifically pertaining to the <u>Guidelines</u> and <u>Procedure</u> are shown.

MODEL CATEGORY	APPLI ID	COUNTY Municipality	LAND CAPBL AREA[1]	ZONING[2]	PROPOSED DEVELOPMENT DESCRIPTION	# INDEPENDENT EVALUATORS
SPECIAL CASE GUIDELINES						
Preservation Area Dist	PAD 1	BURLINGTON Tabernacle	PAD	NA	SFD[3]; 81 acre parcel; septic	2
	PAD 2	BURLINGTON Woodland	PAD	NA	SFD; 6.9 acre parcel; septic	3
Resource Extraction	RE 1	ATLANTIC Hamilton	FA	NA	400 acre parcel	2
	RE 2	BURLINGTON Woodland	PAD	NA	284 acre parcel	3
Infill	I 1	BURLINGTON Medford	RGA	NA	SFD; 0.44 acre parcel; sewer sewer	3
	I 2	ATLANTIC Hamilton	RGA	NA	SFD; 10,375 ft^2 parcel; sewer	3
Cedar Swamp	CS 1	ATLANTIC Hamilton	RGA	NA	Professional office, apartment, parking; 42,500 ft^2 parcel; sewer	3
	CS 2	CAMDEN Waterford	APA	NA	SFD; 3.2 acre parcel; septic	2

Table 3. Continued.

MODEL CATEGORY	APPLI ID	COUNTY Municipality	LAND CAPBL AREA	ZONING	PROPOSED DEVELOPMENT DESCRIPTION	# INDEPENDENT EVALUATORS
SPECIAL CASE GUIDELINES (con't)						
Surface Water/ Inland Marsh	SW 1	BURLINGTON Shamong	FA	NA	Residential subdivision; evaluate 10, 1 acre lots adj. to lake; septic	2
	SW 2	CAMDEN Waterford/Winsl.	RGA	NA	Residential subdivision; evaluate 37 lots adj. to lake; sewer	2
LAND CAPABILITY AREAS PROCEDURE						
Forest Area	FA 1	ATLANTIC Hamilton	FA	20 acre (proposed)	SFD; 20 acre parcel; septic	2
	FA 2	OCEAN Manchester	FA	20 acre	SFD's; 3 lot subdivision; 75 acre parcel; septic	2
	FA 3	GLOUCESTER Monroe	FA	10 acre	SFD; 9 acre parcel; septic	2
	FA 4	BURLINGTON Southampton	FA	5 acre	SFD's; 3 lot subdivision; 15 acre parcel; septic	2
Agricultural Production Area	APA 1	BURLINGTON Shamong	APA	10 acre	SFD's; 5 lot subdivision; 51 acre parcel; septic	2
	APA 2	ATLANTIC Hammonton	APA	10 acre	SFD; 15 acre parcel; septic	2
Rural Development Area	RDA 1	ATLANTIC Hamilton	RDA	5 acre (proposed)	SFD; 10 acre parcel; septic	3
	RDA 2	ATLANTIC Galloway	RDA	3.2 - 5 acres (assumed)	SFD's; 2 lot subdivision; 11.3 & 6.7 acre lots; septic	3

Table 3. Continued.

MODEL CATEGORY	APPLI ID	COUNTY Municipality	LAND CAPBL AREA	ZONING	PROPOSED DEVELOPMENT DESCRIPTION	# INDEPENDENT EVALUATORS
LAND CAPABILITY AREAS PROCEDURE (con't)						
Rural Development Area (con't)	RDA 3	ATLANTIC Galloway	RDA	3.2 - 5 acres (assumed)	SFD's; 10 lot subdivision; 40 acre parcel; septic	2
	RDA 4	BURLINGTON Evesham	RDA	3.2 acres	SFD; 4 acre parcel; septic	2
Regional Growth Area	RGA 1	ATLANTIC Hamilton	RGA	6-9 units/acre (proposed)	Approx. 750 residential units; 141 acre parcel; sewer	2
	RGA 2	ATLANTIC Hamilton	RGA	6-9 units/acre (proposed)	Residential/Commercial PUD; average 8.6 units/acre; 477 acre parcel; sewer	2
	RGA 3	ATLANTIC Hamilton	RGA	5-7 units/acre (proposed)	141 townhouse units; 15.5 acres of upland; 490 acre parcel; sewer	3
	RGA 4	BURLINGTON Medford	RGA	1.25 units/acre	SFD's; 13 lot subdivision; 11 acre parcel; sewer	3
	RGA 5	BURLINGTON Medford	RGA	0.6 units/acre	SFD's; 8 lot subdivision; 12 acre parcel; sewer	3
	RGA 6	OCEAN Barnegat	RGA	9000 ft^2/unit	Scattered SFD's; 1 acre lots; sewer proposed	2
Commercial Development	CD 1	BURLINGTON Medford	RGA	Commercial	Fast food resturant; 1.5 acre parcel; sewer	3
	CD 1	ATLANTIC Hamilton	RGA	Commercial	43,000 ft^2 shopping mall; 21 acre parcel; sewer	3

Footnotes; see next page

Table 3, Continued. (footnotes).

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[1] Land Capability Areas, PAD - Preservation Area District; FA - Forest Area; APA - Agricultural Production Area; RDA - Rural Development Area; RGA - Regional Growth Area

[2] Zoning: Knowledge of zoning was not applicable (NA) for the Special Case Guideline test applications. Zoning requirements for the Procedure applications were obtained from Zoning Ordinances of CMP certified municipalities; or, from proposed ordinances for uncertified municipalities. For uncertified municipalites, with no proposed zoning ordinances, zoning was assumed as indicated.

[3] SFD = Single Family Dwelling

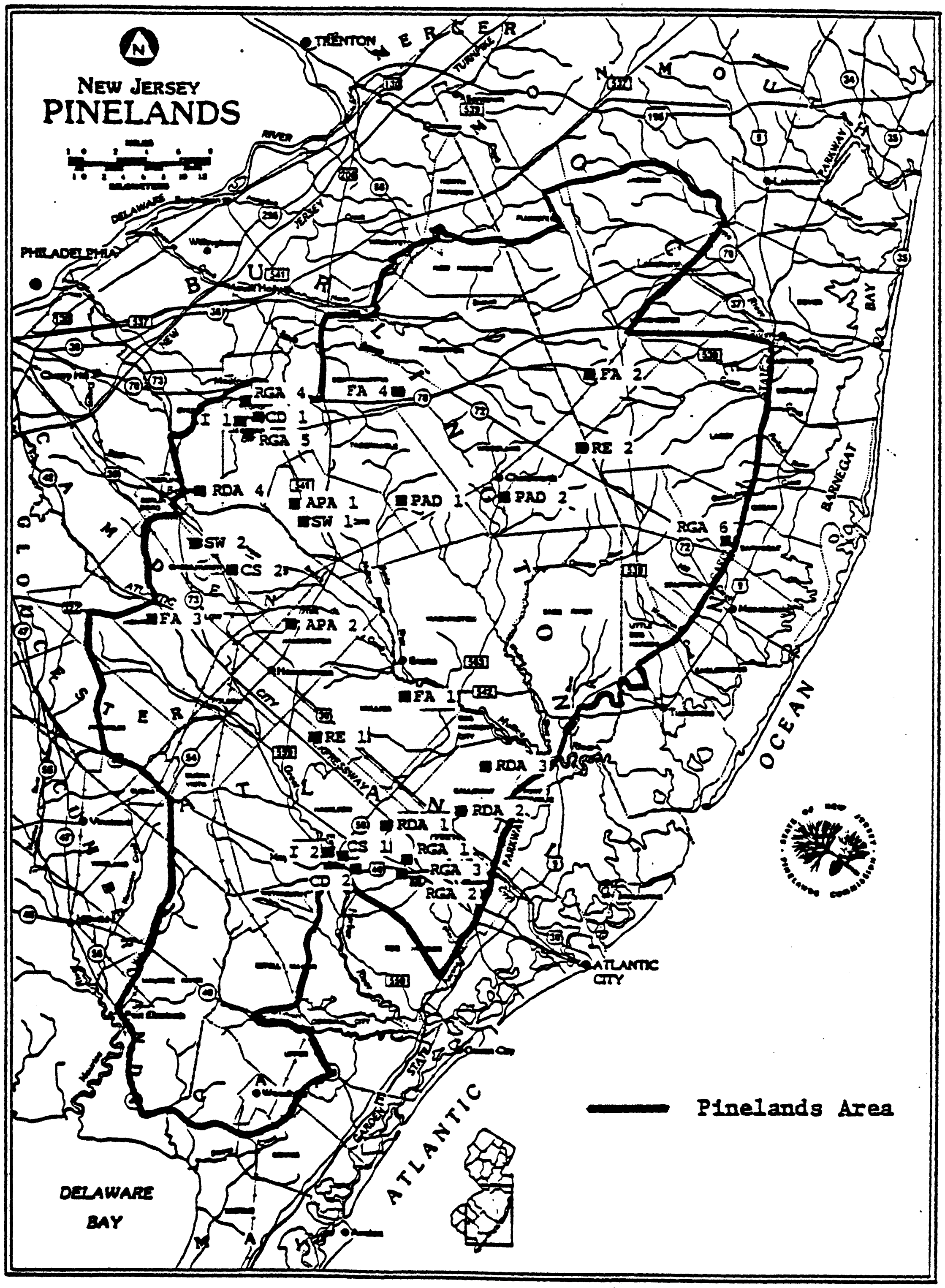

Fig. 5. Regional distribution of the 28 test applications. See Table 3 for an interpretation of the application identifications (i.e., PAD 1, FA 1, etc.).

revisions are based on evaluators specific comments and on more general comments provided by the evaluators and other parties. The suggested revisions are precisely written as they should appear in the revised Model. All revisions are indented for clear identification by the reader.

SPECIAL CASE BUFFER DELINEATION GUIDELINES

Table 4 provides a brief synopsis of the evaluators comments concerning the Guidelines. These comments deal with the evaluators interpretation of the Guideline, clarifying statement(s) and rationale statement as they specifically pertain to the respective application. If appropriate, revisions are suggested.

Preservation Area District

The rationale for this Guideline was generally supported. It should be noted that two evaluators reviewed application PAD 1 according to the Procedure and each derived a buffer of approximately 265 ft. As seen from Table 4, one evaluator states that 300 ft should be assigned for this particular site, and thus, supports the rationale statement. The other evaluator preferred the 265 ft buffer as derived from the Procedure. After careful consideration of these evaluators comments and following review of site plans, maps and other available information, we fully support the 300 ft guideline and rationale for this particular application.

Revisions: NONE

Resource Extraction

This Guideline was supported in total. No revisions to the clarifying statements or rationale statement are recommended.

Revisions: NONE

On-site Domestic Wastewater Treatment

Based on a literature review, Roman and Good (1983) state that a buffer of at least 300 ft between septic leach fields and wetlands is warranted in order that nitrate concentrations entering Pinelands surface waters do not exceed 2 mg/l. Subjective field analysis by evaluators would not contribute to clarification of this Guideline, and thus, it was not field tested.

Revisions: NONE

Infill-type Residential Development

This Guideline was supported in total. Roman and Good (1983) suggest some preliminary criteria to be followed when delineating infill-type areas/lots. These suggested criteria can be made more specific by emphasizing that 1) infill areas should be residential areas which are predominantly developed and preferably surrounded by development, and 2) they should be served by municipal wastewater treatment facilities.

Table 4. Special Case Buffer Delineation Guidelines. Comparison of evaluators derived buffer distances and comments for each independent evaluation.

APPLI ID	BUFFER DISTANCE(ft)	EVALUATORS COMMENTS
PAD 1	300	- agrees with rationale statement and 300 ft buffer; derived 265 ft buffer from Procedure
PAD 1	300	- agrees with rationale statement and 300 ft buffer; however, suggests that 265 ft derived from Procedure would be more objective
PAD 2	300	- agrees with rationale statement and 300 ft buffer
PAD 2	300	- agrees with rationale statement and 300 ft buffer
PAD 2	300	- agrees with rationale statement and 300 ft buffer
RE 1	300	- agrees with rationale statement and 300 ft buffer
RE 1	300	- agrees with rationale statement and 300 ft buffer
RE 2	275	- derived 275 ft from Procedure; no comment on rationale statement and appropriateness of 300 ft
RE 2	300	- agrees with rationale statement and 300 ft buffer; 300 ft is more appropriate than 275 ft derived from Procedure
RE 2	300	- agrees with rationale statement and 300 ft buffer
I 1	50	- agrees with rationale statement
I 1	50	- agrees with rationale statement
I 1	50	- agrees with rationale statement
I 2	50	- agrees with rationale statement
I 2	50	- agrees with rationale statement
I 2	50	- agrees with rationale statement

Table 4. Continued.

APPLI ID	BUFFER DISTANCE (ft)	EVALUATORS COMMENTS
CS 1	300	- agrees with rationale statement and 300 ft buffer
CS 1	290	- derived 290 ft from Procedure; no comment on rationale statement and appropriateness of 300 ft
CS 1	300	- agrees with rationale statement and 300 ft buffer
CS 2	300	- agrees with need for 300 ft buffer; however, does not support the rationale statement
CS 2	300	- agrees with rationale statement and 300 ft buffer
SW 1	<300	- derived 275 ft from Procedure; suggests 150 ft would be appropriate; no comment on rationale statement
SW 1	300	- 300 is appropriate for this particular application; however, disagrees with general appropriateness of Guideline
SW 2	300	- agrees with rationale statement and 300 ft buffer
SW 2	<300	- 300 ft is appropriate for a small portion of the site; however, 175 ft as derived from the Procedure would be appropriate for majority of site; no comment on rationale statement

Revisions: The clarifying conditions should be revised to read as follows;

Clarifying Conditions: To determine if a particular lot, or developed residential area, should be considered infill-type development, the evaluator should follow these general guidelines:

a) Only residential areas which are predominantly developed should be considered for infill.
b) The maximum infill lot size should be 1.0 acre.
c) All infill lots must have direct access to a paved public road.
d) All infill lots must be serviced by a municipal wastewater treatment system.
e) Infill areas should be limited to areas within Pinelands Villages/Towns and Regional Growth Areas.

Atlantic White Cedar Swamps

The evaluators agreed that 300 ft was a necessary buffer for the tested applications. Correspondingly, all evaluators, except one, supported the rationale statement.

An additional application was tested under the Atlantic White Cedar Swamp Guideline. Two evaluators were assigned application FA 1, and it was expected that this application would pertain to the Procedure; however, the wetland adjacent to the proposed development was a cedar swamp. One evaluator tested the application according to the Procedure and derived a 250 ft buffer, but suggested that a 300 ft buffer would be more appropriate; thereby agreeing with the Cedar Swamp Guideline. The second evaluator applied the Cedar Swamp Guideline and concluded that a 300 ft buffer would be appropriate.

No revisions are suggested, although it should be emphasized that the Guideline recommends a 300 ft buffer from the cedar swamp boundary. Under some situations, particularly at larger sites, the wetland adjacent to the development may be a complex of different wetland types. The evaluator should assign a 300 ft buffer from the cedar swamp boundary, and then proceed through the Model to determine the appropriate buffer for the other wetlands types.

Revisions: NONE

Surface Water Bodies/Herbaceous Inland Marshes

The evaluators of applications SW 1 and SW 2 generally disagreed with the need for an absolute 300 ft buffer at these pond sites. Also, others suggested that there are numerous instances in the Pinelands when an absolute 300 ft buffer from surface water bodies would not be appropriate. This is particularly true in Regional Growth Areas where surface water quality is often degraded and lake/pond shorelines are often partially developed; or, in Agricultural Production Areas where small isolated farm ponds are common.

It seems appropriate that a multifactor approach should be employed for the delineation of buffer areas for surface water bodies and herbaceous inland marshes. Therefore, it is recommended that this Guideline be deleted from the Model, and buffer delineation for these wetland types be incorporated into the multifactor Procedure. For delineation of buffer areas between herbaceous inland marshes and proposed upland development, the evaluator should follow the Procedure. All aspects of the Procedure can be applied, except for the relative vegetation quality analysis which would be inappropriate for herbaceous inland marshes. Similarly, permanent streams/rivers, lakes and ponds with a vegetated wetland fringe will be evaluated by the Procedure. If the border between the upland and lake/pond is abrupt with no, or a limited wetland fringe, then the evaluator will, 1) assess the relative quality, values and functions of the lake/pond according to a Lake/Pond Evaluation Scheme (herein proposed), 2) assess the potential for impacts according to the originally proposed Potential for Impacts Scheme, and 3) include the land capability areas factor (i.e., Table 17 of the proposed Model). The Lake/Pond Evaluation Scheme will be presented later in this report.

Revisions: Delete this Guideline from the Model.

LAND CAPABILITY AREAS BUFFER DELINEATION PROCEDURE

Defining Boundaries for Evaluation

The evaluators identified several problems with the determination of wetland site review areas and wetland areas. To provide for consistency among independent evaluations the evaluator is given instructions for determining wetland site review area and wetland area boundaries (See Roman and Good 1983, p. 74). In practice, the evaluators found these instructions to be confusing and difficult to implement. The provided instructions allowed much leeway for subjective "unguided" decisions, and thus, independent evaluators would often delineate different areas. The suggested revisions should alleviate most of the problems and add to consistency been independent evaluations.

Revisions: The section titled "Defining Boundaries for Evaluation" should be rewritten as follows:

> Defining Boundaries for Evaluation
>
> To maintain consistency in the relative values and functions evaluation process, appropriate dimensions of the wetland to be evaluated must be defined. When detailed site-specific field observations are required in order to satisfy a particular aspect of the Procedure, the evaluator will be directed to study the wetland site review area.[3] The evaluator should study the wetlands which are

[3]Note: The concept of wetland site review area is not applicable if the wetland is defined as a lake/pond. The evaluator should proceed to the discussion of wetland area.

within 300 ft of the proposed development site/lot(s). The evaluator must enter the wetland and walk parallel to the wetland-upland boundary of all wetlands to be evaluated (i.e., within 300 ft of the proposed development site/lots). The wetlands surveyed on this parallel walk will be known as the wetland site review area. As noted from plant species composition and vegetation structure, the wetlands evaluated should be relatively free of transitional influences; however, to maintain consistency the evaluator should walk no more than 300 ft into the wetland. The character of the wetland may dramatically change along this transect, and thus, the evaluator may find it necessary to identify two or more distinct wetland site review areas.

By following the above methodology the evaluator should acquire a representative sample of the wetlands in the immediate vicinity of the proposed development. In many situations it would probably be appropriate to review a larger portion of the wetland; however, considering the time, man-power and financial restraints often faced by the Pinelands Commission, local regulatory agencies, and applicants, this methodology seems to be the most feasible. Fig. 6 (a and b) illustrates the methodology for identifying the wetland site review area.

If the appropriate information needed for a particular aspect of the evaluation scheme can be obtained from maps and aerial photographs, then the evaluator will be directed to study the wetland area. To delineate the wetland area, the evaluator should first, accurately map the proposed development site/lot(s) on the 1:24,000 Pinelands Commission vegetation maps, National Wetland Inventory maps, and/or SCS soils maps. If the proposed development site/lot(s) is parallel or adjacent to a wetland (i.e., vegetated wetland or lake/ pond wetland) as noted in Fig. 7(a), then the evaluator should locate the point at which the wetland projects farthest into or closest to the site/lot(s) boundary lines. This point will be the center of a circle (dimensions of the circle will be discussed later) to be drawn on the 1:24,000 map(s). If wetlands are interspersed throughout the proposed development site/lot(s), and thus, it becomes difficult or impossible to locate a central point parallel to the wetland/upland border, then the evaluator must locate the farthest downstream point of wetland which is within the boundaries of the development site/ lot(s). This point will be the center of a circle to be drawn on the appropriate 1:24,000 maps. Examples of this later situation for defining a wetland area are illustrated in Fig. 7 (b).

All wetlands within the circle and within the same drainage basin as the wetlands immediately adjacent to the development site/lot(s) will be included as the wetland area. This area can include wetlands which are both upstream and downstream of the proposed development site/lot(s).

The potential area of wetlands to be evaluated (i.e., circle diameter) should be dependent upon the relative scale and intensity of the proposed development. It is assumed that large scale and/or relatively high intensity developments will have a greater influence on associated wetlands and therefore, the wetland area evaluated for

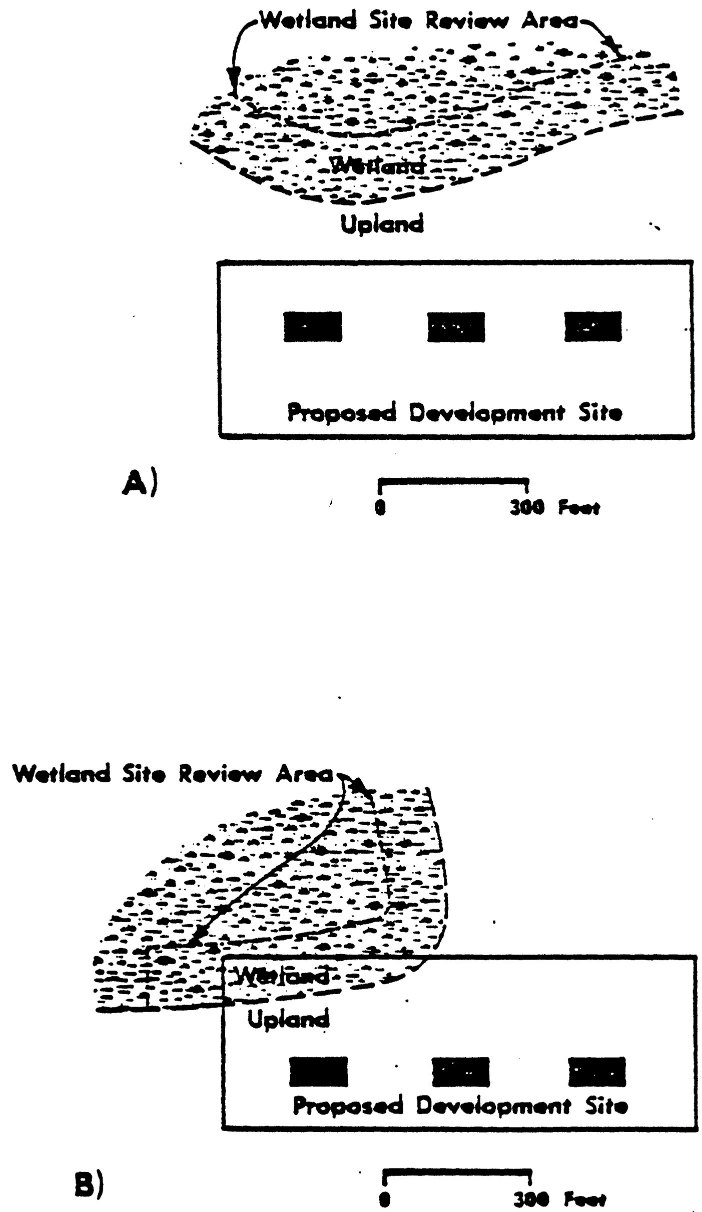

Fig. 6. Field method for identifying the <u>wetland site review area</u>.
a) the entire proposed development site is adjacent to the wetland
b) the proposed development site is partially within the wetland.

SEE TEXT FOR A DETAILED EXPLANATION

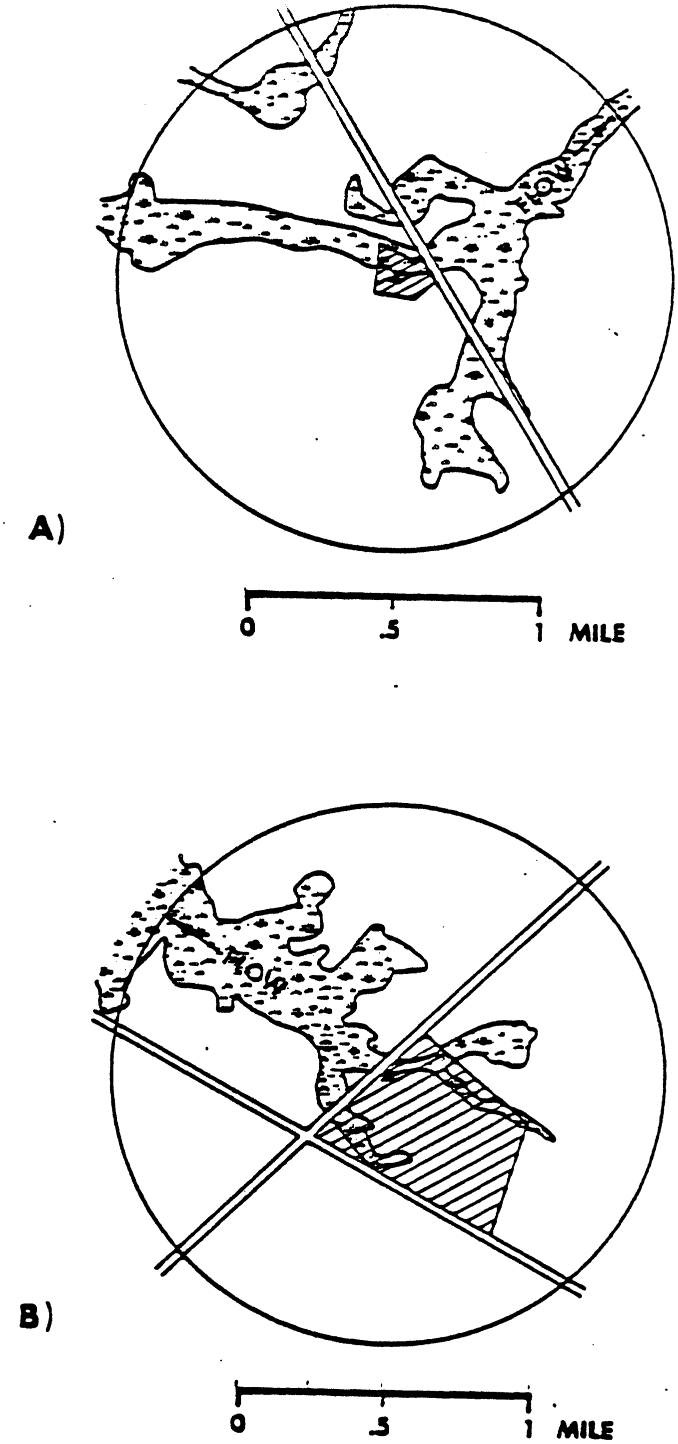

Fig. 7. Method for indentifying the <u>wetland area</u>.
a) The proposed development site (diagonal lines) is adjacent to a wetland. The point at which the wetland projects farthest into the development is the center point of a circle to be drawn.
b) Wetlands are interspersed throughout the proposed development site. The farthest downstream point of wetland which is within the boundaries of the development site is the center point of a circle to be drawn.

SEE TEXT FOR A DETAILED EXPLANATION

the Procedure should be greater and/or include wetlands farther downstream and upstream of the proposed development. When delineating the wetland area, the following guidelines should be followed;

Large Scale and/or High Intensity Development

-Maximum potential area of wetland -- approximately 1800 acres (1:24,000 scale)

-Circle diameter -- 5 inches

-The proposed development site (wetlands and uplands) is ≥ 100 acres and the proposed density of development is ≥ 1 unit/acre; or, the proposed development site is ≤ 25 acres and the proposed density of development is ≥ 4 units/acre; or, the proposed development is commercial or industrial.

All other Development

-Maximum potential area of wetland -- approximately 900 acres (1:24,000 scale)

-Circle diameter --- 3.5 inches

Note - The acreages presented above are for total area within the circle (wetland and upland). The wetland area includes only wetlands within the circle, and thus, the acreage of the wetland area will often be considerably smaller than the total circle acreage.

The Wetland Evaluation Scheme

Each aspect of the Wetland Evaluation Scheme is reviewed as it appeared in the proposed Model. If necessary, appropriate revisions are suggested. Appendix 2 contains the evaluators independent scores. When analyzing consistency among independent evaluators, this Appendix is often referred to. Following discussion of the verification results and suggested revisions, the newly created Lake/Pond Evaluation Scheme is presented.

Vegetation Composition

To determine the relative vegetation quality the evaluator must estimate the percent of the total shrub cover within the wetland site review area that is occupied by shrub species characteristically found in relatively undisturbed wetlands. This was an adaptation of a quadrat sampling method. Most evaluators found that it was extremely difficult to estimate this percent cover parameter. In addition, several evaluators stated that the derived score (high, moderate or low vegetation quality) did not always reflect the apparent vegetation quality at the site. For example, the evaluators noted that the species composition and vegetation structure at sites APA 2 and RGA 1 appeared disturbed. Physical disturbances at these sites supported the evaluators observations (i.e., channelization, nutrient inputs). However, by following the percent cover scheme the derived scores did not reflect this disturbed character.

Since measuring plant species abundance (percent cover) by the preferred quadrat method would be too time consuming, it seems that a more qualitative approach should be employed which assesses the relative quality of vegetation within the wetland site review area. The evaluator should be given the opportunity to determine whether characteristic disturbed site species are non-existent to rare, common or relatively abundant within the wetland site review area. To aid the evaluator in this relative determination, the revision will include a complete listing of shrub, vine and herbaceous species found at disturbed and undisturbed Pinelands sites (from Ehrenfeld 1983; Ehrenfeld and Schneider 1983). With this revised analysis, consistency among evaluators will be maintained assuming that all evaluators have had considerable field experience in the Pinelands and have had exposure to a diversity of Pinelands wetlands ranging from undisturbed to distured.

Revisions: The section titled "Relative Analysis" should be revised to read as follows:

Relative Analysis: To determine the vegetation character of a wetland along a relative scale from undisturbed to disturbed, the evaluator must assess the species composition of the wetland site review area. Shrub and herbaceous species seem to be the most definitive indicators of the relative undisturbed-to-disturbed quality of wetland vegetation. To maintain consistency in this relative vegetation analysis, the evaluator should concentrate on shrubs and vines since they can be identified year-round. Herbaceous species, especially those which are persistent year-round, should be used in support of the shrub/vine analysis. Table 15, adapted from data presented by Ehrenfeld (1983) and Ehrenfeld and Schneider (1983) provides lists of shrub, vine and herbaceous species which characterize relatively undisturbed and relatively disturbed forested and shrub-dominated Pinelands wetlands. The Ehrenfeld (1983) study was based on Pinelands hardwood swamps, while data from Pinelands cedar swamps is presented in the Ehrenfeld and Schneider (1983) study. Pitch pine lowlands and shrub-dominated wetlands were not studied by Ehrenfeld (1983) or Ehrenfeld and Schneider (1983); however, with some additions/deletions to their data, Table 15 can be applied to all Pinelands forested and shrub-dominated wetlands.

Ehrenfeld (1983) reports that vines (i.e., *Ipomoea lacunosa*, *Rhus radicans*, *Smilax* spp., among others), occur more frequently and in greater abundances in disturbed sites, as compared to undisturbed sites. Also, Ehrenfeld (1983) found a shift in disturbed site community structure towards an increased abundance and diversity of herbaceous species, with a corresponding decrease in shrubs. Generally, herbaceous species which are non-native to the Pinelands or cosmopolitan accounted for this observed community shift (i.e., *Allium vineale*, *Daucus carota*, *Phragmites australis*, *Taraxacum officinale*).

The relative vegetation quality score is determined as follows:

High Vegetation Quality
Characteristic disturbed site species are not present or rare within the wetland site review area (see Table 15 for a list of characteristic disturbed site species) 3

Moderate Vegetation Quality
Characteristic disturbed site species are relatively common within the wetland site review area (see Table 15 for a list of characteristic disturbed site species)
. 2

Low Vegetation Quality
Characteristic disturbed site species are relatively abundant within the wetland site review area (see Table 15 for a list of characteristic disturbed site species). 1

Existing Surface Water Quality

As noted from Appendix 2, consistency among the evaluators independent scores was excellent. Long-term water quality data (i.e., STORET data) were available for 8 of the 18 applications tested for the Procedure. This suggests that the availability of long-term data sets is sufficient for this aspect of the Wetland Evaluation Scheme to function effectively. It should be emphasized that Roman and Good (1983, p. 80) state that "if data are not available then the evaluator must assume that the water quality is high (i.e., overall relative score of 3), unless the applicant can demonstrate otherwise." Within the context of this statement, the evaluator (or applicant) has the option of clearly demonstrating that the water quality is less than high quality. For example, location of a wastewater treatment facility, landfill, or intensive agriculture immediately upstream of the proposed development would suggest that surface water quality may be degraded. Measurements of pH can be used to support the above indirect documentation of altered water quality.

Revisions: NONE

Water Quality Maintenance Value

a) Potential for nutrient inputs to the wetland - All wetlands tested for the Procedure were associated with a stream , and thus, were assigned a score of 3, indicating a high nutrient input potential (see Appendix 2). This lack of variability (i.e., no isolated wetlands were encountered from the random selection of applications) suggests that this factor is not effectively contributing to the determination of a particular wetlands relative water quality maintenance value. This factor should be revised so that the role of hydrology can be evaluated in more detail.

Revisions: The section titled, "a) Potential for nutrient inputs to the wetland," should be retitled to, "a) Hydrologic regime." The revised section should be written as follows;

a) Hydrologic regime - Hydrologic regime, as a factor influencing the relative water quality maintenance value of a wetland, is based on 1)

---

[4]Evaluators of applications FA 2 and RDA 2 disagreed as to the non-isolated vs. isolated hydrologic character. Following careful analysis of available maps, we found these sites to be associated with a stream course.

Table 15. Plant species characterisitc of disturbed and undisturbed Pinelands sites. These lists were adapted from Ehrenfeld (1983) and Ehrenfeld and Schneider (1983).

Disturbed Sites

Actaea sp. (Baneberry)

Alisma subcordatum (Small Water Plantain)

Allium vineale (Field Garlic)

Anaphalis margaritacea (Pearly Everlasting)

Arisaema triphyllum (Jack-in-the-pulpit)

Asplenium filixfernia (Lady Fern)

Asclepias syriaca (Common Milkweed)

Aster lateriflorus (Calico Aster)

Aster simplex (Panicled Aster)

Berberis thunbergii (Barberry)

Bidens frondosa (Beggar Ticks)

Boehmeria cylindrica (False Nettle)

Callitriche heterophylla (Water Starwort)

Carex lurida (Sallow Sedge)

Carex silicea (Sea-beach Sedge)

Carex tuckermani (Tuckerman's Sedge)

Circaea quadrisculata (Enchanter's Nightshade)

Convolvulus sp. (Bindweed)

Cuscuta compacta (Dodder)

Decodon verticillata (Water Willow)

Eclipia alba (Yerba-de-tajo)

Erechtites hieracifolia (Pilewort)

Eupatorium perfoliatum (Boneset)

Eupatorium rotundifolium (Round-leaved Boneset)

Fragaria virginiana (Strawberry)

Galium sp. (Bedstraw)

Glyceria sp. (Manna Grass)

Habenaria blephariglottis (White Fringed Orchis)

Habenaria clavellata (Green Wood Orchis)

Habenaria lacera (Ragged Fringed Orchis)

Hypericum multilum (St. John's-wort)

Impatiens biflora (Jewel-weed)

Table 15. Continued.

Lactuca canadensis (Wild Lettuce)

Lemna sp. (Duckweed)

Lonicera japonica (Japanese Honeysuckle)

Ludwigia palustris (Water Purslane)

Lycopus amplectens (Sessile-leaved Water Horehound)

Maianthemum canadense (Lily-of-the Valley)

Medola virginica (Indian Cucumber-root)

Mikania scandens (Climbing Hempweed)

Oxalis stricta (Upright Yellow Wood Sorrel)

Onoclea sensibilis (Sensitive Fern)

Panicum sp. (Panic Grass)

Parthenocissus quinquefolia (Virginia Creeper)

Phragmites australis (Common Reed)

Phytolacca americana (Pokeweed)

Pilea pumila (Clearweed)

Polygonum sp. (Smartweed)

Rannunculus abortius (Small Flowered Crowfoot)

Rannunculus sceleratus (Cursed Crowfoot)

Rhus coppalina (Winged Sumac)

Rhus radicans (Poison Ivy)

Rhus vernix (Poison Sumac)

Rosa sp. (Rose)

Rubus sp. (Blackberry)

Salix alba (White Willow)

Sambucus canadensis (Common Elder)

Smilax sp. (Brier)

Solidago canadensis (Canada Goldenrod)

Solidago graminifolia (Grass-leaved Goldenrod)

Solidago rugosa (Rough-stemmed Goldenrod)

Sparganium androcladum (Branching Bur-reed)

Symplocarpus foetida (Skunk Cabbage)

Taraxacum officinale (Dandelion)

Thalictrum polygamum (Meadow rue)

Vitis sp. (Wild Grape)

Table 15. Continued.

Undisturbed Sites
Aralia nudicaulis (Wild Sarasparilla)
Arethusia bulbosa (Arethusa)
Aster nemoralis (Bog Aster)
Bartonia virginica (Yellow Bartonia)
Carex collinsii (Collins Sedge)
Carex stricta (Tussock Sedge)
Carex walteriana (Walters Sedge)
Chamaedaphne calyculata (Leatherleaf)
Drosera sp. (Sundew)
Eleocharis tuberculosa (Tubercled Spike-rush)
Eriophorum virginicum (Cotton Grass)
Gaylussacia dumosa (Dwarf Huckleberry)
Gayluccacia frondosa (Dangleberry)
Helonias bullata (Swamp-pink)
Juncus canadensis (Canada Rush)
Kalmia angustifolia (Sheep Laurel)
Kalmia latifolia (Mountain Laurel)
Leucothoe racemosa (Fetterbush)
Lyonia mariana (Staggerbush)
Myrica pensylvanica (Bayberry)
Orontium aquaticum (Golden Club)
Panicum ensifolium (Small-leaved Panic)
Pogonia ophioglossoides (Rose Pagonia)
Polygala brevifolia (Short-leaved Milkweed)
Pontederia cordata (Pickerelweed)
Rhexia mariana (Meadow Beauty)
Rhododendronviscosum (Swamp Azalea)
Rhynchospora alba (White Beaked-rush)
Rhynchospora gracilenta (Slender Beaked-rush)
Sarracenia purpurea (Pitcher Plant)
Scirpus cyperinus (Wool Grass)
Utricularia sp. (Bladderwort)
Viburnum nudum (Possum Haw)

Table 15. Continued.

Vaccinium corymbosum (Highbush Blueberry)
Vaccinium macrocarpon (Cranberry)
Viola lanceolata (Lance-leaved Violet)

the potential for nutrient inputs to the wetland, and 2) the potential for interaction/contact between surface waters and the wetland vegetation and substrate. The first criterion differentiates between wetlands which are associated with a stream course and wetlands which are not directly associated with a stream, and thus, are isolated. These isolated systems are primarily dependent on groundwater, surface runoff and precipitation for their water supply. Obviously, stream flow is an additional water supply source for wetlands associated with a water course. Since wetlands associated with streams have more potential sources for nutrient inputs (i.e., stream flow, groundwater flow, runoff, and precipitation) than isolated systems, it follows that their water quality maintenance value would be enhanced; especially when considered from a regional or watershed-wide perspective. For this analysis wetlands that were once adjacent to a stream, but are currently fragmented by development and stream flow is diverted, are to be considered as isolated. Wetlands which are divided or crossed by a road, railroad, right-of-way, etc. but with stream flow <u>maintained</u> by bridges, culverts or other such means must still be considered as being associated with the stream.

With respect to the second factor, the water quality maintenance value of wetlands is generally enhanced as the contact time and interaction between nutrient-laden surface waters and the wetland is increased. It is assumed that hydrology plays a major role in a wetlands capacity to retain/remove nutrients if the wetland is associated with a stream <u>and</u> the wetland is relatively broad, thereby increasing the potential for surface water interaction with wetland vegetation and substrate. The average width of Pinelands wetland complexes (associated with streams) was estimated to be approximately 0.25 mi.

To evaluate the role of hydrology in assessing a wetlands relative water quality maintenance value, the following relative scheme is presented.

<u>Major Hydrologic Role</u>
The <u>wetland area</u> is associated with a stream, river, lake or other such water course, <u>and</u>, the average width of the <u>wetland area</u> is $\geq$ 1500 ft (approx. 0.25 mi). 3

<u>Moderate Hydrologic Role</u>
The <u>wetland area</u> is associated with a stream, river, lake or other such water course, <u>and</u>, the average width of the <u>wetland area</u> is $\leq$ 1500 ft. 2

<u>Minor Hydrologic Role</u>
The <u>wetland area</u> is isolated from streams, rivers, lakes and other such surface water courses. 1

<u>Note</u> - To determine average width of the <u>wetland area</u> the evaluator must draw (on a 1:24000 map) three equally spaced transect lines across the <u>wetland area</u>, perpendicular to the stream course, and then average these distances.

b) Nutrient retention/removal capacity of wetland soils - The evaluators expressed no problems with this section, and as noted, consistency among evaluators was excellent (see Appendix 2).

Revisions: NONE

c) Nutrient retention by vegetation uptake - Consistency among evaluators was generally good. One minor revision is necessary.

Revisions: A tree/shrub cover category was inadvertently omitted from the proposed relative scheme. The category of sparse tree cover (≤ 50%) and dense shrub cover (≥ 75%), should be included under score 2. It should be revised to read as follows;

Dense tree cover (≥ 75%) and sparse shrub cover (< 50%) or, moderate tree cover (50 - 75%) and moderate shrub cover (50 - 75%), or, sparse tree cover (< 50%) and dense shrub cover (≥ 75%) occupy the wetland site review area. 2

Wildlife Habitat Value (Game and non-game species)

The Wildlife Habitat Value scheme was acceptable to all evaluators. Some suggested that the approach was somewhat simplistic; however, these evaluators recognized that incorporation of a more elaborate and comprehensive approach (such as a modification of the U.S. Fish and Wildlife Service Habitat Evaluation Procedures) would be beyond the scope of this Model.

a) Vegetation Interspersion - Consistency among evaluators was good, except for applications FA 4 and RDA 2 (see Appendix 2). For application FA 4, one evaluators interpretations derived from available maps were incorrect. On the other application, the evaluators defined different wetland areas, thereby leading to discrepancies in evaluating vegetation interspersion within the wetland area.

Revisions: NONE

b) Wetland Size - This part of the Wildlife Habitat Value scheme is directly related to the size of the wetland area. More importantly, the intent of this wetland size parameter is directly related to the concept upon which the original definition of wetland area was based (i.e., an individually discrete and nonfragmented wetland unit). With revision of the wetland area definition it becomes necessary to revise this wetland size parameter.

Revisions: The section titled "b) Wetland Size" should be revised as follows:

b) Wetland Size - As wetland size increases, the potential to support wildlife may similarly increase. Also, in large, nonfragmented and contiguous wetlands, animal populations may be protected and somewhat isolated from man-induced disturbance, or natural events such as fire. The relative wetland size scale is as follows.

The wetland immediately adjacent to the proposed development is part of a nonfragmented and contiguous wetland complex of ≥50 acres 3.0

The wetland immediately adjacent to the proposed development is part of a nonfragmented and contiguous wetland complex of ≥25 acres to <50 acres. 2.5

The wetland immediately adjacent to the proposed development is part of a nonfragmented and contiguous wetland complex of ≥10 acres to <25 acres. 2.0

The wetland immediately adjacent to the proposed development is part of a nonfragmented and contiguous wetland complex of ≥5 acres to <10 acres 1.5

The wetland immediately adjacent to the proposed development is part of a nonfragmented and contiguous wetland complex of <5 acres 1.0

c) Surrounding Habitat - Consistency among evaluators was excellent, except for some discrepancies noted for applications RGA 4 and CD 2 (see Appendix 2). Our careful review of these applications revealed no apparent cause for these inconsistencies.

Revisions: NONE

Socio-Cultural Values

Consistency among evaluators was generally good (Appendix 2). As noted below, revision of the relative scale used to derive a socio-cultural score is suggested. Several evaluators commented that the score generally undervalued the socio-cultural attributes of particular wetlands. It is recommended that fewer "YES" responses be required to achieve a moderate or high socio-cultural score.

Revisions: The relative scale associated with the section titled "Relative Socio-cultural Value Score" should be revised as follows:

High Socio-cultural Value
Of the socio-cultural questions, ≥4 were answered "YES" 3

Moderate Socio-cultural Value
Of the socio-cultural questions, 2 or 3 were answered "YES" 2

Low Socio-cultural Value
Of the socio-cultural questions, ≤ 1 were answered "YES" 1

Threatened and Endangered Species

The final step to the Wetland Evaluation Scheme pertains to the presence of threatened or endangered species within the wetland area. If present, the wetland value index is increased by one numerical unit. As noted from Appendix 2, threatened or endangered species were present at 4 of the 18 test sites. Adding one numerical unit increased the wetland value index to the maximum 3.0 (except at a section of RGA 1 where one evaluator derived an index of 2.9). Considering these test results and recognizing the importance of protecting rare species (see Rational Statement, p. 89), it seems appropriate to revise this aspect of the Wetland Evaluation Scheme by initially assigning a wetland value index of 3.0 (high value) if populations of threatened or endangered species are found within the wetland area. With this revision it will be assumed that wetlands with populations of threatened or endangered species are of the highest value, regardless of other wetland value/function attributes. The evaluator will skip the Wetland Evaluation Scheme or Lake/Pond Evaluation Scheme and proceed directly to the Potential for Impacts Scheme.

Revisions: The section titled "Threatened and Endangered Species" should be inserted immediately after the section titled "Defining Boundaries for Evaluation." The "Threatened and Endangered Species" section should be revised as follows:

> Threatened and Endangered Species: If the wetland area is known to support resident and/or breeding population of threatened or endangered species (as designated by the Pinelands Commission, or, other state or federal agencies), and if the wetland area is critical to the survival of said population(s) of threatened or endangered species, then the maximum relative wetland value index or lake/pond value index (i.e., 3.0) should be assigned (see clarifying condition No. 1). It is assumed that wetlands with populations of threatened or endangered species are of the highest relative value. The evaluator should skip the Wetland Evaluation Scheme or Lake/Pond Evaluation Scheme and proceed directly to the Potential for Impacts Scheme.
>
> Clarifying Conditions:
>
> 1) The objective of this threatened and endangered species provision is to provide for priority protection of the particular population and characteristic habitat. Therefore, if there are two distinct wetland habitats adjacent to the proposed development (i.e., pitch pine lowland and wet-open field), and if the primary habitat for the threatened or endangered species is only one of these wetland types, then the evaluator should apply the appropriate Evaluation Scheme to provide for protection of the other habitat.
> 2) The presence of threatened or endangered species within the wetland area will not always result in delineation of a 300 ft buffer width (i.e., When the Potential for Impacts Index is <3.0 the derived buffer will be <300 ft). Under some circumstances, and in accordance with Article 6, section 6-204 and section 6-302 of the CMP, the evaluator may

demonstrate that a particular population of threatened or endangered species warrents buffer protection which is greater than that assigned from the Model to protect the wetland.

Rationale: No Revisions.

LAKE/POND EVALUATION SCHEME

Incorporation of the Lake/Pond Evaluation Scheme into the Procedure will be accomplished by the following revisions:

Revisions: The evaluator must determine if the relative quality of the wetland adjacent to the proposed development should be evaluated according to the Wetland Evaluation Scheme or the Lake/Pond Evaluation Scheme. The section titled "The Wetland Evaluation Scheme" should be retitled to "Evaluating Relative Wetland Quality" and revised as follows:

Evaluating Relative Wetland Quality

An essential aspect to assigning buffer areas between proposed upland development and wetland boundaries is the evaluation of relative wetland values and functions. In developing the evaluation schemes, reference was often made to the numerous wetland evaluation methods currently in existence. Lonard et al. (1981) reviewed the objectives, merits and shortcomings of twenty wetland and wetland-related evaluation methods. Considerable variation in the methods was noted. For example, the Habitat Evaluation Procedures (HEP: U.S. Fish and Wildlife Service 1980), the Habitat Evaluation System (HES; U.S. Army Corps of Engineers 1980) and the Golet (1976) model were developed to specifically address wildlife and/or fish habitat values, while other procedures take a more comprehensive approach and attempt to evaluate wetlands based on several key values and functions (Larson 1976; Reppert et al. 1979; among others). A recent evaluation scheme developed for the Federal Highway Administration (Adamus 1983) attempts to alleviate some of the problems associated with many of these methodologies by addressing all of the presently recognized wetland values and functions, and by having widespread or nationwide utility. These previously developed wetland evaluation methods, although not directly applicable for incorporation into the Pinelands wetlands evaluation scheme, provided extensive guidance when evaluating and organizing the data-base of Pinelands wetlands values and functions in a consistent and objective manner.

Two schemes are provided for evaluating the relative quality of Pinelands wetlands. 1) If the wetland adjacent to the proposed development is a characteristic forested, shrub-dominated or herbaceous wetland, then the evaluator should follow the Wetland Evaluation Scheme. Also, the Wetland Evaluation Scheme should be applied if the wetland is recognized as a surface water body (lake or pond) with a vegetated fringe (i.e., pitch pine lowland, hardwood swamp, cedar swamp, shrub wetland, herbaceous marsh; NOT aquatic bed) of ≥50 ft. This ≥50 ft fringe will provide an adequate area for the evaluator to define a wetland site review area, and thus, fulfill all aspects of the Wetland Evaluation Scheme. 2) The wetland adjacent to the proposed development should be considered a lake/pond, and thus, evaluated according to the Lake/Pond Evaluation Scheme if the fringe of vegetated wetland between the wetland-upland boundary and the lake/pond surface waters is <50 ft. These relative evaluation schemes are presented below.

The Wetland Evaluation Scheme

Evaluating the relative quality, values and functions of a vegetated Pinelands wetland (i.e., forested, shrub-dominated, herbaceous marsh) is based on five factors: 1) existing quality of vegetation; 2) existing surface water quality, 3) relative water quality maintenance attributes; 4) wildlife habitat values; and 5) socio-cultural values. (NOTE: The Wetland Evaluation Scheme was revised earlier in this report).

Revision: The newly created Lake/Pond Evaluation Scheme will be included immediately following the Wetland Evaluation Scheme (section titled "Determining the Overall Relative Wetland Quality Index").

The Lake/Pond Evaluation Scheme

If the wetland adjacent to the proposed development is determined to be a lake/pond, then the evaluator will consider four factors to evaluate the relative quality, values and functions of the surface water body: 1) existing surface water quality, 2) quality of shoreline habitat, 3) percent of the entire lake/pond shoreline which is developed, and 4) socio-cultural values.

Existing Surface Water Quality

The evaluator should follow the relative analysis as presented in the Wetland Evaluation Scheme.

Shoreline Habitat Quality

This factor differentiates between vegetated and unvegetated lake/pond shorelines. It is assumed that shorelines vegetated with tree, shrub, or herbaceous vegetation and/or submerged or floating aquatic vegetation which is characteristic of the Pinelands provide relatively high quality fish and wildlife habitat. To evaluate shoreline habitat quality, the following relative scheme is presented.

High Shoreline Habitat Quality
Adjacent to the proposed upland development site, the shoreline is vegetated with submerged or floating aquatic vegetation, and at least a narrow fringe of forested, shrub or herbaceous wetland 3

Moderate Shoreline Habitat Quality
Adjacent to the proposed upland development site, the shoreline is vegetated with submerged or floating aquatic vegetation, or a fringe of forested, shrub or herbaceous wetland 2

Low Shoreline Habitat Quality
Adjacent to the proposed upland development site, the shoreline is predominately unvegetated (no aquatic or wetland vegetation). 1

Note - Due to the non-persistent character of herbaceous, and submerged/floating aquatic vegetation, the evaluator must carefully study the shoreline for decaying remains during the period from late Fall to early Spring.

Percent Shoreline Development

This factor is based on the assumption that the overall ecological and environmental quality of the lake/pond decreases as the shoreline is encroached upon by development. To evaluate the percent shoreline development factor, the following relative scheme is presented.

Low Percent Shoreline Development
The entire perimeter of the lake/pond shoreline is ≤10% developed 3

Moderate Percent Shoreline Development
The entire perimeter of the lake/pond shoreline is >10% to ≤50% developed. 2

High Percent Shoreline Development
The entire perimeter of the lake/pond shoreline is >50% developed 1

Note - Development refers to structures, driveways, parking areas, clearings, lawns and other development-related practices which cause the relative long-term alteration of the landscape.

Socio-cultural Values

The evaluator should follow the relative analysis as presented in the Wetland Evaluation Scheme.

Determining an Overall Relative Lake/Pond Value Index

The overall value of a lake/pond is determined by assessing four general factors (existing surface water quality, shoreline habitat quality, percent of shoreline development, and socio-cultural values), and assigning a relative score for each. These scores are averaged to derive an overall relative lake/pond value index. Each individual factor is assigned equal priority in calculation of the index. The following scale enables the evaluator to translate this relative numerical index into a more comprehensible perspective.

	Numerical Index
High value	3.0 - 2.6
High to moderate value	2.5 - 2.1
Moderate to low value	2.0 - 1.6
Low value	1.5 - 1.0

The evaluator should proceed to the Potential for Impacts Scheme.

Potential for Impacts Scheme

Potential for Site-Specific Impacts

For this aspect of the scheme the evaluator must have access to the applicants detailed site plans. However, the test evaluators found that such plans often did not provide the information required for the Procedure; especially for proposed single family developments. Revisions must be made to overcome this while still maintaining the intent of this site-specific impacts parameter. Specifically, the intensity of permanent development proposed for the upland site must be considered.

Several evaluators commented that topographic slope between the development and wetland is a factor which affects the potential for site-specific impacts on wetlands. This factor is incorporated in the revisions.

Revisions: The section titled "Potential for Site-Specific Wetland Impacts", should be rewritten as follows.

Potential for Site-Specific Wetland Impacts

The potential for significant adverse impacts to be imposed on the site-specific wetland area relates to the intensity of development on the adjacent upland. For instance, as the percentage of upland that is permanently altered increases, there is a corresponding increase in the suite of potential impacts which are imposed on the adjacent wetland. Topographically, the percent slope from the development site to the wetland will affect the potential for site-specific impacts; most notably, surface runoff.

Relative Analysis: To determine the relative potential for wetland site-specific impacts, the intensity of permanent development proposed for the upland site must be considered. In addition, percent slope must be determined. Permanent development refers to structures, driveways, parking areas, clearings, lawns, and other development related practices which cause the relative long-term alteration of the landscape. Ideally, the evaluator should use detailed site plans to accurately determine the percent of the upland site which the applicant proposes to alter with permanent development. However, detailed site plans are not always available. Therefore, a relative scale is developed which assumes that as the number of development units proposed per acre of upland increases, there is a corresponding increases in the percentage of upland that will be permanently altered, and thus, the potential for site-specific impacts increases. The following relative scale should be used by the evaluator.

High Potential for Site-specific Impacts
The proposed density of residential development on the site is ≥4 units/acre of upland; or, the proposed development is non-residential with ≥40% of the total upland site area proposed to be occupied by permanent development 3.0

High to Moderate Potential for Site-specific Impacts
The proposed density of residential development on the site is <4 units to 2.75 units/acre of upland; or, the proposed development is non-residential with <40% of the total upland site area proposed to be occupied by permanent development. 2.5

Moderate Potential for Site-specific Impacts
The proposed density of residential development on the site is <2.75 units to 1.5 units/acre of upland. 2.0

Moderate to Low Potential for Site-specific Impacts
The proposed density of residential development on the site is <1.5 units to 0.3 units/acre of upland 1.5

Low Potential for Site-specific Impacts
The proposed density of residential development on the site is <0.3 units/acre of upland 1.0

Note - Permanent development refers to structures, driveways, parking areas, clearings, lawns, and other development-related practices which cause the relative long-term alteration of the landscape.

With the above scale, it is intended that industrial, high-use commercial and cluster residential developments will generally be included under the high and high to moderate ranges. At the other extreme, low intensity development will usually be limited to single family dwelling units on relatively large area lots in the Forest Area and parts of Rural Development Areas.

Slope Factor: Incorporated into the relative scale for assessing site-specific impacts is a percent slope factor. Typically, slopes from uplands to wetlands are gradual. For example, as indicated by Markley (1979), slopes of the Pinelands transitional soil series (Lakehurst, Klej and Hammonton) are, 0-3%, 0-5% and 0-5%, respectively. When slopes significantly deviate from this range, it can be assumed that the potential for impacts to the wetland will be accentuated (i.e., increased surface water runoff; localized increase in groundwater flow rate). Therefore, if topographic slope between the proposed upland development and the wetland is ≥10%, the evaluator should increase the potential for site-specific impacts score by 0.5 numerical units. Note that the score cannot be increased above the maximum 3.0.

Potential for Cumulative Impacts

Consistency among evaluators was excellent (Appendix 2), and in general, evaluators found the approach adequate to assess cumulative impacts. For each individual land capability area the scores for different applications generally encompassed the range from 1.0 to 3.0. This suggests that the relative scales are sensitive to the variable density allocation requirements of Pinelands municipalities.

No major revisions are required, however, some clarifying statements are needed. These relate to unit density allocations in uncertified municipalities; density allocations based on with or without Pinelands development credits; density allocations based on gross vs. net land area (upland and wetland vs. upland only); and, density allocation for commercial, industrial and public development. These revisions are best incorporated into the cumulative impacts scheme as Notes.

Revisions: The following notes should appear immediately following the relative density allocation scales.

Notes:

1) For Pinelands municipalities which have not been certified by the Pinelands Commission as being in conformance with the CMP, a score of 3.0 should be assigned, unless the applicant can demonstrate that the potential for cumulative impacts will be less significant.

2) The above density allocations are based on gross land area (upland and wetland). If the municipality bases density allocation on net land area (upland only), then the evaluator must determine an equivalent density allocation range from the above ranges.

3) The evaluator should always use the without development credits density allocation value.

4) All non-residential development should be assigned a score of 3.0. These types of development are usually densely concentrated in prescribed areas (i.e., commercial/industrial zoning), and thus, it can be assumed that the potential for cumulative impacts will be high.

Significance of Watershed-wide Impacts

Consistency among evaluators was good (Appendix 2). The noted discrepancies were generally due to the fact that some evaluators did not use the appropriate municipal density allocation maps, or aerial photos or land use maps.

Several evaluators suggested that downstream sites with threatened or endangered species should be considered as environmentally sensitive.

Considering the need to protect and preserve threatened and endangered species, the scheme will be revised to include and increased score factor if rare species are encountered downstream of the proposed development site.

In addition to this revision, some clarifying statements are included as notes. It should be pointed out that the >500 acre minimum area limit assigned to environmentally sensitive open space/natural areas has been omitted. Thus, all wildlife management areas, parks, forests, or recreation areas which are managed by federal, state or county agencies, principally for resource protection purposes, will be included under this environmentally sensitive lands category. Also, lands owned and managed by recognized conservation organizations, with the same objectives as above, should be included (i.e, The Nature Conservancy, The New Jersey Conservation Foundation, etc.). The other notes are self-explanatory.

Revisions: Scores 3.0 and 2.5 ("High and High to Moderate Potential for Significant Watershed-wide Impacts") should be rewritten as follows:

High Potential for Significant Watershed-wide Impacts
The wetland adjacent to the proposed development site is associated with a stream/water course, and within 2 miles downstream of the development site there is any part of an environmentally sensitive open space/ natural area; or, an active cranberry agriculture area; or, any portion of the Preservation Area District; or, resident and/or breeding populations of threatened or endangered wetland plant or animal species are within 0.5 mile downstream of the development site 3.0

High to Moderate Potential for Significant Watershed-wide Impacts
The wetland adjacent to the proposed development site is associated with a stream/water course, and within 2 miles downstream of the development site there is any part of the Forest Area with low potential for development ($\geq$20 acres/ unit); or, the wetland is isolated from a stream/water course, and a portion of the wetland or upland area immediately adjacent to the isolated wetland is an environmentally sensitive open space/natural area, or portion of the Preservation Area District; or, resident and/or breeding populations of threatened or endangered wetland plant or animal species are >0.5 miles to 1 mile downstream of the development site. 2.5

Following all categories of the relative scale, the following notes should appear.

Notes: 1) Refer to the section on water quality maintenance (The Wetland Evaluation Scheme) for a detailed definition of wetlands associated with streams/water courses and isolated wetlands.

2) Environmentally sensitive open space/natural areas are defined as wildlife management areas, natural areas, parks, forests or recreation areas which are managed by federal, state or county agencies, and maintained principally for resource protection purposes; or, areas managed and maintained as above, by recognized environmental conservation organizations (i.e., The Nature Conservancy, The New Jersey Conservation Foundation, etc.); or, other deed restricted conservation lands, managed and maintained for resource protection purposes.

3) Distance downstream should be measured as the distance along the actual stream course.

4) For clarification of the unit density allocation categories listed, the evaluator should refer to notes 1-4 of the Potential for Cumulative Impacts Scheme.

5) If more than one land use or rare species category is downstream, the evaluator should assign a score according to the most restrictive category (i.e., choose appropriate score closest to 3.0).

Assigning Buffer Areas

Table 5 summarizes the buffer distances derived by the evaluators for each application tested according to the proposed Land Capability Areas Buffer Delineation Procedure. Consistency among evaluators was generally good. For 11 of the 18 applications tested (61%), evaluators derived buffer distances which varied from each other by ≤15 ft. Buffers for 3 applications varied from >15 ft to 25 ft, while the evaluators derived buffers which varied from ≥25 ft to 50 ft on only 4 applications. As previously noted, application FA 1 should have been tested under the Cedar Swamp Special Case Guideline; thereby accounting for the 50 ft difference between evaluators. These results suggest that evaluators can independently derive buffer distances which appear to be comparable. Furthermore, with incorporation of revisions to the Model, especially with respect to clarification of the wetland site review area and wetland area definitions, it is anticipated that consistency among independent evaluators will improve.

Evaluators comments concerning their agreement or disagreement with the drived buffers are also included in Table 5. Of the 48 independent evaluations (not including FA 1), 27 of the derived buffer distances were considered to be sufficient to protect the wetland. For six (6) evaluations it was suggested that the derived buffers were excessive, while additional buffer protection was considered necessary by 4 evaluators. For 11 independent evaluations there were no specific comments or expressed opinions as to the appropriateness of the derived buffer distance.

The suggestions for a greater buffer were for Regional Growth Area applications. After careful examination of these applications it is our opinion that the Model functioned as intended. As clearly stated through-

Table 5. Land Capability Areas Buffer Delineation Procedure. Comparison of evaluators derived buffer distances and comments for each independent evaluation.

APPLI ID	BUFFER DISTANCE(ft)	EVALUATORS COMMENTS
FA 1	250	- derived 250 ft from Procedure; suggested 300 ft would be more appropriate
FA 1	300	- considered this application as a Cedar Swamp Special Case Guideline
FA 2	265	- adequate buffer
FA 2	265	- no comment provided
FA 3	250+	- no comment provided
FA 3	260	- adequate buffer
FA 4	260	- adequate buffer
FA 4	250+	- suggested 200 ft buffer
APA 1	220	- suggested lesser buffer
APA 1	235	- suggested lesser buffer
APA 2	250+	- suggested 100 ft buffer
APA 2	250+	- suggested 150 ft buffer
RDA 1	200	- adequate buffer
RDA 1	200	- adequate buffer
RDA 1	190	- adequate buffer
RDA 2	225	- adequate buffer
RDA 2	200	- suggested lesser buffer
RDA 2	210	- adequate buffer
RDA 3	270	- no comment provided
RDA 3	250	- adequate buffer
RDA 4	230	- adequate buffer
RDA 4	220	- adequate buffer

Table 5. Continued.

APPLI ID	BUFFER DISTANCE(ft)	EVALUATORS COMMENTS
RGA 1a	300	- no comment provided
RGA 1a	285	- adequate buffer
RGA 1b	300	- no comment provided
RGA 1b	285	- adequate buffer
RGA 1c	300	- no comment provided
RGA 1c	285	- adequate buffer
RGA 2	270	- adequate buffer
RGA 2	270	- adequate buffer; however, 300 ft could be considered
RGA 3a	270	- suggested 300 ft buffer
RGA 3a	240+	- adequate buffer
RGA 3a	240+	- adequate buffer
RGA 3b	270	- suggested 300 ft buffer
RGA 3b	240+	- adequate buffer
RGA 3b	240+	- adequate buffer
RGA 4	150	- suggested greater buffer
RGA 4	110+	- no comment provided
RGA 4	150	- adequate buffer
RGA 5	175+	- no comment provided
RGA 5	175+	- adequate buffer
RGA 5	175	- adequate buffer
RGA 6	200+	- no comment provided
RGA 6	210	- adequate buffer
CD 1	240	- no comment provided
CD 1	240	- no comment provided
CD 1	240	- adequate buffer
CD 2	240	- adequate buffer
CD 2	270+	- suggested 300 ft buffer
CD 2	270+	- adequate buffer

out, the Model should function within the framework of the CMP's land allocation strategy. More specifically, the Pinelands Commission designated Regional Growth Areas as land areas which are, 1) adjacent to, or within, existing developed areas; 2) experiencing growth pressures; and 3) capable of accommodating environmentally compatible development (NJ Pinelands Commission 1980).

The four evaluators for application APA 1 and APA 2 suggested that the derived buffers were excessive (Table 5). We concur with their opinions and suggest revisions to the Model based on three general points. These points are 1) following careful review of the application materials, aerial photographs and vegetation maps, coupled with interviews with the evaluators, we agree that the derived buffers for APA 1 and APA 2 were excessive; 2) wetland quality in Agricultural Production Areas is generally less than exceptional on a regional (area wide) basis; and 3) growth in Agricultural Production Areas is generally limited to low intensity, small scale developments. In order that the Procedure adequately reflect these factors (especially factors 2 and 3), it is suggested that the buffer index to buffer distance conversion table (see Table 17, Roman and Good 1983) be revised to include Agricultural Production Areas within the Rural Development Areas category. With this revision, the evaluators concerns for applications APA 1 and APA 2 should be alleviated.

When the derived buffers shown in Table 5 are examined in conjunction with the buffer index to buffer distance conversion table, it is noticed that the derived buffers generally fall within the mid-to-upper limit of their appropriate conversion table scale. For example, according to the conversion table, buffers assigned for development in Forest Areas can range from a minimum of 200 ft to the maximum assignable 300 ft. Derived buffers for all Forest Area test application (FA 1 to FA 4) were 250 ft or greater. Similar trends are noted for the other applications, except for APA 1 and RGA 4, where buffers were respectively 15/30 ft and 25/65/25 ft less than the mid-point distances. These results imply that of the applications tested, the quality of the wetlands was generally good.

It should be noted that evaluators did not use the conversion table as specifically intended. The table caption clearly states that "... the buffer delineation index should be rounded-off and then a buffer distance assigned according to the appropriate land capability area." Most evaluators used the exact index and then derived a buffer distance by interpolation. This practice provides a misleading impression that the Procedure is capable of deriving precise buffer areas. The conversion table caption will be revised to emphasize the more flexible and realistic round-off approach.

Finally, the section titled "Assigning Buffer Areas" should be revised by including a more complete discussion of the Procedures assumptions.

Revisions: The section titled "Assigning Buffer Areas" should be revised as follows:

Assigning Buffer Areas

The final step of the Procedure is the assignment of appropriate buffer areas. By averaging the relative wetland value index or lake/pond value index and potential for impacts index, a buffer delineation index is derived. Referring to Table 17, the evaluator can convert the buffer delineation index to an actual buffer distance.

Wetlands determined to have a high relative value (i.e., value index = 3.0) and a high potential for impacts (i.e., impacts index = 3.0) are assigned the maximum allowable buffer distance of 300 ft. It is assumed that a 300 ft buffer is adequate to protect these high quality wetlands from relatively high impact upland development. Then, based on this 300 ft maximum assignable buffer, it is further assumed that a lesser buffer would be adequate to protect wetlands of a lower relative value and/or to protect wetlands which will be exposed to impacts of a lesser degree.

In addition to the wetland value and potential for impacts factors, a third, and more regionally oriented factor is considered. As noted in Table 17 the minimum buffer distance which can be assigned is variable depending on location of the proposed development site with respect to Pinelands land capability areas. The rationale for creating these variable buffer scales is as follows. On a regional basis the Preservation Area District represents a baseline exemplifying the highest environmental quality of the Pinelands. There is a regional loss or degradation of this quality and a corresponding increase in development with a progression from Forest Areas/Agricultural Production Areas, to Rural Development Areas, to Villages and Towns, and finally to Regional Growth Areas. These regional variations in existing environmental quality and development patterns represent two of the many criteria used by the Pinelands Commission when developing the regions land use planning strategy. Coupled to this environmental gradient effect, it is assumed that there is a corresponding loss of characteristic wetland values and functions on a regional basis. However, it must be emphasized that there are wetland complexes within growth-oriented Pinelands areas which are of high quality. It seems apparent that the general/regional loss of overall wetland quality (not necessarily site-specific wetland quality) would justify the potential for some buffers to be less than 300 ft. This variable buffer provision will facilitate needs for growth in, and adjacent to, existing developed areas, as mandated by the Pinelands legislation, and in a manner which is consistent with the CMP's regional planning objectives.

It must be emphasized that the primary intent of this Procedure is to maintain or enhance the existing quality of wetlands. Providing for environmentally compatible growth is an important and necessary component, and thus has been incorporated into the Procedure; however, priority consideration is placed on the preservation, protection and enhancement of Pinelands wetlands.

NEW SECTION TO MODEL

Revision: A new section acknowledging this verification effort should be included in the revised Model.

BUFFER DELINEATION IN THE PINELANDS: a long-term verification process

The model presented herein provides a consistent, systematic and practical approach to delineating buffer protection areas for Pinelands wetlands. The model was designed to function effectively within the Pinelands Commission development and review process, and more specifically, to aid Commission staff, other resource managers, and applicants in the interpretation and implementation of section 6-114 (Wetland Transition Areas) of the Wetlands Management Program (CMP; Article 6, Part 1, sections 6-101 to 6-114).

Following a rigorous field verification of the Model it appears that these broad objectives will be adequately satisfied (Roman and Good 1984; this report). However, verification of the Model should continue as a long-term process. The Model should be periodically revised and updated as new scientific findings and appropriate information becomes available. Long-term monitoring studies should be initiated at several sites in the Pinelands to determine if a) the buffers assigned through the Model are adequately protecting wetland values and functions, and b) the buffers assigned are excessive, and thus, limiting environmentally compatible growth and development to occur in the Pinelands.

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Appendix 1. Standard evaluation form completed for each application that an evaluator field tested. All individual scores and evaluator comments which are presented in this report were derived from these forms.

BUFFER DELINEATION MODEL

Evaluation of Proposed Development Site

I. Preliminary Information Needs for Model

Application No. ____________________ Applicants Name ________________________

County ____________________ Township ________________

Block and Lot number _________________________

Pinelands Land Capability Area ________________________________

Zoning Requriements ______________________________

Quadrangle ______________ Aerial ID No. _________________________

Brief description of the proposed development ____________________________________

____

II. Special Case Buffer Delineation Guidelines (p. 62)[1]

- Evaluator should follow the decision-making flow diagram (p. 63)

A. If a Special Case Buffer pertains to the proposed development, then the evaluator should assess the appropriateness of the assigned buffer distance.

1) Based on the site inspection and review of maps, aerials, and other reference materials, comment on the value of the wetland and the potential for impacts associated with the proposed development (It is recommended that the evaluator refer to appropriate parts of the Land Capability Areas Buffer Delineation Procedure while commenting on these factors.).

a) Wetland Value

- Wetland Vegetation. Is the wetland characterized by "disturbed" or "undisturbed" species? Comments (attach species list) ____________________________________

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[1] Refers to page numbers in Roman and Good (1983)

- Existing Surface Water Quality. Comments ______________________

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____

(use additional space if necessary)

- Water Quality Maintenance Value. Characterize soils of the wetland area, vegetation structure, and potential for nutrient inputs. Comments ______________________________

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____

(use additional space if necessary)

- Wildlife Habitat Value. Based on vegetation interspersion, wetland size, quality of surrounding habitat, and other factors, evaluate the wildlife habitat value of the particular wetland. Comments ______________________________

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- Socio-cultural values. In terms of recreation value, research and education values, visual/aesthetic attributes, and unique characteristics evaluate the socio-cultural value of the wetland. Comments __________

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- Are any threatened or endangered species known to be present within the wetland area. YES NO. If YES, please comment ____________

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____

b) Potential for Impacts

- What is the potential for site specific impacts? Evaluate the potential for increased runoff, nutrient inputs, noise, etc.

- What is the potential for cumulative impacts to be associated with the proposed development? Comments

- What is the potential for watershed-wide impacts? Identify surrounding and downstream land uses. Comments

- Other impacts or comments relevant to the proposed development and associated wetland. Comments

2) Taking into account the "Rationale" for developing the particular Special Case Guideline (carefully review appropriate rationale statement), the overall value of the wetland, and the potential for impacts, do you think the assigned buffer distance is appropriate?
Summary Statement:

III. Land Capability Areas Buffer Delineation Procedure (p. 74)

A. Define Boundaries for Evaluation (p. 74)

- outline wetland site review area and wetland area on USGS quad, vegetation maps, soils maps and aerials . It is suggested that these areas be outlined on a clear mylar overlay (ie, scales are uniform for quads, soils maps, vegetatation maps, and aerials). If possible, it would be helpful to outline these areas on the applicant's site plan.

- At this particular site, did you encounter any difficulties in delineating the wetland site review area or wetland area? Comments ________________

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____

B. Wetland Evaluation Scheme (p. 75)

1) Vegetation Composition (p. 76)

- During the site inspection the evaluator should develop a species list for the wetland site review area (trees, shrubs, herbs) and provide a brief description of the wetland (for example, hardwood swamp, with canopy dominated by red maple, with understory of blueberry and sweet pepper bush).

Wetland Description (attach species list) ________________________

____

____

Determine Vegetation Quality Score

High Vegetation Quality 3

Moderate Vegetation Quality 2

Low Vegetation Quality 1

SCORE = [ ]

Does the score provide an accurate and reasonable determination of the relative vegetation quality of the wetland site review area and surrounding wetland areas? Do you have any recommendations for change (such as change the % cover ranges)? Comments ____________________________

____

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____

____

2) Existing Surface Water Quality (p. 79)

- Cite the source and location of existing surface water quality data used for this relative analysis (i.e., STORET, County/Local monitoring program, research report/publication; monitoring station ID, if available and descriptive location of station). Comment on geographic location of monitoring station relative to the wetland area. Comment on surrounding land uses (forested, agriculture, suburban, etc.). Comments ______

______

______

______

______

______

______

Determine Existing Surface Water Quality Score

pH (actual value =)

High 3
Moderate 2
Low 1

NO_3 (actual value = mg/1)

High 3
Moderate 2
Low 1

$$SCORE = \frac{\text{pH score } \square + NO_3 \text{ score } \square}{2} = \square$$

Note: If complete data set is not available, then pH or nitrate score can be used alone.

- If no water quality data are available, then assume that the water quality is high (3), unless the applicant has demonstrated otherwise.

  OR, the evaluator should cite indirect evidence which clearly demonstrate that the water quality is degraded. For example, location of a treatment plant, landfill or dense development with septic systems, immediately upstream of the proposed development site. To support these land use observations, pH should be checked with a field meter. Comments ______

______

______

______

______

______

- If the wetland is isolated, with no apparent surface water hydrologic connection, then the existing surface water quality rating must be ommitted from the evaluation. If the isolated wetland is a surface water body type (pond, lake), then pH measurements can be made to evaluate surface water quality.
  Comment ____

  ____

3) Water Quality Maintenance Value (p. 83)

- Evaluator must refer to USGS quad maps, vegetation maps, soils maps, aerials, and field inspection notes.

a) Potential for Nutrient Inputs to the Wetland

High 3
Moderate 2
Low 1

SCORE = ☐

If high value, identify the stream course or water body that the wetland is associated with. ______________________________

____

If isolated, what is the area of the wetland? ____________acres.

b) Nutrient Retention/Removal Capacity of Wetland Soils

Briefly describe soils of the wetland area. ______________________

____

____

High 3
Moderate 2
Low 1

SCORE = ☐

c) Nutrient Retention by Vegetation Uptake

Briefly describe vegetation structure of the wetland site review area (i.e., mostly forested with evidence of prescribed burning. Shrub cover very low/sparse). ______________________________

____

____

SCORE = [ ] (see p. 85 for relative scale)

d) Determine Relative Water Quality Maintenance Score

$$\text{SCORE} = \frac{\text{Nutrient Input } [\ ] + \text{Nutrient Ret/Rem } [\ ] + \text{Vegetation Uptake } [\ ]}{3}$$

SCORE = [ ]

Does the relative water quality maintenance score provide an accurate assessment of the wetland's assimilation/retention capacity? Do you recommend any changes to the scheme? Comments ______________________________

____

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____

____

4) Wildlife Habitat Value (p. 85)

- Evaluator must refer to USGS quads, vegetation maps, aerials, and field inspection notes.

a) Vegetation Interspersion

Briefly describe the structural diversity of the wetland area (edge, presence of ponds, streams, windthrow areas, evergreens mixed with patches of deciduous vegetation, etc.) ______________________________

____

____

a) Vegetation Interspersion (continued)

High 3
Moderate 2
Low 1

SCORE = ☐

b) Wetland Size

What is size of wetland area? ______________ acres

SCORE = ☐ (see p. 86 for relative scale)

c) Surrounding Habitat

Briefly describe surrounding upland habitat of 300 ft. band around the wetland area. What type of agriculture is present? Is developed land present and what kind of development? If undeveloped, describe the type of habitat (forested, old field, shrub area, etc.).

____

____

____

____

SCORE = ☐

d) Determine Relative Wildlife Habitat Score

$$\text{SCORE} = \frac{\text{Vegetation Interspersion } \square + \text{ Size } \square + \text{ Surrounding Habitat } \square}{3}$$

SCORE = ☐

Does the wildlife habitat score provide an accurate assessment of the wetlands habitat value? Do you recommend any changes to the scheme?

____

____

____

____

5) Socio-cultural Values (p. 87)

Answers to questions:

Recreation
Question 1 . . . . Y N
Question 2 . . . . Y N

Research and Education
Question 1 . . . . Y N
Question 2 . . . . Y N

Visual/Aesthetic
Question 1 . . . . Y N

Uniqueness
Question 1 . . . . Y N
Question 2 . . . . Y N
Question 3 . . . . Y N

SCORE = ☐ (see p. 88 for relative scale)

Does this score adequately reflect the wetland's socio-cultural value? Do you recommend any changes to the scheme? ______________________

____

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____

6) Determining an Overall Relative Wetland Value Index

$$\text{INDEX} = \frac{\text{Veg. Score} \; \square + \text{Water Qual. Score} \; \square + \text{Water Qual. Maint. Score} \; \square + \text{Habitat Score} \; \square + \text{Socio-Cult. Score} \; \square}{5}$$

$$\text{WETLAND VALUE INDEX} = \frac{x}{5} = \square$$

6) Continued

Note: If Existing Water Quality Score is not available, then divide by 4 , and not 5 , to derive the wetland value index.

Note: If threatened or endangered species are known to be present within the wetland area, or immediate surrounding area, then increase the WETLAND VALUE INDEX by one (1) unit (see p. 89). Remember, the maximum allowable value index is three (3). Location of known sitings of threatened and endangered plants are available on maps at the Pinelands Commission office. The evaluator should consult these maps. If applicable, comment on the site's threatened and/or endangered population. ______

Overall Summary Statement: Do you feel that the Wetland Value Index provides an accurate assessment of the wetlands relative values and functions? ______

Potential for Impacts Scheme (p. 90)

1) Potential for Site-specific Impacts (p. 90)

For this part of the analysis fairly detailed site plans are needed. However, detailed plans containing information of square footage of sturctures, lawn area, exact location and area of drives, parking lots, etc, are not always provided. In fact, area of lawns for the proposed development is almost never provided; therefore, this part of the relative scheme should be ommitted from consideration. With respect to impervious/pervious surfaces, it should be assumed that single family dwellings (single lots, or 2 lot subdivisions) will use pervious driveway and parking lot materials. However, for other developments (single family dwelling greater than 2 lot subdivisions, townhouses, commercial, etc.) it should be assumed that impervious materials will be used, unless otherwise specified.

If detailed site plans are not provided, then the evaluator should use the following guidelines in order to evaluate percentage of the site developed.

High Potential for Site-specific Impacts - Commercial/Industrial Development, Cluster Residential Development (Townhouse, Apartments, etc.)

Moderate Potential for Site-specific Impacts - Low intensity commercial/industrial, single family developments ($\leq$ 1.5 acre lots)

Low Potential for Site-specific Impacts - Single family dwellings ($>$ 1.5 acre lots)

Determine Score for Potential for Site-specific Impacts

High Potential . . . . . 3'
Moderate Potential . . . 2
Low Potential 1

SCORE = ☐

- Did you use above guidelines or detailed site plans? ____________

____

Does the score adequately represent the potential for site-specific wetland impacts to be imposed by the proposed development ? To objectively evaluate the impacts, the evaluator may want to refer to the nine significant adverse impacts listed in the PLAN (Article 6, Section 7-107). Comments ________

____

____

____

____

____

____

2) Potential for Cumulative Impacts on a Regional Basis (p. 92)

What land capability area is proposed development located ____________

If township is certified, what is the zoning ____________

2) Cumulative Impacts (continued)

Determine Score for Potential for Cumulative Impacts

High 3
Moderate 2
Low 1

SCORE = ☐

Does this score provide a reasonable and general assessment of the potential for cumulative impacts at this particular site? ____________________

____

____

____

____

____

3) Significance of Watershed-wide Impacts (p. 93)

The evaluator must consult aerials, USGS quads, and field inspection notes for this part of the analysis.

Briefly describe the land use of the watershed (downstream development, agriculture, environmentally sensitive areas, etc.)? ____________________

____

____

____

____

Determine Potential for Watershed-wide Impacts Score

High 3
Moderate 2
Low 1

SCORE = ☐

Does the score provide a general assessment of the potential for downstream and adjacent impacts? Other comments. ____________________

____

____

____

4) Overall Relative Potential for Impacts Index (p. 95)

$$\text{INDEX} = \frac{\text{Site Specific } \square + \text{ Cumulative } \square + \text{ Watershed-wide } \square}{3}$$

$$\text{IMPACTS INDEX} = \frac{x}{3} = \square$$

Overall Summary Statement: Does the POTENTIAL FOR IMPACTS INDEX provide an accurate assessment of overall significant adverse impacts imposed on the wetland by the proposed development? ______________________________

____

____

____

____

____

D. Assigning Buffer Distances (p. 96)

$$\text{BUFFER DELINEATION INDEX} = \frac{\text{WETLAND VALUE INDEX } \square + \text{ POTENTIAL FOR IMPACTS INDEX } \square}{2}$$

$$= \square$$

Assigned Buffer Distance = ______ feet (see Table 17, p. 97)

Will this buffer distance provide for the maintenance of the wetland's ecological integrity and associated values and functions? Do you feel the assigned buffer is too small, or too large? Comments ______________________________

____

____

____

(use additional space if necessary)

Appendix 2. Evaluators scores for each independent test of the Land Capability Areas Buffer Delineation Procedure applications. For the Wetland Evaluation Scheme a wetland quality index (WQI) was derived. If threatened or endangered species (T&E) were within the wetland area then a revised or new WQI was calculated. A potential for impacts index (PII) was derived from the Potential for Impacts Scheme. The WQI and PII were averaged to derive a Buffer Index and then an appropriate buffer distance was determined from the index to distance conversion table.

APPLI ID	WETLAND EVALUATION														POTENTIAL IMPACTS				BUFFER INDEX	DIST (ft)
	VEG COMP	SWQ	WATER QUAL MAINT[a]				WILDLIFE HABITAT[b]				SOCIO-CULT	WQI	T&E	NEW WQI	SITE	CUMUL	WATER WIDE	PII		
			1	2	3	Score	1	2	3	Score										
FA 1	3	3	3	3	3	3.0	3	3	3	3.0	2	2.8	-	2.8	1	1	1	1.0	1.9	250
FA 1	(Evaluator considered application as Cedar Swamp Special Case Guideline)																			300
FA 2	2	3	1	1	2	1.3	3	2	3	2.7	2	2.2	+1	3.0	1	1	3	1.7	2.4	265
FA 2	3	3	3	1	2.5	2.2	3	2	3	2.7	2	2.6	+1	3.0	1	1	3	1.7	2.4	265
FA 3	2	1.5	3	3	2	2.7	3	3	3	3.0	2	2.2	-	2.2	1	2	3	2.0	2.1	250+
FA 3	3	1.5	3	3	2	2.7	3	3	3	3.0	2	2.4	-	2.4	1	2	3	2.0	2.2	260
FA 4	3	3	3	1	2.5	2.2	1	1.5	3	1.8	2	2.4	-	2.4	1	2	3	2.0	2.2	260
FA 4	3	2.5	3	1	2.5	2.2	3	3	3	3.0	1	2.3	-	2.3	1	3	2	2.0	2.1	250+
APA 1	2	2	3	3	2	2.7	3	3	3	3.0	1	2.1	-	2.1	1	2	1	1.3	1.7	220
APA 1	1	2	1	1	1	1.0	2	1.5	3	2.2	1	1.4	-	1.4	1	2	1	1.3	1.4	235
APA 2	3	1.5	3	1	1	1.7	3	3	3	3.0	1	2.0	-	2.0	1.25	2	3	2.1	2.1	250+
APA 2	2	2	3	3	3	3.0	3	2	3	2.7	1	2.1	-	2.1	1	2	3	2.0	2.1	250+
RDA 1	3	2	3	3	2.5	2.8	3	3	3	3.0	2	2.6	-	2.6	1	1	2	1.3	2.0	200
RDA 1	3	2	3	3	2.5	2.8	3	3	3	3.0	2	2.6	-	2.6	1	1	2	1.3	2.0	200
RDA 1	3	2	3	3	2.5	2.8	3	3	3	3.0	1	2.4	-	2.4	1	1	2	1.3	1.9	190
RDA 2	3	3	3	2	3	2.7	3	3	3	3.0	2	2.7	-	2.7	2	2	1.5	1.8	2.3	225
RDA 2	3	3	1	2	3	2.0	2	1.5	3	2.2	1	2.2	-	2.2	1	2	2	1.7	2.0	200
RDA 2	3	3	3	1	3	2.3	1	2	3	2.0	2	2.5	-	2.5	1	2	2	1.7	2.1	210

Appendix 2. Continued.

APPLI ID	WETLAND EVALUATION														POTENTIAL IMPACTS				BUFFER INDEX	DIST (ft)
	VEG COMP	SWQ	WATER QUAL MAINT[a]				WILDLIFE HABITAT[b]				SOCIO-CULT	WQI	T&E	NEW WQI	SITE	CUMUL	WATER WIDE	PII		
			1	2	3	Score	1	2	3	Score										
RDA 3	3	3	3	1	3	2.3	3	3	3	3.0	2	2.7	-	2.7	2	3	3	2.7	2.7	270
RDA 3	3	3	3	1	3	2.3	3	3	3	3.0	2	2.7	-	2.7	1	3	3	2.3	2.5	250
RDA 4	3	2.5	3	1	2.5	2.2	3	3	2	2.7	2	2.5	-	2.5	1	2	3	2.0	2.3	230
RDA 4	3	2.5	3	1	2.5	2.2	3	3	2	2.7	1	2.3	-	2.3	1	2	3	2.0	2.2	220
RGA 1a[c]	3	2	3	3	3	3.0	3	2	3	2.7	1	2.3	+1	3.0	3	3	3	3.0	3.0	300
RGA 1a	2	2	3	3	2.5	2.8	2	2	3	2.3	2	2.2	+1	3.0	3	3	2	2.7	2.9	285
RGA 1b	3	2	3	1	3	2.3	3	2	3	2.7	1	2.2	+1	3.0	3	3	3	3.0	3.0	300
RGA 1b	3	2	3	1	3	2.3	3	2	3	2.7	2	2.4	+1	3.0	3	3	2	2.7	2.9	285
RGA 1c	1	2	3	1	2	2.0	2	2	3	2.3	2	1.9	+1	2.9	3	3	3	3.0	3.0	300
RGA 1c	3	2	3	1	2	2.0	3	2	3	2.7	2	2.3	+1	3.0	3	3	2	2.7	2.9	285
RGA 2	3	3	3	3	2.5	2.8	3	3	2	2.7	3	2.9	+1	3.0	3	3	1	2.3	2.7	270
RGA 2	3	3	3	3	2	2.7	3	3	2	2.7	2	2.8	+1	3.0	3	3	1.5	2.5	2.8	270
RGA 3a	3	2	3	3	3	3.0	3	3	3	3.0	2	2.6	+1	3.0	3	3	1.5	2.5	2.8	270
RGA 3a	3	2	3	3	3	3.0	3	3	3	3.0	2	2.6	+1	3.0	3	3	1	2.3	2.7	240+
RGA 3a	3	3	3	3	3	3.0	3	3	3	3.0	2	2.9	+1	3.0	3	3	1	2.3	2.7	240+
RGA 3b	3	2	3	3	3	3.0	3	3	3	3.0	2	2.6	+1	3.0	3	3	1.5	2.5	2.8	270
RGA 3b	3	2	3	3	3	3.0	3	3	3	3.0	2	2.6	+1	3.0	3	3	1	2.3	2.7	240+
RGA 3b	3	3	3	3	3	3.0	3	3	3	3.0	2	2.9	+1	3.0	3	3	1	2.3	2.7	240+
RGA 4	1	1.5	3	2	2.5	2.5	3	3	3	3.0	2	2.0	-	2.0	3	1	1	1.7	1.9	150
RGA 4	1	1.5	3	3	3	3.0	3	3	1	2.3	2	2.0	-	2.0	2	1	1	1.3	1.7	110+
RGA 4	1	1.5	3	3	3	3.0	3	3	1	2.3	2	2.0	-	2.0	2	1	2	1.7	1.9	150

Appendix 2. Continued.

APPLI ID	WETLAND EVALUATION														POTENTIAL IMPACTS				BUFFER INDEX	DIST (ft)
	VEG COMP	SWQ	WATER QUAL MAINT[a]				WILDLIFE HABITAT[b]				SOCIO-CULT	WQI	T&E	NEW WQI	SITE	CUMUL	WATER WIDE	PII		
			1	2	3	Score	1	2	3	Score										
RGA 5	3	3	3	2	2.5	2.5	3	2	3	2.7	3	2.8	-	2.8	2	1	1	1.3	2.1	175+
RGA 5	3	3	3	2	2.5	2.5	3	1	2	2.0	3	2.7	-	2.7	2	1	1.5	1.5	2.1	175+
RGA 5	3	3	3	2	2.5	2.5	3	1	2	2.0	2	2.5	-	2.5	2	1	1.3	1.4	2.0	175
RGA 6	3	3	3	3	3	3.0	3	1.5	3	2.5	1	2.5	-	2.5	2	3	1	2.0	2.3	200+
RGA 6	3	3	3	3	1.5	2.5	2.5	1.5	3	2.3	2	2.6	-	2.6	2	3	1	2.0	2.3	210
CD 1	3	3	3	3	2	2.7	1	3	2	2.0	2	2.5	-	2.5	3	3	1.5	2.5	2.5	240
CD 1	2	3	3	3	2	2.7	2	3	3	2.7	2	2.5	-	2.5	3	3	1.5	2.5	2.5	240
CD 1	3	3	3	3	2	2.7	1	3	2	2.0	2	2.5	-	2.5	3	3	1.5	2.5	2.5	240
CD 2	3	2	3	1	2.5	2.2	3	3	1	2.3	3	2.5	-	2.5	3	3	1.5	2.5	2.5	240
CD 2	3	2	3	1	2.5	2.2	3	3	3	3.0	3	2.6	+1	3.0	3	3	2	2.7	2.9	270+
CD 2	3	2	3	1	3	2.3	2	3	2	2.3	2	2.3	+1	3.0	3	3	2	2.7	2.9	270+

[a] Factors to determine a water quality maintenance score are 1) potential for inputs, 2) soils, and 3) vegetation uptake.

[b] Factors to determine a wildlife habitat value score are 1) vegetation interspersion, 2) wetland size, and 3) surrounding habitat.

[c] For applications RGA 1 and RGA 3 the evaluators independently determined that there were distinctly different wetland site review areas adjacent to the proposed development, and thus, application ID's are identified to show the evaluation of different review areas (i.e., RGA 1a, RGA 1b and so on).