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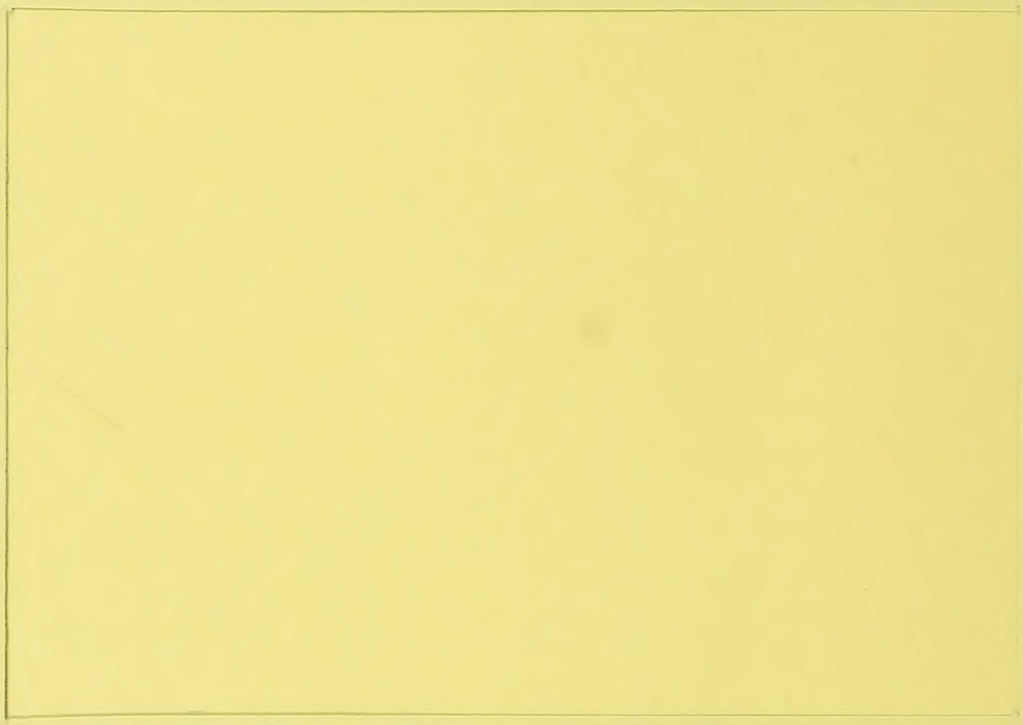

Working Paper

Number 48

THE SURFACE WATER QUALITY IMPACTS OF RESOURCE MANAGEMENT PLANS: A STRUCTURE FOR ANALYSIS

by

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PREFACE

The structure presented in this paper is a step towards the integration of society's environmental quality goals and preferences into the Principles and Standards resource evaluation and planning framework. The structure will be applied within a project that is concerned with the way people view environmental quality goals and perceive environmental quality problems. The structure for assessing water quality impacts will be used in the development of indices that reflect how well a resource development plan achieves environmental quality goals. A detailed discussion of the methodology used to develop quantitative measures and generate environmental indices can be found in Arthur, et al., 1976.

INTRODUCTION

The purpose of this paper is to present a structure for appraising the water quality impacts of a resource management plan. The Principles and Standards (WRC 1974) requires that alternative management plans be evaluated in terms of achievement of goals which have been defined as specific outputs or desired effects. With Principles and Standards requirements in mind it is logical to define water quality goals in terms of technical water quality parameters, the same parameters with which public health and many other water use standards are defined. Consequently, this examination format will identify a set of technical surface water quality parameters, present the various elements of a water resource management plan, identify the potential impacts of plan elements on the surface water quality parameters, and discuss potential constraints to plan implementation.

Plan Elements

Plan Elements are the possible conservation practices listed in Table 1.[1] Both the technical specifications for a conservation practice and the applicability of a practice can change between regions, but the basic way that a practice is defined and reason for its use does not change. The general descriptions, then, are used to establish a set of impacts that are relevant on a national scale.

Conservation practices (elements) are normally planned, analyzed, and applied in sets. While some structural practices may appear to be single purposed, they are normally accompanied by a 'land treatment' package that attempts to treat adjacent land according to its needs, with erosion control and productivity in mind. With respect to environmental impacts and water quality impacts specifically, it is the sets or 'packages' of practices (elements) that are traditionally assessed. There is obvious merit to this 'package' approach for land quality impact assessments where such concepts as soil loss tolerance levels are both goals and measures of land quality. Other impact areas including cultural resources and basic land use conversions, can also be handled very well using the 'package' approach.

Realistically, water quality cannot be dealt with so simply. An individual conservation practice can impact many parameters of water quality which may be major determinants of the physical, chemical, and biological character of the water. These water quality changes in turn affect the human and natural environments. Before these latter impacts can be measured, however, the impacts on water quality parameters must

TABLE 1

SOIL CONSERVATION SERVICE
CONSERVATION PRACTICES
(PLAN ELEMENTS)

ELEMENT

1. Access Road (Ft.)
2. Bedding (Ac.)
3. Mechanical Brush Management (Ac.)
4. Chemical Brush Management (Ac.)
5. Biological Brush Management (Ac.)
6. Chiseling and Subsoiling (Ac.)
7. Clearing and Snagging (Ft.)
8. Conservation Cropping System (Ac.)
9. Contour Farming (Ac.)
10. Cover and Green Manure Crop (Ac.)
11. Critical Area Planting (Ac.)
12. Crop Residue Use (Ac.)
13. Dam, Diversion (No.)
14. Dam, Multiple-Purpose (No. & Ac. Ft.)
15. Debris Basin (No.)
16. Deferred Grazing (Ac.)
17. Dike (Ft.)
18. Diversion (Ft.)
19. Drain System Structure (No.)
20. Drainage Land Grading (Ac.)
21. Emergency Tillage (Ac.)
22. Farmstead and Feedlot Windbreak (Ac.)
23. Fencing (Ft.)
24. Field Border (Ft.)
25. Field Windbreak (Ft.)
26. Firebreak (Ft.)
27. Fishpond Management (No.)
28. Floodwater Diversion (Ft.)
29. Floodway (Ft.)
30. Grade Stabilization Structure (No.)
31. Grassed Waterway or Outlet (Ac.)
32. Grazing Land Mechanical Treatment (Ac.)
33. Heavy Use Area Protection (Ac.)
34. Hedgerow Planting (Ft.)
35. Hillside Ditch (Ft.)
36. Irrigation Canal or Lateral (Ft.)
37. Irrigation Field Ditch (Ft.)

Table 1 cont'd.

ELEMENT

38. Irrigation Land Leveling (Ac.)
39. Irrigation Pit or Regulating Reservoir (No.)
40. Irrigation Storage Reservoir (No. & Ac. Ft.)
41. Irrigation System:*
    (a) Drip (No. & Ac.)
    (b) Sprinkler (Ft.)
    (c) Surface and Subsurface (No. & Ac.)
42. Irrigation System, Tailwater Recovery (No.)
43. Irrigation Water Management (Ac.)
44. Irrigation Water Conveyance (Ft.)
45. Land Clearing (Ac.)
46. Land Smoothing (Ac.)
47. Lined Waterway or Outlet (Ft.)
48. Livestock Exclusion (Ac.)
49. Minimum Tillage (Ac.)
50. Mole Drain (Ft.)
51. Mulching (Ac.)
52. Obstruction Removal (Ac.)
53. Open Channel (Ft.)
54. Pasture and Hayland Managmenet (Ac.)
55. Pasture and Hayland Planting (Ac.)
56. Pipeline (Ft.)
57. Planned Grazing Systems (Ac.)
58. Pond (No.)
59. Pond Sealing or Lining (No.)
60. Prescribed Burning (Ac.)
61. Proper Grazing Use (Ac.)
62. Proper Woodland Grazing (Ac.)
63. Pumped Well Drain (No.)
64. Pumping Plant for Water Control (No.)
65. Range Seeding (Ac.)
66. Reclamation of Surface Mined Land
67. Recreation Area Improvement (Ac.)
68. Recreation Land Grading and Shaping (Ac.)
69. Recreation Trail and Walkway (Ft.)
70. Regulating Water in Drainage Systems (Ac.)
71. Rock Barrier (Ft.)
72. Row Arrangement (Ac.)

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*Where surface water quality impact is the primary concern, Irrigation System (41) is considered a single component. Where constraints are the concern, the specific type of irrigation system is significant.

Table 1 cont'd.

ELEMENT

73. Spoilbank Spreading (Ft.)
74. Spring Development (No.)
75. Stock Trails and Walkways (Ft.)
76. Stream Channel Stabilization (Ft.)
77. Streambank Protection (Ft.)
78. Strip Cropping (Ac.)
79. Structure for Water Control (No.)
80. Stubble Mulching (Ac.)
81. Subsurface Drain (Ft.)
82. Surface Drainage (Ft.)
83. Terrace (Ft.)
84. Toxic Salt Reduction (Ac.)
85. Tree Planting (Ac.)
86. Trough or Tank (No.)
87. Vertical Drain (No.)
88. Waste Management System (No.)
89. Waste Storage Pond (No.)
90. Waste Storage Structure (No.)
91. Waste Treatment Lagoon (No.)
92. Waste Utilization (No. & Ac.)
93. Waterspreading (Ac.)
94. Well (No.)
95. Wildlife Upland Habitat Management (Ac.)
96. Wildlife Watering Facility (No.)
97. Wildlife Wetland Habitat Management (Ac.)
98. Windbreak Renovation
99. Woodland Direct Seeding (Ac.)
100. Woodland Improved Harvesting (Ac.)
101. Woodland Improvement (Ac.)
102. Woodland Pruning (Ac.)
103. Woodland Site Preparation (Ac.)

be specified and related to more general environmental quality goals.

Technical Surface Water Quality Parameters

Developing a single set of technical water quality parameters that can be used to evaluate all conservation alternatives is difficult, but the list presented in Table 2 is sufficient for available Federal guidelines and criteria and meets the needs of a general impact assessment. Most of the parameters have standard definitions and measurements. A few, however, require further description. The Biological Test Parameter (17) provides an index of the ecological well being of a stream, by looking at types and diversity of species. Positive and negative impacts on this parameter imply improvement and deterioration, respectively, of the aquatic ecosystem. The Discharge Parameter (18) relates to potential increases or decreases in the hydrograph peak for a design storm-runoff occurrence. In addition to changes in the hydrograph peak, a few conservation practices such as diversions and control structures may change the actual volume of surface discharge and are recorded as discharge impacts. The Flow Condition Parameter (20) describes the character of a stream in the range from an ephemeral ditch to a perennial stream. A positive impact on this parameter would mean that the stream would tend from its present condition towards a more continuous, stable flow. A negative impact implies that a stream will have a less continuous flow condition in the future than it currently has. In the analysis of the Ortho Phosphate parameter (32), it is generally felt that the soluables (phosphorous) are being included. This is probably true in "sewage" analyses, but where fertilizers and other non-point pollution sources are of concern, "poly-Phosphates" are involved, many of which are soluable and not analyzed under the "Ortho" parameter.

The Nitrogen to Phosphorous ratio (34) is considered for the range of ratio values (5-30) within which "healthy" aquatic growth can be expected. Knowledge of antecedent conditions with respect to this ratio, provides for the assessment of nutrient related impacts of water and related land resource development activities from a "limiting factor" approach.

Plan Element-Technical Parameter Impacts

The potential short term primary downstream impacts of the various conservation practices in Table 1 on technical parameters are given in Table 3. If secondary impacts are considered to be important, "parameter" 35 is marked. If secondary impacts differ significantly from primary, long term differences or significantly different construction or installation related impacts are likely, "parameter" 36 is checked. Blank cells indicate no impact has been identified or specified. Only the positive or negative direction of each impact is noted, as the precies magnitudes

TABLE 2

TECHNICAL PARAMETERS

	Parameter	Description
1.	pH	Acidity-Alkalinity
2.	DO	Dissolved Oxygen
3.	BOD	Biochemical Oxygen Demand
4.	COD	Chemical Oxygen Demand
5.	TDS	Total Dissolved Solids
6.	Hardness	Total as Ca and Mg
7.	Alkalinity	As $CaCO_3$
8.	Pesticides	Specific Types
9.	Fecal Coli.	E. Coli. as indicators
10.	Fecal Strep.	Fecal Strep. as indicators
11.	Mn	Manganese
12.	Fe	Iron
13.	As	Arsenic
14.	Phenols	
15.	TS	Total Solids
16.	Chlorides	
17.	Bio Test	Ecological Condition
18.	Discharge	Hydrograph Peak or Maximum Stage
19.	Temperature	Water Temperature
20.	Flow Condition	Classification (Ephemeral-Perennial)
21.	SS	Suspended Sediment
22.	Color	Cobalt Scale
23.	Odor	Observed
24.	Conductance	Specific Conductance, mhos/cm
25.	Turbidity	Light Penetration
26.	NO_3	Nitrogen as Nitrate
27.	NO_2	Nitrogen as Nitrite
28.	NH	Nitrogen as Ammonia
29.	TKN	Total Kjeldahl Nitrogen
30.	TP	Total Phosphorus
31.	SP	Soluable Phosphorus
32.	OP	Ortho Phosphate
33.	SO_4	Sulphate
34.	N/P	Nitrogen to Phosphorous Ratio
35.	Non-Primary	Impacts are or include those other than primary
36.	Short-Run Only	Long term, secondary, or construction related impacts may be significantly different.
37.	DS	Dissolved Solids (Measure of Salinity)

TABLE 3. PLAN ELEMENT-TECHNICAL PARAMETER IMPACTS

PLAN ELEMENT (CONSERVATION PRACTICES)	pH	DO	BOD	COD	TDS	Hardness	Alkalinity	Pesticides	Fecal Coli.	Fecal Strep.	Mn	Fe	As	Phenols	TS	Chlorides	Bio Test	Discharge	Temperature	Flow Condition	SS	Color	Odor	Conductance	Turbidity	NO_3	NO_2	NH_3	TKN	TP	SP	OP	SO_4	N/P	Non-Primary	Short-Run Only	DS
1. Access Road (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
2. Bedding (Ac.)	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	+	.	.	.	.
3. Mechanical Brush Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
4. Chemical Brush Management (Ac.)	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5. Biological Brush Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6. Chiseling and Subsoiling (Ac.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	+	.	.	.	.
7. Clearing and Snagging (Ft.)	.	-	.	.	.	.	.	.	.	.	.	.	.	.	+	.	-	.	+	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	+	+	.
8. Conservation Cropping System (Ac.)	.	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	-	.	.	.	.
9. Contour Farming (Ac.)	.	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	-	.	.	.	.
10. Cover and Green Manure Crop (Ac.)	.	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	+	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	-	.	.	.	.
11. Critical Area Planting (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	+	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.
12. Crop Residue Use (Ac.)	.	.	.	.	.	.	+	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	-	.	.	.	.
13. Dam, Diversion (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14. Dam, Multiple- Purpose (No. & Ac. Ft.)	.	.	.	.	.	.	.	-	-	.	.	.	.	.	-	.	-	.	+	-	-	-	.	.	-	.	.	.	.	.	.	.	.	.	+	.	.
15. Debris Basin (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.
16. Deferred Grazing (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17. Dike (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18. Diversion (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19. Drain System Structure (No.)	.	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	-	.	.	-	-	.	.	-	-	-	-	.	.	-	-	.	.	.	.	.
20. Drainage Land Grading (Ac.)	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	+	.	.	.	.
21. Emergency Tillage (Ac.)	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	+	.	.	.	.
22. Farmstead and Feedlot Windbreak (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23. Fencing (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24. Field Border (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.
25. Field Windbreak (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26. Firebreak (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
27. Fishpond Management (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28. Floodwater Diversion (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29. Floodway (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30. Grade Stabilization Structure (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.
31. Grassed Waterway or Outlet (Ac.)	.	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	-	.	.	.	.
32. Grazing Land Mechanical Treatment (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.
33. Heavy Use Area Protection (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.
34. Hedgerow Planting (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35. Hillside Ditch (Ft.)	.	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	-	.	.	.	.

Table 3 cont'd.

	pH	DO	BOD	COD	TDS	Hardness	Alkalinity	Pesticides	Fecal Coli.	Fecal Strep.	Mn	Fe	As	Phenols	TS	Chlorides	Bio Test	Discharge	Temperature	Flow Condition	SS	Color	Odor	Conductance	Turbidity	NO_3	NO_2	NH_3	TKN	TP	SP	OP	SO_4	N/P	Non-Primary	Short-Run Only	DS
36. Irrigation Canal or Lateral (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37. Irrigation Field Ditch (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38. Irrigation Land Leveling (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39. Irrigation Pit or Regulating Reservoir (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40. Irrigation Storage Reservoir (No. & Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41. Irrigation System (No. & Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42. Irrigation System, Tailwater Recover (No.)	.	.	.	.	-	.	.	-	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	.	.	.	.
43. Irrigation Water Management (Ac.)	.	.	.	.	-	.	.	-	.	.	.	.	.	.	-	.	.	.	.	.	-	-	.	.	-	-	-	-	.	.	-	-	.	.	.	-
44. Irrigation Water Conveyance (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45. Irrigation Water Conveyance (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
46. Land Smoothing (Ac.)	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	.	.	.	.
47. Lined Waterway or Outlet (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48. Livestock Exclusion (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49. Minimum Tillage (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	.	.	+	.
50. Mole Drain (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51. Mulching (Ac.)	.	.	.	.	.	.	-	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	.	.	.	.
52. Obstruction Removal (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
53. Open Channel (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
54. Pasture and Hayland Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55. Pasture and Hayland Planting (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56. Pipeline (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57. Planned Grazing Systems (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58. Pond (No.)	.	.	.	.	.	.	.	-	-	.	.	.	.	-	.	.	-	.	+	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	+	.
59. Pond Sealing or Lining (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60. Prescribed Burning (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
61. Proper Grazing Use (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62. Proper Woodland Grazing (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
63. Pumped Well Drain (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64. Pumping Plant for Water Control (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65. Range Seeding (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.
66. Reclamation of Surface Mined Land	+	.	.	.	.	.	.	.	.	.	.	.	.	-	.	+	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.
67. Recreation Area Improvement (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	.	-	.	.	.	.	.	.	.	.	.	.	.
68. Recreation Land Grading and Shaping (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
69. Recreation Trail and Walkway (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
70. Regulating Water Drainage Systems (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 3 cont'd.

	pH	DO	BOD	COD	TDS	Hardness	Alkalinity	Pesticides	Fecal Coli.	Fecal Strep.	Mn	Fe	As	Phenols	TS	Chlorides	Bio Test	Discharge	Temperature	Flow Condition	SS	Color	Odor	Conductance	Turbidity	NO_3	NO_2	NH_3	TKN	TP	SP	OP	SO_4	N/P	Non-Primary	Short-Run Only	DS
71. Rock Barrier (Ft.)	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	-	.	.	.	.	.	.	.	.	.	.	.
72. Row Arrangement (Ac.)	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	-	-	-	-	-	-	-	.	.	.	.	.
73. Spoilbank Spreading (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
74. Spring Development (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
75. Stock Trails and Walkways (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
76. Stream Channel Stabilization (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	.	.	.	.	.	.	.	.	.	.	.	.
77. Streambank Protection (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	.	.	.	.	.	.	.	.	.	.	.	.
78. Strip Cropping (Ac.)	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	-	-	-	-	-	-	-	.	.	.	.	.
79. Structure for Water Control (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
80. Stubble Mulching (Ac.)	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	-	-	-	-	-	-	-	.	.	.	.	.
81. Subsurface Drain (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
82. Surface Drainage (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	.	+	.	.
83. Terrace (Ft.)	.	.	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	.	-	-	-	-	-	-	-	-	.	.	.	.
84. Toxic Salt Reduction (Ac.)	+	.	.	+	-	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
85. Tree Planting (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	.	.	.	.	.	.	.	.	.	.	.	.
86. Trough or Tank (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
87. Vertical Drain (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
88. Waste Management System (No.)	+	.	-	-	.	.	.	-	-	-	-	-	.	.	.	.	.	.	.	.	-	.	-	+	.	-	-	-	-	-	.	.	.	.	.	.
89. Waste Storage Pond (No.)	+	.	-	-	.	.	.	-	-	-	-	-	.	.	.	.	.	.	.	.	-	.	-	+	.	-	-	-	-	-	.	.	.	.	.	.
90. Waste Storage Structure (No.)	+	.	-	-	.	.	.	-	-	-	-	-	.	.	.	.	.	.	.	.	-	.	-	+	.	-	-	-	-	-	.	.	.	.	.	.
91. Waste Treatment Lagoon (No.)	+	.	-	-	.	.	.	-	-	-	-	-	.	.	.	.	.	.	.	.	-	.	-	+	.	-	-	-	-	-	.	.	.	.	.	.
92. Waste Utilization (No. & Ac.)	-	.	+	+	.	.	.	+	+	+	+	+	.	.	.	.	.	.	.	.	-	.	+	-	.	+	+	+	+	+	.	.	.	+	.	.
93. Waterspreading (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
94. Well (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
95. Wildlife Upland Habitat Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
96. Wildlife Watering Facility (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
97. Wildlife Wetland Habitat Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
98. Windbreak Renovation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
99. Woodland Direction Seeding (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	-	-	.	-	.	.	.	.	.	.	.	.	.	.	.	.
100. Woodland Improved Harvesting (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
101. Woodland Improvement (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102. Woodland Pruning (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103. Woodland Site Preparation (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

will vary for each specific alternative plan due for example to differences in materials and techniques of installation and size of the application.

While it is not necessary to discuss each impact in Table 3, some of the assumptions used in generating the impacts should be mentioned. Any conservation practice (vegetative or structural) designed to control erosion and runoff on agricultural land is assumed to have a primary impact of reducing pesticides and nutrients, both soluble and insoluble, delivered to streams, in addition to sediment reduction. Practices that potentially increase soil erosion are assumed to have the reverse impact. These pesticide and nutrient oriented impacts are considered to be "associated" primary impacts, while the impacts of changes in production operations or intensity of production as a result of installation of a given conservation practice are considered to be secondary impacts and are not included. The pesticide and nutrient "associated" impacts are not assumed for practices installed on non-agricultural land.

Where a structural measure such as a dam, diversion, or canal, is being installed construction induced water quality impacts are not included in the summary effects but under modifying parameter 36. The only impacts that are included in the main body of the matrix are those that the completed structure will have on specific parameters. In addition, where a structural measure is the "improvement", clearing, or modification of a stream, the summary impacts related are only the impacts that remain when installation is complete. If long term or construction related impacts are seen to be significantly different from the specified impacts, this is related through the modifying parameter 36.

Constraints and Relationships

Regardless of how well an alternative plan element or practice helps to achieve a goal, its application can be limited by constraints ranging from unofficial "in-house rules" to published policy (see bottom of Table 4 for a listing). These constraints can prevent the application of a practice and/or require extensive resource expenditures to precede the application as insurance against significant adverse impacts. It would be foolish to select an alternative on its technical or social appeal without looking at possible constraints to implementation. While the idea of constraints does not plug directly into the Principles and Standards framework, it becomes extremely important where the test of acceptability is applied to an alternative and where plan implementation is a concern.

Table 4 illustrates potential relationships between conservation practices and constraints. Blank cells indicate that no relationship has been identified or specified.

TABLE 4. RELATIONSHIP BETWEEN CONSERVATION PRACTICES AND IMPACT CONSTRAINTS

CONSERVATION PRACTICE	Constraints (see description below)																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Access Road (Ft.)	x	x	.	x	x	.	.	x	.	.	.	.	.	.	x	.	.	x
2. Bedding (Ac.)	x	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	x
3. Mechanical Brush Management (Ac.)	.	x	.	x	.	.	x	.	.	.	.	.	.	.	x	.	.	.
4. Chemical Brush Management (Ac.)	.	x	x	x	.	.	x	.	.	.	.	x	.	.	.	.	x	x
5. Biological Brush Management (Ac.)	.	x	x	x	.	.	.	.	.	.	.	.	.	.	.	.	x	x
6. Chiseling and Subsoiling (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x
7. Clearing and Snagging (Ft.)	.	.	.	x	.	x	.	.	.	.	.	.	x	.	.	.	.	.
8. Conservation Cropping System (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9. Contour Farming (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10. Cover and Green Manure Crop (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11. Critical Area Planting (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
12. Crop Residue Use (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13. Dam, Diversion (No.)	.	x	x	x	x	x	x	.	.	.	.	.	x	.	x	.	.	.
14. Dam, Multiple-Purpose (No. & Ac. Ft.)	.	x	x	x	x	x	x	.	.	.	.	.	x	x	x	.	.	.
15. Debris Basin (No.)	.	x	x	x	x	x	x	.	.	.	.	.	x	x	x	.	.	.
16. Deferred Grazing (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17. Dike (Ft.)	.	x	x	x	x	.	x	.	.	.	.	.	.	.	x	.	.	.
18. Diversion (Ft.)	.	x	x	x	x	.	x	.	.	.	.	.	.	.	x	.	.	.
19. Drain System Structure (No.)	.	x	x	x	x	.	.	.	.	.	.	.	.	.	.	.	.	.
20. Drainage Land Grading (Ac.)	x	.	.	.	.	.	x	.	.	.	.	.	.	.	x	.	.	x
21. Emergency Tillage (Ac.)	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x
22. Farmstead and Feedlot Windbreak (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
23. Fencing (Ft.)	.	.	x	x	.	.	.	.	.	.	.	.	.	.	x	.	.	.
24. Field Border (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25. Field Windbreak (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
26. Firebreak (Ft.)	.	.	.	x	.	.	.	.	.	.	.	.	.	.	x	.	.	.
27. Fishpond Management (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28. Floodwater Diversion (Ft.)	.	x	x	x	x	x	x	.	x	.	.	.	.	.	x	.	.	.
29. Floodway (Ft.)	.	x	x	x	x	x	x	.	x	.	.	.	.	.	x	.	.	.
30. Grade Stabilization Structure (No.)	.	x	x	x	.	.	.	.	.	.	.	.	.	.	x	.	.	.
31. Grassed Waterway or Outlet (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32. Grazing Land Mechanical Treatment (Ac.)	.	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33. Heavy Use Area Protection (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
34. Hedgerow Planting (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
35. Hillside Ditch (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
36. Irrigation Canal or Lateral (Ft.)	.	x	x	x	x	.	.	.	.	.	.	.	.	x	x	.	.	.
37. Irrigation Field Ditch (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.
38. Irrigation Land Leveling (Ac.)	.	.	.	.	.	.	.	.	.	x	.	.	.	.	x	.	.	.
39. Irrigation Pit or Regulating Reservoir (No.)	.	x	x	x	x	.	.	.	.	.	.	.	.	x	x	.	.	.
40. Irrigation Storage Reservoir (No. & Ac. Ft.)	.	x	x	x	x	.	.	.	.	.	.	.	.	x	x	.	.	.
41. Drip Irrigation System (No. & Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42. Sprinkler Irrigation System (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	x	.	.	.

Table 4 cont'd.

43.	Surface & Subsurface Irrigation System (No. & Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	x	.	.	.
44.	Irrigation System, Tailwater Recovery (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.
45.	Irrigation Water Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46.	Irrigation Water Conveyance (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47.	Land Clearing (Ac.)	x	x	x	x	.	.	x	.	.	.	.	.	.	.	x	.	.	x
48.	Land Smoothing (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49.	Lined Waterway or Outlet (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.
50.	Livestock Exclusion (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51.	Minimum Tillage (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52.	Mole Drain (Ft.)	.	.	.	.	x	.	.	.	x	.	.	.	.	.	.	.	.	.
53.	Mulching (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.
54.	Obstruction Removal (Ac.)	x	x	x	x	.	.	.	.	.	.	.	.	.	.	x	.	.	x
55.	Open Channel (Ft.)	x	x	x	x	x	x	x	.	.	.	.	.	x	.	.	.	.	x
56.	Pasture and Hayland Management (Ac.)	.	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.	x	x
57.	Pasture and Hayland Planting (Ac.)	.	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.	x	x
58.	Pipeline (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59.	Planned Grazing Systems (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60.	Pond (No.)	.	x	x	x	x	x	x	.	.	.	.	.	x	x	x	.	.	.
61.	Pond Sealing or Lining (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62.	Prescribed Burning (Ac.)	x	x	x	x	.	.	.	.	.	.	.	.	.	.	x	x	.	.
63.	Proper Grazing Use (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64.	Proper Woodland Grazing (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65.	Pumped Well Drain (No.)	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.
66.	Pumping Plant for Water Control (No.)	.	x	x	x	x	.	.	.	.	.	.	.	.	.	x	.	.	.
67.	Range Seeding (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
68.	Reclamation of Surface Mined Land	.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.
69.	Recreation Area Improvement (Ac.)	.	x	x	x	.	x	x	.	.	.	.	.	.	.	x	.	.	.
70.	Recreation Land Grading and Shaping (Ac.)	x	x	x	x	x	x	x	.	.	.	.	.	.	x	x	.	.	x
71.	Recreation Trail and Walkway (Ft.)	.	x	x	x	x	x	x	.	.	.	.	.	.	.	x	.	.	.
72.	Regulating Water in Drainage Systems (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.
73.	Rock Barrier (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	x	.	.	.
74.	Row Arrangement (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
75.	Spoilbank Spreading (Ft.)	x	x	.	x	.	.	.	.	.	.	.	.	.	x	x	.	.	x
76.	Spring Development (No.)	.	.	x	x	.	.	x	.	.	.	.	.	.	x	.	.	.	.
77.	Stock Trails and Walkways (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
78.	Stream Channel Stabilization (Ft.)	.	x	x	x	x	x	x	.	.	.	.	.	.	.	x	.	.	.
79.	Streambank Protection (Ft.)	.	x	x	x	x	x	x	.	.	.	.	.	.	.	x	.	.	.

Table 4 cont'd.

80.	Strip Cropping (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81.	Structure for Water Control (No.)	.	x	x	x	x	x	x	.	.	.	.	.	.	x	x	.	.	.	.
82.	Stubble Mulching (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
83.	Subsurface Drain (Ft.)	.	.	.	.	x	.	x	.	x	.	.	.	.	.	.	.	.	.	.
84.	Surface Drainage (Ft.)	x	.	.	.	x	.	x	.	.	.	.	.	.	x	.	.	x	x	.
85.	Terrace (Ft.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	x	.	.	.	.
86.	Toxic Salt Reduction (Ac.)	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.
87.	Tree Planting (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.
88.	Trough or Tank (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
89.	Vertical Drain (No.)	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.
90.	Waste Management System (No.)	.	.	.	.	.	.	.	.	.	.	x	.	.	x	x	.	.	.	.
91.	Waste Storage Pond (No.)	.	.	.	.	.	.	.	.	x	.	x	.	.	x	x	.	.	.	.
92.	Waste Storage Structure (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	x	.	.	.	.
93.	Waste Treatment Lagoon (No.)	.	.	.	.	.	.	.	.	x	.	x	.	.	x	x	.	.	.	.
94.	Waste Utilization (No. & Ac.)	.	.	.	.	.	.	.	.	.	.	x	.	.	x	.	.	.	.	.
95.	Waterspreading (Ac.)	.	.	.	x	.	.	x	.	.	.	.	.	x	x	x	.	.	.	.
96.	Well (No.)	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.
97.	Wildlife Upland Habitat Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
98.	Wildlife Watering Facility (No.)	.	.	.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.	.
99.	Wildlife Wetland Habitat Management (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100.	Windbreak Renovation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
101.	Woodland Direct Seeding (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102.	Woodland Improved Harvesting (Ac.)	.	x	x	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103.	Woodland Improvement (Ac.)	.	x	x	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104.	Woodland Pruning (Ac.)	.	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
105.	Woodland Site Preparation (Ac.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Constraints

1. Reduction of erosion at or below "soil loss tolerance levels."
2. Avoiding the disruption of threatened or endangered Floral species.
3. Avoiding the disruption of threatened or endangered Faunal species.
4. Avoiding the disruption of Critical Habitat.
5. Protection or recovery of significant cultural and unique scenic and scientific resources.
6. Protection of locations specified as wilderness or named under the Wild and Scenic Rivers System. Many states have scenic rivers and streams protected.
7. Protection of wetland wildlife habitat types. (USDI Circular 39)
8. Protection of prime agricultural, range and forest land.
9. Protection of groundwater reservoirs.
10. General State or Regional water quality criteria.
11. U.S. Public Health Service Stds. for pathogenic organisms in water.
12. U.S. Public Health Service Stds. for pesticide residues in fish tissue.
13. Maintenance of the waste assimilative capacity of perrenial and intermittent streams.
14. The control of vector born disease.
15. The maintenance of landscape appearance.
16. Ambient air quality standards and Federal law concerning nondegradation of air quality.
17. N/P ratio for aquatic growth (5-30).
18. Reducing nonpoint pollution. (FWPCA and Interim goals for 1983.)

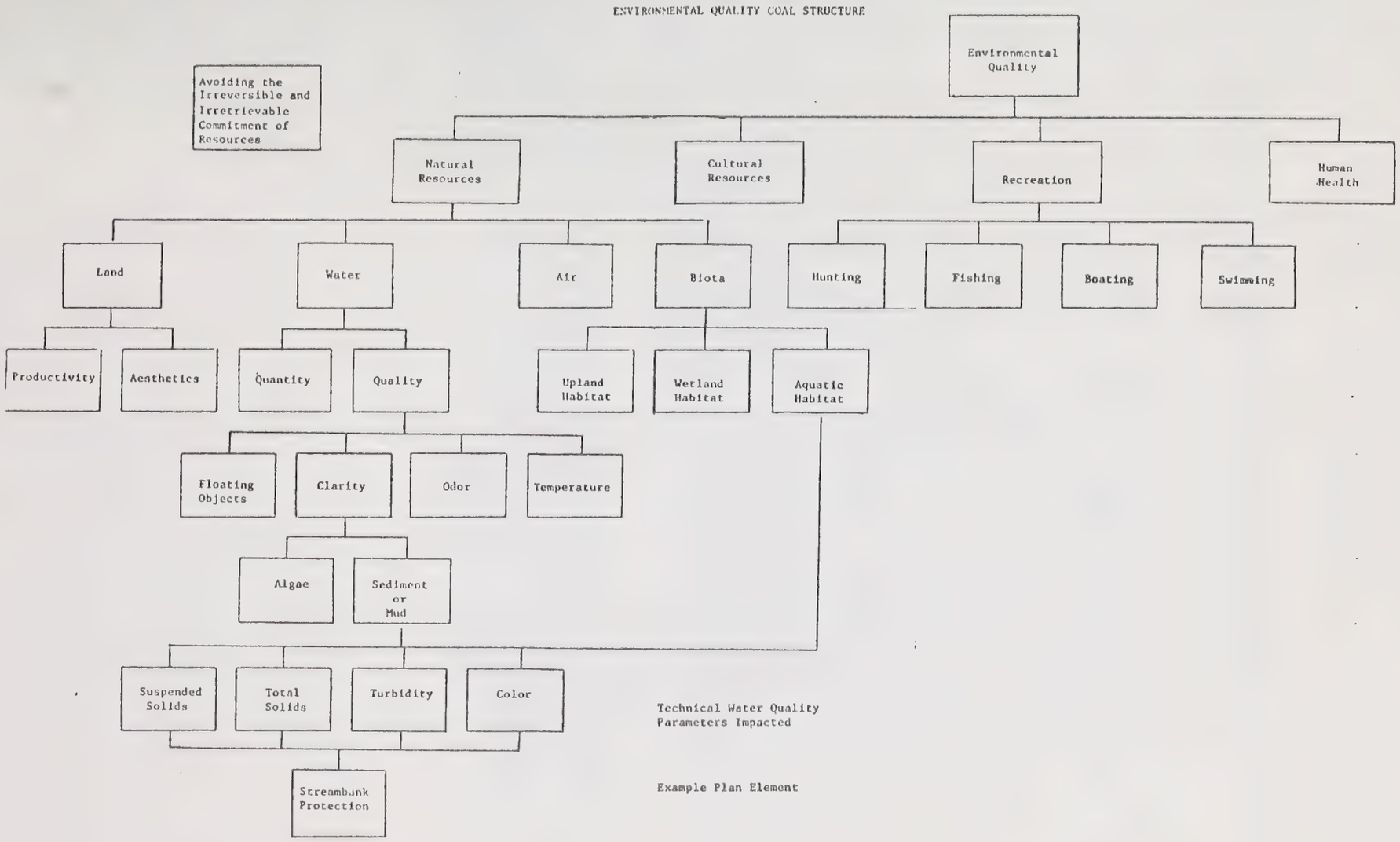
DISCUSSION

The matrix of conservation practice element--technical water quality parameter impacts offered for discussion through this paper serves as a basis for a step forward in water and related land resource planning. Through these basic impacts, the development of quantitative indices can proceed which will in turn, provide a systematic way for assessing the impacts of alternative plans on components of the environmental quality objective.

As an example of how the proposed structure assists in the evaluation of surface water quality impacts, we will assume that an alternative plan involves a single element, streambank protection (Number 77). Table 3 indicates that four of the technical parameters will be impacted by adequately protected streambanks. Concentrations of suspended solids, total solids, and measures of turbidity and color will all be lowered as a result of the installation of this practice. Since there is no indication (parameters 35 and 36) that impacts are other than primary or that significantly different impacts may be encountered during installation or the long term, the magnitudes of impacts on the four parameters can be estimated.[2]

Figure 1 diagrams an overall environmental quality goal structure for surface water quality impacts of a plan element. The overall project as presented in the preface will employ magnitude estimates of the surface water quality impacts of plan elements within the goal structure to determine indices of environmental quality goal achievement. A link that is not illustrated is that between the "quality" and "quantity" sub-goals of water quality and the water based recreation activities (fishing, boating, swimming). This link maps surface water quality impacts on these recreation activities. As we technically quantify from the bottom level of Figure 1 upwards, (Acres of Streambank Protection = decrease in turbidity of X milligrams per liter, etc.) and quantitatively make trade offs among sub-goals at each level from the top down, we will be able to quantitatively rank (index) an alternative plan or set of elements as to how well it achieves overall Environmental Quality or any goal or sub-goal within the structure. A detailed discussion of the system that will be used to develop the quantitative measures and generate the environmental indices, can be found in Arthur, et al., 1976.

Figure 1.


ENVIRONMENTAL QUALITY GOAL STRUCTURE
Environmental Quality
Avoiding the Irreversible and Irretrievable Commitment of Resources
Natural Resources
Cultural Resources
Recreation
Human Health
Land
Water
Air
Biota
Hunting
Fishing
Boating
Swimming
Productivity
Aesthetics
Quantity
Quality
Upland Habitat
Wetland Habitat
Aquatic Habitat
Floating Objects
Clarity
Odor
Temperature
Algae
Sediment or Mud
Suspended Solids
Total Solids
Turbidity
Color
Technical Water Quality Parameters Impacted
Streambank Protection
Example Plan Element

FOOTNOTES

[1]U.S.D.A. Soil Conservation Service's National Handbook of Conservation Practices.

Practices omitted include commercially oriented activities (commercial fish ponds), and activities that have no identifiable water quality impacts or are so single purpose or generally defined (fish stream management) that water quality impacts cannot be assessed. Practices that have been aggregated or incorporated in the list include groups, such as irrigation water conveyance, pond sealing or lining, strip cropping, contour farming, irrigation pit or regulating reservoir, surface drainage and irrigation systems and the individual practices of grasses and legumes in rotation and floodwater retarding structures. Aggregations were made where the subpractices are not seen to have significantly different impacts on down stream water quality and incorporations were made where definitions allowed. For example, it seems of little importance to water whether an irrigation water conveyance (44. Table 1) is a canal or pipeline, and whether the canal is concrete or steel or the pipeline is aluminum tubing or plastic mortar. It seems redundant to consider the impacts of grasses and legumes in rotation when conservation cropping system (8) definitionally includes both activities.

[2]Estimating the magnitudes of impacts, while not being a purpose of this paper, is an activity that should not be taken lightly. Some of the factors which determine how impact magnitude is estimated include: The technical significance of an impact, the importance of an impact to planning objectives, and the availability of data.

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