A DETAILED SOIL SURVEY AND INTERPRETATION FOR IRRIGATED FARMING OF THE LAKE CARL BLACKWELL EXPERIMENTAL RANGE AREA, STILLWATER, OKLAHOMA

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CHAPTER I

INTRODUCTION

At no time during mankind's agricultural history has the proper use of land become so manifest as now. The resurgence of the neo-malthusian doctrine on population growth outstripping food production in a geometric progression, is a grim reminder of the consequences of abusive land use to future generations. There is much more written about rapid population growth and food shortages than suggestions of practical measures to solve the problem. A recent report of the Food and Agricultural Organization of the United Nations suggests that the green revolution has barely improved the world food crisis situation and that improved soil, water management (including irrigation and drainge practices) can probably do more toward increasing food supplies and agricultural income in the irrigated areas of the world than any other agricultural practice (6).

Past civilizations notably, Ancient Egypt on the Nile and Mesopotania on the Tigris and Euphtates, flourished on alluvial irrigated soils and such civilizations collapsed due to improper management of such soils.

In the United States, evidence abounds in Southern Arizona to prehistoric irrigation practices at the Salt River Valley and still more evidence on the inability of such degenerated soils to support a good crop despite the application of modern techniques of soil and land reclamation (10).

The genesis of alluvial soils is associated with destructive erosion of usually badly managed soils upstream. These alluvial soils are man's most fertile and thus most productive soils. However, the alluvial soils are quite vulnerable to abusive use. Awareness of this problem in the United States has been significantly aroused through the Soil Conservation Service and allied organizations engaged in soil classification and better land use.

In Payne County, Oklahoma, much of the alluvial soils are used for small grain production and very little irrigation is practiced on them (25).

The objectives of this report is 1 to classify, map and interpret the results from an alluvial plain for irrigation planning, 2 to study spatial variability of pedons within mapping units in a specified area around Stillwater Creek (Lake Carl Blackwell area), and 3 to provide data, both field and laboratory for detailed classification and proper boundary demarcation of mapping units within the project area.

CHAPTER II

LITERATURE REVIEW

A good knowledge of the soil is a prerequisite for the determination of the maximum use to which land can be put and soil surveys provide this information (26). Development planning without soil surveys is downright irresponsible and projects so undertaken in this way are doomed to failure. To produce a good soil survey for people to use requires an excellent scientific work comprising classification and interpretation of the soils for their expected alternative uses in quantitative terms (12).

Thus, a system of soil taxonomy must be tested through research and against its usefulness in predicting the results of use and management. The aim of classification is to achieve both economy of memory and ease of manipulation. The paramount purpose of classification system is to describe the structure and relationship of the constituent objects to each other and to similar objects and to simplify these relationships in such a way that general statements can be made about classes of objects. A successful classification system generates scientific interest and hypothesis (24).

Soil classification development in the United States can be traced back to the ideas of Dokuchaev, Marbut, Cline, Kellogg and Glinka to mention a few. Dokuchaev, in 1879 proposed the genetic soil classification while Marbut brought the concepts of Dokuchaev to the attention of soil scientists in the United States of America (3).

Marbut's proposed ten requirements for a soil unit are, 1. number of horizons, 2. color of the various horizons with special reference to upper one or two or where color denotes reduction or change in parent materials, 3. texture of the horizons, 4. structure of the horizons, 5. relative arrangements of the horizons, 6. chemical composition of each horizon, 7. thickness of each horizon, 8. geology of the parent material where significant, 9. mineralogy of soil material, and 10. relative landscape position (7).

Marbut clearly pointed out that sound classification of soils must be based strictly on soil characteristics as they exist in nature and not indirectly on inferences (1, 18).

The decision to develop a new soil classification system in the United States was reached in 1951. Among other things, the new system was to account for all the soil characteristics both virgin and cultivated or disturbed soils (12). Early attempts of the classification were known as approximations, the first in 1951 and the seventh in 1960. The system was built from the lowest category upward by a process of reducing homogeneity in each successive higher category. However, the choice of differentiating characteristics in the higher categories is limited to the available knowledge not only of the soil properties but also on relationships among soil properties (4).

Early criticism of the system by soil scientists from other countries was leveled against the concept of 60 inches solum and 40 inches control section of the soil profile. This concept was inadequate in fully describing profile characteristics of Australian soils where pedogenic processes could be detected beyond 100 inches (33).

Stephens also pointed out that earlier approximations showed inadequate relationships between soil and climate and that soils were seperated more on their degree of development rather than their kind of development.

European soil scientists questioned the applicability of the new system to classifying European soils, especially soils like the plaggudents and agrudalfs which were not found in the United States. The base saturation differentia used to separate Ultisols and Alfisols were misleading since different laboratory techniques can provide different base saturation figures (34). Thus, the European soil scientists argued that the base saturation differentia at a higher category needs further study.

Despite the shortcomings of the new system, the quantitative taxa approach has made soil studies a science (soil systematics). Lack of precision in the system is not a fault of the system but of its application, and techniques for feasible evaluation of soil properties (4). Cline also states that "if our knowledge were complete, we should be able to choose the differentiating characteristics of each category but at present not only must we establish the importance of many known relationships but undoubtedly we are still unaware of many relationships that will be discovered" (4).

Perhaps the most important use of this system lies in the fact that it can both serve the American Agriculturist and also be used in international soil correlation and free interchange of ideas on soil science development (13, 14, 23).

Soil Classification and Mapping

Naturally, field identification and study of soils precede soil classification. In order to classify and map soils well, soil scientists have devoted much effort to field study. It has therefore been possible that over the years soil scientists have gathered and recorded reliable and pertinent data for classifying and predicting their potentialities for use and their management requirements.

Many methods have been employed in the past for soil mapping. The cartographic system was most widely used. In-accuracies in this system lies in mapping soils as if contiguous soils are homogeneous. Though such areas do exist, many soil units are not so homogeneous. There may be some spots too small to map or the transition between boundaries may not be well defined. This system basically indicates the geographical extent of soils in the field (18). Experienced scientists do not map soils as landscapes but use both the landscape and other observable features within the soil profile to locate boundaries. Prior to 1930, the system of Triangulation, a laborious system of mapping, was used. This type of plane table mapping showed many discrepancies. Modern soil scientists, however, have the advantage of the use of the air photographs which record both cultural, physiographic and drainage features comparatively easily. Air photographs are more accurate and has been employed extensively in the last 30 years. Thus, the use of air photographs has enabled the classification and mapping of complex areas which hither to were over simplified through less efficient methods of mapping.

Soil maps have been classified into two broad groups; the original soil survey map, which is made in the field and based on direct observation, and the compiled maps which are based upon published and unpublished soil data which includes geology, topography, geomorphology, vegetation, and climate (19). Others have classified soil surveys for mapping into 3 categories: the detailed, the reconnaisance, and the detailed reconnaisance. Detailed soil surveys have accurate plotted boundaries, reconnaisance soil surveys have their boundaries sketched from observations made at intervals and detailed reconnaisance soil surveys are those that combine the two methods (17). This report employs all three methods of soil mapping including the use of air photographs.

Soil Interpretation

The level of development of a society has some direct bearing on the kinds of soil it has and the skills it has mastered in the use of the soils. And the performance of the soil depends on how well people select uses for them and this also depends on the management or the manipulation in accord with the unique combination of properties of soil, which determine their potentials to respond to specific uses (12, 15).

Soil surveys are prepared on the basis of making soil interpretations and the major part of this is the capability groups. This is a grouping of soils to show in a general way their suitability to most kinds of farming. It is a practical classification based on limitations of soils, the risk of damage when they are used and the way they respond to different levels of management. The soils are also classified according to the degree and kind of permanent limitations but without land forming that change their slopes depth or the characteristics of the soil and without consideration of possible major reclamation projects (27).

The grouping recognizes three levels, the capability class, subclass and the unit. Eight capability classes are in the broadest grouping and are designated by Roman numerals I through VIII.

In class I are soils with few limitations, and has the widest use and the least risk to damage when used. The soils in the other classes have varying degrees of limitations which reduce the choice of plants and also need varying intensities of conservation practices.

The subclasses indicate the major specific limitations within a class. Small letters are used to denote subclasses; (e) for risk of erosion without a cover crop, (w) for wetness, water logging condition or high water table requiring drainage, (s) for soil condition such as shallow, droughty, or stony soils, (c) for climate, either cold or dry.

Within the subclasses are capability units which are groups of soils enough alike to be suited to the same crop and to require similar management practices and to have similar productivity and other responses to management. These capability units are designated with arabic numerals 1, 2, 3, etc. and principally used for making many statements about management (27, 28).

Irrigation Suitability and Yield Predictions

Irrigation suitability groupings are closely related to yield estimates under specified management practices suited to specific areas. In establishing irrigation suitability groups, certain soil factors are taken into consideration and these factors relate to soil features and qualities. The soil factors considered are as follows:

1) water holding capacity
2) depth of soil as related to rooting depth
3) slope (affects application efficiency and erosion risk)
4) water intake rate
5) need for drainage, depth to water table
6) susceptability to stream flow (flooding)

7) salinity, alkalinity and sodicity

8) stoniness of solum

9) hazard to water erosion

10) hazard to soil blowing (wind erosion)

11) presence of frazipan or other layer impeding water movement through the profile (risk of perching water table)

12) topography (especially in regard to gravity and subsurface irrigation

13) Cole factor: shrink - swell capacity presence of 2:1 clays

14) irrigation water quality and availability

15) suitability for levee or embankment construction risk of soil piping and sliding (29, 30).

The severity of limitations of these factors to irrigation depends on skill of farmer and the type of irrigation system adopted. It could be flooding, furrow, corrugation, subsurface or sprinkler irrigation.

Yield predictions either for dry land or irrigated farming practice draws from observations made by soil scientists, information from farmers, and crop specialists of S.C.S, the universities, Federal and county extension personnel (28). Yield predictions are linked to levels of management and two levels are recognized (A and B).

(A) Common or average management is the level of management most commonly used by farmers in the area.

(B) Optimum management is the level of management actually applied by farmers as result of their experience, field trials and recent research findings up to the present indicate would give the highest returns. This is a higher level of management than A and yields are therefore higher. It is pertinent to establish here that yield figures are mere estimates or predictions or averages which take into consideration bumper crop harvests and total crop failures. Variables like local weather, soil heterogeneity and human factors determine actual year to year yields.

Soil Forming Factors in Relation to Project Area

Soils are a result of interrelated influences of climate, biosphere parent material relief and time. The key to understanding soils, their formation, differences and potentialities must come from their genetic influences best observed and classified in their natural setting (7, 20).

Some soils lend themselves to easy study in the field others do not. Alluvial soils are among soils of the latter because of their short spacial variability, stratification and youthfulness. It thus becomes difficult to separate properties that are sedimentary features and those that are pedogenic (21).

Parent Material

The parent material exerts a controlling effect on the soil properties of the soil. Jenny defined parent material as "the state of the soil system at time zero of soil formation" (11). Alluvium, a product of erosion, constitutes the parent material within the project area. The Stillwater Creek, from whose sediments the soils have been formed, has undergone successive rejuvenations resulting in down cutting and depositions under different climatic nuclei from Pleistocene to recent geologic time (16). Much of the alluvium varies from very fine sand, silt and to a lesser extent, clay. The alluvium overlies Permian Red

Beds (25).

Climate

This factor affects the pedogenic processes principally additions, losses, translocation and transformations. Indirectly, the climate of a place determines the types and quantities of its flora and fauna.

The climate of the project area is subhumid with generally mild winters and hot summers. The mean winter temperature is 37.8°F. Snowfall is light. The summer temperatures can rise up to 108°F. The average maximum temperature is 71.2° and the average minimum temperature is 47.5°. The normal growing season is 200 days and average rainfall, 34". A greater part of it falls in late spring, summer and early fall.

Vegetation

To a large extent, the organic matter level of the soil is determined by the type of vegetation. Generally, grasses add more organic matter to the soil than trees because of their physiological nature. Pedogenic processes like acid leading are mainly accounted for by type of vegetation. Payne County appears to lie in a transitional belt between the prairies and the plains, but it's soil and vegetation are more related to the prairies. Forest vegetation consists of elm chinquapin, post, blackjack oaks, cottonwood and greenash. Some typical grass species include bluestems, dropseed, buffalo grass, Indian grass, Johnson grass, broom sedge and other andropogons (20, 25, 32).

Relief

Signifies the relative elevations or irregularities of land surface and affects the moisture and temperature which in turn affects the drainage and erosion of a place. Much of the relief in the alluvial plains is generally flat with depressions, depending on the land's proximity to the Stillwater Creek. Soils near uplands receive over burdens of out wash from adjoining uplands. The area is drained by the Stillwater Creek, a tributary of the Cimarron River.

Time

The degree of horizonation of a soil profile is time dependent. Soils develop through the stages of youth maturity and senility (20). The soils in the project area range in age from the Pleistocene to recent times. The older soils, which are further away from the stream, have relatively well-developed profiles with argillic (Bt) horizons while soils nearer the streams have not as yet developed the argillic characteristics but have stratified horizons of fine sands and silts with recent over wash material.

CHAPTER III

MATERIALS AND METHODS

An aerial photograph of the project area (Figure 1) was used to locate various boundaries and points of mapping units while a traced map (Figure 2) was used for locating transects. The project area which includes uplands, covered 480 acres. The legal descriptions is S½ Sec 3 and SE¼ Sec 4 T 19N.R1W. and is located in the Lake Carl Blackwell area of Payne County, Oklahoma, property of the Oklahoma State University, Stillwater. The scale of the map is approximately 1:7920 or 8 inches to the mile. This report does not include the uplands.

Sixteen transects were located on the base map (Figure 2). Starting from the point 140' West and 30' N. of SE corner of Sec 3, T19N, R1W and traversing westward, transects were located at 1000 ft. intervals. Minor adjustments were made where similarity or dissimilarity of the soils made it necessary to alter this trend. Pedons were sampled at 200 ft. intervals on individual transects. In all, 26 pedons were described and a further 31 pedons described and sampled. Labeling technique adopted was as follows. 76 represented the year OK for Oklahoma; 60 for Payne County number; the next number representing the profile sampled and the next set of numbers the actual samples taken per horizon within the pedon. The first pedon sampled had a designation of 76-OK-60-1-(1-6).

In most cases, the mechanical soil probe mounted on a field pickup

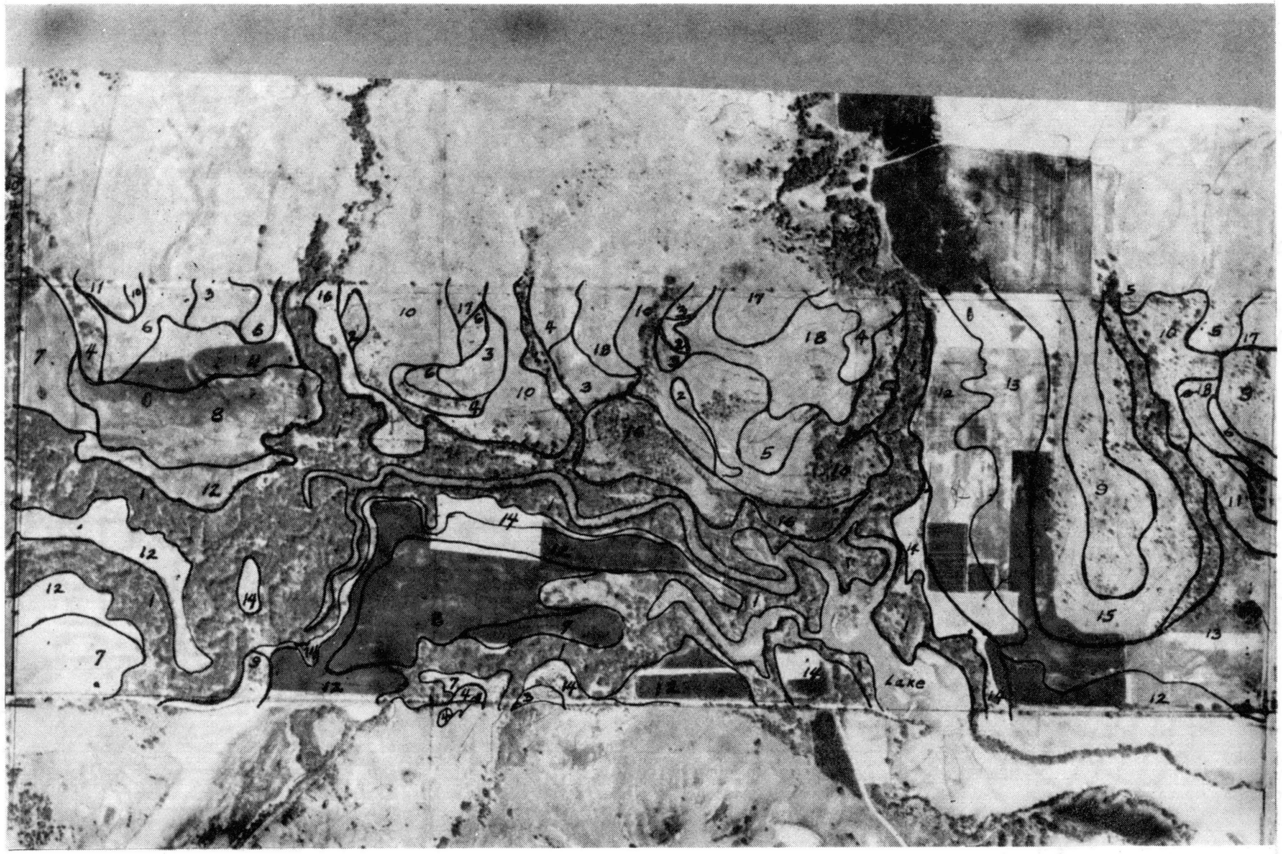

Figure 1. Soil Survey of S½ of Sec. 3 and SE¼ of Sec. 4, T.19N., R.1W., Lake Carl Blackwell. By O.S.U. and SCS (unpublished).

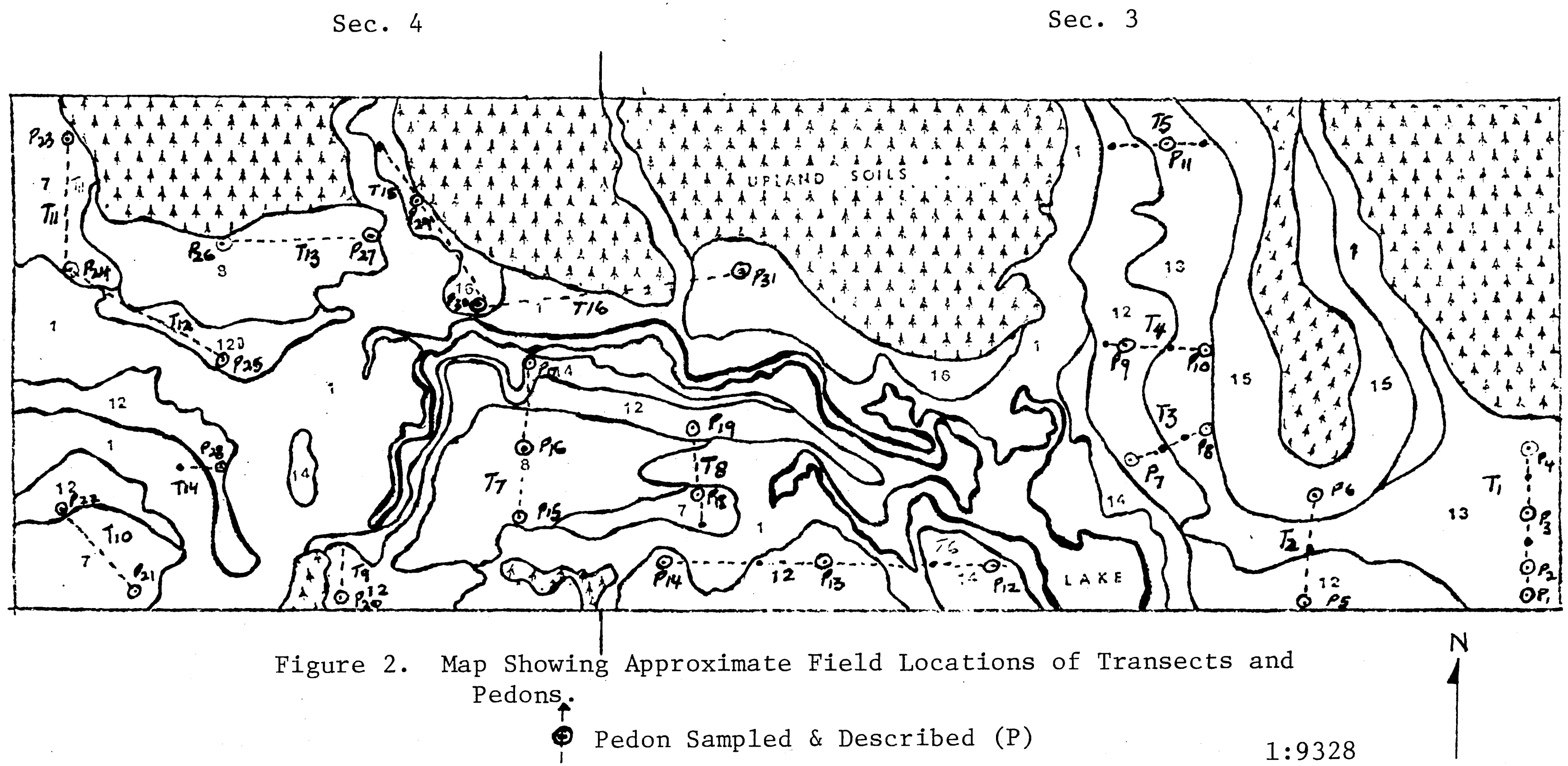

Figure 2. Map Showing Approximate Field Locations of Transects and Pedons.

Pedon Sampled & Described (P)

Pedon Described

1:9328

TABLE I

LEGEND OF MAPPING UNITS ON AERIAL PHOTO

SYMBOL	NAME
1	Broken loamy alluvial land
2	Eroded land, 2-5% slopes
3	Grainola silt loam, 3-5% slopes
4	Grainola-Lucien complex, 5-20% slopes
5	Lucien loam, 3-5% slopes
6	McLain silt loam
7	McLain-Drummond complex
8	Norge loam, 1-3% slopes
9	Norge loam, 3-5% slopes
10	Norge loam, eroded, 3-5% slopes
11	Port loam
12	Port-Oscar complex
13	Pulaskifine sandy loam variant
14	Teller loam, 3-5% slopes
15	Teller loam, 1-3% slopes
16	Zaneis loam, 1-3% slopes
17	Zaneis loam, 3-5% slopes

truck was used but in some cases, hand augering was necessary where the ground was too wet to reach a selected point. Soil description and sampling were made according to USDA guidelines (31).

Laboratory Analysis

Soil samples were air dried in the soil morphology laboratory and ground for laboratory analysis. The laboratory procedures used were those used in the soil morphology laboratory (5). Organic matter, pH (1:1), E.C. (1:1) and particle size analysis was carried out on all 31 pedons but only 4 profiles were analyzed for extractable cations (Na, Ca, Mg, K).

Field Problems

Since most of the sampling was done in winter, cold weather and strong winds hampered progress of work. Suspected salic and sodic spots were difficult to probe mechanically or auger manually.

Field aids. The report (unpublished) Gray and Nance (8) and Ford and Gray (9) were useful.

CHAPTER IV

RESULTS AND DISCUSSION

Field Study of Soils (Descriptions)

The soil classification as shown in Table III distinguishes the representative soil series developed within the Stillwater alluvial plain and it's immediate highlands. The soil associations in relation to the topography and parent material are shown in Figure 3. The

Mollisols are represented by Port and McLain series which are developed from fine silty and loamy alluvial material with either Cumulic or pachic epipedons. The Drummond and Oscar represent Mollisols or Alfisols with natric diagnostic horizons and with fine silty loamy alluvium as parent material.

Coarse loamy Pulaski series is developed on nearly level flood plains of the Stillwater Creek drainway. These soils have stratified sandy and loamy upper horizons and they also carry burdens of overwash material, a result of cleared local vegetation and fluvial activity.

Teller series are associated with uplands and they occur on fairly level to strongly sloping areas bordering the major upland soils of Norge and Kirkland series to the north of the project area. Other pedons classified are merely tax-adjuncts to the major series because of the peculiarities of their diagnostic horizons as observed in situ.

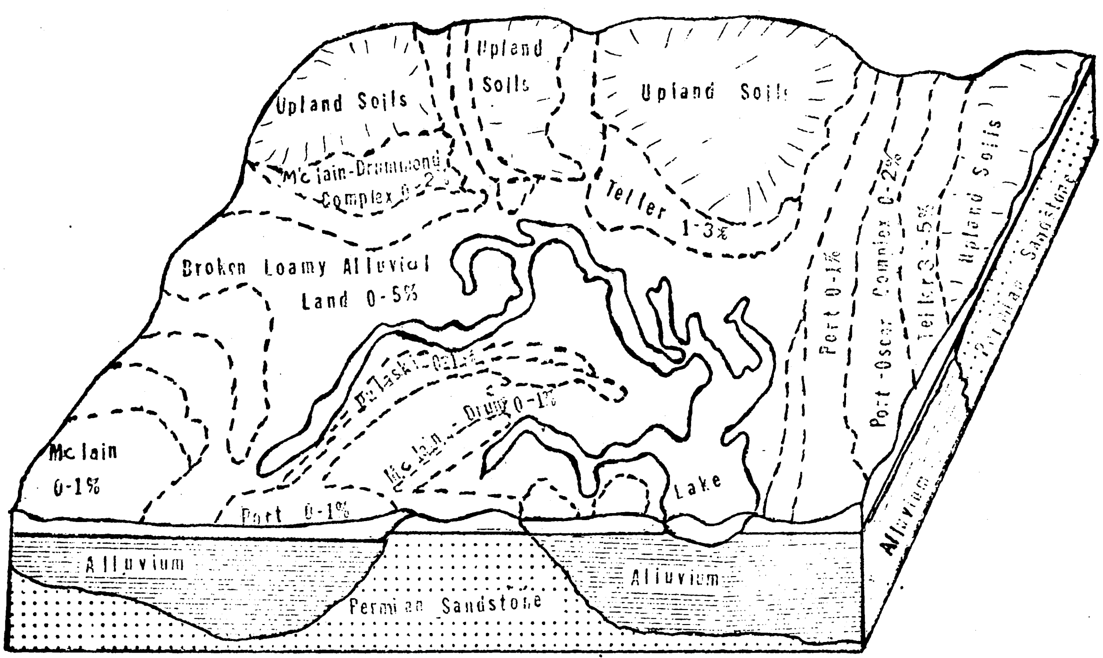

Figure 3. Block Diagram Showing Soil, Geologic Material, and Topography of the Project Area.

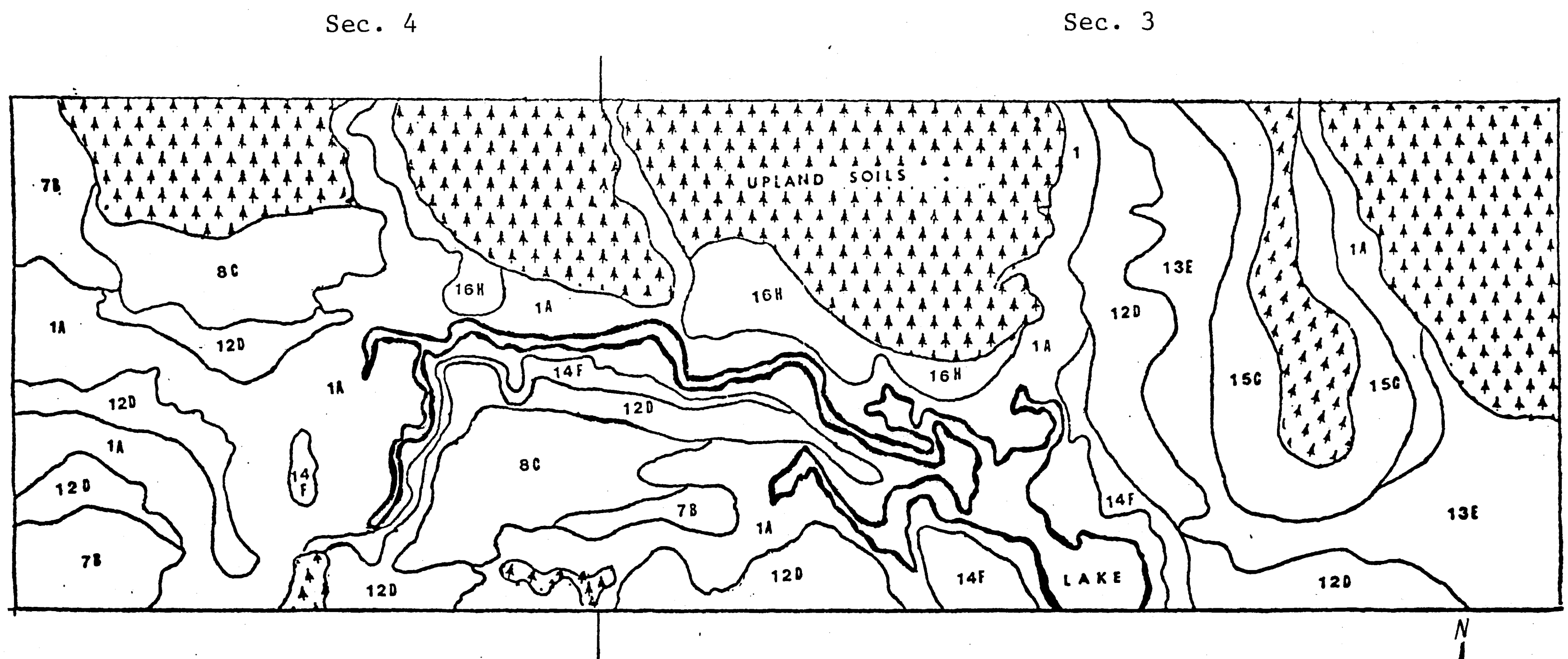

Figure 4. Detailed Soil Map of Project Area Showing Mapping Unit.

TABLE 2

SOIL SURVEY LEGEND FOR DETAILED SOIL MAP
AND PEDON DESCRIPTIONS THAT FOLLOW

7B	McLain silty clay loam
12D	Port silt loam 0-1%
14F	Pulaski fine silty loam variant 0-1%
16H	Teller loam variant 1-3%
8C	McLain-Drummond complex 0-2%
13E	Port-Oscar complex 0-2%
15G	Teller loam, taxadjunct 3-5%
1A	Broken loamy alluvial land 0-5%

TABLE III

CLASSIFICATION OF SAMPLED PEDONS ON THE SOIL MAP OF LAKE CARL BLACKWELL AREA

Serial # Pedon*	Map Unit	Name of Series**	Family	Subgroup	Order
76-OK-60-1	13E	Taxadjunct to Port	Fine-silty, mixed, thermic, non-acid	Typic Ustifluvents	Entisols
76-OK-60-2	13E	Taxadjunct to Oscar	Fine-silty, mixed, thermic	Typic Natrustolls	Mollisols
76-OK-60-3	13E	Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols
76-OK-60-4	13E	Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols
76-OK-60-5	12D	Taxadjunct to Port	Fine-silty, mixed, thermic, non-acid	Typic Ustifluvents	Entisols
76-OK-60-6	15G	Taxadjunct to Teller	Fine-loamy or Fine-silty, mixed, thermic, non-acid	Udic Argiustolls	Mollisols
76-OK-60-7	14F	Taxadjunct to Pulaski	Coarse-silty, mixed thermic, non-acid	Typic Ustifluvents	Entisols
76-OK-60-8	13E	Inclusion in Port	Fine-silty, mixed thermic	Udic Argiustolls	Mollisols
76-OK-60-9	12D	Port	Fine-silty, mixed thermic	Cumulic Haplustolls	Mollisols
76-OK-60-10	13E	Oscar	Fine-silty, mixed, thermic	Typic Natrustolls	Alfisols

TABLE III(CONTINUED)

Serial # Pedon*	Map Unit	Name of Series**	Family	Subgroup	Order
76-OK-60-11	13E	Oscar	Fine-silty, mixed, thermic	Typic Natrustalfs	Alfisols
76-OK-60-12	14F	Taxadjunct to Pulaski	Coarse-silty, mixed thermic, non-acid	Typic Ustifluvents	Entisols
76-OK-60-13	12D	Taxadjunct to Port	Fine-silty, mixed, thermic	Pachic Argiustolls	Mollisols
76-OK-60-14	12D	Pulaski (inclusion)	Coarse-loamy or Coarse-silty, mixed, thermic, non-acid	Typic Ustrifluvents	Entisols
76-OK-60-15	8C	Taxadjunct to Drummond	Fine-silty, mixed, thermic	Typic Natrustolls	Mollisols
76-OK-60-16	8C	Taxadjunct to McLain	Fine-silty, mixed, thermic	Pachic Argiustolls	Mollisols
76-OK-60-17	14F	Port-like inclusion	Fine-silty, mixed, thermic, non-acid	Typic Ustrifluvents	Entisols
76-OK-60-18	7B	Taxadjunct to McLain	Fine-silty, mixed, thermic	Pachic Argiustolls	Mollisols
76-OK-60-19	12D	Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols
76-OK-60-20	12D	Taxadjunct to Port	Fine-silty, mixed, thermic	Fluventic Haplustolls	Mollisols

TABLE III(CONTINUED)

Serial # Pedon*	Map Unit	Name of Series**	Family	Subgroup	Order
76-OK-60-21	7B	Taxadjunct to McLain	Fine-silty, mixed thermic	Pachic Argiustolls	Mollisols
76-OK-60-22	12D	Port	Fine-silty, mixed thermic	Cumulic Haplustolls	Mollisols
76-OK-60-23	7B	Port-like inclusion	Fine-silty, mixed, thermic	Fluventic Haplustolls	Mollisols
76-OK-60-24	7B	McLain	Fine, mixed, thermic	Pachic Argiustolls	Mollisols
76-OK-60-25	12D	Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols
76-OK-60-26	8C	Taxadjunct to McLain	Fine-silty, mixed, thermic	Pachic Argiustolls	Mollisols
76-OK-60-27	8C	Taxadjunct to McLain	Fine-silty, mixed, thermic	Pachic Argiustolls	Mollisols
76-OK-60-28	12D	Taxadjunct to Port	Fine-silty, mixed, thermic	Fluventic Haplustolls	Mollisols
76-OK-60-29	16H	Taxadjunct to Teller	Fine-silty, mixed, thermic	Udic Argiustolls	Mollisols
76-OK-60-30	16H	Taxadjunct to Teller	Fine-silty, mixed, thermic	Udic Argiustolls	Mollisols
76-OK-60-31	16H	Taxadjunct to Teller	Fine-silty, mixed thermic	Udic Argiustolls	Mollisols

*Pedon location relates to Figure 2

**Taxadjuncts and inclusions are further explained in detail soil description under Discussions.

McLain Silt Clay Loam (7B) 0 - 1%

The McLain silt loam consists of deep moderately well drained soils with moderately slow permeability usually associated with Stillwater Creek and other creeks. These soils are rarely flooded. Also included in this mapping unit are about 35% of similar soils that have fine silty control section and 5% of similar soils that have sodic and alkali problems.

A typical pedon of McLain silty clay loam was sampled at the project area located 2530' west and 1940' north of southeast corner of Sec 4; T.19N.; R.1W.; Payne County, Oklahoma. The Pedon designation was 76-OK-60-24 transect 12, Figure 2 and 3.

Ap - 0 to 11 inches; dark brown (7.5YR 3/2) silty clay loam; weak, fine granular to moderate medium, subangular blocky; friable moist; smooth, clear boundary.

B21t - 11 to 28 inches; dark reddish brown (5YR 3/3) silty clay loam, weak, fine, angular blocky; firm, moist; clay films on ped surfaces; smooth, gradual boundary.

B22t - 28 to 39 inches; reddish brown (2.5YR 4/4) silty clay loam; weak, medium, subangular blocky; firm, moist; clay films on ped surfaces, few black bodies; smooth clear boundary.

B31 - 39 to 49 inches; red (2.5YR 4/6) silt loam; weak, coarse, subangular blocky; firm, moist, smooth diffused boundary.

B32 - 49 to 59 inches; red (2.5YR4/6) loam; weak, coarse, subangular blocky; friable moist, smooth clear boundary.

B33 - 59 to 72 inches; red (2.5YR 4/6) silty clay loam; weak, medium, subangular blocky, firm, moist, thin clay films, few black bodies.

Recent sediments from associated uplands range from 0 - 19 inch thickness. The Ap horizon may have dark brown or dark reddish brown in hues 5YR and 7.5YR, colors recent sediments are 4 chroma and value in some areas, the texture is silt loam or loam; reaction is slightly acid through moderately alkaline. The B3 horizon is dark red, red or reddish brown in hue 2.5YR, textures are clay loam, silty clay loam or silt loam reactions are neutral through moderately alkaline.

Port Silt Loam (12D) 0 - 1%

The Port silt loam consists of deep, well drained, moderately permeable soils formed in the alluvium of Stillwater Creek and other creeks around Stillwater. These soils are occasionally flooded and receive over wash sediments. Included in this mapping unit are about 40% similar soils except the mollic epipedon; thickness is 10 to 20 inches and 15% similar soils except they lack a mollic epipedon or the central section is loamy or fine loamy. These soils are generally found in slight depressions.

A typical pedon of Port silt loam can be located 970 feet east and 1000 feet north of the southwest corner Sec 3; T.19N.; R.1W.; Payne County, Oklahoma. The Pedon designation is 76-OK-60-19, transect 8, figure 2 and 3.

Ap - 0 to 13 inches; reddish brown (2.5YR 4/4) silt loam; weak, fine granular structure; friable moist; over wash sediments; smooth, clear boundary.

B21 - 13 to 21 inches; dusky red (2.5YR 3/3) silty clay loam; weak fine subangular blocky; firm, moist; smooth, clear boundary.

B22 - 21 to 30 inches; dusky red (2.5YR 3/3) loam; weak, fine, subangular blocky; friable moist; smooth, clear boundary.

B23 - 30 to 41 inches; dusky red (2.5YR 3/3) loam; weak, coarse, subangular blocky; friable moist; few white bodies; smooth, clear boundary.

B31 - 41 to 51 inches; reddish brown (2.5YR 4/4) loam; weak, coarse, subangular blocky; friable moist; smooth, clear boundary.

B32 - 51 to 72 inches; red (2.5YR 4/6) loam; weak, coarse, subangular blocky; friable moist.

The A horizon including the over wash sediments is dark brown or dark reddish brown in hues of 7.5YR, 5YR or 2.5YR. The reaction is medium and through neutral. The over wash sediments up to 20 inches are present in most areas. Where present, they are reddish brown, dark reddish brown or brown in hues 2.5YR, 5YR or 7.5YR. The textures of the A are silt loam, silty clay loam, clay loam or loam B2 and B2 colors are similar to those of A1 or Ap horizon.

Pulaski Fine Sandy Loam (variant) (14F) 0 - 1%

The Pulaski fine sandy loam consists of deep, well drained soils on the flood plains that is occasionally flooded. This map unit is a variant of the Pulaski series in that the control section is fine loamy. The permeability is moderate. Included in this mapping are about 30 percent similar soils, except the control section, 10 to 40 inches is fine silty and 15 percent soils have a coarse loamy control section.

A typical pedon of Pulaski fine sandy loam variant can be located 4600 feet west, 175 feet north of southeast corner, Sec 3; T.19N.; R.1W.; pedon designation is 76-OK-60-14 in transect 6, Payne County, Oklahoma.

Ap - 0 to 10 inches; reddish brown (5YR 4/3) fine, sandy loam; weak, fine granular; friable moist; smooth, clear boundary.

AC - 10 to 26 inches; reddish brown (2.5YR 4/4) fine, sandy loam; weak, coarse granular; friable moist; smooth, abrupt boundary.

II Ab - 26 to 38 inches; dark reddish brown (5YR 3/2) loam; moderate medium granular; friable moist; smooth, gradual boundary.

II B21t - 38 to 52 inches; dark reddish brown (5YR 3/4) silty clay loam; weak, fine, subangular blocky, firm, moist; smooth, clear boundary.

II B22t - 52 to 62 inches; reddish brown (2.5YR 4/4) silty clay loam; weak, very fine, subangular blocky; firm, moist.

The A horizon is reddish brown, dark reddish brown, or yellowish red in hues 2.5YR and 5YR, textures are fine sandy loam or very fine sandy loam.

The AC horizon is reddish brown, yellowish red, or red in hues 2.5YR or 5YR, textures are clay loam, loam, or silt loam. The II B2 horizons are dark reddish brown, reddish brown, or dark red in hues of 5YR, 2.5YR. Their textures are silty clay loam to clay loam.

Teller Loam Variant (16H) 1 - 3%

This map unit is a variant to the Teller series because they are rarely flooded and receive over wash sediments from associated upland soils. These soils are well drained and have moderate permeability. The surface horizons range from 8 to 10 inches with dark reddish brown in hues of 2.5YR and 5YR. The textures are loam at the surface horizons and silt clay loam to loam in the subsurface horizons.

Included in this mapping unit are minor amounts of Norge series (upland soils). A typical pedon of this mapping unit can be located

1900 feet north and 940 feet east of southwest corner of Sec 3; T.19N.; R.1W.; Payne County, Oklahoma. Pedon designation is 76-OK-60-31 on transect 16, Figure 2.

Ap - 0 to 8 inches; dark reddish brown (5YR 3.5/3) loam; weak, fine, granular; very friable moist; smooth, gradual boundary.

B21t - 8 to 17 inches; dark reddish brown (5YR 3/3) loam; weak, coarse granular; friable moist; smooth, gradual boundary.

B22t - 17 to 35 inches; reddish brown (2.5YR 4/4) loam; weak, coarse, subangular blocky; friable moist; thin clay films on ped surfaces; smooth, abrupt boundary.

B23t - 35 to 53 inches; reddish brown (2.5YR 4/4) loam; weak, coarse, subangular blocky; thin clay films on ped surfaces; friable moist; smooth abrupt boundary.

II B24t - 53 to 76 inches; reddish brown (2.5YR 4/4) silt loam; weak, coarse, granular; friable moist; thin clay films on ped surfaces; smooth boundary.

II B25t - 76 to 90 inches; reddish brown (2.5YR 4/4) clay loam; moderate, medium, subangular blocky; friable moist; thin clay films on ped surfaces.

The A horizon is dark reddish brown in hues of 5YR or 2.5YR. The Bt horizon ranges from dark reddish brown to reddish brown in hues of 2.5YR and 5YR. The texture is loam in the Ap and B2t horizons, but silty clay loam, silt loam or clay loam in the II B2 burried horizon.

McLain-Drummond Complex (8c) 0 - 2%

The McLain-Drummond complex consists of deep, moderately well drained, slowly permeable soils on very gently sloping alluvial plains.

This complex is a mixture or rarely flooded soils that are impractical to map separately with this scale of mapping. They usually consist of about 35 percent McLain soils; 30 percent soils similar to McLain except the percentage of sodium is higher than normal in some parts of the solum; 15 percent soils that have a natric horizon; and 20 percent soils similar to McLain except the control section (upper 20 inches of the argillic) is fine silty.

A typical pedon of McLain in this complex can be found at the location 870 west and 2010 north of southeast corner of Sec 4; T.19N.; R.1W.; Payne County, Oklahoma. The pedon designation is 76-OK-60-27 on transect 13, Figure 2.

Ap - 9 to 22 inches; dark brown (7.5YR 3/2) silt loam; weak, medium granular; friable moist; smooth, clear boundary.

B1 - 22 to 31 inches; dark reddish brown (5YR 3/4) silt loam; weak, coarse, subangular blocky; friable moist; smooth, gradual boundary.

B21t - 31 to 40 inches; reddish brown (5YR 4/4) clay loam; weak, medium, subangular blocky; firm moist; few black bodies; clay films on ped surfaces; smooth, clear boundary.

B22t - 40 to 50 inches; red (2.5YR 4/5) silty clay loam; weak, fine, angular blocky; firm moist; few black bodies; clay films on ped surfaces; smooth, gradual boundary.

B3 - 50 to 72 inches; red (2.5YR 4/6) clay loam; weak, coarse, subangular blocky; friable moist; few black bodies.

The Ap of the McLain is dark brown to very dark grayish brown in hues of 5YR to 10YR. The texture is loam to silt clay loam.

The B2t is dark brown or reddish brown in hues of 5YR and 7.5YR with clay loam to silty clay loam textures.

The B3 is red to reddish brown in 5YR and 2.5YR hues. The texture ranges from loam to clay loam. Associated uplands provide sediments which can be as thick as 19 inches.

Drummond Series in McLain-Drummond Complex

The typical Drummond pedon in this complex can be located 80 feet west and 460 feet north of southeast corner of Sec 4; T.19N.; R.1W.; Payne County, Oklahoma. The pedon designation is 76-OK-60-15, transect 7, Figure 2.

Ap - 0 to 12 inches; dark reddish brown (5YR 3/3) loam; platy structure, 1/2 inch thick, and weak, medium, granular bottom; friable moist; smooth, abrupt boundary.

A12 - 12 to 25 inches; dark reddish brown (5YR 3/3) silt loam; moderately very fine subangular blocky; friable moist; smooth, clear boundary.

B21t - 25 to 39 inches; dark reddish brown (2.5YR 3/4) silty clay loam; columnar breaking to moderately weak, angular blocky; firm moist; clay films on ped surfaces; smooth gradual boundary.

B22t - 39 to 64 inches; dark reddish brown (2.5YR 3/4) silty clay loam; columnar breaking to weak, very fine, angular blocky; firm moist; smooth, clear boundary.

B3 - 64 to 77 inches; dark red (2.5YR 3/6) clay loam; weak, medium, subangular blocky, firm moist.

The Ap horizon is dark reddish brown in hues of 5YR. The B2t horizon is the same color but in 2.5YR hue. The reaction ranges from mildly alkaline to strongly alkaline. Parts of the solum has more than normal sodium levels.

Port-Oscar Complex (13E) 0 - 2%

The Port part of this complex is deep, moderately well drained, slowly to moderate permeable soil; while the Oscar part is moderately well drained and slowly permeable. This complex occurs on gently sloping (0 - 2%) alluvial plains and the permeability is slow to moderately slow. This complex is occasionally flooded soils that are impractical to separate on this scale of mapping.

The soils consist of about 30 percent Port (variant) soils. These soils differ from Port by having a minimal B2t horizon, moderately slow permeability; 15 percent soils similar to Port except the mollic epipedon is 10 to 20 inches thick, 15 percent of the soils are similar to Port except the control section (10 to 40 inches) is fine loamy; 20 percent Oscar soils; 10 percent soils similar to Port except they lack mollic epipedon and 10 percent soils similar to Port except they leave udic moisture regime.

A typical pedon of the Port (variant) part of this complex can be located 140 feet west and 430 feet north of the southeast corner of Sec 3; T.19N.,; R.1W.; Payne County, Oklahoma. The pedon designation is 76-OK-60-3 on transect one.

Ap - 0 to 6 inches; dark brown (7.5YR 3/2) silt loam; weak, medium columnar break to weak, medium angular blocky; firm moist; smooth, clear boundary.

A12 6 to 12 inches; dark brown (7.5YR 3/2) weak, medium angular blocky; firm moist; smooth, clear boundary.

B1 - 12 to 20 inches; dark brown (7.5YR 3/2) silt loam; weak, medium subangular blocky; firm moist; smooth, clear boundary.

B2t - 20 to 32 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine angular blocky; firm moist; few clay films on ped surfaces; smooth, clear boundary.

B31 - 32 to 52 inches; dark brown (7.5YR 3/2) loam; weak, fine subangular blocky; friable moist; smooth, gradual boundary.

B32 - 52 to 84 inches; reddish brown (5YR 4/4) loam, weak, fine subangular blocky; friable moist; few $CaCO_3$ bodies.

There are out wash loam sediments of up to 20 inches in some areas. The color ranges from reddish brown to dark brown hues 2.5YR, 5YR and 7YR. The A horizon without the out wash sediments is dark brown or dark reddish brown in hues of 7.5YR, 5YR or 2.5YR. The B2 and B3 horizon colors are similar to those in the A1 and also include reddish brown, brown, dark red or red in hues of 2.5YR, 5YR, 7.5YR. The texture ranges from silty clay loam, clay loam, silt loam or loam.

<u>Typical Pedon of Oscar (Oscar Silt Loam) in the Port-Oscar Complex</u>

This pedon is located 140 feet west and 99 feet north of the southeast corner of Sec 3; T.19N.; R.1W.; Payne County, Oklahoma. The pedon designation is 76-OK-60-2 on transect one.

Ap - 0 to 8 inches; dark reddish brown (5YR 3/3) silt loam; weak, medium subangular blocky; friable moist; smooth, clear boundary.

B21t - 8 to 13 inches; dark reddish brown (5YR 3/2) silty clay loam; columnar breaking to moderate, fine subangular blocky; friable moist; clay films on ped surfaces; smooth, clear boundary.

B22t - 13 to 19 inches; dark reddish brown (5YR 3/2) silty clay loam; columnar breaking to weak, fine subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B23t - 19 to 35 inches; dark reddish brown (5YR 3/2) silty clay loam, columnar breaking to weak, fine subangular blocky; friable moist; smooth, clear boundary.

B31 - 35 to 44 inches; reddish brown (2.5YR 4/4) silt loam; weak, medium granular; friable moist; smooth, clear boundary.

B32 - 44 to 61 inches; reddish brown (2.5YR 4/4) silt loam; weak, medium granular; friable moist.

The A horizon carries an out wash of loam sediments up to 20 inches thick in some areas. The color ranges from reddish brown or brown in hues 2.5YR, 5YR, 7.5YR. The A horizon without the out wash is dark brown or dark reddish brown in hues 5YR and 7.5YR. The texture range is from loam to silt loam. The B2t horizon is natric. Colors are reddish brown, dark brown, or very dark grayish brown in hues of 5YR, 7.5YR, 10YR. The texture is silt clay loam or clay loam. The B3 horizon is reddish brown, brown, red or yellowish and in hues 2.5YR, 5YR or 7.5YR range. The texture range is loam, silt loam, clay loam, or silty clay loam.

Teller Loam, Taxadjunct (15G) 3 - 5%

The Teller loam consist of deep, well drained soils with moderate permeability. These soils have slopes up to 5 percent. These soils are associated with upland soils of Norge and Zaneis. These soils are taxadjuncts to the Teller series because they lack a mollic epipedon.

A typical pedon of this mapping unit can be located in 1100 feet west and 500 feet north of southeast corner Sec 3; T.19N.; R.1W.; Payne County, Oklahoma. Profile designation is 76-OK-60-6, transect 2.

Ap - 0 to 7 inches; dark reddish brown (2.5YR 3/4) silt loam; weak, fine granular upper section and weak, coarse subangular blocky lower layer; very friable moist; smooth, clear boundary.

A12 - 7 to 16 inches; dark reddish brown (5YR 3/4) loam; weak, coarse subangular blocky; very friable moist; smooth, clear boundary.

B1 - 16 to 24 inches; dark reddish brown (5YR 3/4) loam; weak, coarse subangular blocky; friable moist; smooth, gradual boundary.

B21t - 24 to 44 inches; red (2.5YR 4/6) loam; weak, coarse subangular blocky; friable moist; mica flakes prominant; thin clay films on ped surfaces; dominant fine sands; smooth, clear boundary.

II B22t - 44 to 56 inches; dark yellowish brown (10YR 4/4) clay loam; weak, medium subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B3 - 56 to 62 inches; red (2.5YR 4/6) mixed; dark yellowish brown (10YR 4/4) loam; weak, coarse subangular blocky sandstone fragments; firm moist.

The A horizon is dark reddish brown, reddish brown or brown in hues 5YR or 7.5YR. The texture range is silt loam, loam to very fine sandy loam. There is a similarity in characteristics. Color texture of A to B1 horizon.

The B2t is red or yellowish red in hues of 5YR and 2.5YR. The B3 colors are similar to the B2t and the textures follow similar trends too. The soils are described with reference to Figure 4 with their corresponding mapping units legend.

Broken Loamy Alluvial Land (1A) 0 - 5%

This mapping unit occupies the biggest acreage of the project area.

It has a total acreage of 117; about 24% of the entire farm, i.e. including the uplands (Figure 1). This is a miscellaneous mapping unit which consist of land associated with natural stream of the area. The physiography of the area consist of varied slopes and depressions - Figure 3. The stream banks are very strongly sloping with common cliffs. The natural vegetation consist of oaks, greenash elms, cottonwood, hickory, with an understory of shrubs and grasses. The common grass species include blue grass, dropseed, buffalo grass, and western wheat grass.

The soils consist of a mixture of alluvial soils that are impractical to separate; it includes many soil series that change abruptly within a short linear distance. The soils have control sections that are coarse-silty calcareous, non-calcareous, coarse-loamy calcareous and non-calcareous, fine-silty calcareous and non-calcareous, fine-loamy calcareous and non-calcareous. These soils are frequently to occasionally flooded.

From Figure 2 it can be observed that none of the sampled pedons fall within this mapping unit. This is so because of the extreme mixture of soils within the map unit. All of the soils sampled in the other mapping units are included in this mapping unit except the saline and sodic soils are not represented within 1A. This map unit also includes several other similar soils. The time required to study and sample the map unit will be prohibitive. This mapping unit can better serve as place for wild life habitat and the cover may prevent serious gullying of the area.

CHAPTER V

PHYSICAL AND CHEMICAL PROPERTIES OF SOILS IN RELATION TO SOIL AND AGRICULTURAL INTERPRETATION

The following parameters have been selected for discussion, particle size, organic matter, electrical conductivity and soil reaction of representative profiles.

Particle Size Distribution in Profiles

The particle size distribution of McLain series, Figure 5, shows a high silt content in the upper horizons and this trend contiues uniformly down the profile. The sands (fine sands) are very low in the upper horizons but increases gradually down the profile with a sharp increase at 49 inches, depth of 31%. The clays show a similar trend as silts, that is, high in the upper horizons but decreases uniformly down the profile. The textural class of this profile varies from silt clay loam in the upper horizons through silt loam and loam down the profile.

The particle size distribition of Teller series, Figure 5, shows a very high silt content at 20 inches down the profile. This increase in silt content at the 20 inches depth is comparable to the percentage silt of McLain at the 0 to 5 inches depth. This profile has high clays in the upper horizons and this decreases down the profile. The sands are low in the upper horizons similar to McLain series but increases

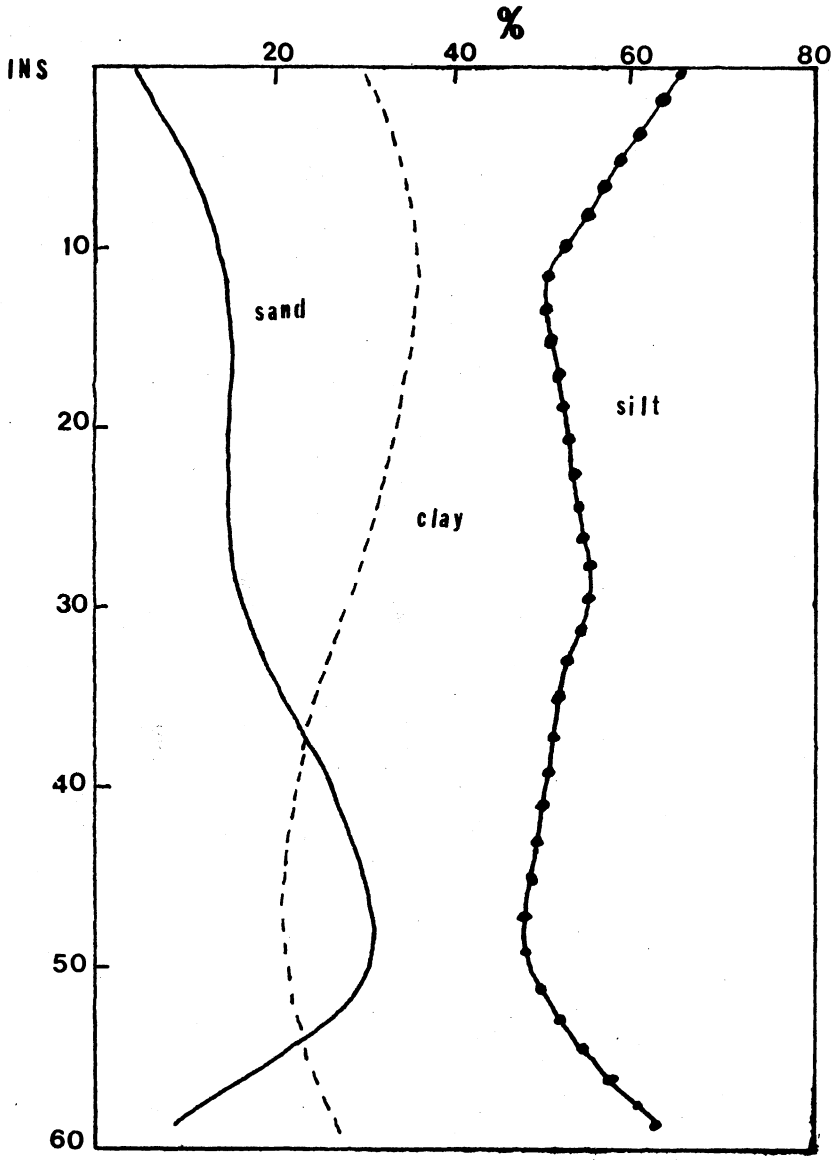

Figure 5. Particle Size Distribution in a Solum McLain Silty Clay Loam.

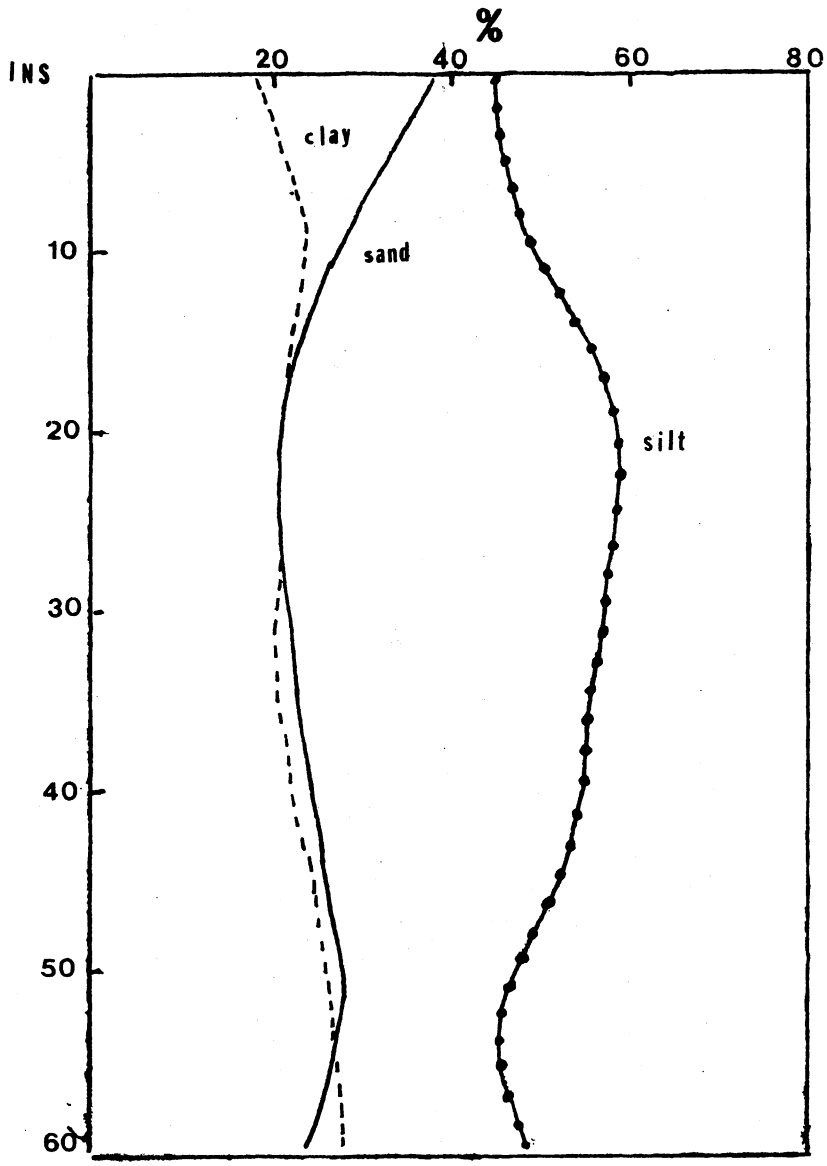

Figure 5. Particle Size Distribution in a
(con't) Solum Taxadjunct to Teller
Series.

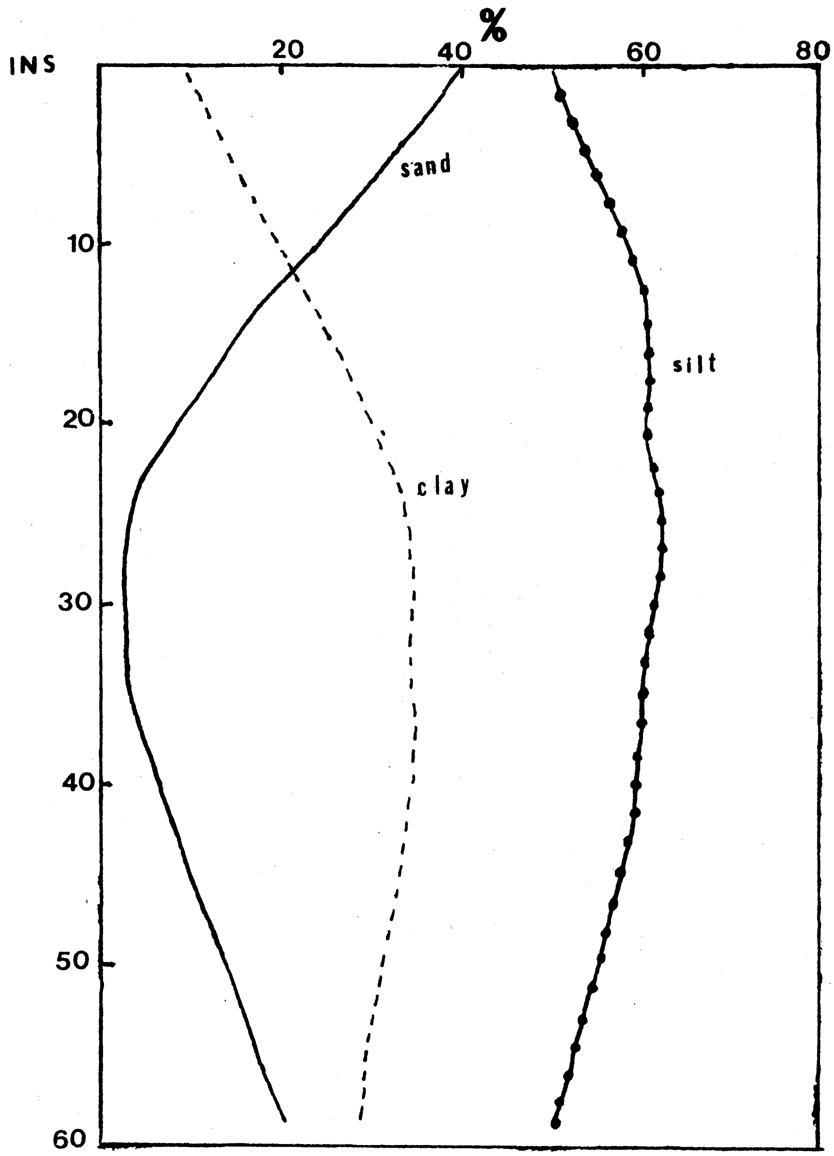

Figure 5. Particle Size Distribution in a
(con't) Solum Taxadjunct to Drummond
Series.

and decreases erratically down the profile. The textural class of this pedon is silty clay loam in the A horizon and silty clay loam in the B2t horizon.

The particle size distribition of Drummond series, Figure 5, shows an equally high silt content as McLain in the upper horizons but a gradual decrease down the profile. The clays are low in the upper horizons but exhibits a sharp rise at the B2t horizon and then drops gradually down the profile. The sand movement in this horizon is rather erratic It starts high in the upper horizon and drops very sharply at the B2t horizon and then picks up again gradually down the profile. The textural class ranges from loam in the A horizon through silt loam in the A12 to silt clay loam in the B2t horizon and then changes to clay loam in the B3 horizon. The texture of a pedon is directly related to the infiltration rate and water retention which are important parameters for irrigation soil classification.

Organic Matter Distribution

The organic matter distribution down the profile of the selected pedon, McLain series takes a regular sequence, Figure 6. There is a gradual decline from the A horizon (1.8%) to as low as 0.2% in the B3 horizon. The influence on the structure of the soil ranges from weak fine granular at the upper horizons where the organic matter is highest, to weak medium subangular blocky in the middle horizons as the organic matter decreases and then grades to weak coarse subangular blocky in the lower horizons. The thick organic matter accumulation gives this pedon a classification of Pachic Argiustolls.

The organic matter distribution of Teller series, Figure 6, is

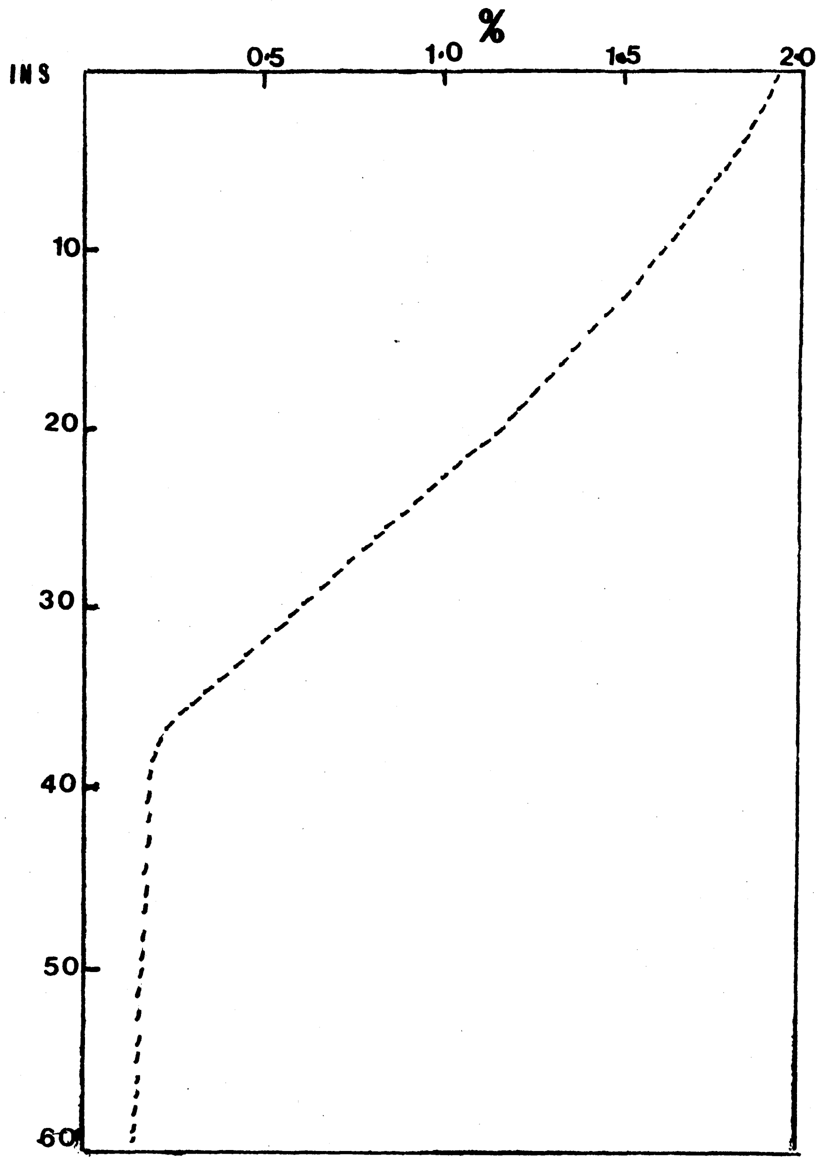

Figure 6. Organic Matter Distribution McLain Series Pachic Argiustolls.

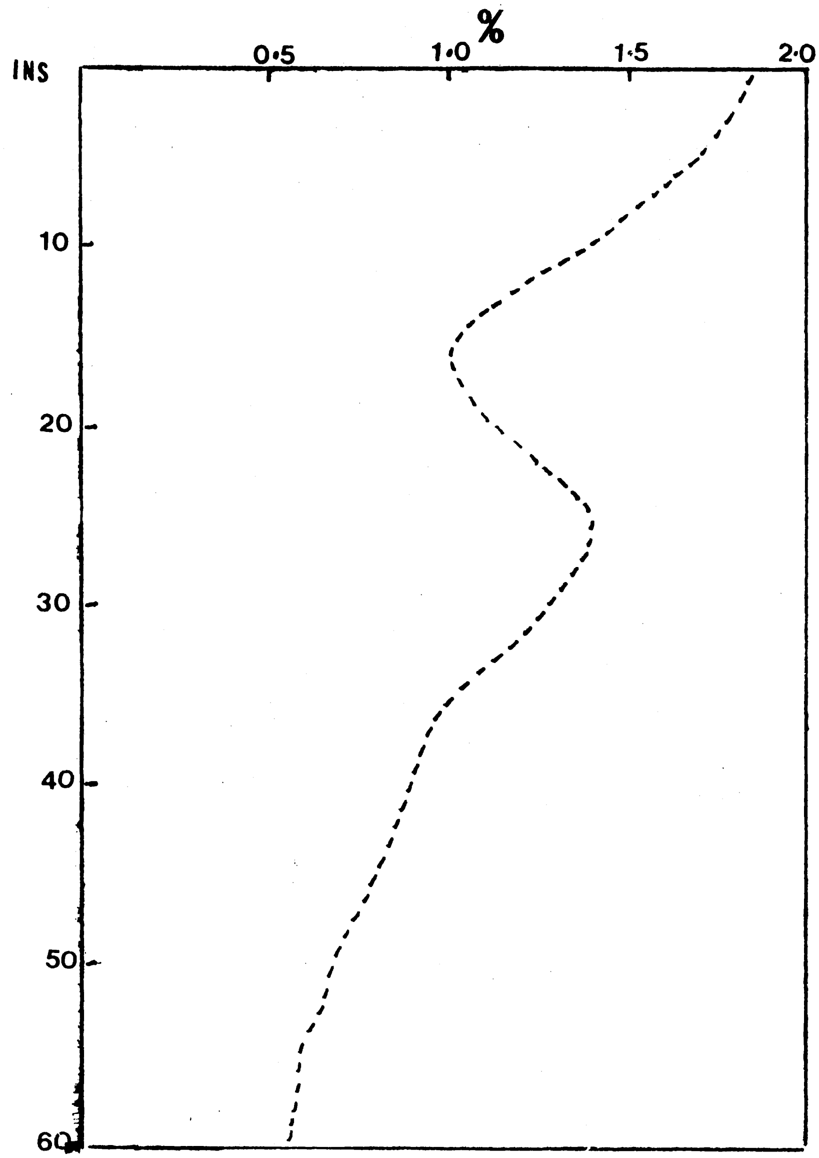

Figure 6. Organic Matter Distribution Taxadjunct
(con't) to Teller Series Udic Argiustolls.

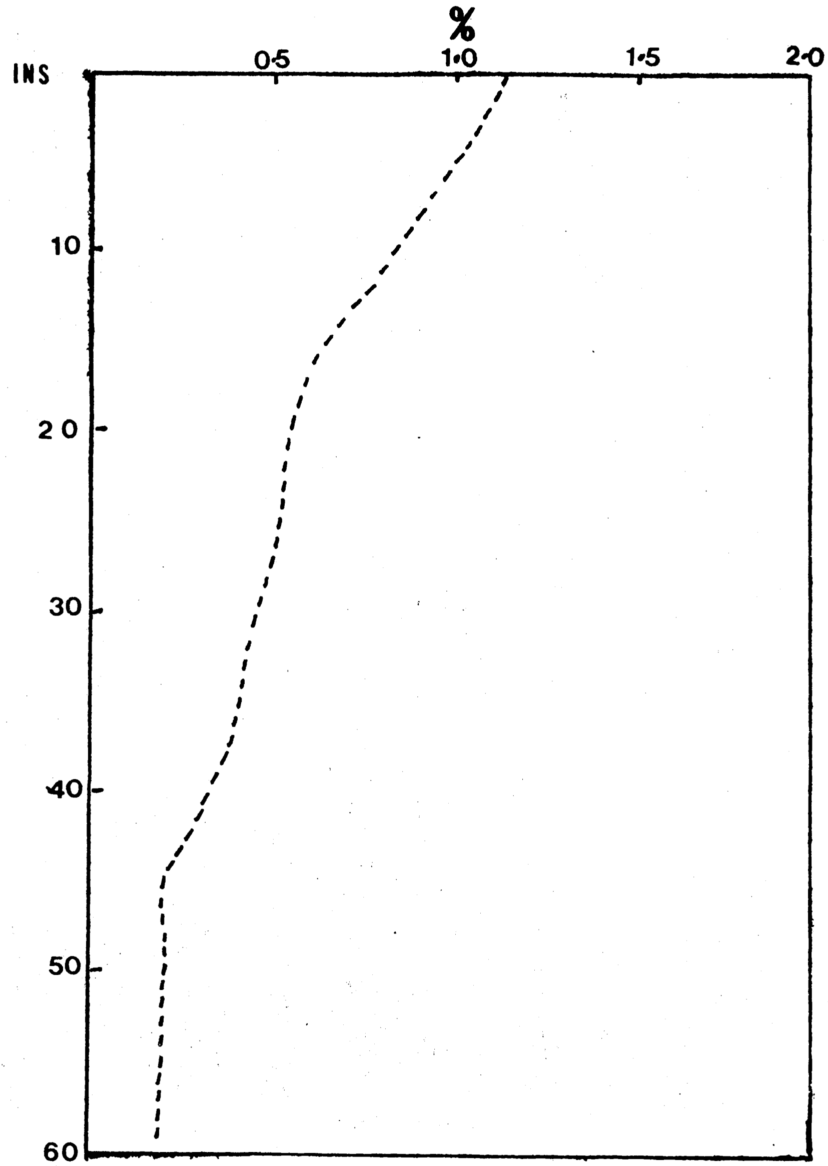

Figure 6. Organic Matter Distribution Oscar
(con't) Series Typic Natrustalfs.

irregular. There is a buried horizon at 38 inches down the profile, an indication of fluvial interruption during soil development. There is, however, a high level of organic matter accumulation at greater depths down the profile. The structural variability of this pedon ranges from moderate fine subangular blocky at the A horizon then to moderate medium granular at the buried horizon and medium subangular blocky which further grades to weak medium subangular blocky. This pedon is a Udic Argiustolls.

The organic matter distribution of Oscar series, Figure 6, shows low overall percentages has a regular reduction down the profile. The percentage organic matter barely makes a 1% mark in the upper horizon. The structural variability shows less significant organic matter influence in structural formation even in the upper horizons. There is a platy vesicular surface of about one inch below which there is a weak medium subangular blocky structure. The structure grades to weak medium subangular blocky. Field probing and examination indicate some degree of structural degeneration due to the influence of salts. The classification of this pedon is Typic Natrustalfs.

Organic matter content of a soil is related to the favorable structural development of such a soil and this in turn has a bearing on good root development and crop growth.

Electrical Conductivity (E.C.)

There is considerable variability in salt content of pedons examined, Figure 7. The variations range from low levels in Port series to higher levels in Oscar series.

The E.C. 25^{o}C (1:1 water extract) in the taxadjunct Port series

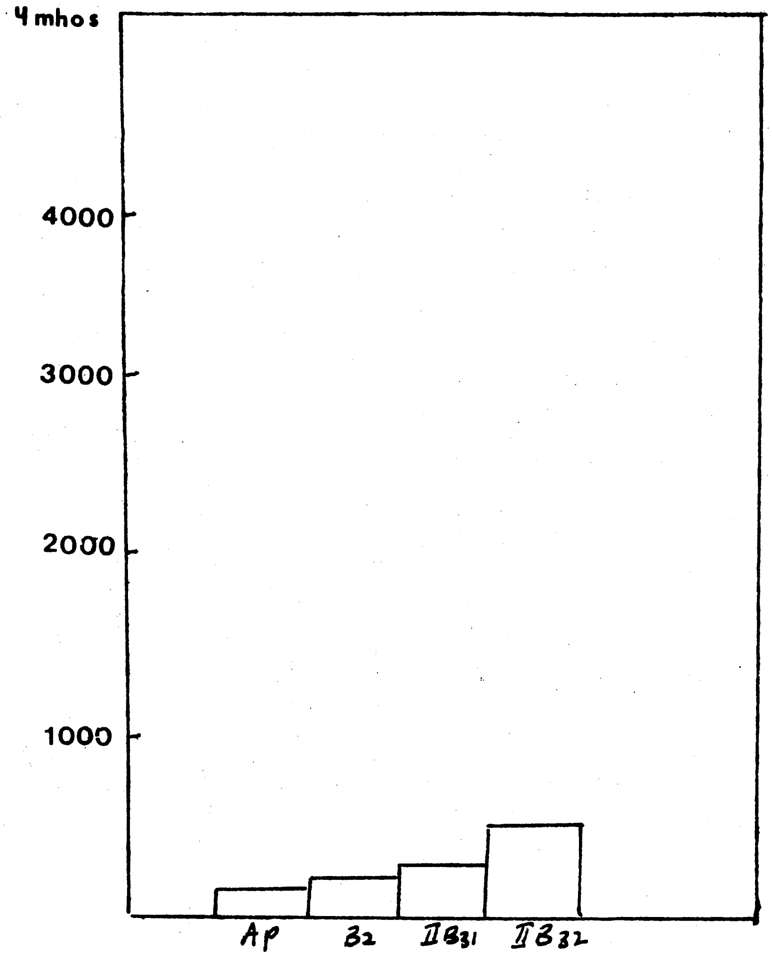

Figure 7. Salinity levels taxadjunct to Port Series Fluventic Haplustolls.

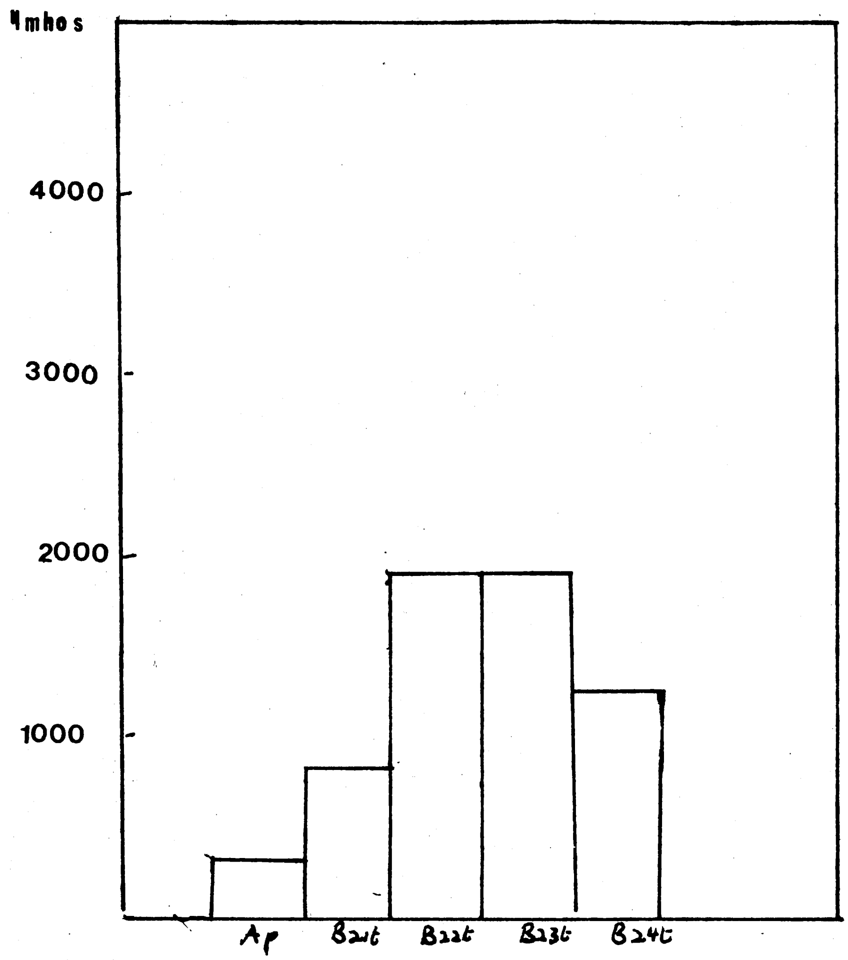

Figure 7. Salinity level Oscar Series Typic
(con't) Natrustalfs.

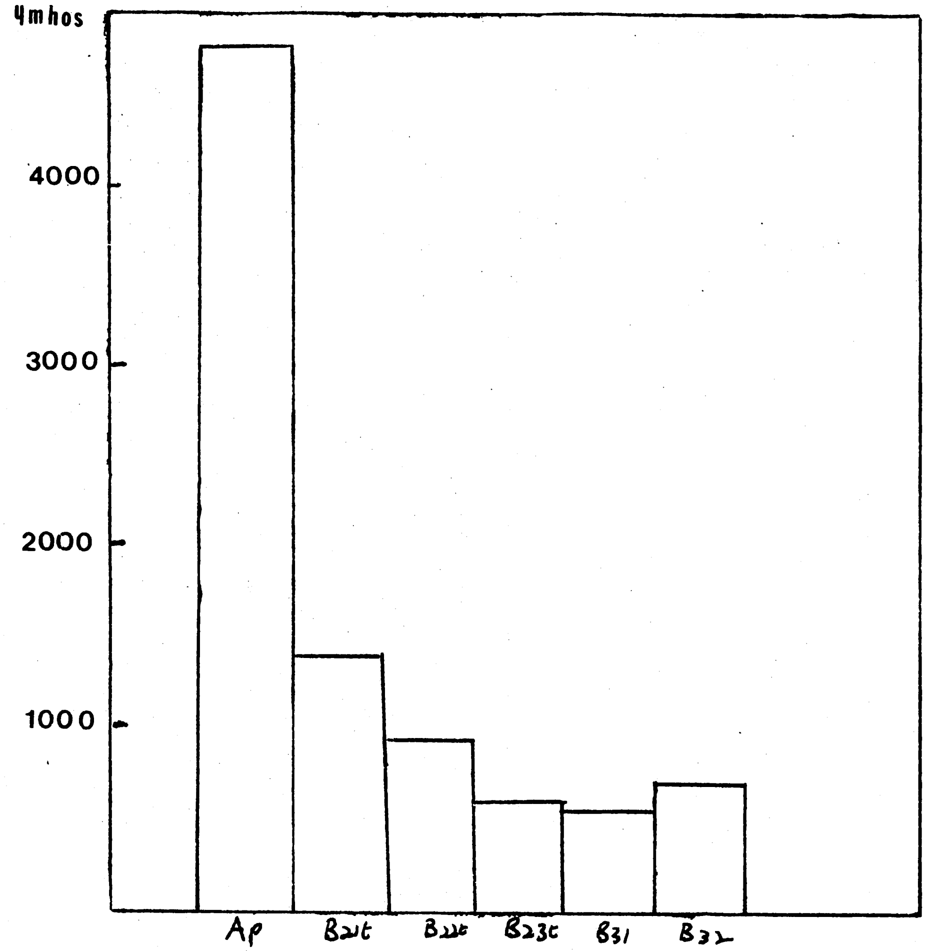

Figure 7. Salinity level Taxadjunct to Oscar
(con't) Series Typic Natrustolls.

(Figure 7) shows the lower level to be 500 micro mhos/cm. There is a gradual increase in the levels down the profile in this series. These levels are negligible and the profile may be considered as being free from salinity problem. The Oscar fine silt loam (Figure 7) shows some accumulation in salts. The E.C. reading is close to 2000 micro mhos/cm. There is an increase down the profile with much of the accumulation in B22, B23 horizons. The levels then drop off down the profile. The source of salts may be from two sources dissolved salts from the Permian Red Beds within the catchment area of the Stillwater Creek and from groundwater table movements. Though these levels are still low to offer any salinity problems, there is a possibility of a build-up with time.

The taxadjunct to Oscar pedon shows a higher accumulation of salts; the highest E.C. reading being 4,800 ymhos/cm. Similar pedons profile 11, transect 5, show even higher levels of 5,600 ymhos/cm. (Appendix B) 76-OK-60-10, transect 4. These levels are high enough to affect most crops, the wheat crop found at the location at the time of sampling was adversely affected. This pedon showed some salt crust on the surface with streaks ("eyes" of salt) down the profile. Salt accumulation is highest at the surface and reduces sharply down the profile. The high water table of this pedon suggest that most of the salts might be from the groundwater, however, the adjoining upland supply some part of the salt since the parent material, Permian Red Beds, are known to be high in salts.

Sodium Levels

The variability in sodium levels follows a similar trend as the variability in salt content of affected pedons. The sodium levels are

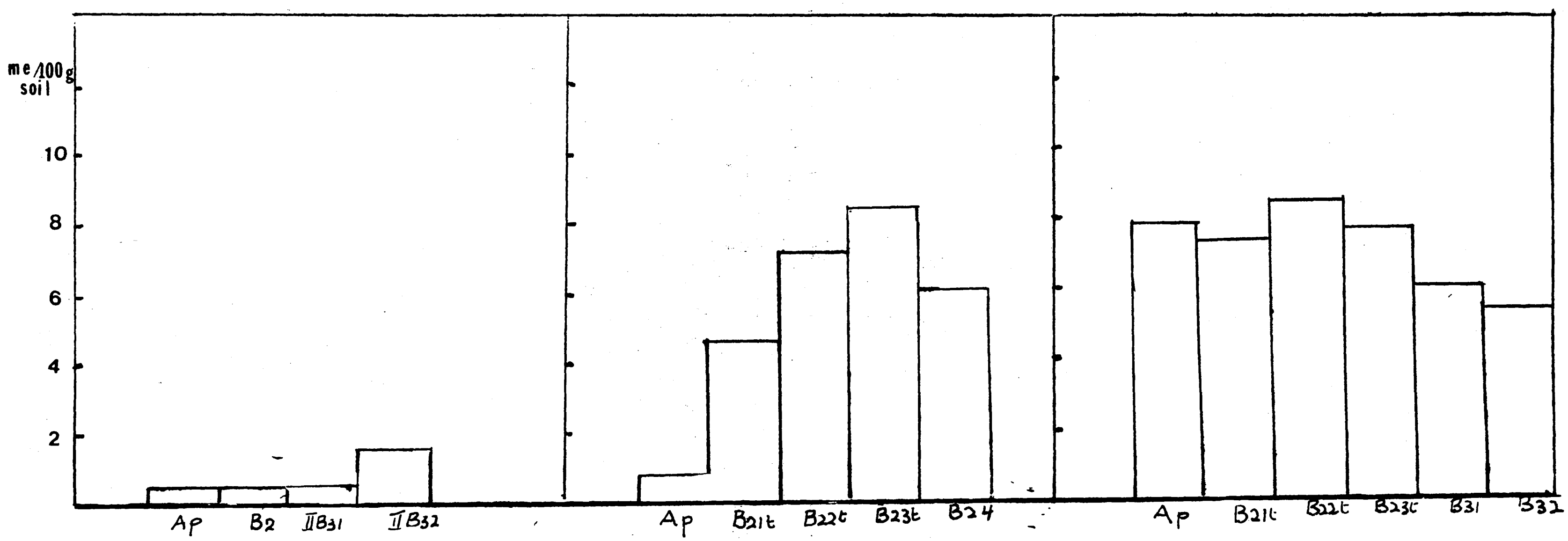

Figure 8. Sodium Levels in Selected Pedons

Taxadjunct Port Series

Oscar Series

Taxadjunct to Oscar Series

measured in milli-equivalents per 100 gms. of soil. The Port silt loam (Figure 8) has the lowest level of sodium, with levels increasing with depth. This trend is similar to the salt trend. The Oscar fine silt loam (Figure 8) shows higher levels of sodium than Port silt loam. A-part from the A horizon where levels are low in the Oscar series, the levels increase with depth down to B23t and then decline gradually. The trend in sodium accumulation is similar to the salt accumulation in the same profile.

The levels of sodium in Oscar part of Port-Oscar complex shows significantly high levels throughout both in the Oscar and Oscar taxad-junct series (Figure 8) and have adversely affected their permeability to water and air. These soils are also difficult to probe or auger. The trend in salinity or sodicity of the two affected pedons (8b, 8c) is towards saline alkaline soil. This situation is further aggravated by the texture of the soil which is of a fine, silty nature.

Soil Reaction in Relation to Alkalinity and Salinity of 2 Pedons (Table IV)

There is considerable variation in soil pH reaction, E.C., and ex-changeable sodium percentage in both the Oscar and the taxadjunct to Oscar pedons. In addition, these 2 pedons exhibit a fluctuating water table with the taxadjunct to Oscar rising up to the soil surface (Table IV). The rise in the water table is associated with the transportation of salts up to the profiles.

The high pH values of Oscar between 8 and 9 suggest significant amounts of exchangeable sodium in this profile thus the soil can be said to be alkaline (2). The E.S.P. values are also above 15% in cer-

TABLE IV

PHYSICAL AND CHEMICAL CHARACTERISTICS OF OSCAR SERIES, TYPIC NATRUSTALF

		Percent			Extractable Cations Me/100g.						OM		Water Table
Horizon	Depth	Sand	Silt	Clay	Ca	Mg	K	Na	pH	Ec	%	ESP	Variation
Ap	0-10	43.7	45.0	11.3	5.0	5.5	0.4	0.7	6.5	310	1.0	6.03	
B21t	10-19	15.0	62.5	22.5	11.1	12.7	0.4	4.5	8.6	820	0.6	15.67	1 > 5ft.
B22t	19-29	33.7	45.0	21.3	28.1	14.5	0.4	6.9	8.7	1940	0.5	13.83	
B23t	29-50	31.3	47.5	21.2	24.0	15.1	0.4	8.1	8.9	1940	0.4	17.02	
B24t	50-73	16.3	60.0	23.7	12.9	8.7	0.4	6.1	9.0	1190	0.2	21.7	
					Taxadjunct to Oscar, Typic Natrustolls								
Ap	0-8	27.5	52.5	20.0	5.7	6.2	0.4	7.9	7.7	4810	1.8	39.11	
B21t	8-13	8.8	62.5	28.7	7.9	10.3	0.4	7.3	8.1	1400	1.6	28.19	
B22t	13-19	2.5	60.0	37.5	8.8	13.1	0.5	8.5	8.2	930	1.9	27.51	0 > 5ft.
B23t	19-35	6.3	57.5	36.2	21.4	21.0	0.5	7.7	8.5	610	1.3	15.22	
B31	35-44	20.0	52.5	27.5	29.7	16.7	0.5	6.1	8.6	540	0.6	11.51	
B32	44-61	18.8	57.5	23.7	42.2	15.1	0.4	5.4	8.6	710	0.5	8.56	

tain parts of the horizon, an indication that this pedon is trending towards sodicity.

The taxadjunct to Oscar in the Port-Oscar mapping unit gives an indication of high alkalinity and salinity. The E.C. are above 4,000 micro mhos in the upper horizons and reduces down the profile. The E.S.P. is far above the 15% level and pH values range between 8.6 to 9.0 throughout most part of the profile. Thus, Oscar pedon in Port-Oscar complex can also be classified as being sodic (2, 35).

Physical and Chemical Properties of Soils in Relation to Irrigation Interpretation (Table V)

The use of physical and chemical properties of soil for irrigation and drainage interpretation depends heavily on knowledge of the principles and techniques of agronomy, engineering, economics, hydrology, ecology and other related disciplines. The intricate interrelaionship of these disciplines can be demonstrated in the field, for example, field processes such as land leveling, pipe or tile installations, land clearing and crop cultivation, require the cooperation of all the related disciplines. The interpretation of soil properties for irrigation in the alluvial plain will include soil properties in relation to type of irrigation system.

Soils in the Group A, Table 5, will not require much land movement if flooding or furrow irrigation is to be used. However, the low infiltration rate will require special techniques for furrow cropping. With sprinkler irrigation, soils in this group will not offer high ponding risks since application rates can be adjusted to suite the intake rate. The soil reaction is slightly acid in the upper horizons

TABLE V

OBSERVED AND MEASURED SOIL PROPERTIES AND SOIL QUALITIES OF THE PROJECT AREA FOR BASIC IRRIGATION USE

A* Series Name	Pedon #	Map Symbol	Surface Horizon A & B2 ins	Seasonal water table levels feet	U.S.D.A. Solum Texture	Permeability ins/hr.	Available Water Holding Capacity 60"	Soil Reaction Ranges	Electrical Conductivity Ranges 4 mhos/cm 25°C
McLain	18	7B	21	2 > 5	SiL over SicL	0.2-0.6	>8"	6.2-8.2	140-340
McLain[1/]	21	7B	32	2 > 5	SicL over SiL	02.-0.6	>8"	6.5-8.3	120-260
Port	22	12D	44	4 > 5	SiL over SicL	0.2-0.6	>8"	6.4-8.2	110-270
Port-like in McLain[2/]	23	7B	53	> 6	SiL over L	0.6-2.0	>8"	6.2-8.2	130-270
McLain	24	7B	39	> 6	SicL over SiL	0.2-0.6	>8"	6.4-7.9	120-270
Port[1/]	5	12D	62	3 > 6	L over SiL	0.6-2.0	>8"	5.5-7.4	230-390
Pulaski[1/]	7	14F	62	> 6	SiL over L	0.6-2.0	>8"	5.5-6.4	270-540
Port	9	12D	80	> 6	SiL over L	0.6-2.0	>8"	6.3-7.0	140-230
Pulaski[1/]	12	14F	62	> 6	L over SiL	0.6-2.0	6-8"	6.2-6.7	140-230
Port[1/]	13	12D	45	4 > 6	L over SiL	0.6-2.0	>8"	6.0-8.1	150-430
Pulaski[2/]	14	12D	62	4 > 6	SL over L	0.6-2.0	6>8"	5.9-8.0	160-650
Port[2/]	17	14F	47	4 > 6	L over SiL	0.6-2.0	>8"	6.6-8.0	190-300
Port	19	12D	41	3 > 5	SiL over L	0.6-2.0	>8"	6.5-8.0	160-410
Port[1/]	20	12D	23	2 > 6	CL over L	0.06-0.2	6-8"	6.7-8.6	170-500
Port	25	12D	41	3 > 6	L over SiL	0.2-0.6	>8"	5.9-8.3	140-300

TABLE V (CONTINUED)

Series Name	Pedon #	Map Symbol	Surface Horizon A & B2 ins	Seasonal water table levels feet	U.S.D.A. Solum Texture	Permeability ins/hr.	Available Water Holding Capacity 60"	Soil Reaction Ranges	Electrical Conductivity Ranges 4 mhos/cm 25°C
Port[1/]	28	12D	35	> 6	SiL over SicL	0.2-0.6	>8"	6.1-7.8	140-350
B*									
Teller[1/]	29	16H	49	4 > 6	L over SiL	0.6-2.0	>8"	5.7-8.2	150-350
Teller[1/]	30	16H	72	> 6	L over SiL	0.6-2.0	>8"	5.8-6.7	140-760
Teller[1/]	31	16H	76	> 6	L over SiL	0.6-2.0	>8"	6.2-8.0	170-430
Teller[1/]	6	15G	56	> 6	SiL over L	0.6-2.0	>8"	5.3-6.2	290-380
C*									
Port[1/]	1	13E	65	3 > 6	SiL over SiL	0.6-2.0	>8"	5.7-8.2	230-620
Oscar[1/]	2	13E	35	0 > 5	SiL over SiCL	0.06-0.2	>6"	7.7-8.6	540-4810
Port	3	13E	32	3 > 6	L over SiL	0.6-2.0	>8"	7.0-8.1	510-820
Port	4	13E	77	5 > 6	L over SiL	0.6-2.0	>8"	6.3-7.0	120-390
Port[2/]	8	13E	35	3 > 6	L over SiCL	0.6-2.0	>8"	5.3-7.9	280-730
Oscar	10	13E	46	1 > 5	L over SiCL	0.06-0.2	>6"	7.1-8.5	660-5620
Oscar	11	13E	73	1 > 5	L over SiCL	0.2-0.6	>8"	6.5-9.0	310-1940
Drummond	15	8C	64	1 > 5	L over SiCL	0.06-0.2	>8"	7.2-8.7	370-1510
McLain[1/]	16	8C	45	2 > 5	L over SiCL	0.2-0.6	>8"	6.4-7.0	290-380

TABLE V ‘CONTINUED)

Series Name	Pedon #	Map Symbol	Surface Horizon A & B2 ins	Seasonal water table levels	U.S.D.A. Solum Texture	Permeability ins/hr.	Available Water Holding Capacity 60"	Soil Reaction Ranges	Electrical Conductivity Ranges 4 mhos/cm 25°C
McLain[1/]	26	8C	48	3 > 6	SiL over SiCL	0.2-0.6	>8"	5.8-8.5	260-1190
McLain[1/]	27	8C	50	> 6	SiL over CL	0.2-0.6	>8"	5.8-7.0	120-230

*A, B, C - Irrigation Classification grouping. Page 58 Figure 9

1/ Taxadjunct

2/ Inclusion

while the electrical conductivity readings are within safe limits for most crops. The high silt content of the upper horizons will offer stability and compacting problems if used for levee constructions. The silt is also likely to clog subsurface tile installations and thus might require regular maintenance.

Soils in Group B, Table 5, have deep topsoils and high water holding capacity. The major limitation is slope which varies from moderate to severe. Problem of land leveling and land compaction will arise if flooding or furrow irrigation is to be used. Shorter furrows might be the answer for soil series in this group with fairly steep slopes.

With sprinkler irrigation, head losses will be high and sprinkler lines will have to be moved at shorter intervals. Since the soils have a moderate intake rate, Table 6, the rate of application can be adjusted to avoid ponding problems. The sprinkler irrigation system is probably the most suited for this group of soils. This soil group does not offer drainge problems and there is no risk of flooding from the Stillwater Creek. The soil texture is quite suitable for levee and embankment construction.

The group C soils, like the group A and B, are deep soils with variable water holding capacity. Though the soils have moderate slopes, other soil factors like salinity and sodicity will make application of water less efficient.

These soils are occasionally and rarely flooded, but there is a need for drainage. The rise of the water table to the upper horizons during the wetter parts of the season brings along undesirable salts which partly account for the high soil reaction. The flood waters from the upland soils developed from the Permian Red Beds (high salt content) also contribute to the salinity. These soils will thus require surface drainage to correct the high salt problem.

Irrigation Soil Grouping of Project Area
Figure 9 and Table VI

Soils are grouped using similarity in properties and qualities from the standpoint of irrigation suitability.

This grouping takes into consideration factors that affect the use of these alluvial soils for two types of irrigation; namely sprinkler and furrow irrigation. Soil factors such as permeability, infiltration, salinity and alkalinity are considered. Other factors considered are susceptibility to stream overflow, erosion and suitability for levee or embankment construction (Table 4).

Four groups are recognized - A, B, C, and D:

Group A. Soils have deep to very deep profiles. Soil textures range from moderately fine to medium. Permeability is moderate to moderately slow, drainage is good and available, water holding capacity is greater than 6 inches per 40 inches of soil. Salinity problem is non-existent and slopes do not exceed 1%.

Group B. Soils have deep profiles. Soil texture ranges from moderately fine to medium. The permeability and water holding capacity are moderate and drainage is good. There is no salinity problem but slopes range from 1 - 5%. Some amount of earth movement will be needed if furrow irrigation to be used.

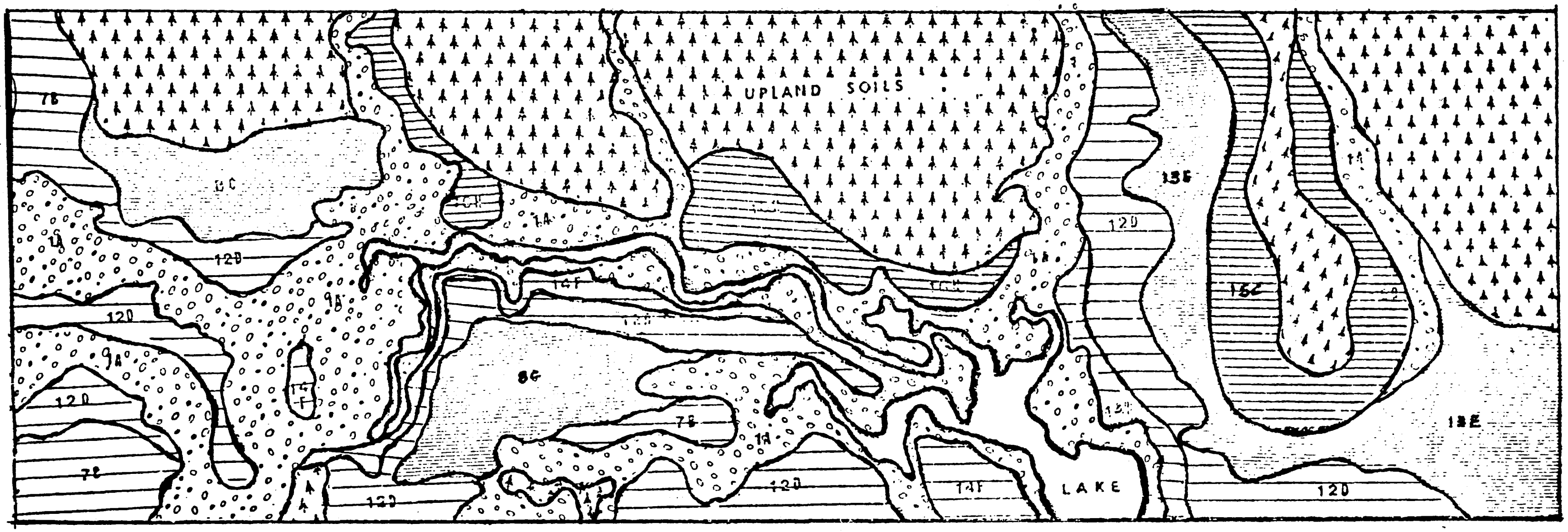

Figure 9. Irrigation Suitability Groups

	Very Good Soil	Class A
	Good Soil	Class B
	Fair Soil	Class C
	Not Suitable	Class D

TABLE VI

Interpretation For Irrigation Groups in Figure 9

Name	Map Unit	Irrigation Group	Water Holding Capacity	Root Depth of Soils	Slope Related to Efficiency of H_2O and Potential Erosion	Water Intake Rate	Need for drainage and depth to water table	Susceptibility to Stream Overflow	Salinity or Alkalinity	Topography Related and Subsurface Irrigation	Hazard of H_2O Erosion	Hazard of Soil Blowing	Levees & Embankment Stability Compressibility Resistant to Piping
McLain Silty Clay Loam 0-1%	7B	A	High	Deep	Slight	Moderately Slow	Slight	Rare	None	None	None	Slight	Poor
Port Silt Loam 0-1%	12D	A	High	Deep	Slight	Moderate	None to Slight	Occassional	None	None	None	Slight	Fair
Pulaski Fine Sandy Loam Variant 0-1%	14F	A	High	Deep	Slight	Moderate	None	Occassional	None	None	None	Slight	Fair
Teller Loam Variant 1-3%	16H	B	High	Deep	Moderate	Moderate	None	Rare	None to Slight	Slight to Moderately Severe	Slight	None	Fair
Teller Loam Taxadjunct 3-5%	15G	B	High	Deep	Severe	Moderate	None	Rare	None	Severe	Slight	None to Slight	Fair
McLain-Drummond Complex 0-2%	8C	C	Medium	Deep	Moderate	Slow	Severe	Rare	Severe	Slight to Moderately Severe	Slight	None	Poor
Port-Oscar Complex 0-2%	13E	C	Medium	Deep	Moderate	Slow to Moderately Slow	Severe	Occassional	Moderate to Severe	Severe	Slight	None to Slight	Poor
Broken Loamy Alluvial Land 0-5%	1A	D			Too Variable to Rate								

Group C. Soils have deep profiles. The texture of the soils are moderately fine to fine. Permeability is slow to moderately slow. Drainage is poor and various degrees of salinity hazards exist.

Group D. Soils are highly variable in nature. They range from deep to moderately deep. The texture also shows some considerable degree of variability from fine through coarse. These soils are also subject to frequent flooding. The topography varies from 0 - 5%. The area is scattered with depressions and hummocks. These soils are not suitable for either sprinkler or furrow irrigation unless they are greatly improved.

Land Capability Classification of Project Area
Table VII and Figure 10

Of the 8 capability classes to which land is normally classified, the project area falls into four of the groups, Figure 5. All soils in the Payne County area carry capability grouping which give general information on their limitations.

The McLain series is in Class I, that is, soils have few limitations and different types of crops can be cultivated on such soils with minimum problems and good yields. These soils are normally highly priced. The Port silt loam has wetness as a limitation, a result of the occasional flooding to which it is subjected seasonally. The Teller loam variant has erosion as a limitation. This is because of 1 - 3% slope while the Pulaski has wetness as a limitation. Both the McLain-Drummond complex and Port-Oscar complex have quite severe limitations;

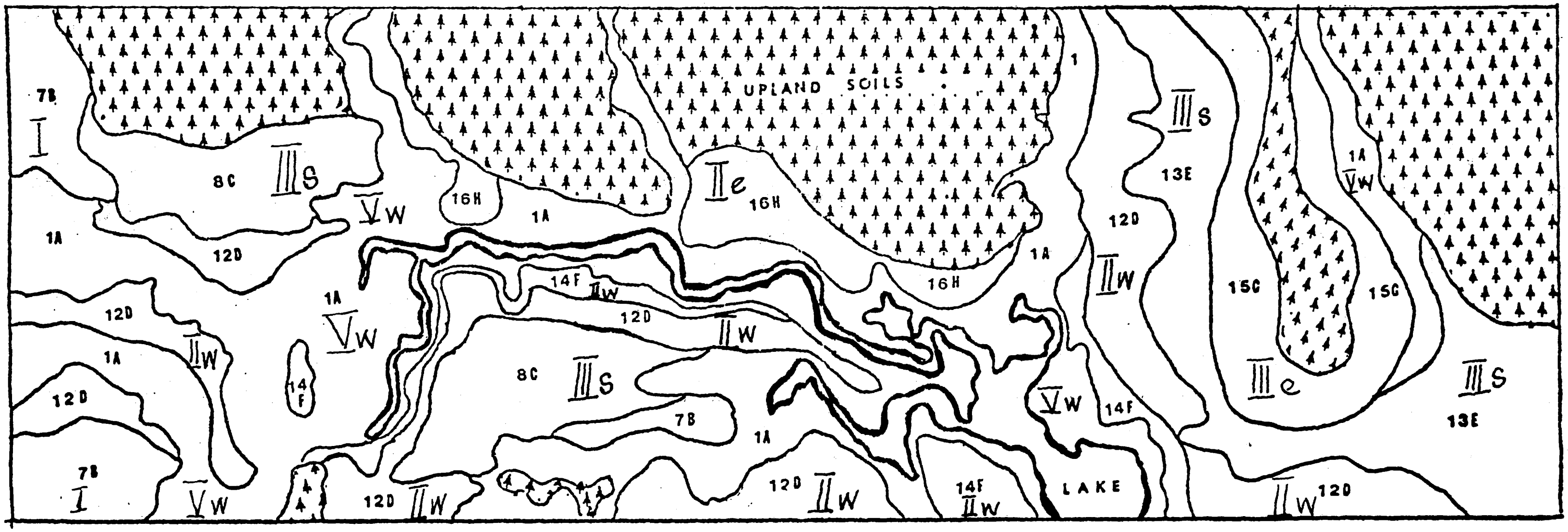

Figure 10. Land Capability Classification (Dryland).

TABLE VII

LAND CAPABILITY CLASSIFICATION

Soil Name	Soil Symbol	Capability Class	Brief Description of Soil and It's Limitations
McLain Silty Clay Loam 0-1%	7B	I	Deep, nearly level loamy soils on rarely flooded flood plain
Port Silt Loam 0-1%	12D	IIw	Deep, nearly level loamy soils on occassionally flooded flood plain
Pulaski Fine Sandy Loam Variant 0-1%	14F	IIw	Deep, nearly level loamy soils on occassionally flooded flood plain
Teller Loam Variant 1-3%	16H	IIe	Deep, very gently sloping loamy old alluvial soils that receive run off water from adjacent uplands
McLain-Drummond Complex 0-2%	8C	IIIs	A mixture of deep, nearly level and very gently sloping loamy soils and alkaline and saline soils on rarely flooded flood plain
Port-Oscar Complex 0-2%	13E	IIIs	A mixture of deep, nearly level and very gently sloping loamy soils and alkali and saline soils on occassionally flooded flood plain
Teller Loam Taxadjunct 3-5%	15G	IIIe	Deep, gently sloping loamy old alluvial soils that are susceptible to moderate erosion
Broken Loamy Alluvial Land	1A	Vw	Deep, nearly level through sloping loamy soils on frequently and occassionally flooded flood plain

these include both slope and salinity and/or alkalinity. The Teller loam taxadjunct by virtue of it's high slopes is susceptible to erosion. The broken loamy alluvial land has such variability of soil types and such severe limitations that it belongs to Class V. Such soils are normally not suitable for crop cultivation and they are generally left in their natural state.

Crop Yields Dryland and Irrigated
Table VIII

Irrigation practice in Payne County is not widely practied; the major reason being lack of water. Also, the crops cultivated under dryland conditions fairly fit into the rainfall pattern (annual rainfall 33"). The major crop is wheat. Historically, some irrigation, mainly sprinkler type, was being practiced in the county on a small scale since 1918. Unpublished records on Payne County show that much of the irrigation was supplemental carried out on strawberries, vegetables, grain sorghum, soybeans and alfalfa pasture (22).

The highest acreage cultivated on record was in 1958, (3,400 acres), using surface water and much of the acreage was used for alfalfa cultivation. Since then, acreages irrigated have dropped to 400 acres (1975) and much of it was on alfalfa.

Though the quality of water on the main Cimmaron River is low, the Stillwater Creek has high quality water for irrigation. The SAR figures throughout the year and the Boron levels are known to be far below toxic levels. The method of irrigation suitable for farming is of the supplemental type. The adaptation of this method of irrigation mangement will depend on the quantity and distribution of rainfall from year to year and demand by consumers for better crop quality. Much of the supple-

TABLE VIII

ESTIMATED CROP YIELDS UNDER THREE LEVELS OF MANAGEMENT, COMMON (A) HIGH LEVEL (B) AND IRRIGATED

Soil Name	Map Unit	Acreage	Bu/Ac Grain Sorghum Dryland A	Bu/Ac Grain Sorghum Dryland B	Bu/Ac Grain Sorghum Irrigated	Bu/Ac Soy Bean Dryland A	Bu/Ac Soy Bean Dryland B	Bu/Ac Soy Bean Irrigated	Tons/Ac Alfalfa Dryland A	Tons/Ac Alfalfa Dryland B	Tons/Ac Alfalfa Irrigated
McLain Silty Clay Loam 0-1%	7B	20	51	72	122	24	34	58	3.6	5.0	7.0
Port Silt Loam 0-1%	12D	61	50	72	122	24	34	58	3.4	5.0	7.0
Pulaski Fine Sandy Loam Variant 0-1%	14F	17	35	67	114	17	32	54	2.6	4.6	6.4
Teller Loam Variant 1-3%	16H	15	41	59	100	19	28	48	1.8	3.0	4.2
McLain-Drummond Complex 0-2%	8C	29	31	58	99	15	27	46	1.7	4.0	5.6
Port-Oscar Complex 0-2%	13E	34	19	35	60	--		--	1.5	3.4	4.8
Teller Loam Taxad-junct 3-5%	15G	27	32	47	80	--		--	---		---
Broken Loamy Alluvial Land 0-5%	1A	117		--	--			--	---		---
Upland	--	160		--	--			--	---		---
TOTAL		480									

mental irrigation can be applied to avoid crop water stress or to enhance better crop cultivation timing. On balance, all the three crops: grain, sorghum and soybeans, may require approximately an additional 15 to 18 inches of water per annum (22).

With high levels of management under dryland cultivation, and irrigation, an expected 70% increase over dryland figures is expected in the county for grain crops and soybean and 40% for alfalfa in the Payne County. The percentage increase of irrigated versus dryland crop yields will be higher if the normal management levels are applied to dryland cultivation.

Yields are significantly high in the Class A soils (McLain silty clay loam, Port silt loam and Pulaski fine sandy loam). The Class B (Teller 1 - 3% and 3 - 5%) have higher yields than Class C soils (McLain-Drummond and Port-Oscar complex). High salts in Class C will adversely affect all three crops though they all have moderate levels of salt tolerance. The effect will be more apparent with the Port-Oscar complex soils where E.S.P. and E.C. values are appreciably high. The Class D soils, Broken loamy alluvial soils, are not suitable for irrigation.

CHAPTER VI

SUMMARY AND CONCLUSION

There has always been complex problems associated with mapping and classifying alluvial soils because of their spacial variability. In spite of this, it is possible to map, classify and interpret alluvial soils for both dryland and irrigated farming as this report has demonstrated. Variability of soils within short distances is less pronounced in older alluvial soils which are not subject to frequent flooding as is the case of McLain and Port series in 7B and 12D mapping units, than in younger soils which are frequently flooded as in the 1A mapping unit. Soil complexes as in Port-Oscar complex have more than one interpretation. The Port series, which is free from alkalinity problems, will manage differently from the Oscar series which is normally saline and alkaline. The same interpretation applies to soil inclusions within a major series.

The problem of salinity and alkalinity, is not yet very serious within the project areas. In most affected areas, the trend is towards increased salinity and alkalinity. Such soils can present formidable problems in the forseeable future if not corrected now. The soils affected are fine textured with high seasonal water tables which makes correction highly problematic. Soils like Oscar series are not only saline, but alkaline as well.

Soil interpretation for irrigation farming (supplemental type) is a feasible preposition, in spite of existing problems. Crops such as sorghums, soybeans and alfalfa can be cultivated profitably with less risks of total crop loss due to adverse weather condition, principally erratic frequency of rainfall. The importance of supplemental irrigation can gain momentum when better crop quality is required, where prices are increased and if more surface dams are built in the Payne County. The cropping potentials of the project area have not been fully exploited. This report on mapping, classifying and interpreting of an alluvial plain can help realize this possibility. It is also evident from this report that soils with extreme variability such as in the 1A mapping unit are impracticable to map with the scale used and the time available.

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APPENDIX A

DESCRIPTIONS OF OTHER PEDONS EXAMINED WITHIN THE PROJECT AREA WITH SOILS ARRANGED ACCORDING TO THE ORDER THEY WERE SAMPLED

FIGURE 2

NAME: Port Taxadjunct to Port lacks mollic epipedon

CLASSIFICATION: Typic Usti-fluvents fine, silty mixed thermic non-acid.

PEDON NUMBER: 76-OK-60-1 Transect 1

LOCATION: 140' west and 30' north of southeast corner of Sec 3; T.19N.; R.1W.

MAP UNIT: 13 E

Alp - 0 to 14 inches; dark reddish brown (5YR 3/4) silt loam; weak, fine, granular structure; friable moist; smooth, clear boundary.

B2 - 14 to 25 inches; reddish brown (2.5YR 4/4) silt loam, moderate fine subangular blocky; friable, smooth, clear boundary.

Ab - 25 to 32 inches; dark reddish brown (5YR 3/3) silt loam; moderate fine granular; friable moist, gradual boundary.

II B21t - 32 to 40 inches; dark brown (7.5YR 3/2) silt loam; strong, medium angular blocky and strong, medium subangular blocky; firm moist; clay films on ped surface; smooth, clear boundary.

II B22t 40 to 47 inches; dark reddish brown (5YR3/4) silty clay loam; moderate, fine, angular blocky and moderate fine subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

II B23t - 47 to 65 inches; dark reddish brown (2.5YR 3/4) silt loam; weak, medium, subangular blocky; clay films on ped surfaces; friable when moist.

SOIL TYPE: Port

CLASSIFICATION: Cumulic Haplustolls Fine Silty Mixed Thermic

PEDON NUMBER: 76-OK-60-4 Transect 1

LOCATION: 140' west and 830' north of southeast corner Sec 3; T.19N.; R.1W.

MAP UNIT: 13 E

A1 - 0 to 9 inches; dark brown (7.5YR 3/4) loam; weak, fine granular; friable moist; smooth, clear boundary.

B2 - 9 to 26 inches; reddish brown (5YR 4/4) loam; weak, coarse prismatic; friable moist; smooth, clear boundary.

Ab - 26 to 41 inches; very dark brown (7.5YR 2/2) silt loam; moderate, fine granular; friable moist; smooth, clear boundary.

II B1 - 41 to 59 inches; dark reddish brown (5YR 3/3) loam; weak, medium subangular blocky; friable moist; smooth, gradual boundary.

II B21 - 59 to 68 inches; reddish brown (5YR 4/4) matrix mottled red (2.5YR 4/6) and brown (7.5YR 5/3) clay loam; weak, fine subangular blocky; firm moist; smooth, gradual boundary.

II B22t 68 to 77 inches; yellowish red (5YR 4/6) clay loam; moderate, fine angular blocky; firm moist; clay films on ped surfaces; smooth, abrupt boundary.

SOIL TYPE: Taxadjunct to Port, Lacks Mollic Epipedon

CLASSIFICATION: Typic Usti-fluvents, fine silty, mixed, thermic, non-acid.

PEDON NUMBER: 76-OK-60-5 Transect 2

LOCATION: 1140' west and 30' north of southeast corner Sec 3; T.19; R.1W.

MAP UNIT: 12 D

Alp - 0 to 22 inches; yellowish red (5YR 4/6) loam; very weak, fine granular; very friable moist; smooth, abrupt boundary.

II Al - 22 to 30 inches; dark reddish brown (2.5YR 3/4) loam; weak, coarse subangular blocky; weak, firm moist; smooth, clear boundary.

II A12 - 30 to 45 inches; dark brown (7.5YR 3/2) silt loam; weak, fine granular; weak, firm moist; smooth, clear boundary.

II B2 - 45 to 62 inches; reddish brown (2.5YR 4/4) silty clay loam; weak, fine angular blocky; firm moist.

SOIL NAME: Taxadjunct to Pulaski because of coarse silty control section

CLASSIFICATION: Typic Usti-fluvent coarse silty mixed thermic non-acid

TRANSECT NUMBER: 76-OK-60-7 Transect 3

LOCATION: 1900' west and 510' north of southeast corner Sec 3; T.19N.; R.1W.

MAP UNIT: 14 F

Alp - 0 to 6 inches; reddish brown (5YR 4/4) silt loam; weak, fine granular; very friable moist; smooth clear boundary.

A12 - 6 to 13 inches; reddish brown (2.5YR 4/4) loam; weak, fine subangular blocky; friable moist; smooth, clear boundary.

Ab - 13 to 30 inches; dark reddish brown (5YR 3/2) loam; moderate, medium subangular blocky; friable moist; smooth, diffused boundary.

II B21 - 30 to 48 inches; dark reddish brown (2.5YR 2/4) silt loam; moderate, medium subangular blocky; firm moist; smooth boundary.

II B22 - 48 to 62 inches; dark reddish brown (2.5YR 3/4) silt loam; weak, medium subangular blocky; very firm moist.

SOIL NAME: An inclusion in Port, it has argillic and mollic less than 20"

CLASSIFICATION: Udic Argiustolls fine silty mixed thermic

PEDON NUMBER: 76-OK-60-8 Transect 3

LOCATION: 1710' west and 850' north of southeast corner of Sec 3; T.19N.; R.1W.

MAP UNIT: 13 E

A1p - 0 to 7 inches; dark reddish brown (5YR 3/3) silt loam; moderate, fine granular; friable moist; smooth, clear boundary.

B1 - 7 to 15 inches; dark reddish brown (5YR 3/4) loam; weak, coarse subangular blocky; friable moist; smooth, clear boundary.

B2t - 15 to 35 inches; dark reddish brown (5YR 3/4) silty clay loam; weak, coarse subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B31 - 35 to 50 inches; reddish brown (2.5YR 4/4) clay loam; weak, coarse subangular blocky; firm moist; smooth, clear boundary.

B 32 - 50 to 62 inches; dark red (2.5YR 4/6) clay loam; weak, coarse subangular blocky; firm moist.

NAME: Port series with 13" overwash

CLASSIFICATION: Cumulic Haplustolls fine silty mixed thermic

PEDON NUMBER: 76-OK-60-9 Transect 4

LOCATION: 2040' west and 1480' north of southeast corner of Sec 3;
T.19N.; R.1W

MAP UNIT: 12 D

A1p - 0 to 13 inches; yellowish red (5YR 4/6) very fine silty laom; weak, fine granular; very friable moist; smooth, abrupt boundary.

A12 - 13 to 23 inches; dark reddish brown (5YR 3/3) silt loam; moderate, medium subangular blocky; friable moist; smooth, gradual boundary.

A13 - 23 to 36 inches; dark reddish brown (5YR 3/3) silt loam; weak, coarse subangular blocky; friable moist; smooth, gradual boundary.

B21 - 36 to 49 inches; yellowish red (5YR 3/6) loam; weak, coarse subangular blocky; friable moist; smooth, clear boundary.

B22 - 46 to 62 inches; yellowish red (5YR 3/6) silt loam; moderate, medium subangular blocky; friable moist; smooth, clear boundary.

B23 - 62 to 80 inches; red (2.5YR 4/6) loam; weak, coarse subangular blocky; friable moist.

NAME: Oscar

CLASSIFICATION: Typic Natrustalfs, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-10 Transect 4

LOCATION: 1640' west and 1480' north of southeast corner Sec 3; T.19N.; R.1W.

MAP UNIT: 13 E

A1p - 0 to 10 inches; reddish brown (5YR 4/4) loam; weak, fine granular; friable moist; smooth, clear boundary.

B21t - 10 to 19 inches; reddish brown (2.5YR 4/4) silty clay loam; weak, medium subangular blocky; firm moist; smooth gradual boundary.

B22t - 19 to 28 inches; reddish brown (2.5YR 4/4) silty clay loam; weak, medium subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B23t - 28 to 46 inches; dark red (2.5YR 3/6) loam; weak, coarse subangular blocky; friable moist; clay films on ped surfaces; smooth, clear boundary.

B3 - 46 to 70 inches; red (2.5YR 4/6) loam; weak, coarse granular; friable moist.

NAME: Oscar series

CLASSIFICATION: Typic Natrustalfs, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-11 Transect 5

LOCATION: 1975' west and 2480' north of southeast corner of Sec 3; T.19N.; R.1W.

MAP UNIT: 13 E

A1p - 0 to 10 inches; dark reddish brown (5YR 3/4) loam; platy vesicular top; weak, medium subangular blocky; friable moist; smooth, clear boundary.

B21t - 10 to 19 inches; reddish brown (2.5YR 4/4) silt loam; weak, medium subangular blocky; firm moist; smooth, clear boundary.

B22t - 19 to 29 inches; red (2.5YR 4/6) loam; weak, coarse subangular blocky; friable moist; clay films on ped surfaces; smooth, clear boundary.

B23t - 29 to 50 inches; red (2.5YR 4/6) loam; weak, coarse subangular blocky; friable moist; clay films on ped surfaces; smooth, clear boundary.

B24t - 50 to 73 inches; red (2.5YR 4/6) silt loam; weak, coarse granular; friable moist; patchy clay films.

NAME: Taxadjunct to Pulaski because of coarse silty control

CLASSIFICATION: Typic Usti-fluvents, coarse-silty, mixed, thermic, non-acid

PEDON NUMBER: 76-OK-60-12 Transect 6

LOCATION: 2970' west and 125' north of southeast corner of Sec 3; T.19N.; R.1W.

MAP UNIT: 14 F

Alp - 0 to 12 inches; dark reddish brown (5YR 3/4) loam; weak, fine granular; very friable moist; smooth boundary.

B2 - 12 to 26 inches; red (2.5YR 4/6) loam; weak, coarse granular; friable moist; smooth, clear boundary.

Ab - 26 to 40 inches; dusky red (2.5YR 3/3) silt loam; moderate, medium granular; friable moist; smooth, gradual boundary.

II B21 - 40 to 55 inches; dusky red (2.5YR 3/3) silt loam; moderate fine subangular blocky; friable moist; smooth, clear boundary.

II B22 - 55 to 62 inches; reddish brown (2.5YR 4/4) silt loam; weak, fine angular blocky; friable moist.

NAME: Taxadjunct to Port because of argillic and 17" overwash

CLASSIFICATION: Pachic Argiustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-13

LOCATION: 3560' west and 280' north of southeast corner of Sec 3; T.19N.; R.1W.

MAP UNIT: 12 D

A1p - 0 to 10 inches; dusky red (2.5YR 3/3) loam; weak, medium granular; friable moist; smooth, abrupt boundary.

B2 - 10 to 17 inches; dark red (2.5YR 3/6) loam; weak, coarse granular; friable moist; smooth, abrupt boundary.

Ab - 17 to 25 inches; dusky red (2.5YR 3/3) silt loam; weak, medium subangular blocky; friable moist; smooth, gradual boundary.

II B2t - 25 to 45 inches; dark reddish brown (5YR 3/2) silt loam; moderate very fine subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

II B3 - 45 to 72 inches; dark red (2.5YR 3/6) silt loam; weak, medium subangular blocky; friable moist.

NAME: Taxadjunct to McLain because of fine-silty control section and had 13" overwash

CLASSIFICATION: Pachic Argiustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-16 Transect 7

LOCATION: 880' north and 80' west of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 8 C

A1p - 0 to 13 inches; dark reddish brown (5YR 3/4) loam; weak, fine, granular; friable moist; smooth, gradual boundary.

B21t - 13 to 34 inches; dark reddish brown (5YR 3/2) silty clay loam; moderate, very fine angular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B22t - 34 to 54 inches; reddish brown (5YR 4/4) silty clay loam; weak, very fine angular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B3 - 45 to 62 inches; reddish brown (2.5YR 4/4) loam; weak, medium angular/subangular blocky; firm moist.

NAME: Port-like. Inclusion in Pulaski map unit

CLASSIFICATION: Typic Usti-fluvents, fine-silty, mixed, thermic, non-acid

PEDON NUMBER: 76-OK-60-17 Transect 7

LOCATION: 1280' north and 80' west of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT; 14 F

Alp - 0 to 11 inches; yellowish red (5YR 4/6) loam; weak, fine granular; very friable moist; smooth, gradual boundary.

AC - 11 to 24 inches; yellowish red (5YR 4/6) silt loam; weak, coarse granular; friable moist; smooth, clear boundary.

Ab - 24 to 47 inches; dark reddish brown (5YR 3/3) silty clay loam to clay loam; weak, very fine subangular blocky; firm moist; smooth, clear boundary.

II C - 47 to 66 inches; red (2.5YR 4/6) fine sandy loam; massive to weak, very fine granular; very friable moist.

NAME: Taxadjunct to McLain series because of fine-silty control section

CLASSIFICATION: Pachic Argiustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-18 Transect 8

LOCATION: 970' east and 600' north of southwest corner of Sec 3; T.19N.; R.1W.

MAP UNIT: 7 B

Ap - 0 to 10 inches; dusky red (2.5YR 3/3) silt loam; weak, medium granular; friable moist; smooth, gradual boundary.

B2t - 10 to 21 inches; dusky red (2.5YR 3/3) silty clay loam; moderate, medium subangular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B31 - 21 to 34 inches; dark reddish brown (2.5YR 3/4) silt loam; weak, coarse subangular blocky; friable moist; smooth, clear boundary.

B32 - 34 to 53 inches; dark red (2.5YR 3/6) clay loam; weak, medium, subangular blocky; friable moist; smooth, gradual boundary.

C - 53 to 84 inches; red (2.5YR 4/6) clay loam; weak, coarse subangular blocky; friable moist.

NAME: Port series lacks 20" of mollic epipedon

CLASSIFICATION: Fluventic Haplustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-20 Transect 9

LOCATION: 1120' west and 150' north of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 12

A1p - 0 to 13 inches; dark reddish brown (5YR 3/2) clay loam; weak, medium granular; weak fine subangular blocky; friable moist; smooth, gradual boundary.

B2 - 13 to 23 inches; dark reddish brown (5YR 3/3) clay loam; weak, coarse subangular blocky; friable moist; smooth, clear boundary.

II B31 - 23 to 51 inches; yellowish red (5YR 4/6) loam; weak, coarse, prismatic; friable moist; smooth, clear boundary.

II B32 - 51 to 72 inches; reddish brown (2.5YR 4/4) silty clay loam; weak, medium angular blocky; friable moist.

NAME: Taxadjunct to McLain because of fine-silty instead of fine.

CLASSIFICATION: Pachic Argiustolls, fine-silty, mixed, thermic

PEDON NUMBER: 2250' west and 210' north of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 7 B

A1p - 0 to 10 inches; dark reddish brown (5YR 3/3) silty clay loam; weak, fine subangular blocky; friable moist; smooth, abrupt boundary.

B21t - 10 to 21 inches; dark reddish brown (5YR 3/2) silty clay loam; moderate, very fine angular/subangular blocky; firm moist; clay films on ped surfaces; smooth, gradual boundary.

B22t - 21 to 32 inches; dark reddish brown (5YR 3/3) silty clay loam; weak, medium subangular blocky; friable moist; clay films on ped surfaces; smooth, clear boundary.

B3 - 32 to 43 inches; reddish brown (2.5YR 4/4) silt loam; weak, coarse subangular blocky; friable moist; smooth, gradual boundary.

C1 - 43 to 60 inches; red (2.5YR 4/6) silty clay loam; weak, coarse subangular blocky; friable moist; smooth, abrupt boundary.

C2 - 60 to 84 inches; red (2.5YR 4/6) loam; weak, coarse, prismatic; friable moist.

NAME: Port silt loam with 13" overwash

CLASSIFICATION: Cumulic Haplustoll, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-22 Transect 10

LOCATION: 2520' west and 450' north of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 12 D

A1p - 0 to 13 inches; red (2.5YR 4/6) silt loam; weak, fine granular, very friable moist; smooth, abrupt boundary.

A12 - 13 to 19 inches; dark reddish brown (5YR 3/3) silt loam; weak, medium granular; friable moist; smooth, clear boundary.

B21 - 19 to 30 inches; dark reddish brown (5YR 3/3) silty clay loam; weak, medium subangular blocky; firm moist; smooth, clear boundar.

B22 - 30 to 44 inches; reddish brown (2.5YR 4/4) silt loam; weak, medium subangular blocky; friable moist; smooth, gradual boundary.

B23 - 44 to 65 inches; red (2.5YR 4/6) silt loam; weak, coarse subangular blocky; friable moist; smooth, gradual boundary.

B3 - 65 to 84 inches; red (2.5YR 4/6) loam; weak, coarse prismatic; friable moist.

NAME: Port-like. Inclusion in McLain map unit

CLASSIFICATION: Fluventic Haplustoll, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-23 Transect II

LOCATION: 2280' west and 2390' north of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 7 B

A1p - 0 to 15 inches; dark brown (7.5YR 3/2) silt loam; moderate, medium granular; friable moist; smooth, gradual boundary.

B21 - 15 to 27 inches; dark reddish brown (5YR 3/4) silt loam; weak, medium subangular blocky; firm moist; smooth, clear boundary.

B22 - 27 to 41 inches; dark reddish brown (2.5YR 3/4) silt loam; weak, medium subangular blocky; firm moist; smooth, gradual boundary.

B23 - 41 to 53 inches; dark reddish brown (2.5YR 3/4) loam; weak, medium subangular blocky; firm moist; smooth gradual boundary.

B24 - 53 to 70 inches; reddish brown (2.5YR 4/4) silt loam; weak, coarse subangular blocky; firm moist; smooth clear boundary.

B3 - 70 to 84 inches; reddish brown (2.5YR 4/6) loam; weak, coarse subangular blocky; firm moist.

NAME: Port series with 19" overwash

CLASSIFICATION: Cumulic Haplustoll, fine-silty, mixed thermic

PEDON NUMBER: 76-OK-60-25 Transect 12

LOCATION: 1550' north and 1890' west of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 12 D

A1p - 0 to 19 inches; reddish brown (2.5YR 4/4) loam; weak, fine granular; friable moist; smooth, abrupt boundary.

A12 - 19 to 30 inches; dark reddish brown (5YR 3/3) silt loam; moderate, medium granular; friable moist; smooth, gradual boundary.

B2 - 30 to 41 inches; dark reddish brown (5YR 3/3) silty clay loam; weak, medium subangular blocky; firm moist; smooth, gradual boundary.

B31 - 41 to 58 inches; reddish brown (2.5YR 4/4) loam; weak, medium subangular blocky; firm moist; smooth, gradual boundary.

B32 - 58 to 72 inches; reddish brown (2.5YR 4/4) loam; weak, medium subangular blocky; firm moist.

NAME: Taxadjunct to McLain fine-silty instead of fine control section

CLASSIFICATION: Pachic Argiustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-26 Transect 13

LOCATION: 1860' west and 1910' north of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 8 C

A1p - 0 to 11 inches; dark brown (7.5YR 3/2) silt loam; moderate, medium granular; friable moist; smooth, gradual boundary.

B21t - 11 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate, medium granular and moderate, medium subangular blocky; friable moist; clay films on ped surfaces; smooth, gradual boundary.

B22t - 24 to 36 inches; dark brown (7.5YR 3/2) silty clay loam; weak, fine angular blocky; firm moist; clay films on ped surfaces; smooth, gradual boundary.

B23t - 36 to 48 inches; reddish brown (5YR 4/4) clay loam; weak, fine angular blocky; firm moist; clay films on ped surfaces; smooth, clear boundary.

B31 - 48 to 61 inches; reddish brown (5YR 4/4) loam; weak, fine subangular blocky; firm moist; smooth, clear boundary.

C - 61 to 72 inches; red (2.5YR 4/6) clay loam; weak, fine subangular blocky; firm moist.

NAME: Port taxadjunct lacks 20" mollic epipedon has 19" overwash

CLASSIFICATION: Fluventic Haplustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-28 Transect 14

LOCATION: 1640' west and 810' north of southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 12 D

Alp - 0 to 9 inches; reddish brown (5YR 4/3) silt loam; weak, fine granular; very friable; smooth, clear boundary.

A12 - 9 to 19 inches; reddish brown (2.5YR 4/4) silt loam; moderate medium subangular blocky; friable moist; smooth, clear boundary.

Ab - 19 to 35 inches; dark reddish brown (5YR 3/3) silty clay loam; moderate, fine subangular blocky; firm moist; smooth, clear boundary.

Acl - 35 to 52 inches; reddish brown (2.5YR 4/4) reddish brown (5YR 4/4) stratification, silt loam; weak, very fine subangular blocky; friable moist; smooth, clear boundary.

Ac2 - 52 to 72 inches; red (2.5YR 4/6) silt loam; weak, fine subangular blocky; friable moist.

NAME: Taxadjunct to Teller because Teller is fine loamy

CLASSIFICATION: Udic Argiustolls, fine-silty, mixed, thermic

23" overwash from upland

PEDON NUMBER: 76-OK-60-29 Transect 15

LOCATION: 670' west and 2325' north of the southeast corner of Sec 4; T.19N.; R.1W.

MAP UNIT: 16 H

A1p - 0 to 10 inches; dark reddish brown (5YR $\frac{3.5}{3}$) loam; weak, fine granular; very friable; smooth, clear boundary.

A12 - 10 to 23 inches; reddish brown (5YR 4/3) loam; weak, fine subangular blocky; friable moist; smooth, clear boundary.

Ab - 23 to 32 inches; dark reddish brown (5YR 3/3) loam; weak, coarse subangular blocky; friable moist; smooth, clear boundary.

B2t - 32 to 49 inches; red (2.5YR 4/5) silty clay loam; weak, medium subangular blocky; firm moist; clay films on ped surfaces; smooth gradual boundary.

B3 - 49 to 72 inches; red (2.5YR 4/5) clay loam; weak, very fine subangular blocky; firm moist.

NAME: Taxadjunct of Teller series because Teller is fine-loamy

CLASSIFICATION: Udic Argiustolls, fine-silty, mixed, thermic

PEDON NUMBER: 76-OK-60-30 Transect 16

LOCATION: 970' east and 1720' north of southwest corner of Sec 3;
T.19N.; R.1W.

MAP UNIT: 16 H

Ap - 0 to 9 inches; dark reddish brown (2.5YR $\frac{3.5}{3}$) loam; moderate, fine subangular blocky; friable moist; smooth, abrupt boundary.

A12 - 9 to 18 inches; reddish brown (2.5YR 4/4) loam; moderate, fine subangular blocky; friable moist; smooth gradual boundary.

Ab - 18 to 38 inches; dark reddish brown (5YR 3/3) silt loam; moderate, medium granular; friable moist; smooth, gradual boundary.

B1 - 38 to 51 inches; dark reddish brown (5YR 3/3) silt loam; moderate, medium subangular blocky.

B2t - 51 to 72 inches; reddish brown (5YR 4/4) clay loam; weak, fine subangular blocky; friable moist; clay films on ped surfaces; smooth, gradual boundary.

B3 - 72 to 90 inches; reddish brown (5YR 4/4) clay loam; weak, fine subangular blocky; friable moist.

APPENDIX B

PHYSICAL AND CHEMICAL SOIL CHARACTERIZATION DATA

ARRANGED ACCORDING TO THE SEQUENCE

THE PEDONS WERE SAMPLED IN

THE FIELD

TAXADJUNCT TO PORT: 76-OK-60-1 TRANSECT 1

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-14	35.0	52.5	12.5	5.7	230	2.2
B2	14-25	30.0	55.0	15.0	6.2	270	1.7
Ab	25-32	20.0	62.5	17.5	7.8	480	1.6
II B21t	32-40	22.5	57.5	20.0	8.0	520	1.6
II B22t	40-47	12.5	60.0	27.5	8.0	570	1.8
II B23t	47-65	16.3	62.5	21.2	8.2	620	1.4

TAXADJUNCT TO OSCAR: 76-OK-60-2 TRANSECT 1

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.	Extractable Catrons Me/100g			
								Ca	Mg	K	Na
Ap	0-8	27.5	52.5	20.0	7.7	4810	1.8	5.7	6.2	0.4	7.9
B21t	8-13	8.8	62.5	28.7	8.1	1400	1.6	7.9	10.3	0.4	7.3
B22t	13-19	2.5	60.0	37.5	8.2	930	1.9	8.8	13.1	0.5	8.5
B23t	19-35	6.3	57.5	36.2	8.5	610	1.3	21.4	21.0	0.5	7.7
B31	35-44	20.0	52.5	27.5	8.6	540	0.6	29.7	16.7	0.5	6.1
B32	44-61	18.8	57.5	23.7	8.6	710	0.5	42.2	15.1	0.4	5.4

PORT: 76-OK-60-3 TRANSECT 1

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-8	38.7	45.0	16.3	7.0	630	1.9
A12	6-12	30.0	47.5	22.5	7.3	820	1.7
B1	12-20	27.5	55.0	17.5	7.6	800	1.3
B2t	20-32	23.7	52.5	23.8	8.0	530	1.5
B31	32-52	41.2	42.5	16.3	8.1	560	1.5
B32	52-84	37.5	45.0	17.5	8.1	510	0.5

PORT: 76-OK-60-4 TRANSECT 1

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-9	35.0	45.0	20.0	6.3	320	1.8
B2	9-26	38.8	46.2	15.0	6.2	250	1.1
Ab	26-41	22.5	60.0	17.5	6.1	390	1.6
II B1	41-59	37.5	41.5	21.0	6.4	130	1.2
II B21t	59-68	30	35.5	34.5	6.6	130	0.7
II B22t	68-77	29.5	33.5	37.0	7.0	120	0.8

TAXADJUNCT TO PORT: 76-OK-60-5 TRANSECT 2

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-22	46.2	45.0	8.8	5.5	230	1.0
II A1	22-30	40.0	47.5	12.5	6.5	380	0.9
II A12	30-45	30.0	55.0	15.0	7.4	380	1.6
B2t	45-62	10.0	60.0	30.0	7.4	390	0.7
TAXADJUNCT TO TELLER: 76-OK-60-6 TRANSECT 2							
Ap	0-7	41.2	50.0	8.8	5.3	380	1.3
A12	7-16	52.5	37.5	10.0	5.2	340	1.1
B1	16-24	48.7	40.0	11.3	5.8	290	1.1
B21t	24-44	45.0	40.0	15.0	6.1	290	0.8
B22t	44-56	22.5	47.5	30.0	6.1	290	0.6
B3	56-62	40.0	45.0	15.0	6.2	290	0.4
TAXADJUNCT TO PULASKI: 76-OK-60-7 TRANSECT 3							
Ap	0-6	36.2	55.0	8.8	5.5	540	1.2
A12	6-13	42.5	45.0	12.5	6.1	300	0.8
Ab	13-30	36.2	50.0	13.8	6.3	390	1.4
II B21	30-48	32.5	55.0	12.5	6.3	480	1.4
II B22	48-62	17.5	57.5	25.0	6.4	270	0.8

INCLUSION IN PORT: 76-OK-60-8 TRANSECT 3

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-7	37.5	50.0	12.5	5.3	280	1.6
B1	7-15	41.2	45.0	13.8	5.5	400	1.1
B2t	15-35	20.0	47.5	32.5	7.5	580	0.9
B31	35-50	22.5	50.0	27.5	7.9	730	0.7
B32	50-62	30.0	45.0	25.0	7.8	460	0.2
		PORT: 76-OK-60-9 TRANSECT 4					
Ap	0-13	40.0	50.0	10.0	6.3	150	0.6
A12	13-23	11.3	72.5	16.2	6.7	220	1.4
A13	23-36	23.8	62.5	13.7	7.0	210	1.3
B21	36-49	38.7	47.5	13.8	6.8	140	0.6
B22	49-62	15.0	62.5	22.5	6.4	180	0.6
B23	62-80	35.0	45.0	20.0	6.9	230	0.3
		OSCAR: 76-OK-60-10 TRANSECT 4					
Ap	0-10	43.7	45.0	11.3	7.1	660	1.0
B21t	10-19	10.0	60.0	30.0	8.0	4100	0.6
B22t	19-28	10.0	62.5	27.5	8.0	5620	0.5
B23t	28-46	32.5	45.0	22.5	8.3	1620	0.5
B3	46-70	30.0	47.5	22.5	8.5	820	0.3

OSCAR: 76-OK-60-11 TRANSECT 5

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.	Extractable Catrons Me/100g Ca	Mg	K	Na
Ap	0-10	43.7	45.0	11.3	6.5	310	1.0	5.0	5.5	0.4	0.7
B21t	10-19	15.0	62.5	22.5	8.6	820	0.6	11.1	12.7	0.4	4.5
B22t	19-29	33.7	45.0	21.3	8.7	1940	0.5	28.1	14.5	0.4	6.9
B23t	29-50	31.3	47.5	21.2	8.9	1940	0.4	24.0	15.1	0.4	8.1
B24t	50-73	16.3	60.0	23.7	9.0	1190	0.2	12.9	8.7	0.4	6.1

TAXADJUNCT TO PULASKI: 76-OK-60-12 TRANSECT 6

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-12	42.5	47.5	10.0	6.2	230	1.2
B2	12-26	37.5	50.0	12.5	5.8	150	0.7
Ab	26-40	25.0	62.5	12.5	6.2	140	1.1
II B21t	40-55	15.0	65.0	20.0	6.8	140	1.2
II B22t	55-62	8.8	70.0	21.2	6.7	150	0.8
TAXADJUNCT TO PORT BECAUSE OF ARGILLIC AND 17" OVERWASH: 76-OK-60-13 TRANSECT 6							
Ap	0-10	47.5	41.2	11.3	6.0	300	1.1
B2	10-17	41.3	46.2	12.5	6.4	150	0.7
Ab	17-25	37.5	50.0	12.5	6.5	160	1.1
II B2t	25-45	17.5	62.5	20.0	6.8	210	1.2
II B3	45-72	25.0	50.0	25.0	8.1	430	0.3

PULASKI: 76-OK-60-14 TRANSECT 6

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-10	48.8	45.0	6.2	6.1	650	1.7
Ac	10-26	45.0	47.5	7.5	5.9	390	0.6
Ab	26-38	42.5	47.5	10.0	6.2	280	1.3
II B21t	38-52	17.5	57.5	25.0	6.7	160	0.6
II B22t	52-62	18.8	50.0	31.2	8.0	360	0.4

TAXADJUNCT TO DRUMMOND BECAUSE DRUMMOND IS NOT A MOLLISOL
76-OK-60-15 TRANSECT 7

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.	Extractable Cations Me/100g Ca	Mg	K	Na
Ap	0-12	40.0	50.0	10.0	7.2	370	1.0	8.5	4.5	0.3	0.3
A12	12-25	20.0	60.0	20.0	8.2	610	1.3	22.0	14.9	0.5	3.7
B21t	25-39	3.8	62.5	33.7	8.8	710	1.2	21.3	20.1	0.5	10.6
B22t	39-64	6.3	60.0	33.7	8.8	930	0.9	17.9	19.3	0.5	12.6
B3	64-77	21.3	50.0	28.7	8.7	1510	0.3	30.0	18.2	0.4	11.8

TAXADJUNCT TO MCLAIN BECAUSE IT HAS FINE SILTY CONTROL SECTION
76-OK-60-16 TRANSECT 7

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-13	31.2	47.5	21.3	6.4	380	1.6
B21t	13-34	3.8	62.5	33.7	6.8	360	1.9
B22t	34-45	20.0	50.0	30.0	7.0	290	1.1
B3	45-62	35.0	47.5	17.5	7.0	350	0.7
INCLUSION IN PULASKI MAP UNIT; PORT-LIKE BECAUSE IT LOOKS MOLLIC 76-OK-60-17 TRANSECT 7							
Ap	0-11	53.7	35.0	11.3	6.6	270	0.5
Ac	11-24	30.0	52.5	17.5	6.9	190	0.7
Ab	24-47	6.3	65.0	28.7	6.8	270	1.2
II C	47-66	18.8	62.5	18.7	8.0	300	0.5
TAXADJUNCT TO MCLAIN BECAUSE OF FINE-SILTY INSTEAD OF FINE 76-OK-60-18 TRANSECT 8							
Ap	0-10	16.3	60.0	23.7	6.2	340	1.3
B2t	10-21	5.0	62.5	32.5	6.9	260	1.0
B31	21-34	12.5	65.0	22.5	7.8	140	0.8
B32	34-55	27.5	47.5	25.0	8.2	260	0.5
C	55-84	21.3	50.0	28.7	8.1	300	0.4
PORT WITH 13" OVERWASH: 76-OK-60-19 TRANSECT 8							
Ap	0-13	27.5	50.0	22.5	6.5	250	0.9
B21	13-21	16.3	50.0	33.7	7.0	160	1.2
B22	21-30	35.0	47.5	17.5	7.3	350	1.0
B23	30-41	40.0	52.5	7.5	8.0	340	1.0
B31	41-51	40.0	50.0	10.0	7.8	410	0.7
B32	51-72	35.0	50.0	15.0	8.0	340	0.3

TAXADJUNCT TO PORT BECAUSE IT LACKS 20" MOLLIC EPIPEDON
76-OK-60-20 TRANSECT 9

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.	Ca	Mg	K	Na
Ap	0-13	25.0	47.5	27.5	6.7	170	1.4	10.3	8.1	0.4	0.4
B2	13-23	21.3	50.0	28.7	7.1	170	0.8	8.6	9.5	0.4	0.4
II B31	23-51	30.0	48.7	21.3	8.1	280	0.4	11.3	8.8	0.3	0.4
II B32	51-72	18.8	47.5	33.7	8.6	500	0.2	72.7	11.3	0.3	1.5

TAXADJUNCT TO MCLAIN BECAUSE IT IS FINE-SILTY INSTEAD OF FINE
76-OK-60-21 TRANSECT 10

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-10	7.5	65.0	27.5	6.5	140	1.4
B21t	10-21	5.0	60.0	35.0	7.2	120	1.4
B22t	21-32	10.0	61.2	28.8	8.0	260	0.8
B3	32-43	18.7	55.0	26.3	8.0	260	0.6
C1	43-60	17.5	52.5	30.0	8.1	260	0.3
C2	60-84	35.0	42.5	22.5	8.3	260	0.1
PORT: 76-OK-60-22 TRANSECT 10							
Ap	0-13	31.3	52.5	16.2	6.4	120	0.7
A12	13-19	7.5	67.5	25.0	6.5	150	1.1
B21	19-30	10.0	55.0	35.0	6.9	110	1.2
B22	30-44	17.5	55.0	27.5	7.3	120	0.6
B23	44-65	18.7	60.0	21.3	8.2	270	0.5
B3	65-84	25.0	50.0	25.0	8.2	270	0.4
TAXADJUNCT TO PORT: 76-OK-60-23 TRANSECT 11							
Ap	0-15	13.7	65.0	21.3	6.2	260	1.4
B21	15-27	15.0	60.0	25.0	6.7	150	0.8
B22	27-41	20.0	55.0	25.0	6.8	140	0.4
B23	41-53	27.5	47.5	25.0	7.0	130	0.2
B24	53-70	18.7	57.5	23.8	7.9	270	0.1
B3	70-84	28.8	47.5	23.7	8.2	240	0.2
MCLAIN: 76-OK-60-24 TRANSECT 11							
Ap	0-11	5.0	65.0	30.0	6.4	130	1.8
B21t	11-28	13.7	50.0	36.3	6.5	120	1.4
B22t	28-39	15.0	55.0	30.0	7.2	140	0.8
B31	39-49	26.3	50.0	23.7	7.3	130	0.3
B32	49-59	31.3	47.5	21.2	7.4	170	0.2
B33	59-72	8.8	62.5	28.7	7.9	270	0.2

PORT: 76-OK-60-25 TRANSECT 12

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-19	32.5	50.0	17.5	5.9	140	1.1
A12	19-30	15.0	60.0	25.0	6.0	150	1.3
B2	30-41	5.0	63.8	31.2	7.7	300	1.1
B31	41-58	25.0	50.0	25.0	8.1	290	0.8
B32	58-72	27.5	48.8	23.7	8.3	270	0.4
TAXADJUNCT TO MCLAIN BECAUSE OF FINE-SILTY: 76-OK-60-26 TRANSECT 13							
Ap	0-11	20.0	60.0	20.0	5.8	260	2.0
B21t	11-24	17.5	55.0	27.5	7.3	300	1.9
B22t	24-36	7.5	65.0	27.5	8.3	610	0.8
B23t	36-48	22.5	50.0	27.5	8.3	1130	0.4
B31	48-61	30.0	45.0	25.0	8.5	1140	0.4
C2	61-72	22.5	47.5	30.0	8.4	1190	0.3
TAXADJUNCT TO MCLAIN BECAUSE OF FINE-SILTY INSTEAD OF FINE 76-OK-60-27 TRANSECT 13							
Ap	0-22	23.8	55.0	21.2	5.8	230	1.5
B1	22-31	22.5	55.0	22.5	6.6	220	0.9
B21t	31-40	21.2	50.0	28.8	6.7	130	0.7
B22t	40-50	13.8	50.0	36.2	6.8	120	0.5
B3	50-72	31.3	41.2	27.5	7.0	120	0.3
TAXADJUNCT TO PORT - LACKS MOLLIC AND HAS 19" OVERWASH 76-OK-60-28 TRANSECT 14							
Ap	0-9	35.0	50.0	15.0	6.1	220	1.5
A12	9-19	23.8	52.5	23.7	6.3	140	1.1
Ab	19-35	3.8	65.0	31.2	6.6	160	1.5
AC1	35-52	26.2	50.0	23.8	7.7	350	0.8
AC2	52-72	26.3	50.0	23.7	7.8	350	0.4
TAXADJUNCT TO TELLER: 76-OK-60-29 TRANSECT 15							
Ap	0-10	32.5	47.5	20.0	5.7	350	1.4
A12	10-23	28.8	50.0	21.2	5.9	160	1.1
Ab	23-32	33.8	50.0	16.2	6.3	150	1.3
B2t	32-49	16.3	52.5	31.2	7.0	180	0.6
B3	49-72	22.5	50.0	27.5	8.2	280	0.3

TAXADJUNCT TO TELLER: 76-OK-60-30 TRANSECT 16

Horizon	Depth In	Sand	%Silt	Clay	pH 1:1	E.C. 1:1	% OM.
Ap	0-9	37.5	45.0	17.5	6.7	150	1.7
A12	9-18	28.8	47.5	23.7	6.4	140	1.0
Ab	18-38	21.3	57.5	21.2	6.2	210	1.4
B1	38-51	23.7	55.0	21.3	5.9	190	1.0
B2t	51-72	27.5	46.2	26.3	5.8	140	0.8
B3	72-90	22.5	48.8	28.7	6.3	760	0.6
TAXADJUNCT TO TELLER: 76-OK-60-31 TRANSECT 16							
Ap	0-8	40.0	47.5	12.5	6.3	430	2.5
B21t	8-17	32.5	47.5	20.0	6.2	210	1.4
B22t	17-35	36.2	40.0	23.8	6.5	670	0.5
B23t	35-53	41.2	37.5	21.3	6.6	890	0.4
II B24t	53-76	26.3	52.5	21.2	7.5	170	0.3
II B25t	76-90	25.0	48.8	26.2	8.0	220	0.3

VITA

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